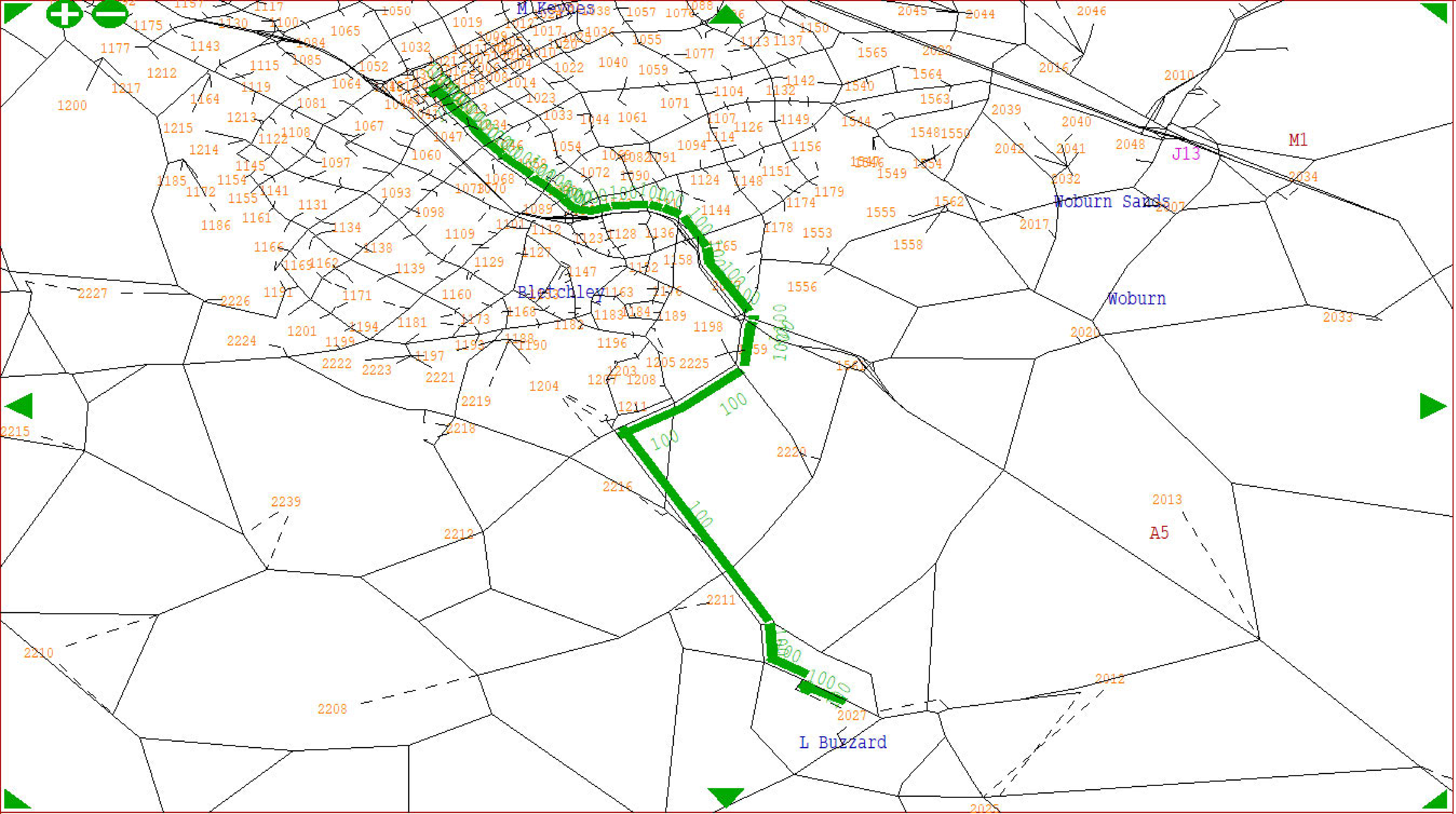


Tree build
Menu:

Origin 1028 x
Destin 2027 x

Tij= 0.28

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

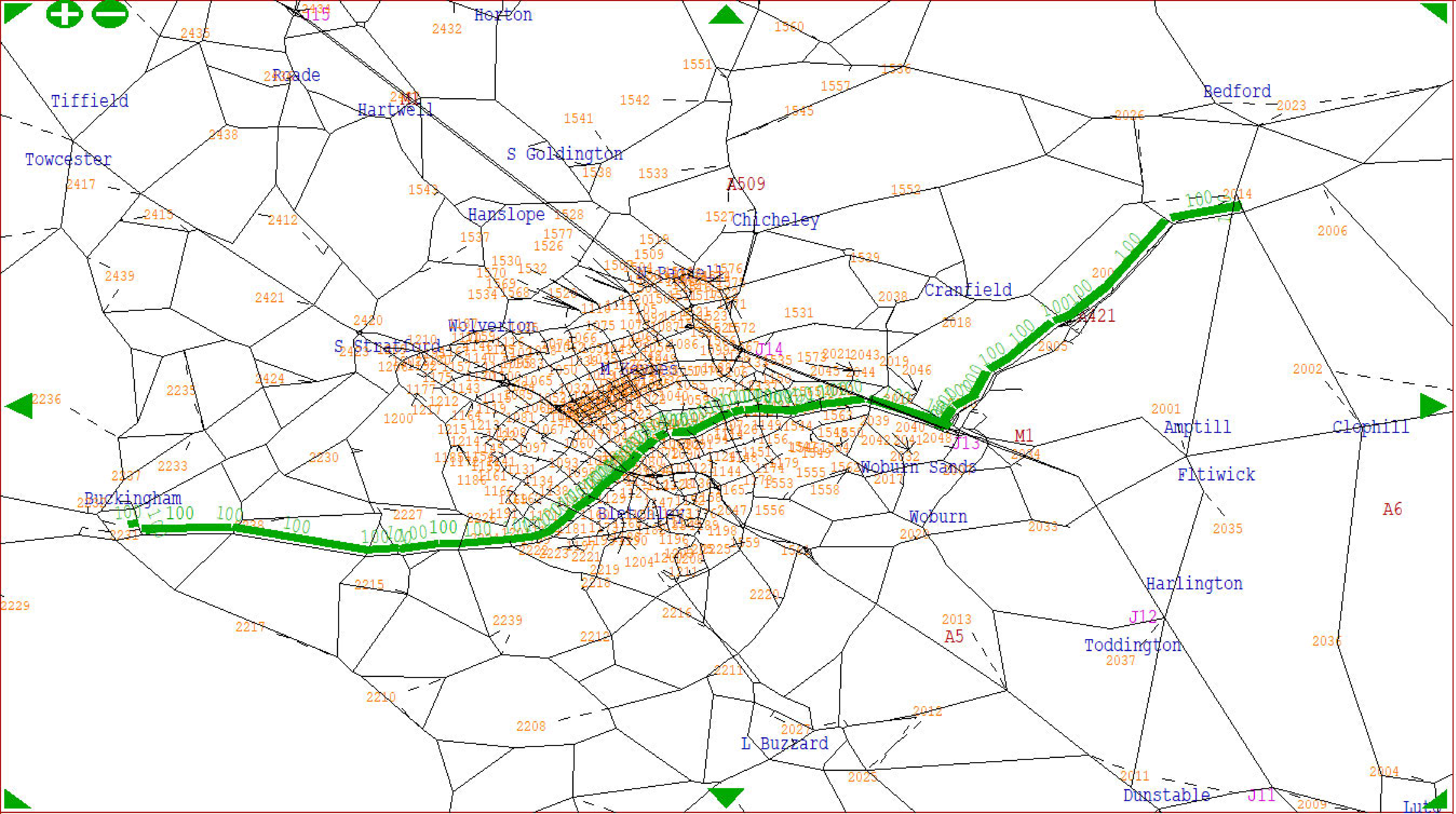
dEstination-
based option >

Spider tree?
No

Q - Return

+ Menu bar!

2016 - Inter-Peak - Network 2_5 24- 2-20



2016 - Inter-Peak - Network 2_5 24- 2-20

Tree build
Menu:

Origin 2231 x
Destin 2014 x

Tij= 0.50

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

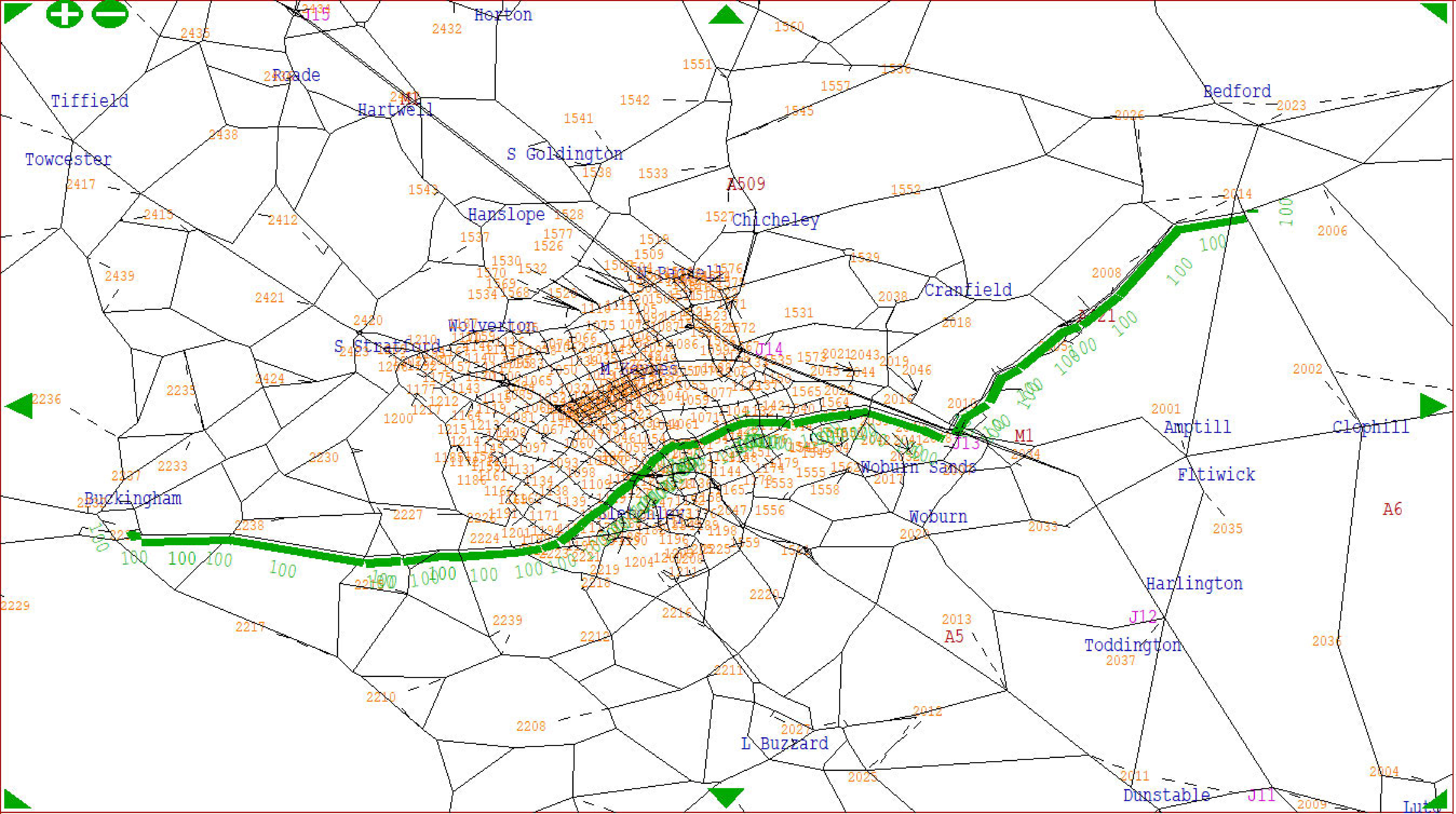
oPtions-UC.. >

dEstination-
based option >

Spider tree?
No

Q - Return

+ Menu bar!



Tree build
Menu:

Origin 2014 x
Destin 2231 x

Tij= 0.73

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

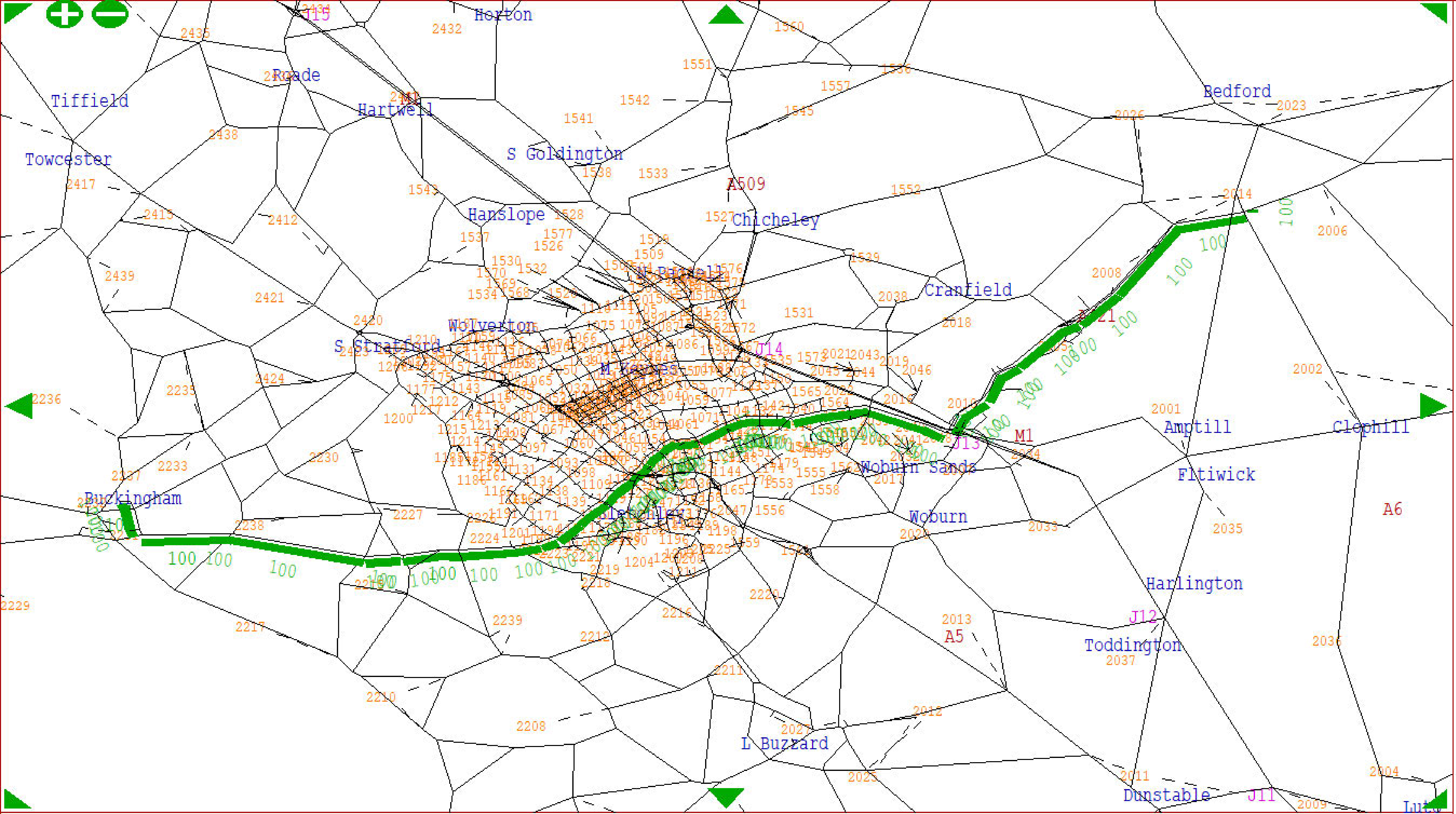
dEstination-
based option >

Spider tree?
No

Q - Return

+ Menu bar!

2016 - Inter-Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 2014 x
Destin 2232 x

Tij= 0.64

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

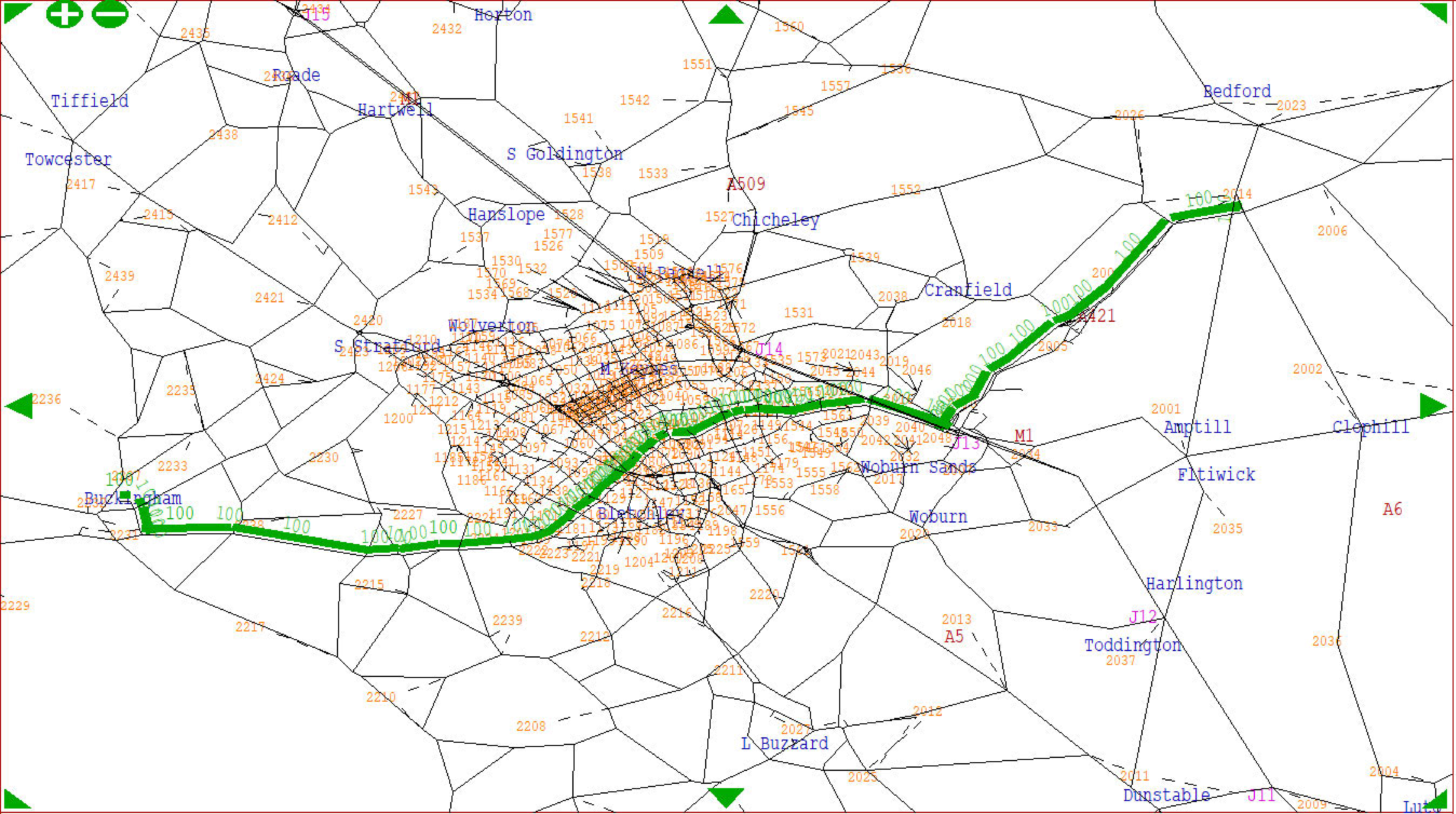
dEstination- >
based option

Spider tree?
No

Q - Return

+ Menu bar!

2016 - Inter-Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 2232 x
Destin 2014 x

Tij= 0.43

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

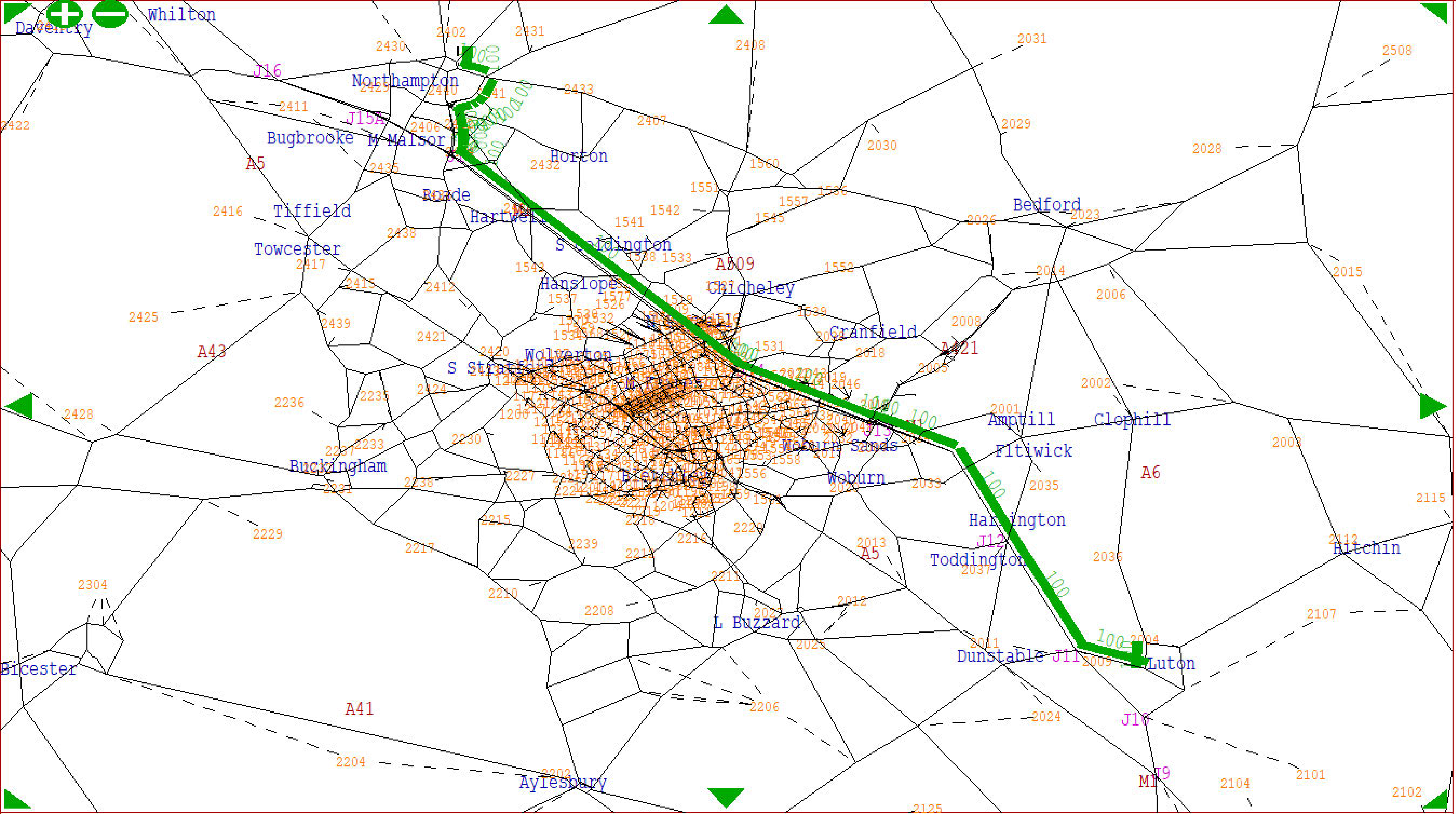
dEstination- >
based option

Spider tree?
No

Q - Return

+ Menu bar!

2016 - Inter-Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 2402 x
Destin 2004 x

Tij= 0.39

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

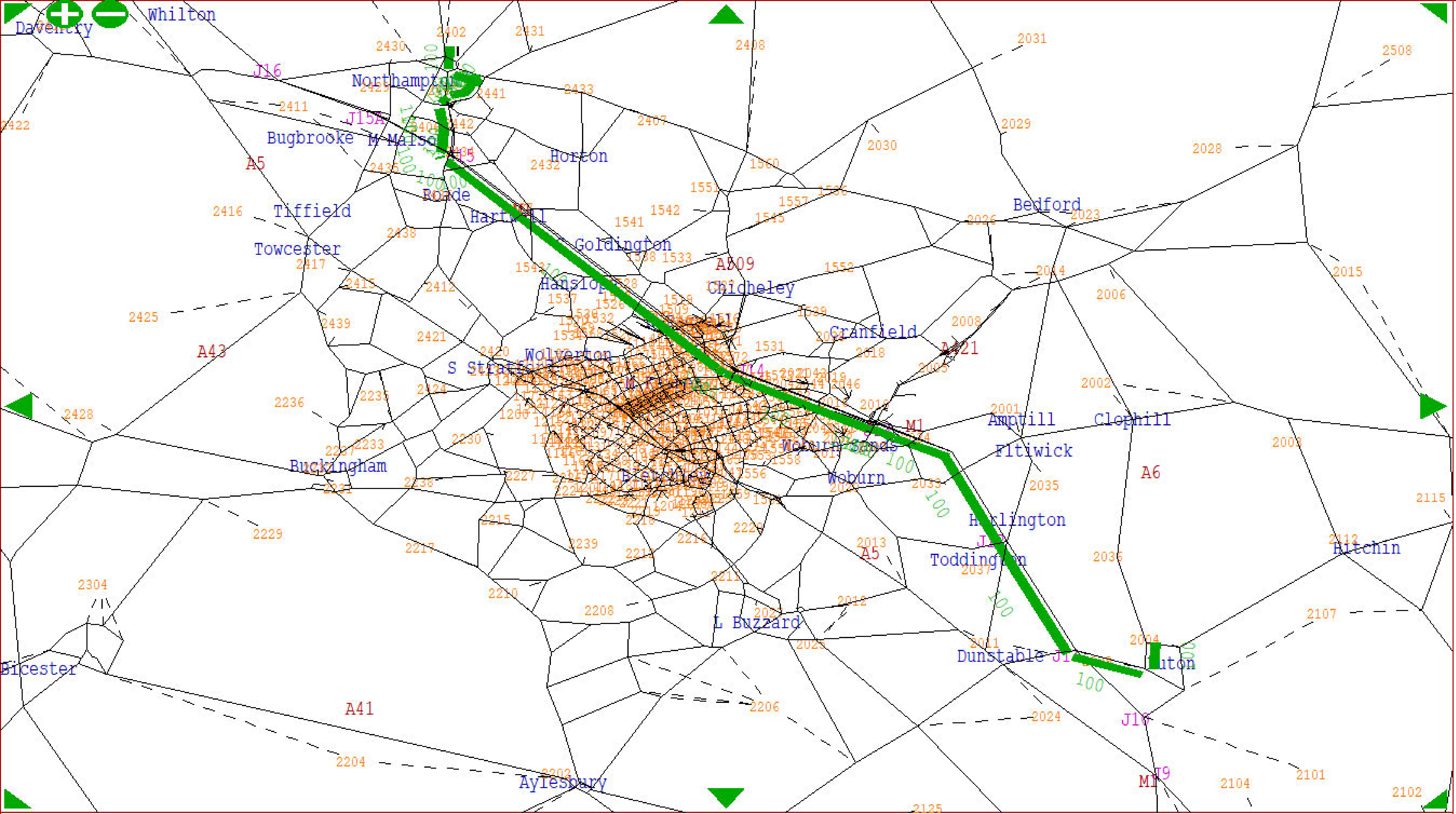
dEstination- >
based option

Spider tree?
No

Q - Return

+ Menu bar!

2016 - Inter-Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 2004 x
Destin 2402 x

Tij= 0.36

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

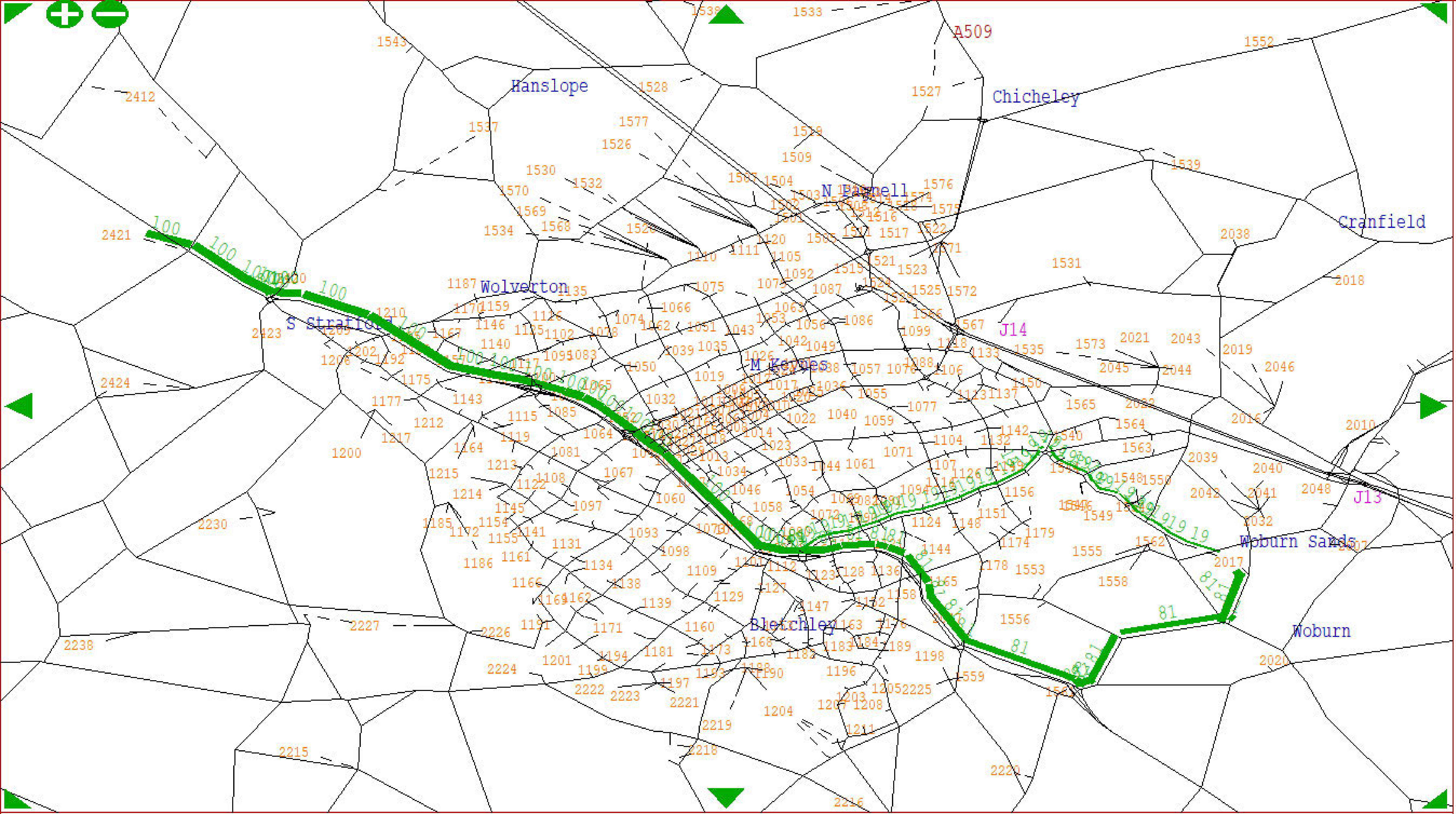
dEstination- >
based option

Spider tree?
No

Q - Return

+ Menu bar!

2016 - Inter-Peak - Network 2_5 24- 2-20



2016 - Inter-Peak - Network 2_5 24- 2-20

Tree build Menu:

Origin 2421 x
Destin 2017 x

Tij = 0.0143

U.C. = 1 ?

Origin-based Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

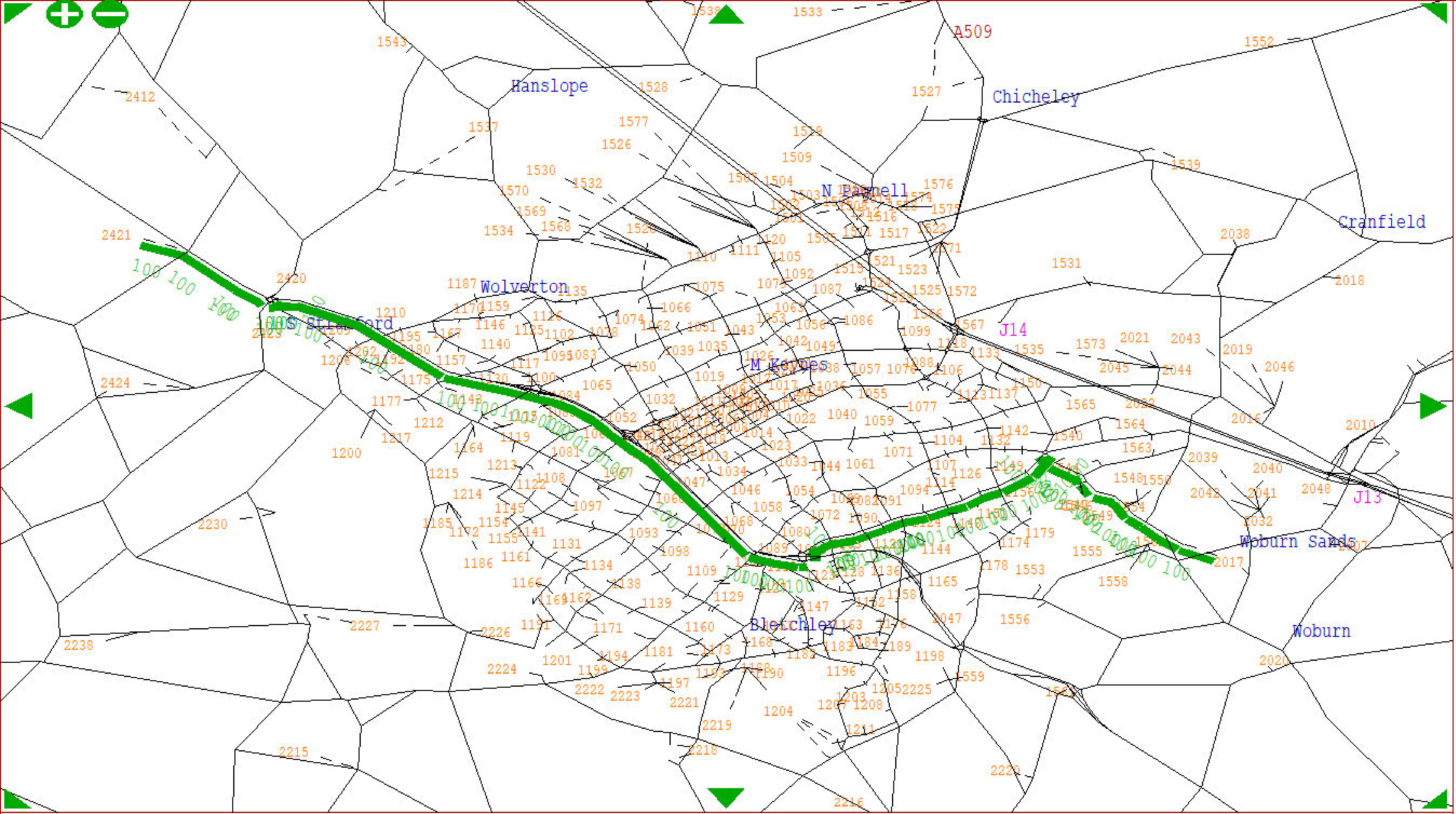
oPtions-UC.. >

dEstination-based option >

Spider tree? No

Q - Return

+ Menu bar!



Tree build
Menu:

Origin 2017 x
Destin 2421 x

Tij = 0.0198

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

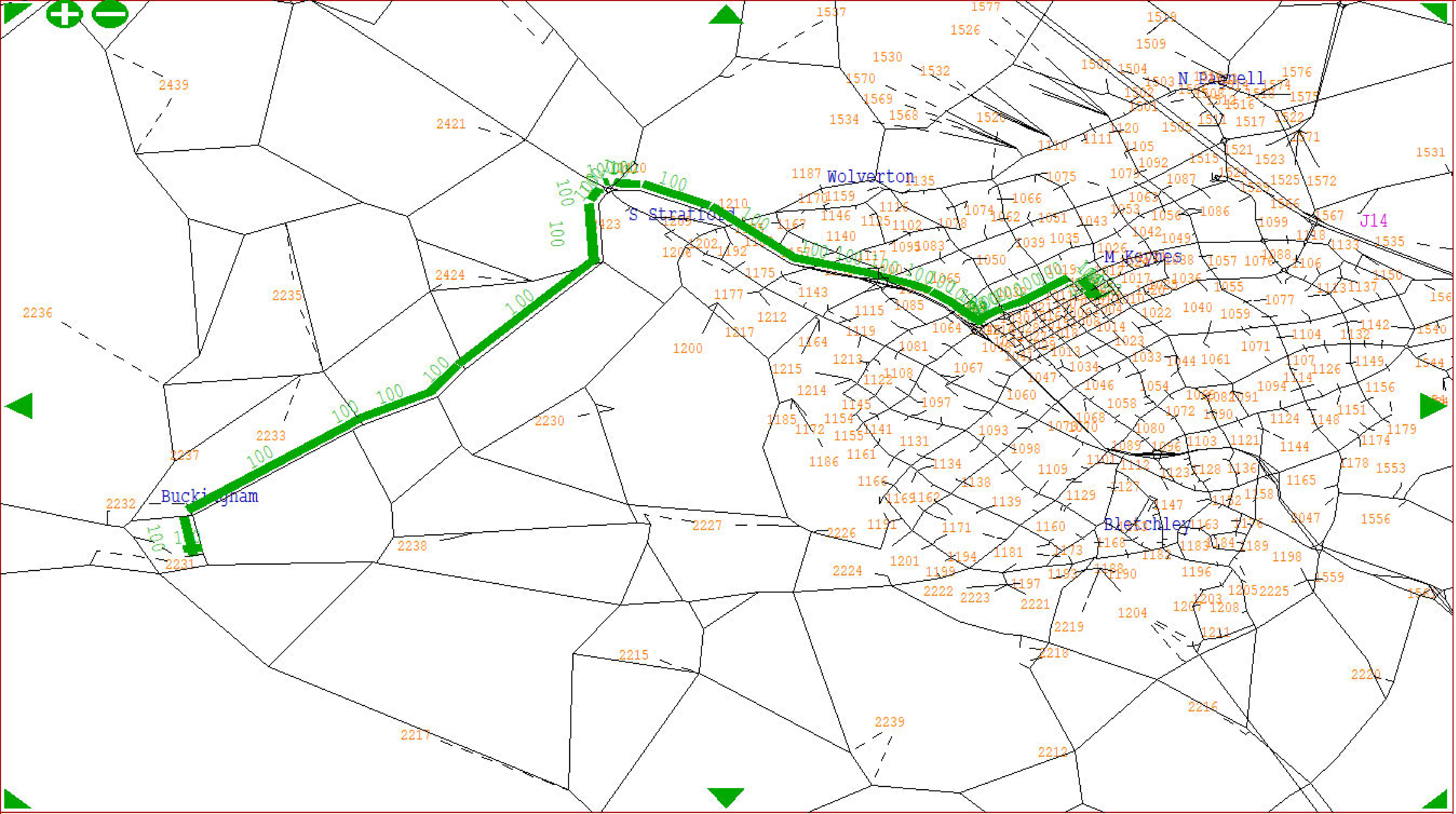
dEstination-
based option >

Spider tree?
No

Q - Return

+ Menu bar!

2016 - Inter-Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 2231 x
Destin 1001 x

Tij = 0.0274

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

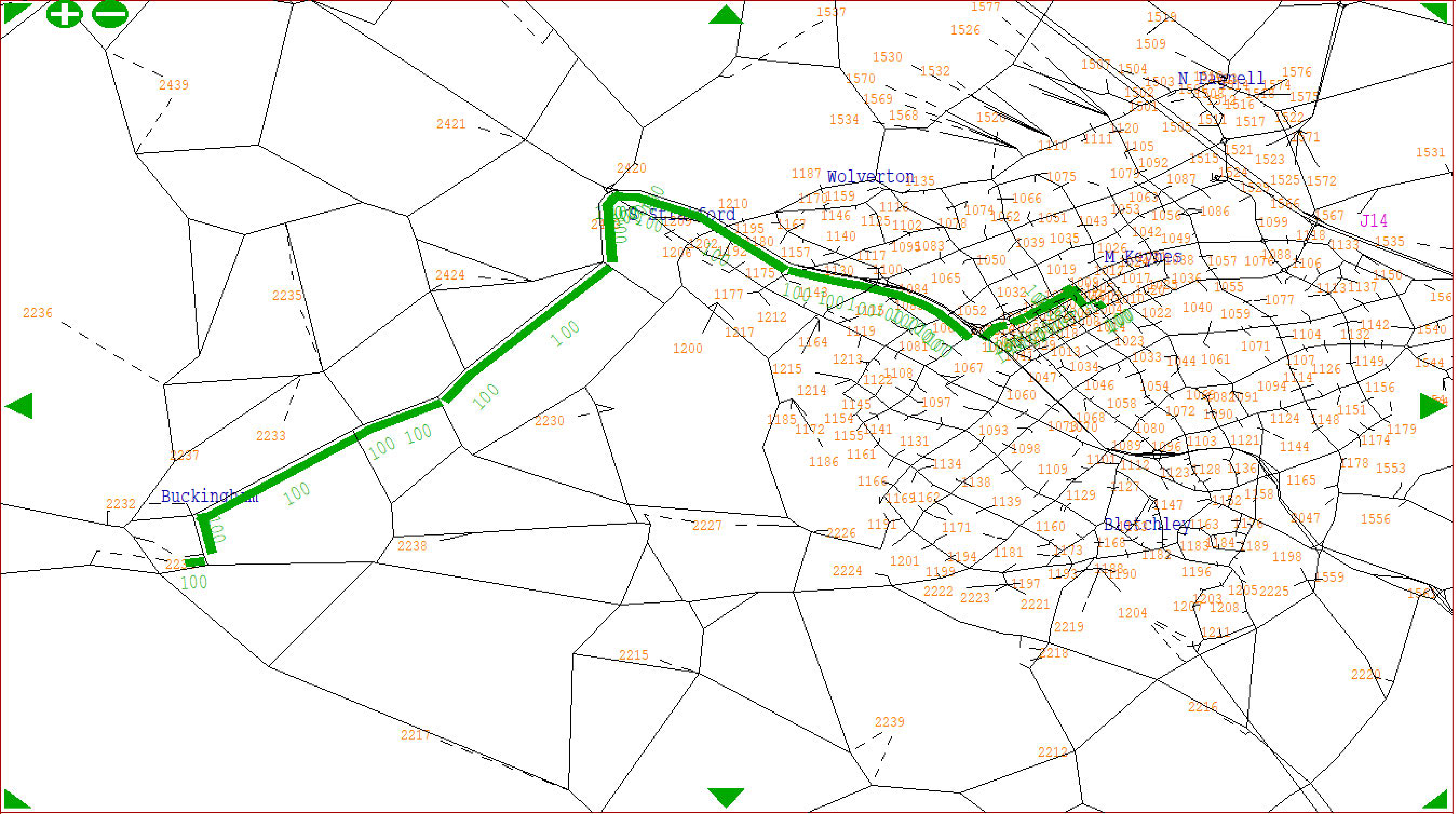
oPtions-UC.. >

dEstination-
based option >

Spider tree?
No

Q - Return

+ Menu bar!



Tree build
Menu:

Origin 1001 x
Destin 2231 x

Tij = 0.0226

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

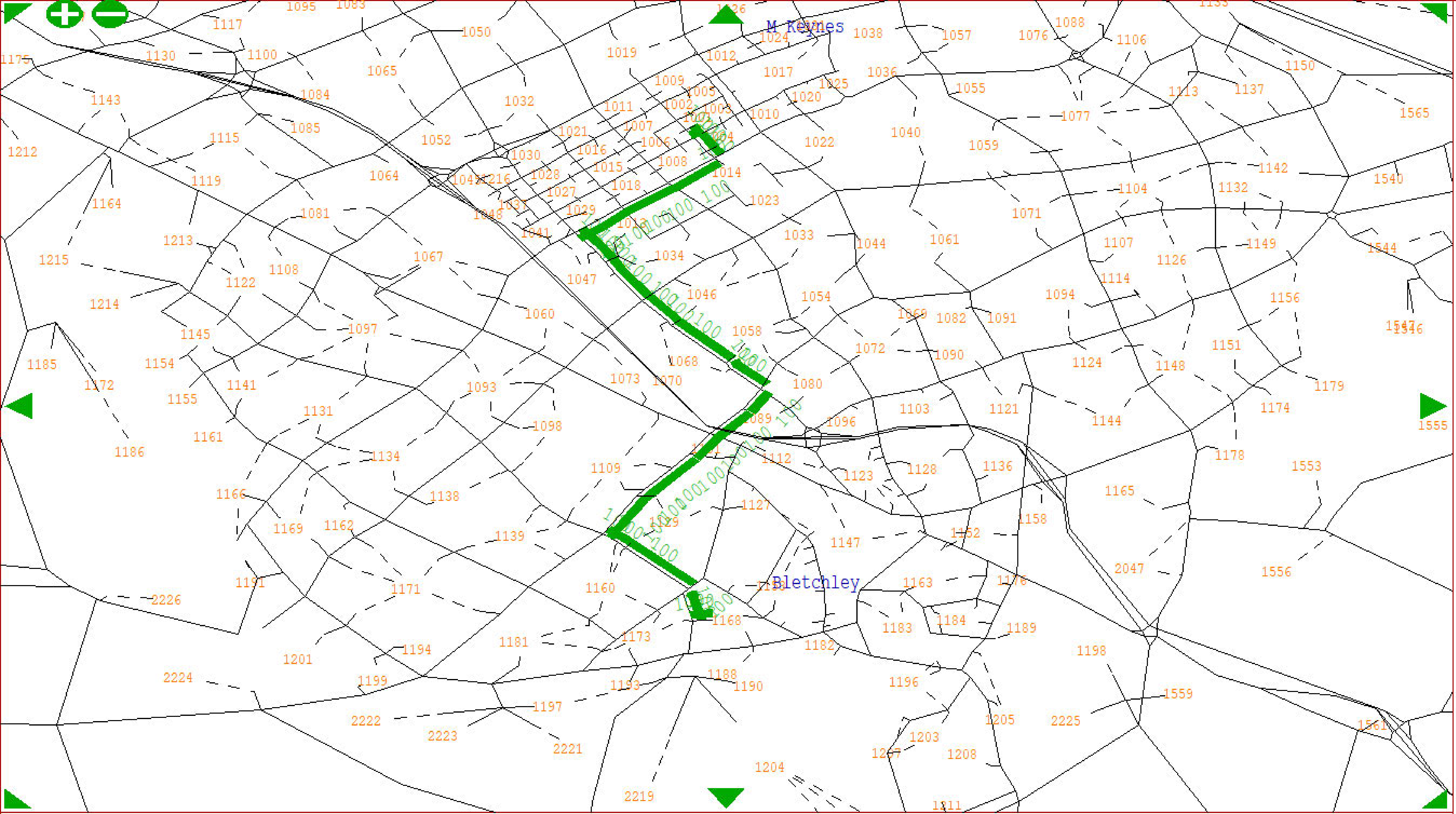
dEstination-
based option >

Spider tree?
No

Q - Return

+ Menu bar!

2016 - Inter-Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 1001 x
Destin 1168 x

Tij = 0.0390

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

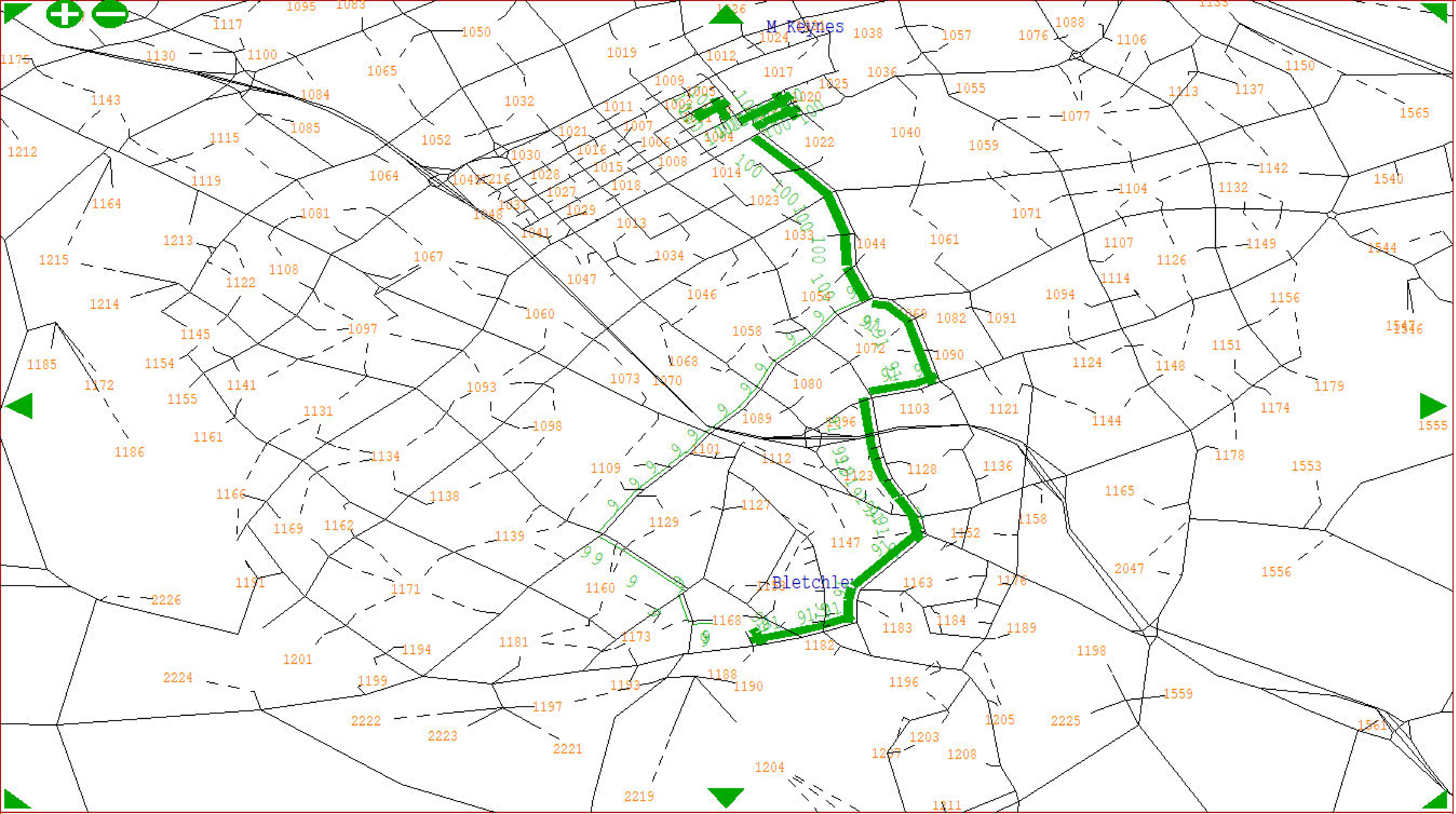
dEstination- >
based option

Spider tree?
No

Q - Return

+ Menu bar!

2016 - Inter-Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 1168 x
Destin 1001 x

Tij = 0.0071

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

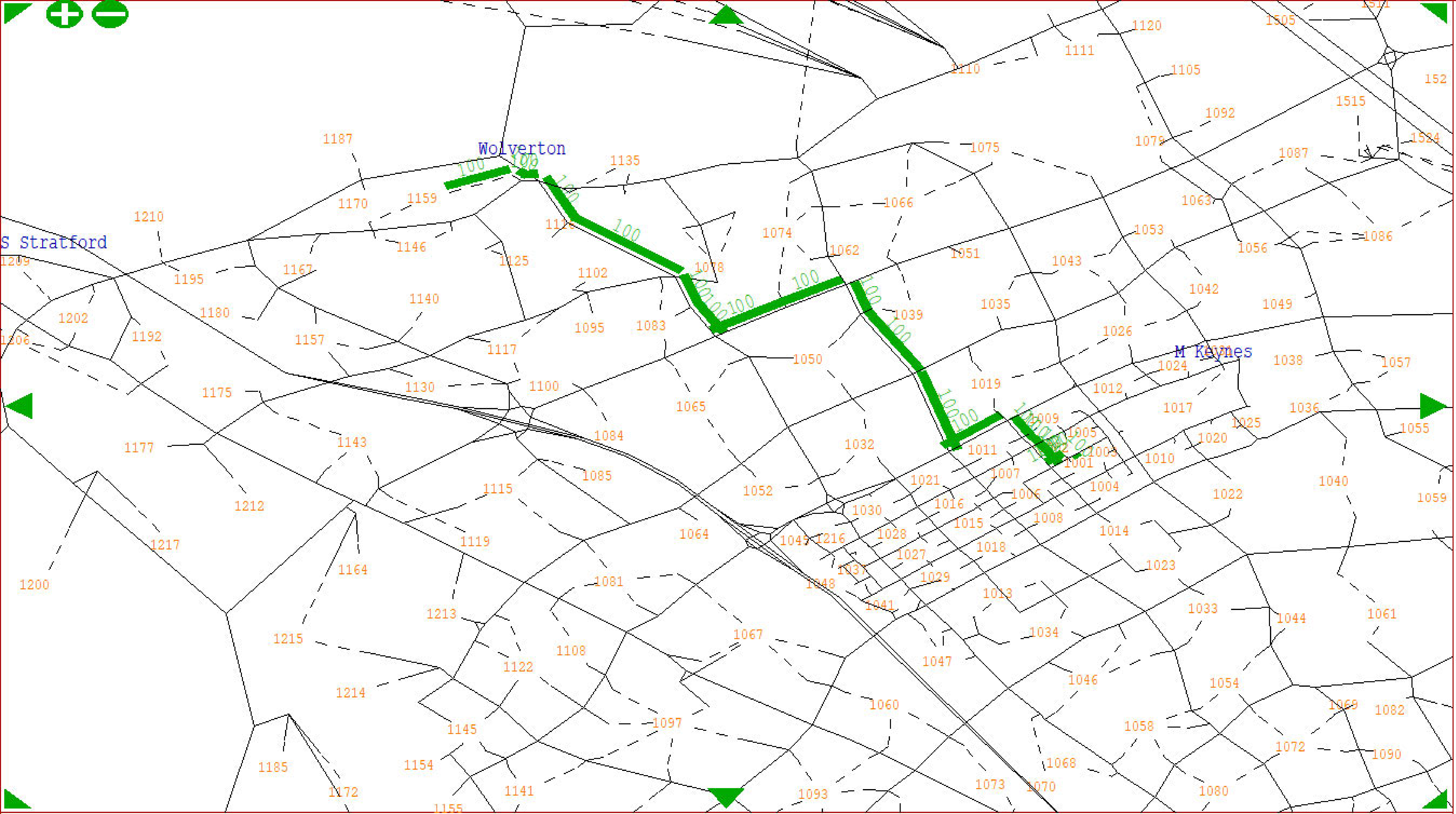
dEstination-
based option >

Spider tree?
No

Q - Return

+ Menu bar!

2016 - Inter-Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 1159 x
Destin 1001 x

Tij = 0.0167

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

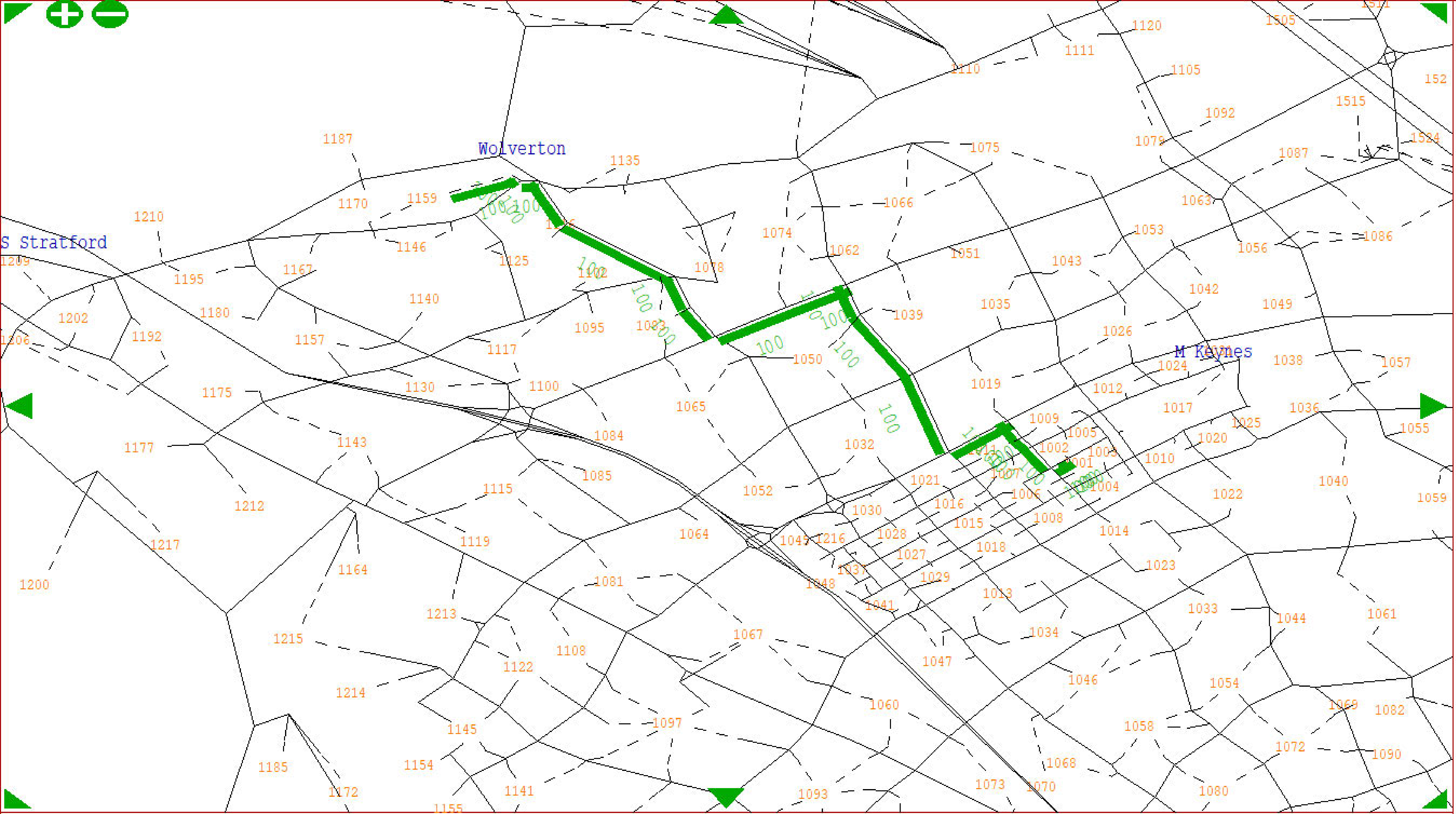
dEstination- >
based option

Spider tree?
No

Q - Return

+ Menu bar!

2016 - Inter-Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 1001 x
Destin 1159 x

Tij = 0.0207

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

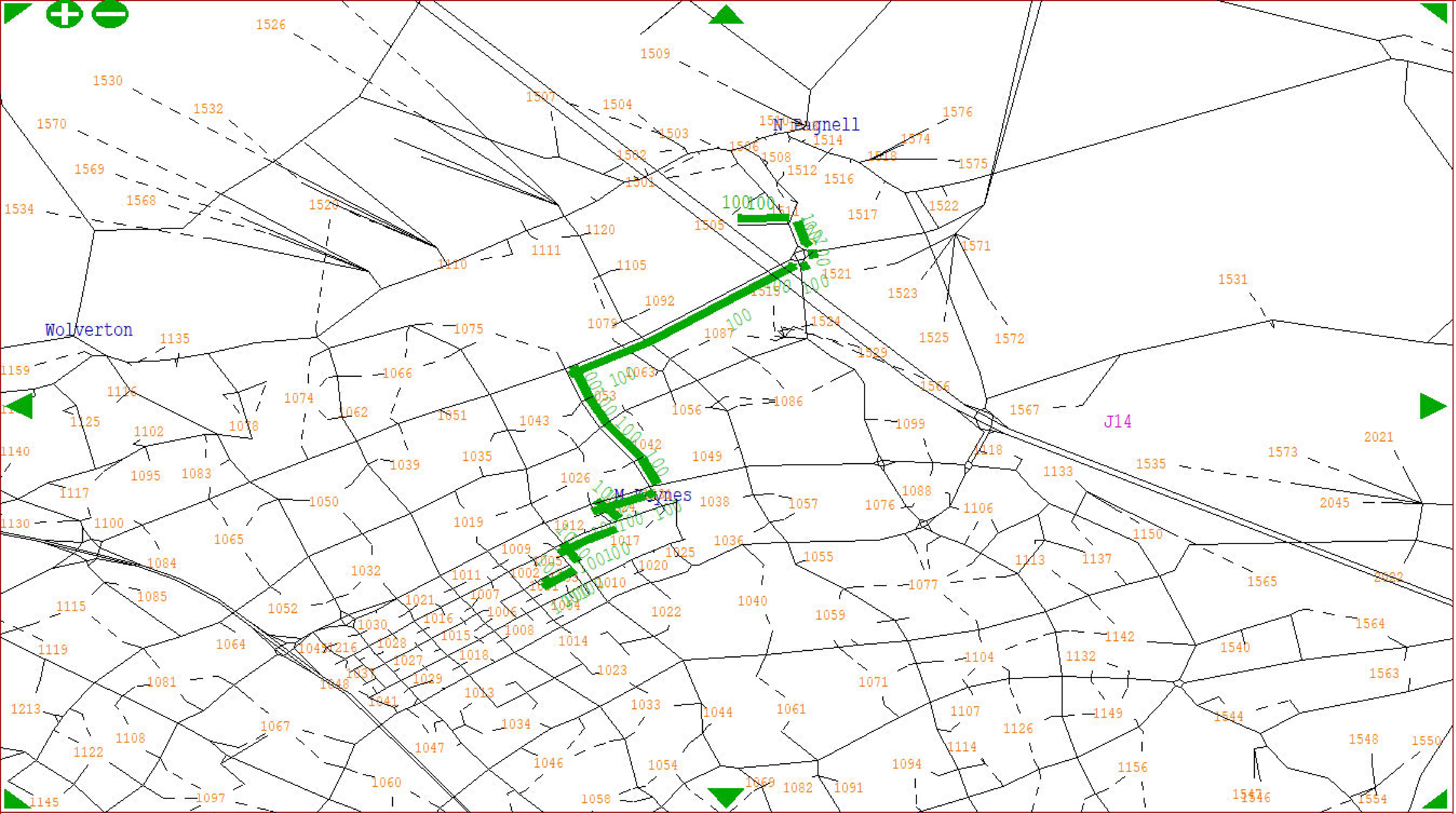
dEstination-
based option >

Spider tree?
No

Q - Return

+ Menu bar!

2016 - Inter-Peak - Network 2_5 24- 2-20



2016 - Inter-Peak - Network 2_5   24- 2-20

Tree build
Menu:

Origin 1505 x
Destin 1001 x

Tij = 0.0303

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

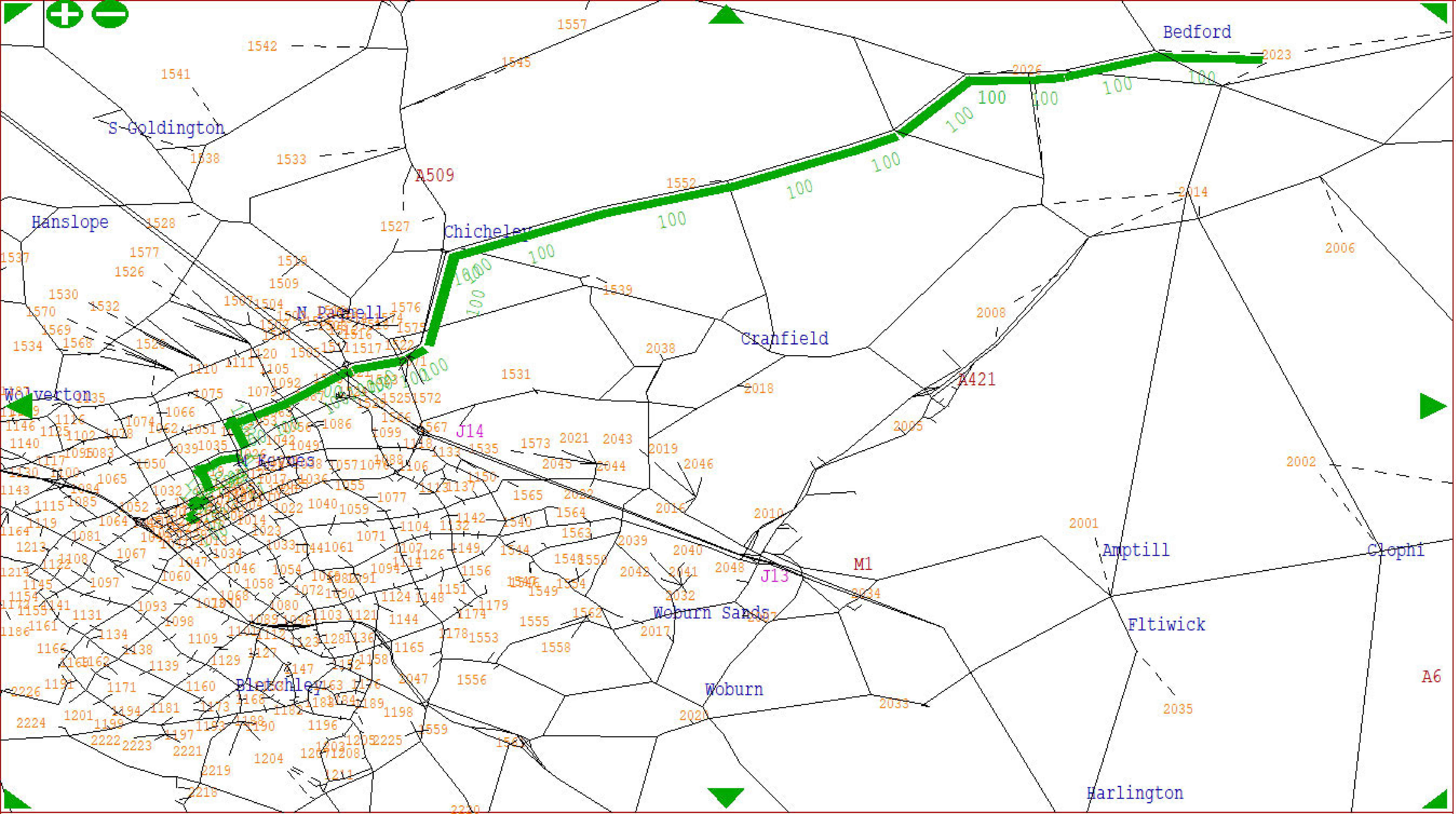
oPtions-UC.. >

dEstination-
based option >

Spider tree?
No

Q - Return

+ Menu bar!



2016 - PM Peak - Network 2_5 24- 2-20

Tree build
Menu:

Origin 2023 x
Destin 1028 x

Tij= 0.19

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

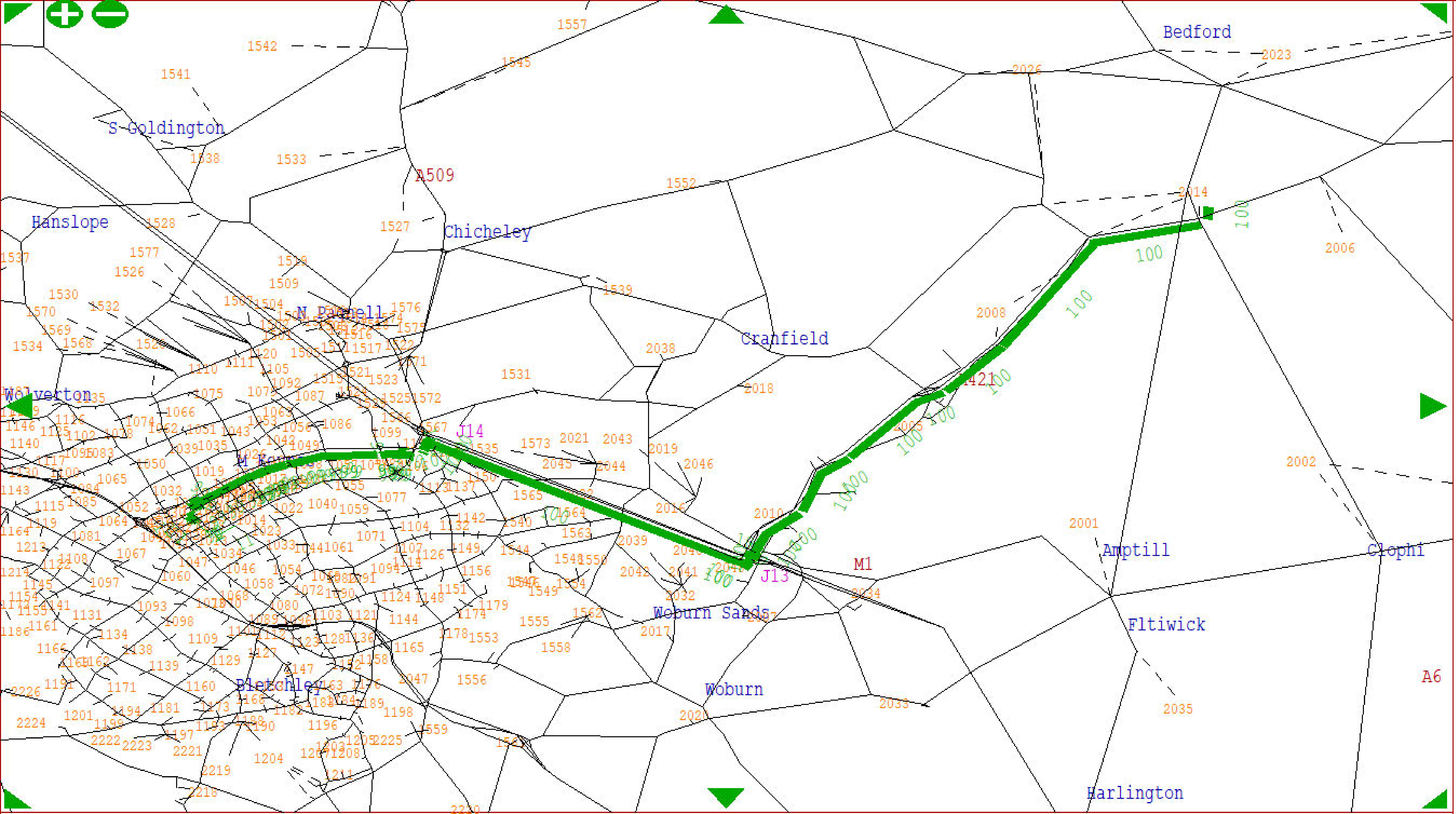
oPtions-UC.. >

dEstination-
based option >

Spider tree?
No

Q - Return

+ Menu bar!



Tree build
Menu:

Origin 2014 x
Destin 1028 x

Tij= 0.23

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

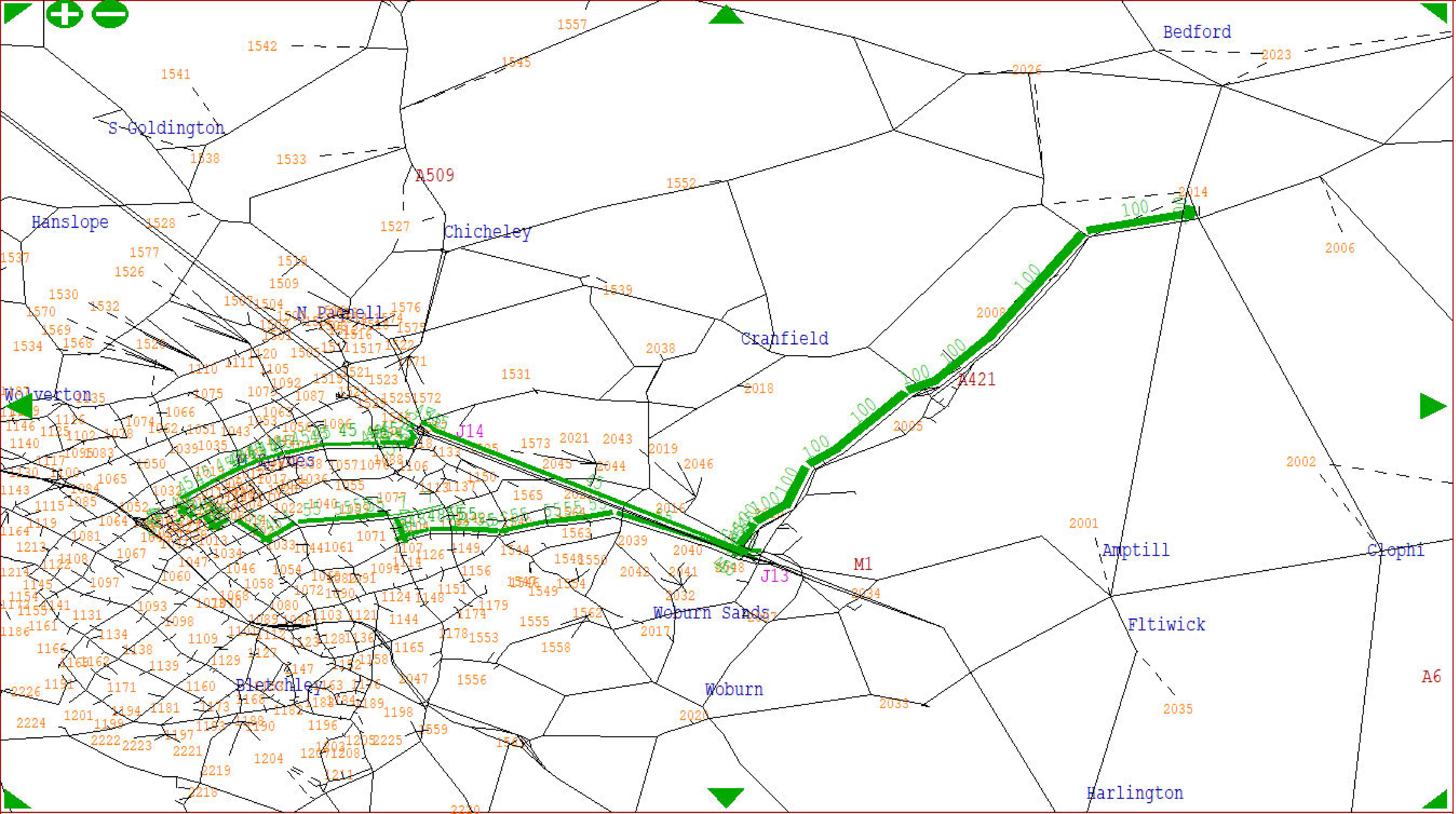
dEstination- >
based option

Spider tree?
No

Q - Return

+ Menu bar!

2016 - PM Peak - Network 2_5 24- 2-20



2016 - PM Peak - Network 2_5 24- 2-20

Tree build
Menu:

Origin 1028 x
Destin 2014 x

Tij= 5.08

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

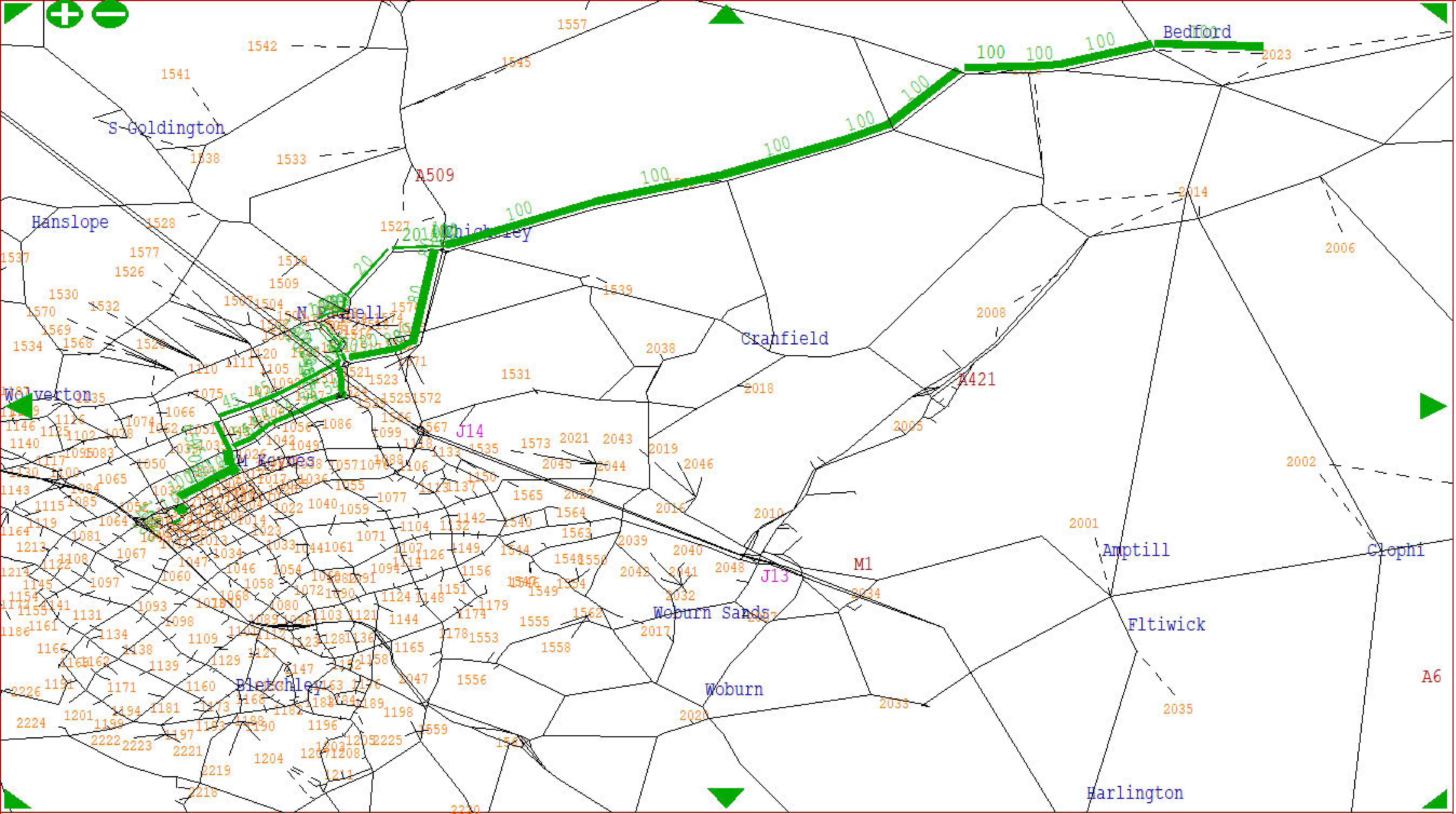
oPtions-UC.. >

dEstination- >
based option

Spider tree?
No

Q - Return

+ Menu bar!



2016 - PM Peak - Network 2_5 24- 2-20

Tree build
Menu:

Origin 1028 x
Destin 2023 x

Tij= 7.91

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

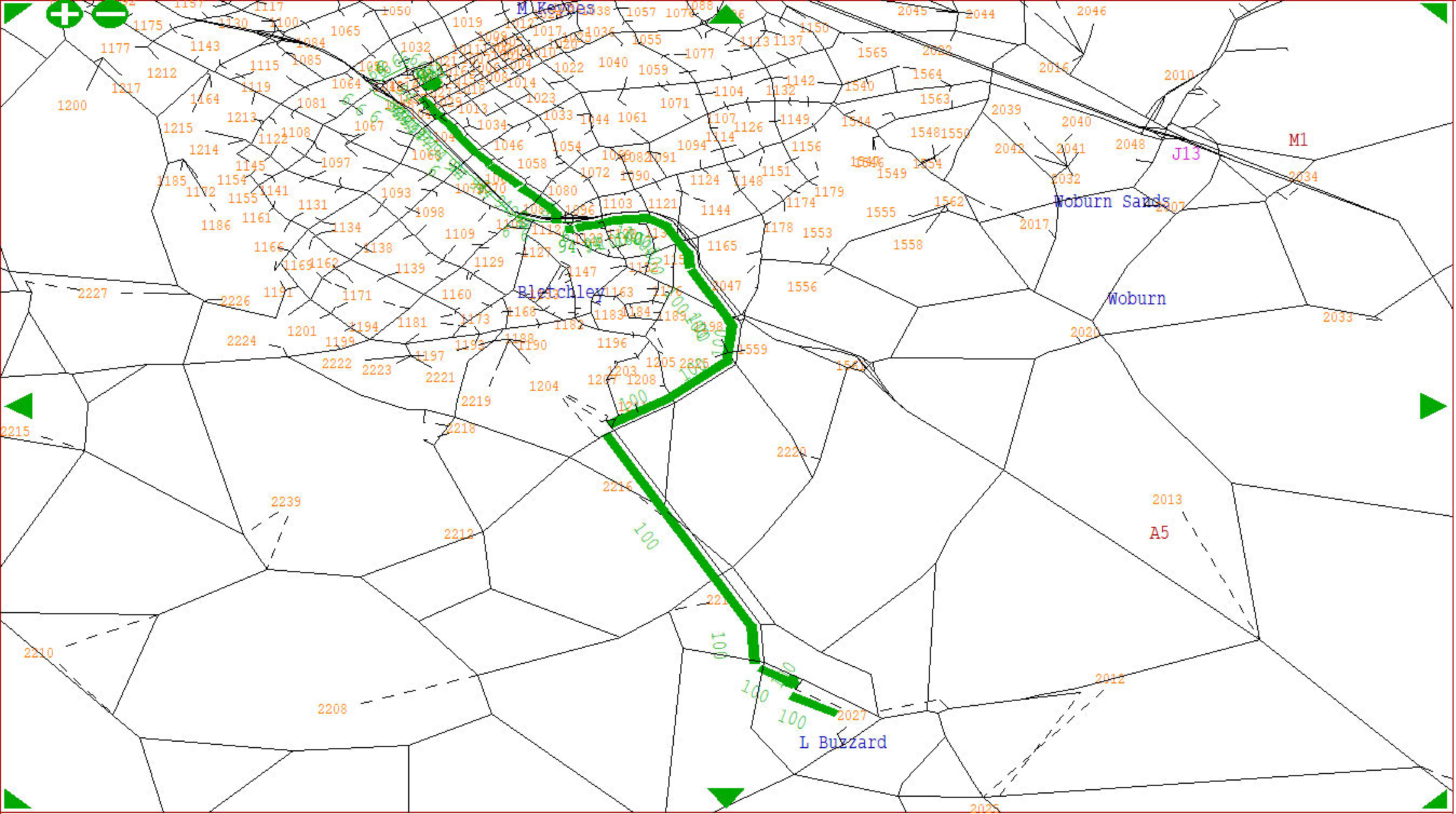
oPtions-UC.. >

dEstination- >
based option

Spider tree?
No

Q - Return

+ Menu bar!



Tree build
Menu:

Origin 2027 x
Destin 1028 x

Tij= 1.74

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

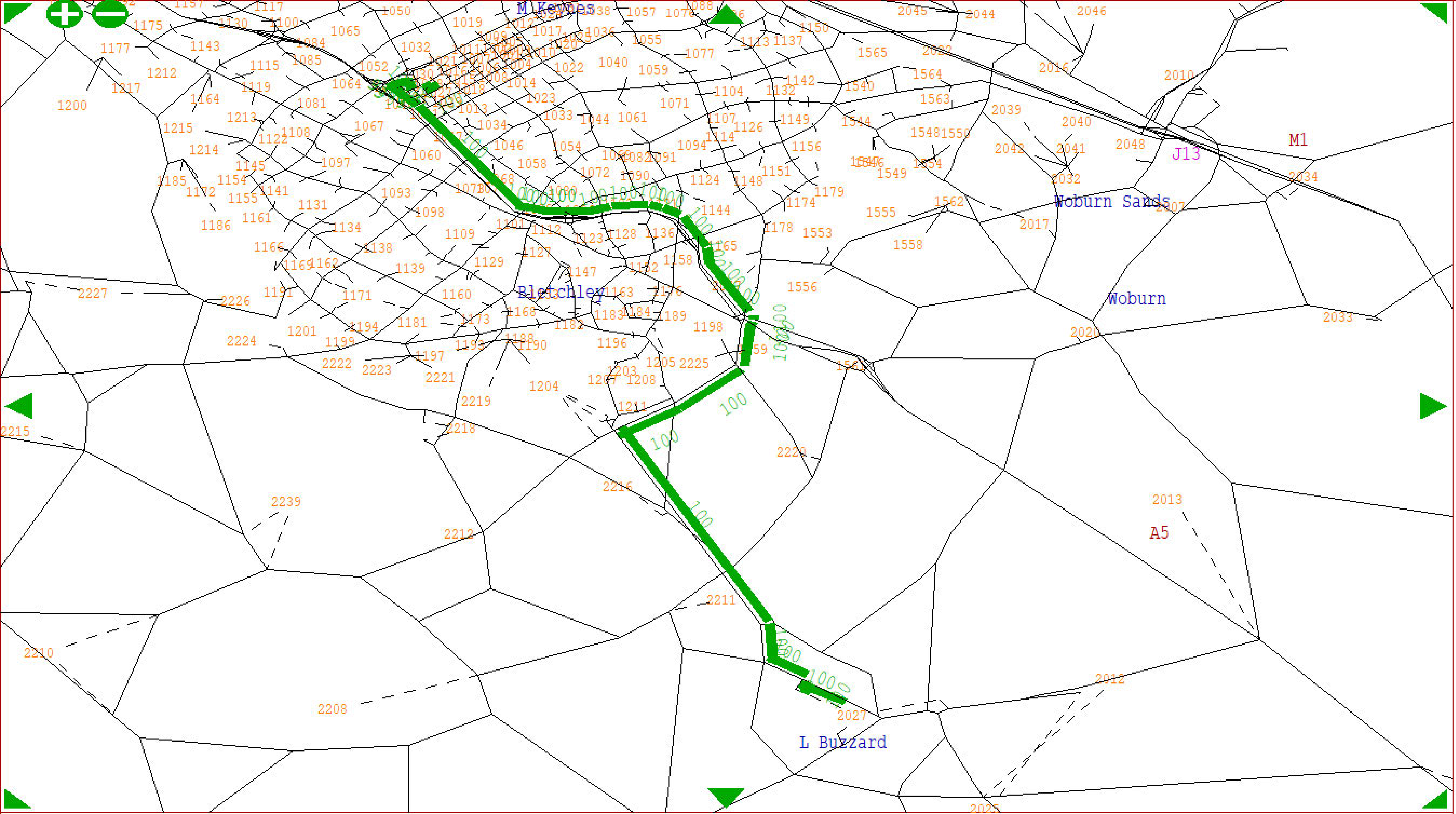
oPtions-UC.. >

dEstination-
based option >

Spider tree?
No

Q - Return

+ Menu bar!



Tree build
Menu:

Origin 1028 x
Destin 2027 x

Tij= 4.24

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

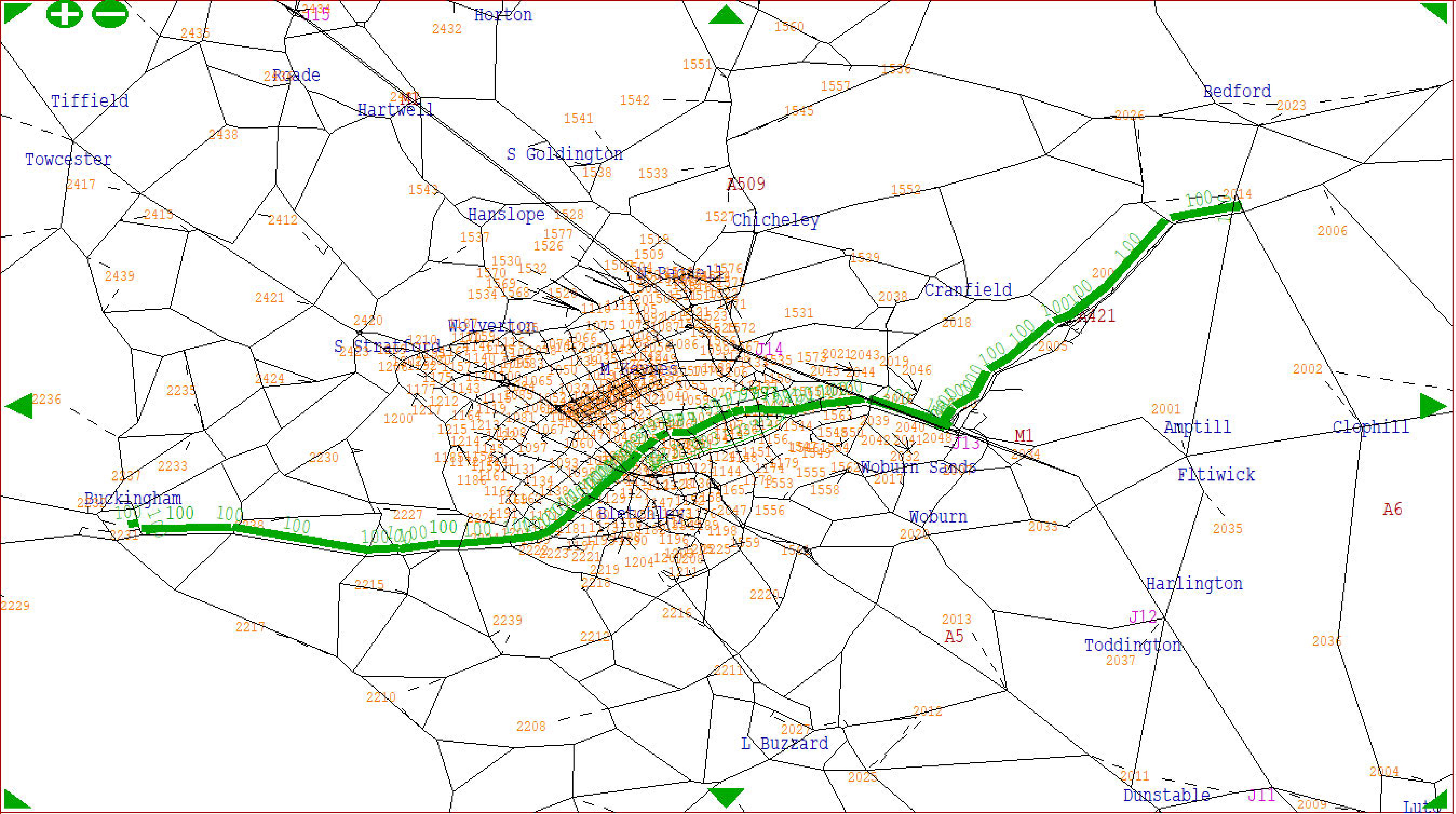
dEstination-
based option >

Spider tree?
No

Q - Return

+ Menu bar!

2016 - PM Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 2231 x
Destin 2014 x

Tij= 2.40

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

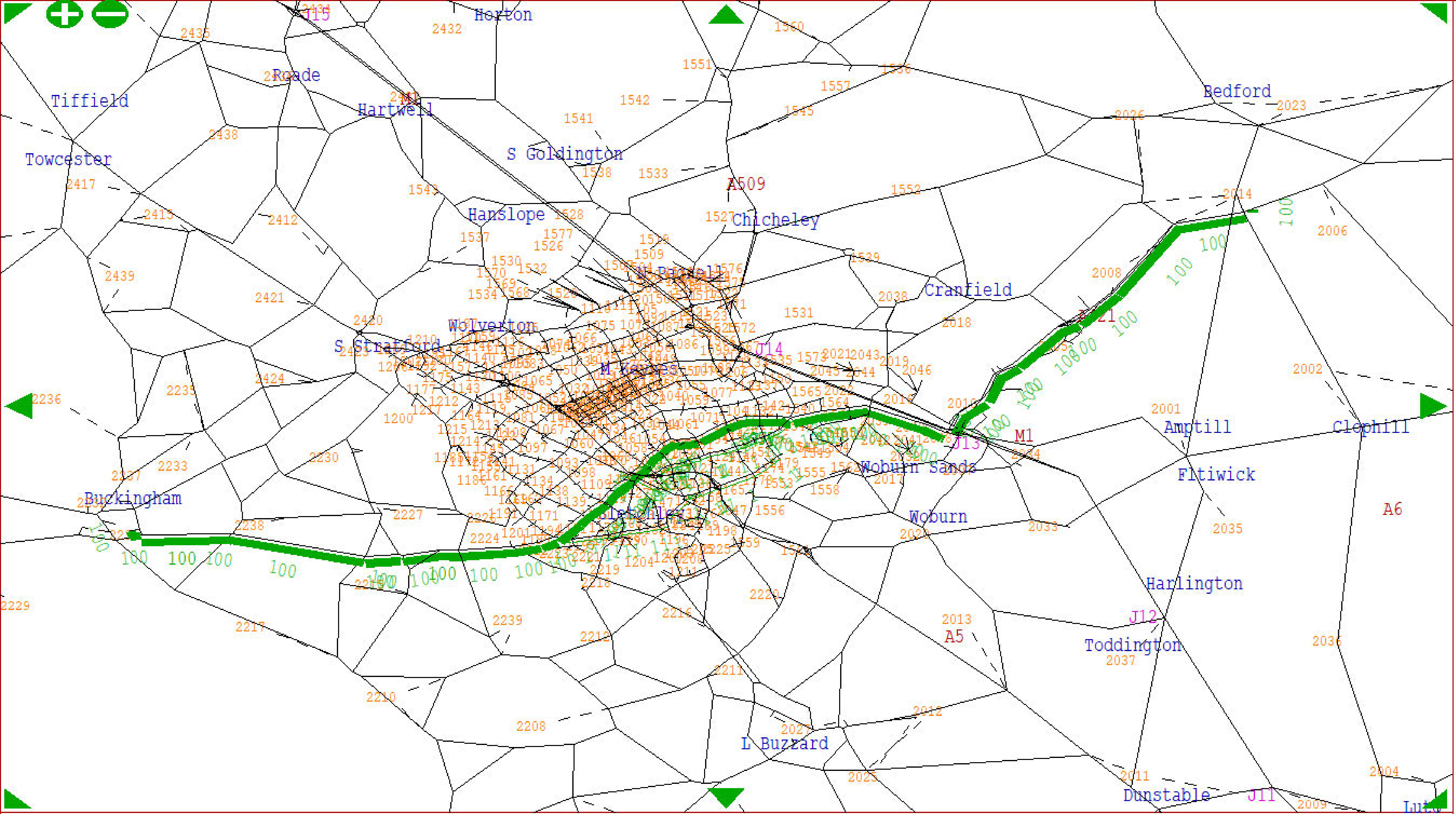
dEstination- >
based option

Spider tree?
No

Q - Return

+ Menu bar!

2016 - PM Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 2014 x
Destin 2231 x

Tij= 5.20

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

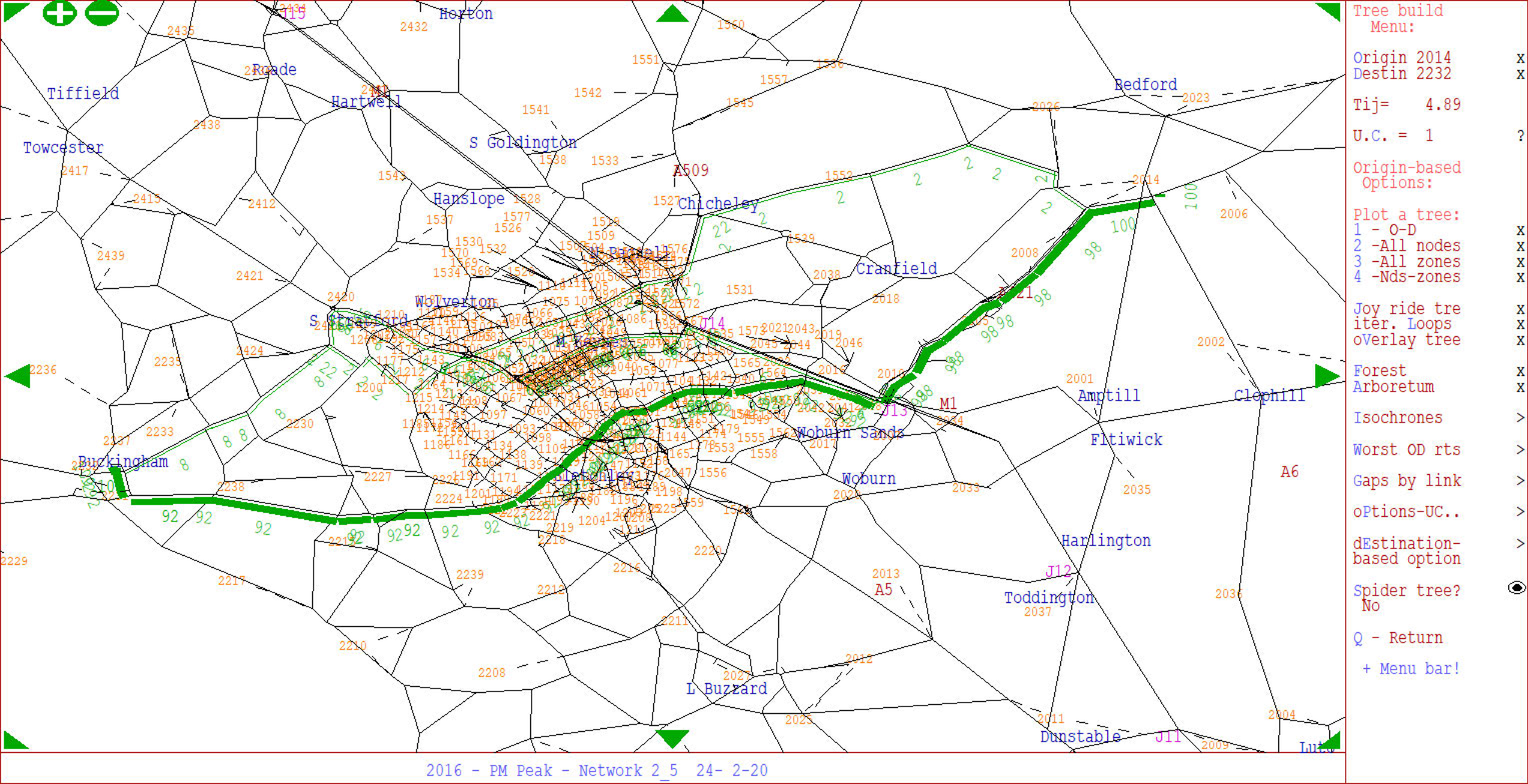
dEstination- >
based option

Spider tree?
No

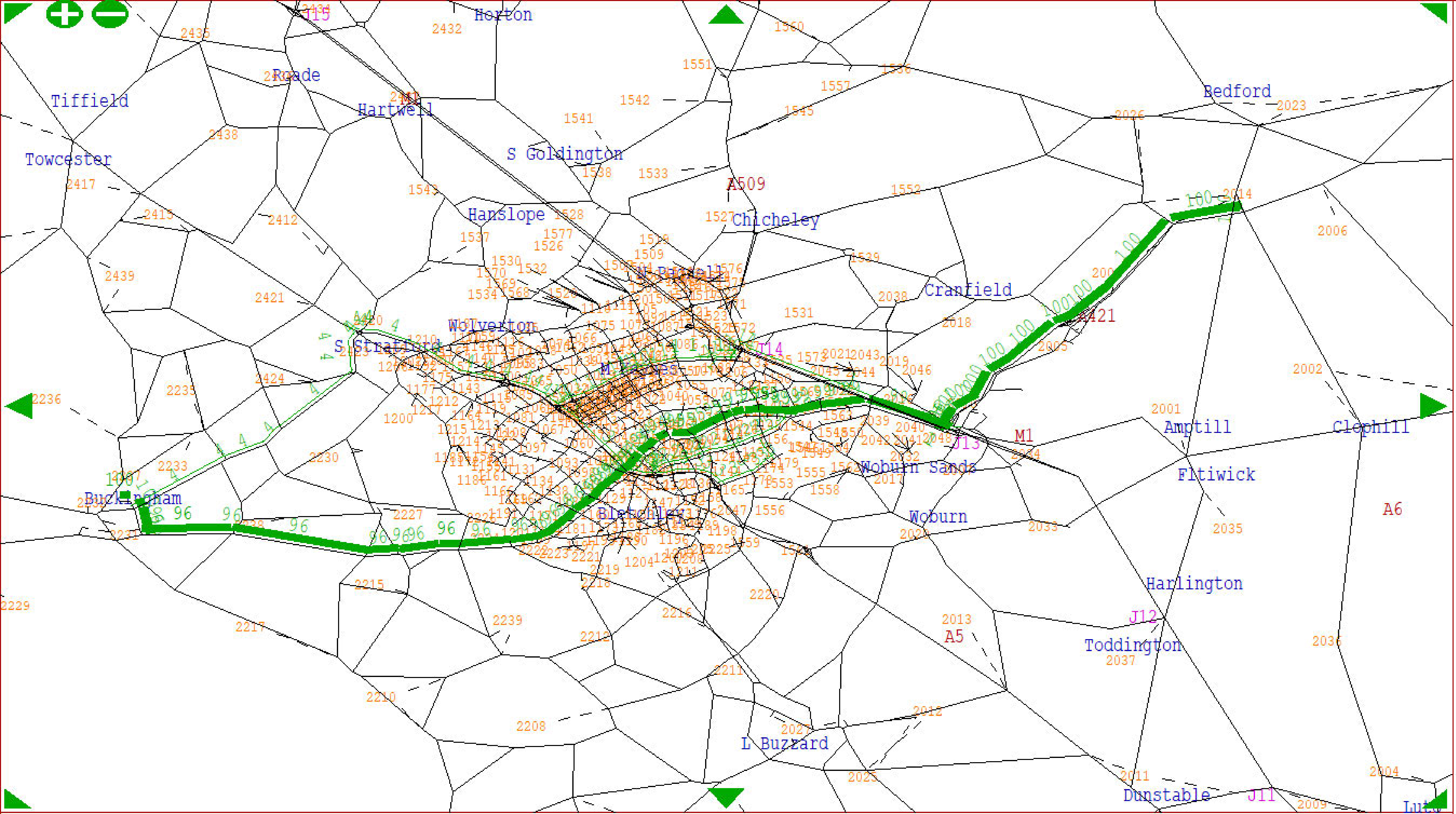
Q - Return

+ Menu bar!

2016 - PM Peak - Network 2_5 24- 2-20



Tree build
Menu:
Origin 2014
Destin 2232
Tij= 4.89
U.C. = 1
Origin-based
Options:
Plot a tree:
1 - O-D
2 -All nodes
3 -All zones
4 -Nds-zones
Joy ride tre
iter. Loops
oVerlay tree
Forest
Arboretum
Isochrones
Worst OD rts
Gaps by link
oPtions-UC..
dEstination-
based option
Spider tree?
No
Q - Return
+ Menu bar!
Horton
Roade
Hartwell
Tiffield
Towcester
S Goldington
A509
Hanslope
Chicheley
Bedford
Cranfield
Wolverton
S Stratford
J14
J13
M1
Amptill
Clophill
Flitwick
Woburn Sands
Woburn
Buckingham
Bletchley
A6
Harlington
J12
Toddington
A5
L Buzzard
Dunstable
J11
2016 - PM Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 2232 x
Destin 2014 x

Tij= 1.74

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

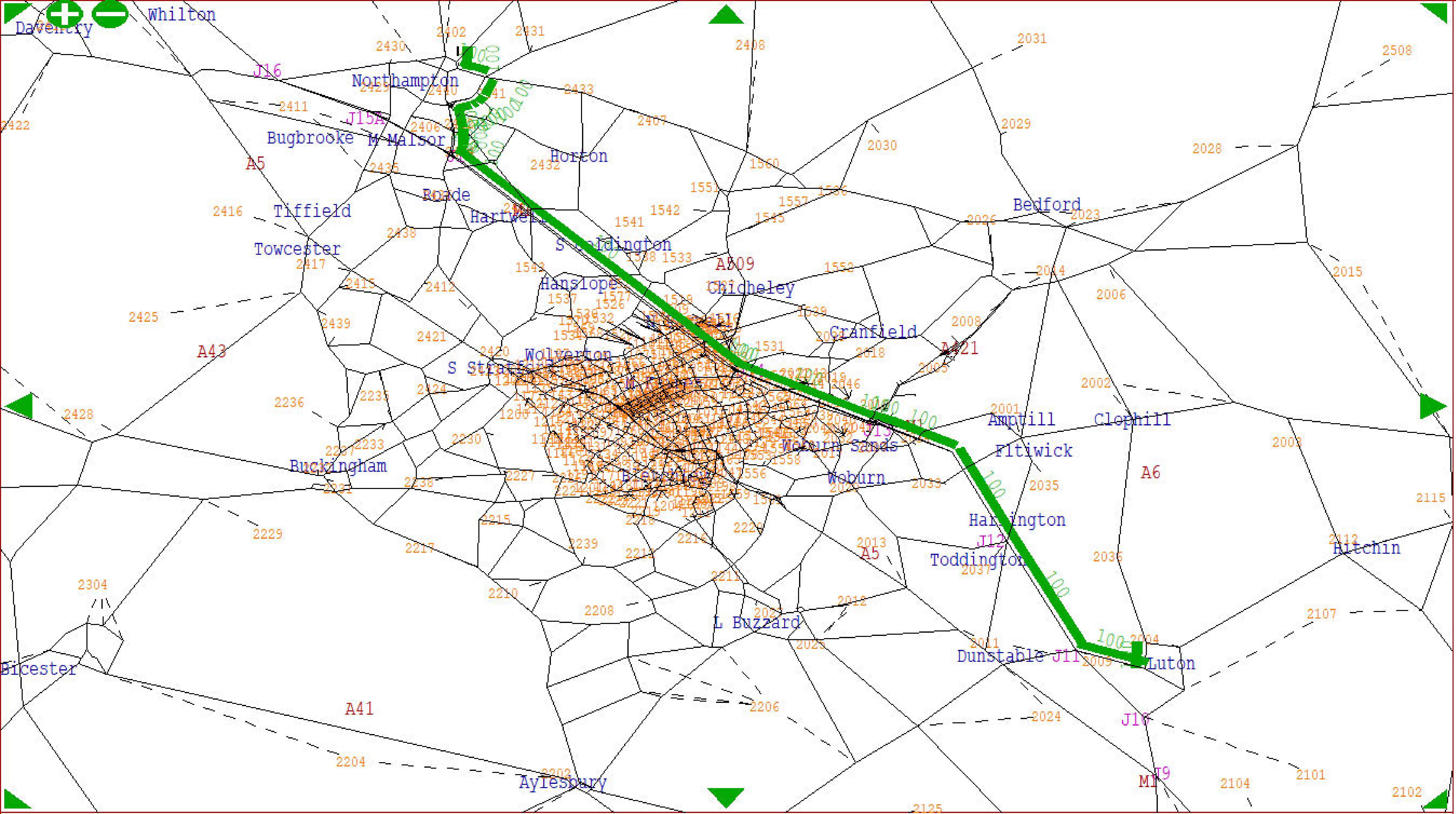
dEstination-
based option >

Spider tree?
No

Q - Return

+ Menu bar!

2016 - PM Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 2402 x
Destin 2004 x

Tij= 3.01

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

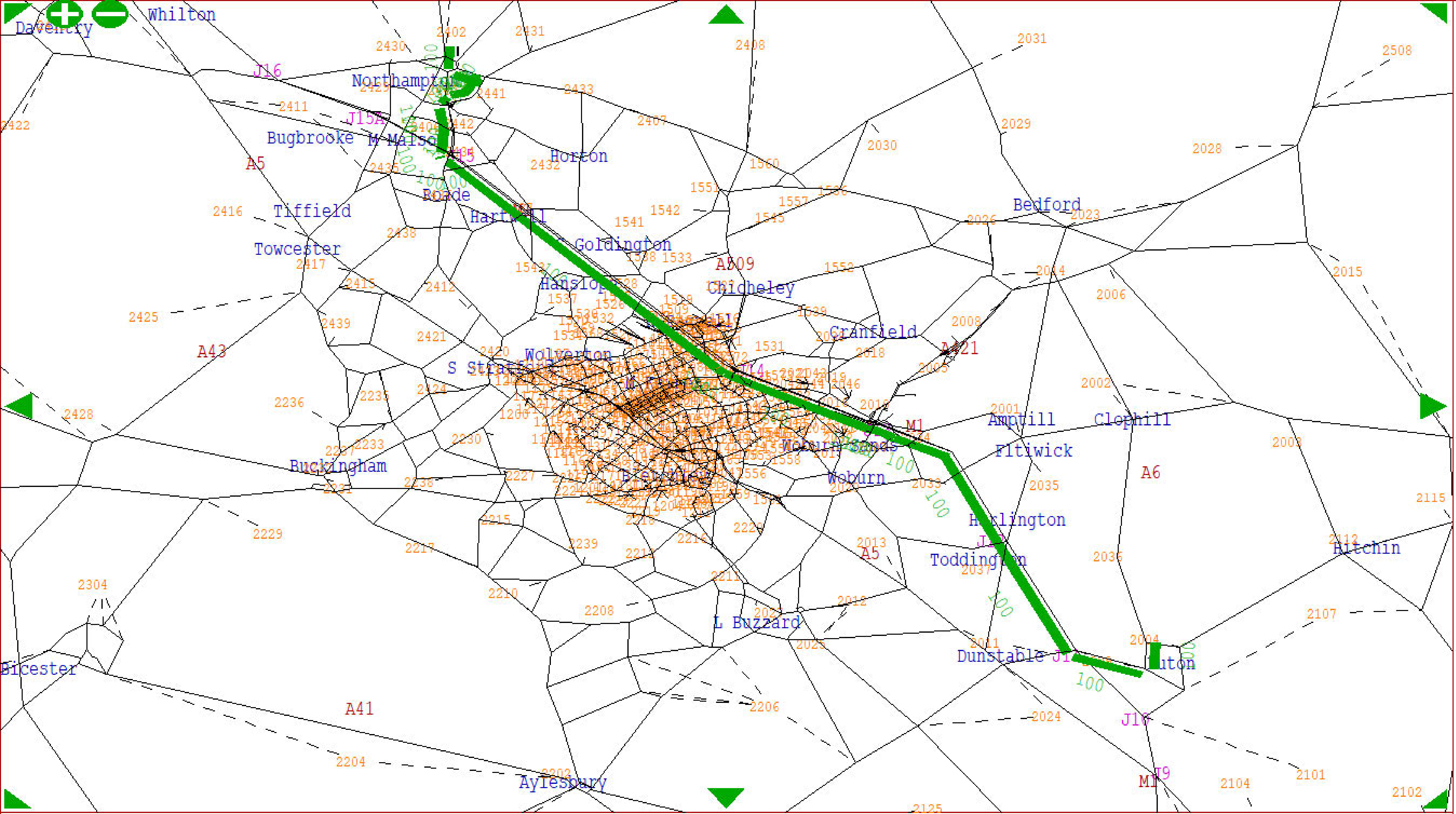
dEstination- >
based option

Spider tree?
No

Q - Return

+ Menu bar!

2016 - PM Peak - Network 2_5 24- 2-20



2016 - PM Peak - Network 2_5 24- 2-20

Tree build Menu:

Origin 2004 x
Destin 2402 x

Tij= 0.80

U.C. = 1 ?

Origin-based Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

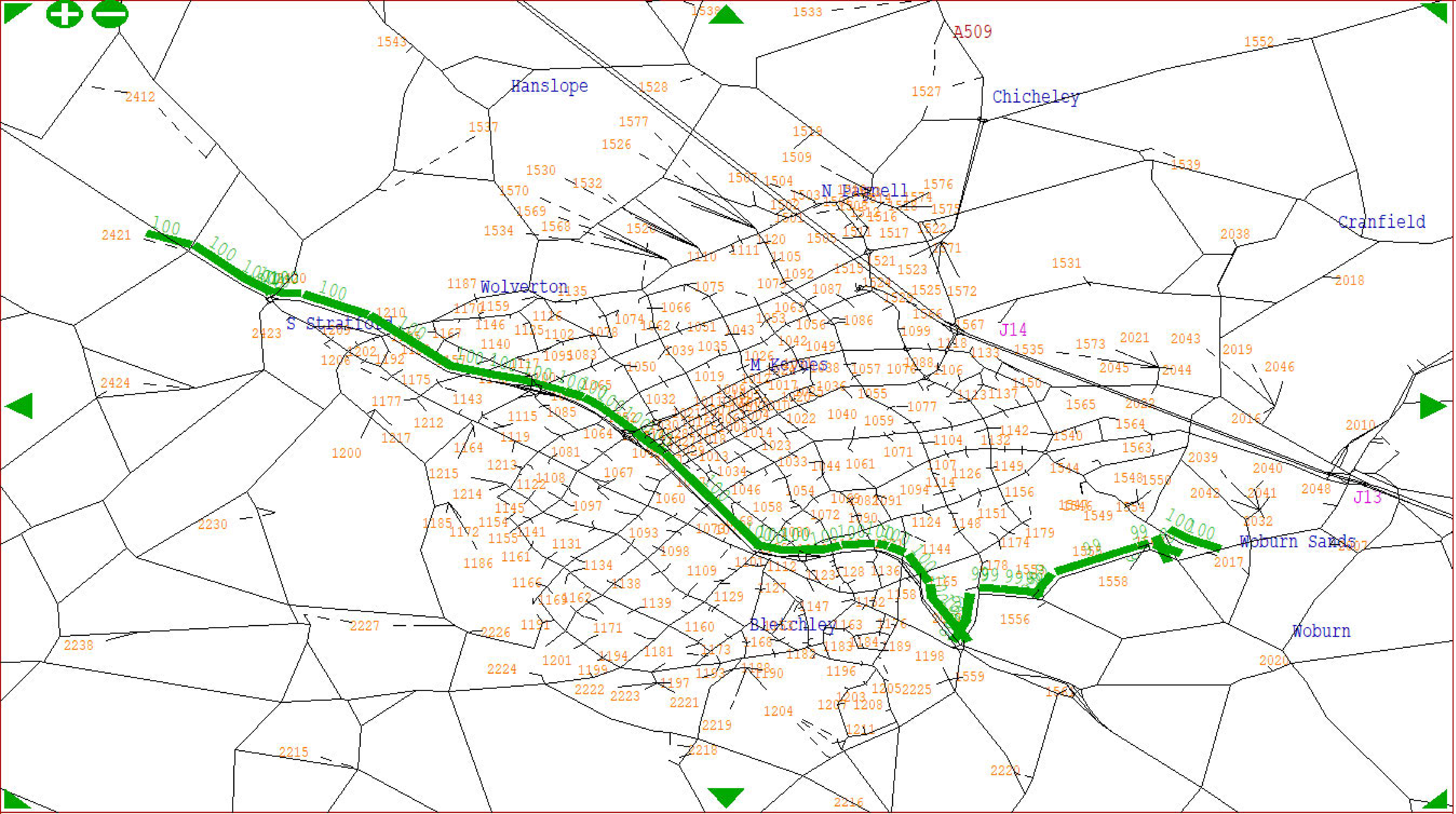
oPtions-UC.. >

dEstination-based option >

Spider tree? No

Q - Return

+ Menu bar!



Tree build
Menu:

Origin 2421 x
Destin 2017 x

Tij = 0.0269

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

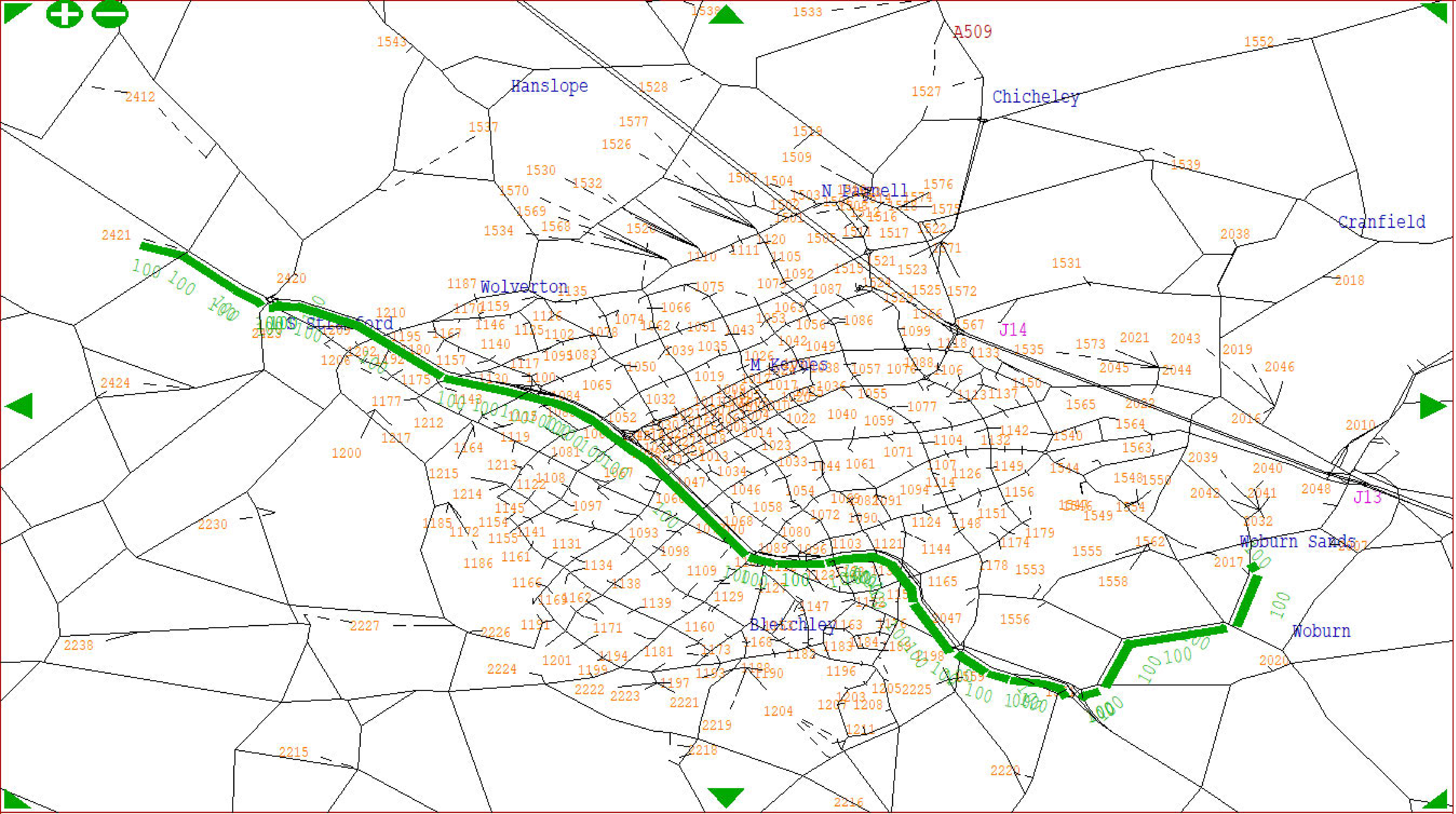
dEstination-
based option >

Spider tree?
No

Q - Return

+ Menu bar!

2016 - PM Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 2017 x
Destin 2421 x

Tij = 0.0783

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

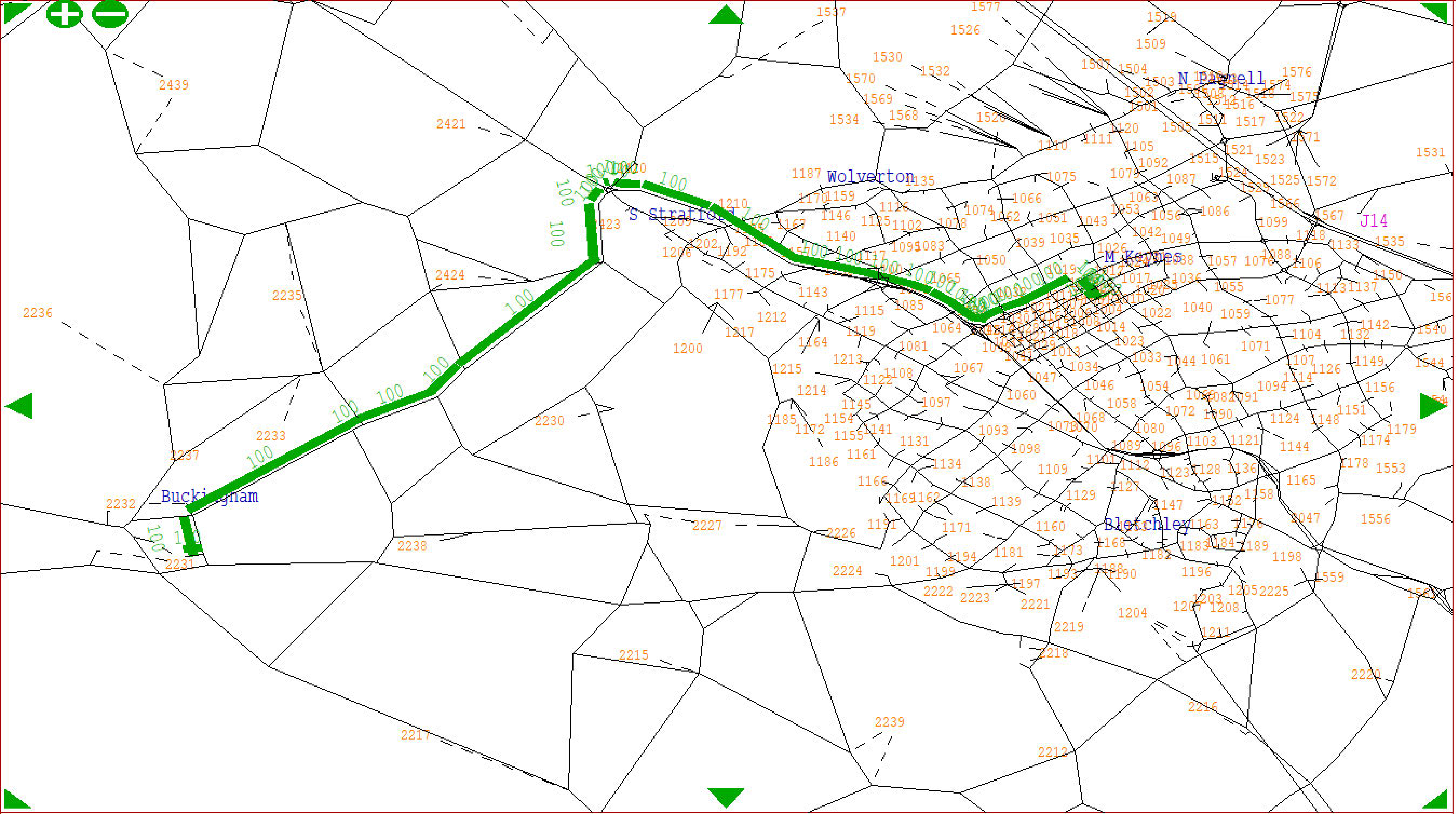
dEstination- >
based option

Spider tree?
No

Q - Return

+ Menu bar!

2016 - PM Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 2231 x
Destin 1001 x

Tij = 0.0491

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

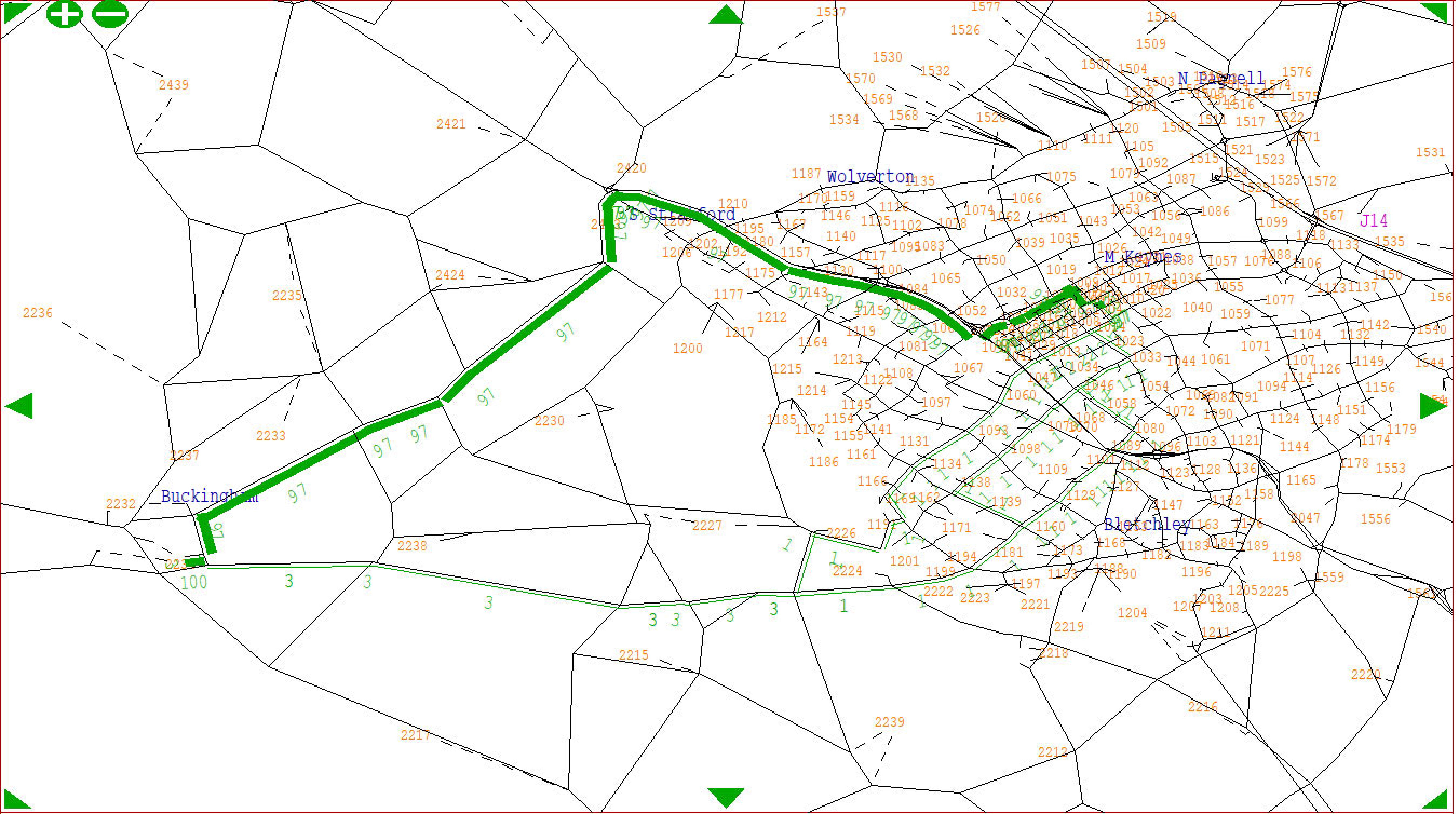
dEstination-
based option >

Spider tree?
No

Q - Return

+ Menu bar!

2016 - PM Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 1001 x
Destin 2231 x

Tij= 0.19

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

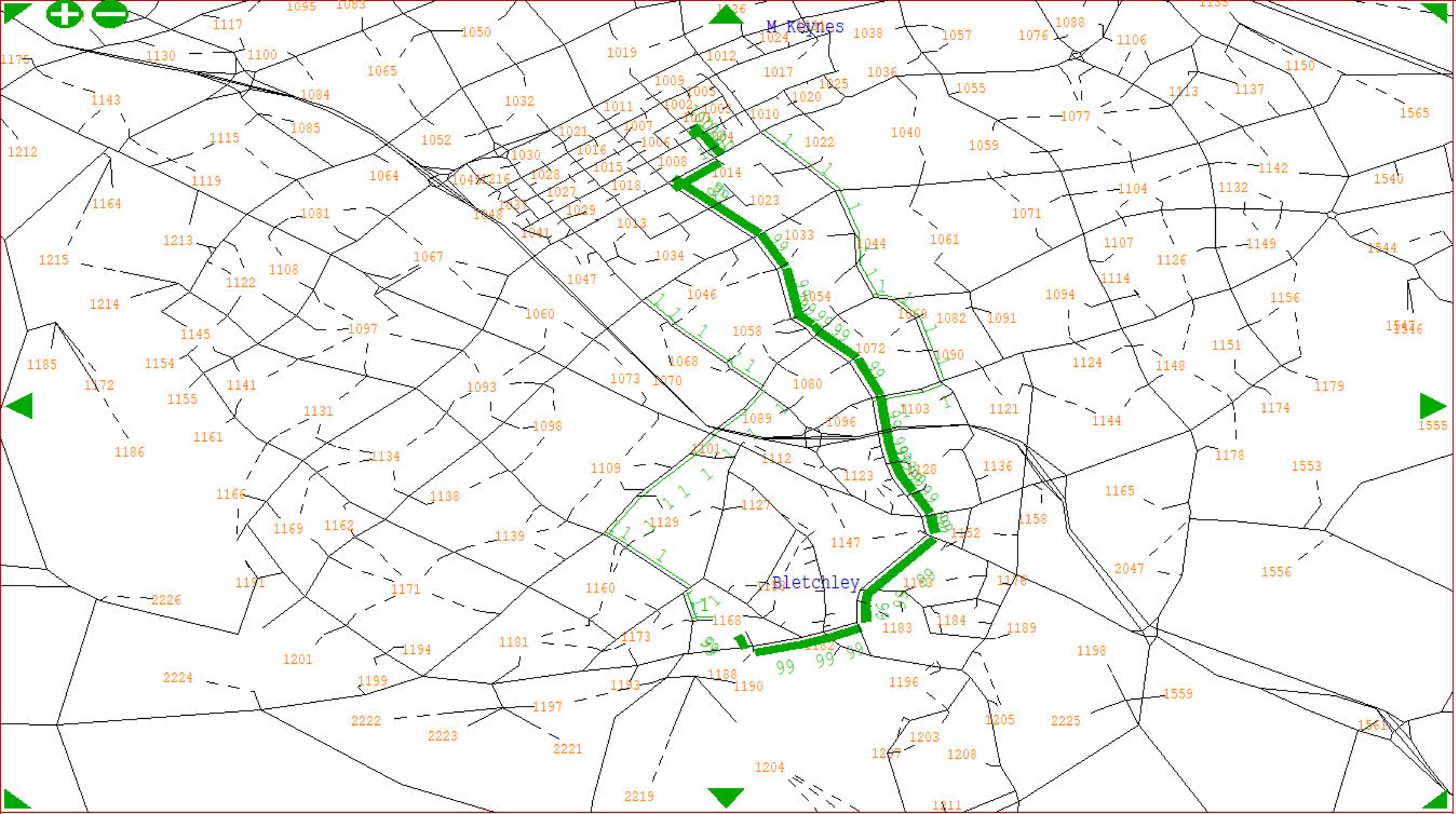
dEstination-
based option >

Spider tree?
No

Q - Return

+ Menu bar!

2016 - PM Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 1001 x
Destin 1168 x

Tij= 0.25

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

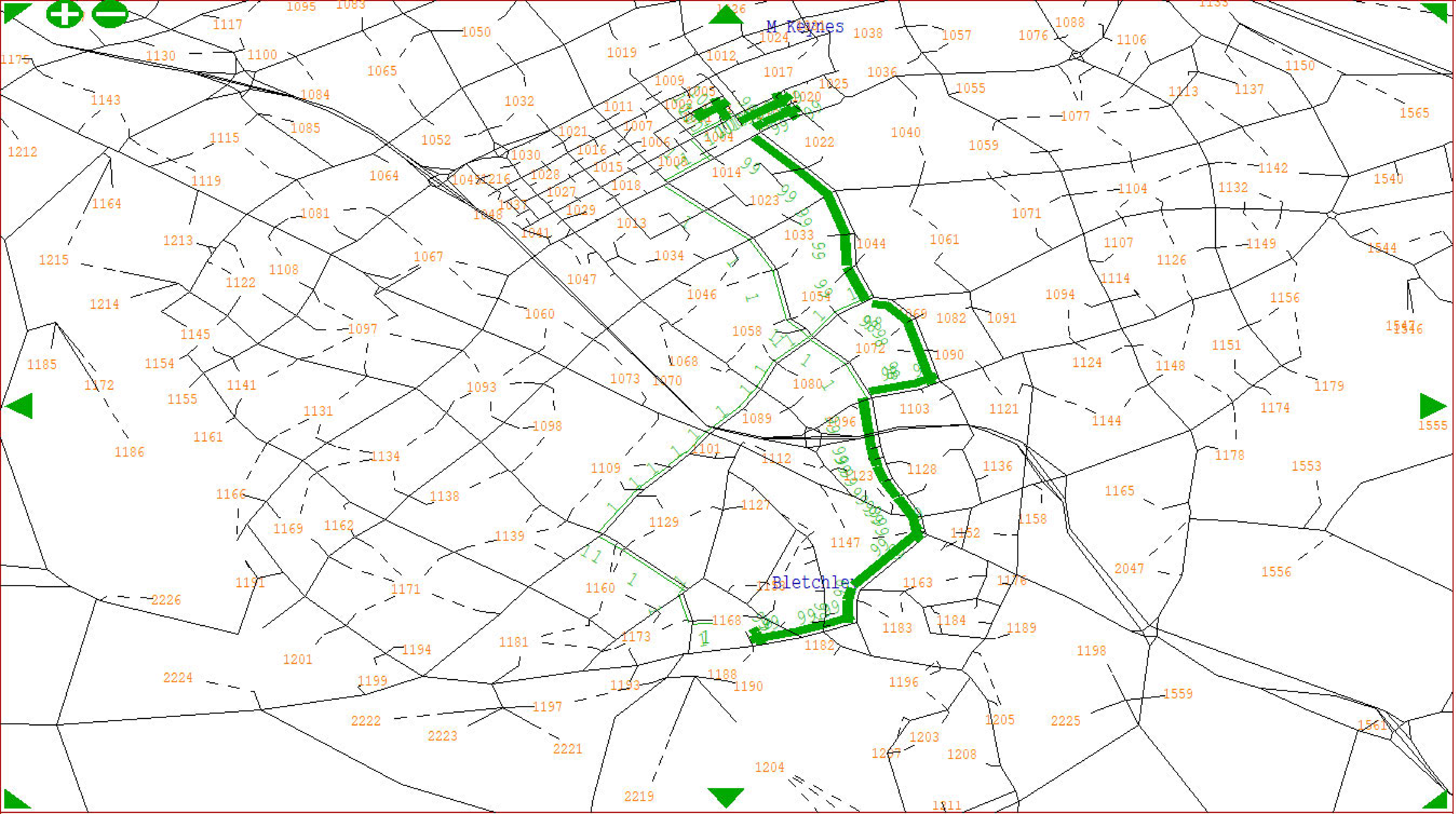
dEstination-
based option >

Spider tree?
No

Q - Return

+ Menu bar!

2016 - PM Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 1168 x
Destin 1001 x

Tij = 0.0216

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

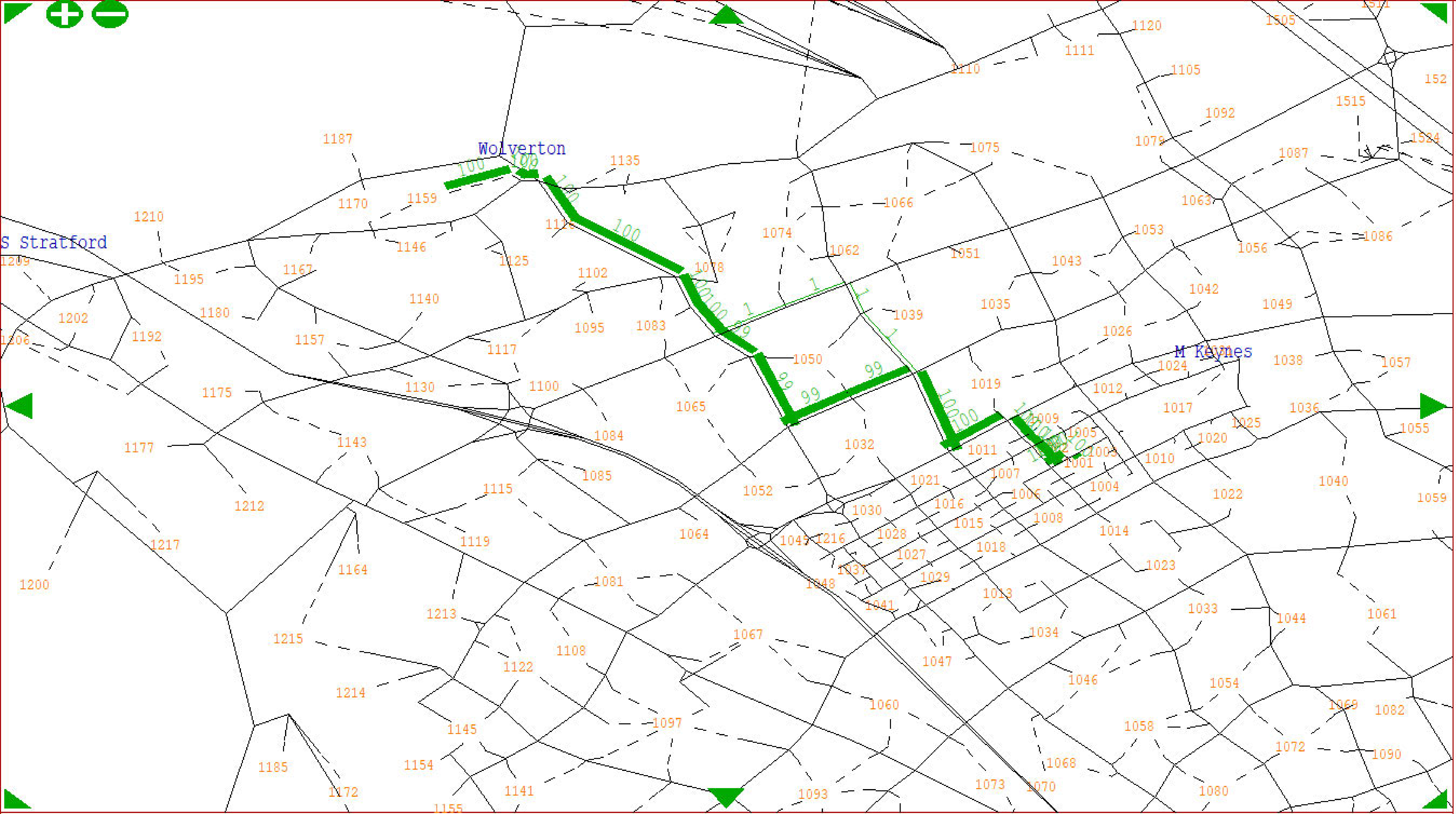
dEstination- >
based option

Spider tree?
No

Q - Return

+ Menu bar!

2016 - PM Peak - Network 2_5 24- 2-20



2016 - PM Peak - Network 2_5 24- 2-20

Tree build
Menu:

Origin 1159 x
Destin 1001 x

Tij = 0.0446

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

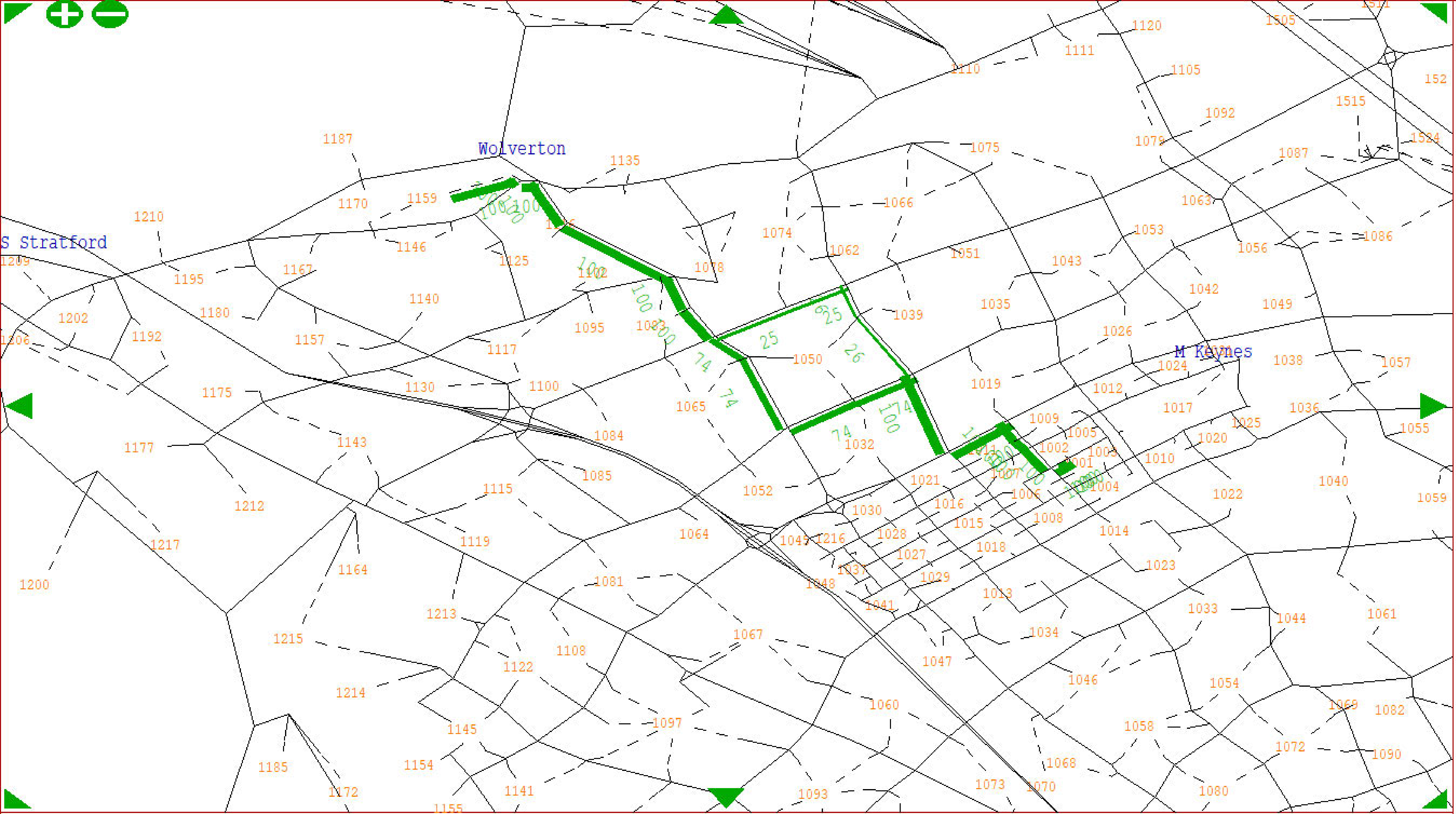
oPtions-UC.. >

dEstination- >
based option

Spider tree?
No

Q - Return

+ Menu bar!



Tree build
Menu:

Origin 1001 x
Destin 1159 x

Tij= 0.15

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

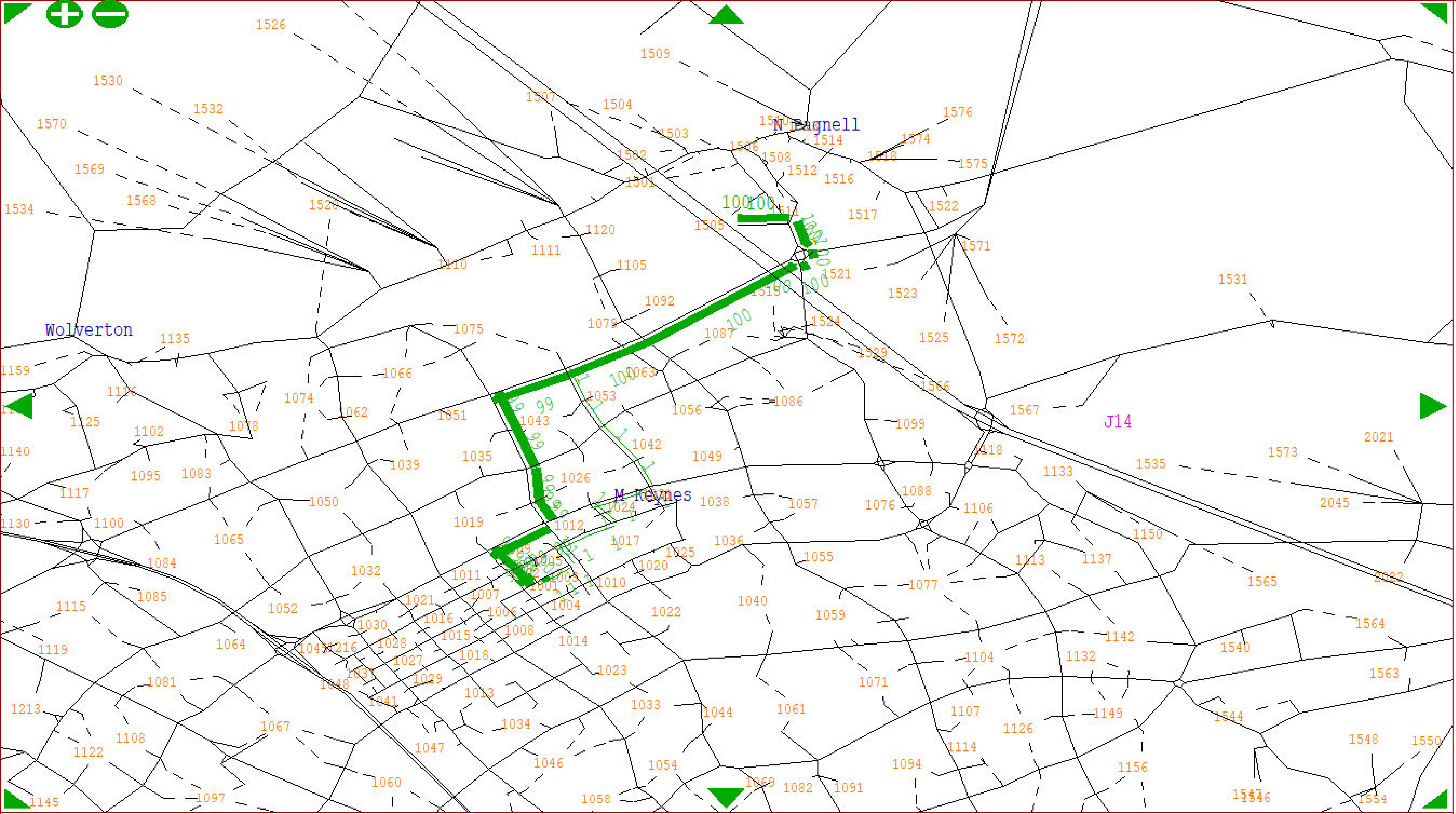
dEstination-
based option >

Spider tree?
No

Q - Return

+ Menu bar!

2016 - PM Peak - Network 2_5 24- 2-20



Tree build
Menu:

Origin 1505 x
Destin 1001 x

Tij = 0.0097

U.C. = 1 ?

Origin-based
Options:

Plot a tree:
1 - O-D x
2 -All nodes x
3 -All zones x
4 -Nds-zones x

Joy ride tre x
iter. Loops x
oVerlay tree x

Forest x
Arboretum x

Isochrones >

Worst OD rts >

Gaps by link >

oPtions-UC.. >

dEstination-
based option >

Spider tree?
No

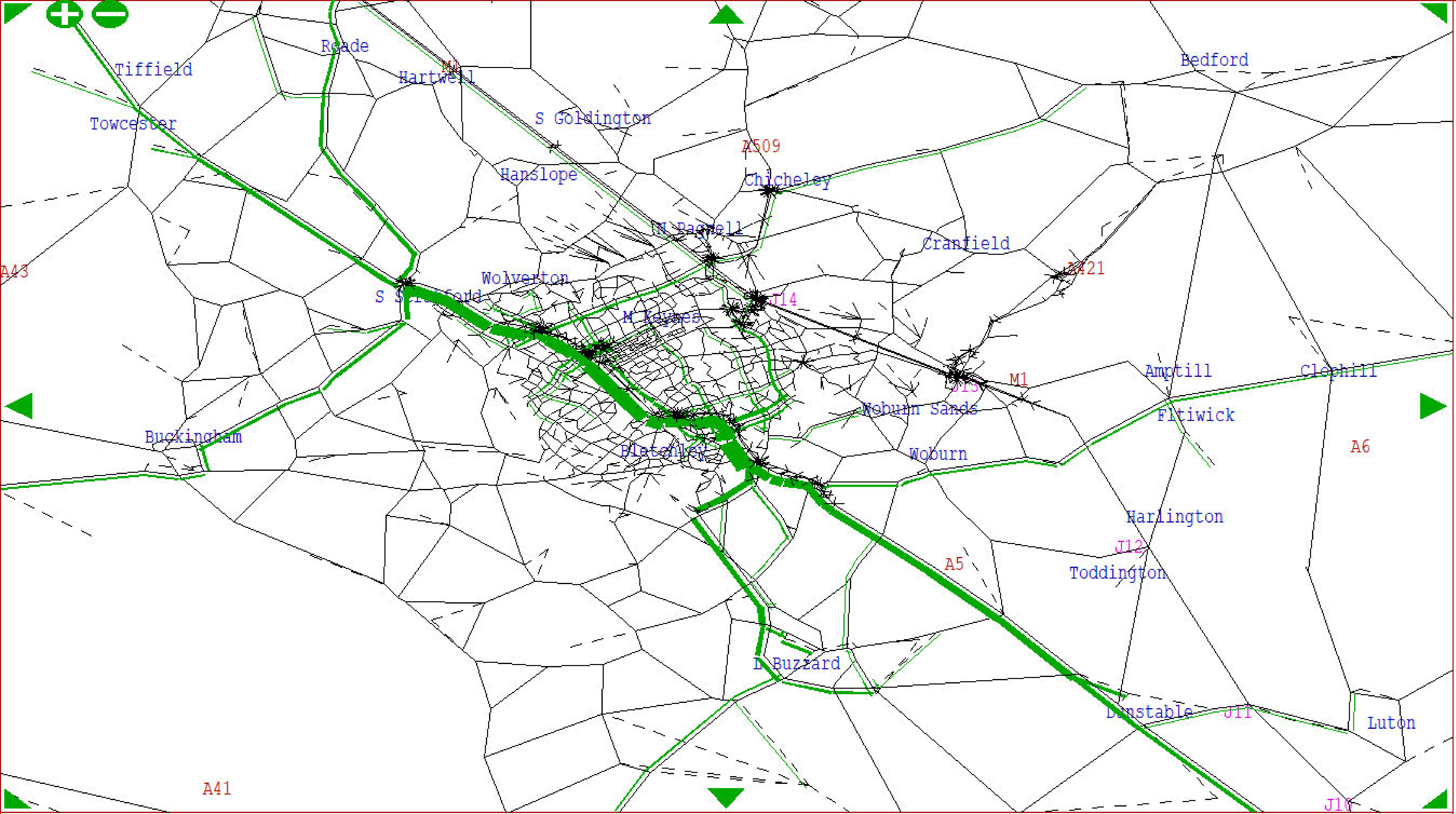
Q - Return

+ Menu bar!

2016 - PM Peak - Network 2_5 24- 2-20

Appendix B:

Route Choice Validation



Selected
Link
Assignment
Thru links:

1701	3116
1702	3113
1703	1704
1704	9333
1860	3111

+ 17 others

Minimum of
1 Crossings

Total Actual
Flow = 3960

Network fixd
Flow = 80

All User Cls

saVe in D.B. x

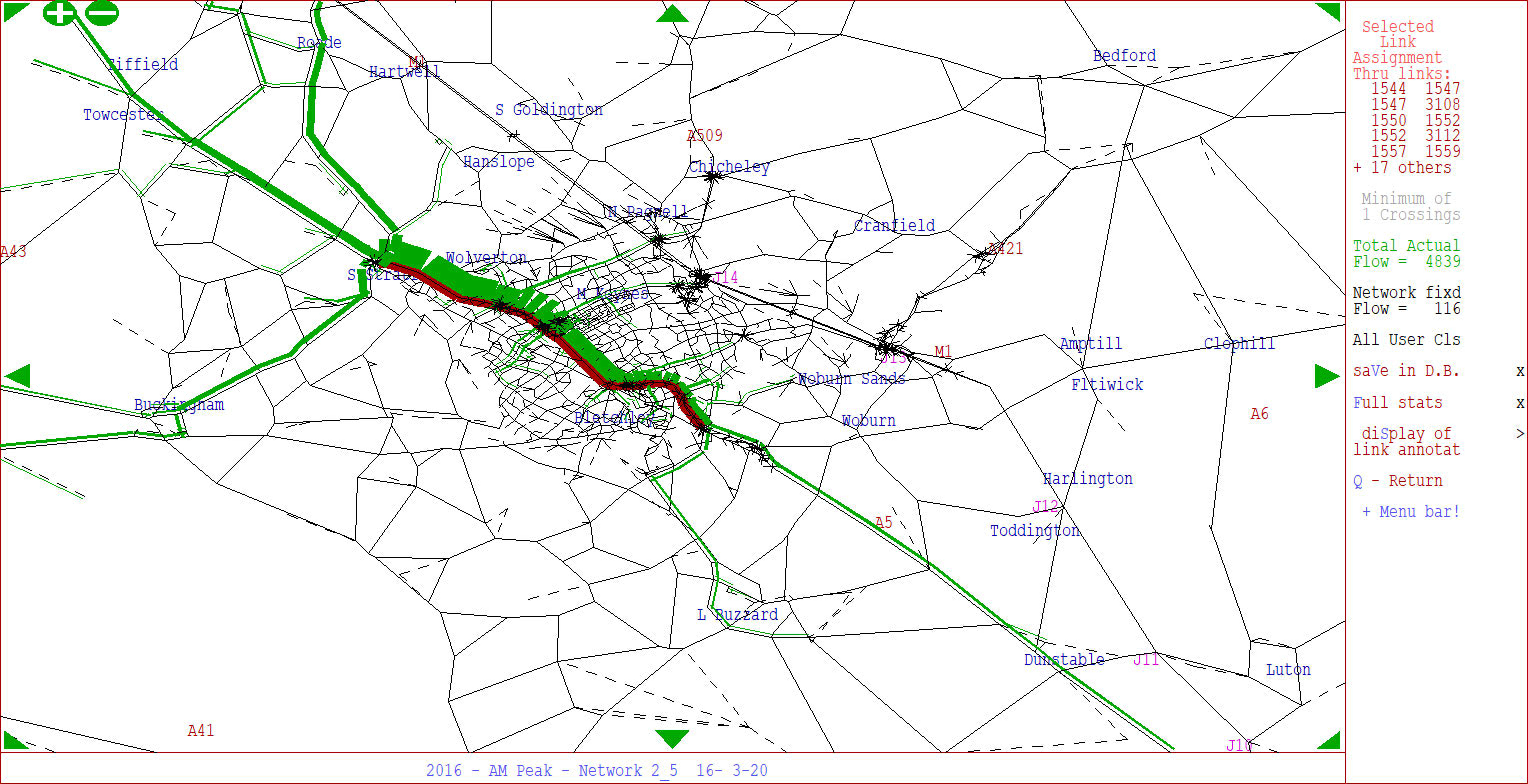
Full stats x

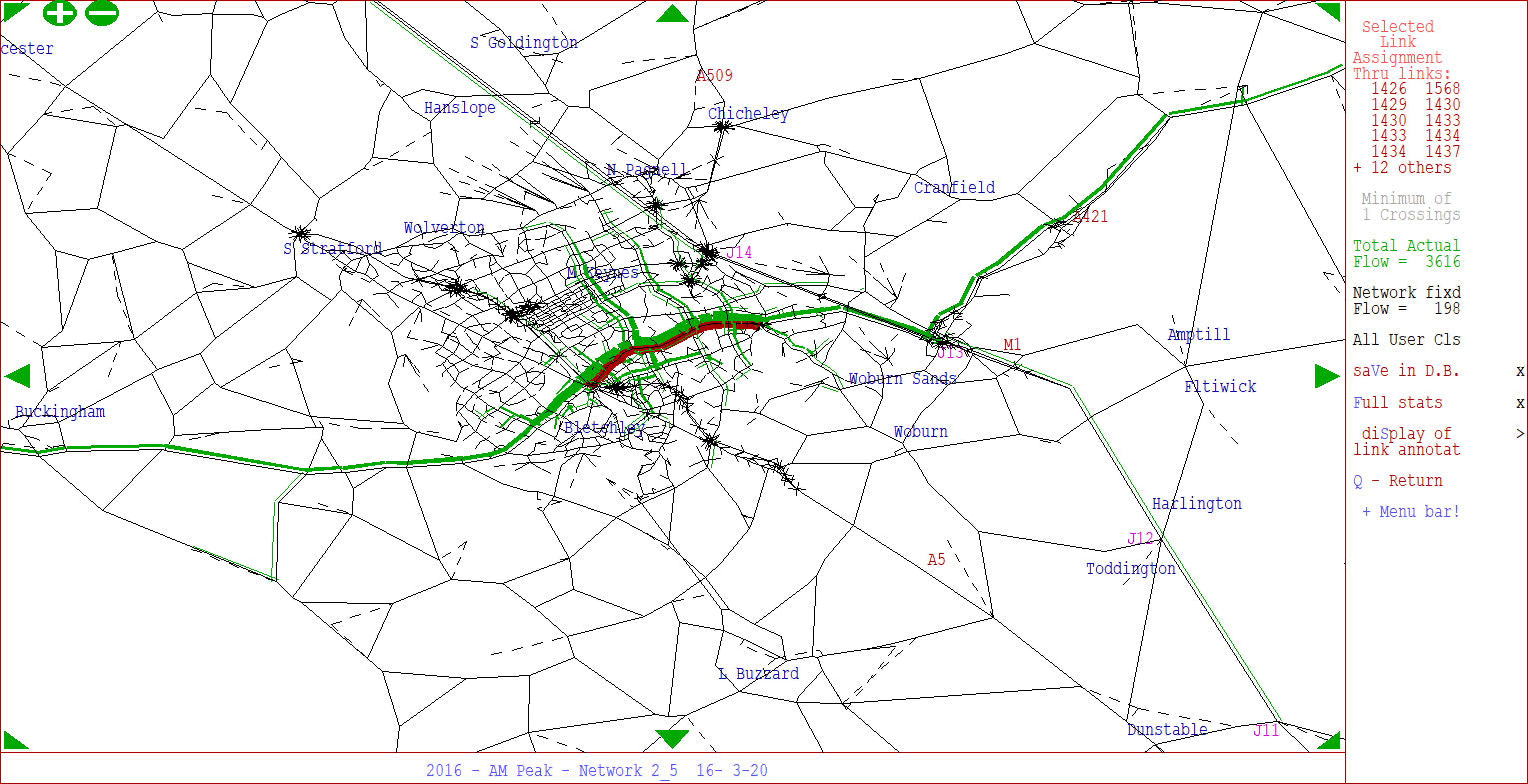
diSplay of
link annotat >

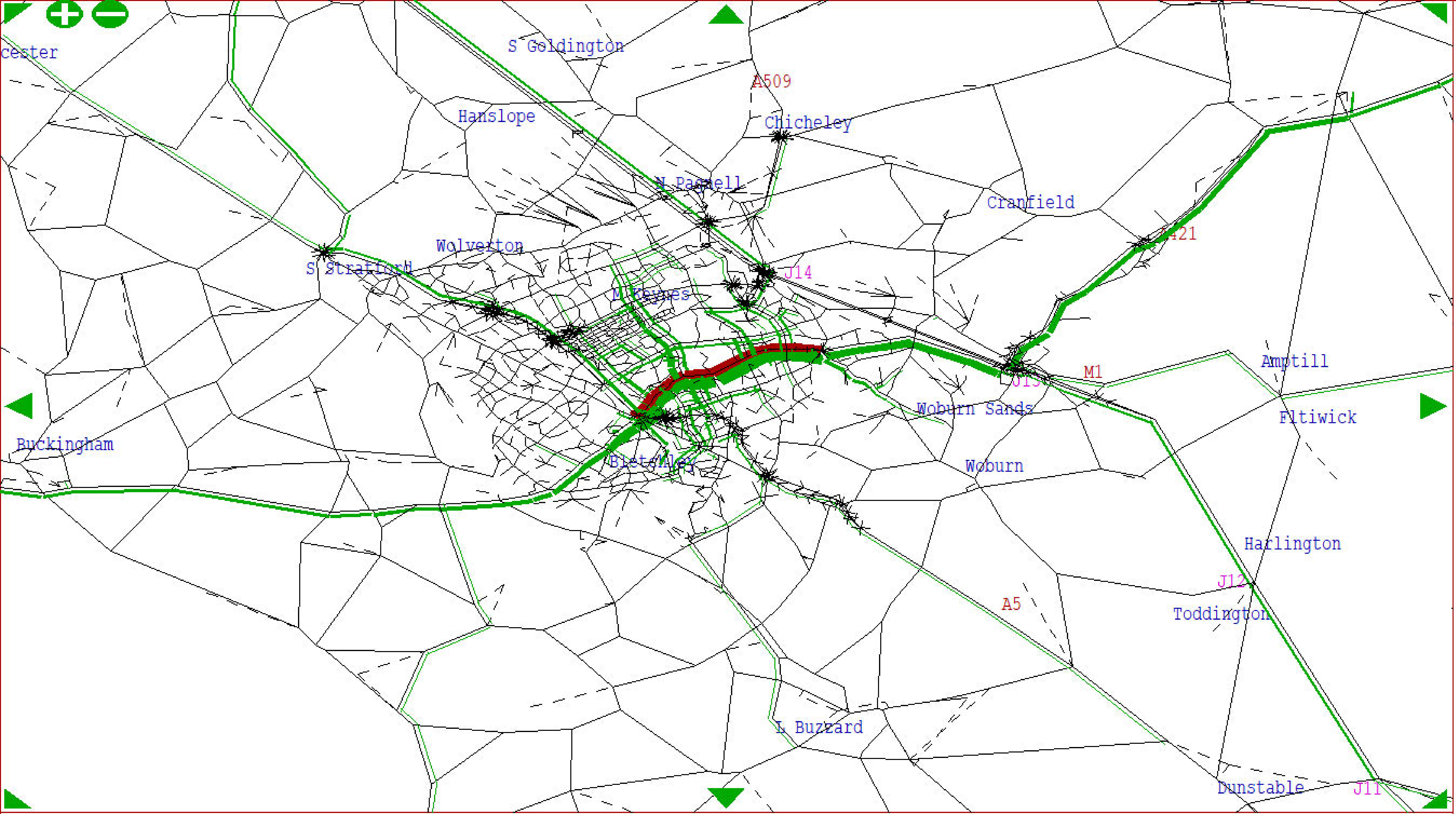
Q - Return

+ Menu bar!

2016 - AM Peak - Network 2_5 16- 3-20


Roade
Hartwell
M1
Towcester
S Goldington
Hanslope
A509
Chicheley
N Pagnell
Cranfield
A421
A43
Wolverton
M Keynes
J14
Bedford
M1
Amptill
Clophill
Woburn Sands
Fltiwick
Buckingham
Bletchley
Woburn
A6
Harlington
J12
Toddington
A5
L Buzzard
Dunstable
J11
Luton
A41
J10
2016 - AM Peak - Network 2_5 16- 3-20
Selected Link Assignment
Thru links:
1544 1547
1547 3108
1550 1552
1552 3112
1557 1559
+ 17 others
Minimum of 1 Crossings
Total Actual Flow = 4839
Network fixd Flow = 116
All User Cls
saVe in D.B. x
Full stats x
diSplay of link annotat >
Q - Return
+ Menu bar!


cester
S Goldington
A509
Hanslope
Chicheley
N Pagnell
Cranfield
A421
Wolverton
S Stratford
J14
M Keynes
M1
J13
Amptill
Woburn Sands
Fltiwick
Buckingham
Bletchley
Woburn
Harlington
J12
A5
Toddington
L Buzzard
Dunstable
J11
Selected
Link
Assignment
Thru links:
1426 1568
1429 1430
1430 1433
1433 1434
1434 1437
+ 12 others
Minimum of
1 Crossings
Total Actual
Flow = 3616
Network fixd
Flow = 198
All User Cls
saVe in D.B. x
Full stats x
diSplay of
link annotat >
Q - Return
+ Menu bar!
2016 - AM Peak - Network 2_5 16- 3-20



Selected
Link
Assignment
Thru links:

1429	1568
1430	1429
1433	1430
1434	1433
1437	1434

+ 12 others

Minimum of
1 Crossings

Total Actual
Flow = 4303

Network fixd
Flow = 230

All User Cls

saVe in D.B. x

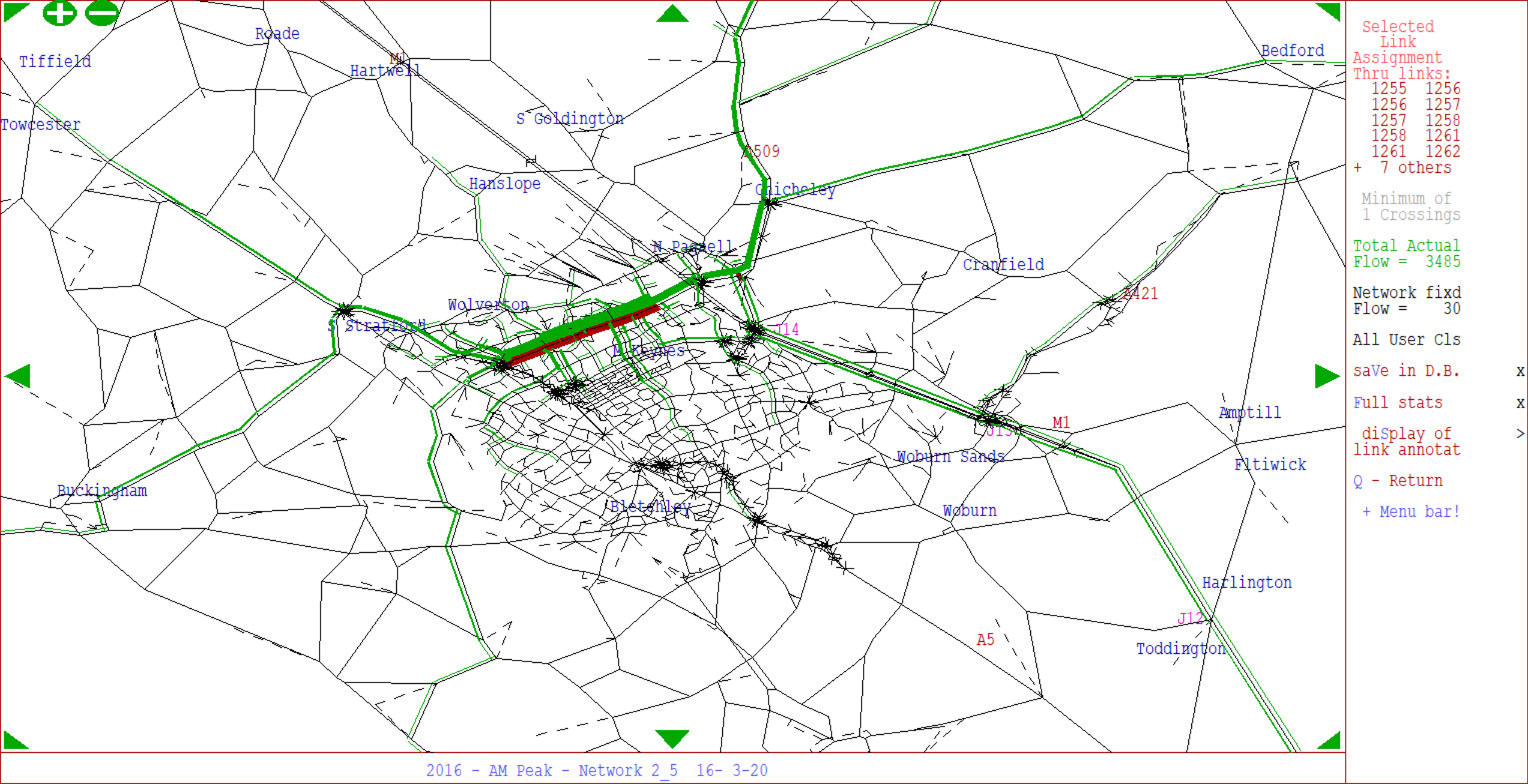
Full stats x

disPlay of
link annotat >

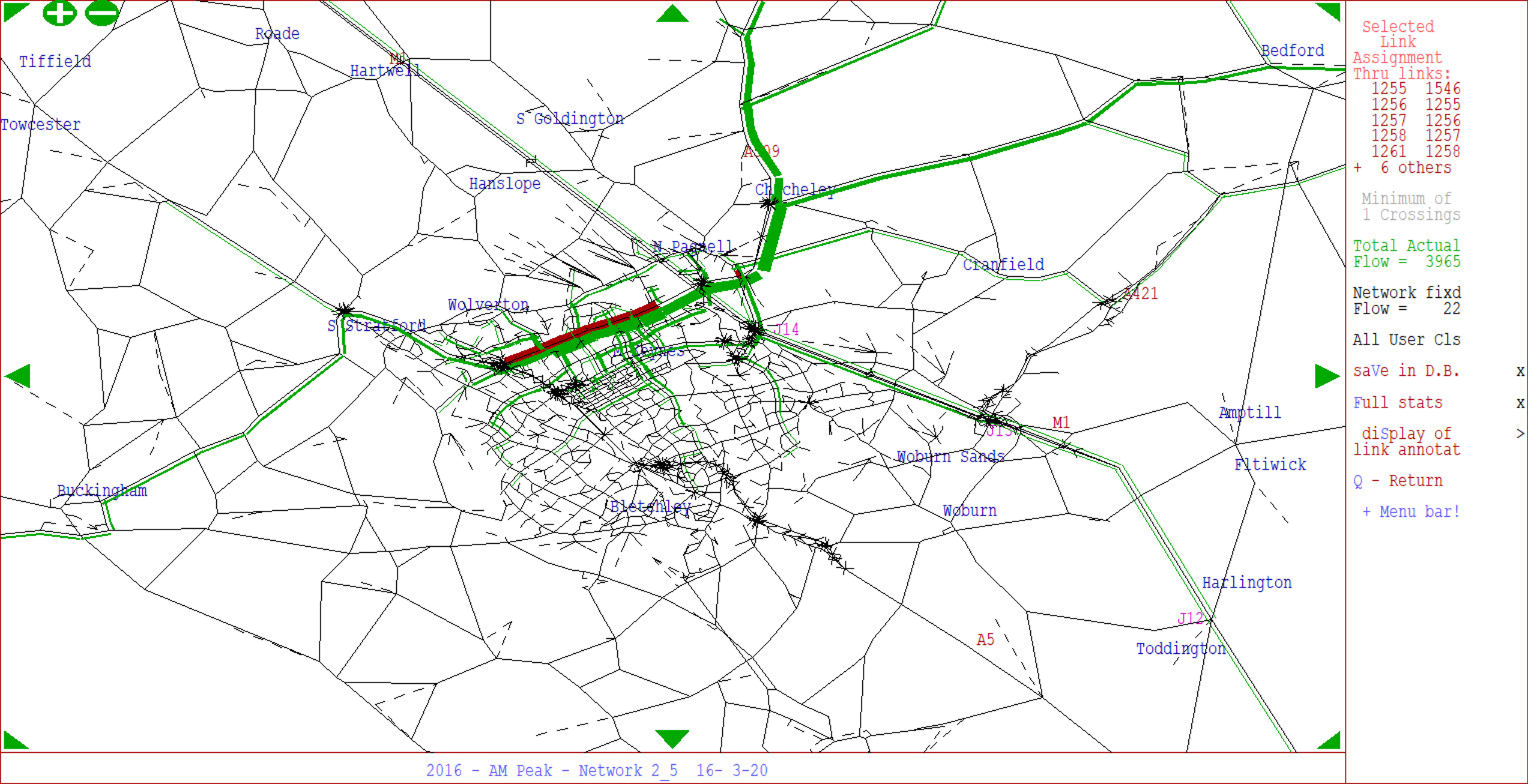
Q - Return

+ Menu bar!

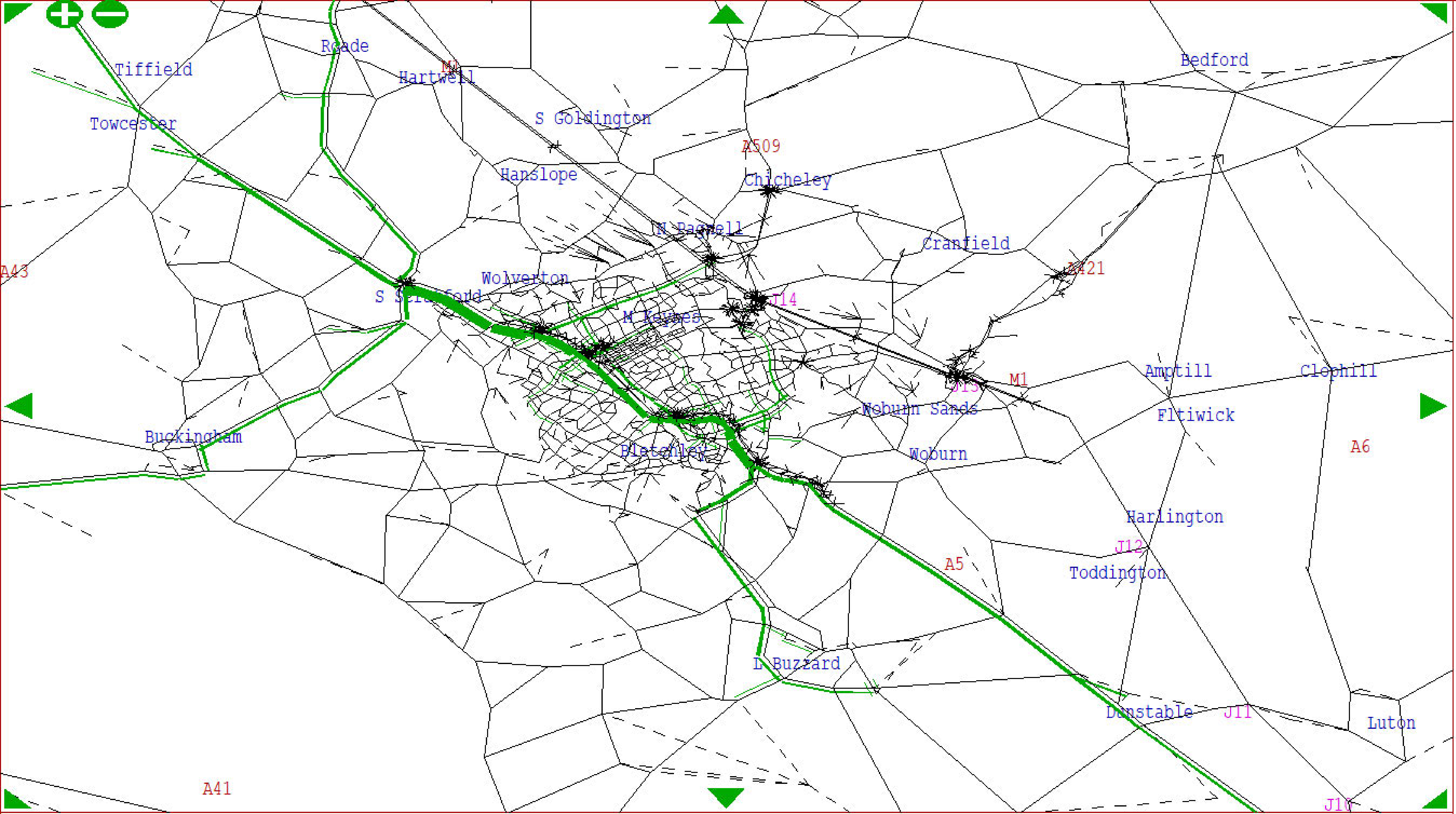
2016 - AM Peak - Network 2_5 16- 3-20



Tiffield
Roade
M1
Hartwell
Towcester
S Goldington
A509
Hanslope
Chicheley
N Pagnell
Cranfield
Bedford
A421
Wolverton
S Stratford
M Keynes
J14
M1
J13
Woburn Sands
Amptill
Fltiwick
Buckingham
Bletchley
Woburn
Harlington
J12
A5
Toddington
Selected Link Assignment Thru links:
1255 1256
1256 1257
1257 1258
1258 1261
1261 1262
+ 7 others
Minimum of 1 Crossings
Total Actual Flow = 3485
Network fixd Flow = 30
All User Cls
saVe in D.B. x
Full stats x
diSplay of link annotat >
Q - Return
+ Menu bar!
2016 - AM Peak - Network 2_5 16- 3-20



Roade
Tiffield
M1
Hartwell
Towcester
S Goldington
Hanslope
N Pagnell
Cranfield
Wolverton
S Stratford
J14
A421
Bedford
Amptill
M1
Woburn Sands
Fltiwick
Buckingham
Bletchley
Woburn
Harlington
J12
A5
Toddington
Selected
Link
Assignment
Thru links:
1255 1546
1256 1255
1257 1256
1258 1257
1261 1258
+ 6 others
Minimum of
1 Crossings
Total Actual
Flow = 3965
Network fixd
Flow = 22
All User Cls
saVe in D.B. x
Full stats x
diSplay of
link annotat >
Q - Return
+ Menu bar!
2016 - AM Peak - Network 2_5 16- 3-20



Selected Link Assignment
Thru links:

1701	3116
1702	3113
1703	1704
1704	9333
1860	3111

+ 17 others

Minimum of 1 Crossings

Total Actual Flow = 2567

Network fixd Flow = 98

All User Cls

saVe in D.B. x

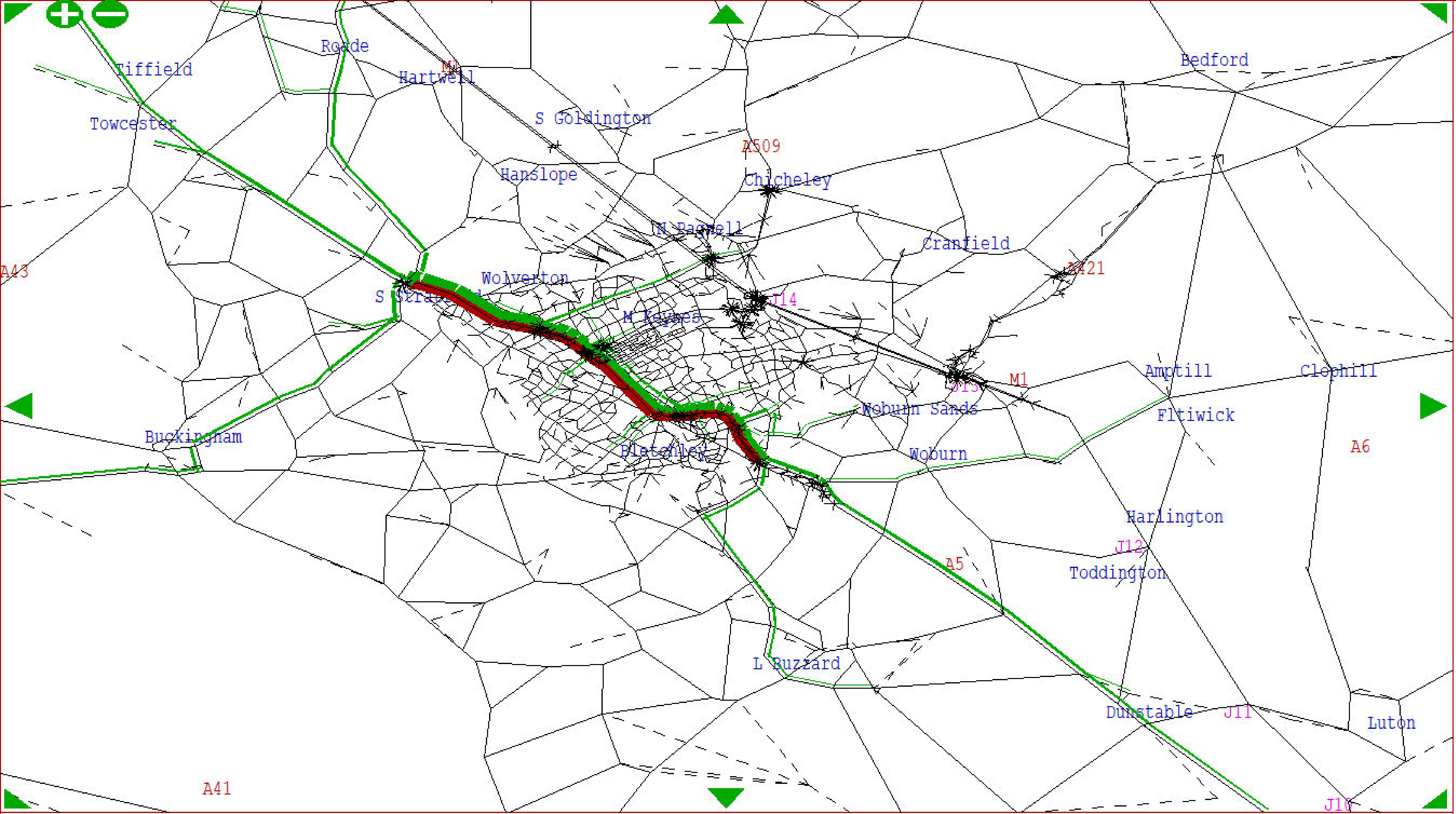
Full stats x

diSplay of link annotat >

Q - Return

+ Menu bar!

2016 - Inter-Peak - Network 2_5 16- 3-20



Selected
Link
Assignment
Thru links:

1544	1547
1547	3108
1550	1552
1552	3112
1557	1559

+ 17 others

Minimum of
1 Crossings

Total Actual
Flow = 2273

Network fixd
Flow = 98

All User Cls

saVe in D.B. x

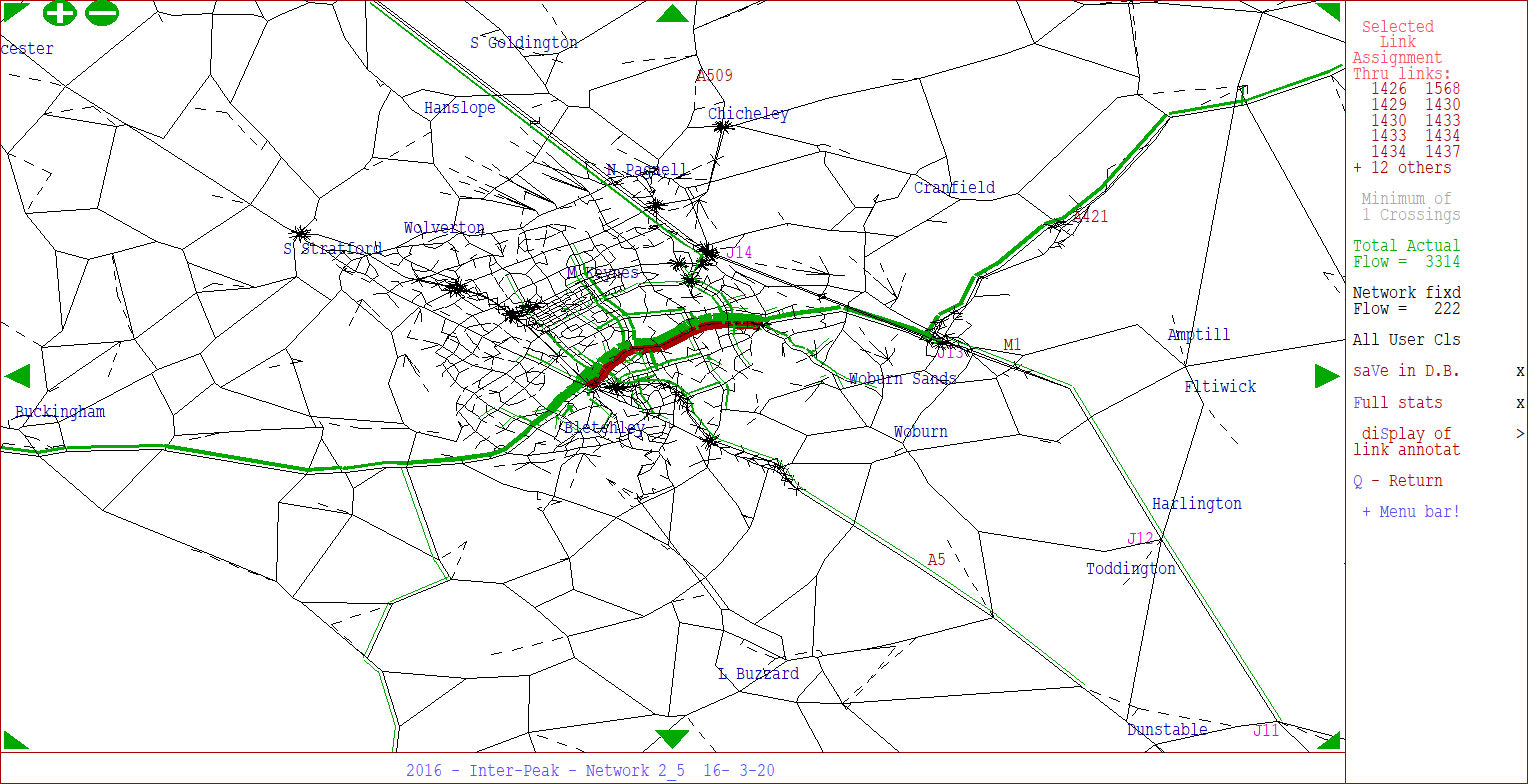
Full stats x

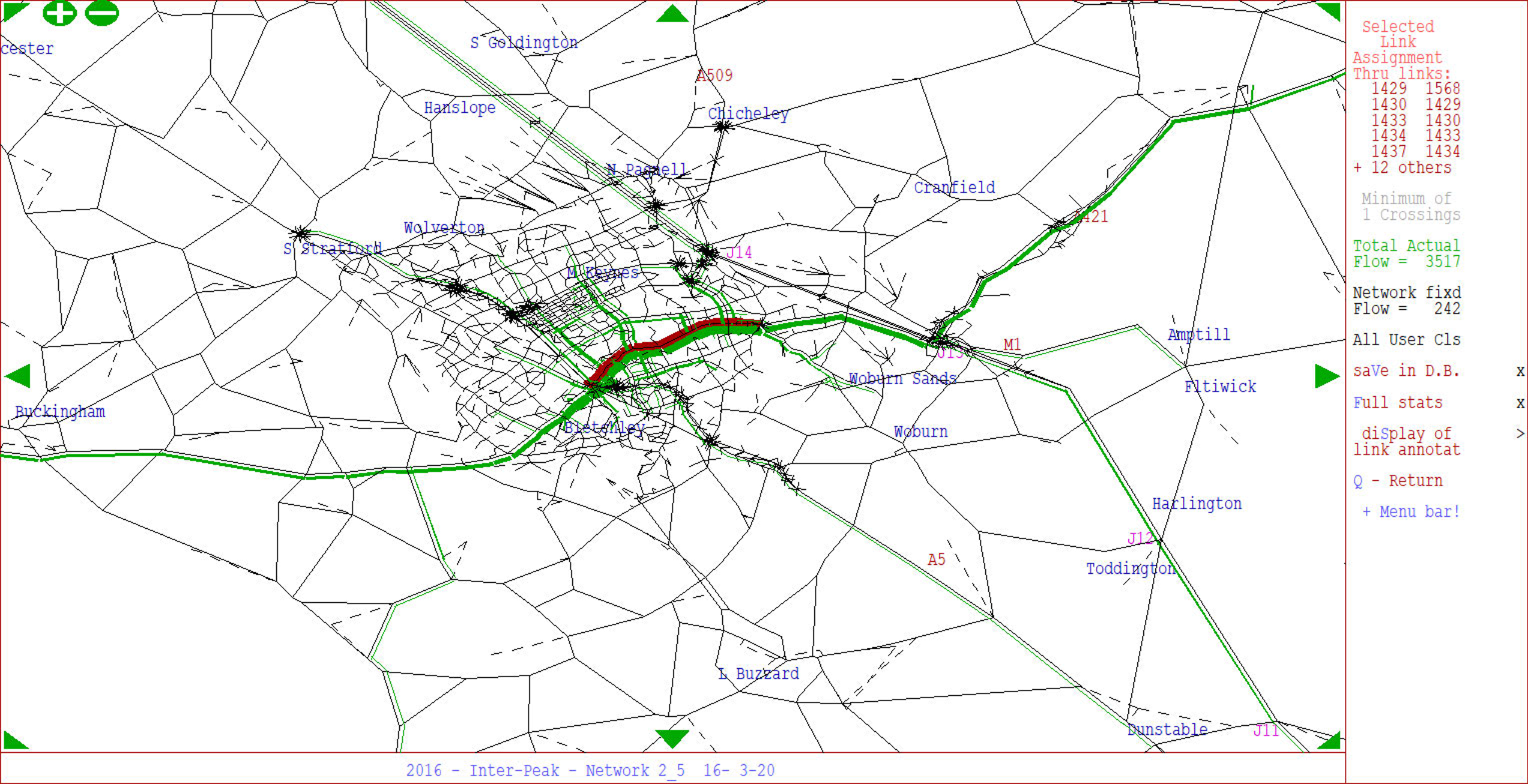
diSplay of
link annotat >

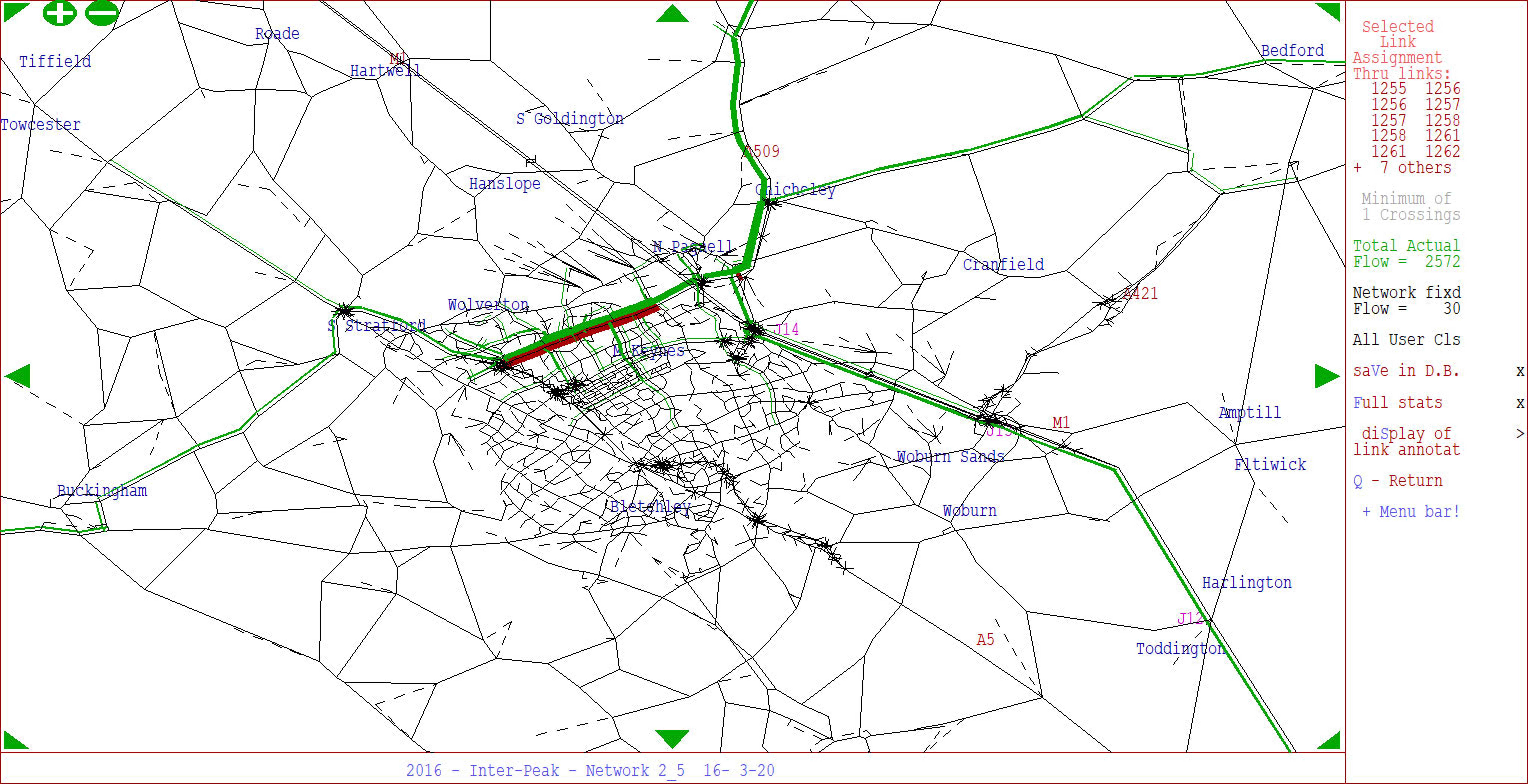
Q - Return

+ Menu bar!

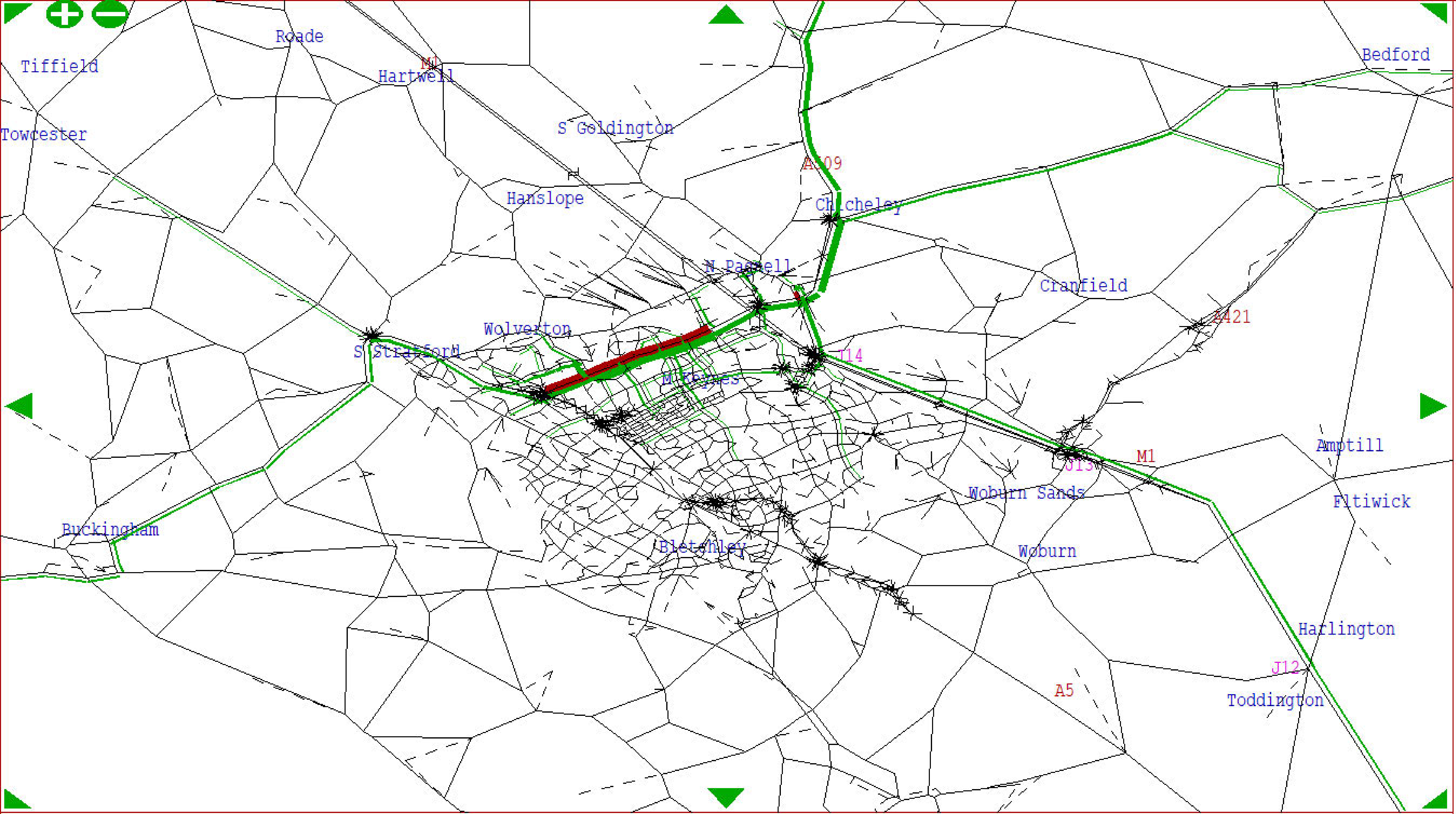
2016 - Inter-Peak - Network 2_5 16- 3-20


cester
S Goldington
A509
Hanslope
Chicheley
N Pagnell
Cranfield
A421
Wolverton
S Stratford
J14
M Keynes
M1
J13
Amptill
Woburn Sands
Fltiwick
Buckingham
Woburn
Bletchley
Harlington
J12
A5
Toddington
L Buzzard
Dunstable
J11
Selected
Link
Assignment
Thru links:
1426 1568
1429 1430
1430 1433
1433 1434
1434 1437
+ 12 others
Minimum of
1 Crossings
Total Actual
Flow = 3314
Network fixd
Flow = 222
All User Cls
saVe in D.B. x
Full stats x
diSplay of
link annotat >
Q - Return
+ Menu bar!
2016 - Inter-Peak - Network 2_5 16- 3-20


cester
S Goldington
A509
Hanslope
Chicheley
N Pagnell
Cranfield
A421
Wolverton
S Stratford
J14
M Keynes
M1
J13
Amptill
Woburn Sands
Fltiwick
Buckingham
Bletchley
Woburn
Harlington
J12
A5
Toddington
L Buzzard
Dunstable
J11
Selected
Link
Assignment
Thru links:
1429 1568
1430 1429
1433 1430
1434 1433
1437 1434
+ 12 others
Minimum of
1 Crossings
Total Actual
Flow = 3517
Network fixd
Flow = 242
All User Cls
saVe in D.B. x
Full stats x
diSplay of
link annotat >
Q - Return
+ Menu bar!
2016 - Inter-Peak - Network 2_5 16- 3-20



Roade
Tiffield
M1
Hartwell
Towcester
S Goldington
A509
Hanslope
Chicheley
N Pagnell
Cranfield
A421
Wolverton
S Stratford
M Keynes
J14
Bedford
M1
Amptill
Woburn Sands
Fltiwick
Buckingham
Bletchley
Woburn
Harlington
J12
A5
Toddington
Selected Link Assignment
Thru links:
1255 1256
1256 1257
1257 1258
1258 1261
1261 1262
+ 7 others
Minimum of 1 Crossings
Total Actual Flow = 2572
Network fixd Flow = 30
All User Cls
saVe in D.B. x
Full stats x
diSplay of link annotat >
Q - Return
+ Menu bar!
2016 - Inter-Peak - Network 2_5 16- 3-20



Selected
Link
Assignment
Thru links:

1255	1546
1256	1255
1257	1256
1258	1257
1261	1258

+ 6 others

Minimum of
1 Crossings

Total Actual
Flow = 2543

Network fixd
Flow = 22

All User Cls

saVe in D.B. x

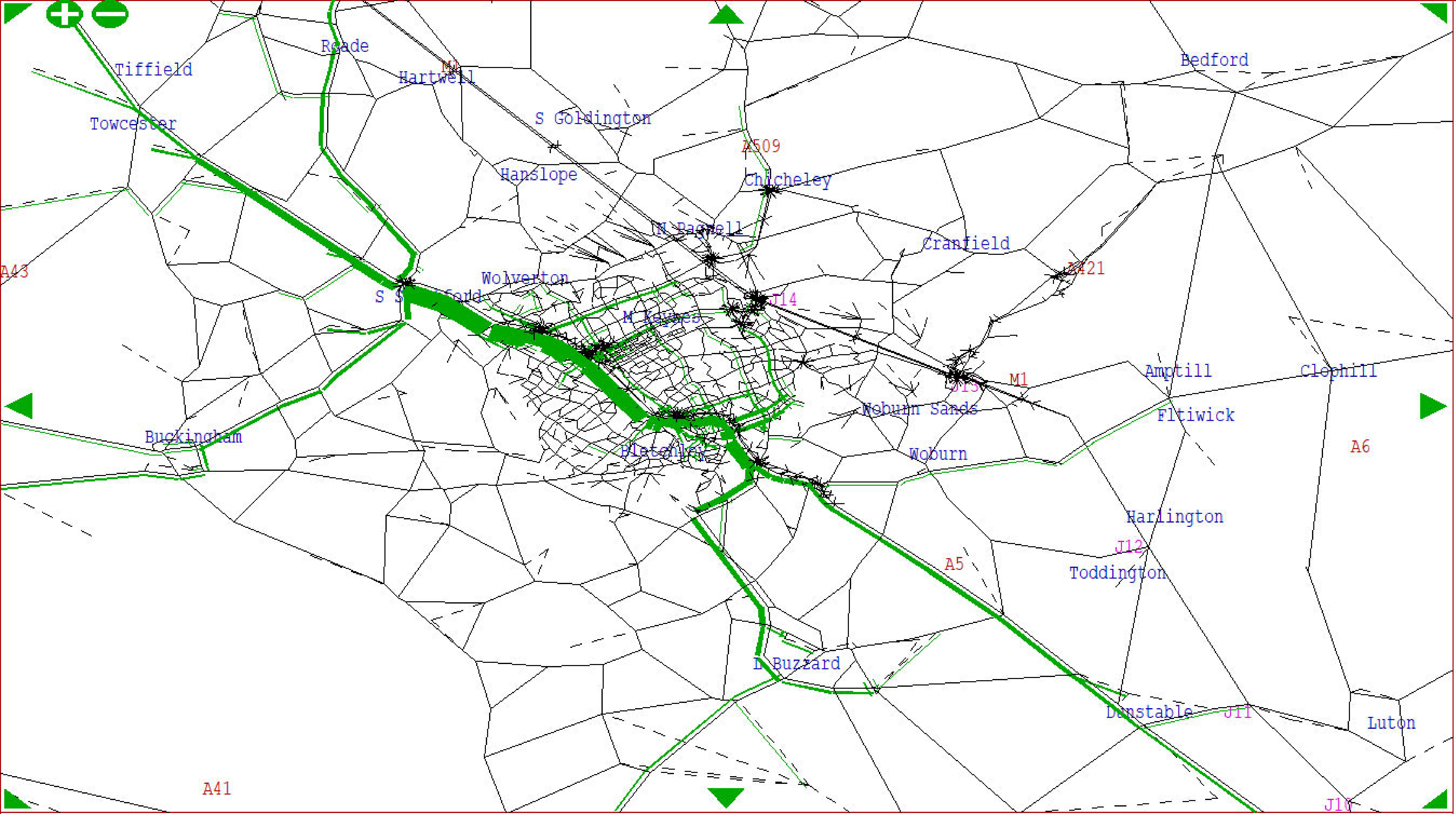
Full stats x

diSplay of
link annotat >

Q - Return

+ Menu bar!

2016 - Inter-Peak - Network 2_5 16- 3-20



Selected
Link
Assignment
Thru links:

1701	3116
1702	3113
1703	1704
1704	9333
1860	3111

+ 17 others

Minimum of
1 Crossings

Total Actual
Flow = 4522

Network fixd
Flow = 80

All User Cls

saVe in D.B. x

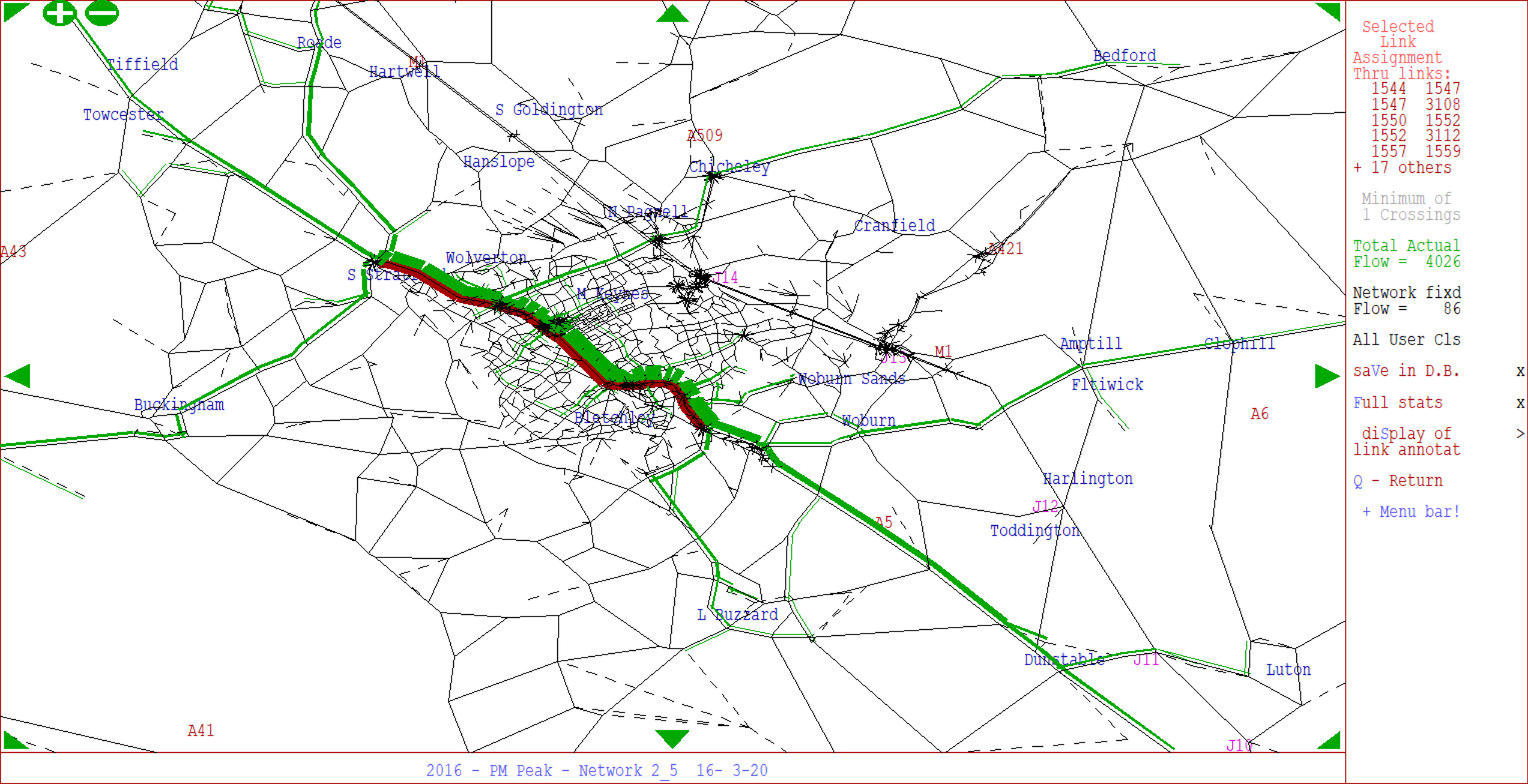
Full stats x

diSplay of
link annotat >

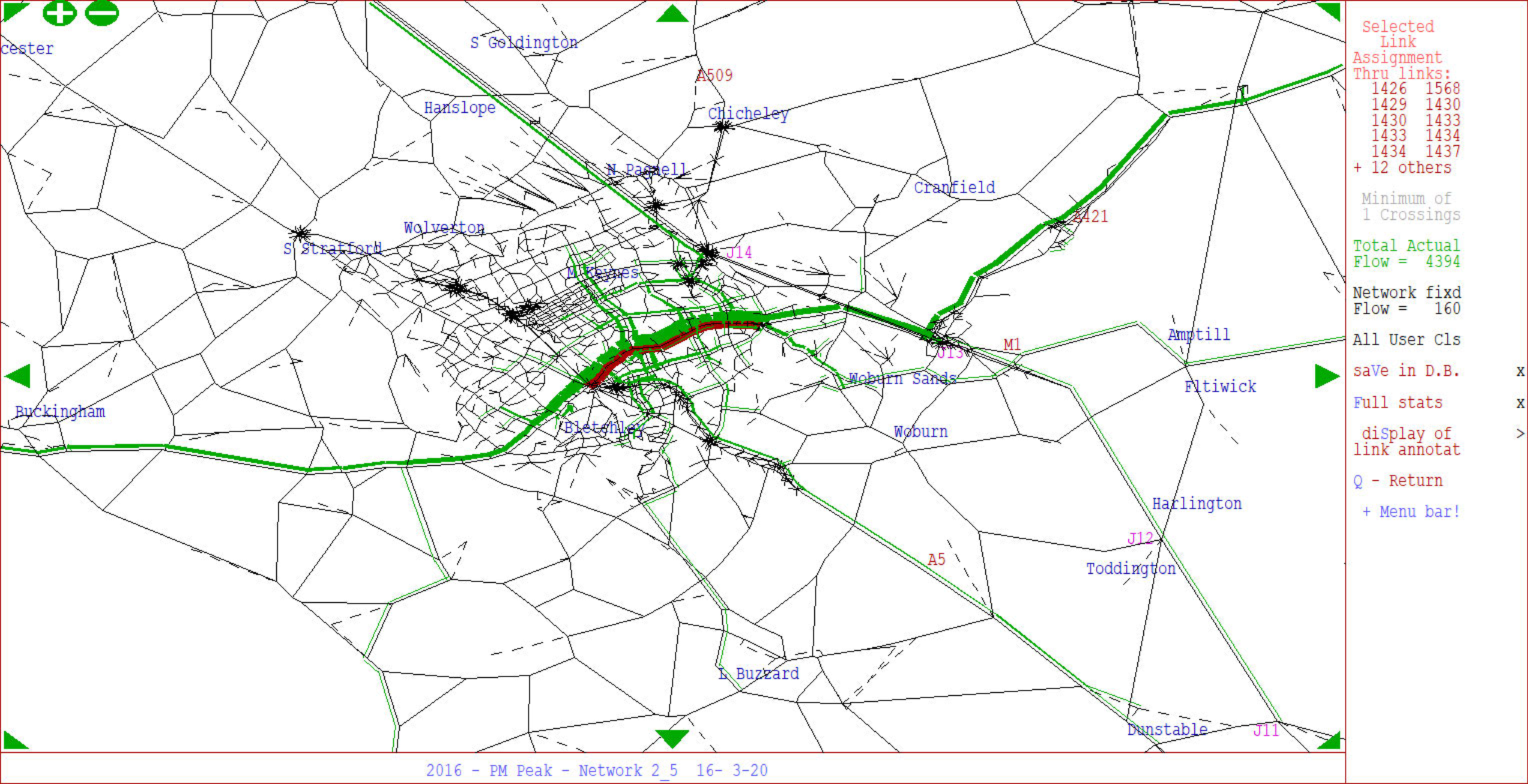
Q - Return

+ Menu bar!

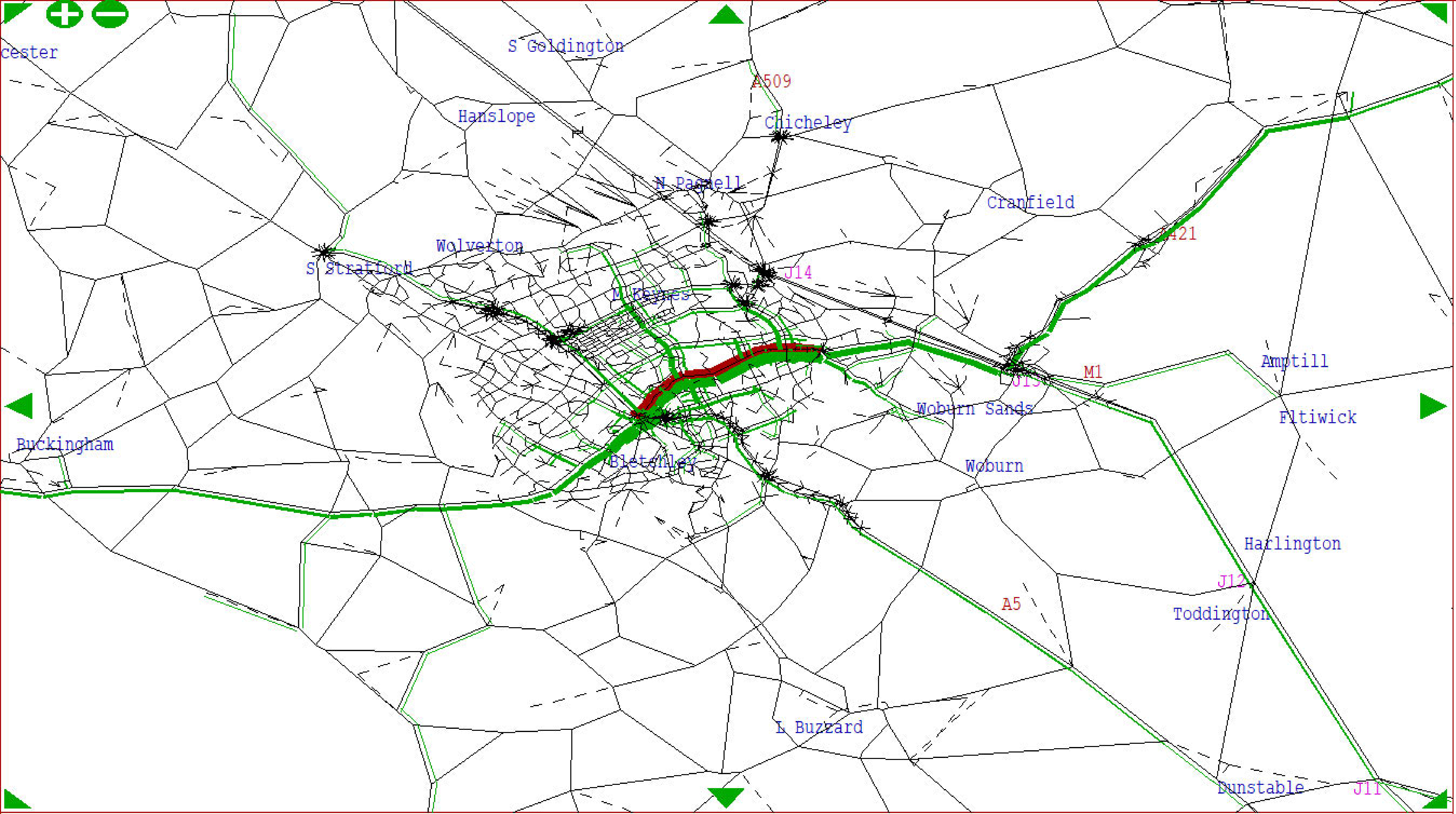
2016 - PM Peak - Network 2_5 16- 3-20



Tiffield
Roade
Hartwell
M1
Towcester
S Goldington
A509
Hanslope
Chicheley
N Pagnell
Cranfield
A421
Bedford
A43
Wolverton
M Keynes
J14
J13
M1
Amptill
Clophill
Woburn Sands
Fltiwick
Buckingham
Bletchley
Woburn
A6
Harlington
J12
A5
Toddington
L Buzzard
Dunstable
J11
Luton
A41
J10
Selected
Link
Assignment
Thru links:
1544 1547
1547 3108
1550 1552
1552 3112
1557 1559
+ 17 others
Minimum of
1 Crossings
Total Actual
Flow = 4026
Network fixd
Flow = 86
All User Cls
saVe in D.B. x
Full stats x
diSplay of
link annotat >
Q - Return
+ Menu bar!
2016 - PM Peak - Network 2_5 16- 3-20



cester
S Goldington
A509
Hanslope
Chicheley
N Pagnell
Cranfield
A421
Wolverton
S Stratford
J14
M Keynes
M1
J13
Amptill
Woburn Sands
Fltiwick
Buckingham
Woburn
Bletchley
Harlington
J12
A5
Toddington
L Buzzard
Dunstable
J11
Selected
Link
Assignment
Thru links:
1426 1568
1429 1430
1430 1433
1433 1434
1434 1437
+ 12 others
Minimum of
1 Crossings
Total Actual
Flow = 4394
Network fixd
Flow = 160
All User Cls
saVe in D.B. x
Full stats x
diSplay of
link annotat >
Q - Return
+ Menu bar!
2016 - PM Peak - Network 2_5 16- 3-20



Selected
Link
Assignment
Thru links:

1429	1568
1430	1429
1433	1430
1434	1433
1437	1434

+ 12 others

Minimum of
1 Crossings

Total Actual
Flow = 4351

Network fixd
Flow = 202

All User Cls

saVe in D.B. x

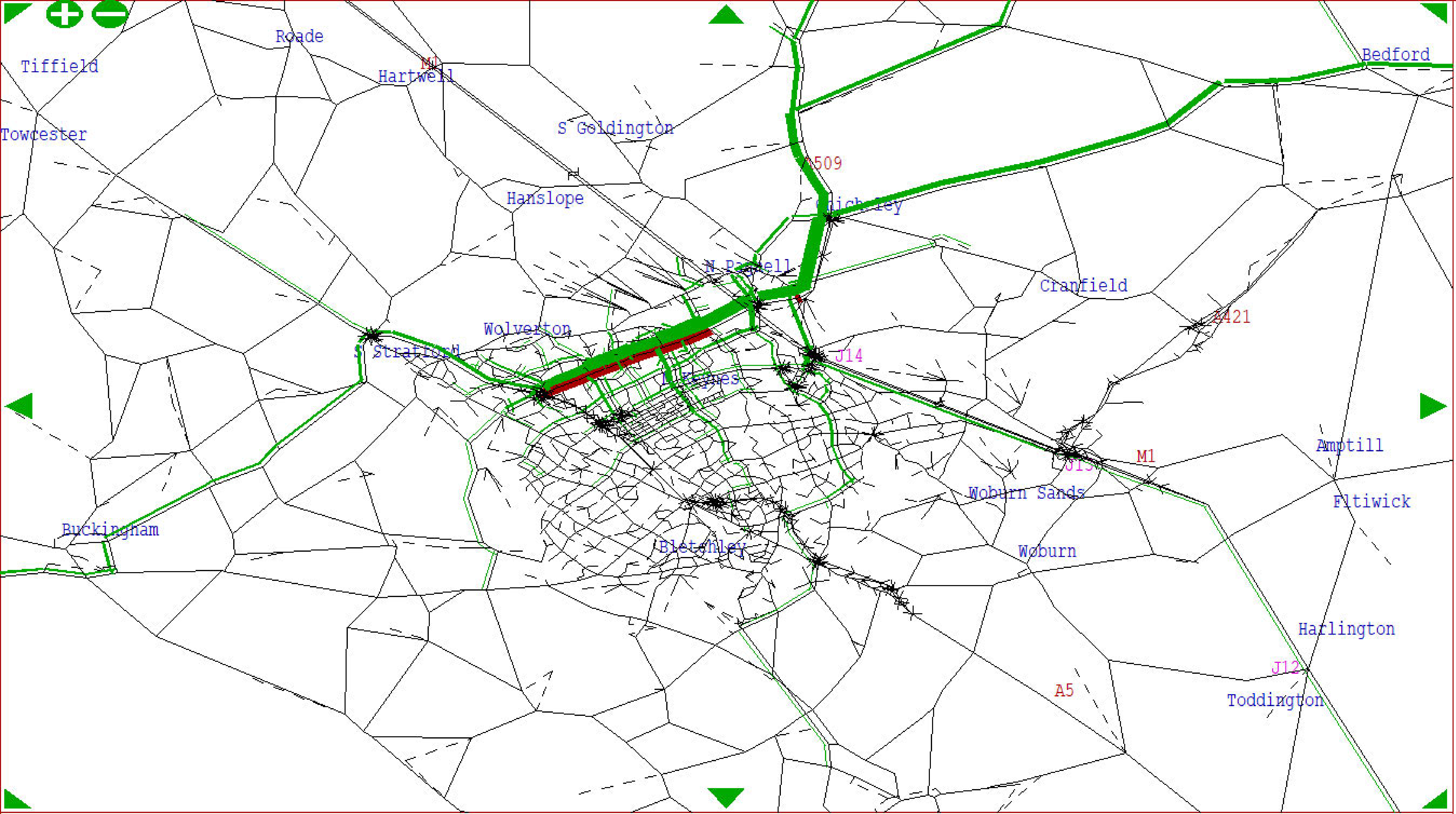
Full stats x

diSplay of
link annotat >

Q - Return

+ Menu bar!

2016 - PM Peak - Network 2_5 16- 3-20



Selected Link Assignment
Thru links:

1255	1256
1256	1257
1257	1258
1258	1261
1261	1262

\+ 7 others

Minimum of 1 Crossings

Total Actual Flow = 3834

Network fixd Flow = 14

All User Cls

saVe in D.B. x

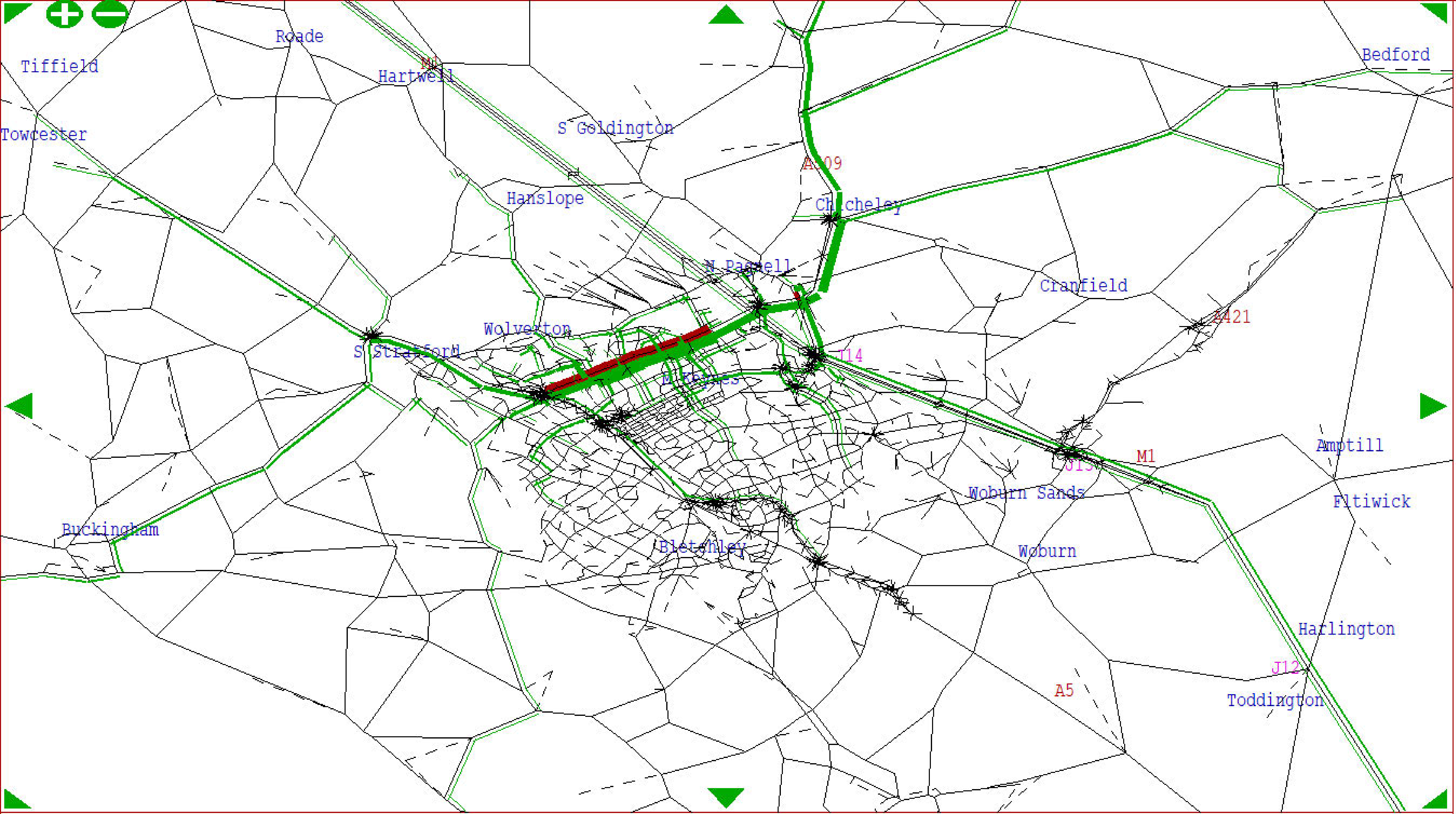
Full stats x

diSplay of link annotat >

Q - Return

\+ Menu bar!

2016 - PM Peak - Network 2_5 16- 3-20



Selected
Link
Assignment
Thru links:

1255	1546
1256	1255
1257	1256
1258	1257
1261	1258

+ 6 others

Minimum of
1 Crossings

Total Actual
Flow = 4120

Network fixd
Flow = 14

All User Cls

saVe in D.B. x

Full stats x

diSplay of
link annotat >

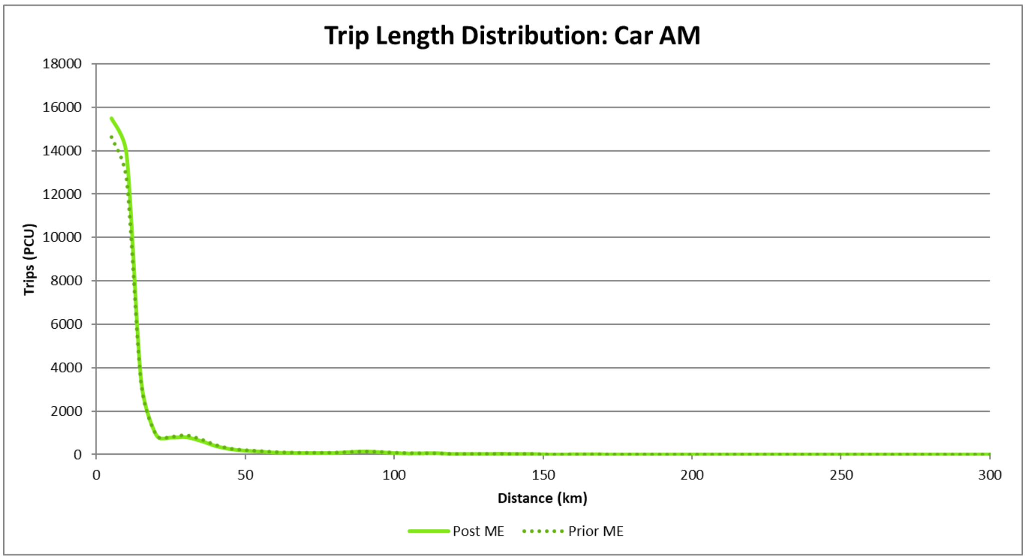
Q - Return

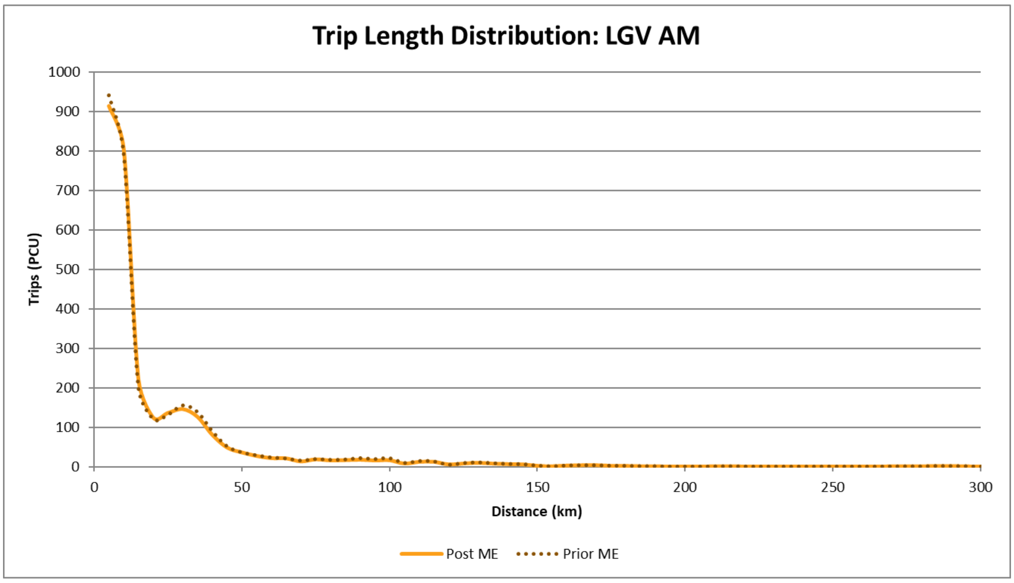
+ Menu bar!

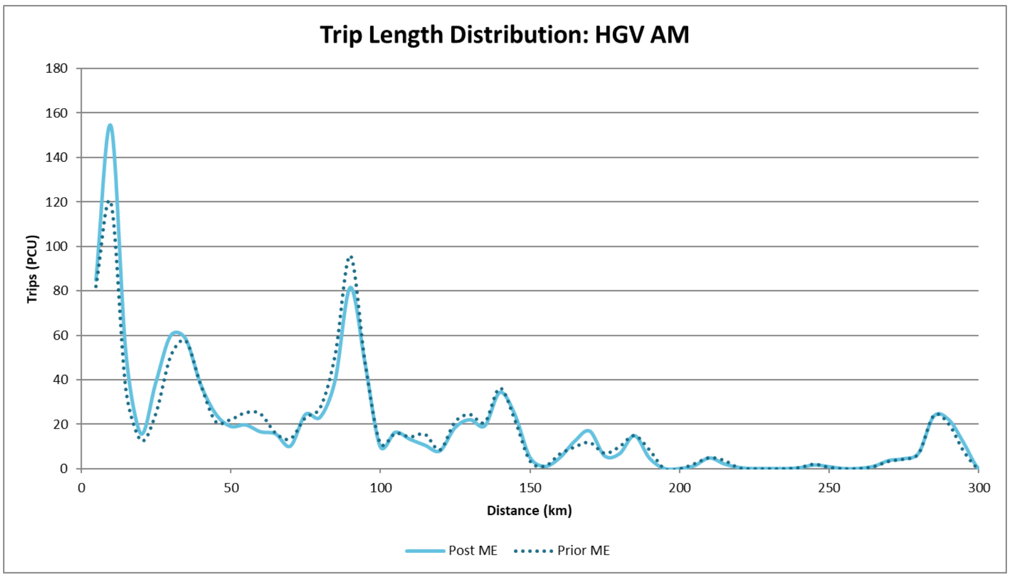
2016 - PM Peak - Network 2_5   16- 3-20

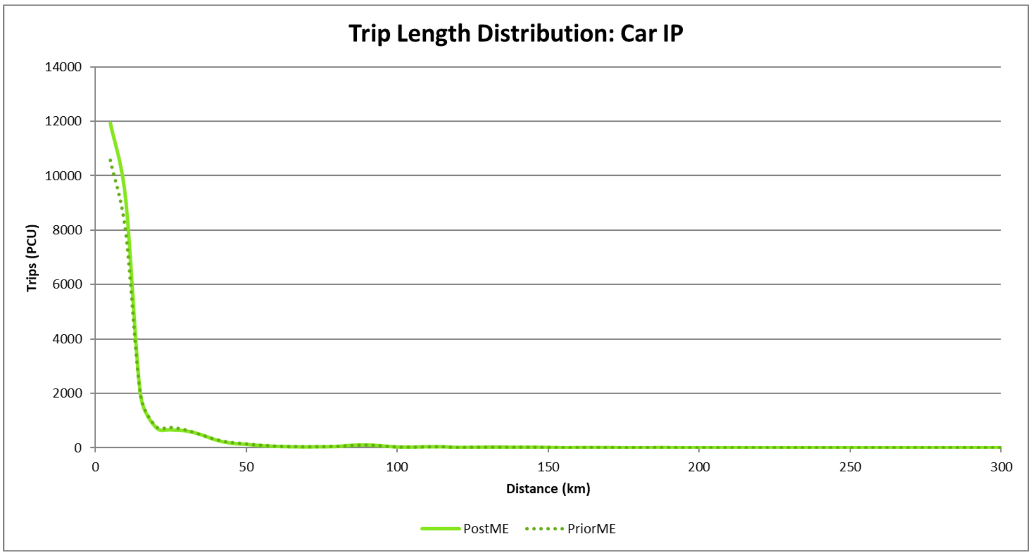
Appendix C:

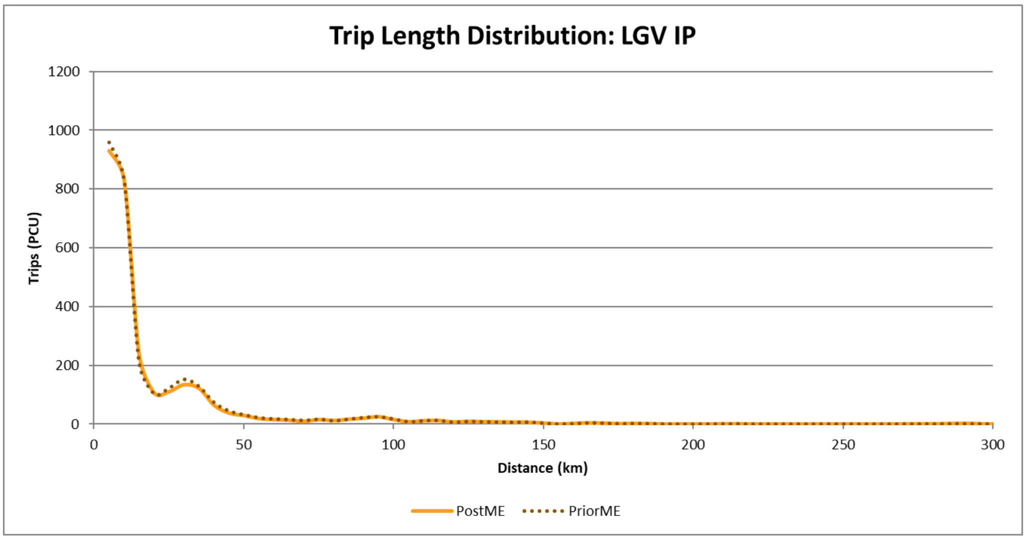
Trip Length Distribution

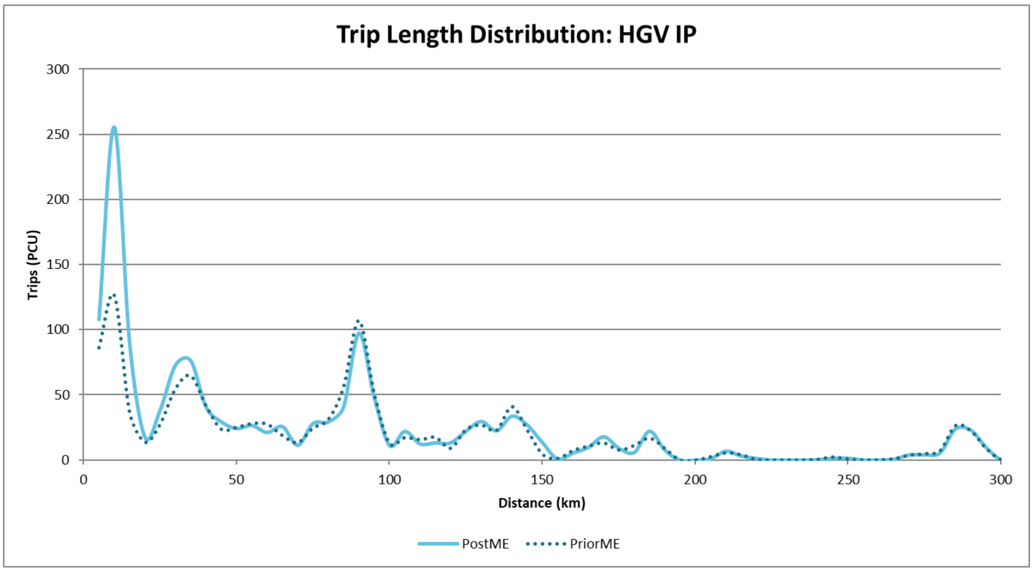

Trip Length Distribution: Car AM
Trips (PCU)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
50
100
150
200
250
300
Distance (km)
Post ME
Prior ME

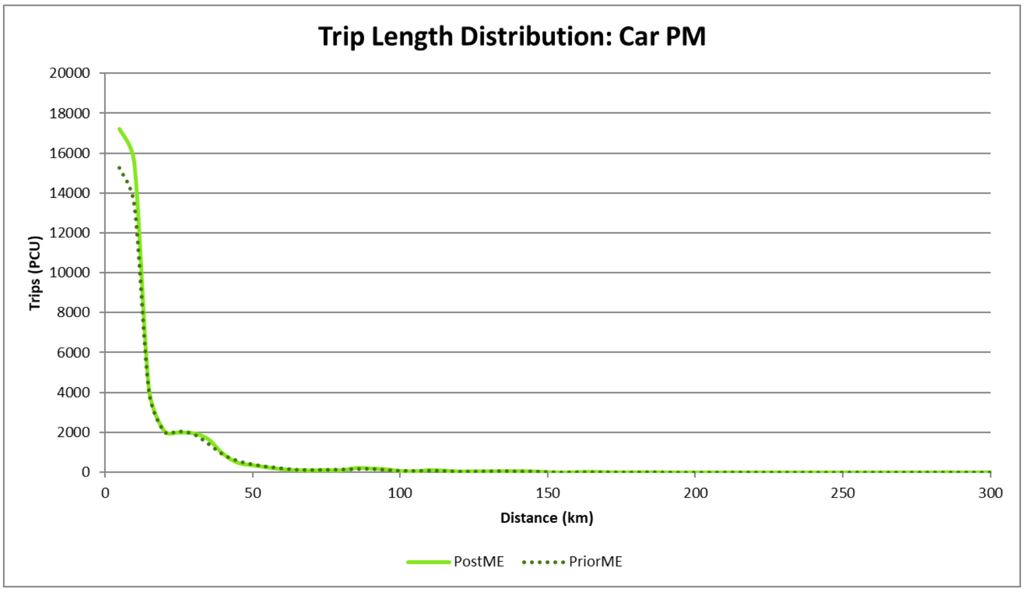

Trip Length Distribution: LGV AM
Trips (PCU)
1000
900
800
700
600
500
400
300
200
100
0
0
50
100
150
200
250
300
Distance (km)
Post ME
Prior ME


Trip Length Distribution: HGV AM
Trips (PCU)
180
160
140
120
100
80
60
40
20
0
0
50
100
150
200
250
300
Distance (km)
Post ME
Prior ME

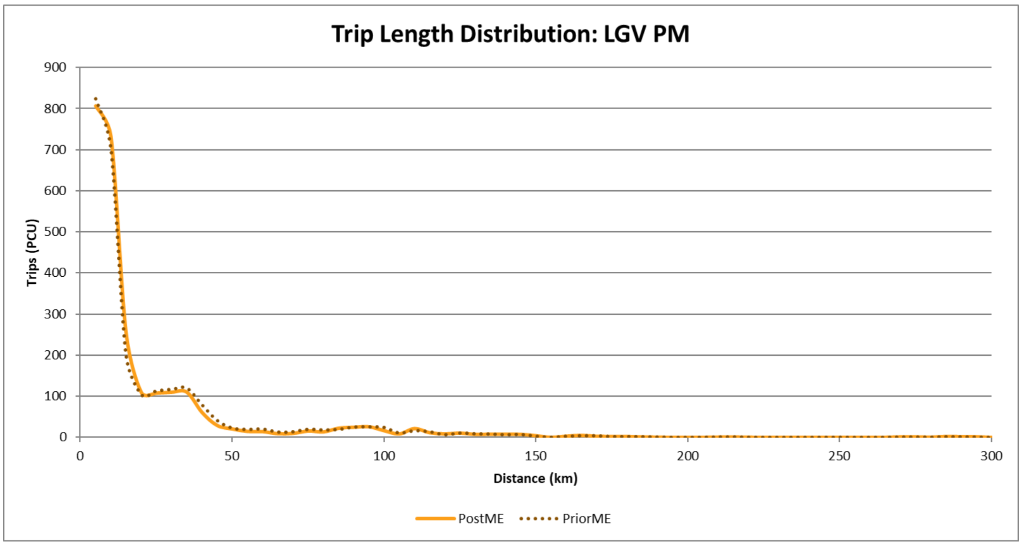

Trip Length Distribution: Car IP
Trips (PCU)
Distance (km)
PostME
PriorME
0
2000
4000
6000
8000
10000
12000
14000
0
50
100
150
200
250
300


Trip Length Distribution: LGV IP
Trips (PCU)
Distance (km)
PostME
PriorME
0
200
400
600
800
1000
1200
0
50
100
150
200
250
300

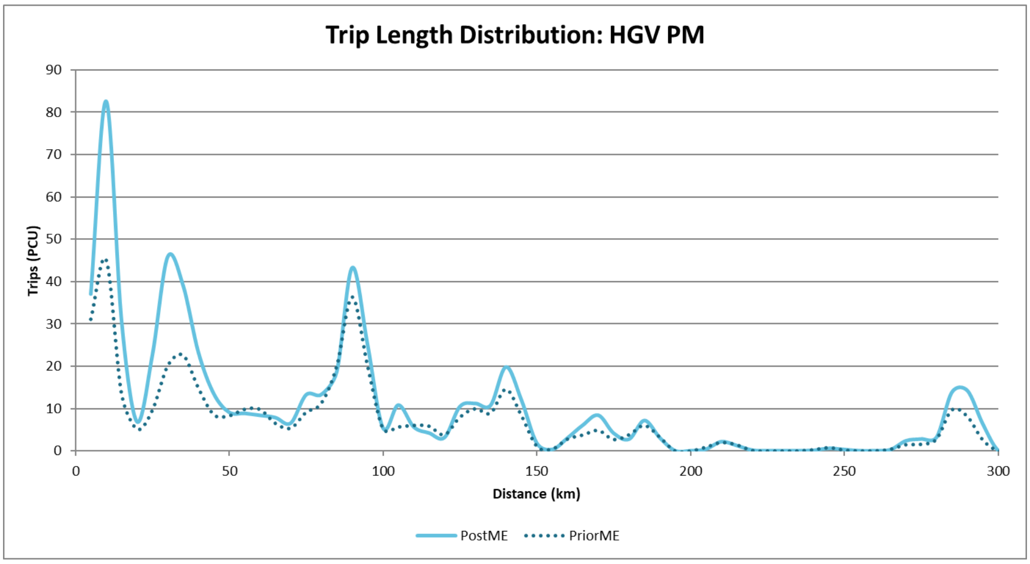

Trip Length Distribution: HGV IP
Trips (PCU)
Distance (km)
PostME
PriorME
0
50
100
150
200
250
300
0
50
100
150
200
250
300



Trip Length Distribution: Car PM
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Trips (PCU)
0
50
100
150
200
250
300
Distance (km)
PostME
PriorME



Trip Length Distribution: LGV PM
900
800
700
600
500
400
300
200
100
0
Trips (PCU)
0
50
100
150
200
250
300
Distance (km)
PostME
PriorME



Trip Length Distribution: HGV PM
90
80
70
60
50
40
30
20
10
0
Trips (PCU)
0
50
100
150
200
250
300
Distance (km)
PostME
PriorME

Appendix D:

Screenline and Cordon Calibration and Validation

AM All vehicle Calibration Flow Stats by Count Group

Full Screenlines and Cordons

Lookup	No.	Screenline / Cordon	Total Count Sites	Sites meeting Criteria A	% pass for criteria A	Observed count LB (vehs)	Observed Count (vehs)	Observed count UB (vehs)	Modelled Actual Flow (Vehs)	Difference (vehs)	% Diff
RSI Inbound		RSI Inbound Cordon	24	23	96%	18398	22296	26194	21829	-467	-2%
RSI Outbound		RSI Outbound Cordon	24	23	96%	9673	12414	15154	12289	-125	-1%
Canal EB		Canal EB	6	6	100%	4828	5685	6541	5644	-41	-1%
Canal WB		Canal WB	6	5	83%	6867	8084	9301	7397	-687	-9%
CMK IB		CMK IB	12	10	83%	7538	9222	10906	9168	-54	-1%
CMK Outbound		CMK Outbound	12	11	92%	2321	3548	4775	3391	-157	-4%
Southern SB		Southern SB	7	7	100%	3897	4750	5603	4567	-183	-4%
Southern NB		Southern NB	7	6	86%	4219	5097	5975	4617	-479	-9%
Northern SB		Northern SB	6	6	100%	5072	5967	6862	5870	-97	-2%
Northern NB		Northern NB	6	5	83%	3868	4607	5347	4334	-273	-6%
Western EB		Western EB	5	4	80%	3352	4051	4749	3719	-332	-8%
Western WB		Western WB	5	4	80%	2191	2737	3283	2478	-259	-9%
Newport Pagnell IB		Newport Pagnell Inbound Cordon	8	7	88%	2139	2939	3739	2842	-97	-3%
Newport Pagnell OB		Newport Pagnell Outbound Cordon	8	6	75%	2535	3438	4341	3865	427	12%
M1 NB		M1 NB	5	4	80%	12653	14187	15721	13469	-718	-5%
M1 SB		M1 SB	5	5	100%	11551	13046	14540	13335	289	2%
MKE NE		MKE NE	19	18	95%	6277	8343	10409	8076	-267	-3%
MKE SW		MKE SW	19	17	89%	9705	12064	14423	11999	-65	-1%
		Total excluding M1	**180**	**172**	**96%**	**97487**	**120735**	**143982**	**117653**	**-3081**	**-3%**
		Total Excluding M1 and RSI	**132**	**117**	**89%**	**69417**	**86025**	**102634**	**83536**	**-2489**	**-3%**

Validation full Screenlines

Lookup	No.	Screenline / Cordon	Number of Count Sites	Number of Sites	% pass for criteria A	Observed LB (vehs)	Observed Count	Observed UB (vehs)	Modelled Actual Flow	Difference (vehs)	% Diff
A422 NB		A422 NB	7	3	43%	4383	5249	6116	4849	-400	-8%
A422 SB		A422 SB	7	6	86%	7307	8519	9732	8301	-218	-3%
Railway EB		Railway EB	7	4	57%	8818	10288	11758	9823	-465	-5%
Railway WB		Railway WB	7	2	29%	5497	6476	7455	6009	-466	-7%
		Total	**26**	**13**	**50%**	**22229**	**26164**	**30099**	**24622**	**-1542**	**-6%**
A5 NB		A5 NB	2	2	100%	2408	2833	3258	2866	33	1%
A5 SB		A5 SB	2	2	100%	3283	3790	4296	3790	0	0%

IP All vehicle Calibration Flow Stats by Count Group

	Lookup	No.	Screenline / Cordon	Total Count Sites	Sites meeting Criteria A	% pass for criteria A	Observed count LB (vehs)	Observed Count (vehs)	Observed count UB (vehs)	Modelled Actual Flow (Vehs)	Difference (vehs)	% Diff
Full Screenlines and Cordons	RSI Inbound		RSI Inbound Cordon	24	24	100%	6817	9372	11927	9374	2	0%
	RSI Outbound		RSI Outbound Cordon	24	24	100%	7157	9724	12291	9711	-13	0%
	Canal EB		Canal EB	6	6	100%	3405	4090	4775	4089	-2	0%
	Canal WB		Canal WB	6	6	100%	3361	4027	4694	4039	12	0%
	CMK IB		CMK IB	12	12	100%	3824	5087	6350	5047	-41	-1%
	CMK Outbound		CMK Outbound	12	11	92%	4050	5281	6511	5125	-156	-3%
	Southern SB		Southern SB	7	7	100%	2453	3165	3876	3148	-17	-1%
	Southern NB		Southern NB	7	7	100%	2394	3100	3805	3106	6	0%
	Northern SB		Northern SB	6	6	100%	2346	2955	3563	2972	18	1%
	Northern NB		Northern NB	6	6	100%	2496	3141	3785	3136	-5	0%
	Western EB		Western EB	5	5	100%	1602	2135	2667	2017	-118	-6%
	Western WB		Western WB	5	4	80%	1689	2216	2744	2055	-161	-7%
	Newport Pagnell IB		Newport Pagnell Inbound Cordon	8	8	100%	966	1766	2566	1780	15	1%
	Newport Pagnell OB		Newport Pagnell Outbound Cordon	8	8	100%	941	1741	2541	1760	19	1%
	M1 NB		M1 NB	5	5	100%	11597	13044	14491	13227	183	1%
	M1 SB		M1 SB	5	5	100%	10257	11691	13126	11797	106	1%
	MKE NE		MKE NE	19	19	100%	5946	7936	9927	7650	-286	-4%
	MKE SW		MKE SW	19	18	95%	5299	7271	9242	7110	-160	-2%
			Total excluding M1	**180**	**187**	**104%**	**57181**	**76070**	**94959**	**75221**	**-850**	**-1%**
			Total Excluding M1 and RSI	**132**	**129**	**98%**	**43207**	**56975**	**70742**	**56136**	**-838**	**-1%**

	Lookup	No.	Screenline / Cordon	Number of Count Sites	Number of Sites	% pass for criteria A	Observed LB (vehs)	Observed Count	Observed UB (vehs)	Modelled Actual Flow	Difference (vehs)	% Diff
Validation full Screenlines	A422 NB		A422 NB	7	2	29%	3242	4023	4805	3996	-27	-1%
	A422 SB		A422 SB	7	4	57%	3233	4000	4766	3844	-156	-4%
	Railway EB		Railway EB	7	3	43%	4171	5031	5892	5188	156	3%
	Railway WB		Railway WB	7	4	57%	4261	5119	5977	5204	85	2%
			Total	**26**	**11**	**42%**	**13058**	**16000**	**18941**	**16083**	**84**	**1%**
	A5 NB		A5 NB	2	2	100%	1462	1729	1997	1710	-19	-1%
	A5 SB		A5 SB	2	2	100%	1450	1709	1967	1699	-10	-1%

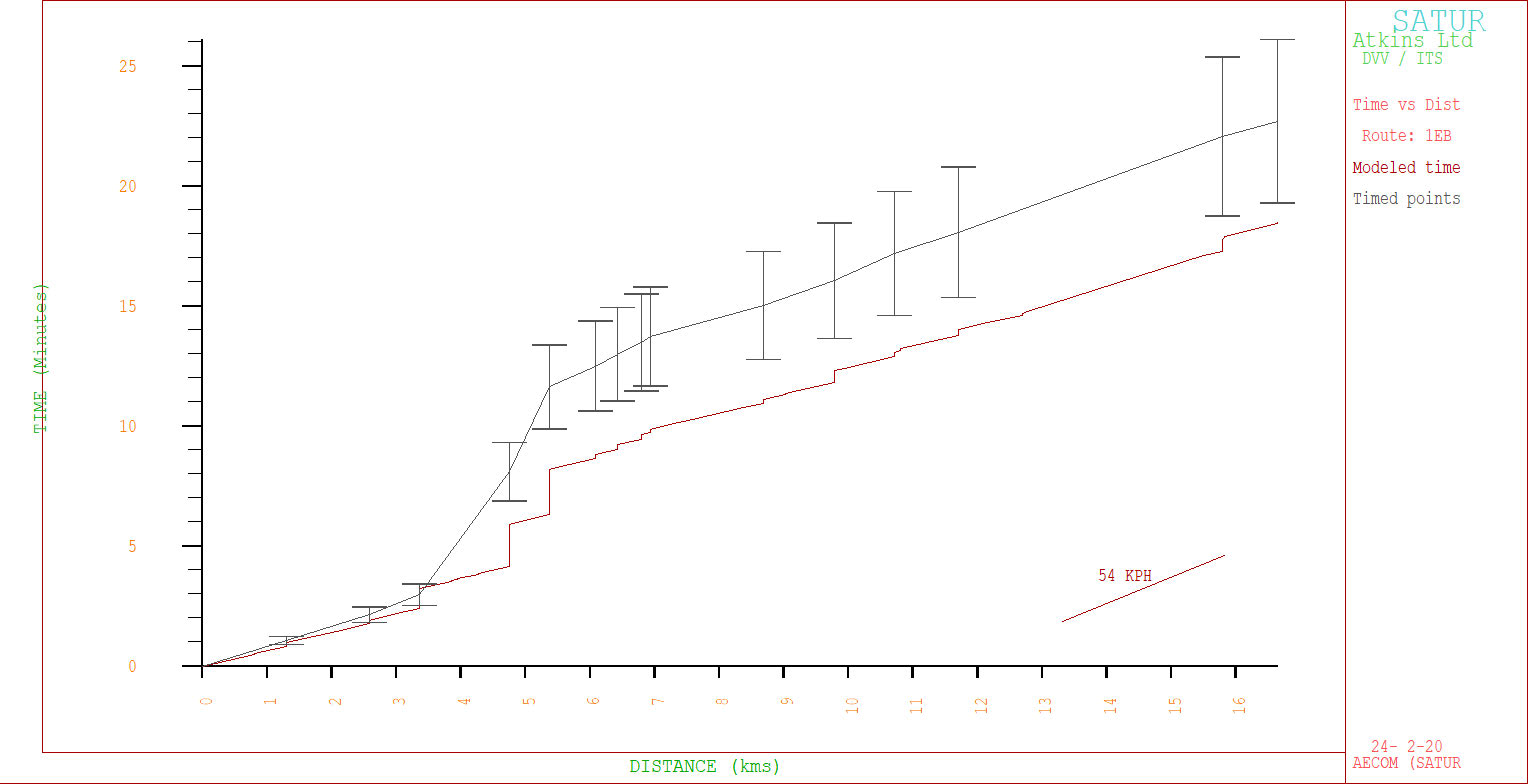
PM All vehicle Calibration Flow Stats by Count Group

	Lookup	No.	Screenline / Cordon	Total Count Sites	Sites meeting Criteria A	% pass for criteria A	Observed count LB (vehs)	Observed Count (vehs)	Observed count UB (vehs)	Modelled Actual Flow (Vehs)	Difference (vehs)	% Diff
Full Screenlines and Cordons	RSI Inbound		RSI Inbound Cordon	24	23	96%	10625	13598	16571	13564	-34	0%
	RSI Outbound		RSI Outbound Cordon	24	22	92%	16609	20191	23773	20070	-121	-1%
	Canal EB		Canal EB	6	6	100%	6648	7825	9003	7843	18	0%
	Canal WB		Canal WB	6	6	100%	5493	6463	7432	6405	-58	-1%
	CMK IB		CMK IB	12	12	100%	4102	5380	6658	5252	-128	-2%
	CMK Outbound		CMK Outbound	12	10	83%	7552	9074	10595	8896	-178	-2%
	Southern SB		Southern SB	7	6	86%	4402	5295	6188	5093	-202	-4%
	Southern NB		Southern NB	7	7	100%	3905	4746	5587	4769	24	0%
	Northern SB		Northern SB	6	6	100%	3894	4597	5300	4564	-33	-1%
	Northern NB		Northern NB	6	6	100%	4607	5429	6251	5415	-14	0%
	Western EB		Western EB	5	4	80%	2219	2794	3368	2682	-112	-4%
	Western WB		Western WB	5	4	80%	3234	3898	4562	3794	-104	-3%
	Newport Pagnell IB		Newport Pagnell Inbound Cordon	8	8	100%	2547	3451	4356	3487	36	1%
	Newport Pagnell OB		Newport Pagnell Outbound Cordon	8	7	88%	2181	2981	3781	3201	220	7%
	M1 NB		M1 NB	5	5	100%	12933	14453	15973	14411	-42	0%
	M1 SB		M1 SB	5	5	100%	13162	14675	16187	14435	-240	-2%
	MKE NE		MKE NE	19	18	95%	10714	13116	15518	13119	3	0%
	MKE SW		MKE SW	19	19	100%	7224	9341	11458	9425	84	1%
			Total excluding M1	**180**	**180**	**100%**	**100179**	**123227**	**146275**	**122583**	**-644**	**-1%**
			Total Excluding M1 and RSI	**132**	**125**	**95%**	**72944**	**89437**	**105930**	**88949**	**-489**	**-1%**

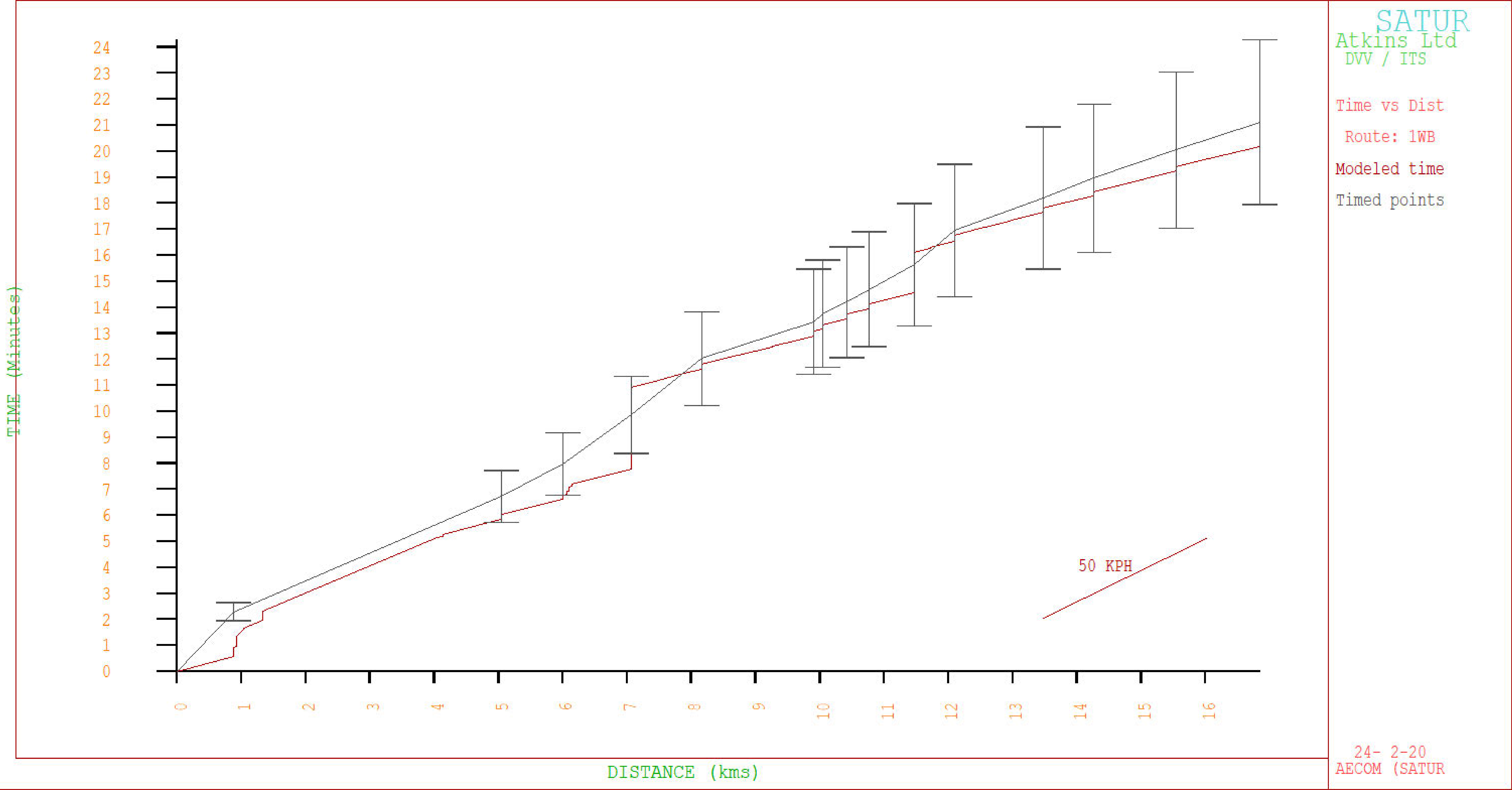
	Lookup	No.	Screenline / Cordon	Number of Count Sites	Number of Sites	% pass for criteria A	Observed LB (vehs)	Observed Count	Observed UB (vehs)	Modelled Actual Flow	Difference (vehs)	% Diff
Validation full Screenlines	A422 NB		A422 NB	7	4	57%	6605	7774	8942	7502	-272	-3%
	A422 SB		A422 SB	7	3	43%	4912	5862	6812	5497	-365	-6%
	Railway EB		Railway EB	7	2	29%	6253	7356	8459	7184	-172	-2%
	Railway WB		Railway WB	7	5	71%	8236	9658	11080	10141	483	5%
			Total	**26**	**12**	**46%**	**22713**	**26776**	**30840**	**26615**	**-161**	**-1%**
	A5 NB		A5 NB	2	2	100%	2850	3353	3856	3205	-148	-4%
	A5 SB		A5 SB	2	2	100%	2524	2969	3415	2969	0	0%

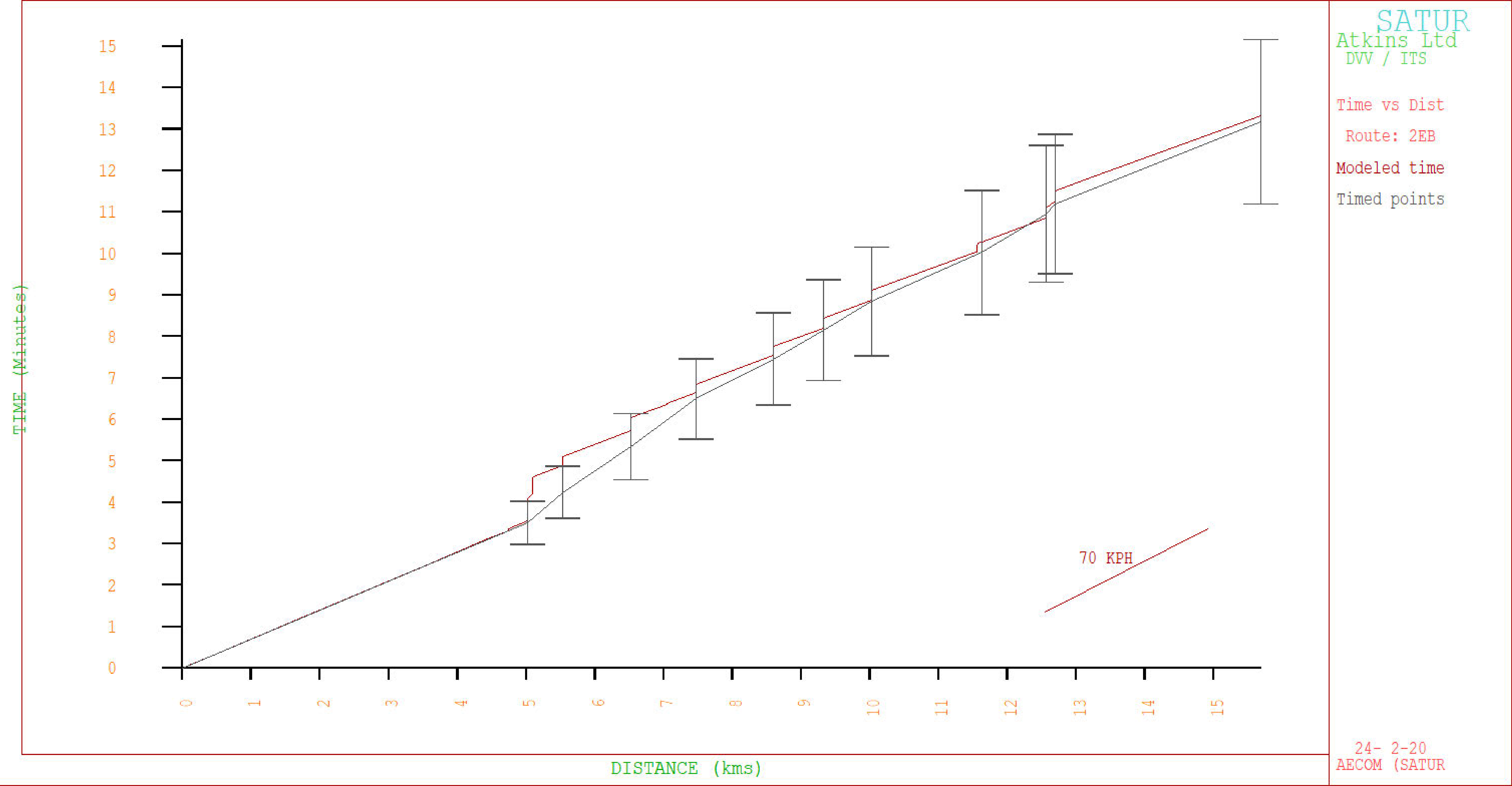
Appendix E:

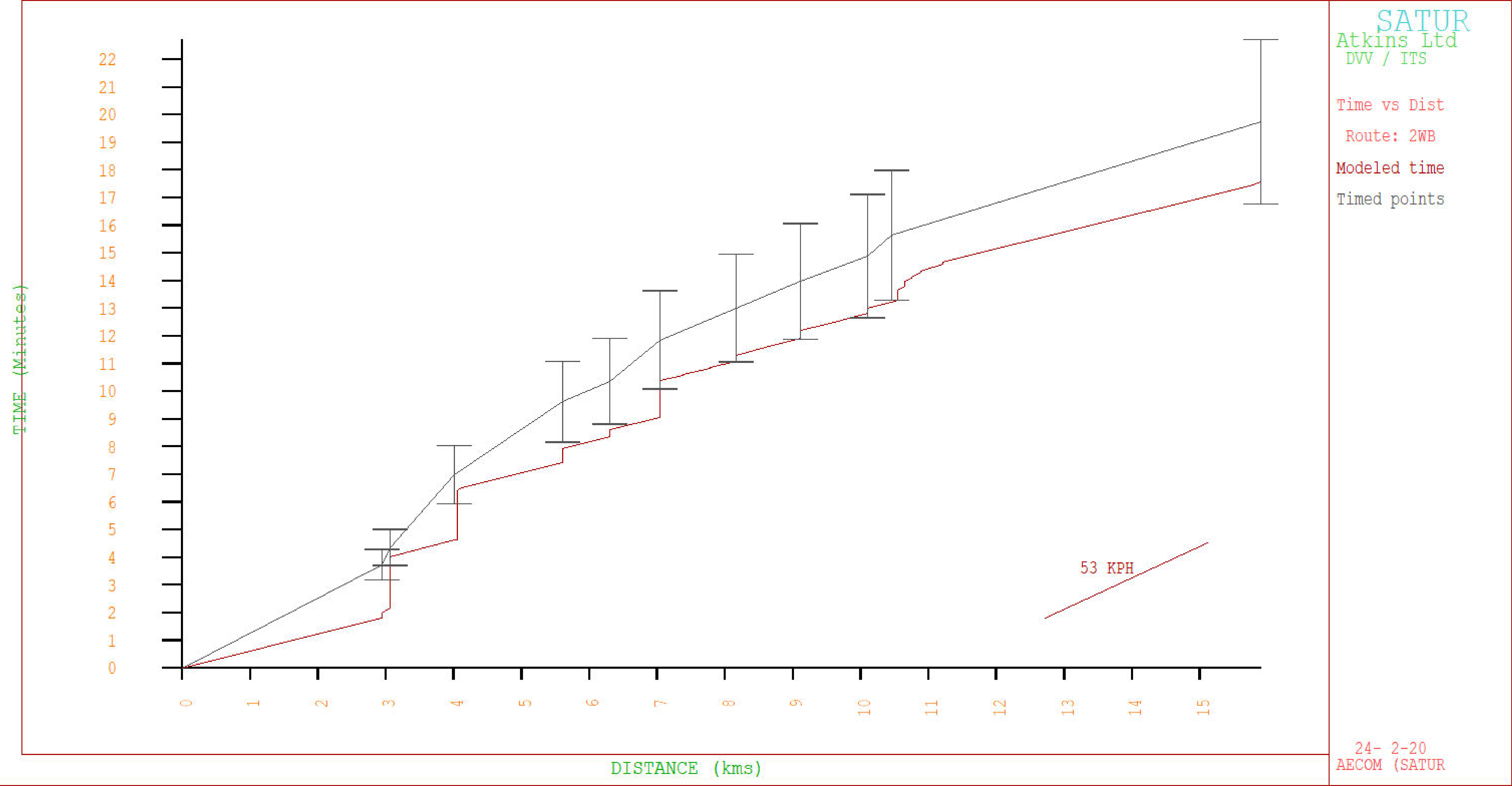
Journey Times



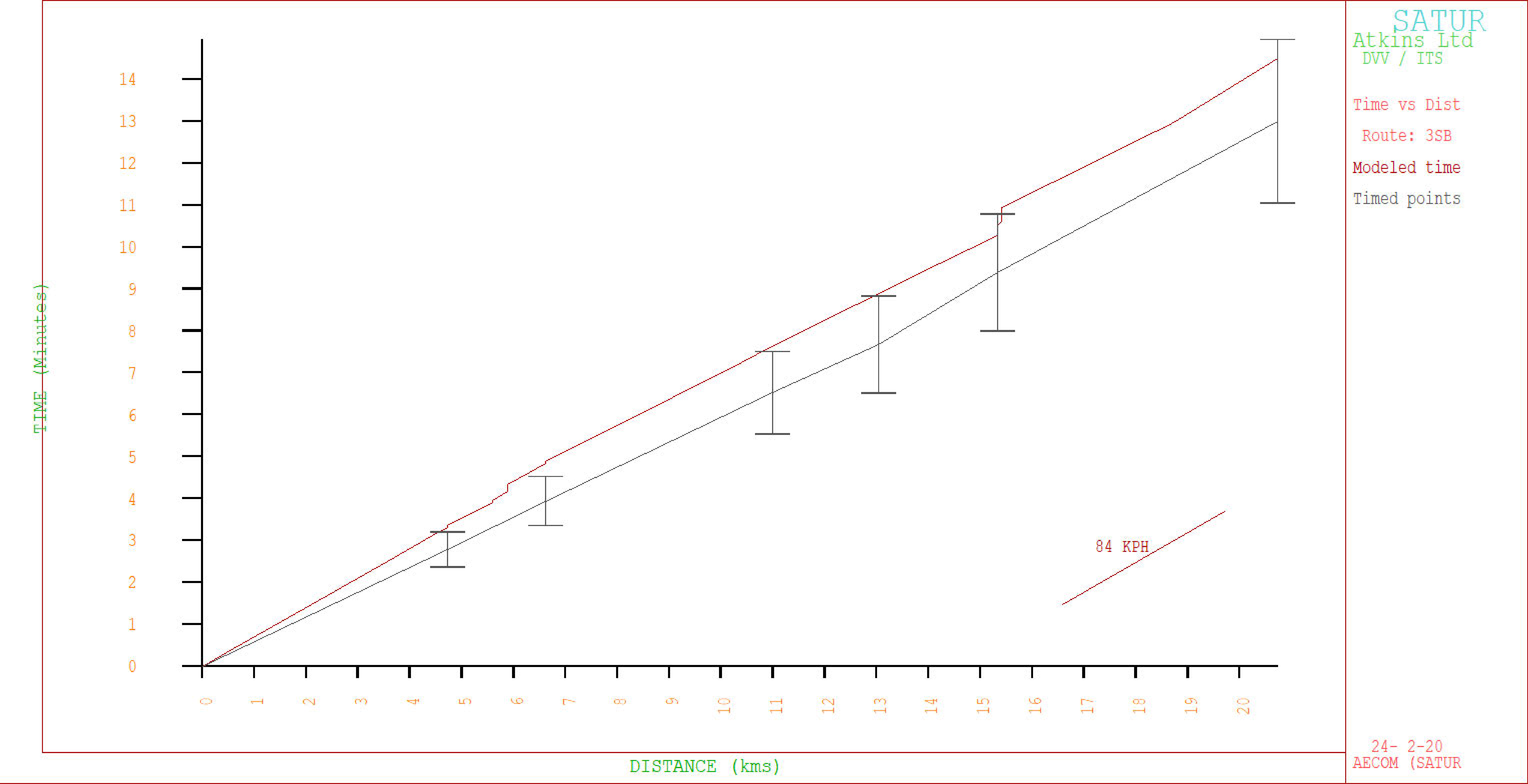
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 1EB
Modeled time
Timed points
54 KPH
TIME (Minutes)
0
5
10
15
20
25
DISTANCE (kms)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
24- 2-20
AECOM (SATUR

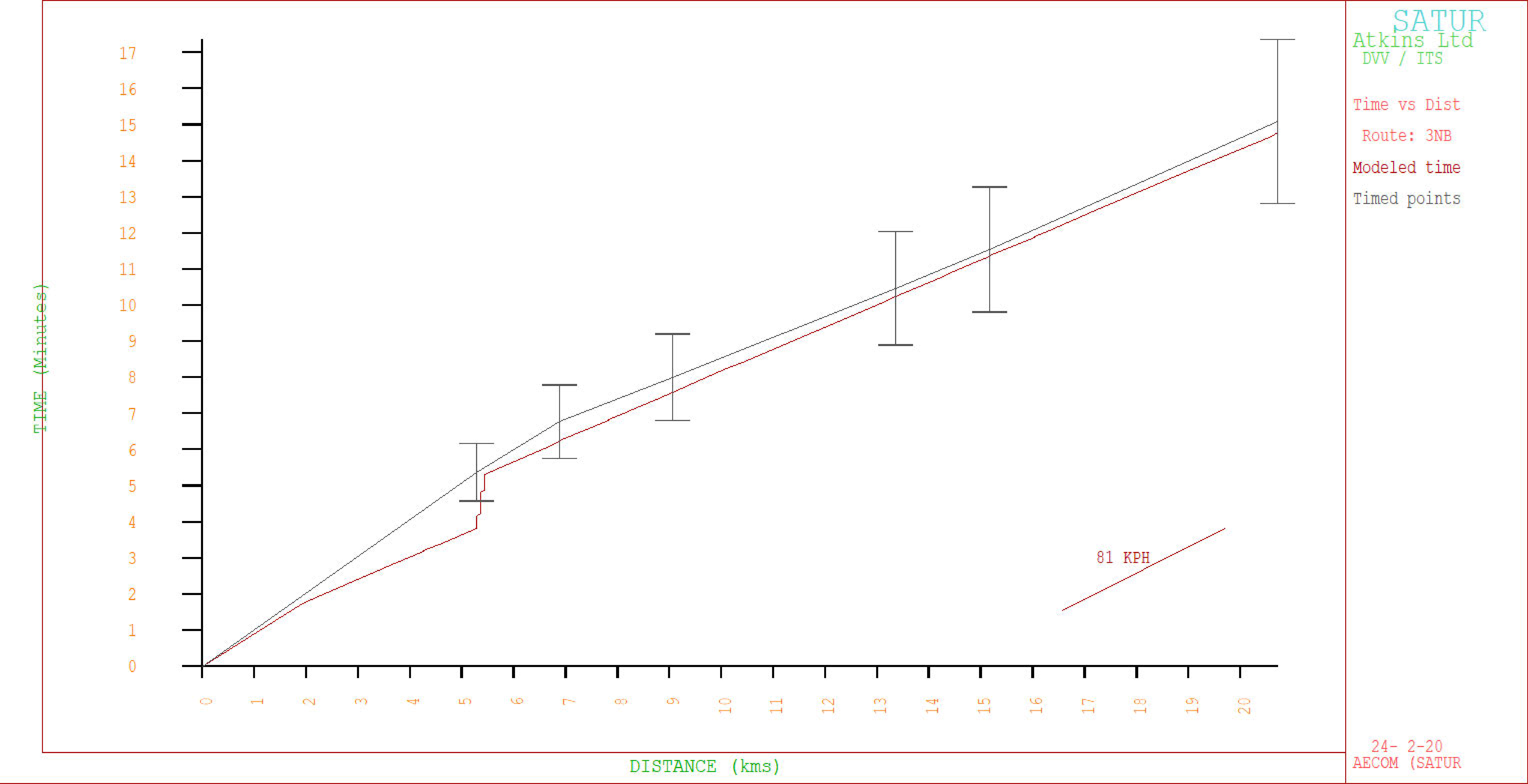

SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 1WB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
50 KPH
24- 2-20
AECOM (SATUR


SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 2EB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
70 KPH
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
24- 2-20
AECOM (SATUR

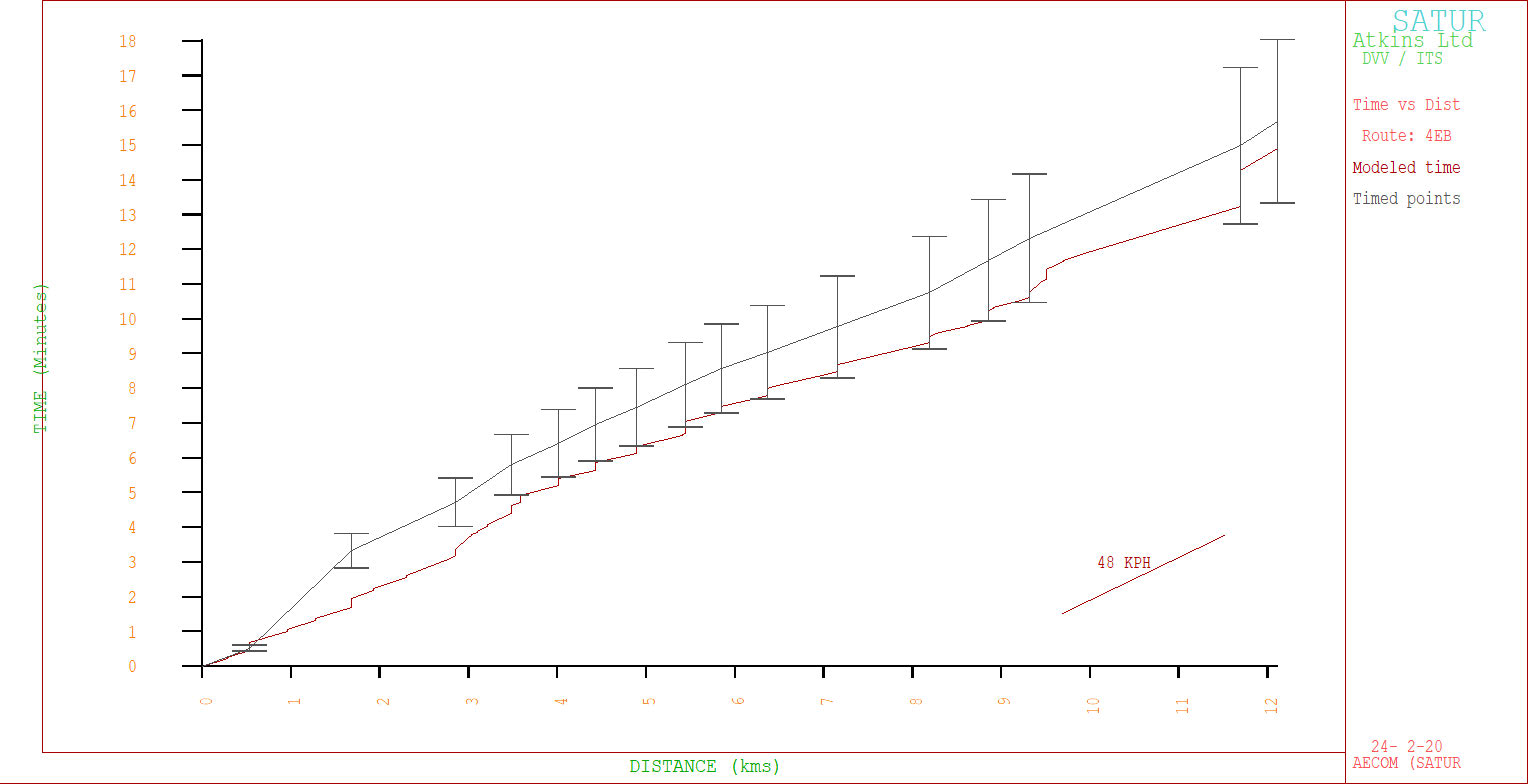


22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
TIME (Minutes)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
DISTANCE (kms)
53 KPH
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 2WB
Modeled time
Timed points
24- 2-20
AECOM (SATUR

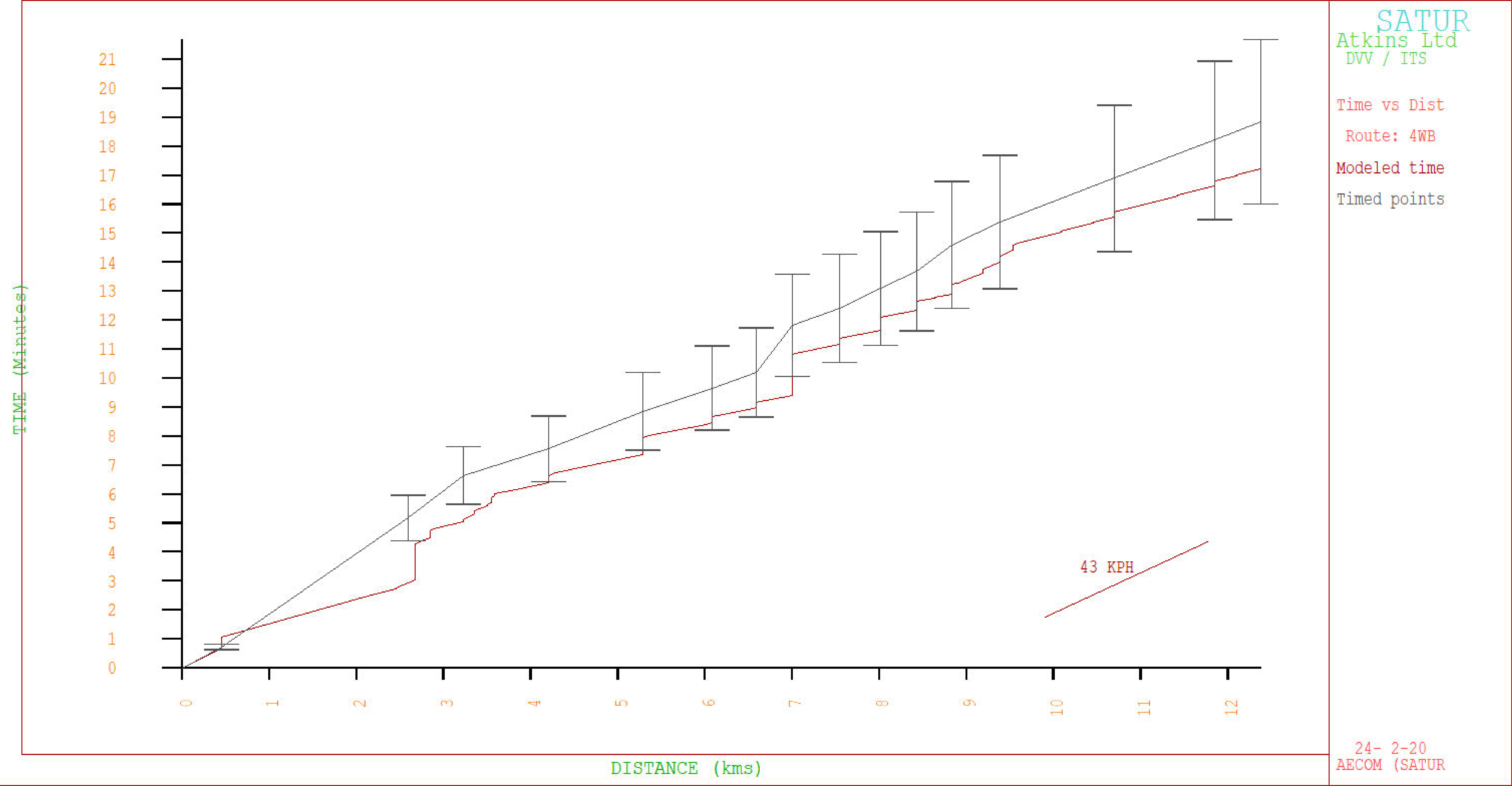

SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 3SB
Modeled time
Timed points
84 KPH
TIME (Minutes)
DISTANCE (kms)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
24- 2-20
AECOM (SATUR



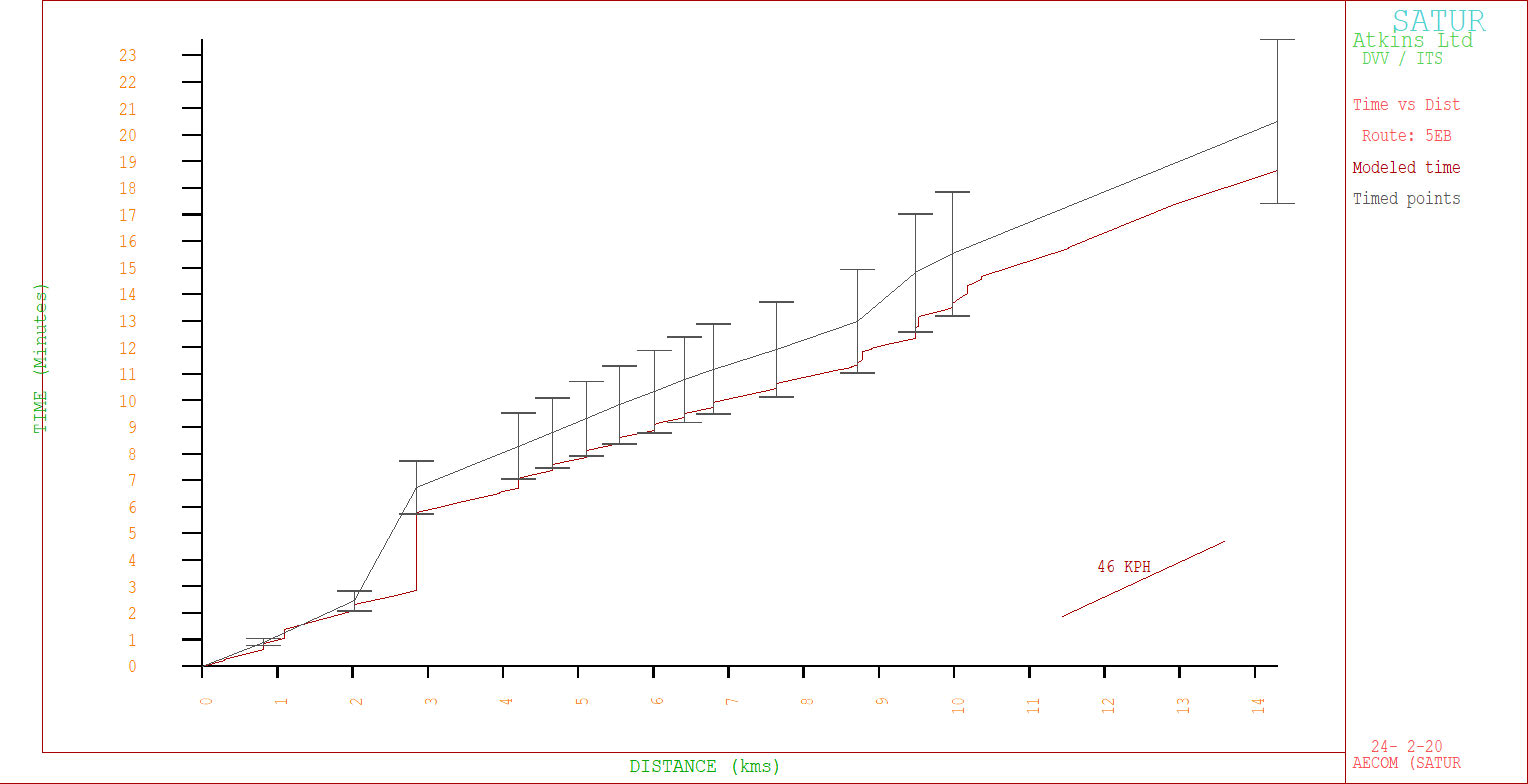
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 3NB
Modeled time
Timed points
81 KPH
TIME (Minutes)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
DISTANCE (kms)
24- 2-20
AECOM (SATUR



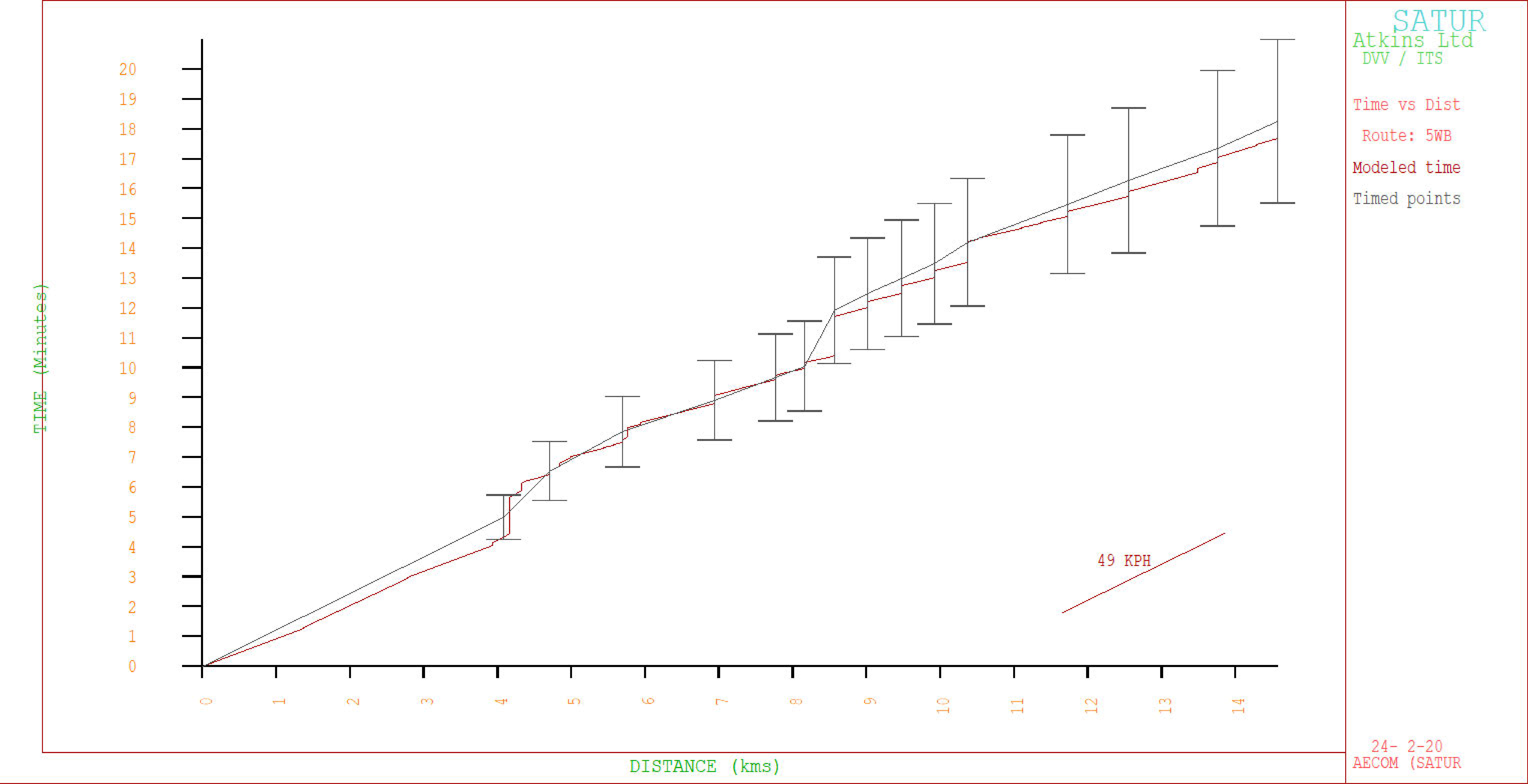
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 4EB
Modeled time
Timed points
TIME (Minutes)
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
48 KPH
0
1
2
3
4
5
6
7
8
9
10
11
12
DISTANCE (kms)
24- 2-20
AECOM (SATUR



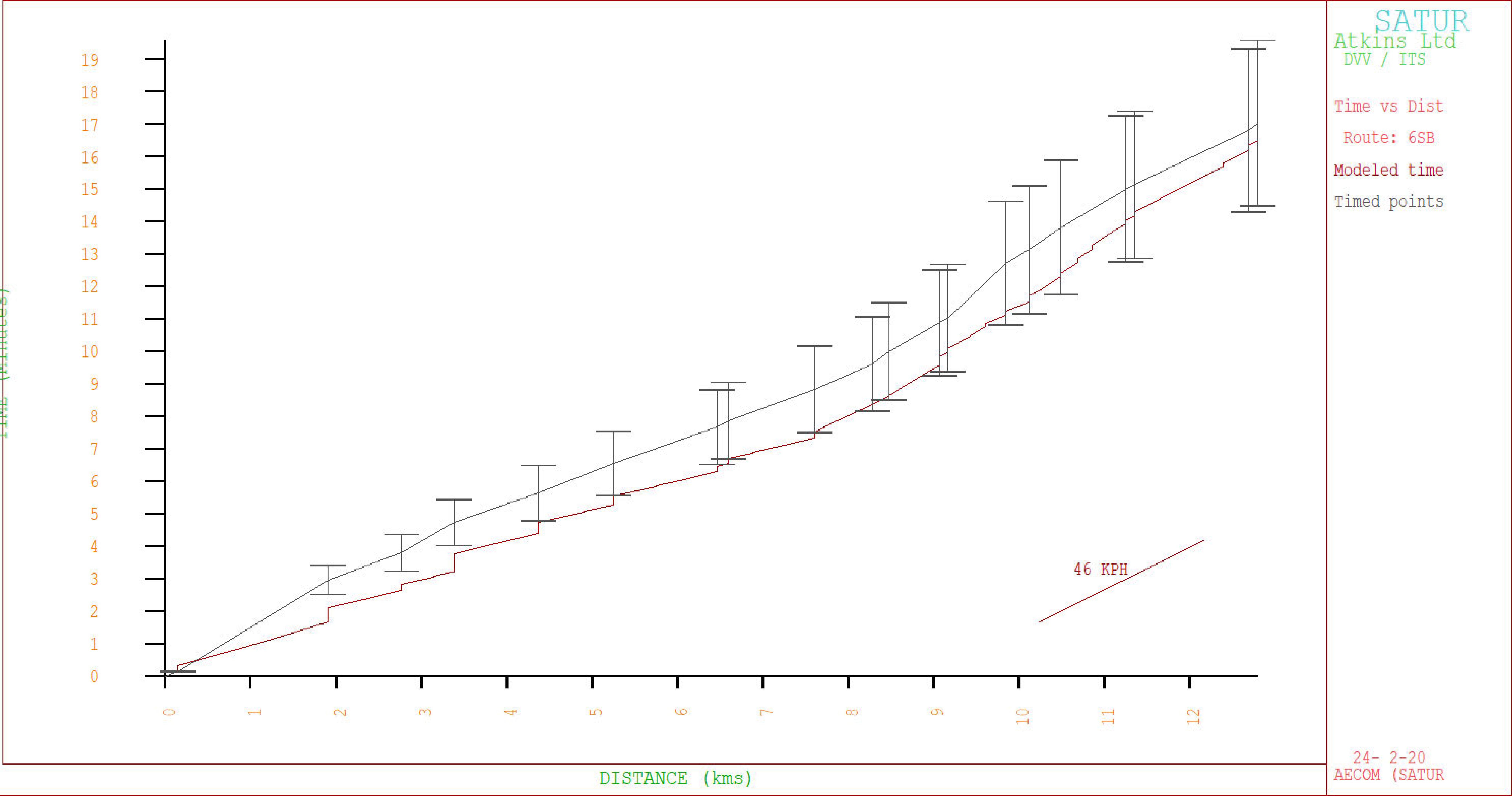
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 4WB
Modeled time
Timed points
TIME (Minutes)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
DISTANCE (kms)
0
1
2
3
4
5
6
7
8
9
10
11
12
43 KPH
24- 2-20
AECOM (SATUR



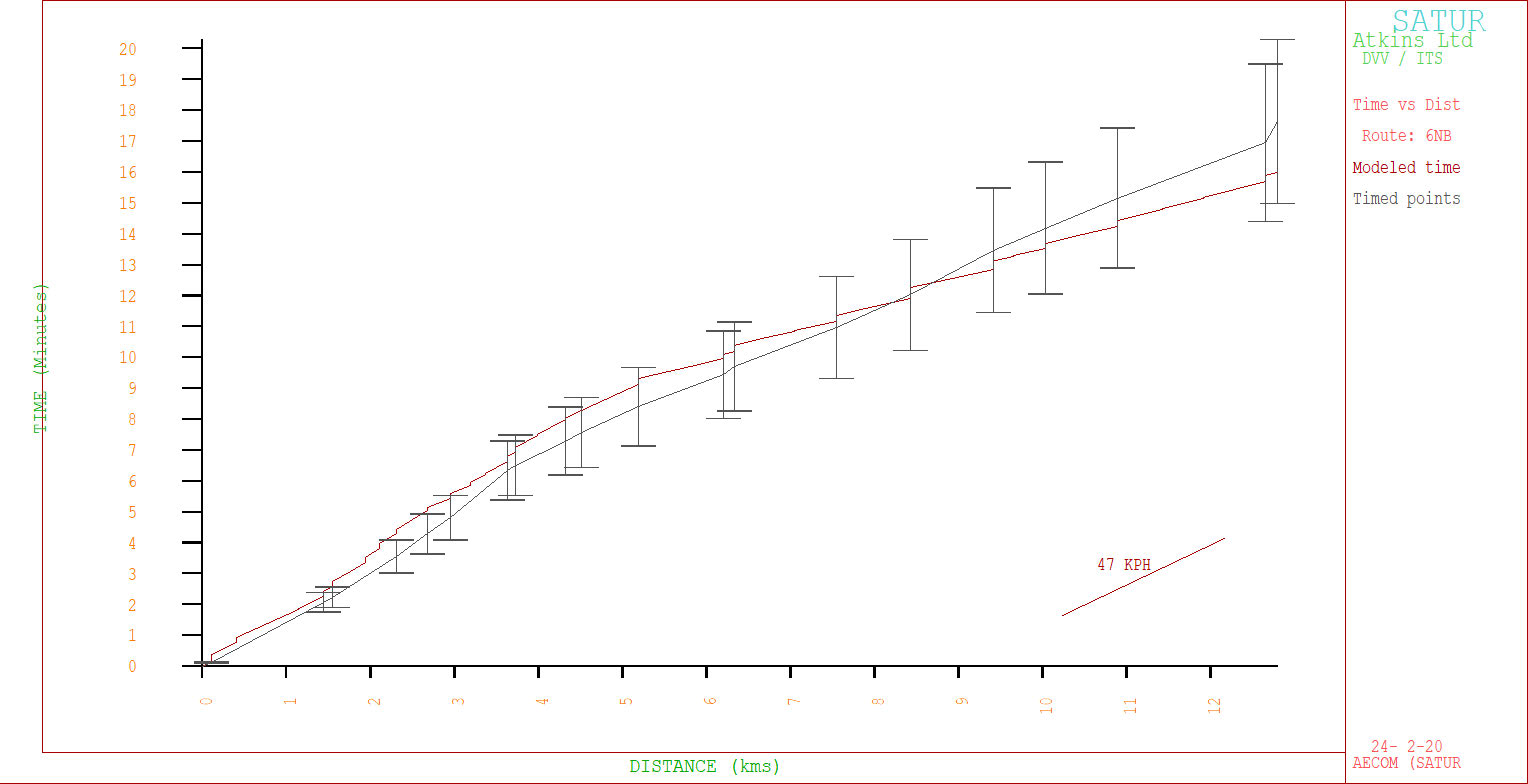
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 5EB
Modeled time
Timed points
46 KPH
TIME (Minutes)
DISTANCE (kms)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24- 2-20
AECOM (SATUR



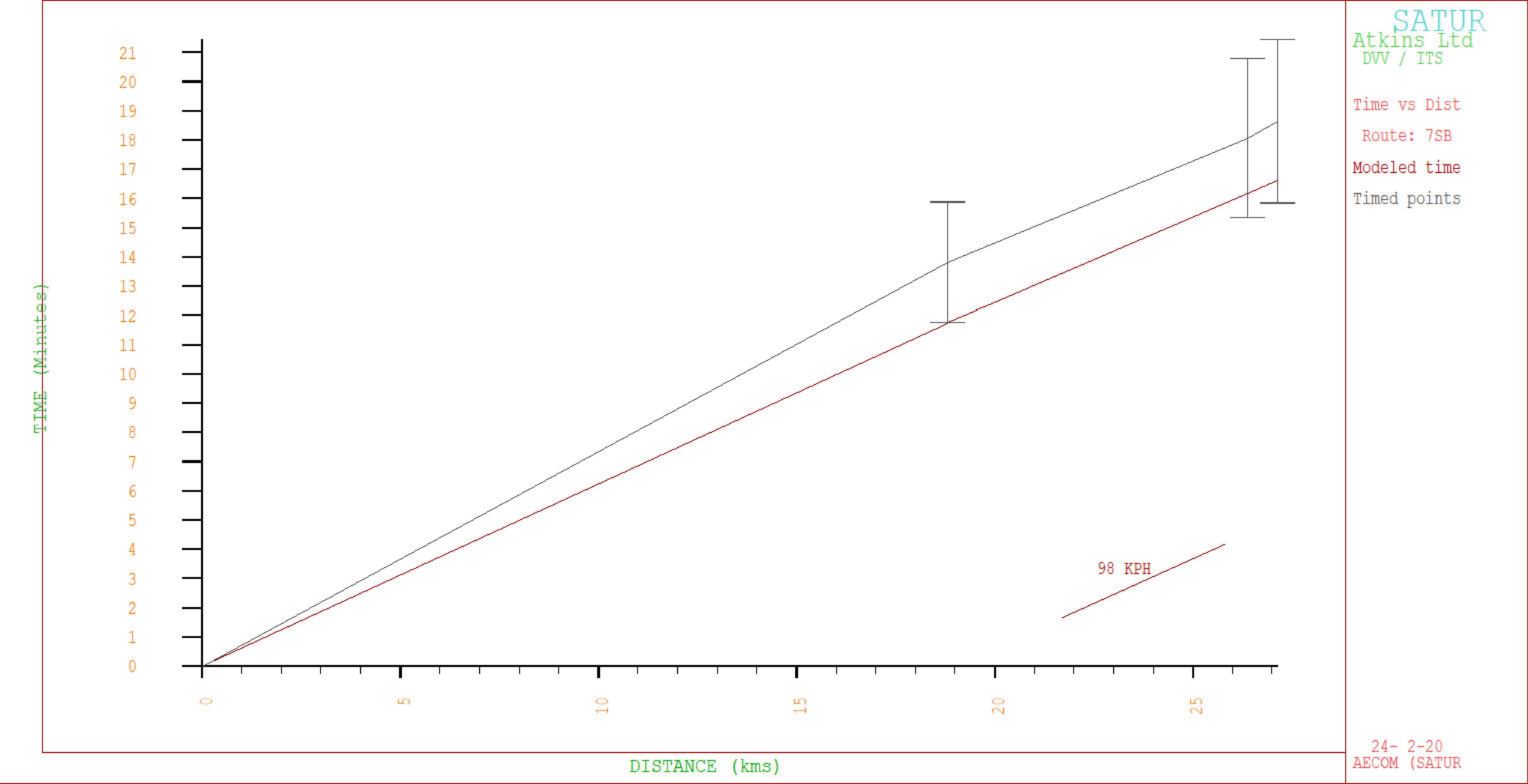
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 5WB
Modeled time
Timed points
TIME (Minutes)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
DISTANCE (kms)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
49 KPH
24- 2-20
AECOM (SATUR



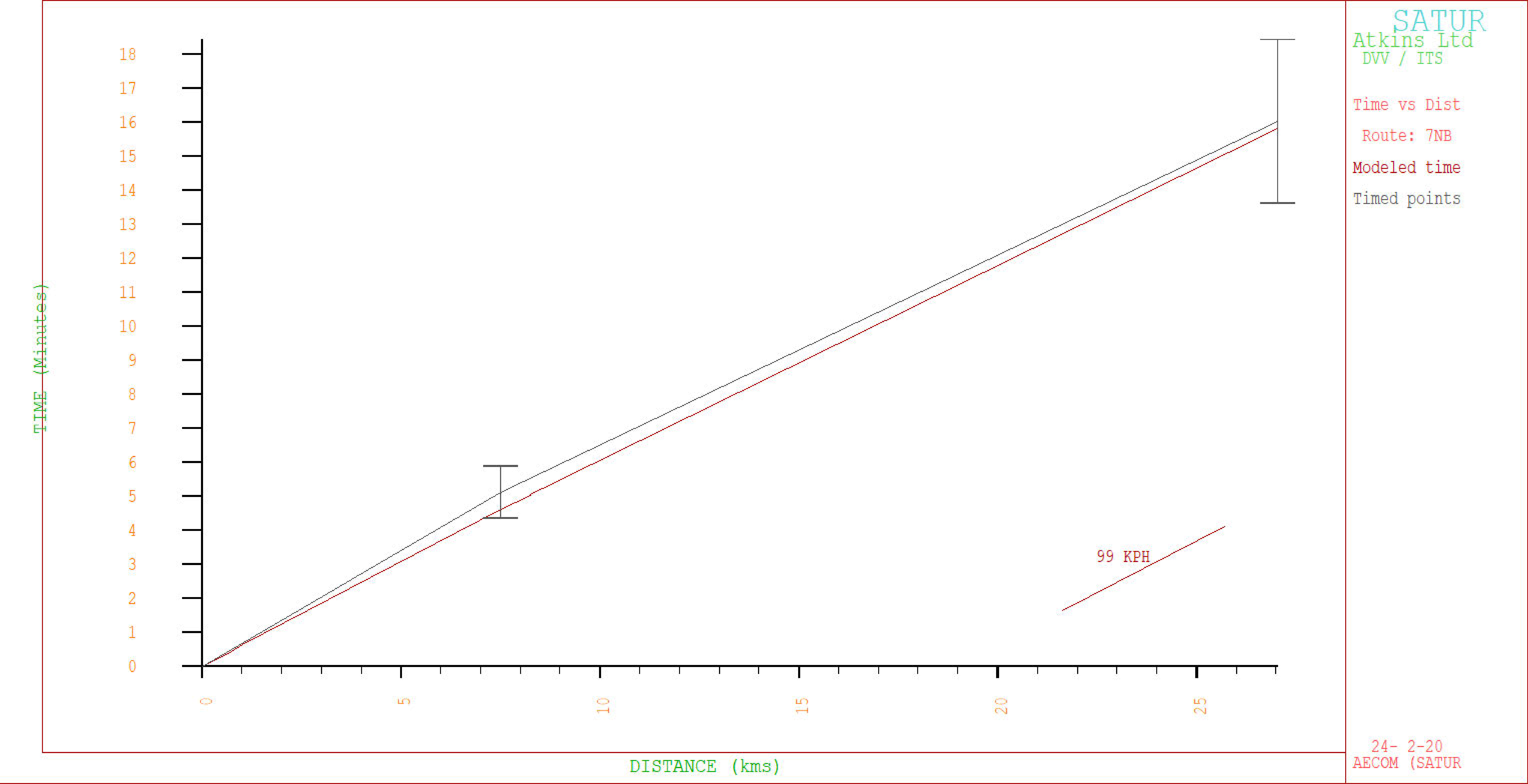
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 6SB
Modeled time
Timed points
TIME (Minutes)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
DISTANCE (kms)
46 KPH
24- 2-20
AECOM (SATUR



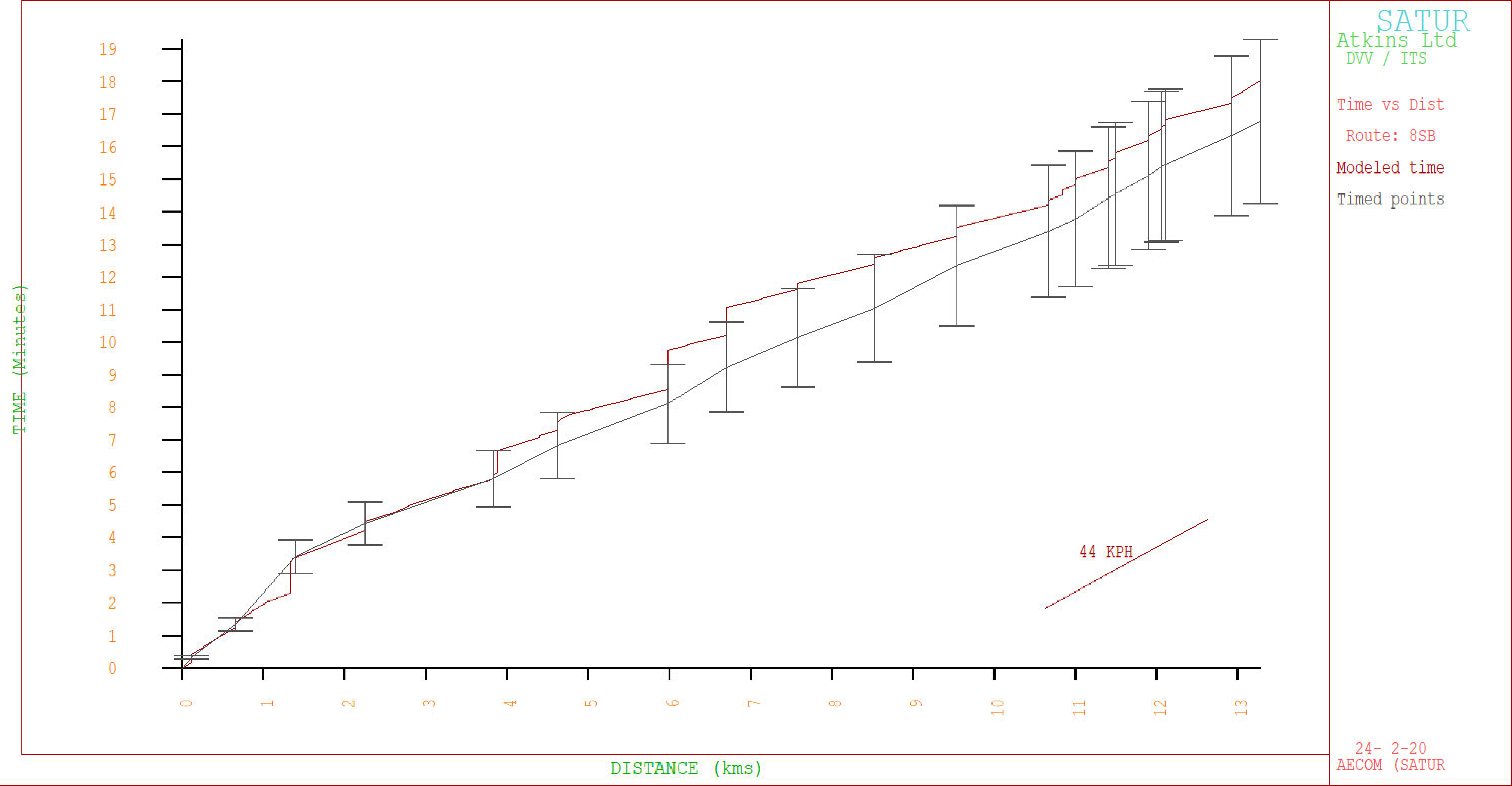
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 6NB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
47 KPH
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
24- 2-20
AECOM (SATUR



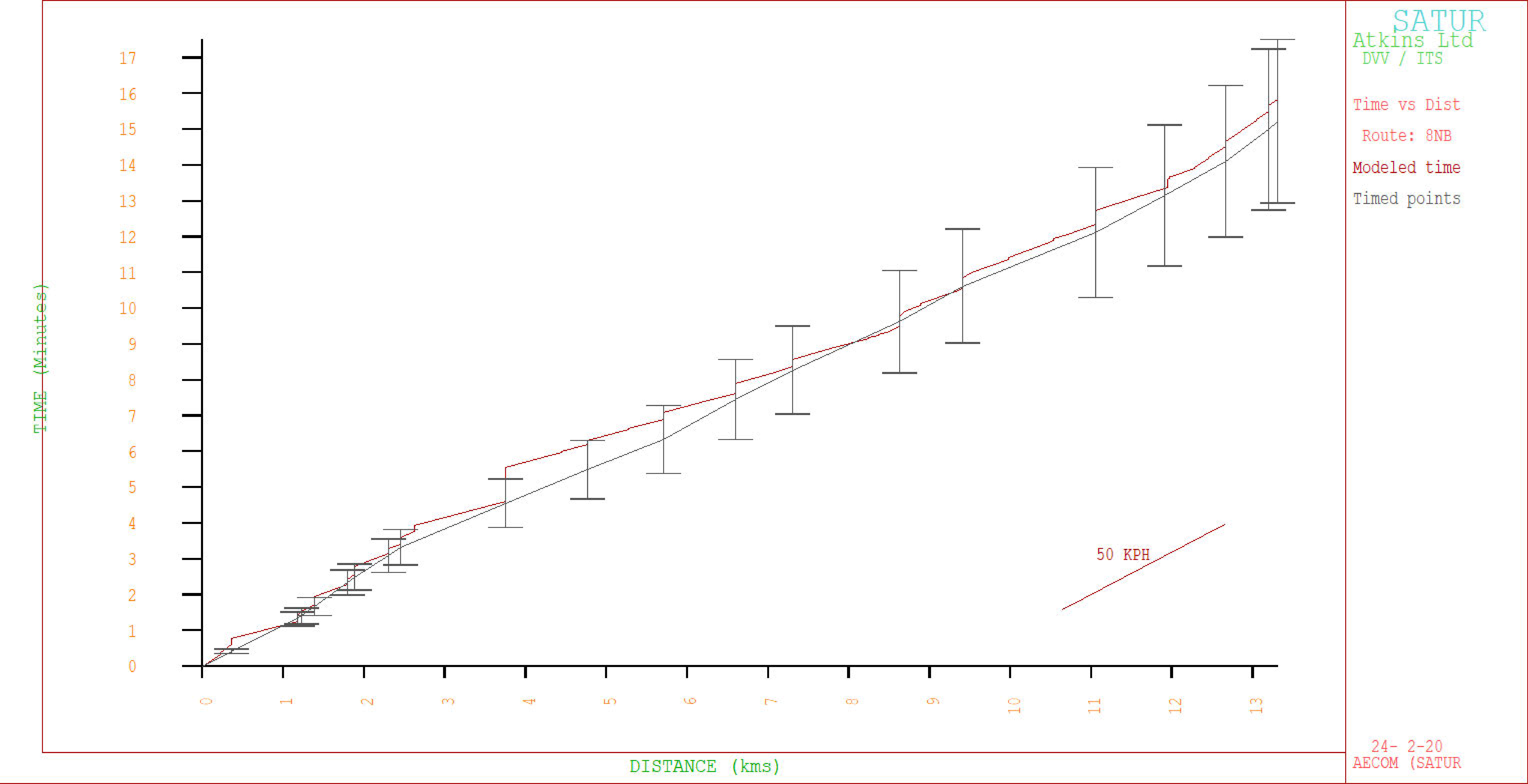
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 7SB
Modeled time
Timed points
TIME (Minutes)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
98 KPH
0
5
10
15
20
25
DISTANCE (kms)
24- 2-20
AECOM (SATUR



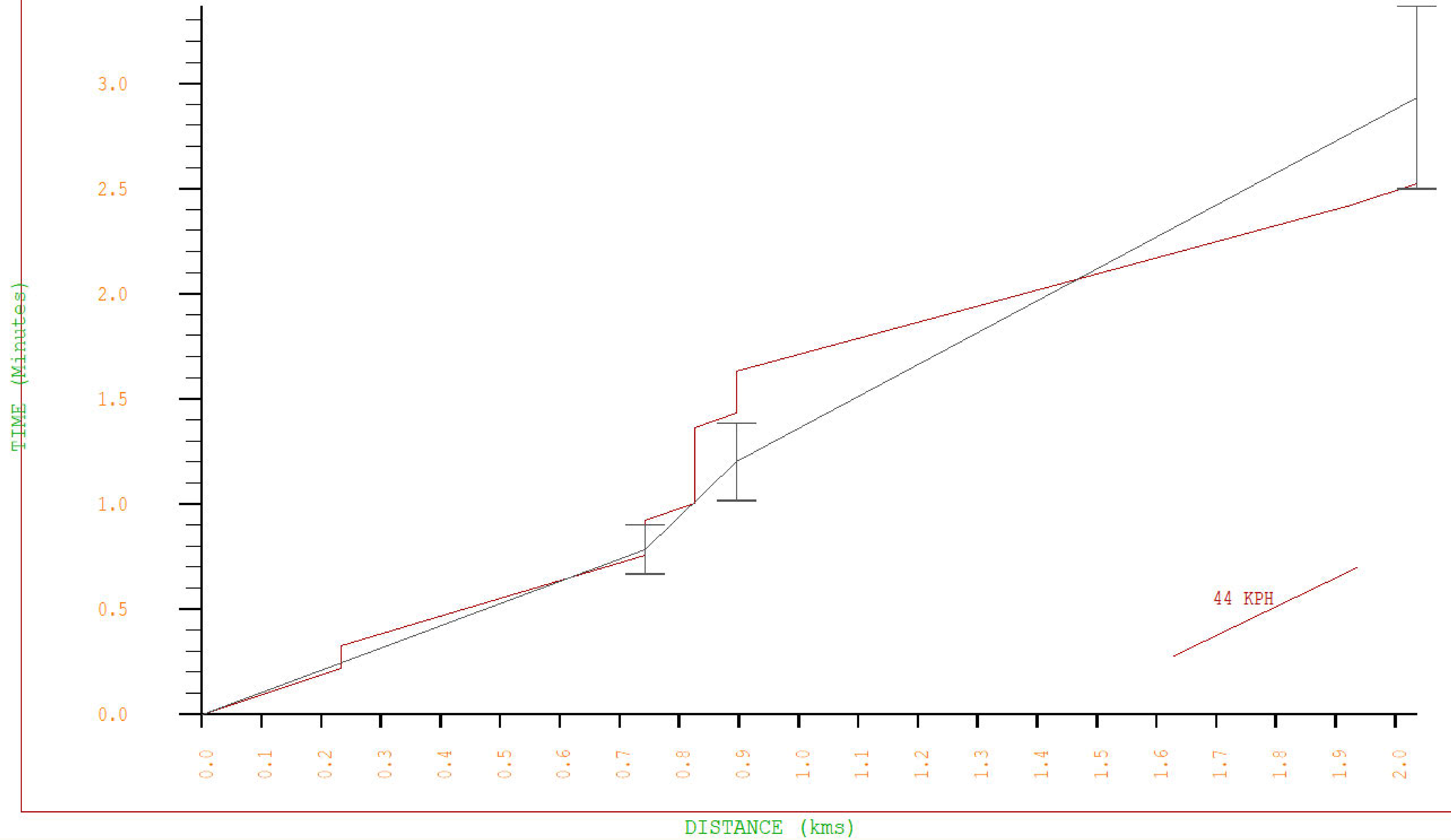
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 7NB
Modeled time
Timed points
TIME (Minutes)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
0
5
10
15
20
25
99 KPH
DISTANCE (kms)
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 8SB
Modeled time
Timed points
44 KPH
TIME (Minutes)
DISTANCE (kms)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
0 1 2 3 4 5 6 7 8 9 10 11 12 13
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 8NB
Modeled time
Timed points
TIME (Minutes)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
DISTANCE (kms)
50 KPH
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS

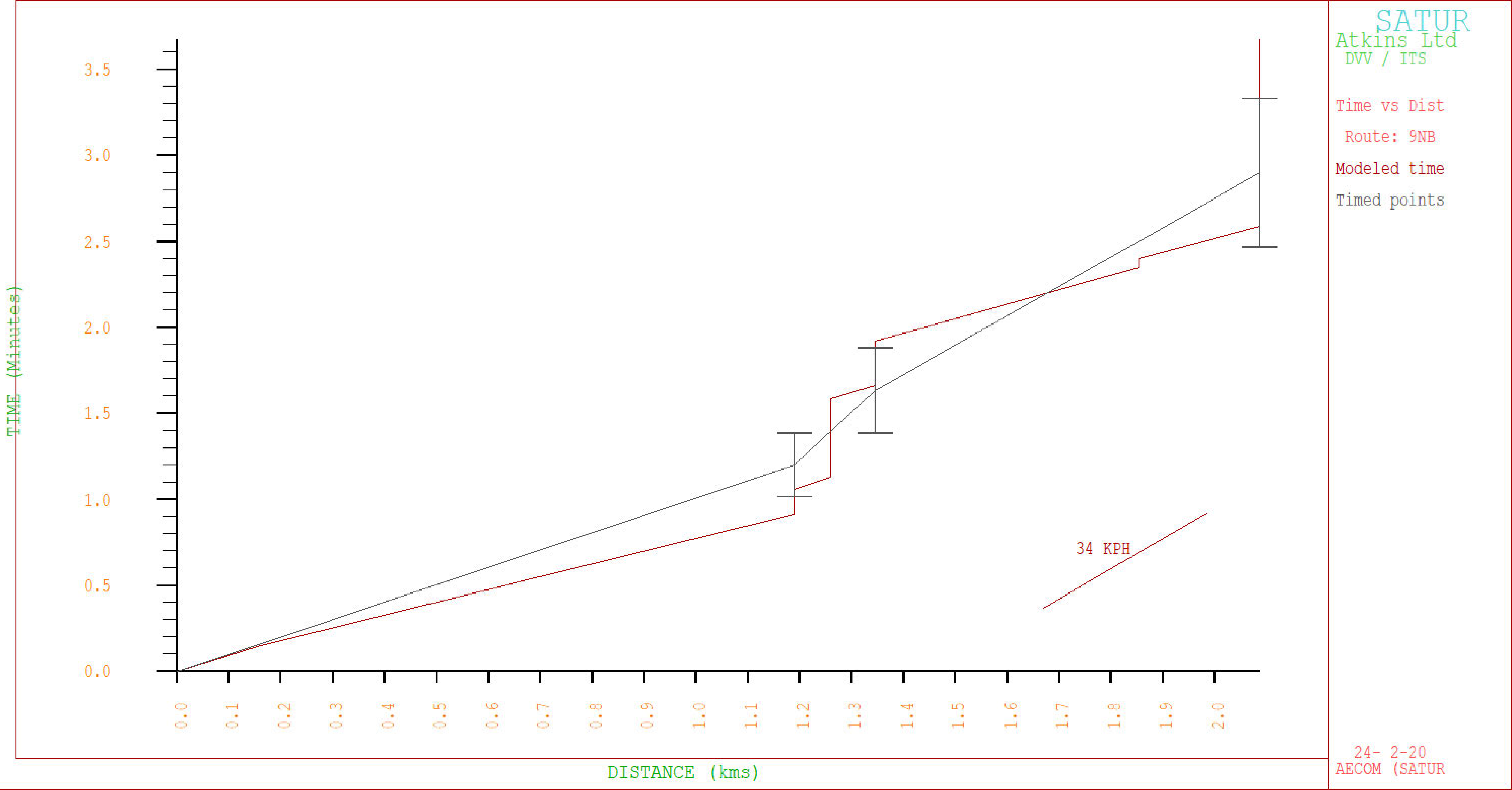
Time vs Dist

Route: 9SB

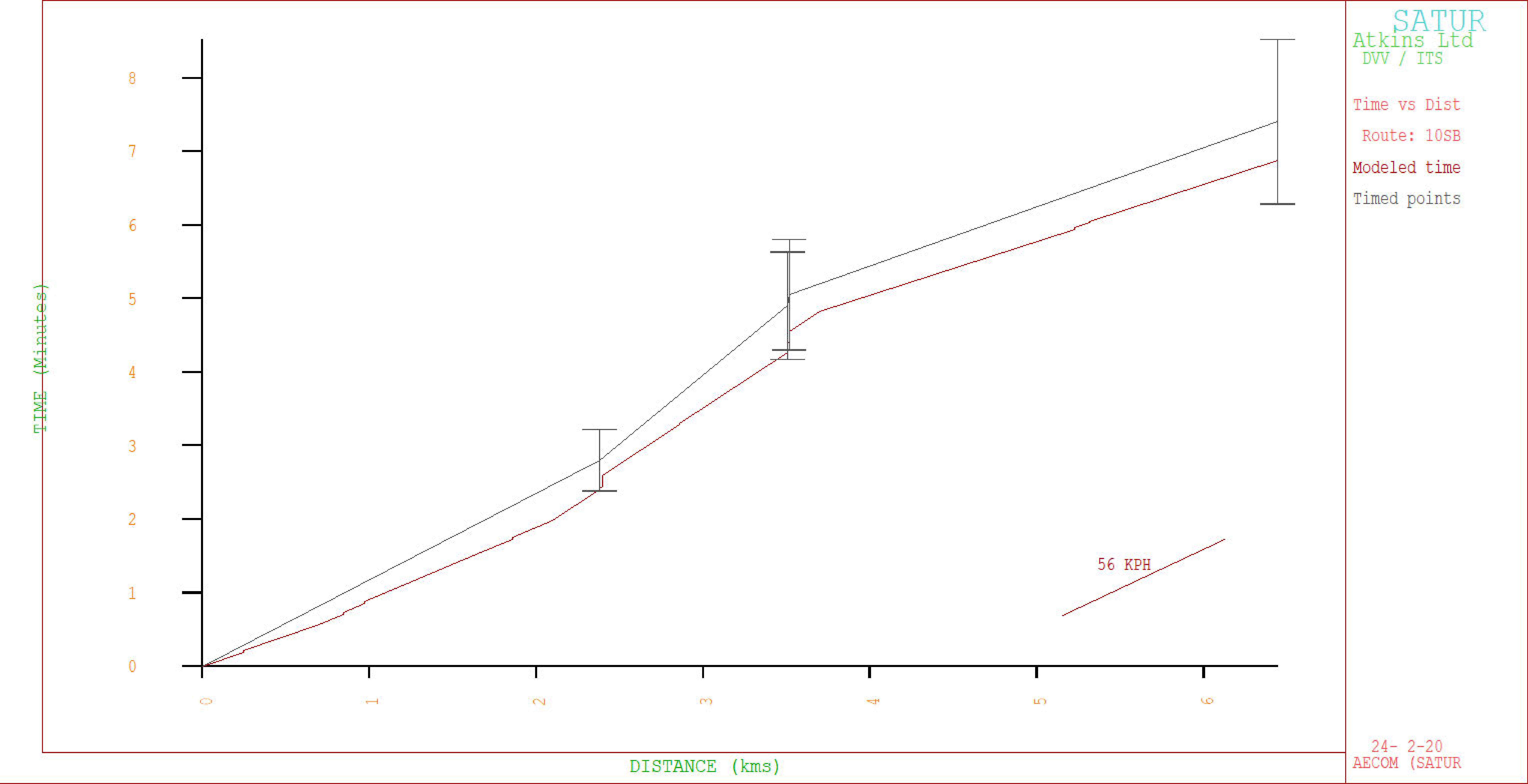
Modeled time

Timed points

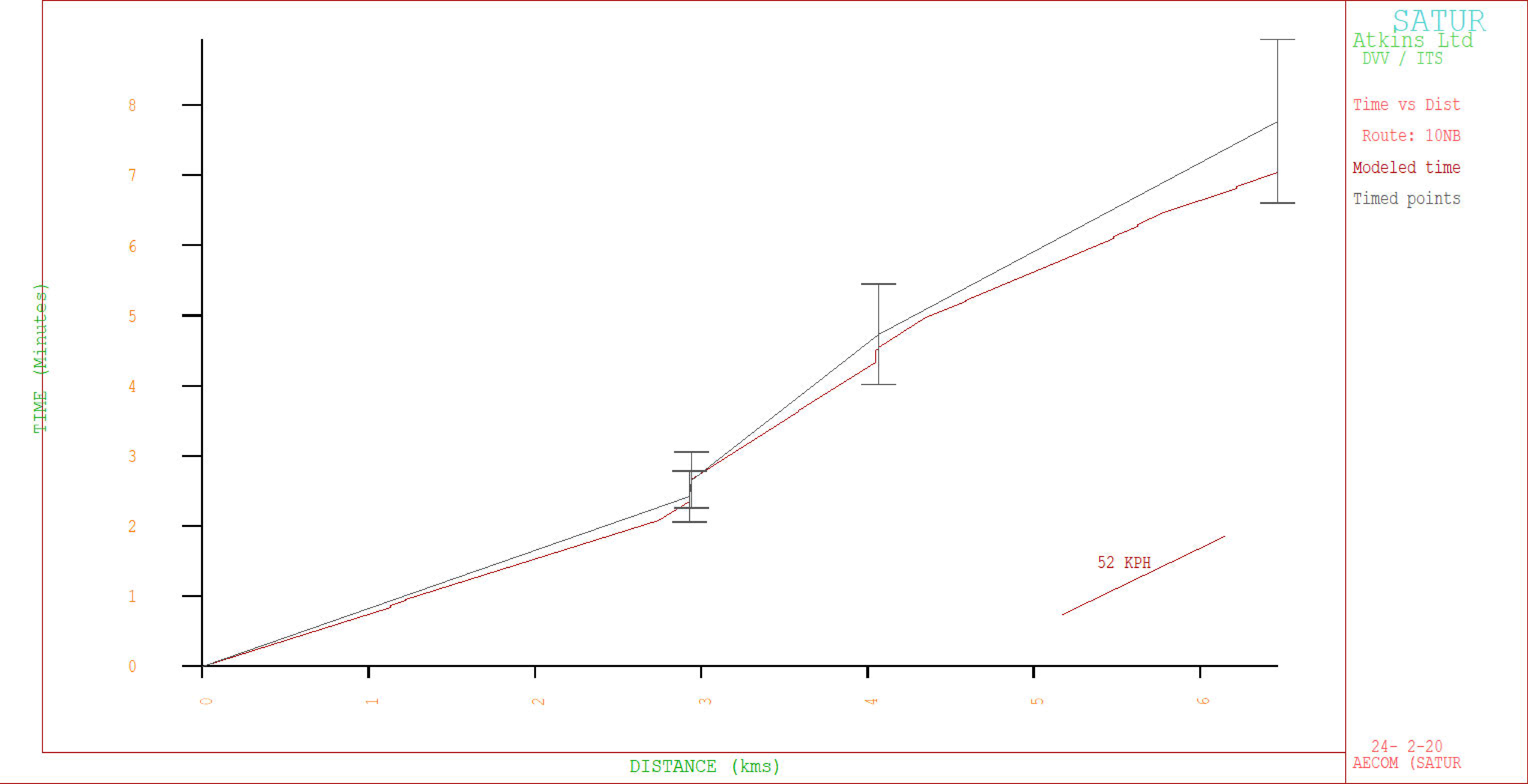
24- 2-20
AECOM (SATUR



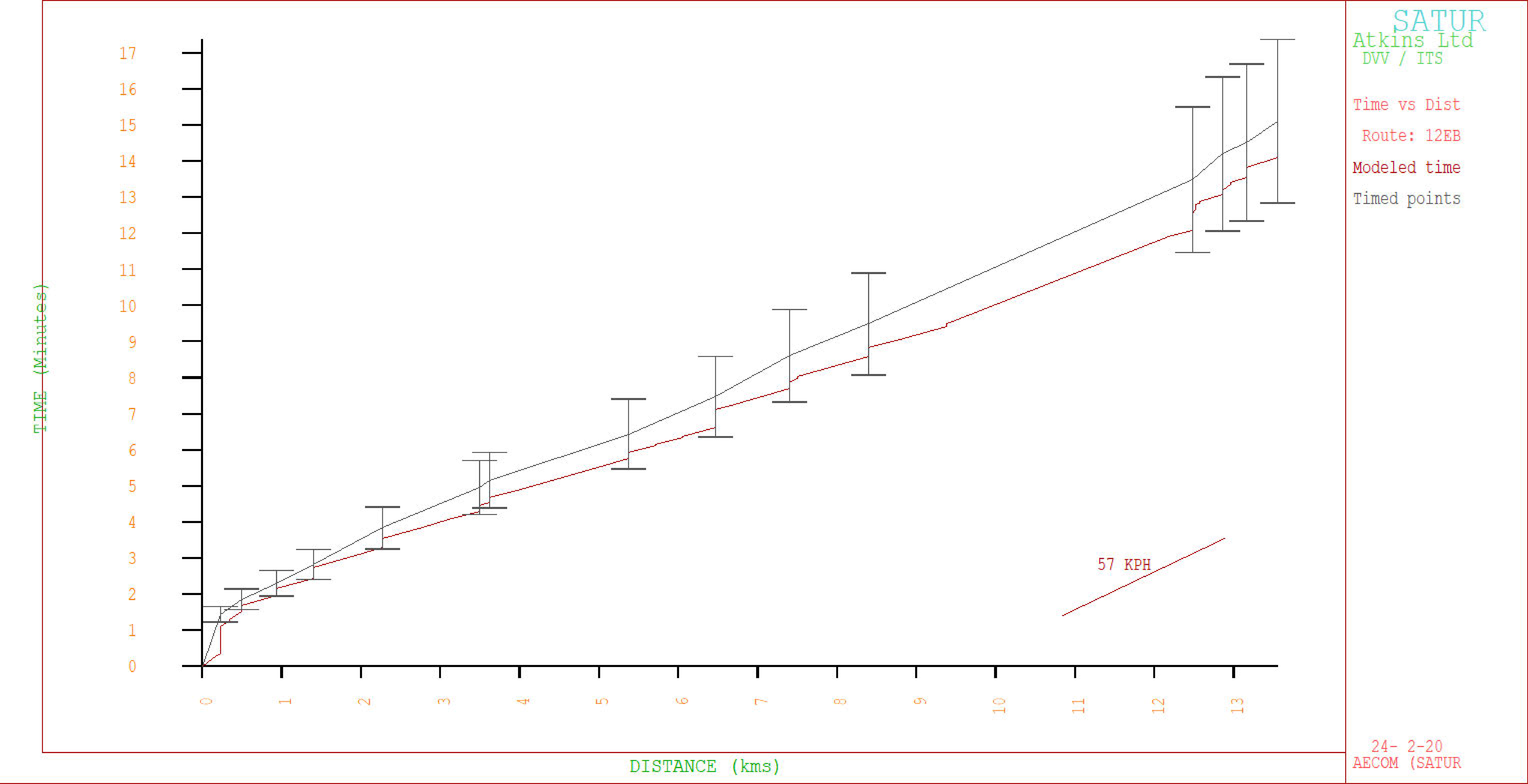
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 9NB
Modeled time
Timed points
TIME (Minutes)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
DISTANCE (kms)
34 KPH
24- 2-20
AECOM (SATUR



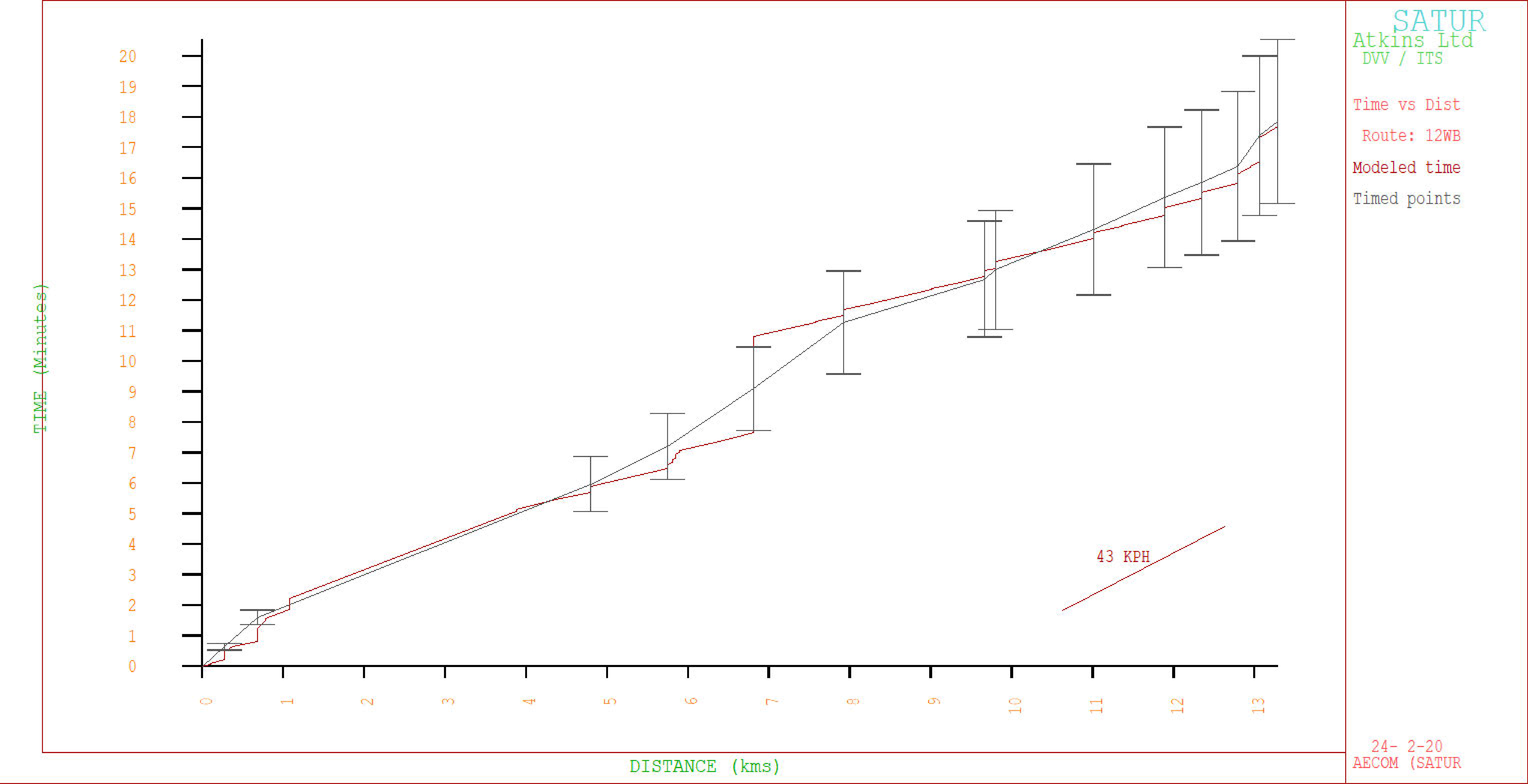
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 10SB
Modeled time
Timed points
56 KPH
TIME (Minutes)
0
1
2
3
4
5
6
7
8
DISTANCE (kms)
0
1
2
3
4
5
6
24- 2-20
AECOM (SATUR

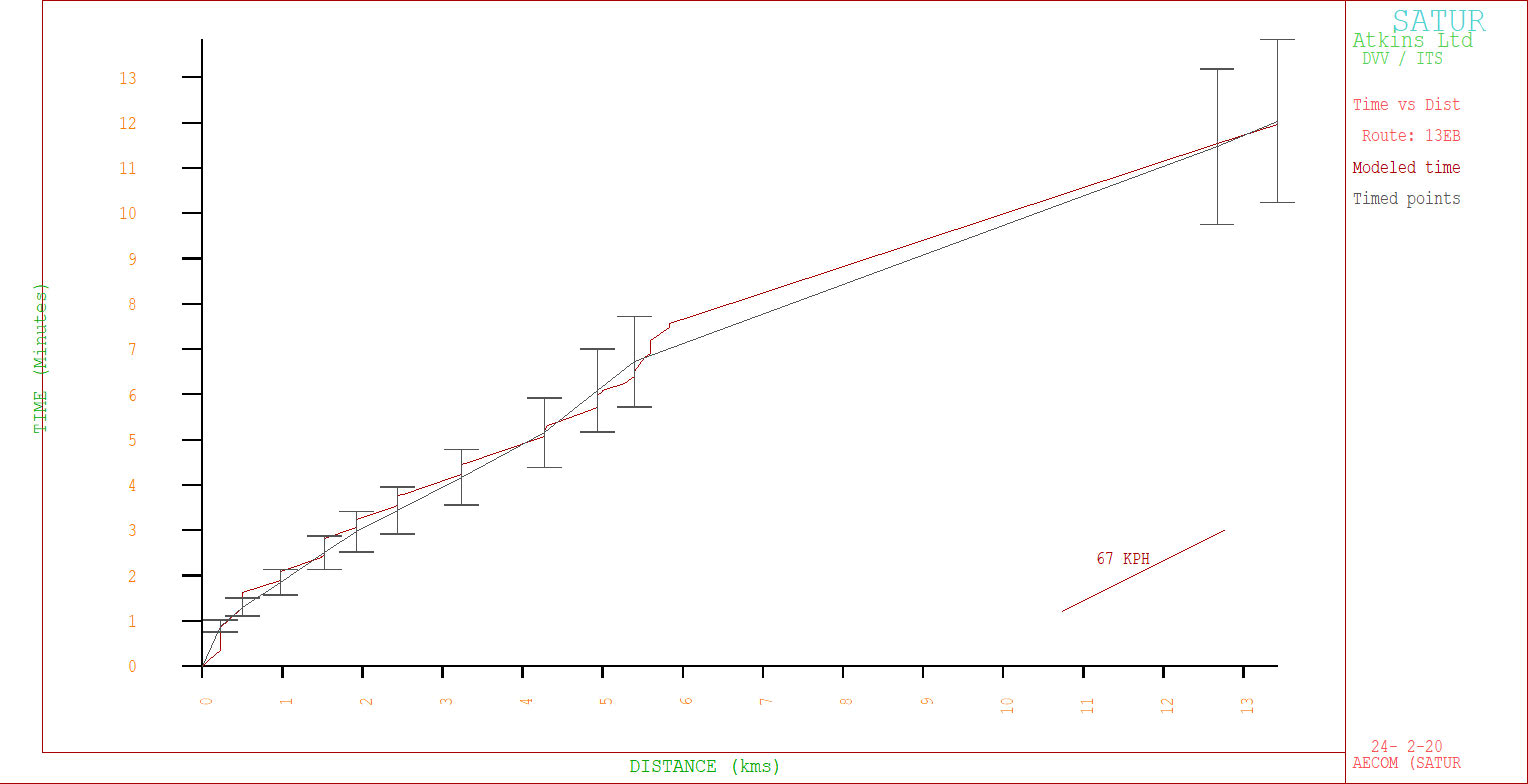


SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 10NB
Modeled time
Timed points
TIME (Minutes)
0
1
2
3
4
5
6
7
8
DISTANCE (kms)
0
1
2
3
4
5
6
52 KPH
24- 2-20
AECOM (SATUR

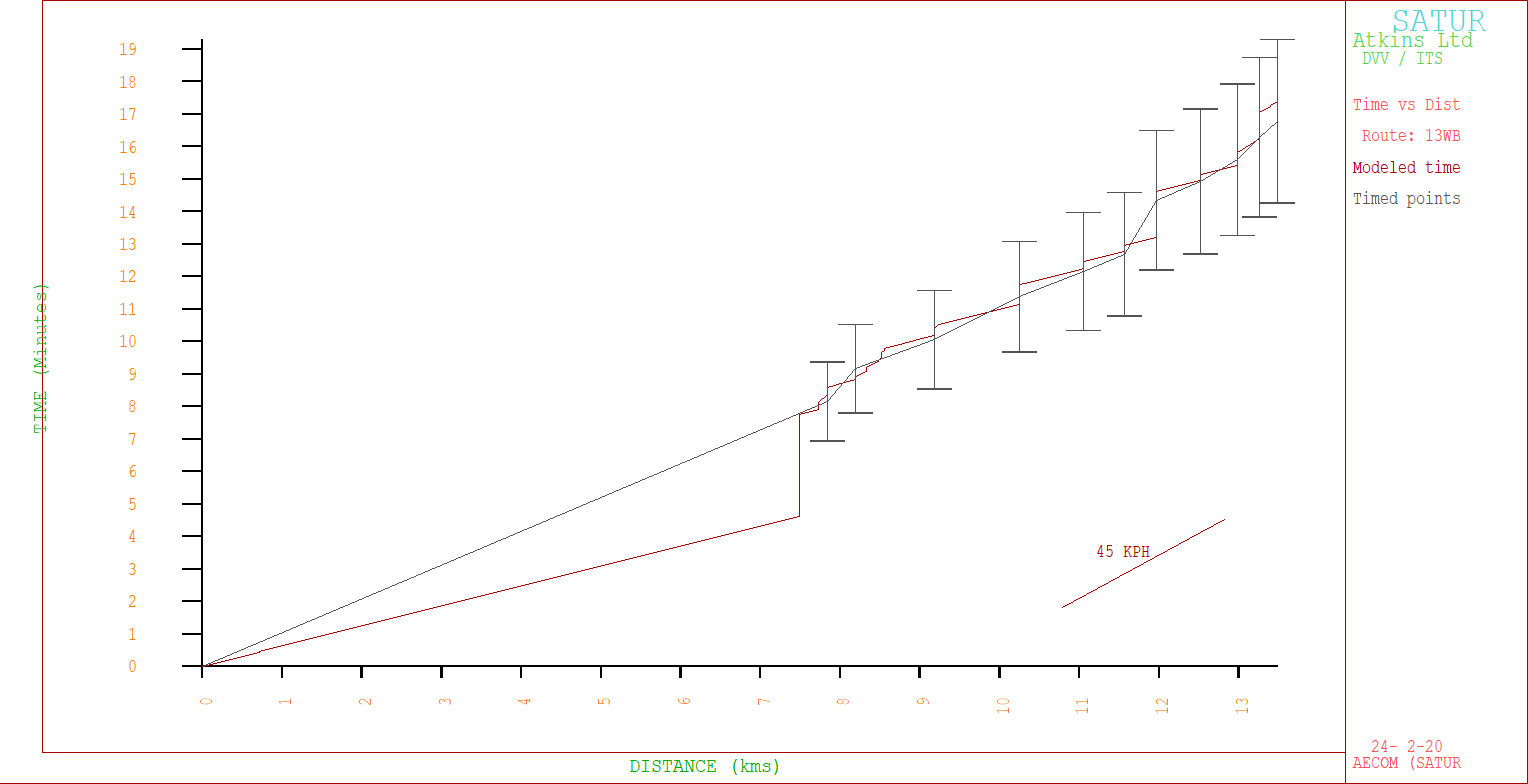


SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 12EB
Modeled time
Timed points
TIME (Minutes)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
57 KPH
DISTANCE (kms)
24- 2-20
AECOM (SATUR

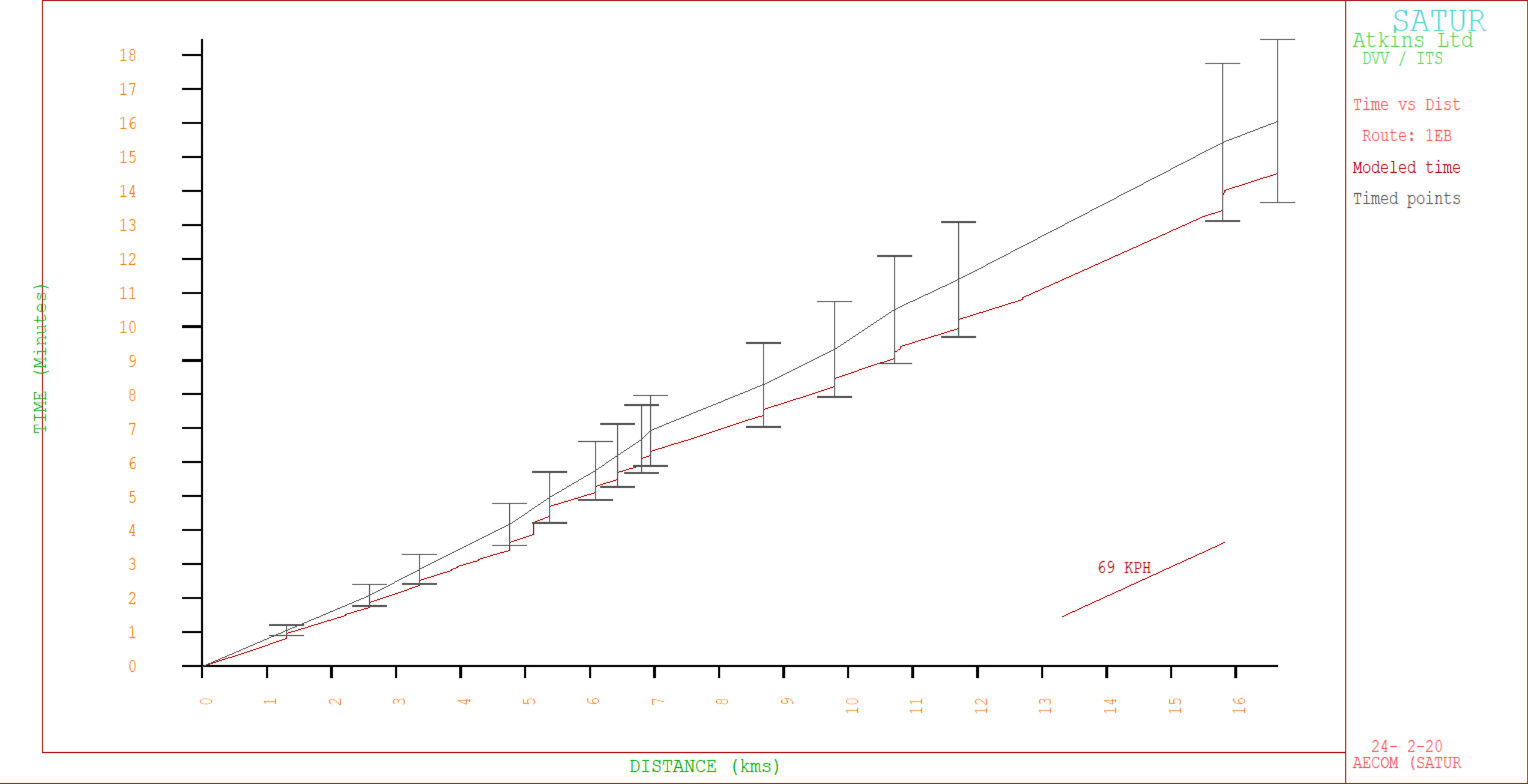

SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 12WB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
43 KPH
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
24- 2-20
AECOM (SATUR



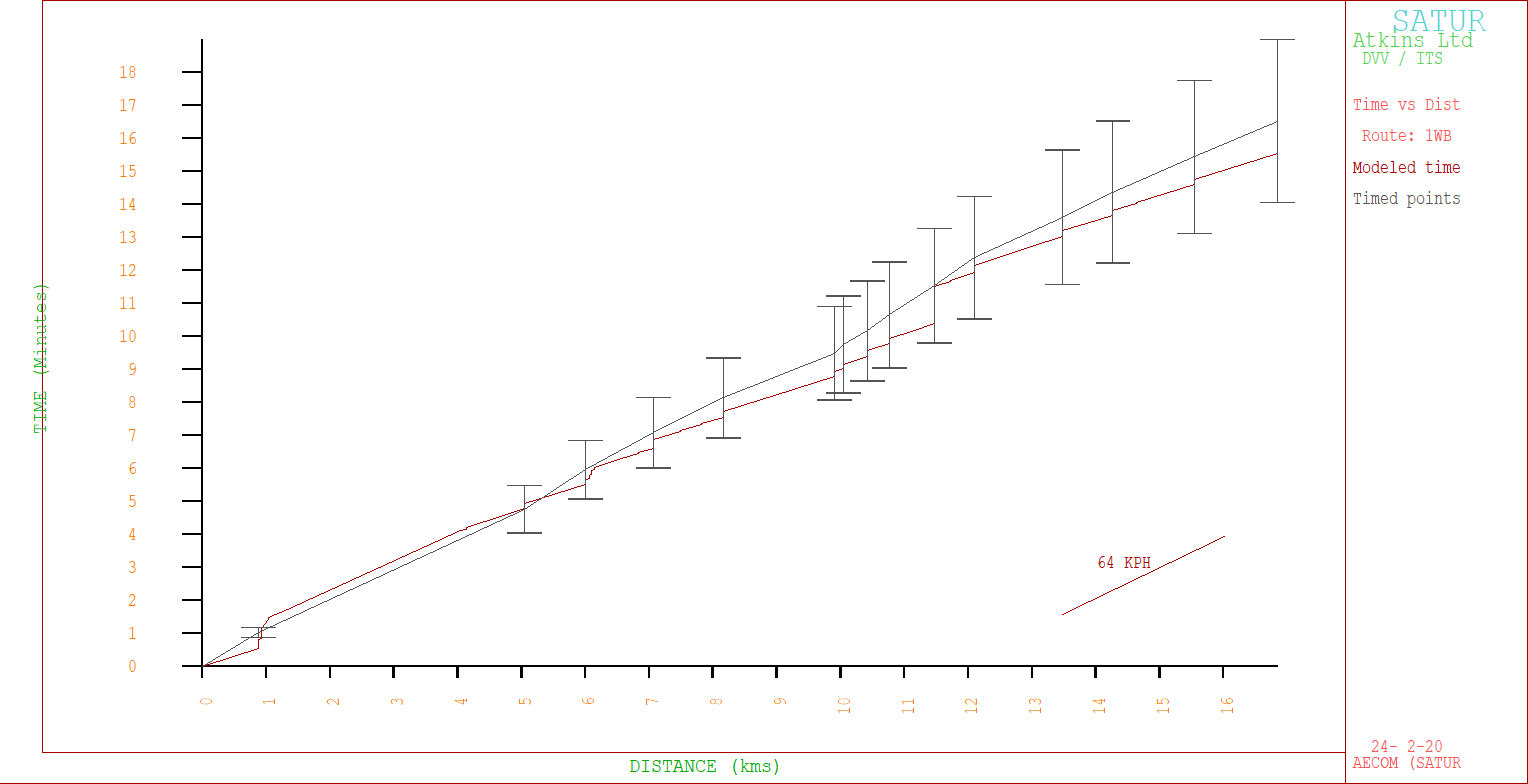
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 13EB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
67 KPH
0 1 2 3 4 5 6 7 8 9 10 11 12 13
24- 2-20
AECOM (SATUR



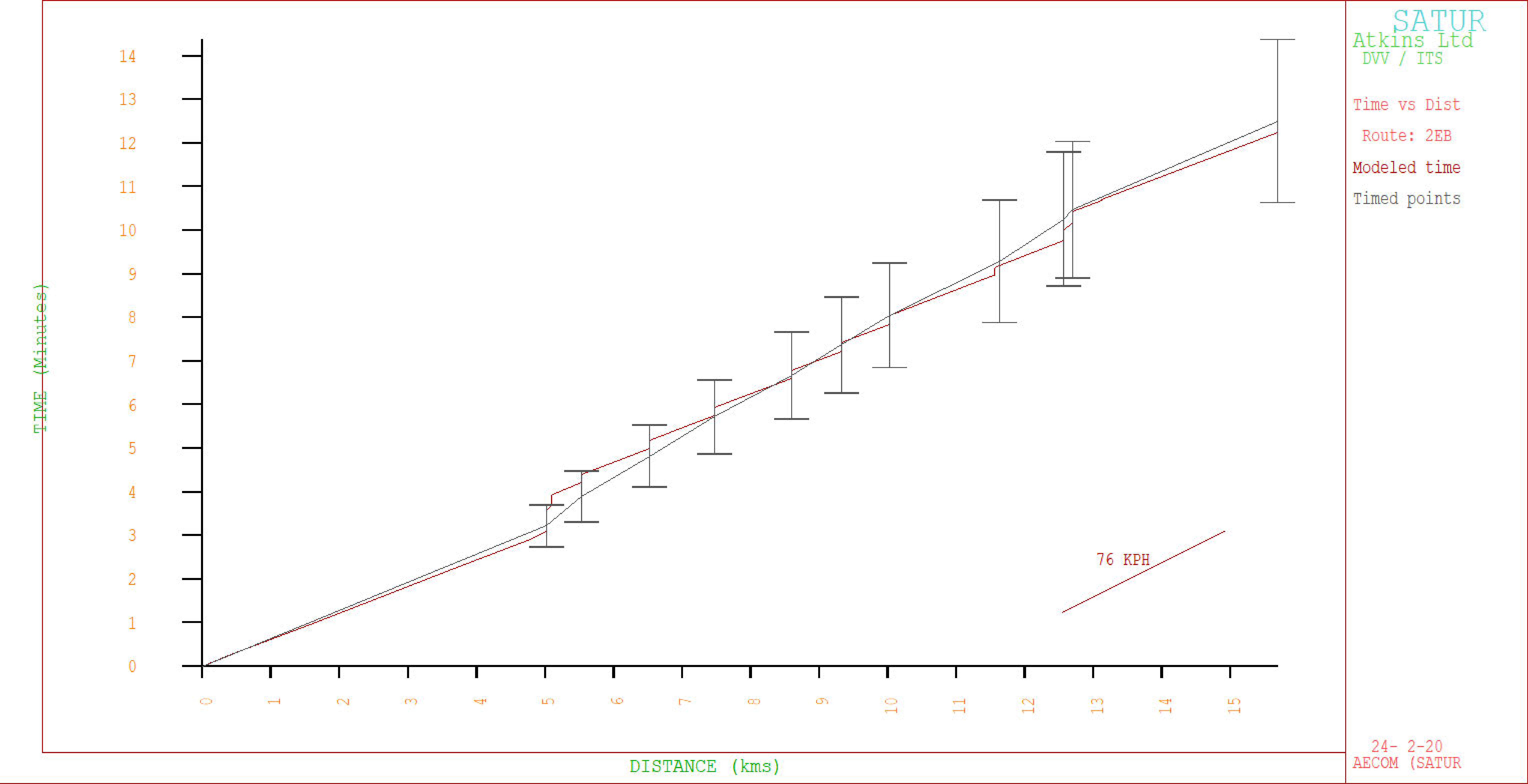
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 13WB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
45 KPH
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
0 1 2 3 4 5 6 7 8 9 10 11 12 13
24- 2-20
AECOM (SATUR



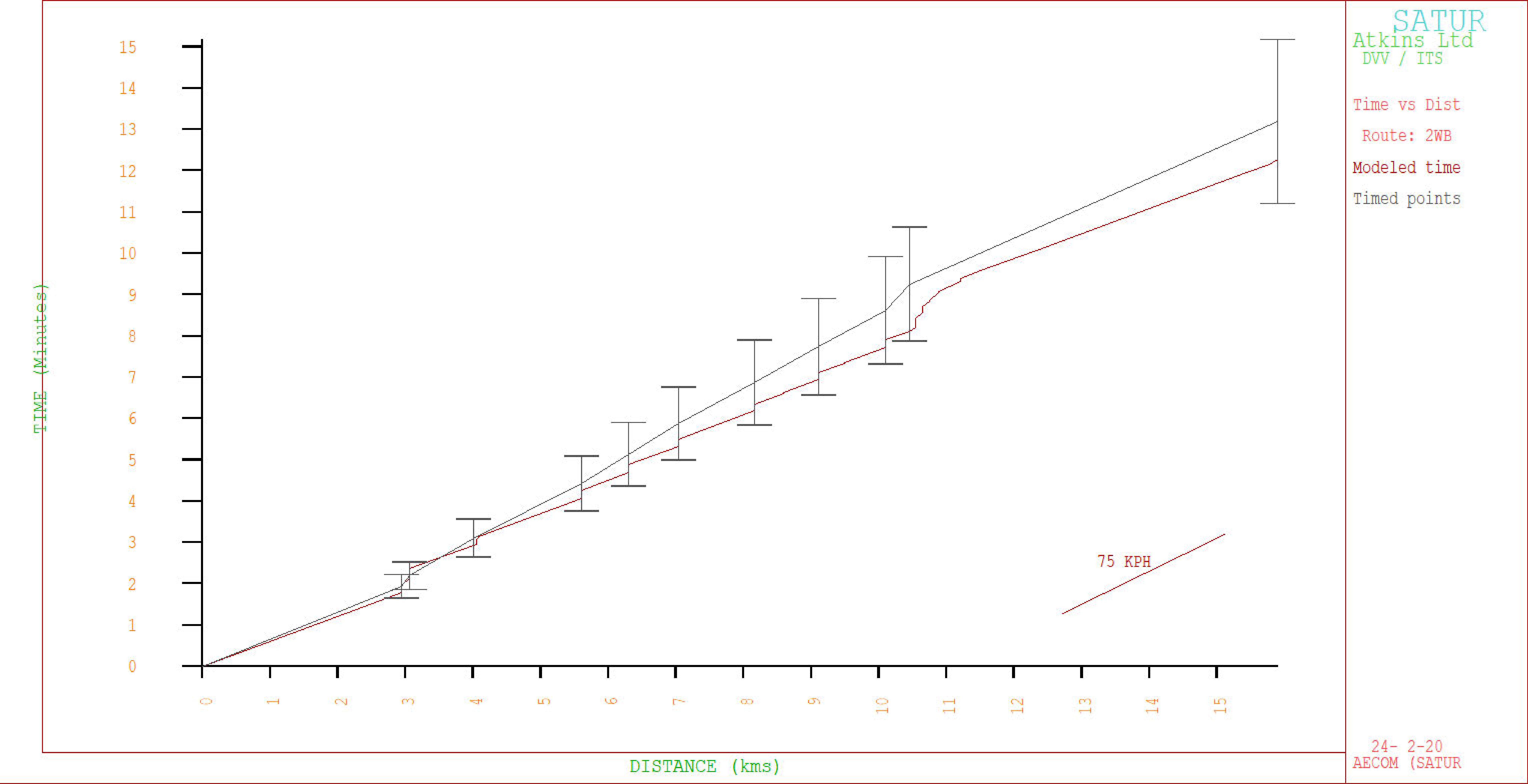
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 1EB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
69 KPH
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
24- 2-20
AECOM (SATUR



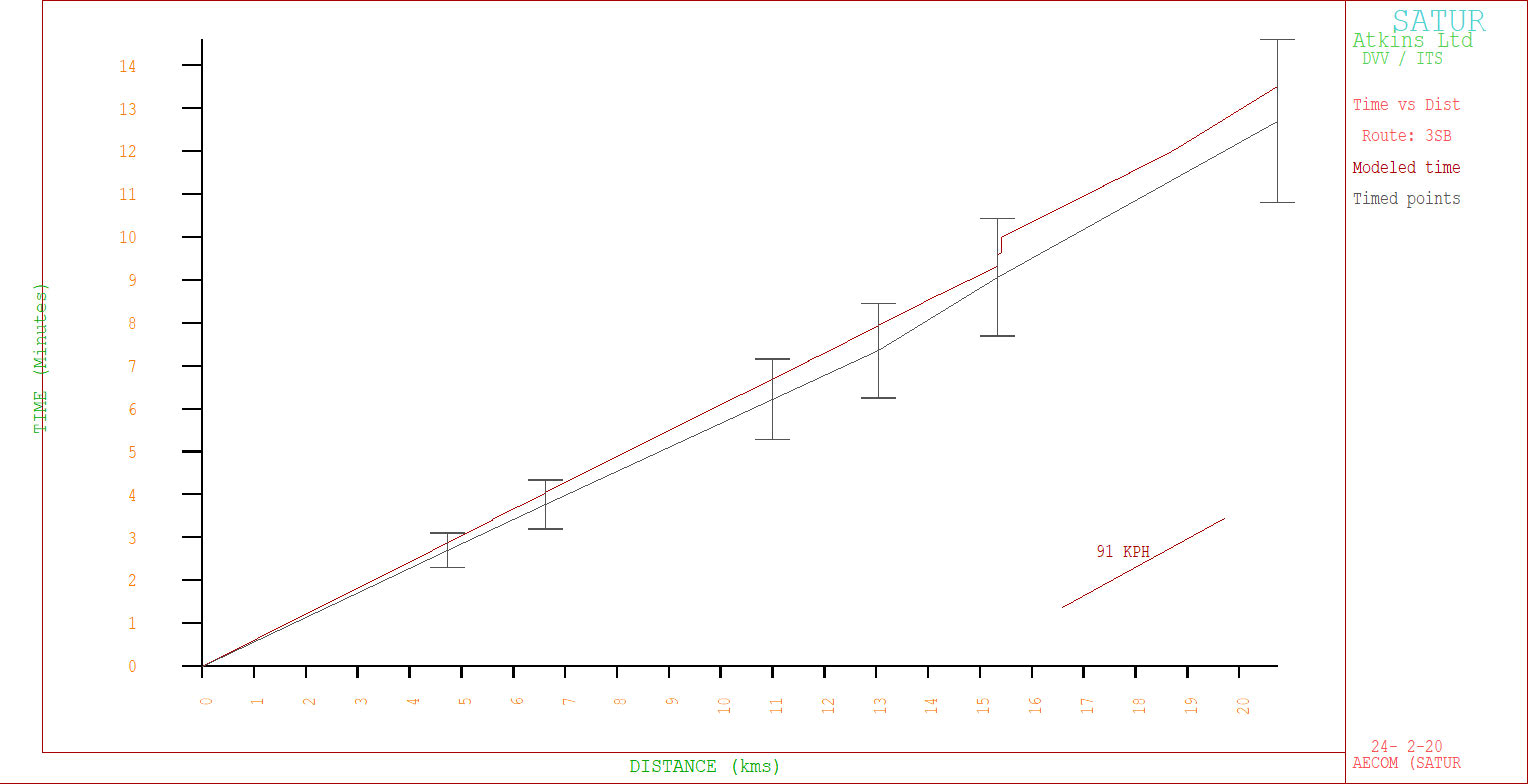
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 1WB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
64 KPH
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
24- 2-20
AECOM (SATUR

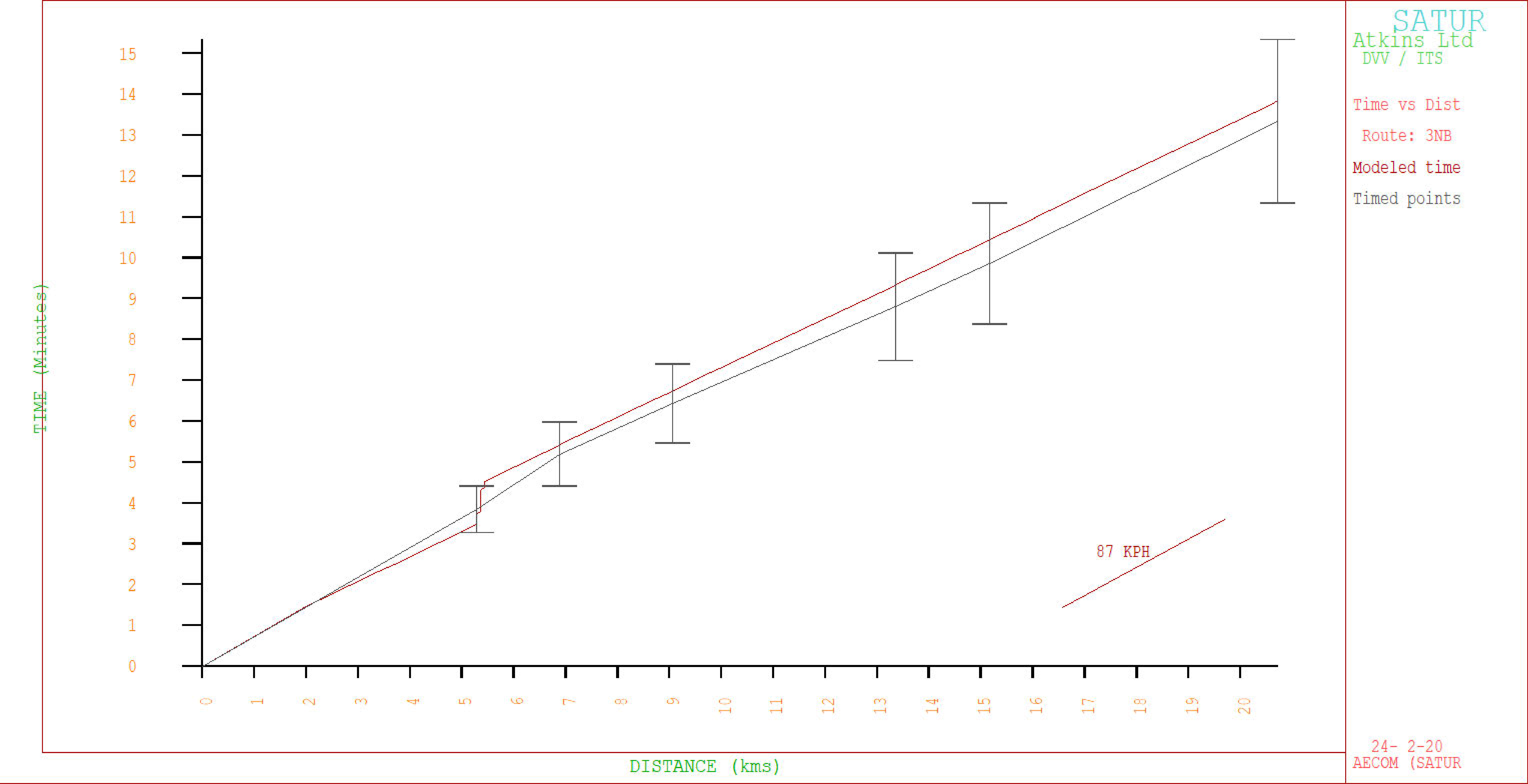


SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 2EB
Modeled time
Timed points
76 KPH
TIME (Minutes)
DISTANCE (kms)
24- 2-20
AECOM (SATUR

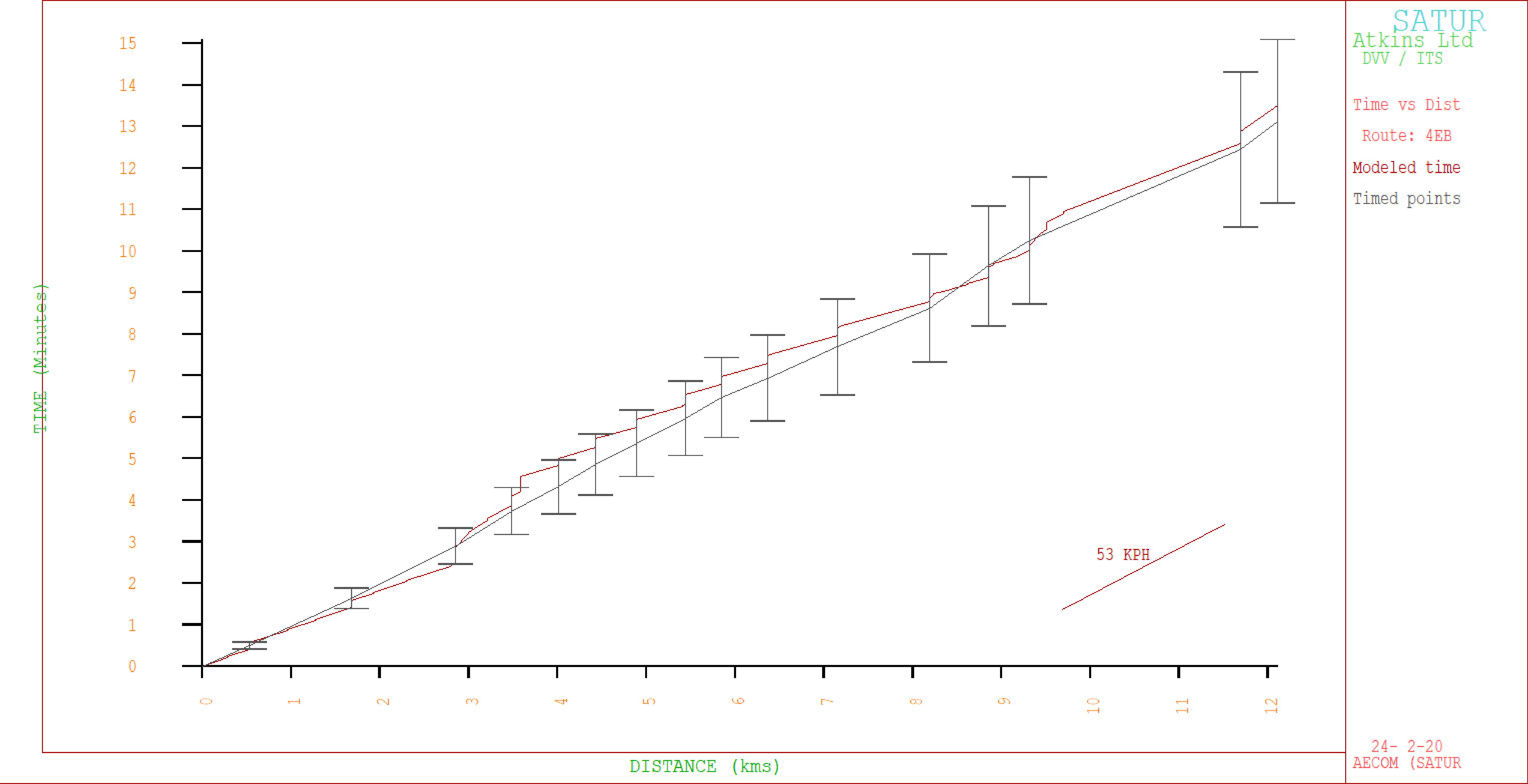


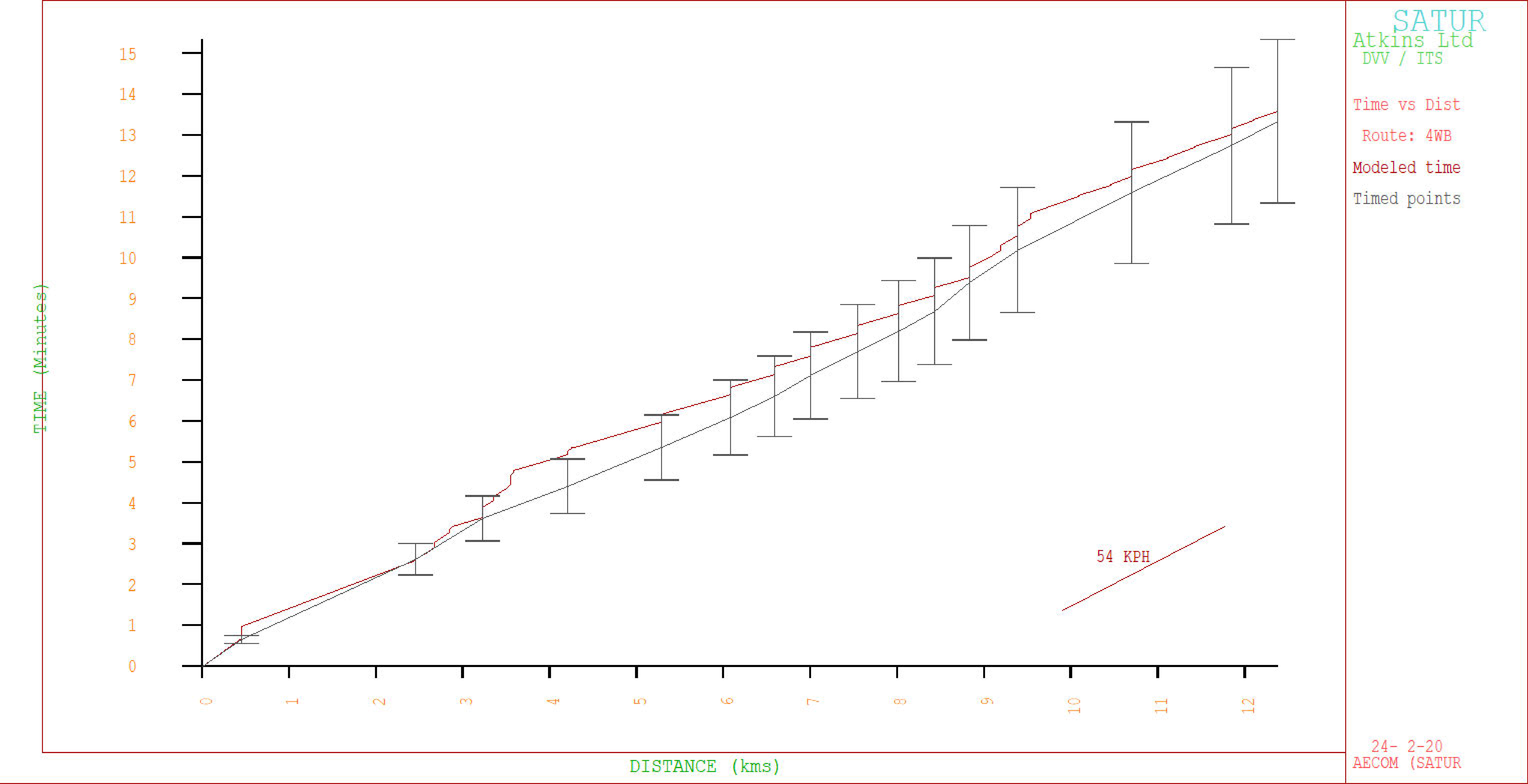
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 2WB
Modeled time
Timed points
75 KPH
TIME (Minutes)
DISTANCE (kms)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
24- 2-20
AECOM (SATUR

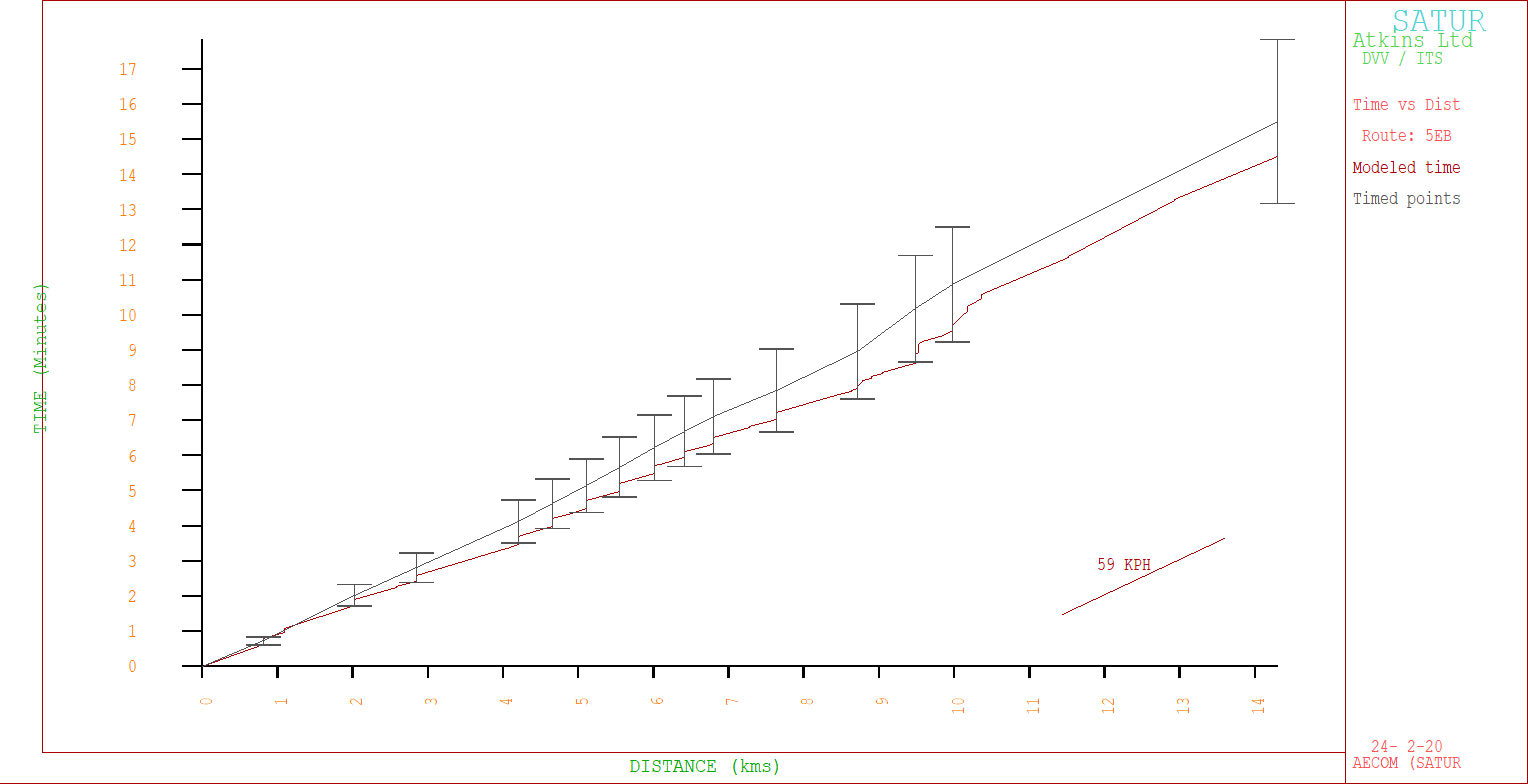

SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 3SB
Modeled time
Timed points
91 KPH
TIME (Minutes)
DISTANCE (kms)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
24- 2-20
AECOM (SATUR



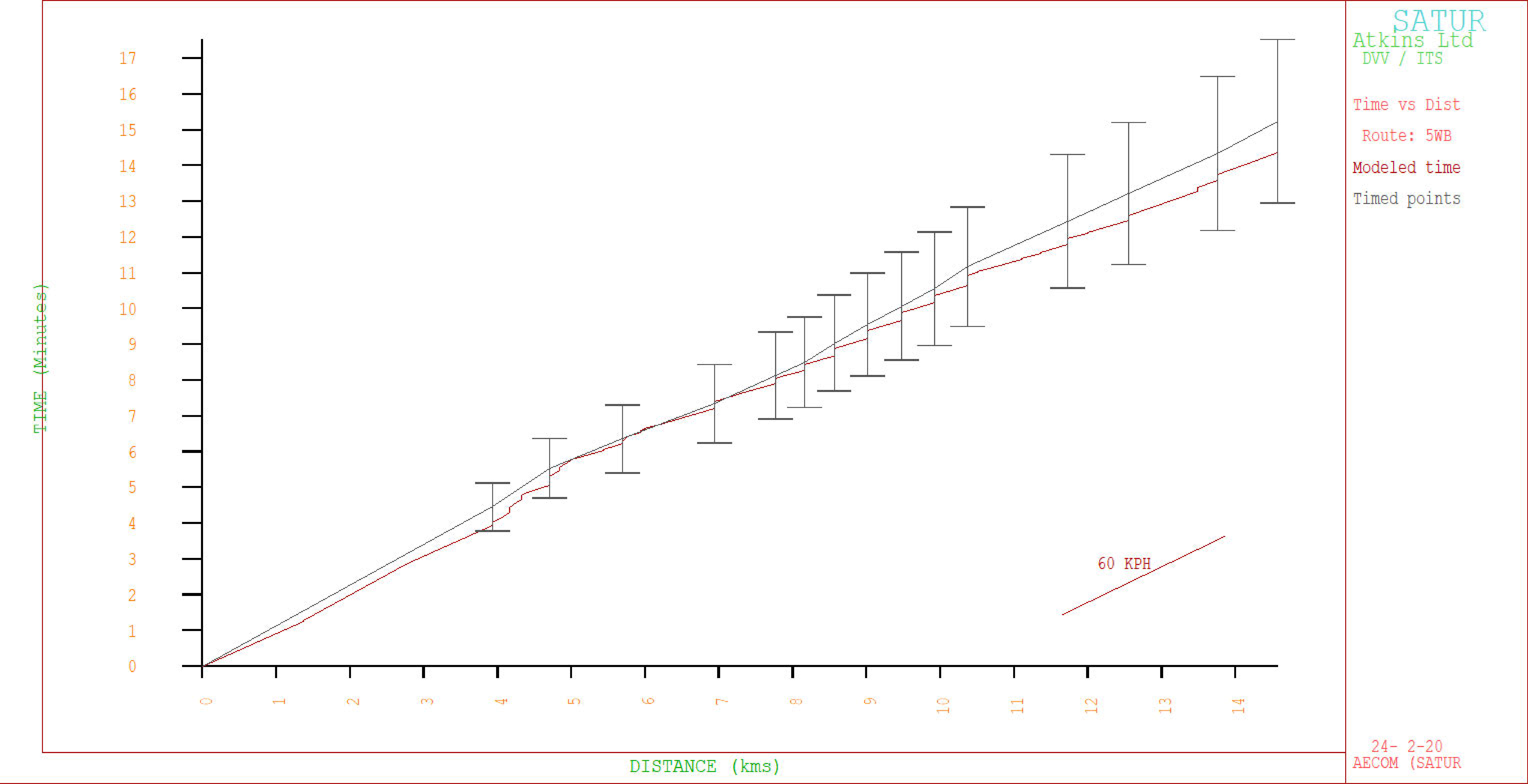
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 3NB
Modeled time
Timed points
TIME (Minutes)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
DISTANCE (kms)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
87 KPH
24- 2-20
AECOM (SATUR


SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 4EB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
53 KPH
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
24- 2-20
AECOM (SATUR

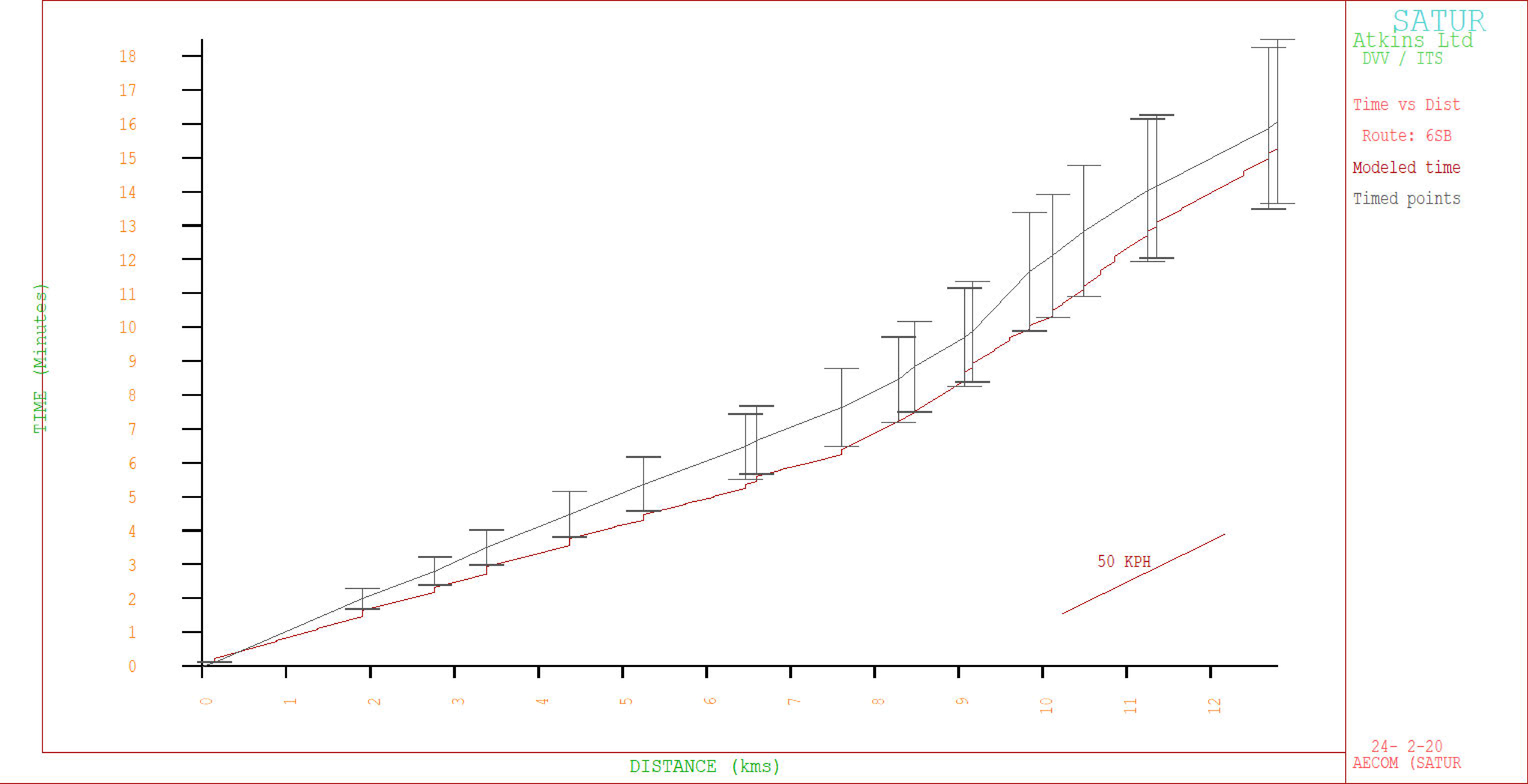

SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 4WB
Modeled time
Timed points
54 KPH
TIME (Minutes)
DISTANCE (kms)
24- 2-20
AECOM (SATUR
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15



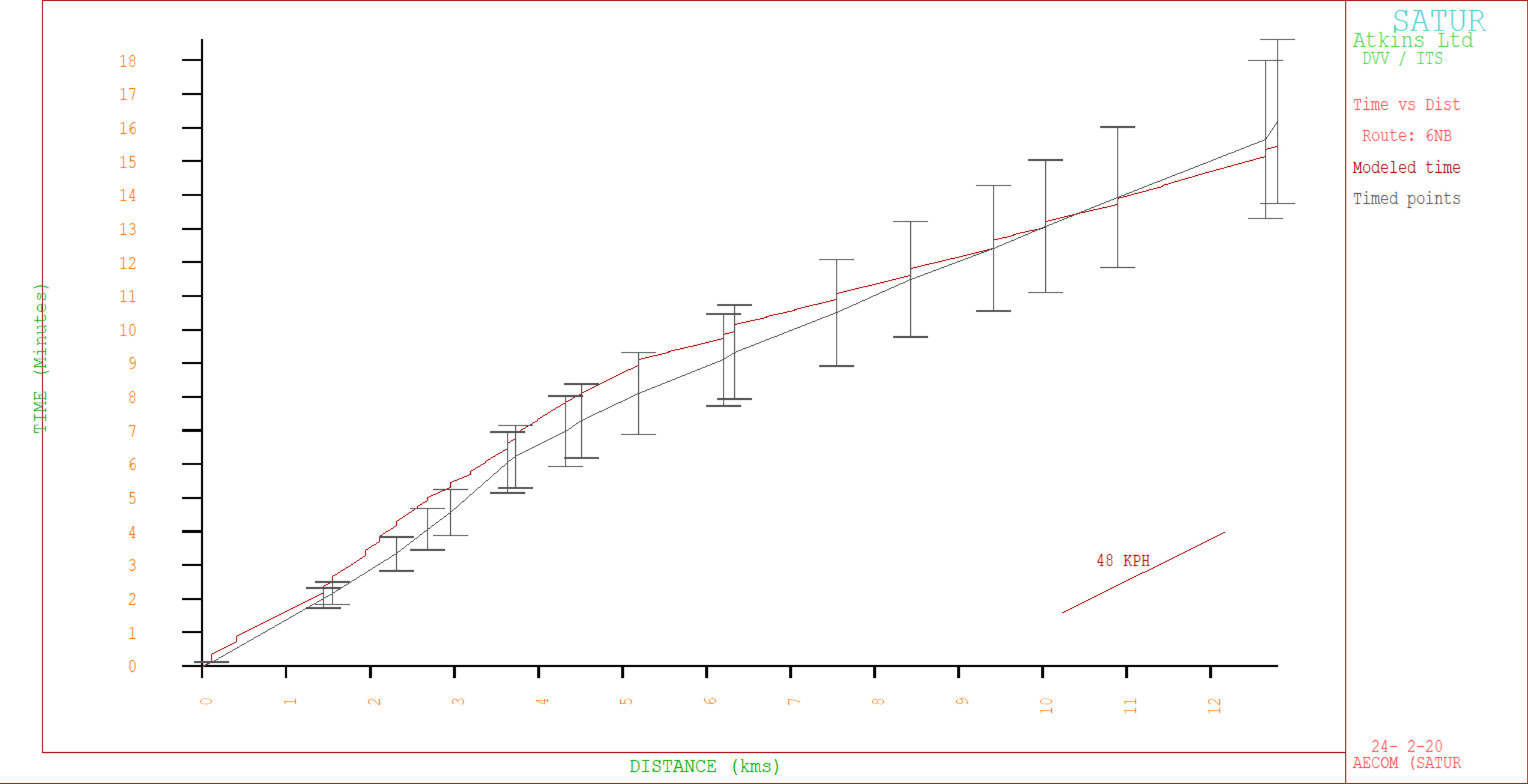
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 5EB
Modeled time
Timed points
TIME (Minutes)
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
DISTANCE (kms)
59 KPH
24- 2-20
AECOM (SATUR

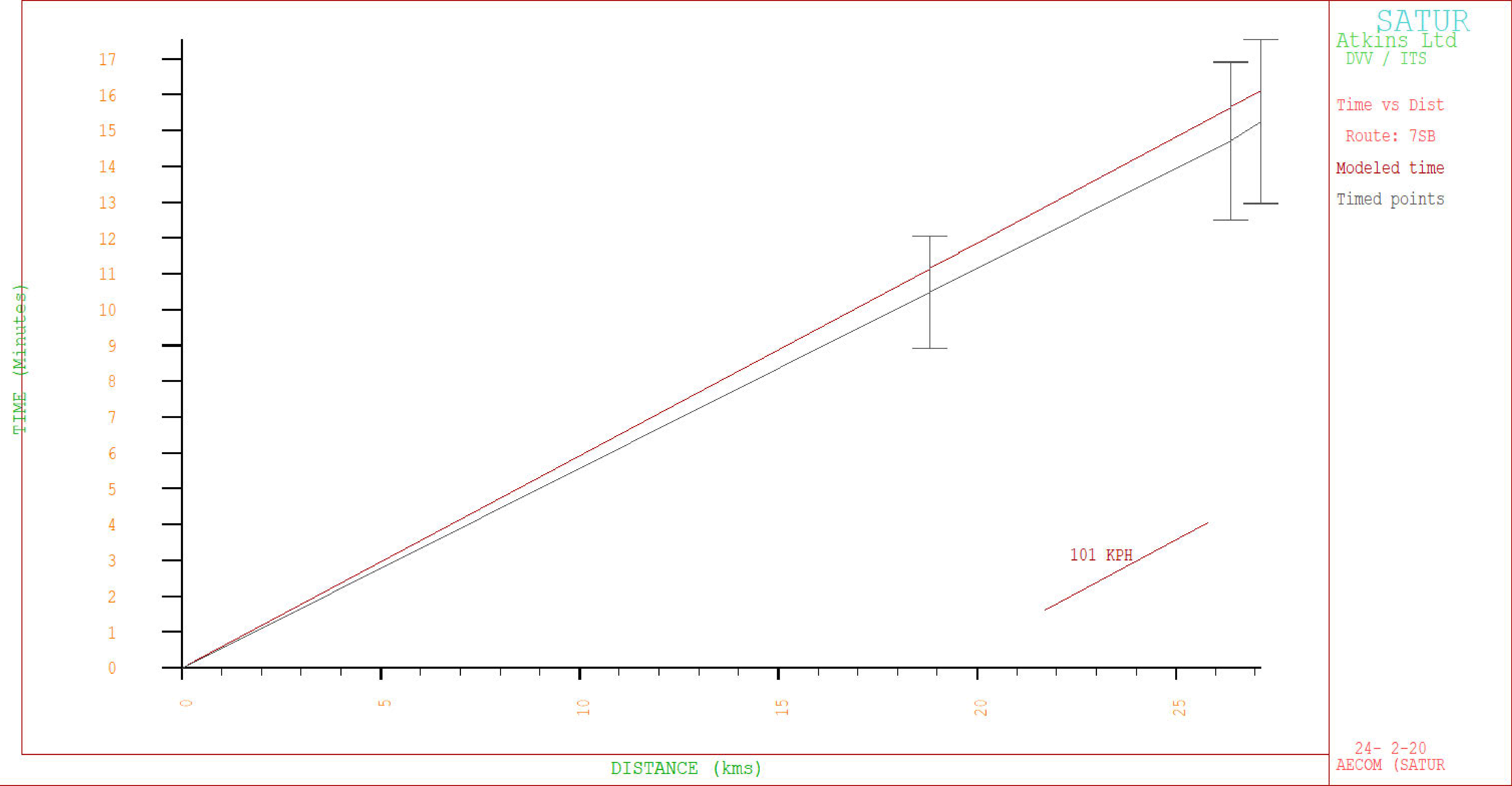


TIME (Minutes)
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
DISTANCE (kms)
60 KPH
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 5WB
Modeled time
Timed points
24- 2-20
AECOM (SATUR

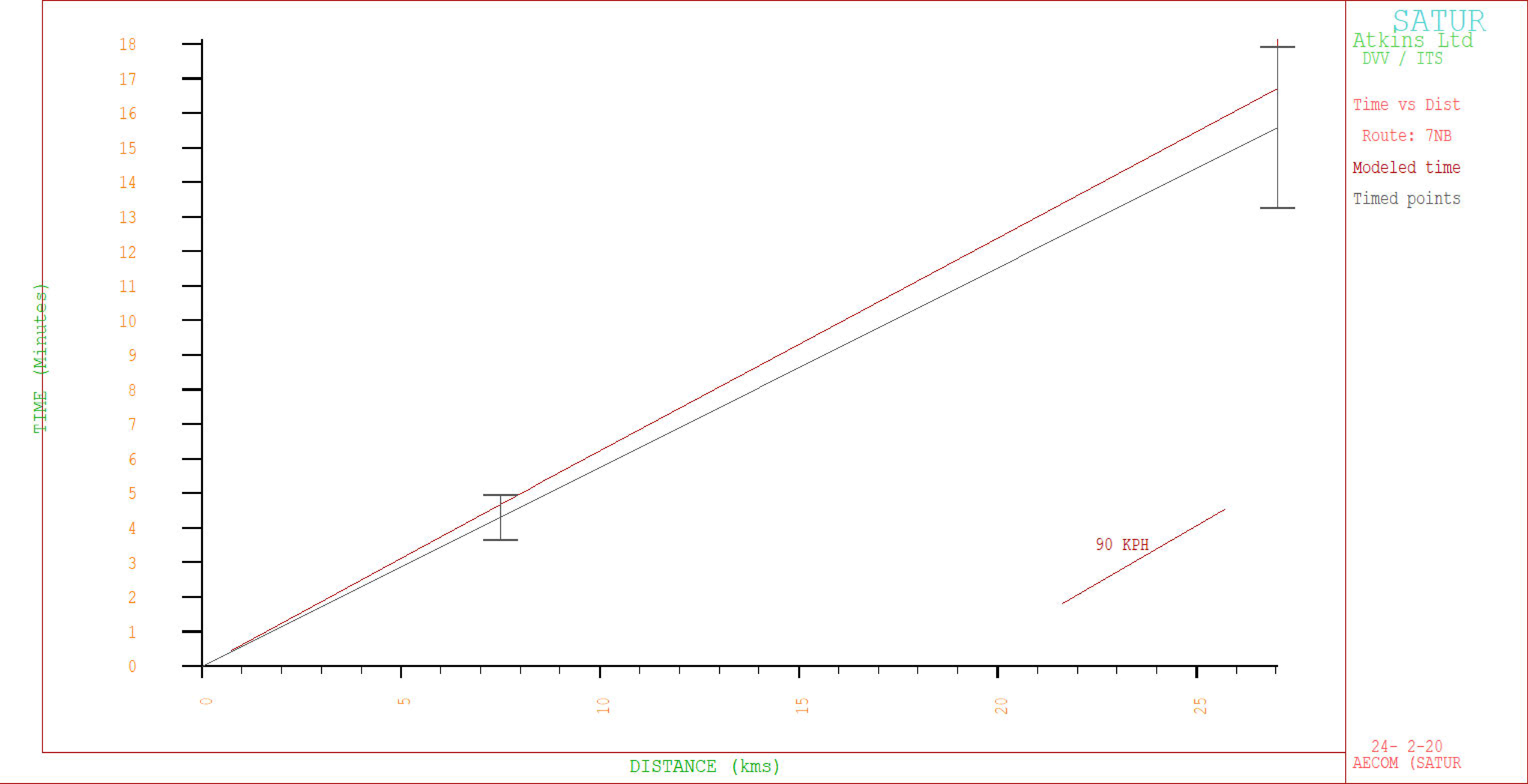


SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 6SB
Modeled time
Timed points
TIME (Minutes)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
DISTANCE (kms)
0
1
2
3
4
5
6
7
8
9
10
11
12
50 KPH
24- 2-20
AECOM (SATUR

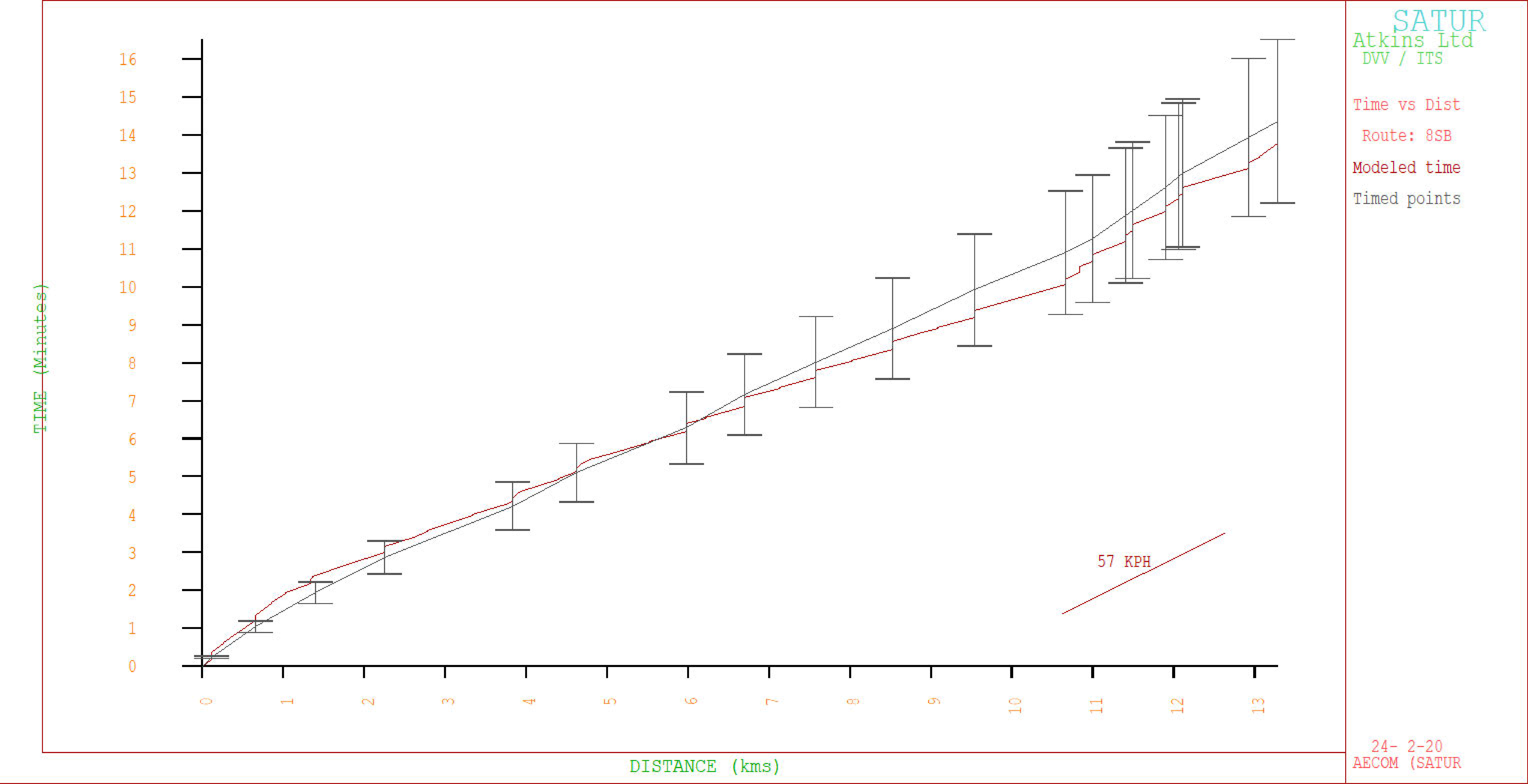

SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 6NB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
48 KPH
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
24- 2-20
AECOM (SATUR



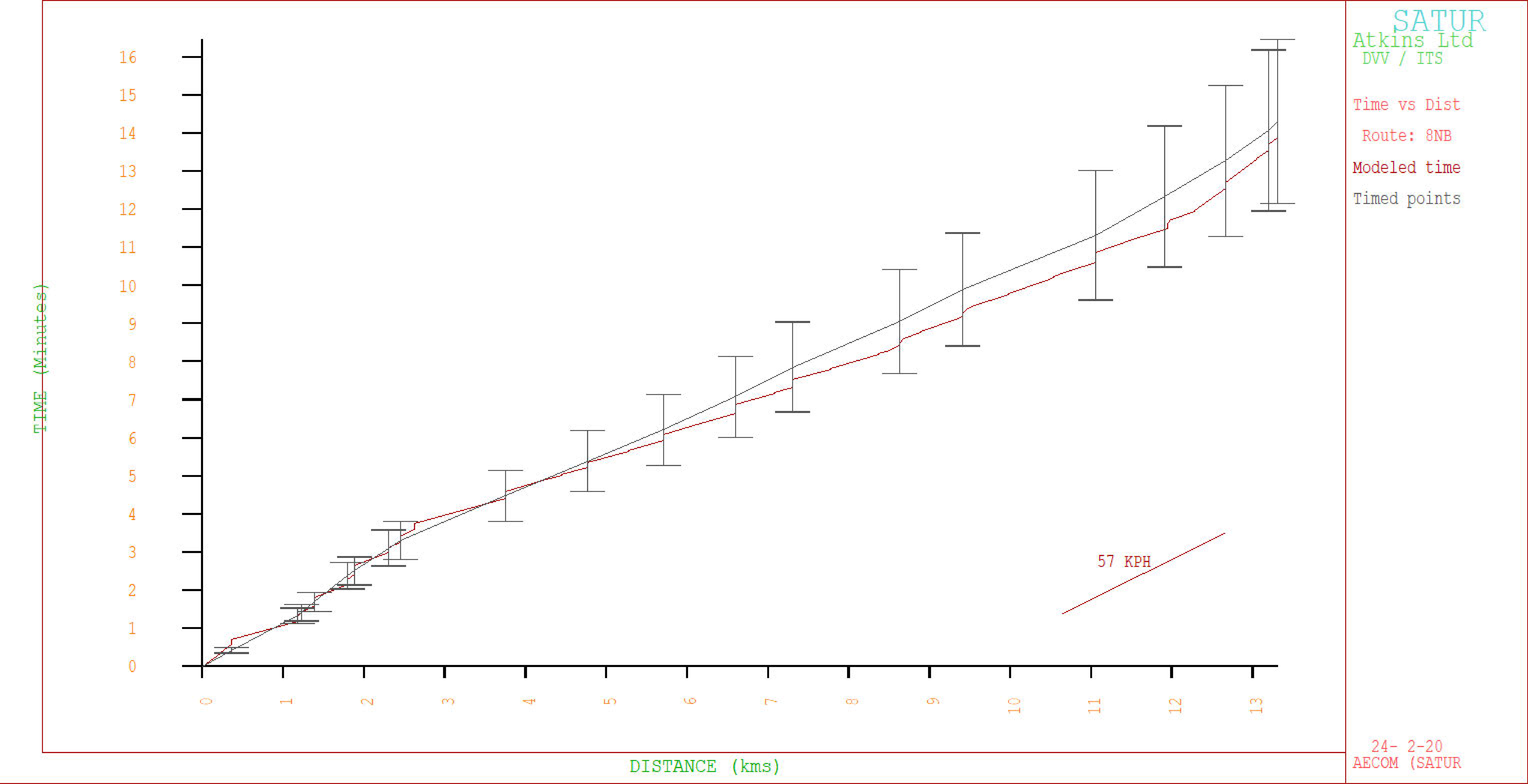
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 7SB
Modeled time
Timed points
TIME (Minutes)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
0
5
10
15
20
25
DISTANCE (kms)
101 KPH
24- 2-20
AECOM (SATUR



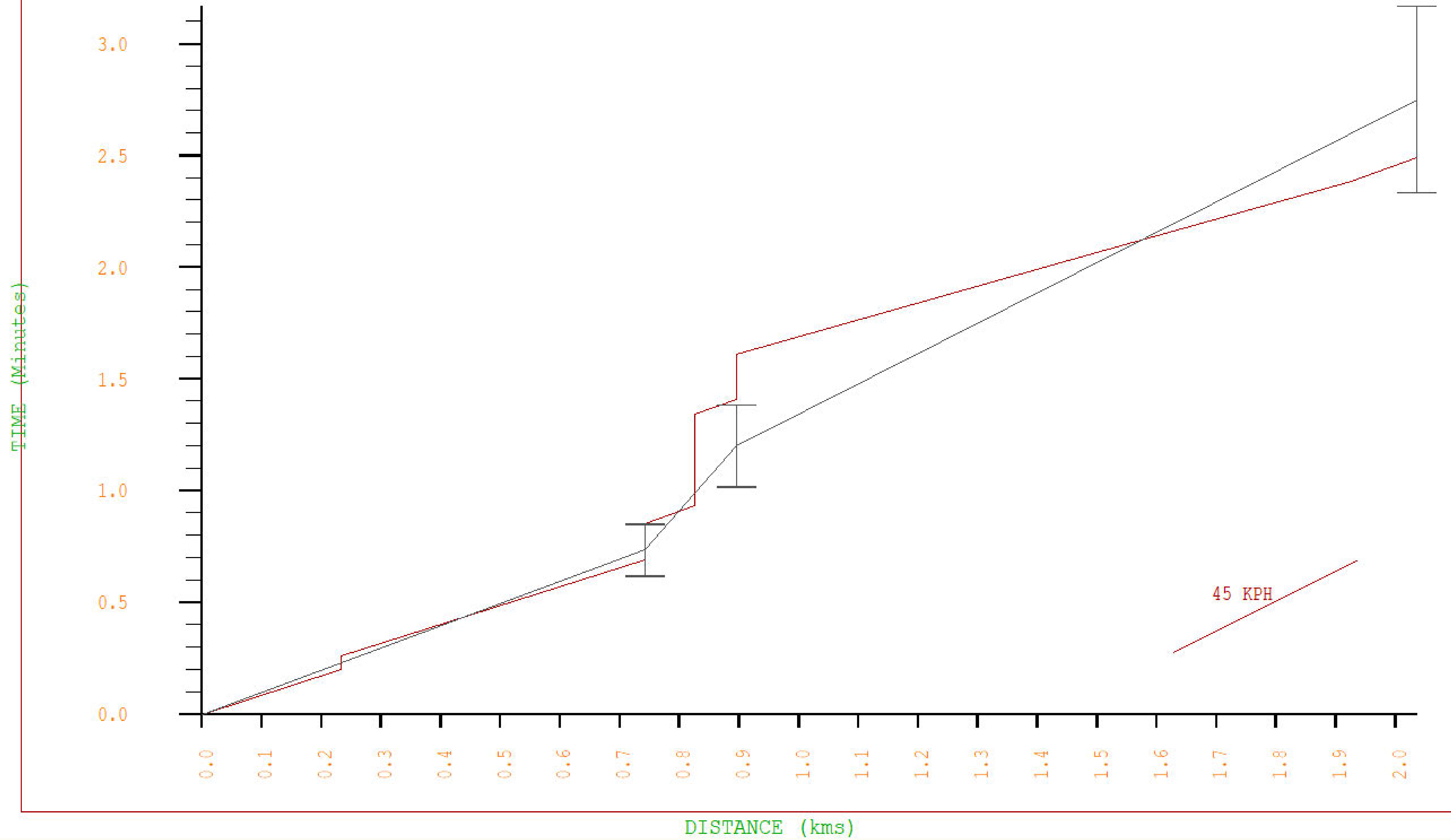
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 7NB
Modeled time
Timed points
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
TIME (Minutes)
90 KPH
0
5
10
15
20
25
DISTANCE (kms)
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 8SB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
57 KPH
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 8NB
Modeled time
Timed points
57 KPH
TIME (Minutes)
DISTANCE (kms)
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS

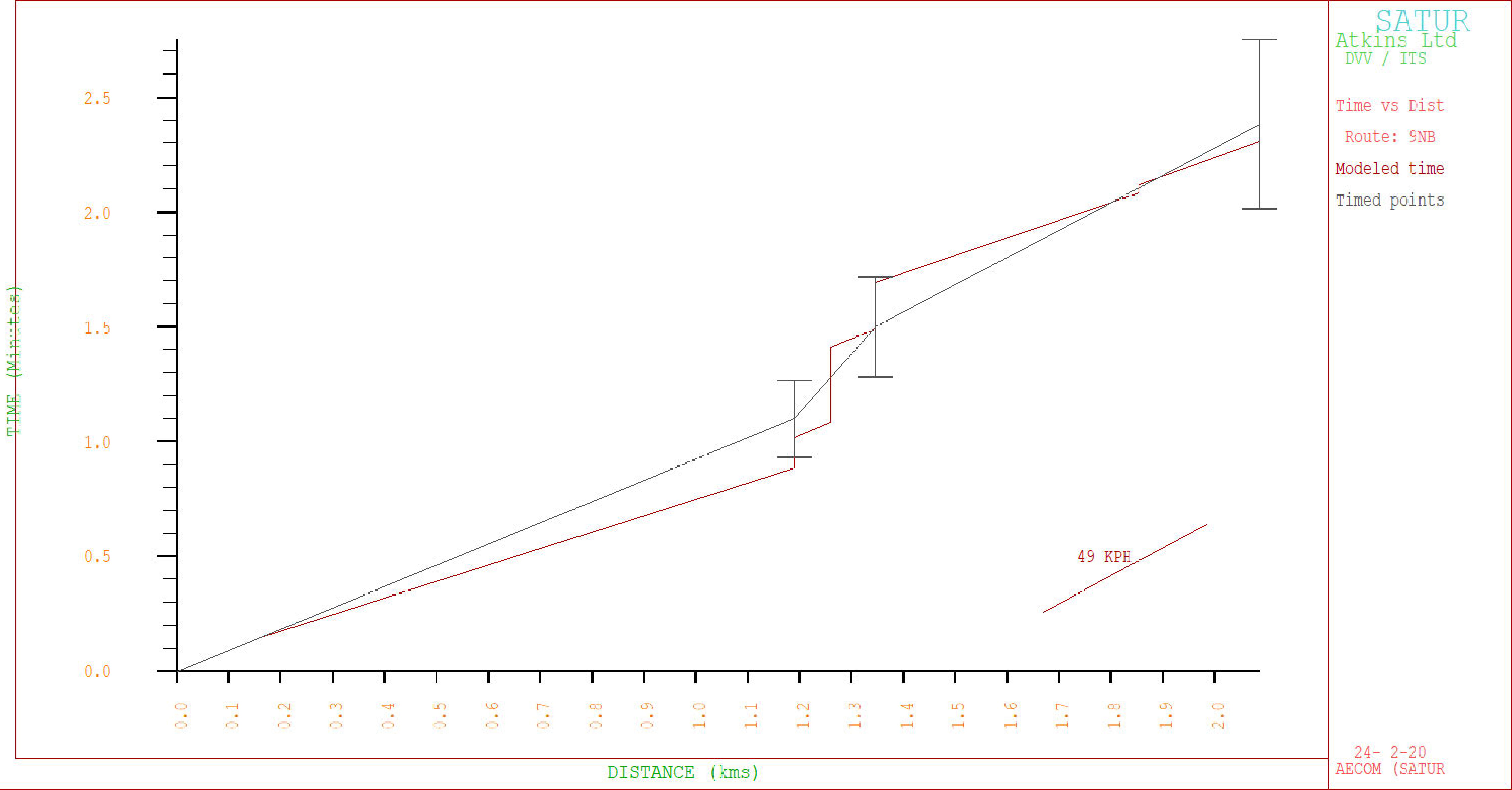
Time vs Dist

Route: 9SB

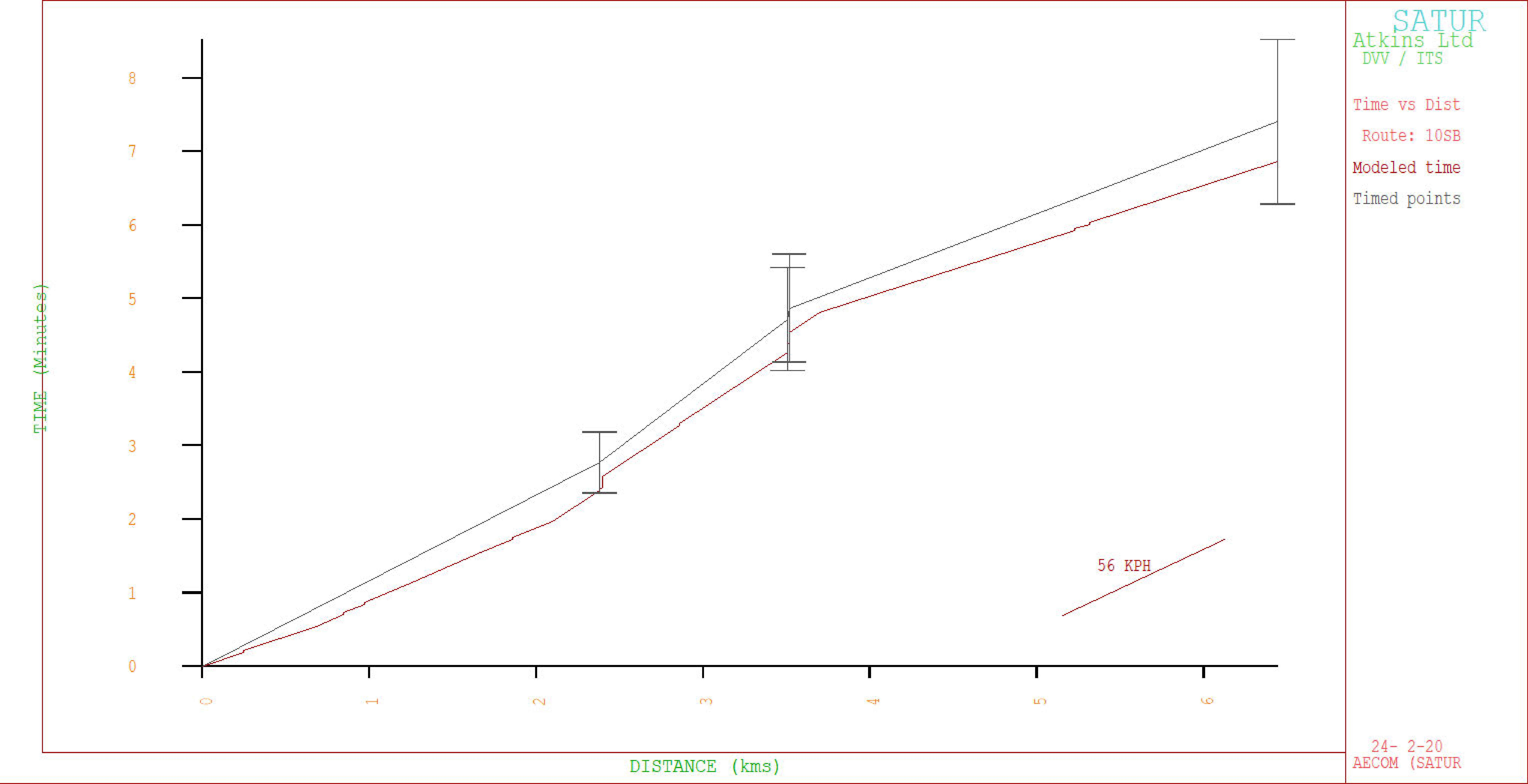
Modeled time

Timed points

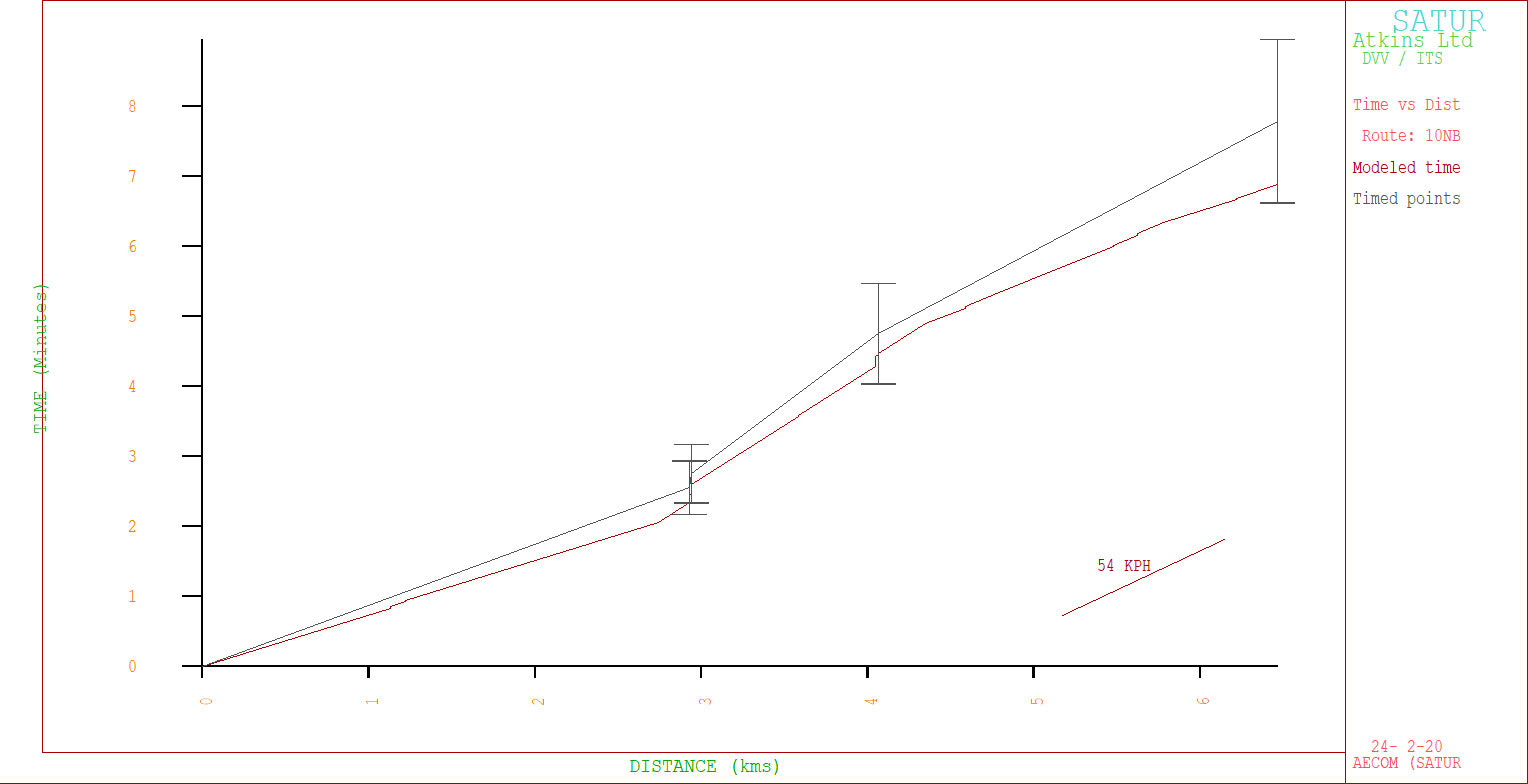
24- 2-20
AECOM (SATUR

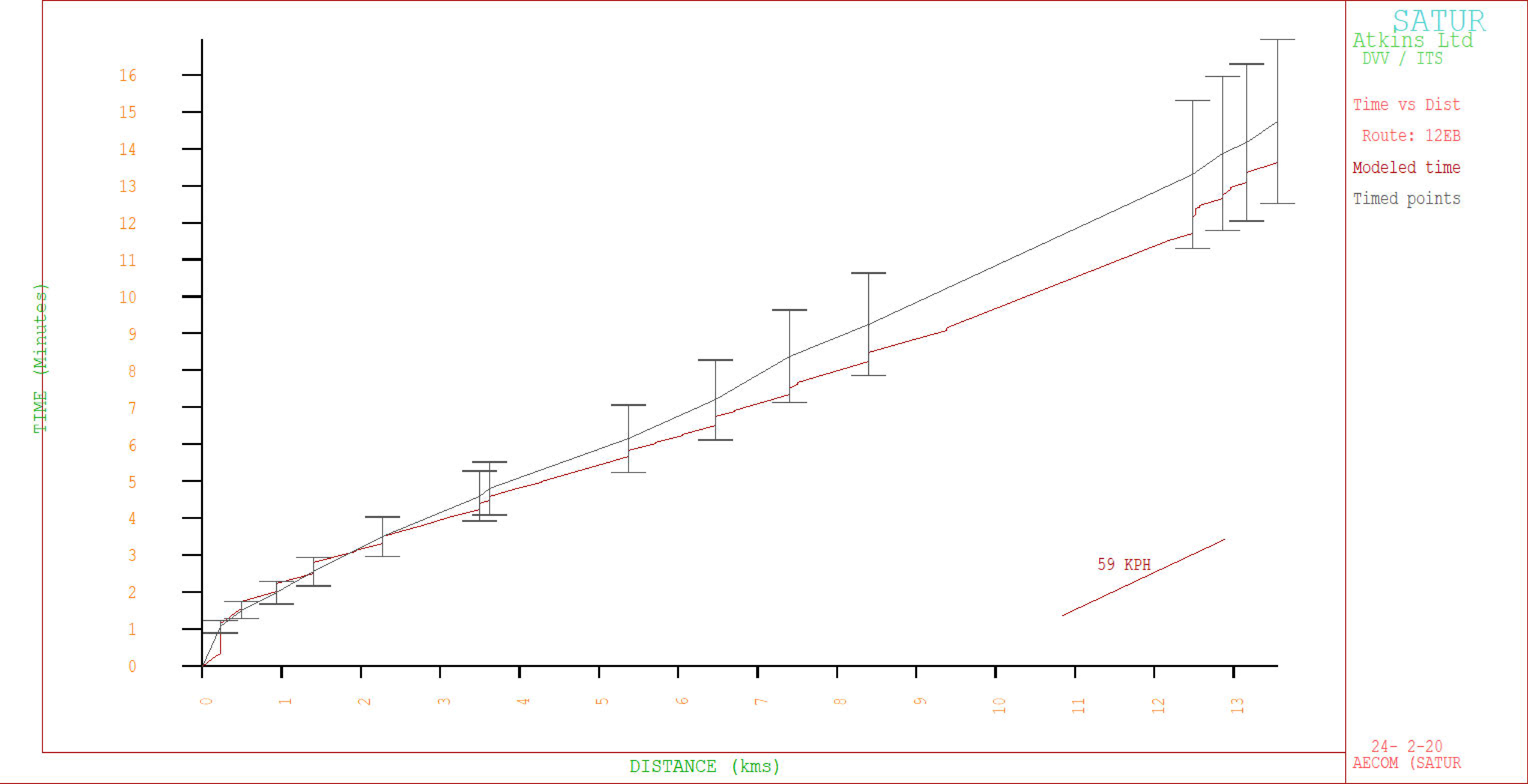


SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 9NB
Modeled time
Timed points
49 KPH
TIME (Minutes)
DISTANCE (kms)
0.0
0.5
1.0
1.5
2.0
2.5
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2.0
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 10SB
Modeled time
Timed points
56 KPH
TIME (Minutes)
0
1
2
3
4
5
6
7
8
DISTANCE (kms)
0
1
2
3
4
5
6
24- 2-20
AECOM (SATUR


SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 10NB
Modeled time
Timed points
TIME (Minutes)
0
1
2
3
4
5
6
7
8
DISTANCE (kms)
0
1
2
3
4
5
6
54 KPH
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 12EB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
59 KPH
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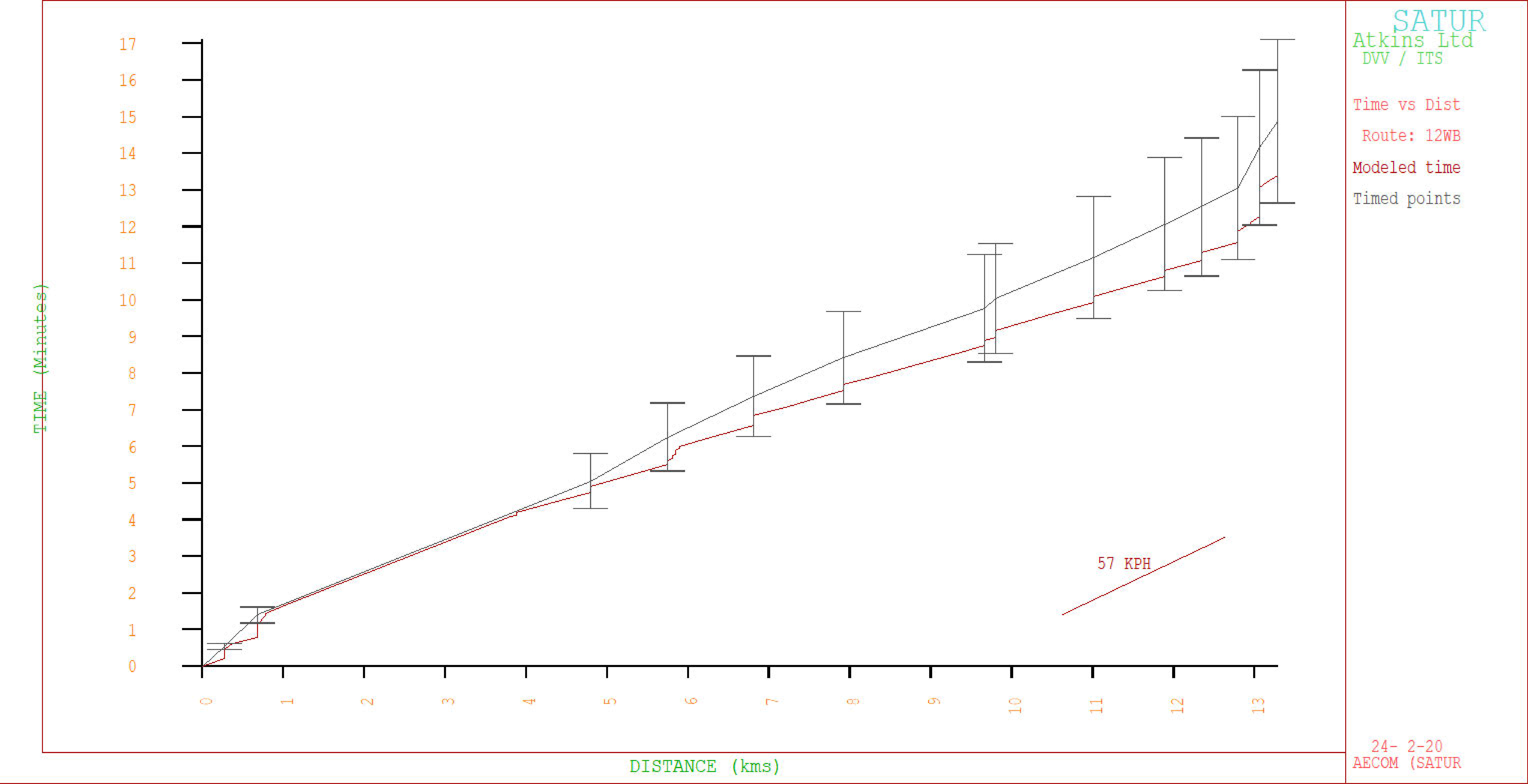
0 1 2 3 4 5 6 7 8 9 10 11 12 13
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 12WB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
57 KPH
0
1
2
3
4
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6
7
8
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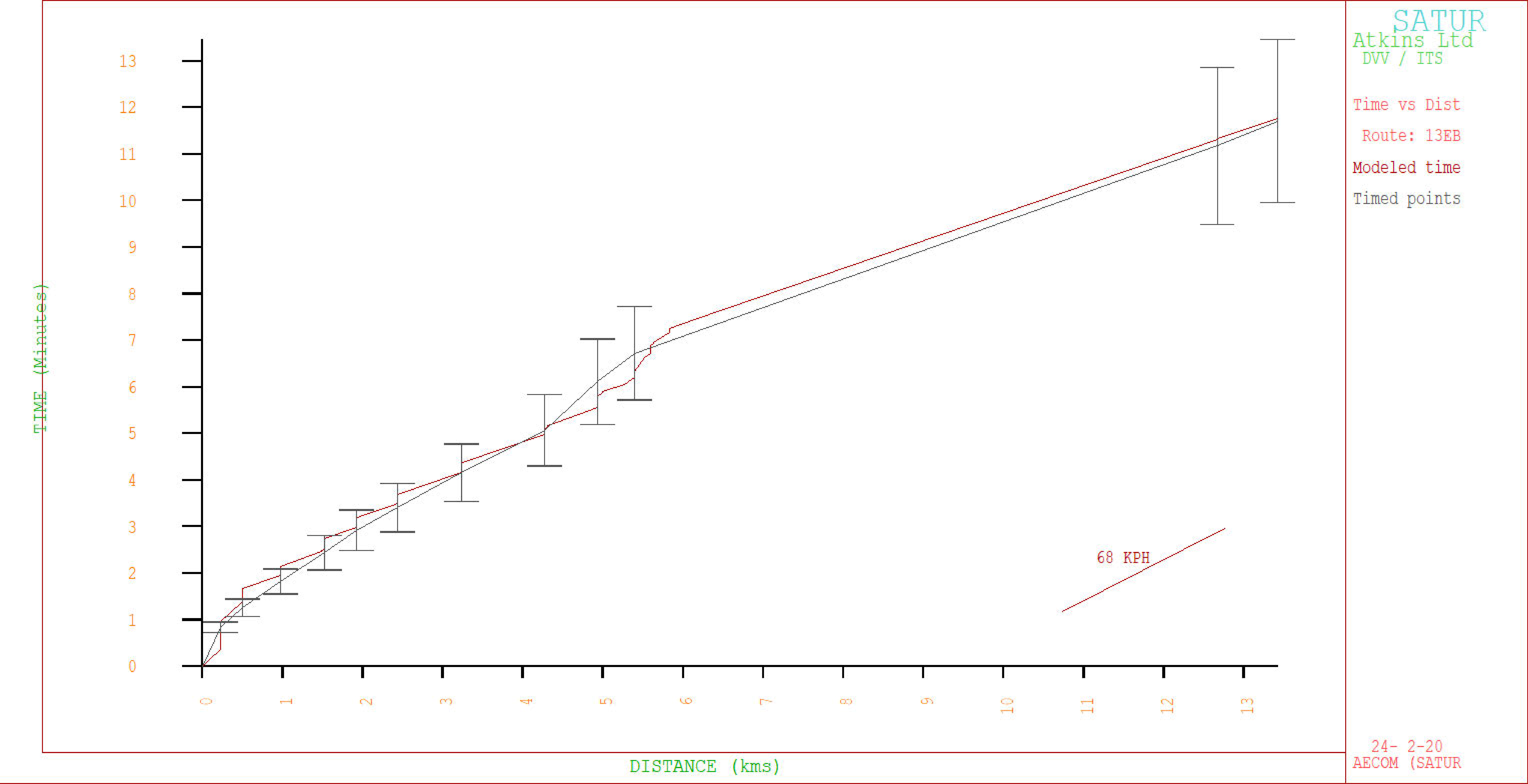
10
11
12
13
14
15
16
17
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 13EB
Modeled time
Timed points
68 KPH
TIME (Minutes)
DISTANCE (kms)
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2
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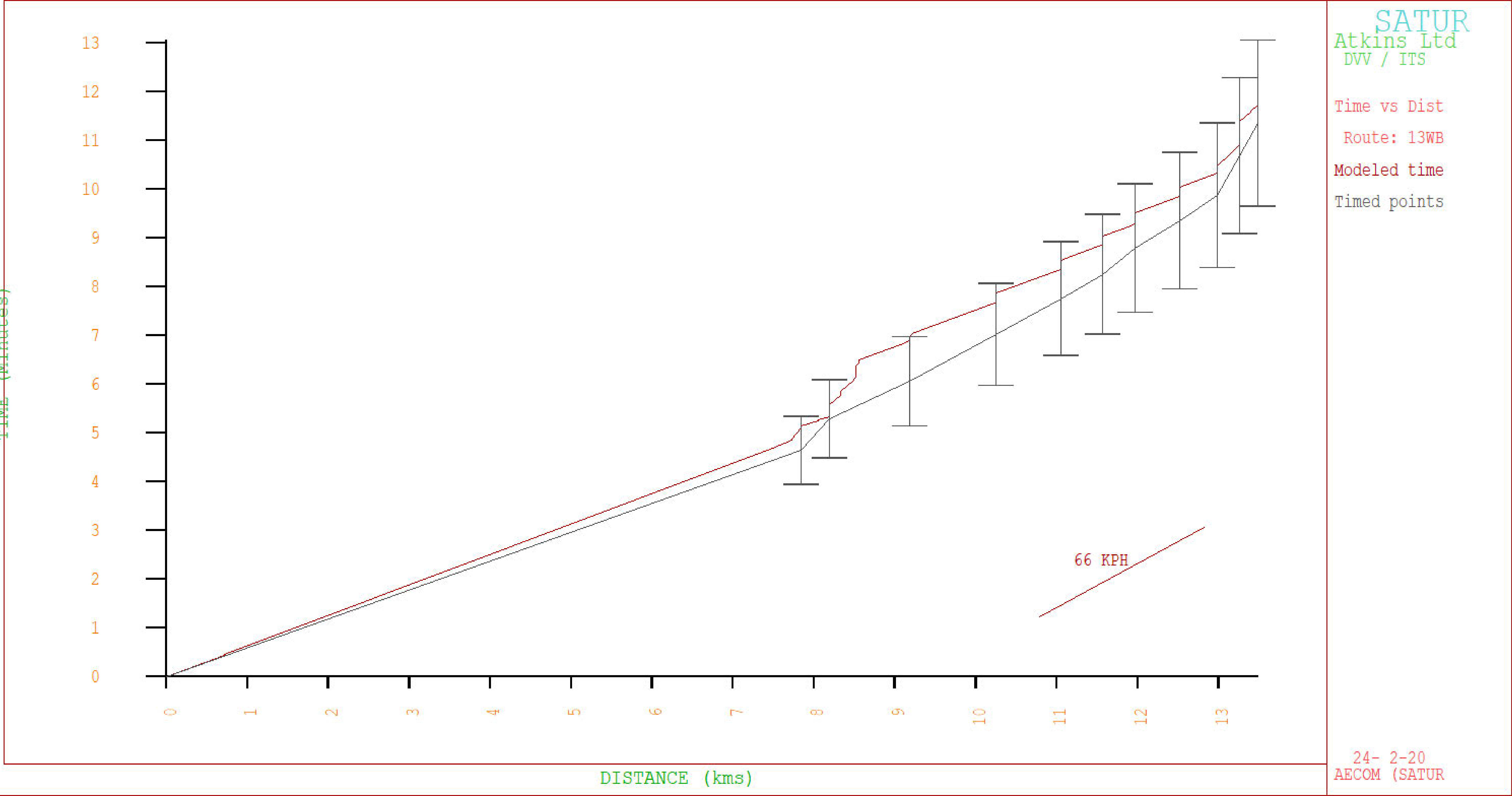
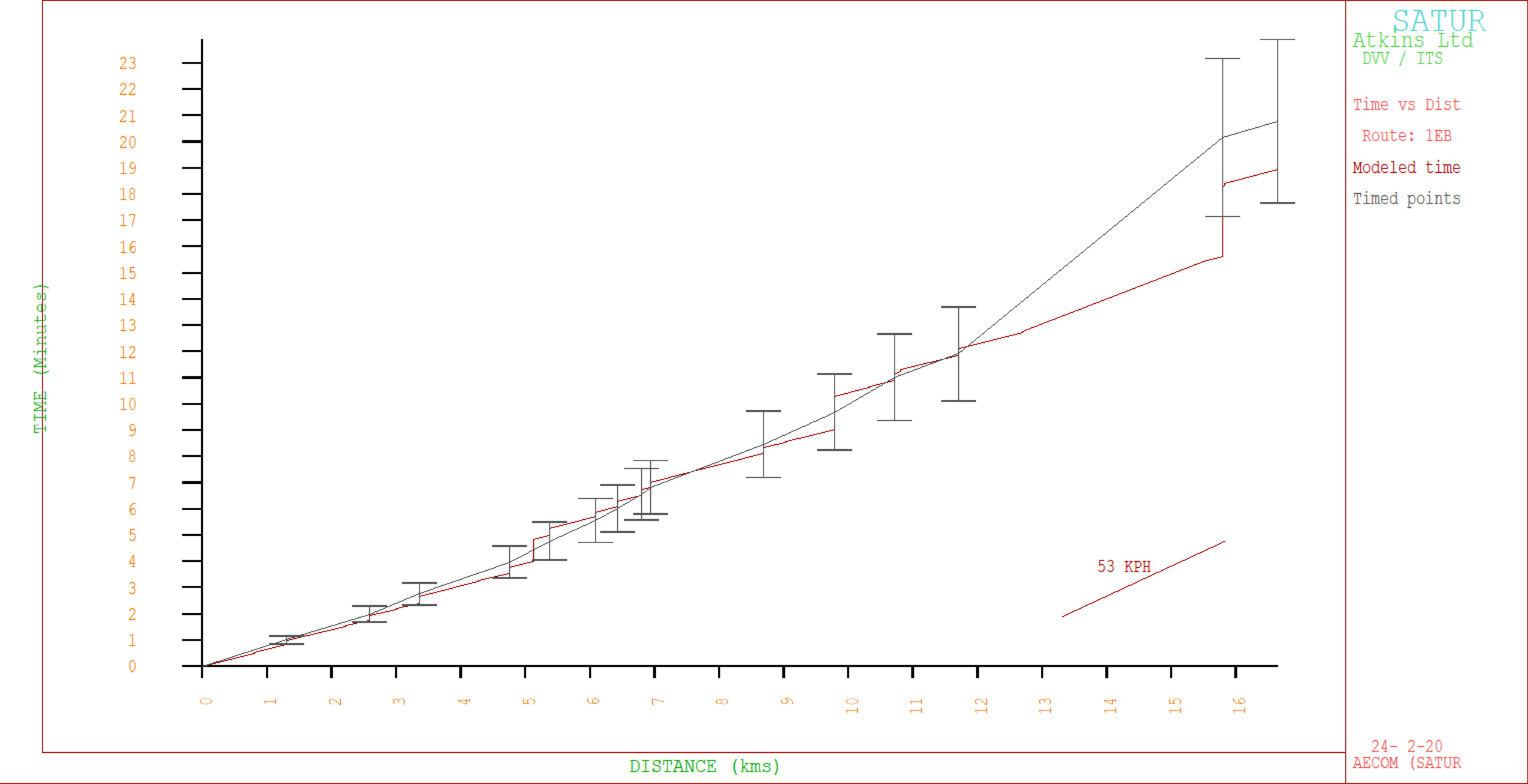
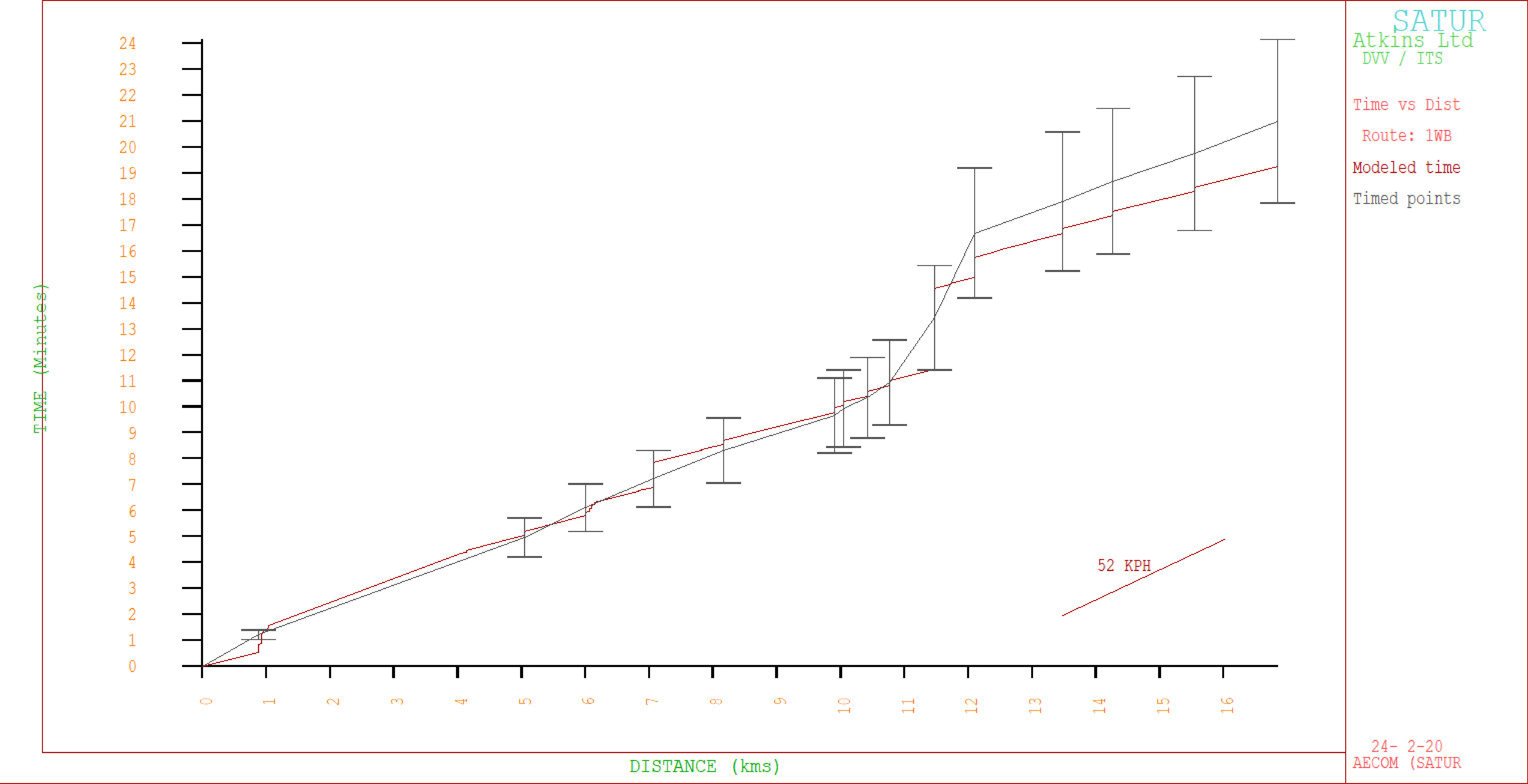
4
5
6
7
8
9
10
11
12
13
24- 2-20
AECOM (SATUR

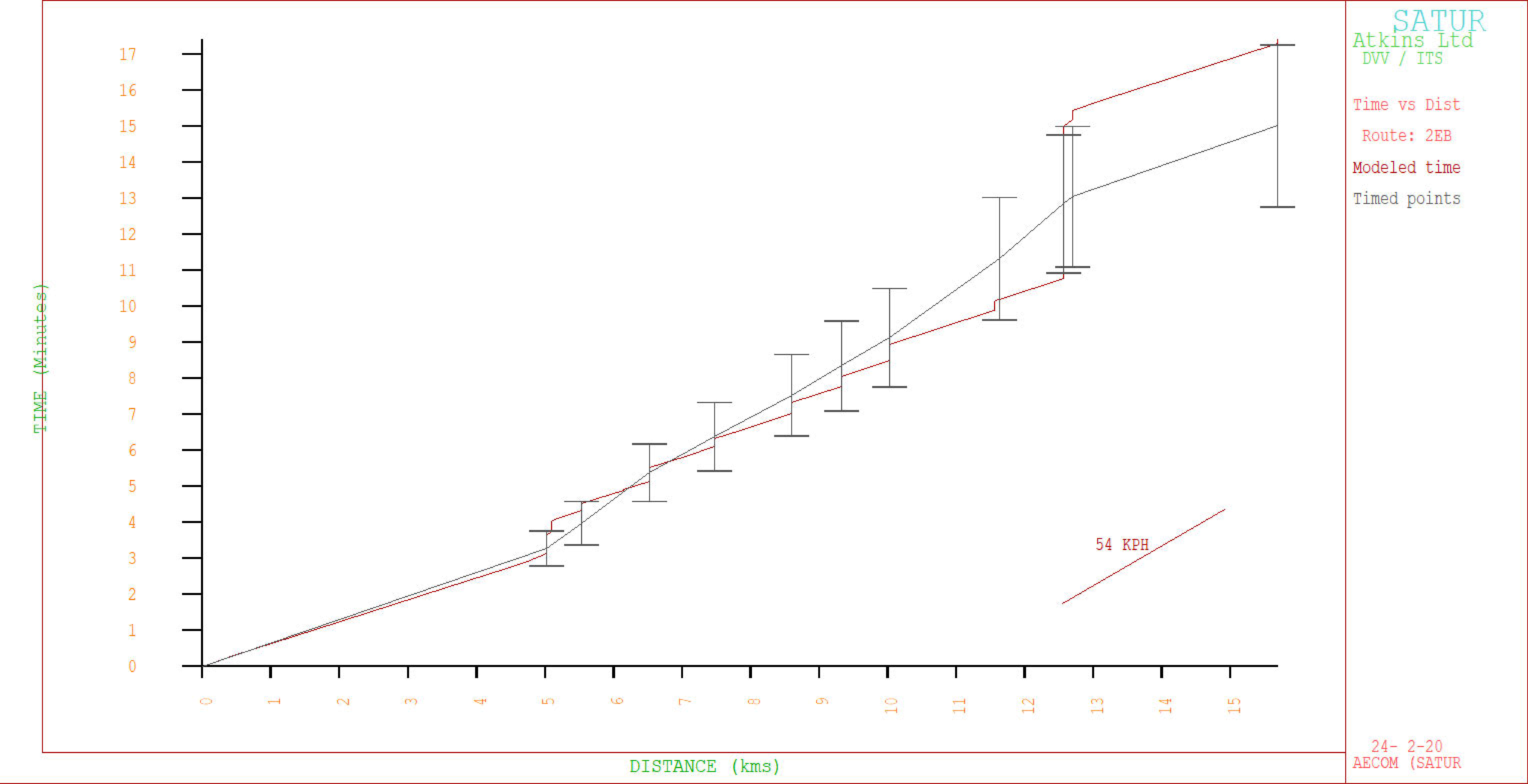


SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 13WB
Modeled time
Timed points
TIME (Minutes)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
66 KPH
DISTANCE (kms)
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 1EB
Modeled time
Timed points
TIME (Minutes)
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
53 KPH
DISTANCE (kms)
24- 2-20
AECOM (SATUR


SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 1WB
Modeled time
Timed points
52 KPH
TIME (Minutes)
DISTANCE (kms)
24- 2-20
AECOM (SATUR


SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 2EB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
54 KPH
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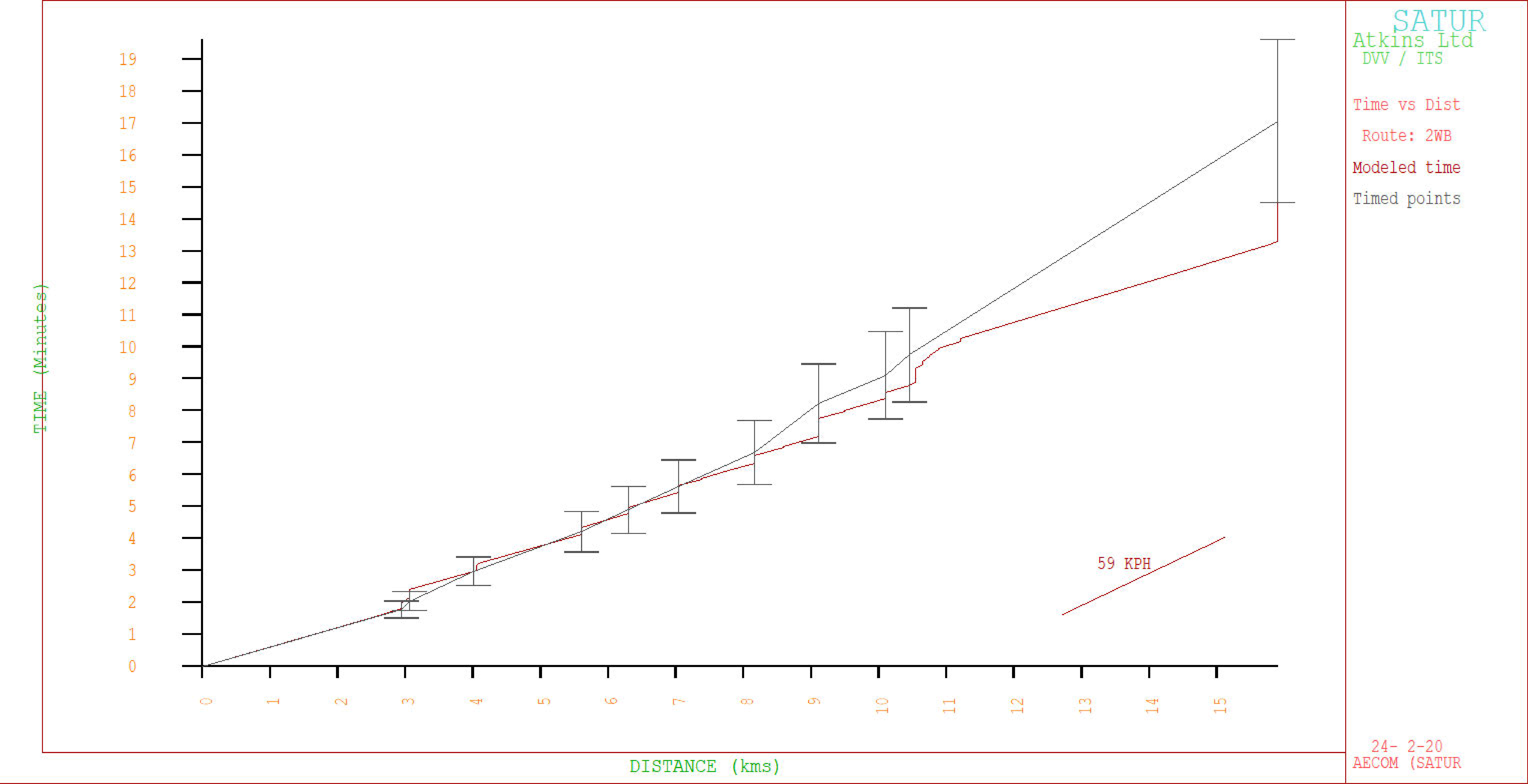
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
24- 2-20
AECOM (SATUR


SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 2WB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
59 KPH
0
1
2
3
4
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6
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14
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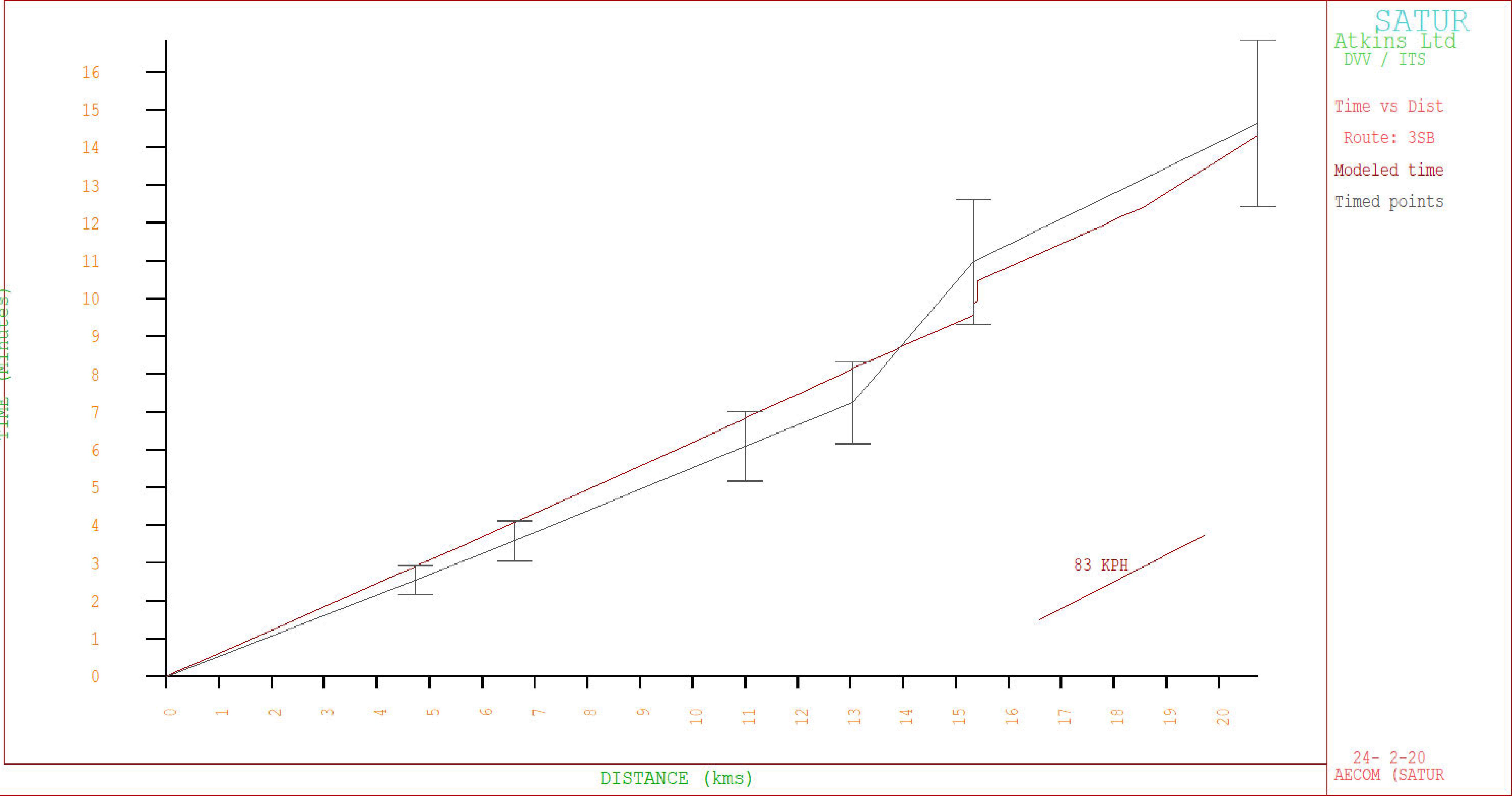
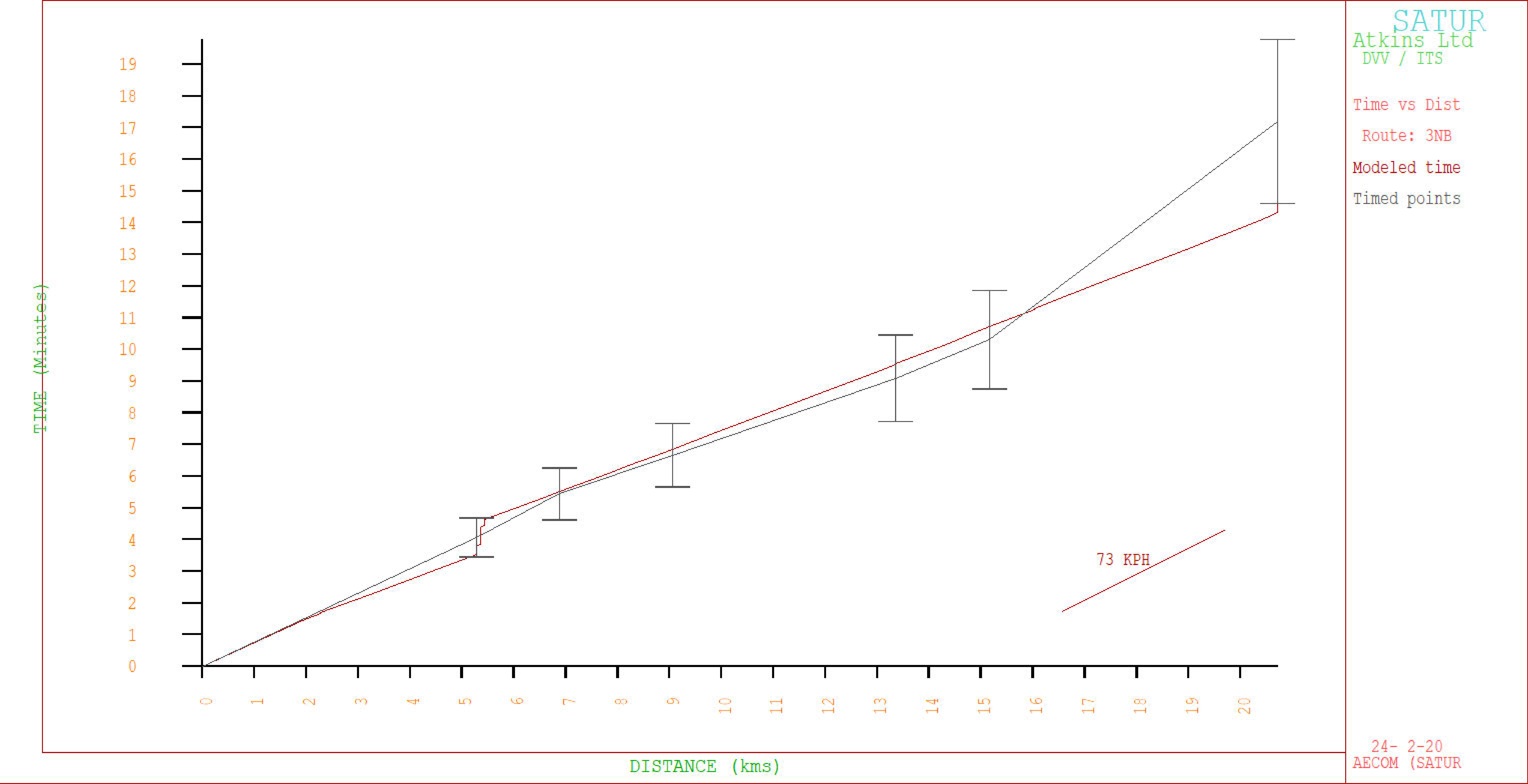
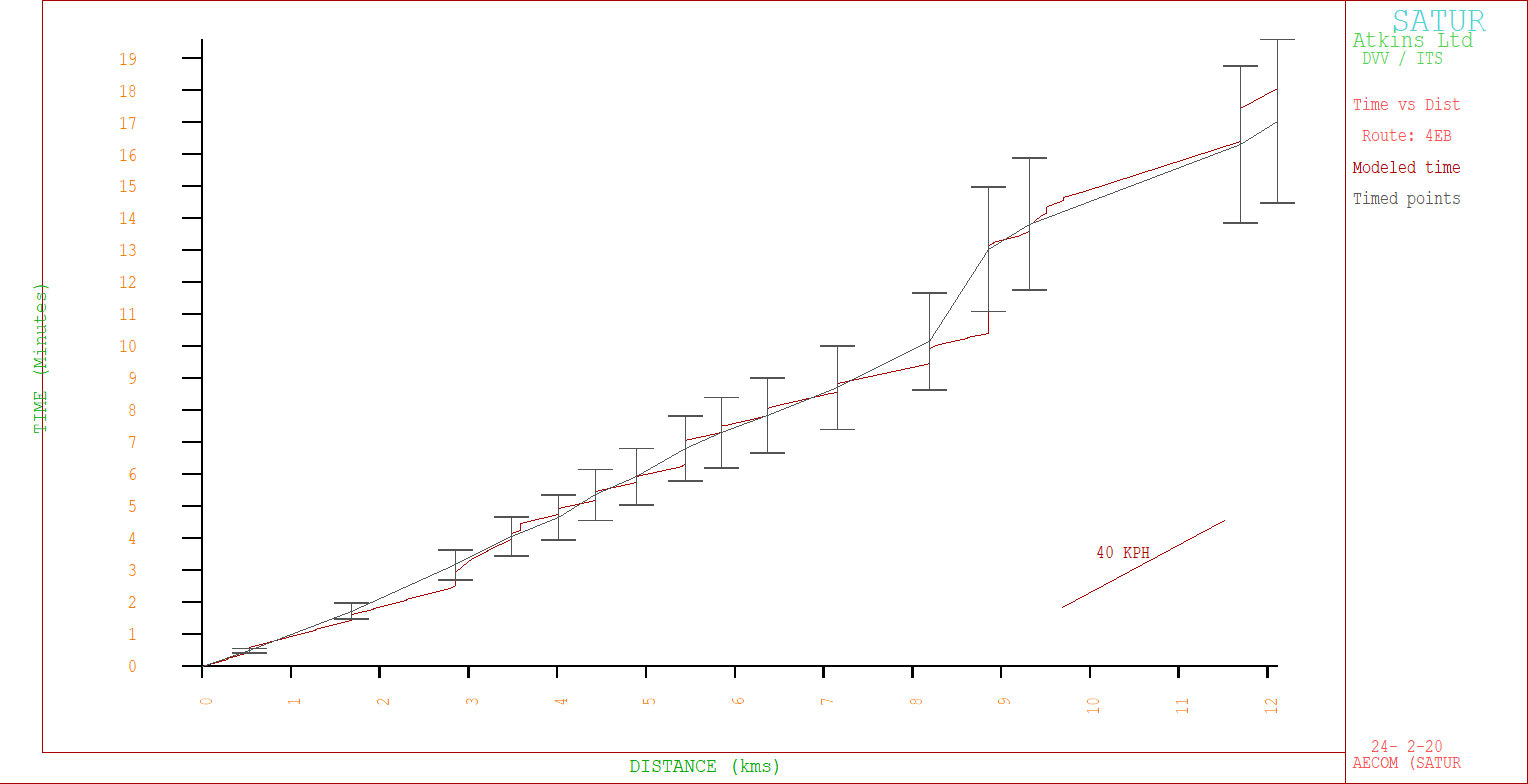
16
17
18
19
24- 2-20
AECOM (SATUR



TIME (Minutes)
DISTANCE (kms)
83 KPH
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 3SB
Modeled time
Timed points
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 3NB
Modeled time
Timed points
73 KPH
TIME (Minutes)
DISTANCE (kms)
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 4EB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
40 KPH
0
1
2
3
4
5
6
7
8
9
10
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15
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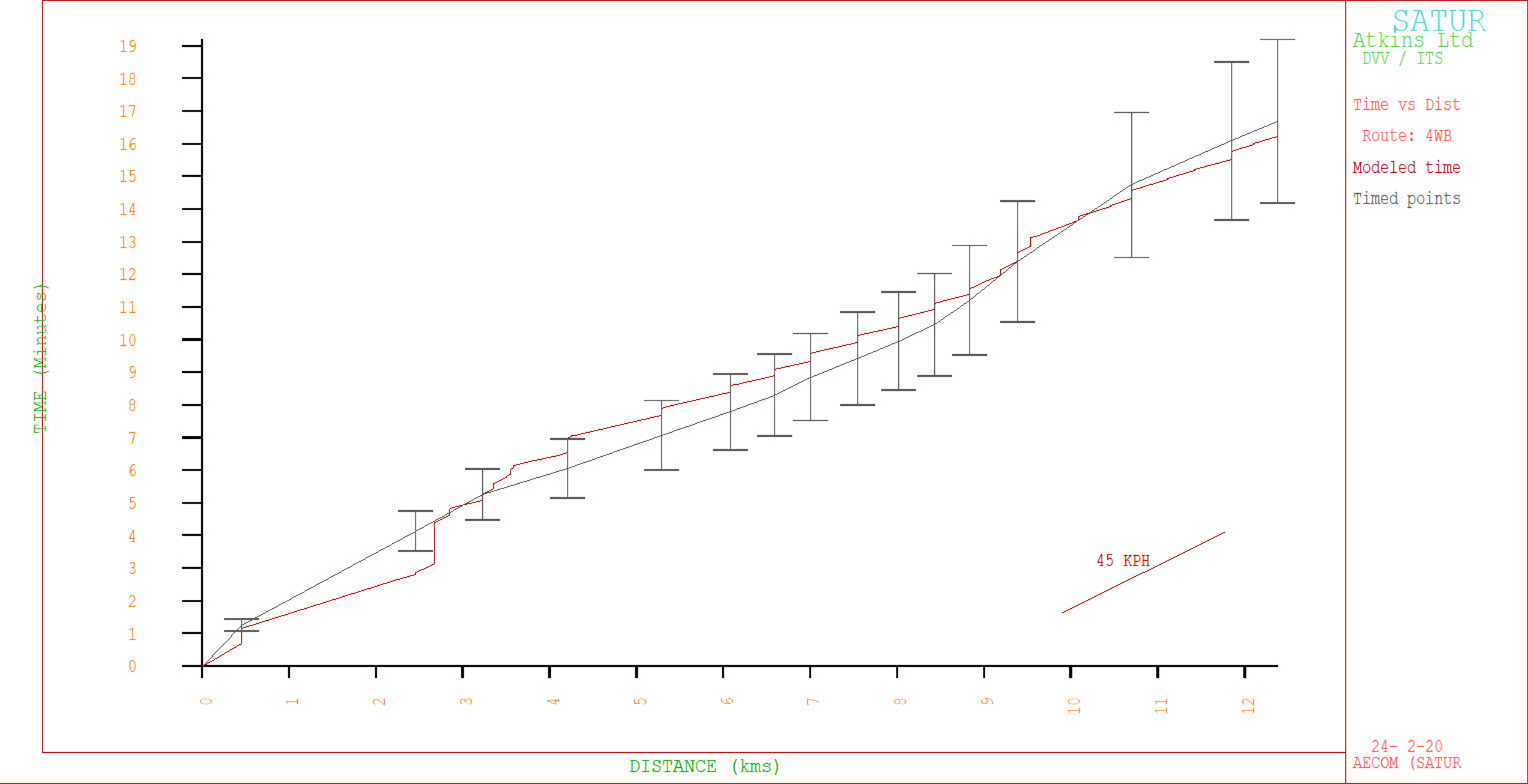
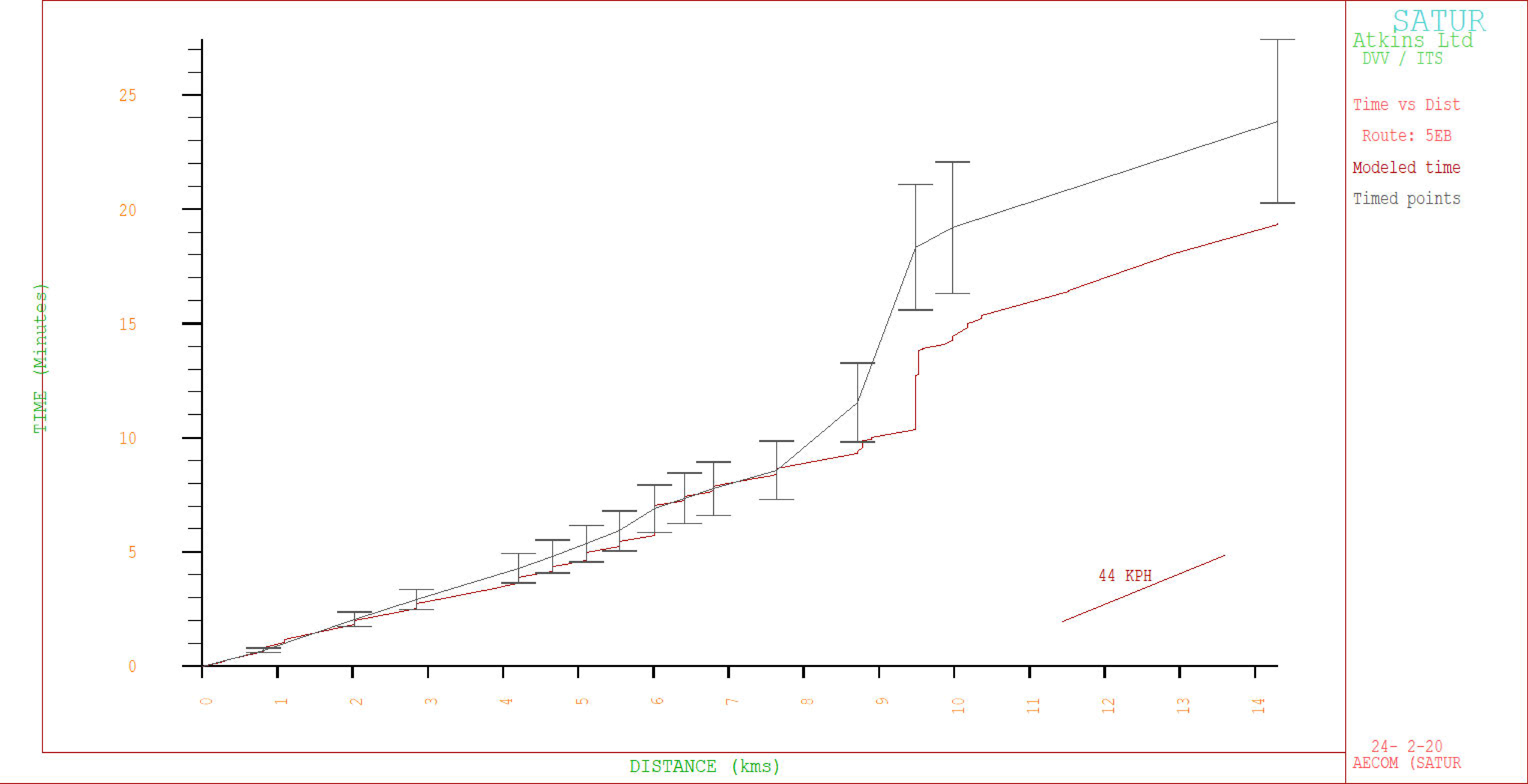
17
18
19
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 4WB
Modeled time
Timed points
TIME (Minutes)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
0
1
2
3
4
5
6
7
8
9
10
11
12
45 KPH
DISTANCE (kms)
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 5EB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
44 KPH
0
5
10
15
20
25
0
1
2
3
4
5
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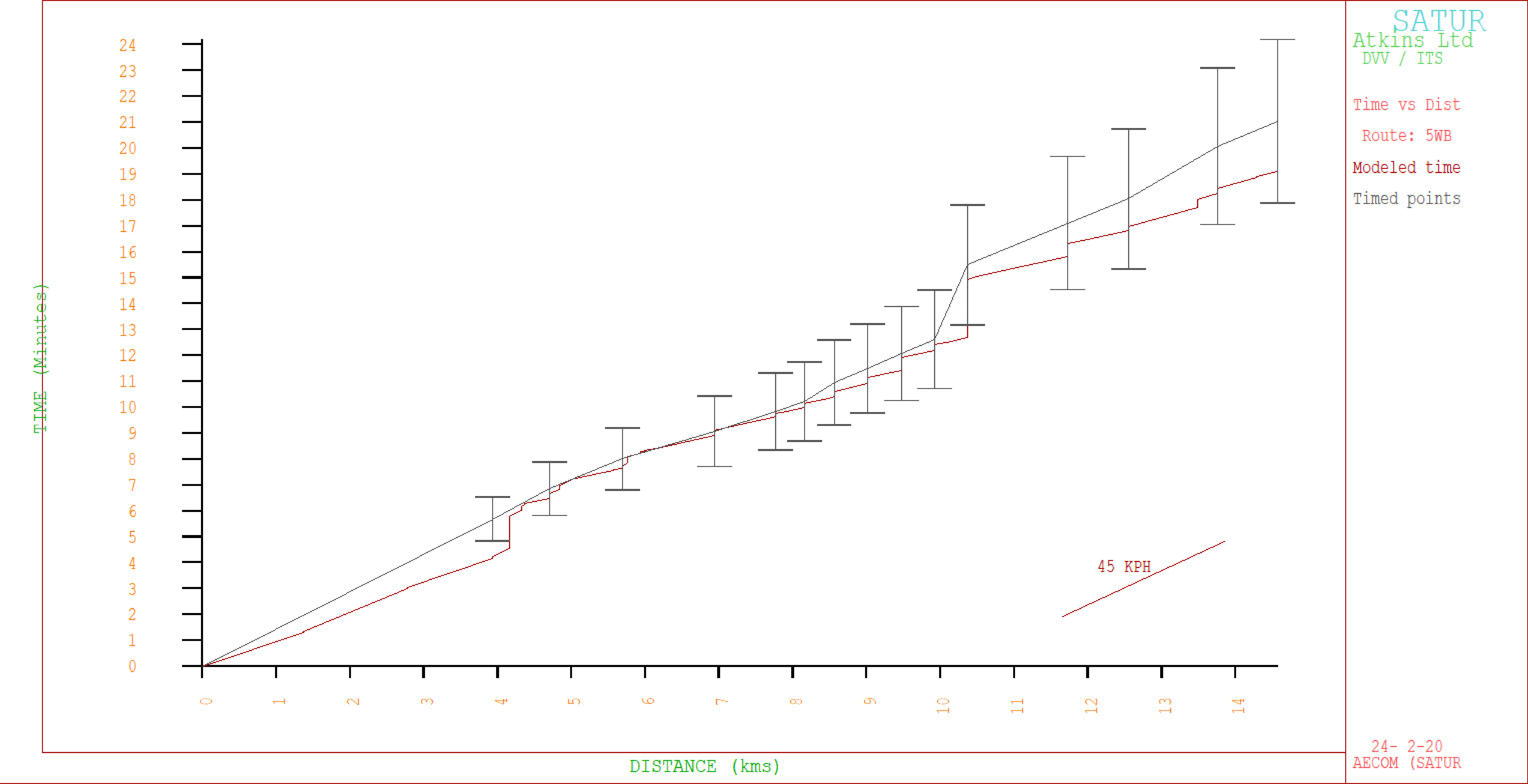
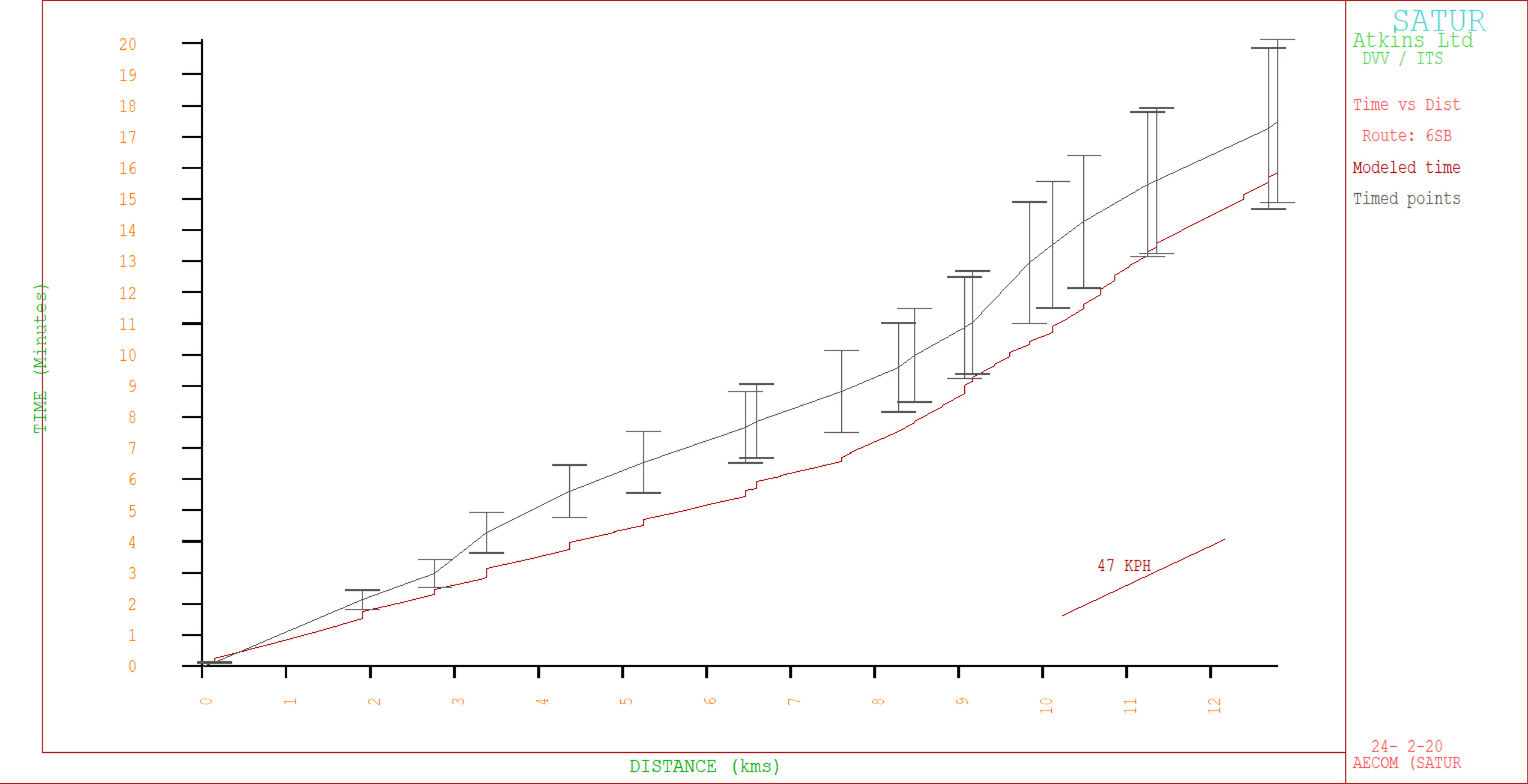
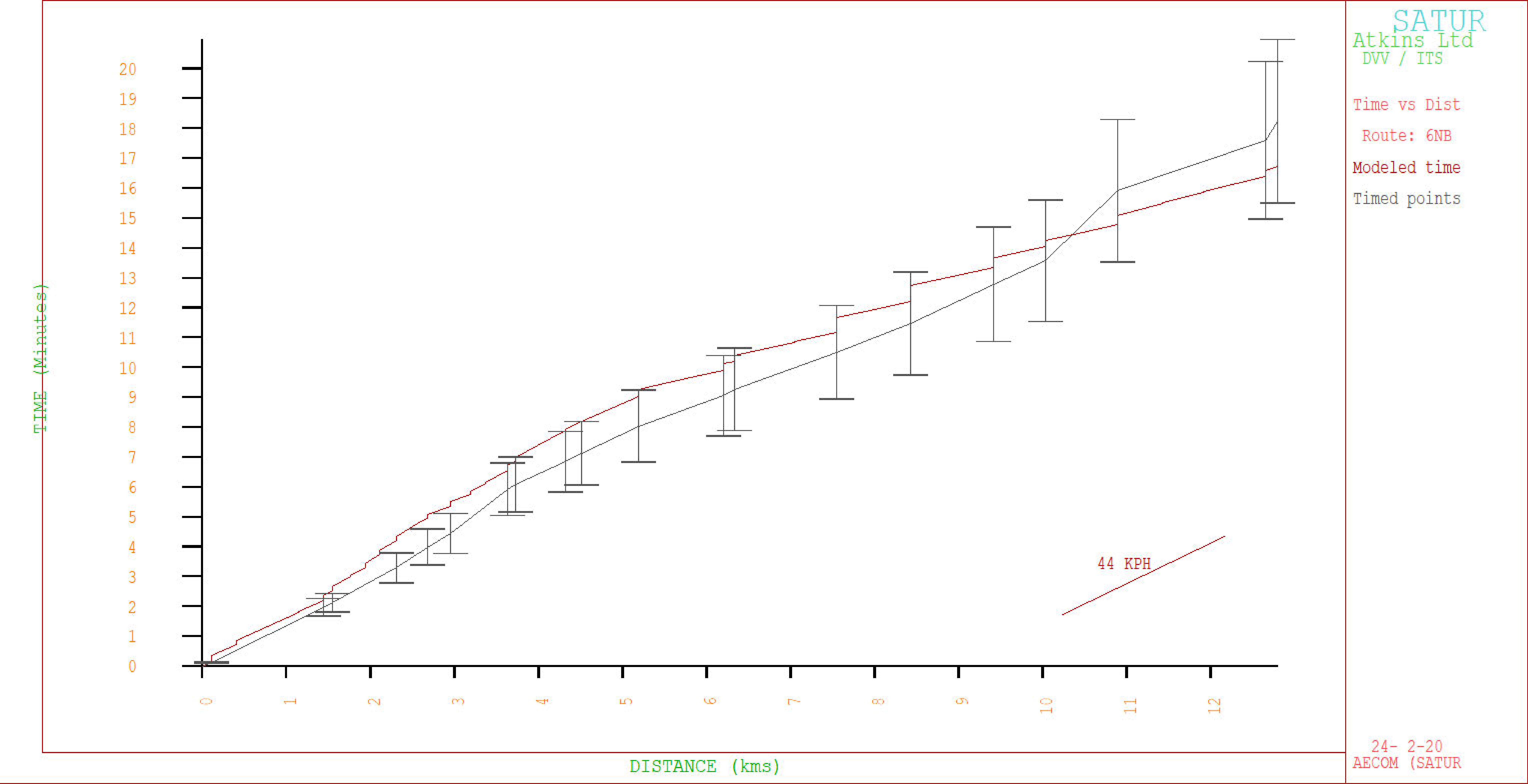
8
9
10
11
12
13
14
24- 2-20
AECOM (SATUR



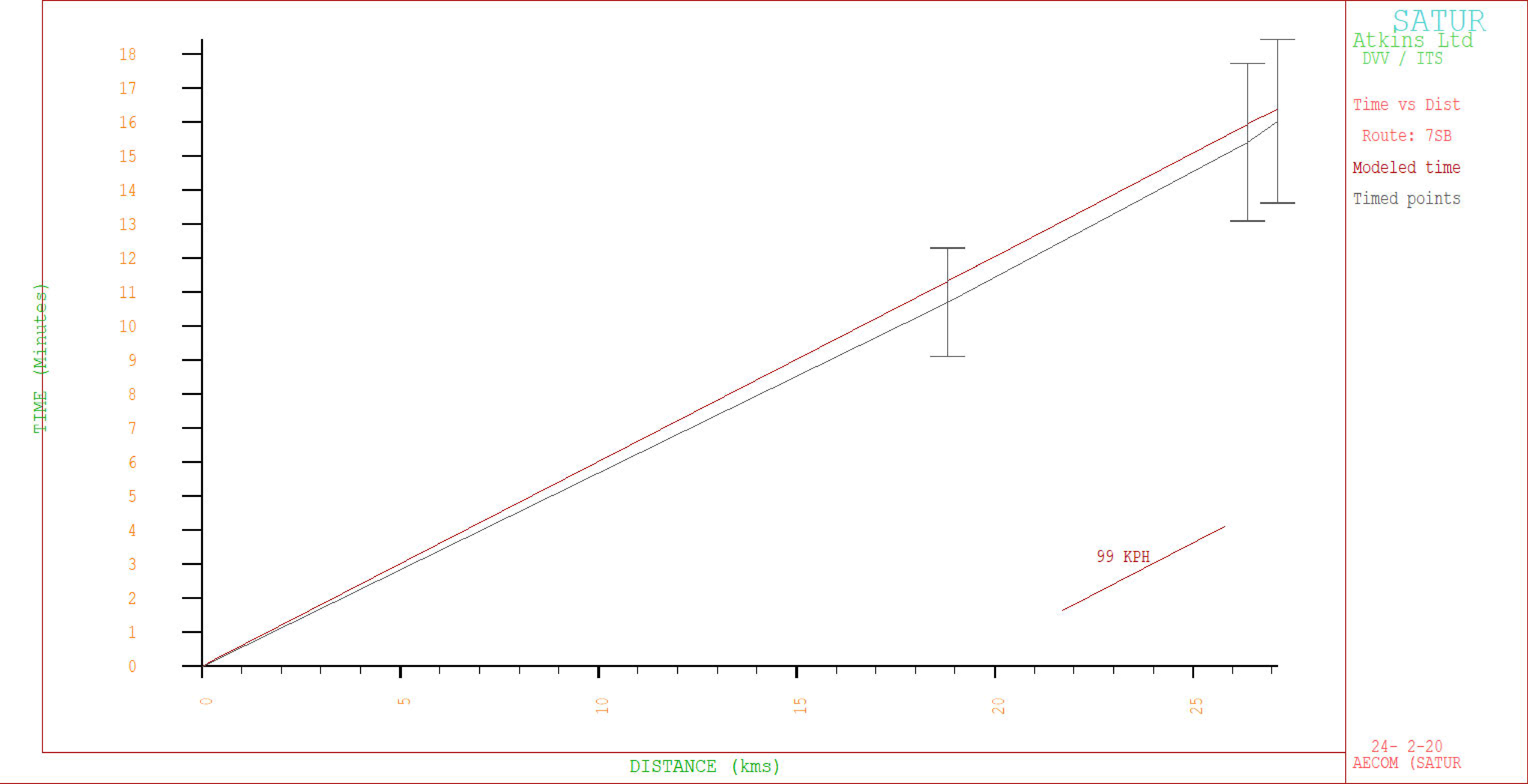
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 5WB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
45 KPH
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
24- 2-20
AECOM (SATUR



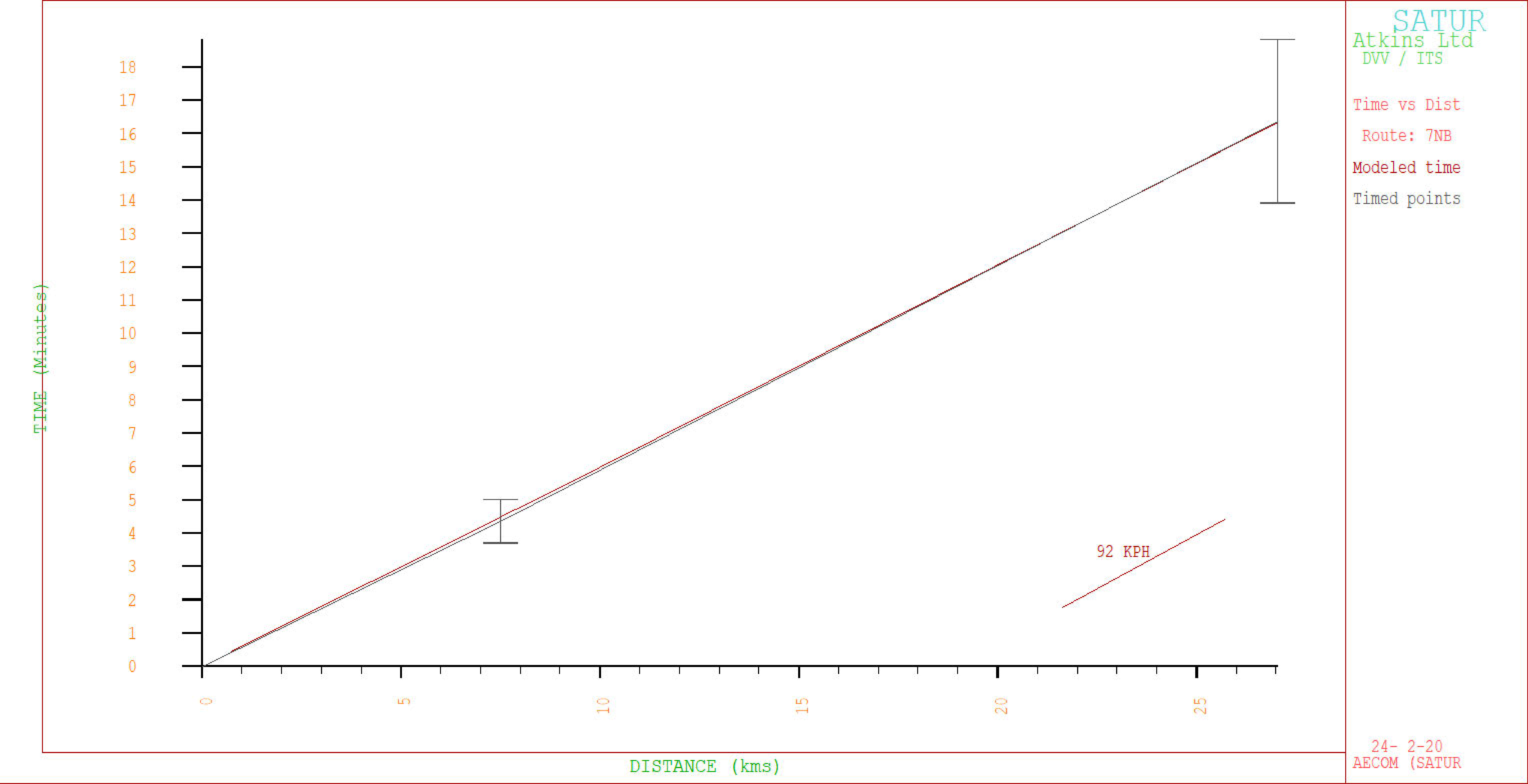
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 6SB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
47 KPH
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
24- 2-20
AECOM (SATUR

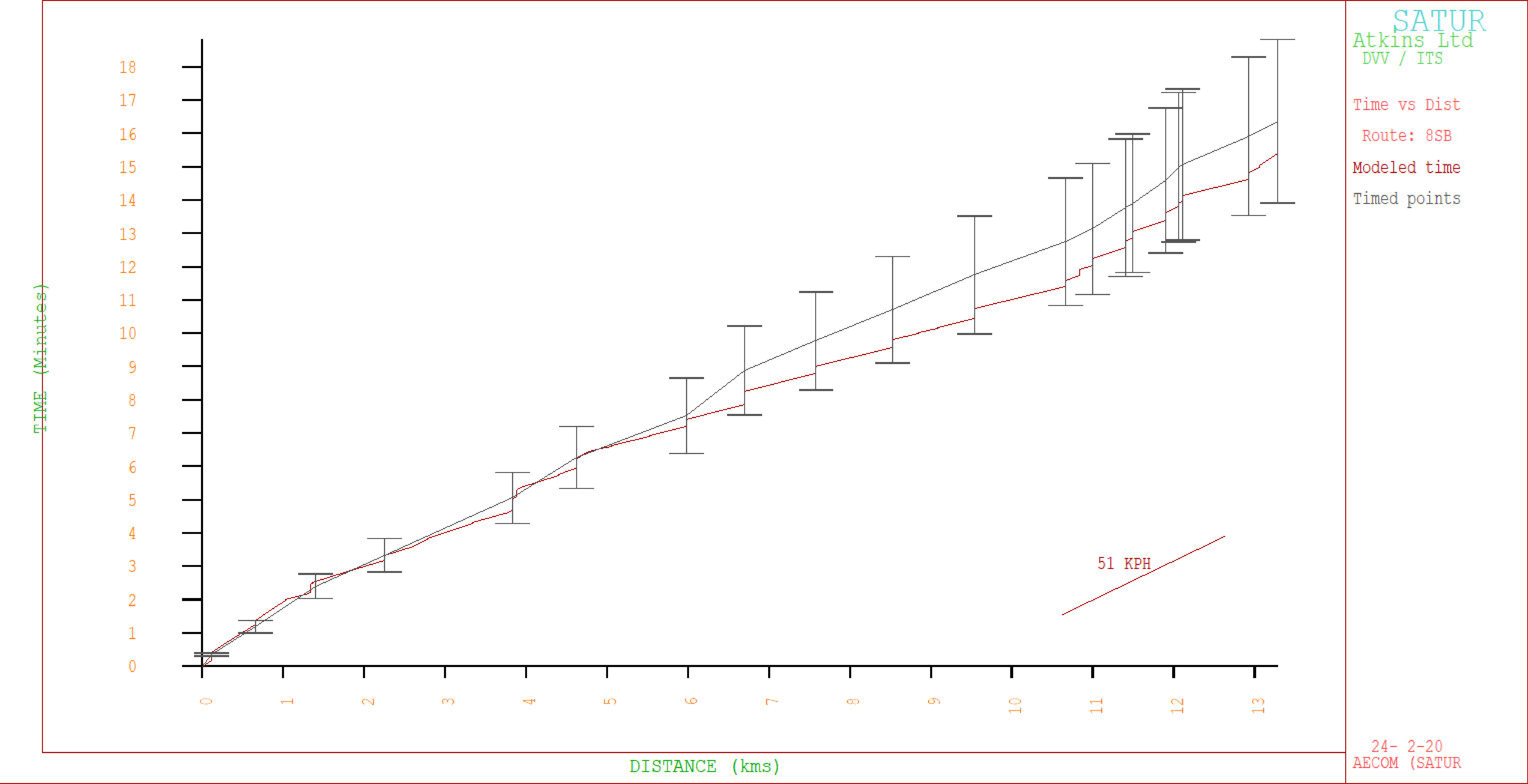


SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 6NB
Modeled time
Timed points
TIME (Minutes)
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0
1
2
3
4
5
6
7
8
9
10
11
12
44 KPH
DISTANCE (kms)
24- 2-20
AECOM (SATUR

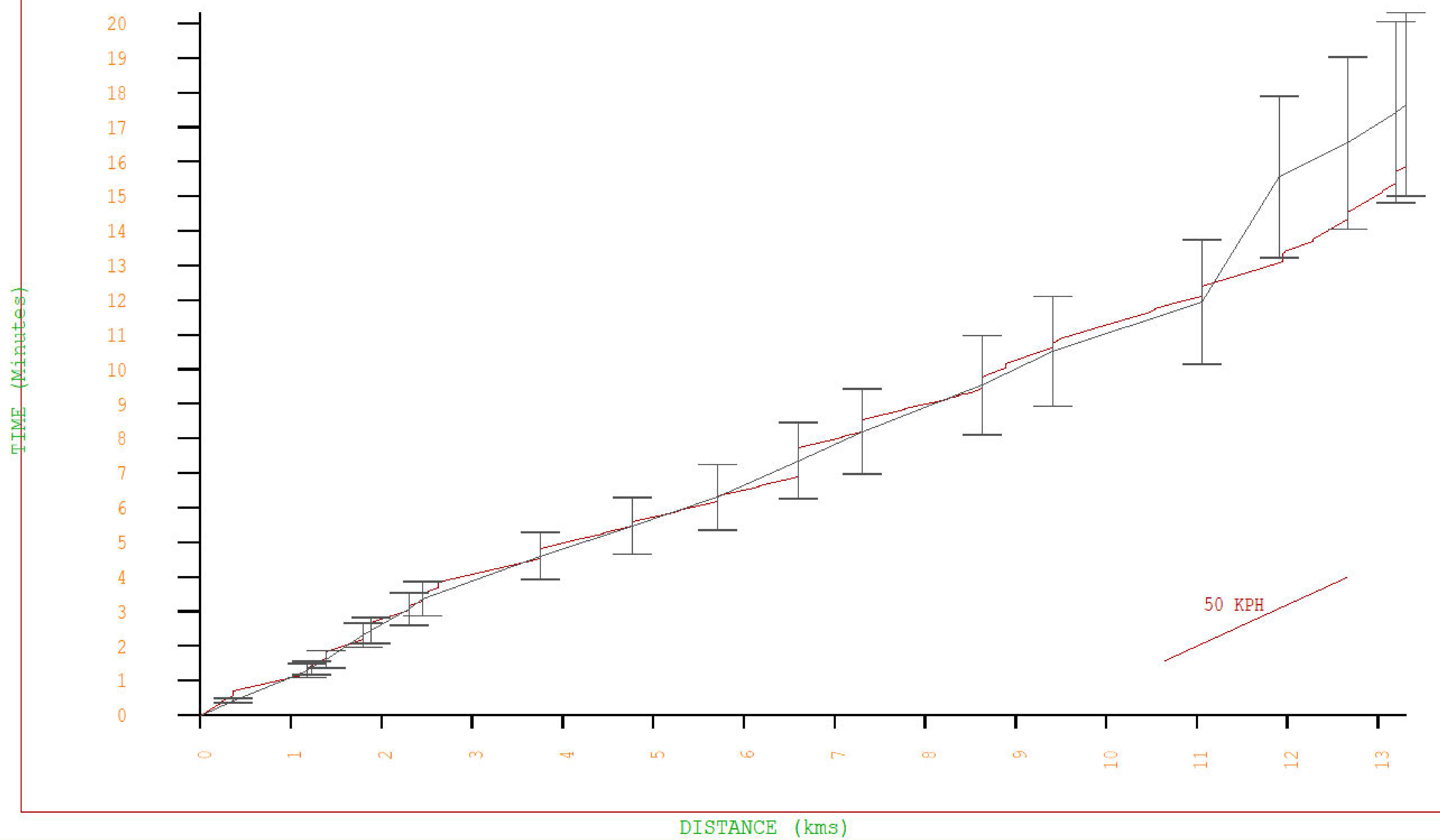


SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 7SB
Modeled time
Timed points
TIME (Minutes)
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0
5
10
15
20
25
DISTANCE (kms)
99 KPH
24- 2-20
AECOM (SATUR


SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 7NB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
92 KPH
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
0
5
10
15
20
25
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 8SB
Modeled time
Timed points
TIME (Minutes)
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
51 KPH
DISTANCE (kms)
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS

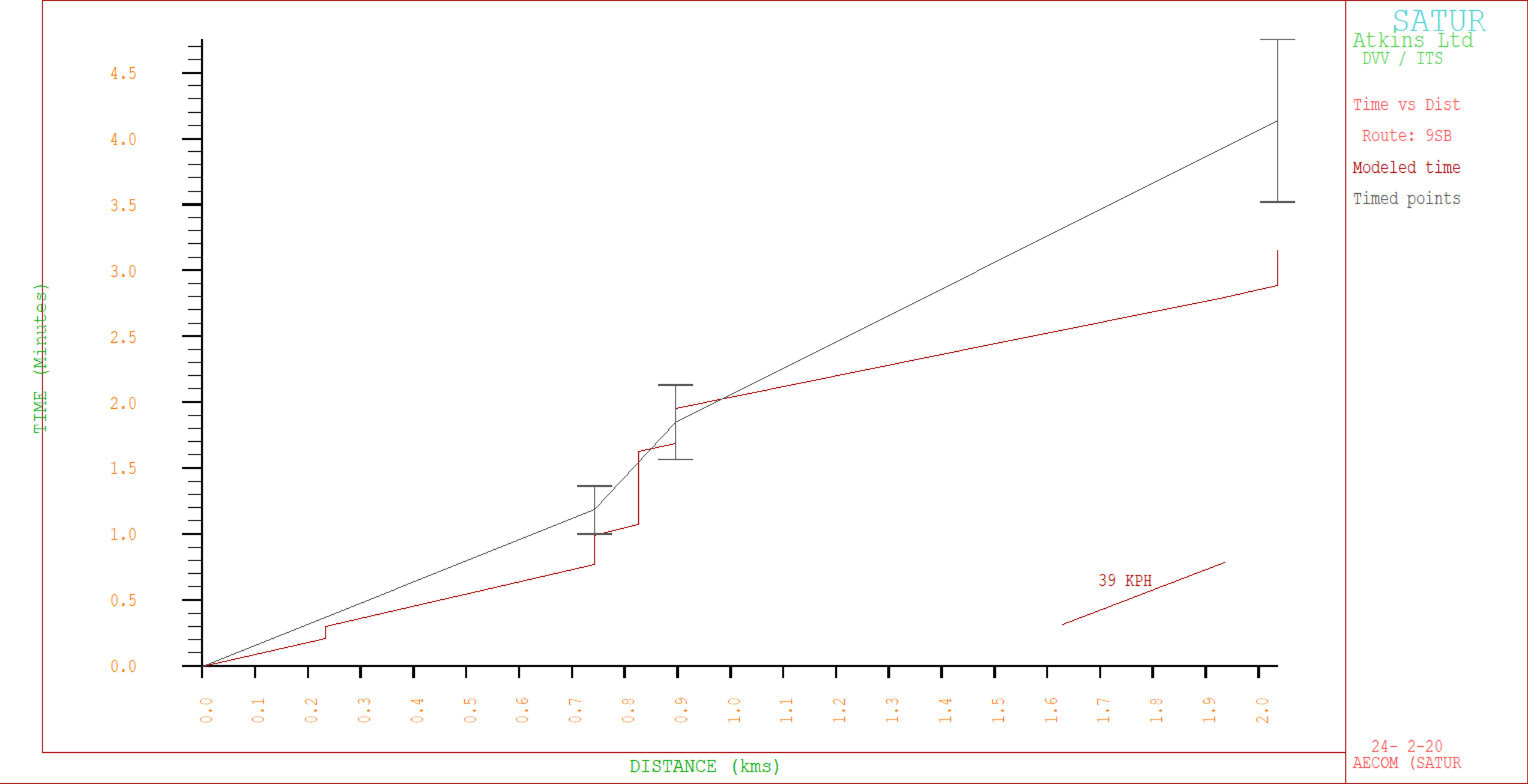
Time vs Dist

Route: 8NB

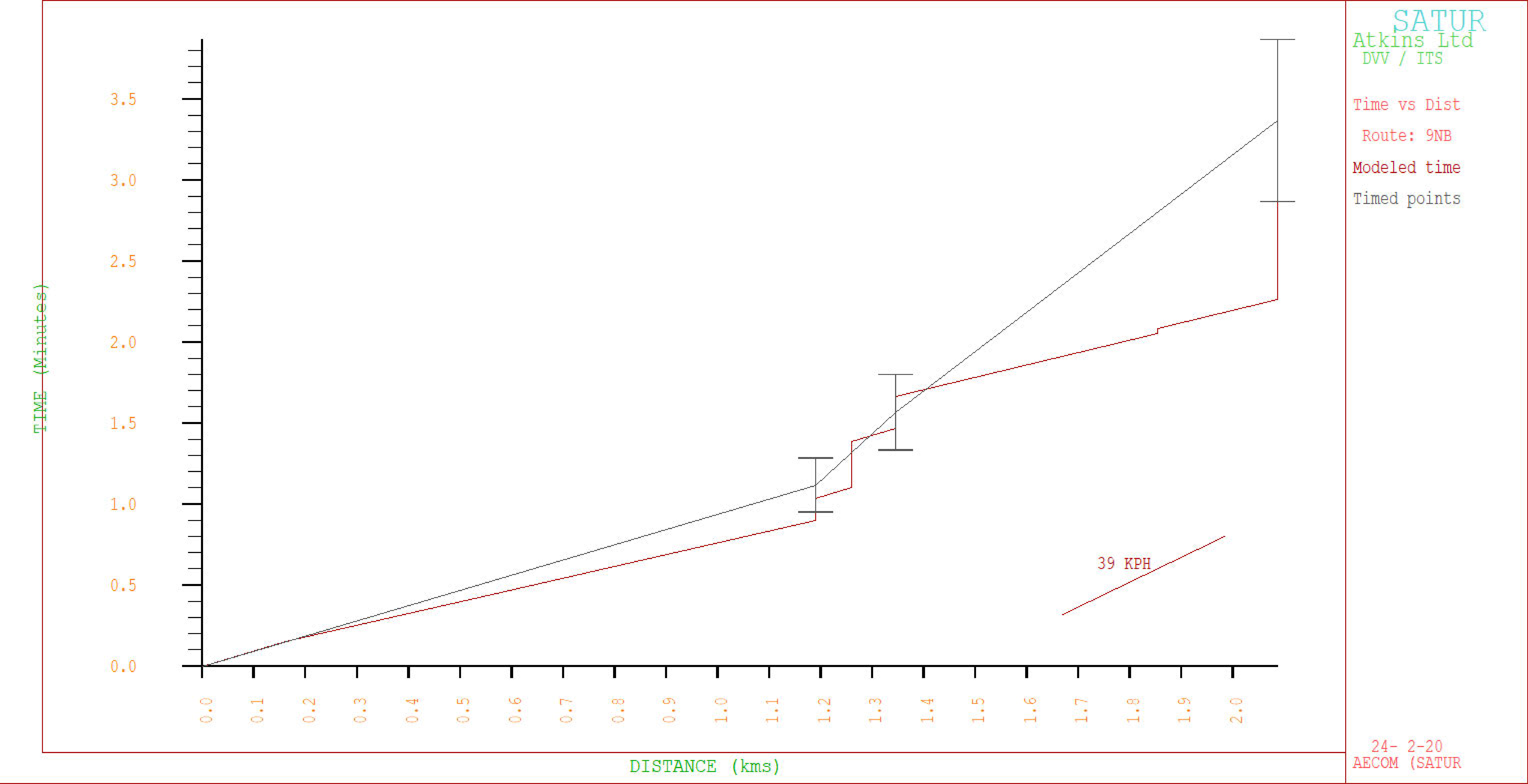
Modeled time

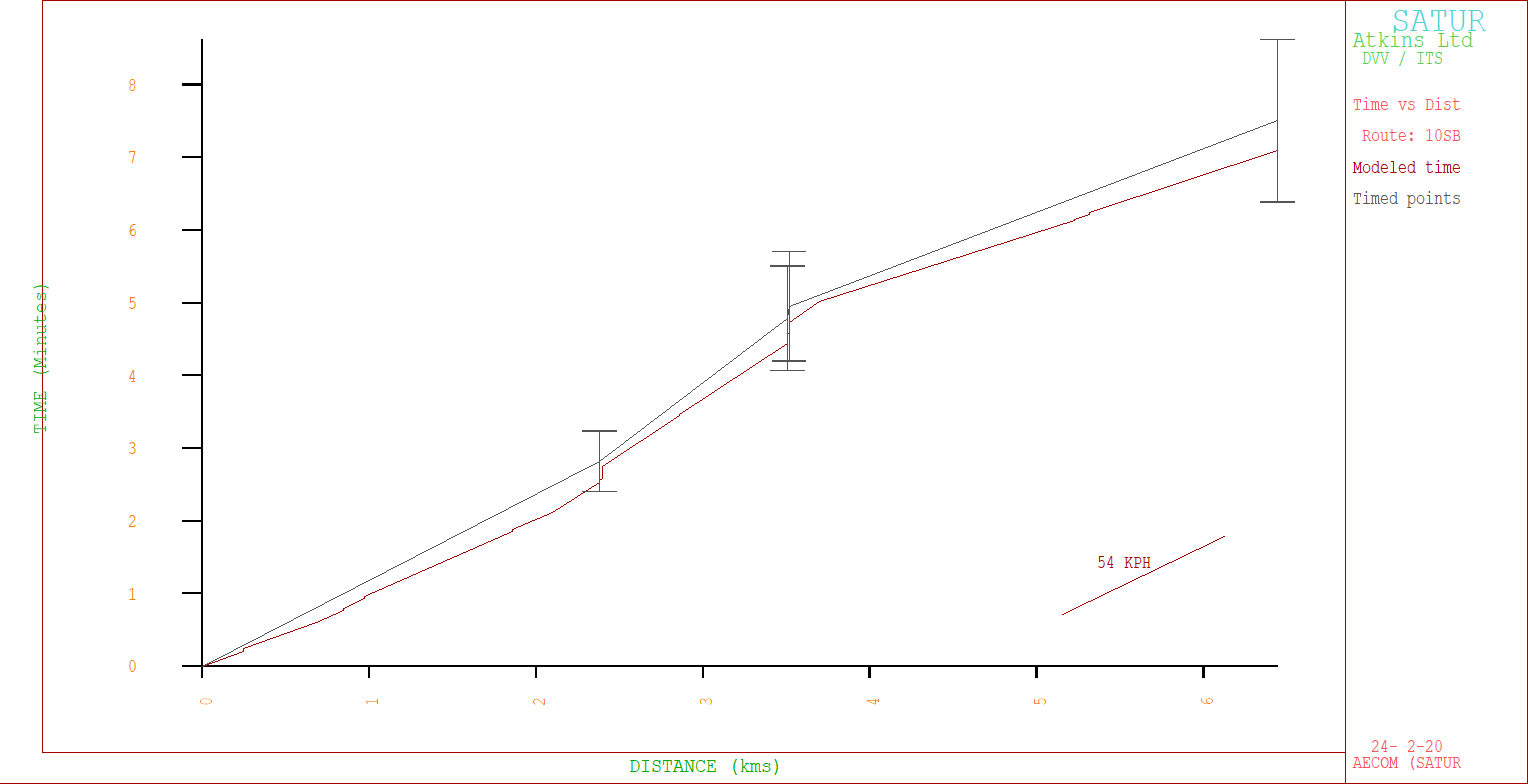
Timed points

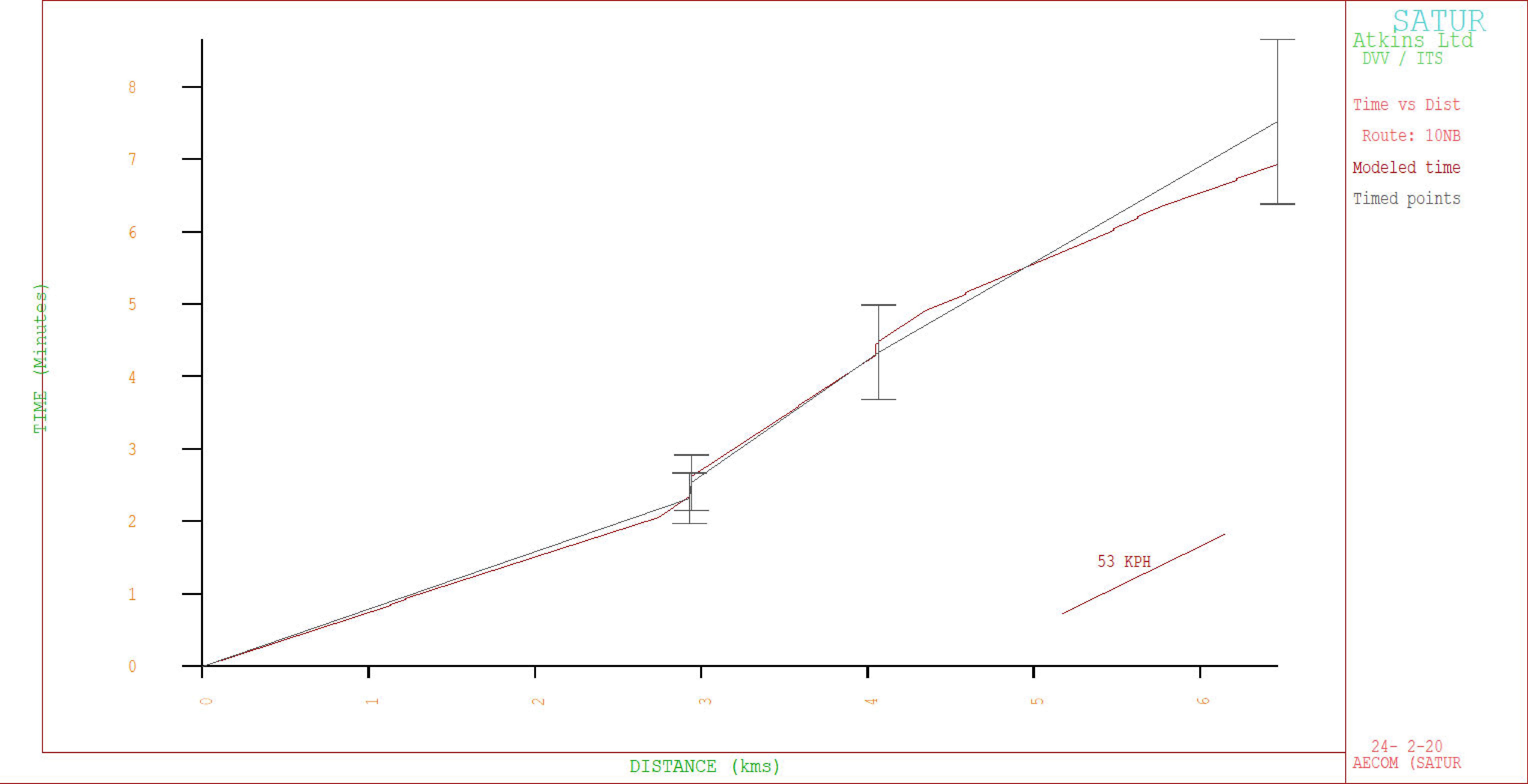
24- 2-20
AECOM (SATUR



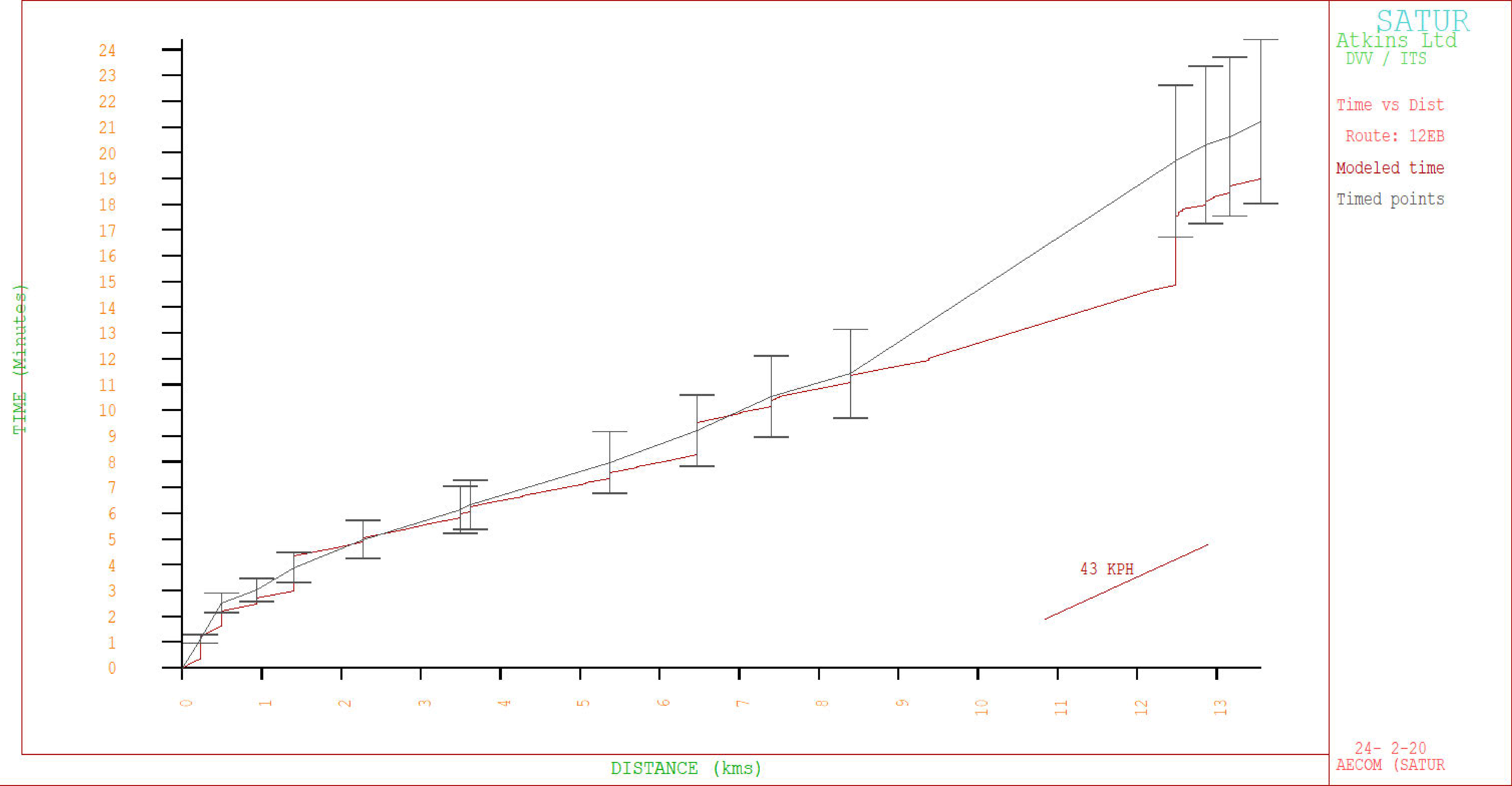
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 9SB
Modeled time
Timed points
TIME (Minutes)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
DISTANCE (kms)
39 KPH
24- 2-20
AECOM (SATUR


SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 9NB
Modeled time
Timed points
TIME (Minutes)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2.0
39 KPH
DISTANCE (kms)
24- 2-20
AECOM (SATUR

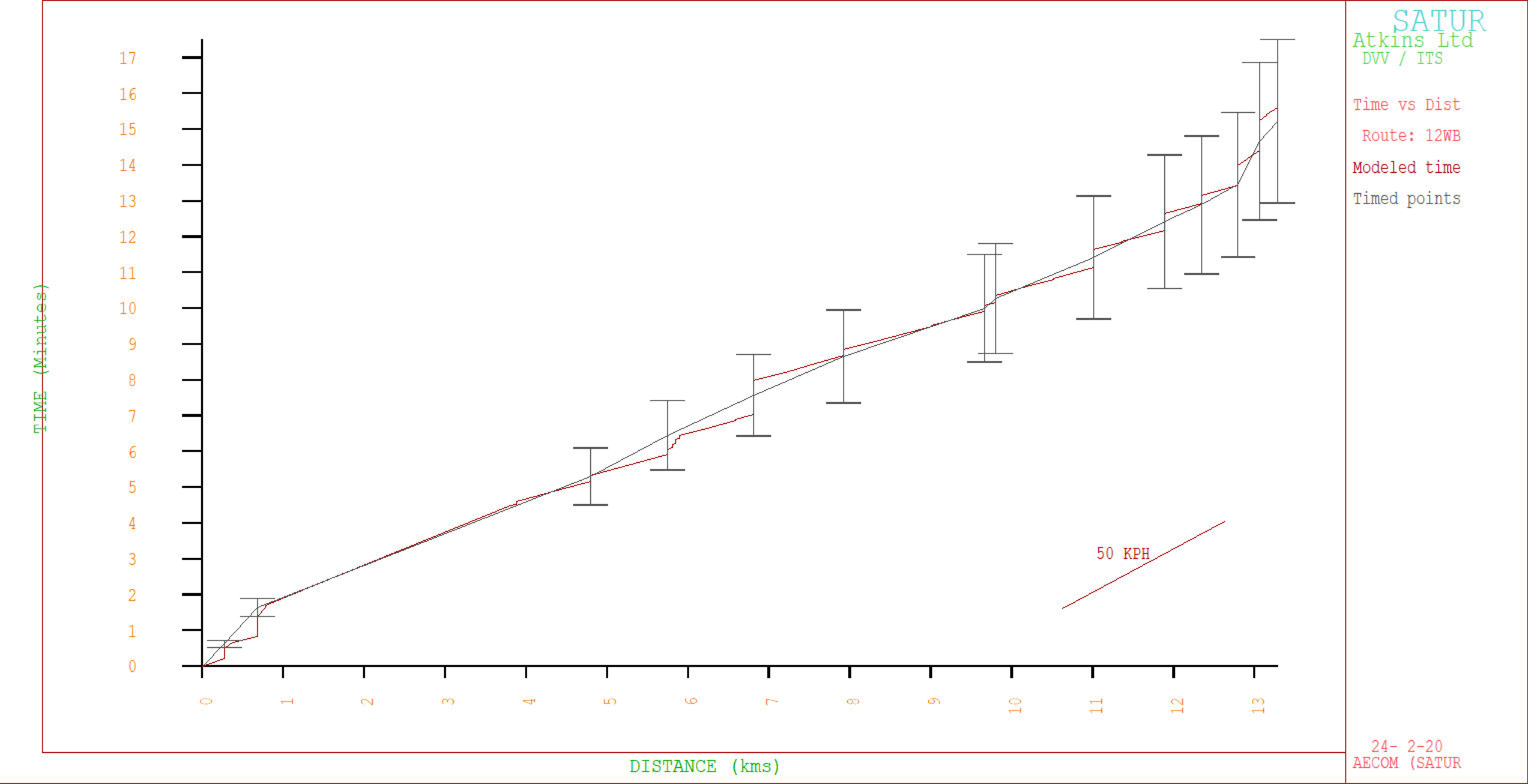

SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 10SB
Modeled time
Timed points
TIME (Minutes)
0
1
2
3
4
5
6
7
8
0
1
2
3
4
5
6
DISTANCE (kms)
54 KPH
24- 2-20
AECOM (SATUR



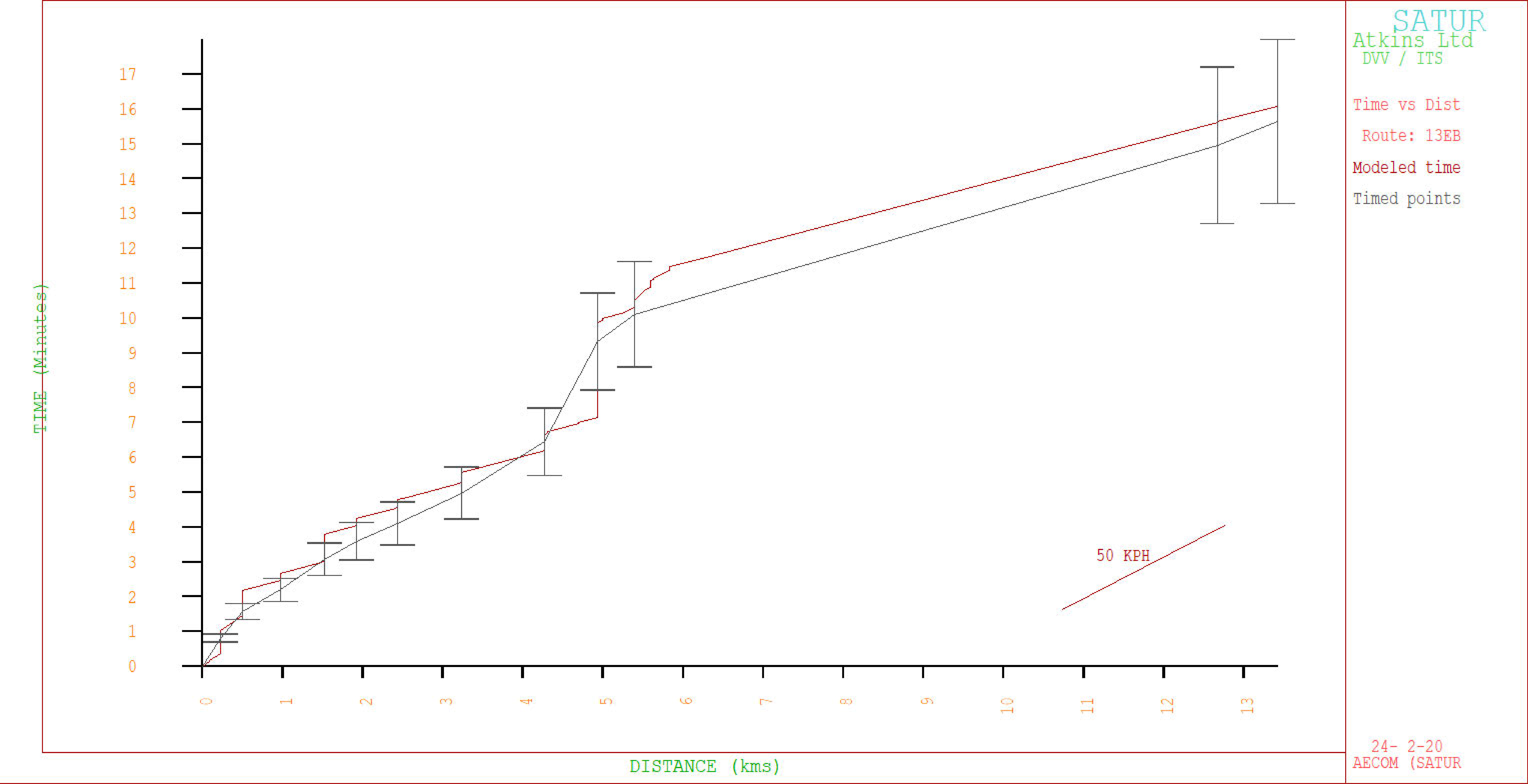
SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 10NB
Modeled time
Timed points
TIME (Minutes)
0
1
2
3
4
5
6
7
8
DISTANCE (kms)
53 KPH
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 12EB
Modeled time
Timed points
TIME (Minutes)
DISTANCE (kms)
43 KPH
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
0 1 2 3 4 5 6 7 8 9 10 11 12 13
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 12WB
Modeled time
Timed points
50 KPH
TIME (Minutes)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
DISTANCE (kms)
24- 2-20
AECOM (SATUR


SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 13EB
Modeled time
Timed points
TIME (Minutes)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
50 KPH
DISTANCE (kms)
0
1
2
3
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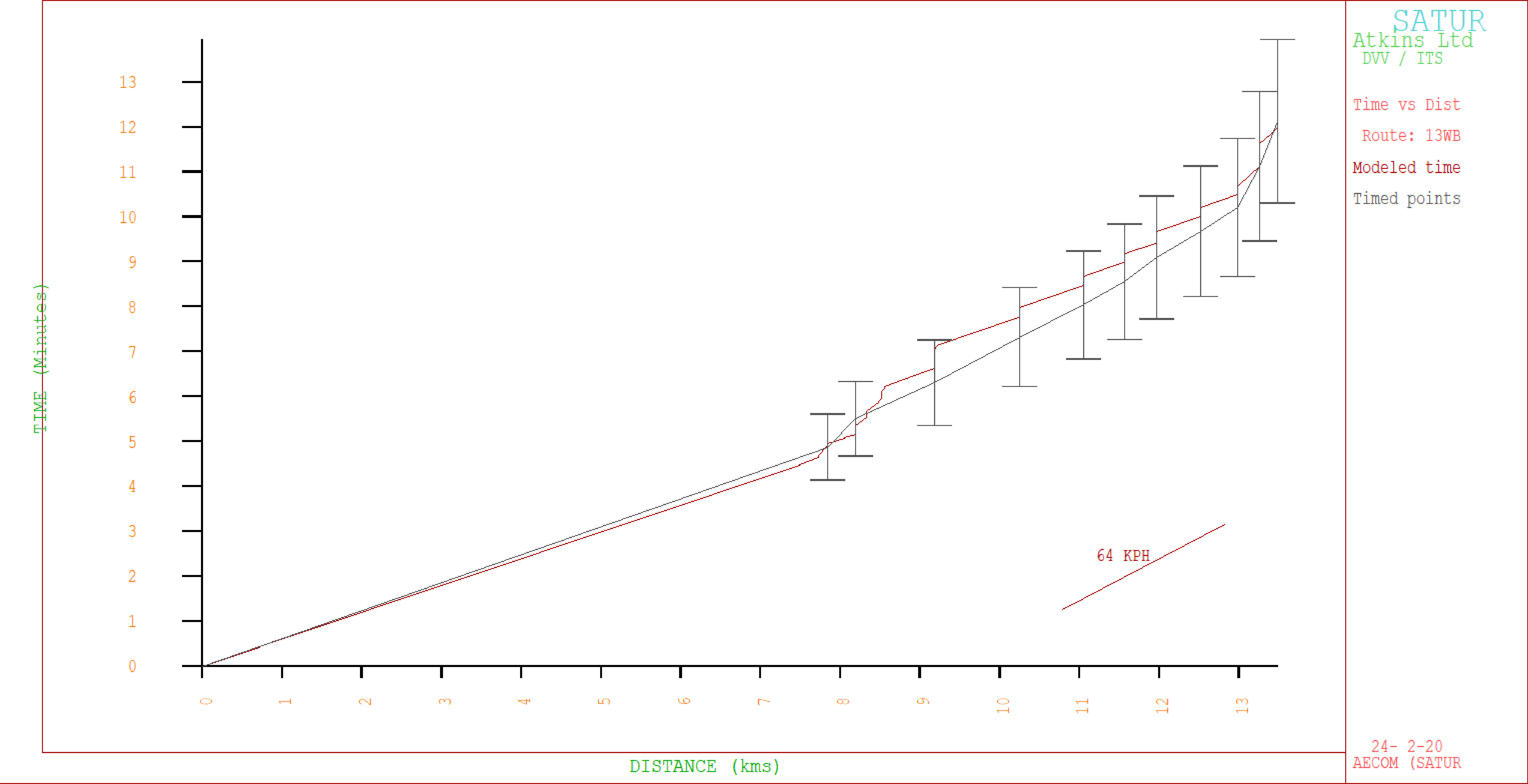
6
7
8
9
10
11
12
13
24- 2-20
AECOM (SATUR



SATUR
Atkins Ltd
DVV / ITS
Time vs Dist
Route: 13WB
Modeled time
Timed points
TIME (Minutes)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
DISTANCE (kms)
64 KPH
24- 2-20
AECOM (SATUR

Appendix K.2

AECOM - TN30 (MKMMM - MKE IMPACT STUDY)

Milton Keynes Multi-Modal Model

TN30: Impacts of Milton Keynes East

Milton Keynes Council

Project Number: 60624806

March 2021

Quality information

Prepared by	Checked by	Approved by
Robert Wilson Consultant	Martin Rutter Principal Consultant	Steven Wood Major Projects Director

Revision History

Revision	Revision date	Details	Authorised	Name	Position
1	22/12/2020	1st draft for client review	M. Rutter	Martin Rutter	Principal Consultant
2	04/03/2021	2nd draft for client review	M. Rutter	Martin Rutter	Principal Consultant
3	22/03/2021	Final draft	M. Rutter	Martin Rutter	Principal Consultant

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Milton Keynes Council; and
WSP.

Prepared by:

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Consultant

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St Albans.
AL1 3ER
UK

aecom.com

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1. Introduction and Overview

1.1 Study Background and Objectives

1.1.1 Milton Keynes East (MKE) is allocated within Plan:MK for a mixed residential and employment development. The Milton Keynes East Strategic Urban Extension (MKE SUE) will deliver around 5,000 new homes, 105 ha of employment land, a comprehensive transport network and supporting social and green infrastructure.

1.1.2 Milton Keynes Council (MKC) commissioned AECOM to update the Milton Keynes Multi-Modal Model (MKMMM) "Reference Case" in advance of the need for its use to assess the impact of the MKE development on current and proposed infrastructure. The main purpose of the model was to provide a robust means of assessing the impact of additional traffic associated with the development on both the local and strategic network.

1.1.3 The MKMMM work in relation to MKE can be split into two main stages:

- Develop the forecast 2031 and 2048 Reference Case; and
- Develop the 2031 and 2048 MKE Do-Something scenario.

1.2 Report Structure

1.2.1 This report includes an overview of the Base Year Model development and covers both forecasting stages, describing how the 2031 and 2048 Reference Case models have been updated and demand assumptions applied to create the forecast MKE scenario. The report has the following structure:

- Section 2: Overview of Base Year Model (summary of previous work, description of the base year model set-up and key validation results);
- Section 3: Reference Case (the methodology, including details of the uncertainty log, used in producing the Reference Case scenario and outcomes of the Reference Case)
- Section 4: MKE Scenario (overview of model inputs and outcomes of the Do-Something model)
- Section 5: MKE Impact
- Section 6: Summary
- Section 7: Sensitivity Test 1
- Section 8: Sensitivity Test 2

2. Overview of Base Year Model

2.1 Introduction

2.1.1 This section gives a brief overview of the re-calibration of the base year model to enhance accuracy and detail in the MKE area, specifically to provide the basis for the future MKE tests

2.1.2 The underlying development of the original base year highway and demand models is documented in the Local Model Validation Report (LMVR)[1], with the development of the Public Transport Model in the Public Transport LMVR Technical note[2].

2.1.3 Technical Note 29[3] also provides further detail of the re-calibration of the base year model, which was issued by AECOM in April 2020. This can be found in Appendix B.

2.2 Base Year Model Development

2.2.1 In March 2019 MKC submitted a successful Housing Infrastructure Fund (HIF) bid to central government to release investment to extend MK's existing highway grid system eastwards over the M1 via a new M1 overbridge to connect the site with the existing MK urban area via Tongwell Street that will also be used for a new public transport corridor.

2.2.2 This investment will address capacity constraints within the highway network and in particular create new links between the east and west sides of the M1 which not only constrain traffic movements but also limit the potential to provide high quality, fast bus services to / from Milton Keynes. These capacity constraints cannot be overcome without significant investment, without which, the MKE allocation cannot be unlocked.

2.2.3 While the Milton Keynes Multi-Modal Model (MKMMM) was considered appropriate for use to support the HIF bid, further refinement in the locality of the MKE site was required to ensure it is sufficiently robust to support the planning application.

2.2.4 The developer's consultants, WSP, outlined the suggested modelling approach in a Technical Note[4]. Essentially this approach, agreed with MKC and AECOM, was to enhance local network and zone coding detail and then to re-apply the final stage of a standard calibration to the model, namely 'matrix estimation', whereby additional counts were collected in the MKE area in 2019 and used to 'finesse' the underlying travel matrices to better replicate these counts when assigned to the network. Any more comprehensive update would have necessitated more fundamental changes beyond the available timescale and were not deemed necessary given the already generally good standard of the model validation

2.2.5 This chapter gives an overview of the first main element; update of the base year local recalibration and validation focussed around MKE. Further information can be found in Technical Note 29[5].

[1] MKMMM Local Model Validation Report v1.4, June 2017
[2] Milton Keynes Model Update - TN09 Public Transport LMVR v1, June 2017
[3] Milton Keynes Model - TN29 MK East Re-calibration_FINAL_DRAFT
[4] Milton Keynes East Transport Technical Note: Modelling Approach for MKE Planning Application, March 2019
[5] Milton Keynes Model - TN29 MK East Re-calibration_FINAL_DRAFT

2.3 Base Model Description and Specification

2.3.1 On the supply side, the existing highway model has a base year of 2016 and was developed using SATURN version 11.3.12U. In addition to the updates, the simulation network area was extended to better model the impacts of the proposed expansion areas. A public transport model sits alongside the highway model. The Milton Keynes Multi-Modal Model (MKMMM) public transport model was developed in INRO's Emme software, version 4.2.9, and covers both bus and rail modes. It is designed to model public transport in and around the Milton Keynes urban area.

2.3.2 On the demand side, a variable demand model has been developed using Emme software to estimate the effects of changes in transport infrastructure and in travel costs upon patterns of demand. That is, the way travellers respond to changes in transport infrastructure other than choosing different routes which is forecast by the highway and public transport assignment models.

2.4 Study Area

2.4.1 The model study area covers Milton Keynes and the proposed expansion areas.

2.4.2 For analysis purposes an area referred to as 'Milton Keynes urban area' was defined as shown in Figure 1. Traffic zones within the Milton Keynes urban area were defined as internal and traffic zones outside were defined as external.

2.4.3 A more detailed description of the expansion area can be found in section 4.1.

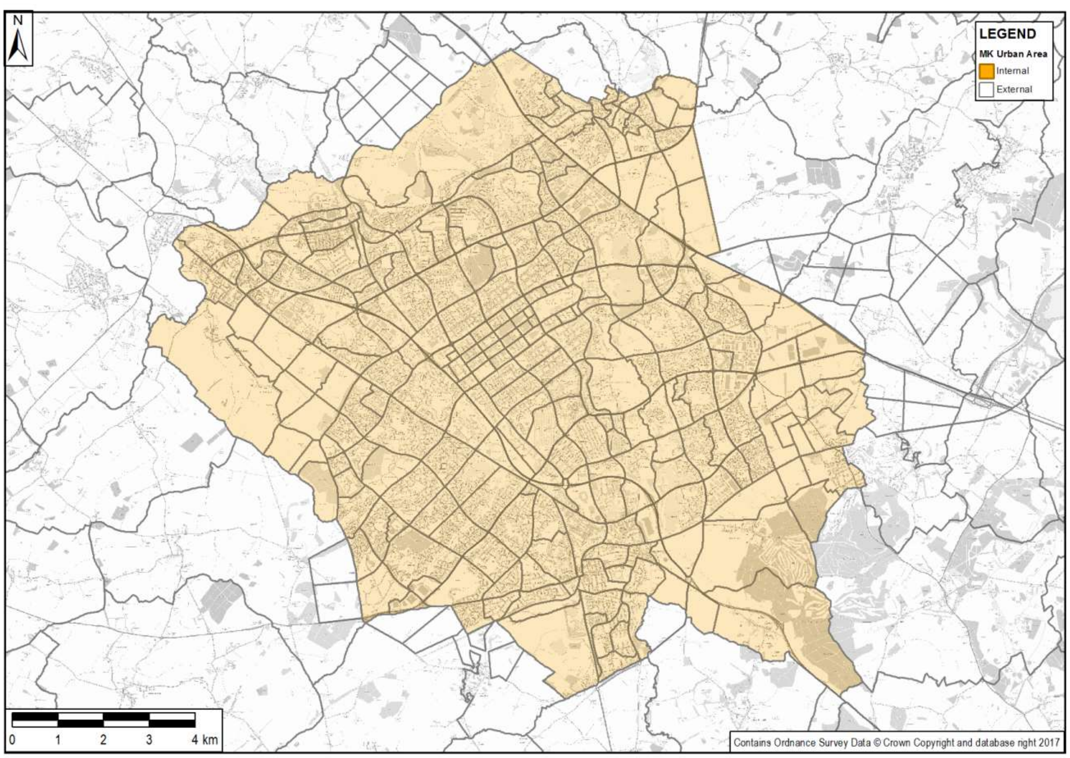

Figure 1. Milton Keynes Urban Area

2.5 Modelling Detail

2.5.1 The network and accompanying coding detail were split into three levels as shown in Figure 2:

- The simulation area which covered Milton Keynes and the areas to the north, east, south and west;
- The buffer network with speed flow curves which extended across the boroughs surrounding Milton Keynes; and
- The buffer network with fixed speeds which covered the network further beyond the hinterland around Milton Keynes.

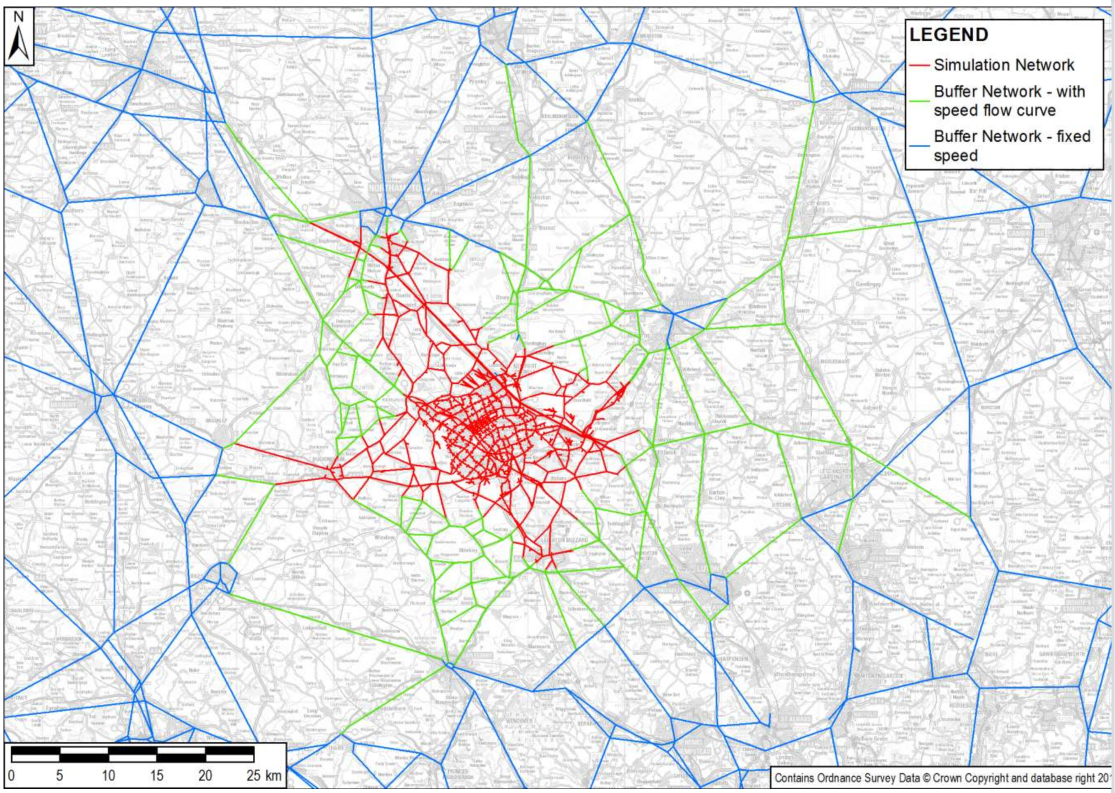

Figure 2. Network Coding Levels of Detail

2.5.2 There are 513 zones in the 2016 Base Year model, which are shown in Figure 3 and Figure 4.

2.5.3 Both the network and zone system were subsequently reviewed in the 2019 update. Following this the network coding for 21 junctions were updated as well as the zoning system in the MKE area; where several development zones were relocated to give better flexibility in future modelling work.

2.5.4 Further information on this can be found in Chapter 5 of Technical Note 29.

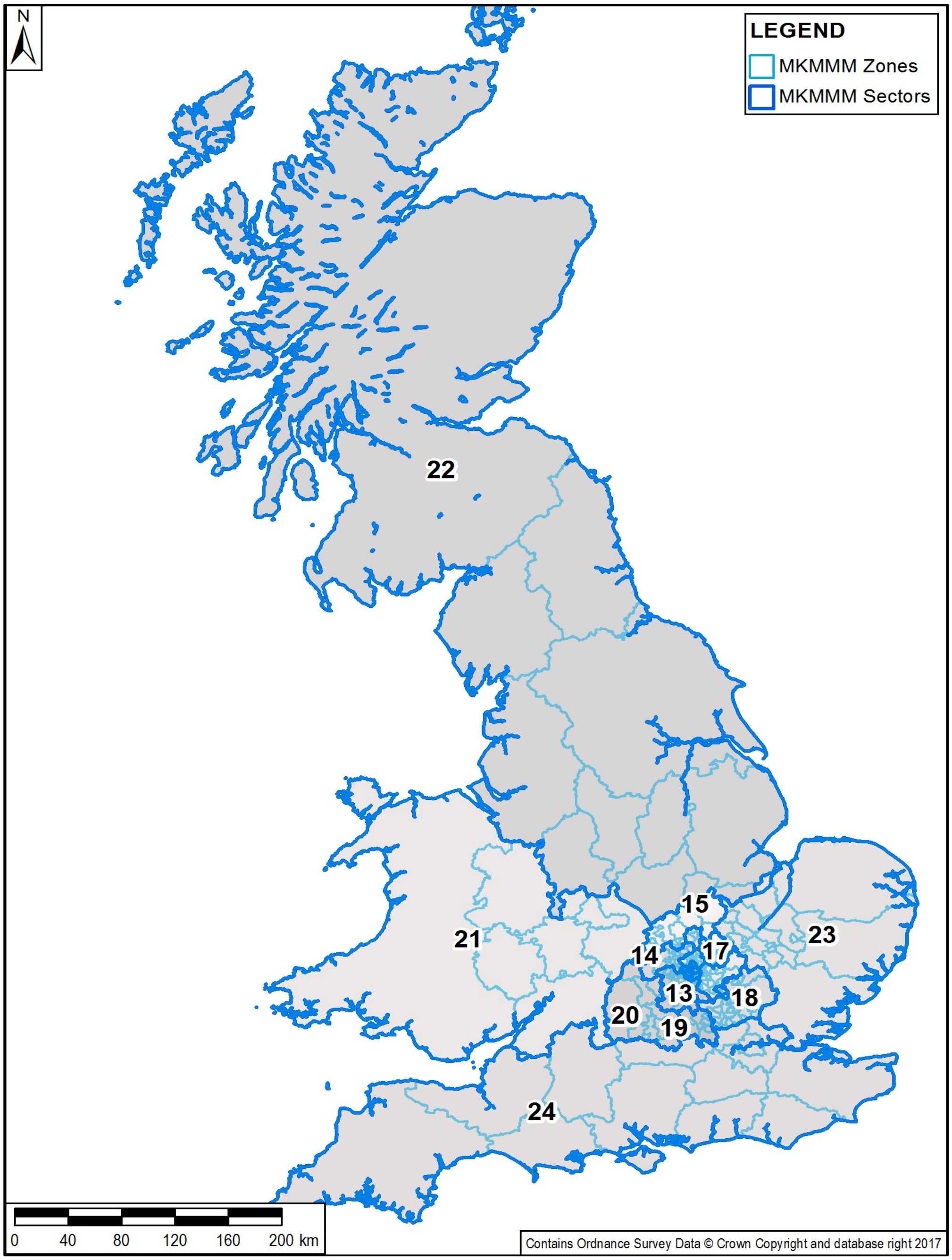

Figure 3. MKMMM Zone Plan Version 1.4 and Sectors – UK

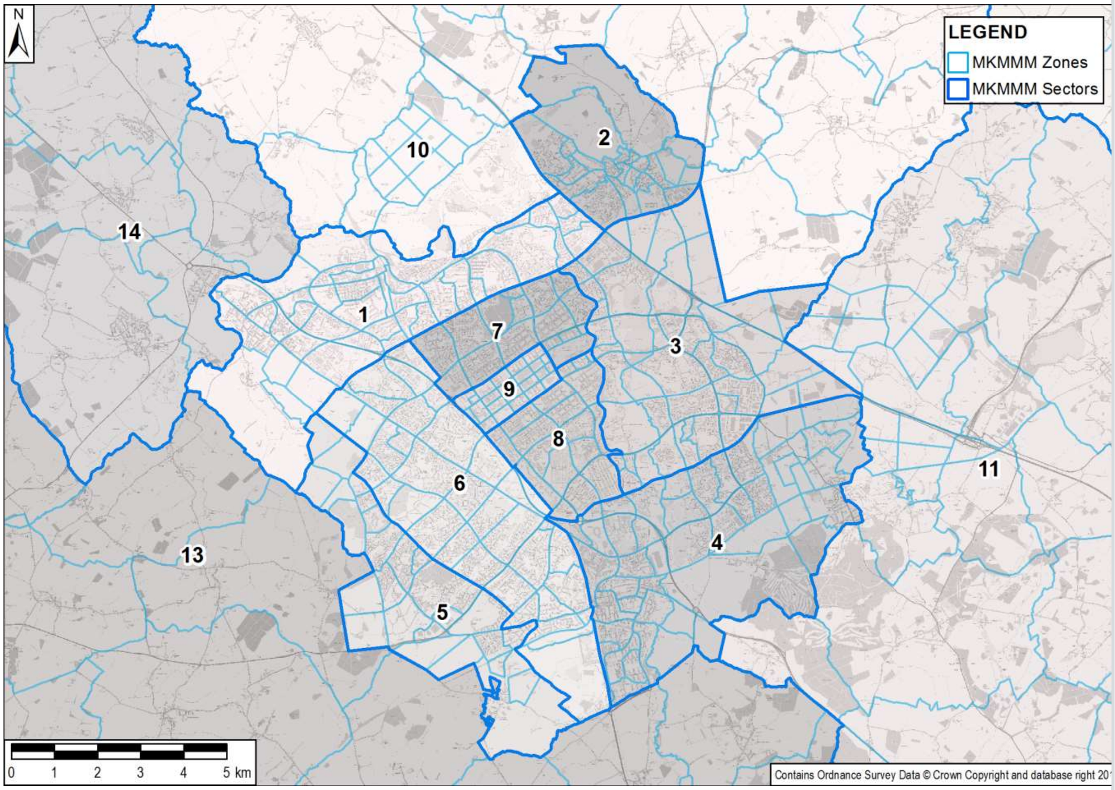

Figure 4. MKMMM Zone Plan Version 1.4 and Sectors – Milton Keynes Local Area

2.6 Time Periods

Highway Model

2.6.1 The base year represents an average Monday to Thursday in June 2016. The modelled time periods remain unchanged as most historic MKC data has been collected for 60-minute periods commencing at the start of each hour. These periods being:

- AM peak – 0800-0900;
- PM Peak – 1700-1800; and
- Inter-peak – average of 1000-1600.

2.7 Link Flow Calibration and Validation Criteria

2.7.1 The UK Department for Transport (DfT) guidelines have been used as a measure of the model calibration and validation in terms of link flows, screenline and journey time comparisons (Modelled against observed) and model convergence criteria. The TAG guidelines for modelled and observed link flow comparisons are listed in Table 1.

Source: TAG Unit M3.1 Table 2

Criteria	Description of Criteria	Acceptability Guideline
A	Individual flows within 100 veh/h of counts for flows less than 700 veh/h	>85% of cases
	Individual flows within 15% of counts for flows from 700 to 2,700 veh/h	>85% of cases
	Individual flows within 400 veh/h of counts for flows more than2,700 veh/h	>85% of cases
B	GEH < 5 for individual flows	>85% of cases

Table 1: Link Flow and Turning Movement Validation Criteria and Acceptability Guidelines

2.8 Journey Time Validation Criteria

2.8.1 The DfT TAG guidelines as shown below, have been used as guidance for the journey time validation.

Source: TAG Unit M3.1 Table 3

Criteria	Acceptability Guideline
Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher than 15%)	> 85% of routes

Table 2: Journey Time Validation Criterion and Acceptability Guideline

2.9 Vehicle and User Classes

2.9.1 The SATURN model has been built using the three vehicle classes:

- Cars;
- Light Goods Vehicles (LGV); and
- Heavy Goods Vehicles (HGV).

2.9.2 For model assignment purposes cars are defined as being one of three trip purposes, commuting, business or other. This results in there being five user classes for highway assignment purposes as shown in Table 3 along with their corresponding vehicle class:

User Class	Vehicle Class	Purpose
1	1	Car Commute
2	1	Car Employer's Business
3	1	Car Other
4	2	LGV
5	3	OGV

Table 3: Model User and Vehicle Classes

2.9.3 Bus routes and services in and around Milton Keynes have been extracted from the Emme Public Transport Model and coded as fixed flows in the model.

2.10 Assignment Algorithm and Method

2.10.1 Assignment of trips to the highway network was undertaken using a user-equilibrium assignment according to the first of Wardrop's principles, assumed to govern the routes chosen by drivers travelling from a given origin to a given destination.

2.10.2 This principle of equilibrium is such that: 'The journey times on all the routes actually used are equal and less than those which would be experienced by a single vehicle on any unused route'.

2.10.3 User-equilibrium, as implemented in SATURN version 11.3.12, is based on the Frank-Wolfe algorithm, which employs an iterative process based on successive all-or-nothing assignments to generate a set of combined flows on links that minimise an objective function. The travel costs are re-calculated for each iteration and then compared to those from the previous iteration. The process is terminated when the costs obtained from successive iterations do not change significantly. At this point, the model is said to have converged.

2.11 Trip Matrix Calibration and Validation

Introduction

2.11.1 This section provides an overview of the process adopted to produce assignments that replicated the observed set of traffic counts within appropriate tolerances. Further details regarding this process can be found in Technical Note 29.

2.11.2 This followed a two staged process below;

- The network was calibrated by comparing modelled results produced using the prior matrices, using observed link journey times and screenline flows.
- The model was then further adjusted using Matrix Estimation (ME) but also further network edits where appropriate, so that the differences between modelled and observed data sets were within acceptable tolerances.

Matrix Estimation and Monitoring

2.11.3 Matrix estimation was conducted using the SATPIJA and SATME2 modules of the SATURN modelling package. The process adjusts the matrix by factoring origin and destination pairs to better match the observed count data.

2.11.4 The process is purely mathematical with no behavioural basis so ideally it should be used for refinement rather than significant changes. Hence the aim to minimise the impacts of ME to the prior matrix in line with section 4.2 of TAG Unit M3.1, Highway Assignment Modelling (January 2014). As such the network calibration was conducted using the factored prior matrices to a suitable point before running ME.

2.11.5 The Matrix Estimation Process is shown in Figure 5. The original prior matrices were factored up to address the general shortfall of trips within the RSI Cordon. The factored prior matrices were used in the matrix estimation process.

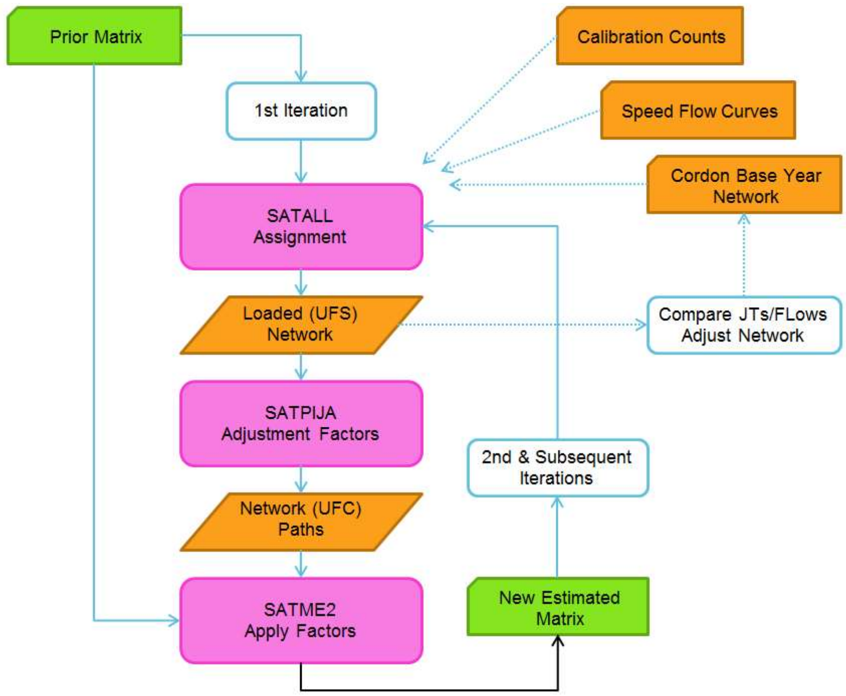

Figure 5. SATURN's 'ME2' Matrix Estimation Process

Final Results

2.11.6 To measure the impact of the ME process the following measures were used:

- Scatter plots and regression of modelled against observed flows,
- Post and factored prior ME trip length distributions,
- Post and factored prior ME trip end scatter plots and regressions statistics.

2.11.7 TAG guidelines (Section 3.2 TAG Unit M3.1, Highway Assignment Modelling Jan 2014) were used as a measure of the model validation.

2.11.8 Detailed results of this can be found in Technical Note 29[6].

2.12 Assignment Calibration and Validation

2.12.1 It is important to ensure the results produced by the model are logical when the trip matrices are assigned to the network. As such both link count and journey time data were reviewed regularly throughout the process.

2.12.2 The cordons and screenlines were monitored by direction. This section provides the results and summarises the 'pass' rate based on the TAG criteria detailed in Table 1.

[6] Milton Keynes Model - TN29 MK East Re-calibration_FINAL_DRAFT

2.13 Assignment Validation Results Overview

2.13.1 The proportion of calibration and validation links where modelled flows passed the TAG link flow validation criteria in Table 1 was also reviewed.

2.13.2 Table 4 to Table 6 show the proportion of counts that meet the TAG criteria for how well the modelled and observed flows compare with each other. In all time periods the calibration counts meet the TAG criteria that >85% of flows meet the link flow criteria (A). Fewer validation flows satisfy Criteria A.

All Sites	Total no. of Counts	Counts that pass	%
Calibration Counts: Flows	190	172	91%
Calibration Counts: GEH	190	172	91%
Calibration Counts Either	190	175	92%
Validation Counts: Flows	26	13	50%
Validation Counts: GEH	26	15	58%
Validation Counts Either	26	15	58%

Table 4: Total Calibration and Validation Counts (Full Screenlines) - AM Peak

All Sites	Total no. of Counts	Counts that pass	%
Calibration Counts: Flows	190	187	98%
Calibration Counts: GEH	190	185	97%
Calibration Counts Either	190	187	98%
Validation Counts: Flows	26	11	42%
Validation Counts: GEH	26	13	50%
Validation Counts Either	26	13	50%

Table 5: Total Calibration and Validation Counts (Full Screenlines) - Inter-Peak

All Sites	Total no. of Counts	Counts that pass	%
Calibration Counts: Flows	190	180	95%
Calibration Counts: GEH	190	181	95%
Calibration Counts Either	190	181	95%
Validation Counts: Flows	26	12	46%
Validation Counts: GEH	26	13	50%
Validation Counts Either	26	13	50%

Table 6: Total Calibration and Validation Counts (Full Screenlines) – PM Peak

2.13.3 Table 7 to Table 9 show a breakdown by vehicle class. It can be seen that LGV and HGV have a higher percentage of validation counts that pass Criteria A but this is due to lower volumes having a higher relative tolerance within the formula for passing Criteria A.

All Sites	Total no. of Counts	Car		LGV		HGV	
		Counts that pass	%	Counts that pass	%	Counts that pass	%
Calibration Counts:	190	172	91%	190	100%	190	100%
Calibration Counts:	190	174	92%	183	96%	186	98%
Calibration Counts	190	174	92%	190	100%	190	100%
Validation Counts:	26	14	54%	26	100%	26	100%
Validation Counts:	26	16	62%	21	81%	26	100%
Validation Counts	26	16	62%	26	100%	26	100%

Table 7: Total Calibration and Validation Counts (Full Screenlines) by Vehicle Class - AM Peak

All Sites	Total no. of Counts	Car		LGV		HGV	
		Counts that pass	%	Counts that pass	%	Counts that pass	%
Calibration Counts:	190	188	99%	190	100%	190	100%
Calibration Counts:	190	186	98%	189	99%	190	100%
Calibration Counts	190	188	99%	190	100%	190	100%
Validation Counts:	26	11	42%	26	100%	26	100%
Validation Counts:	26	13	50%	21	81%	25	96%
Validation Counts	26	13	50%	26	100%	26	100%

Table 8: Total Calibration and Validation Counts (Full Screenlines) by Vehicle Class - Inter-Peak

All Sites	Total no. of Counts	Car		LGV		HGV	
		Counts that pass	%	Counts that pass	%	Counts that pass	%
Calibration Counts:	190	183	96%	190	100%	190	100%
Calibration Counts:	190	181	95%	188	99%	190	100%
Calibration Counts	190	184	97%	190	100%	190	100%
Validation Counts:	26	12	46%	26	100%	26	100%
Validation Counts:	26	13	50%	23	88%	26	100%
Validation Counts	26	13	50%	26	100%	26	100%

Table 9 Total Calibration and Validation Counts (Full Screenlines) by Vehicle Class - PM Peak

2.13.4 Journey time data was also used in the model calibration and validation process. The modelled journey times were compared to the observed journey time data extracted from Trafficmaster data.

2.13.5 92% of the modelled and observed journey times are within bounds defined in TAG for the AM time period, while 96% and 88% of IP and PM respectively are within bounds.

2.13.6 A more detailed overview of these results can be found in Technical Note 29[7].

[7] Milton Keynes Model - TN29 MK East Re-calibration_FINAL_DRAFT

2.14 Standards Achieved

2.14.1 Table 10 to Table 12 summarises the key statistics of the model update.

2.14.2 The counts calibration for the highway assignment model is good and individual counts pass at a comparable level to the original base year model.

2.14.3 Although the validation count pass rate is less than the TAG guidance, the majority of overall validation screenline comparisons were within 5%. The grid system in Milton Keynes makes representation of observed flows particularly challenging. Due to the limited observed data within Milton Keynes, traffic survey and signal timings, the limited timescale and the strong flow calibration which has been improved around MKE and journey time validation these results were deemed acceptable.

2.14.4 Further information can be found in Chapter 10 of Technical Note 29.

Calibration Counts	Model Update Pass %
AM	92%
IP	98%
PM	95%

Table 10: Summary Calibration Count Results

Validation Counts	Model Update Pass %
AM	58%
IP	50%
PM	50%

Table 11: Summary Validation Count Results

2.14.5 The TAG criteria that > 85% of routes should be within 15% of surveyed times is met for all three time periods. Journey time route pass rates are the same or slightly lower than the previous model. The journey time validation on routes through MKE is also strong.

Journey Times	Model Update Pass %
AM	92%
IP	96%
PM	88%

Table 12: Summary Journey Time Results

3. Reference Case

3.1 Introduction

3.1.1 This section of the report outlines the methodology used in producing the Reference Case for the MKMMM model and the model outcomes.

3.1.2 Traffic forecasts have been developed for a total of two future years as detailed in 3.3 below.

Forecast Year	Description
2031	Milton Keynes East is allocated within Plan:MK which is intended to be delivered by 2031, as such this is the initial forecast year modelled, using the expected phased MKE built-out to that point.
2048	The full build out is expected to be complete by 2048, as such this is the second forecast year modelled.

Table 13: Forecast Years

Study Area Development Zones

3.1.3 The trip end model is structured to allow explicit planning inputs to be entered for zones within the 'Internal' Area as shown in Figure 6.

3.1.4 In terms of development growth the primary area considered was Milton Keynes Borough, with strategic infrastructure schemes in the general vicinity also included.

3.1.5 In Aylesbury Vale, the South West Milton Keynes (SWMK) development was included due to its close proximity to Milton Keynes.

3.1.6 Originally it had been intended to input committed developments in other neighbouring districts in zones within the 'Internal' Area, however due to limited data availability, in part due to limited certainty on developments, and due to differing formal planning time horizons, it was agreed that NTEM data should be used in place of these.

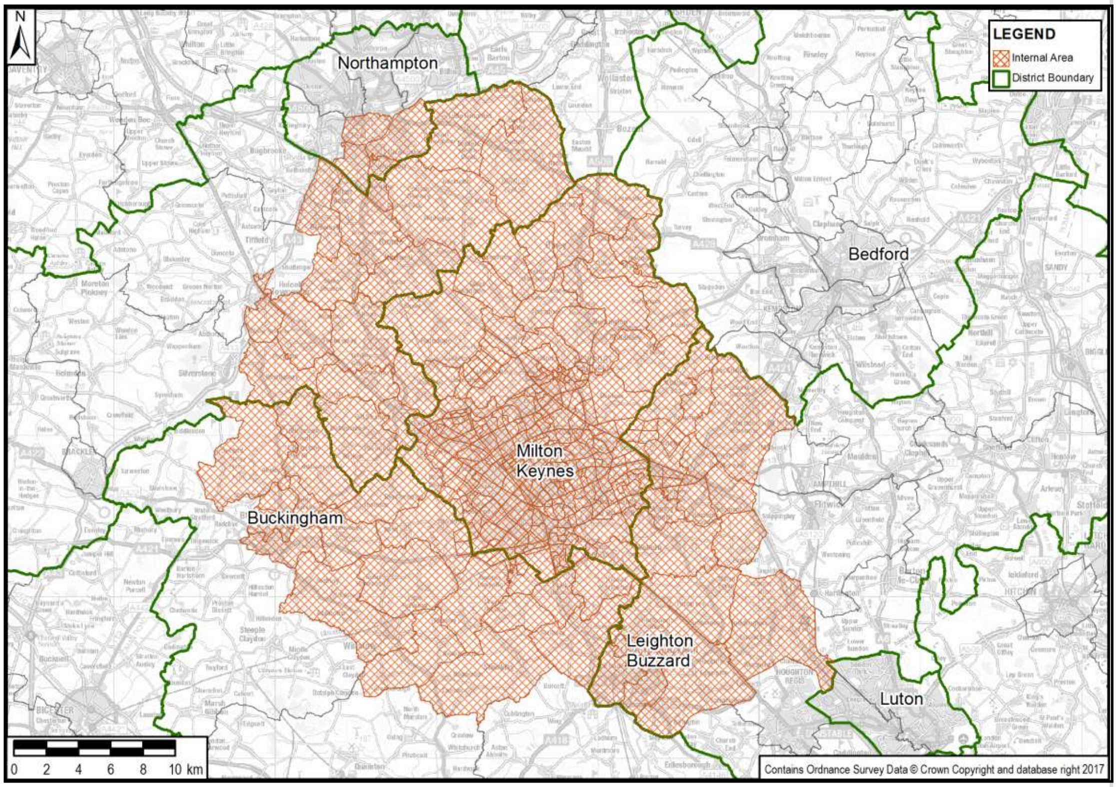

Figure 6. MKMMM 'Internal' Model Area

2031 Growth

3.1.7 The 2031 Reference Case scenario includes the currently planned growth in Milton Keynes Borough up to 2031 which includes approximately 29,000 dwellings and 30,700 jobs with infrastructure that is expected to be in place by 2031, as derived from the 'Uncertainty Log', described below.

3.1.8 The 2031 Reference Case scenario also includes some specified growth in the external area; specifically, in Central Bedfordshire including approximately 3,100 dwellings and 4,600 jobs.

3.1.9 Outside the Milton Keynes Borough TEMPRO growth has been applied, including Central Bedfordshire where TEMPRO growth has not been constrained to the National Trip End Model (NTEM) predictions. TEMPRO is DfT software that interrogates and computes information from their NTEM, projections in terms of demographic forecasts and trip end growth factors by traveller types. Its use to control overall forecasts ensures consistency across models nationally.

2048 Growth

3.1.10 It was agreed with MKC that 2048 TEMPRO growth would be applied (unconstrained) to both Milton Keynes Borough and outside of Milton Keynes Borough, excluding 5 developments in Central Bedfordshire where specific growth has been applied, including approximately 2,800 dwellings and 2,400 jobs.

3.2 Uncertainty Log

3.2.1 The purpose of the Uncertainty Log is to collate a list of future developments and scheme assumptions whilst applying a level of certainty as to how likely they are to be built. This is then used to inform the Reference Case scenario providing a more accurate local estimate of development growth than TEMPRO.

3.2.2 The Uncertainty Log created for this project was compiled following discussions with MKC. All the developments and schemes are categorised according to the likelihood of their construction using the four categories as outlined in TAG unit M4 Table A2. TAG refers to a ‘Core Scenario’ in the context of a major infrastructure scheme or package rather than Reference Case, in essence they are the same, in providing a forecast baseline or yardstick scenario from which to measure impacts of an alternative ‘Do-Something’ scenario intervention, which in this case is MKE.

Source: TAG unit M4 Table A2. November 2014

Probability of Input	Status Definition	Core Scenario Assumption
Near certain (NC): The outcome will happen or there is a high probability that it will happen.	Intent announced by the proponent to regulatory agencies. Approved development proposals. Projects under construction.	This should form part of the Core Scenario.
More than likely (MTL): The outcome is likely to happen but there is some uncertainty.	Submission of planning or consent application imminent. Development application within the consent process.	This could form part of the Core Scenario.
Reasonably foreseeable (RF): The outcome may happen, but there is significant uncertainty.	Identified within a development plan. Not directly associated with the transport strategy/ scheme, but may occur if the strategy/ scheme is implemented. Development conditional upon the transport strategy/ scheme proceeding. Or, a committed policy goal, subject to tests (e.g. of deliverability) whose outcomes are subject to significant uncertainty.	These should be excluded from the Core Scenario but may form part of the alternative scenarios.
Hypothetical (H): There is considerable uncertainty whether the outcome will ever happen.	Conjecture based upon currently available information. Discussed on a conceptual basis. One of a number of possible inputs to an initial consultation process. Or, a policy aspiration.	These should be excluded from the Core Scenario but may form part of the alternative scenarios.

Table 14. Uncertainty Log Probability Classifications from TAG

3.3 Reference Case Growth

3.3.1 Planning data was provided by MKC for Milton Keynes Borough by model zone. In some instances, there was a development that spanned multiple zones. In these cases, it was assumed an even split of jobs and or dwellings across each zone within the development. Similarly, if a development included multiple job categories, an even split was assumed. The dwellings growth is plotted by zone in Figure 7 and jobs growth by zone in Figure 8.

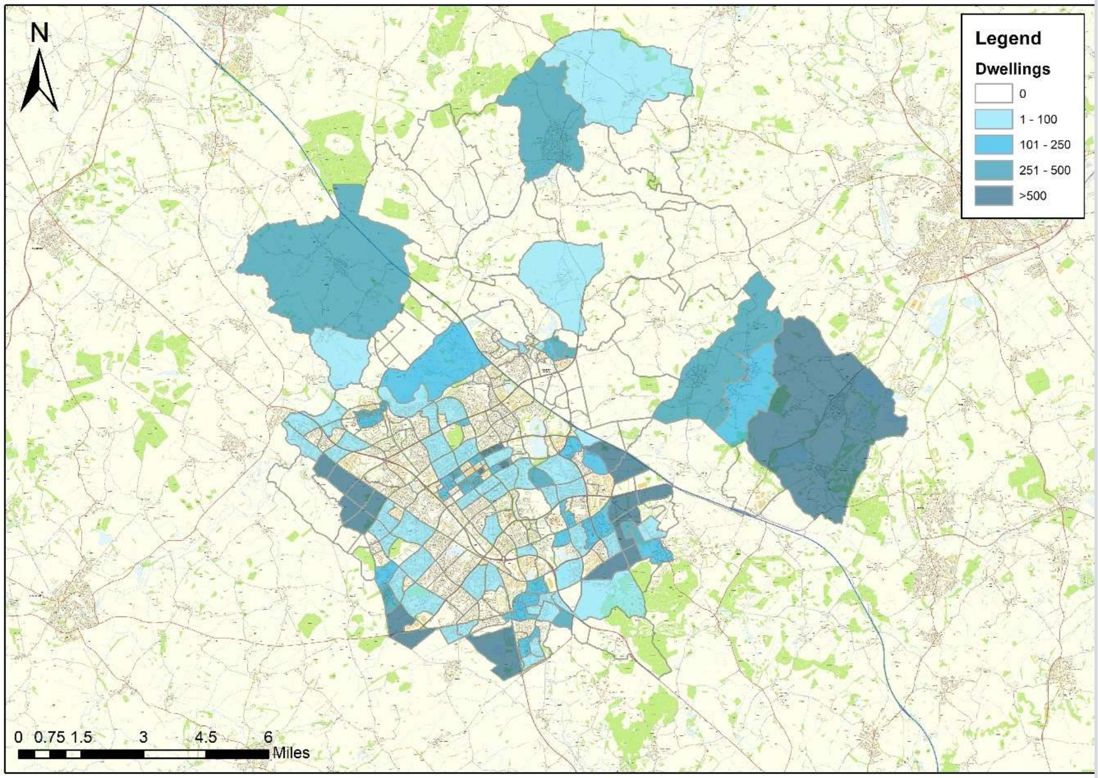

Figure 7. Dwellings Growth to 2031

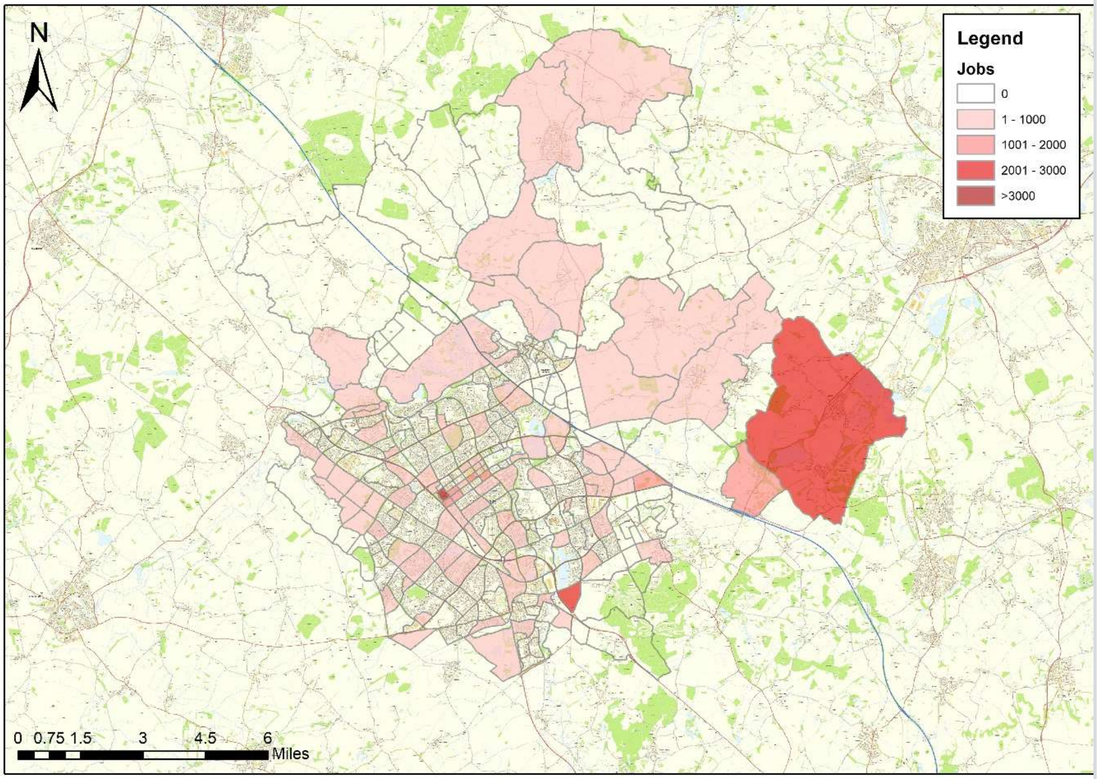

Figure 8. Jobs Growth to 2031

3.4 TEMPRO (NTEM) Adjustments for General Growth

3.4.1 Forecast growth provided by MKC has been used as given and has not been constrained to NTEM within Milton Keynes Borough and external to Milton Keynes Borough, i.e. Buckinghamshire and Central Bedfordshire.

3.4.2 The 2031 forecast growth includes housing and employment within Milton Keynes Borough, Buckinghamshire and Bedfordshire. The 2048 forecast growth provided includes only developments within Central Bedfordshire, where it was otherwise likely that NTEM would underestimate growth.

3.4.3 For 2048 it was agreed with MKC that 2031 to 2048 NTEM growth would be applied (unconstrained) to all zones within the Milton Keynes Borough, on top of the 2016 to 2031 growth. Outside of Milton Keynes Borough, 2016 to 2048 growth would be applied, excluding four zones in Central Bedfordshire where forecast growth has been provided by MKC and has been used as given.

3.4.4 NTEM growth was not constrained over the study areas as this is only critical where economic analyses are needed, whereas this is for a Transport Assessment where it is more important not to underestimate potential traffic through constraining.

3.5 Modelled Schemes

3.5.1 The schemes listed in Table 15 are those included in the highway model. East-West rail was the only scheme added to the Public Transport Model. Apart from East-West Rail, no information was available on any proposed amendments to bus and rail services, so PT routes and frequencies were assumed to remain the same as in 2016.

3.5.2 East-West rail was represented in the public transport model with the addition of hourly services in each direction between Oxford and Bedford, Oxford and Milton Keynes and between Aylesbury and Milton Keynes, all of which route via a new station added to the model at Winslow.

3.5.3 East-West rail is expected to increase the train frequency across the level crossings from one per hour in each direction to two per hour. This change was applied to the highway model by halving the cycle time, from 30 minutes to 15 minutes, at the signal nodes representing the level crossings. The inter-green time (representing the barrier down time) was kept the same, but the total green time was reduced accordingly.

Scheme	Delivered by
A421 Dualling	By 2031
Monkston & Brinklow Junctions	2019
Crownhill & Loughton Junctions	2019
A5 Improvements	By 2031
Bletchley Station Highway Improvements	2017
Brooklands City Street Phase 2	2017
Nova City Street	2018
Calverton Lane/Fairways	2021
Kiln Farm Junction	2016
Bridge over Broughton Brook	2018
H10 Extension	2018
V2/H4 Extension	2021
East-West Rail	2024
M1 J13-J16 SMP	By 2031
M1 J16-J19 SMP	2021
M1 J11a / Dunstable Northern Bypass	2017
Kelly’s Kitchen Junction Improvements (Hamburger junction)	By 2031
M1 J14 SMP improvements	By 2031

Table 15. Forecast Year Transport Schemes included in Reference Case

3.6 Trip End Model Outputs

3.6.1 The trip end model produces 24-hour trip ends by mode:

- Car,
- PT and
- Active Mode (Walking/Cycling),

3.6.2 and by purpose:

- Home based employers business (HBEB)
- Home based other (HBO)
- Home based work (HBW)
- Non-home based employers business (NHBEB)
- Non-home based Other (NHBO)

3.6.3 As shown in Table 16, within the Milton Keynes Urban Area, Car attraction trip ends increase the most, with growth in attractions comparable across each car purpose and higher than growth in productions. The large employment growth has resulted in this large increase in attractions.

Mode	Purpose	Total Daily Productions				Total Daily Attractions			
		2031 Ref Case	2048 Ref Case	2031 - 2048	% Diff	2031 Ref Case	2048 Ref Case	2031 - 2048	% Diff
Car	**TOTAL**	**563,057**	**1,107,016**	**543,959**	**97%**	**835,268**	**1,626,446**	**791,178**	**95%**
	HBEB	16,721	32,298	15,577	93%	26,969	52,690	25,722	95%
	HBO	315,085	632,962	317,877	101%	517,257	1,014,914	497,657	96%
	HBW	131,238	246,750	115,512	88%	180,107	344,508	164,401	91%
	NHBEB	17,700	34,453	16,754	95%	16,054	30,924	14,871	93%
	NHBO	82,314	160,553	78,239	95%	94,882	183,409	88,527	93%
PT	**TOTAL**	**49,220**	**86,499**	**37,280**	**76%**	**96,836**	**173,572**	**76,736**	**79%**
	HBEB	1,470	2,594	1,124	76%	960	1,678	718	75%
	HBO	26,791	47,791	21,000	78%	76,100	137,032	60,933	80%
	HBW	13,302	21,977	8,674	65%	13,099	22,945	9,846	75%
	NHBEB	699	1295.197	596	85%	647.6385	1145.76	498	77%
	NHBO	6,958	12,843	5,885	85%	6,030	10,771	4,741	79%
Active Mode	**TOTAL**	**172,935**	**317,474**	**144,539**	**84%**	**231,570**	**434,370**	**202,800**	**88%**
	HBEB	1,192	2,063	872	73%	1,096	1,971	876	80%
	HBO	118,841	220,341	101,500	85%	195,622	367,988	172,366	88%
	HBW	21,568	35,577	14,008	65%	15,833	28,631	12,798	81%
	NHBEB	1,737	3,288	1,551	89%	2,297	4,269	1,972	86%
	NHBO	29,597	56,205	26,608	90%	16,723	31,511	14,788	88%

Table 16. Comparison of 2031 and 2048 trip ends for zones within the MK Urban Area

3.7 Convergence Summary

3.7.1 The parameter %Flow was used to assess the convergence within the SATURN assignment model. This measures the percentage of links on which flows vary by more than a pre-defined percentage between consecutive assignment iterations.

Source: TAG Unit M3.1

Measure of Convergence	Base Model Acceptable Values
Delta and %GAP	Less than 0.1% or at least stable with convergence fully documented and all other criteria met
Percentage of links with flow change (P)<1%	Four consecutive iterations greater than 98%
Percentage of links with cost change (P2)<1%	Four consecutive iterations greater than 98%
Percentage change in total user costs (V)	Four consecutive iterations less than 0.1% (SUE only)

Table 17. TAG Convergence Criteria

3.7.2 TAG provides further guidance on model stability in Appendix C of TAG unit M3.1. This recommends that the Average Absolute Difference (AAD) between consecutive iterations and also the Relative Average Absolute Difference (RAAD) in link flows between iterations. It is this which is the preferred measure with a target value of 0.1%.

3.7.3 Table 18 shows a summary of convergence results for the 2031 and 2048 Reference Case model runs. The %Gap figures are all well below 0.1. All highways runs converged within 81 loops with %Flows above 99. It is considered that the highways model is well converged.

	%GAP		Loops		%Flows	
	2031	2048	2031	2048	2031	2048
AM	0.00076	0.00081	53	81	99.66	99.46
IP	0.00006	0.00033	27	47	99.51	99.23
PM	0.00093	0.0012	50	66	99.44	99.50

Table 18: Summary of Reference Case VDM Convergence Results

3.8 Volume over Capacity

3.8.1 It is generally considered that a V/C of 85% indicates the practical capacity of a junction. Figure 9 to Figure 16 show the average junction V/C ratio of 85% and over, and approach link V/C of 85% and over in 2031 and 2048.

3.8.2 The link and junction data have been displayed separately on the plots to give a clearer indication of where junctions and links are approaching or at capacity. Link delays are shown as line bandwidths and junctions delays are shown as circular ‘hotspots’.

3.8.3 In the Milton Keynes Urban Area in the inter-peak period, junction and link V/C is much lower when compared to both the AM and PM peak periods, which have the highest amount of junctions and links with V/C greater than 85%.

3.8.4 This section therefore concentrates on the V/C values identified for:

- 2031 Reference Case – AM Peak
- 2031 Reference Case – PM Peak
- 2048 Reference Case – AM Peak
- 2048 Reference Case – PM Peak

3.8.5 In the 2031 AM peak period the Tickford Roundabout including the northbound and southbound approaches and Willen Road (southbound) is approximately 85% to 114% V/C. In the PM peak period Tickford Roundabout including the northbound and southbound approaches are approximately 85% to 99% V/C and the eastbound approach is above 115% V/C.

3.8.6 The M1 junction 14 southbound off-slip is approximately 85% to 99% V/C and the northbound off-slip is at approximately 100 to 114% capacity in the 2031 AM peak period. In the PM peak period, the southbound off-slip is between 85% to 99% V/C.

3.8.7 In 2048 the V/C at Tickford Roundabout increases above 100% in the AM peak period and 115% in the PM peak period. In the AM peak period both the northbound and southbound approaches are above 115% V/C and the eastbound approach is 85% to 99% V/C.

3.8.8 In the PM peak period Tickford Roundabout is above 115% V/C with all four approaches above 100% V/C.

3.8.9 The M1 junction 14 off-slips for northbound and southbound traffic are 85% to 99% V/C in the AM peak period. In the PM peak period, the off-slips for both northbound and southbound traffic are at 85% to 99% V/C.

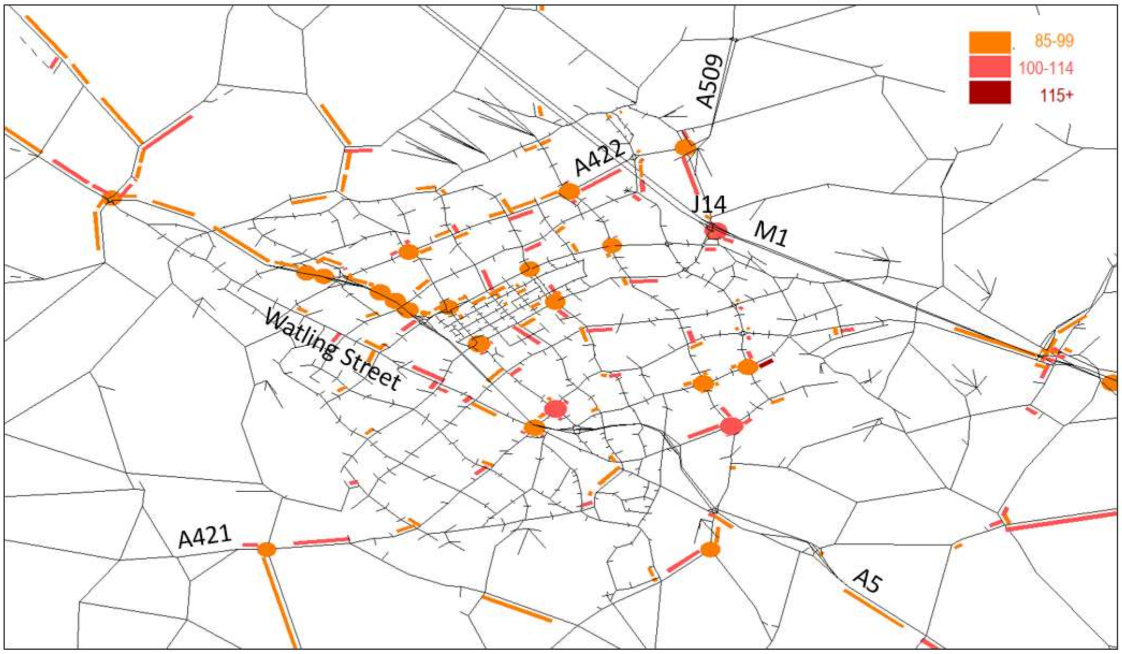

Figure 9. Reference Case, link and junction V/C over 85%, 2031 AM Peak

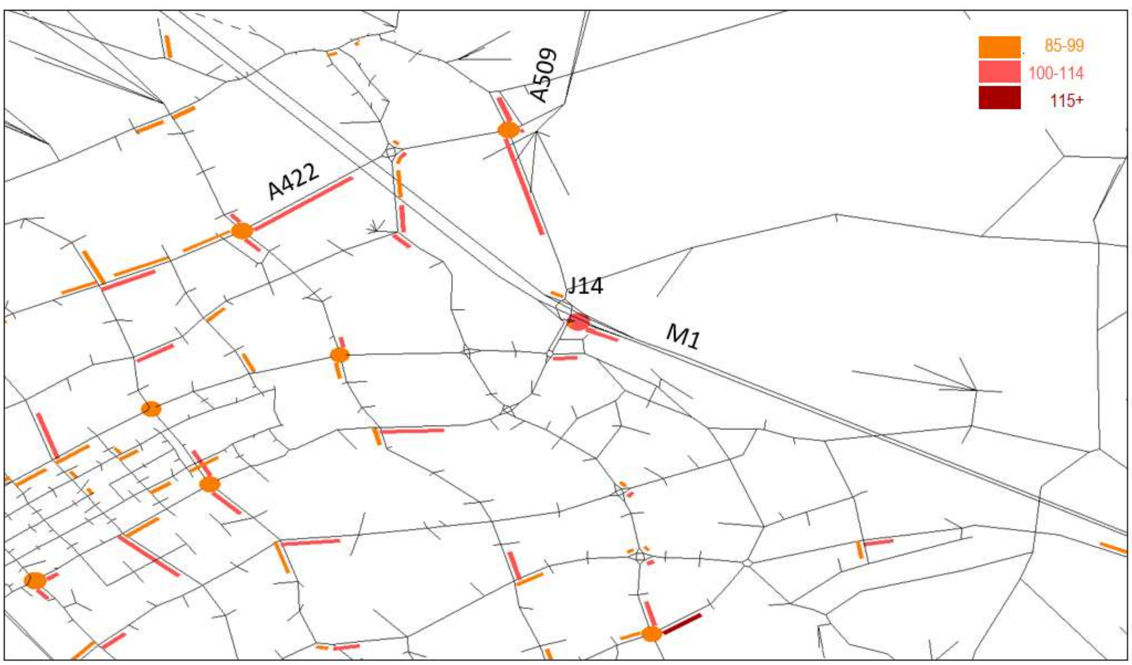

Figure 10. Reference Case – MK East, link and junction V/C over 85%, 2031 AM Peak

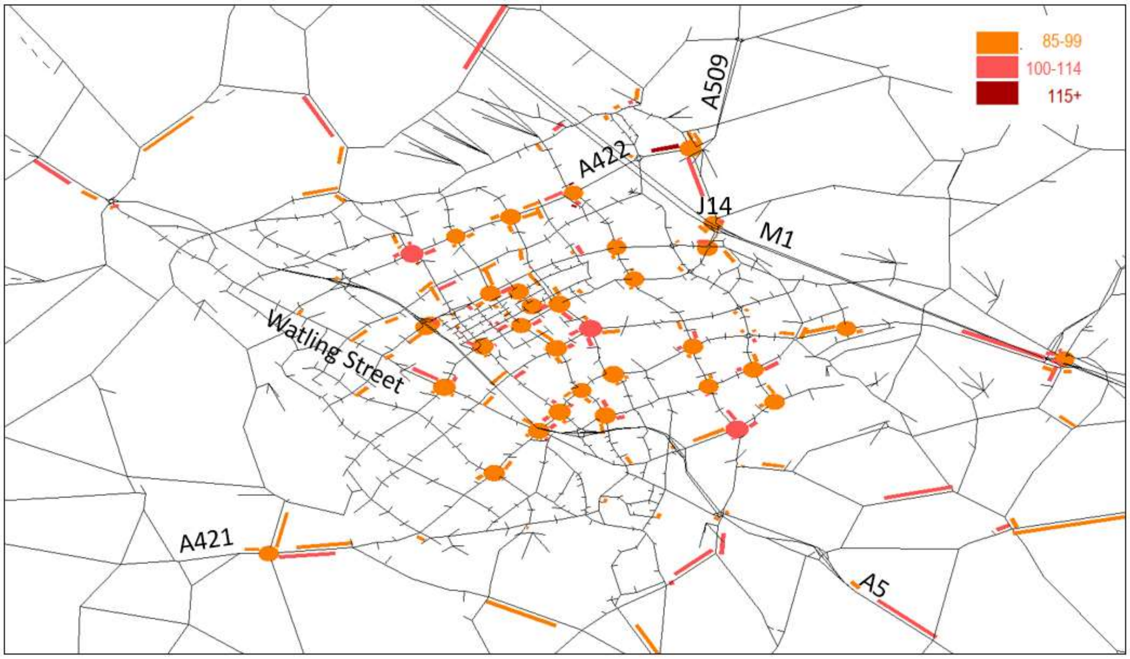

Figure 11. Reference Case, link and junction V/C over 85%, 2031 PM Peak

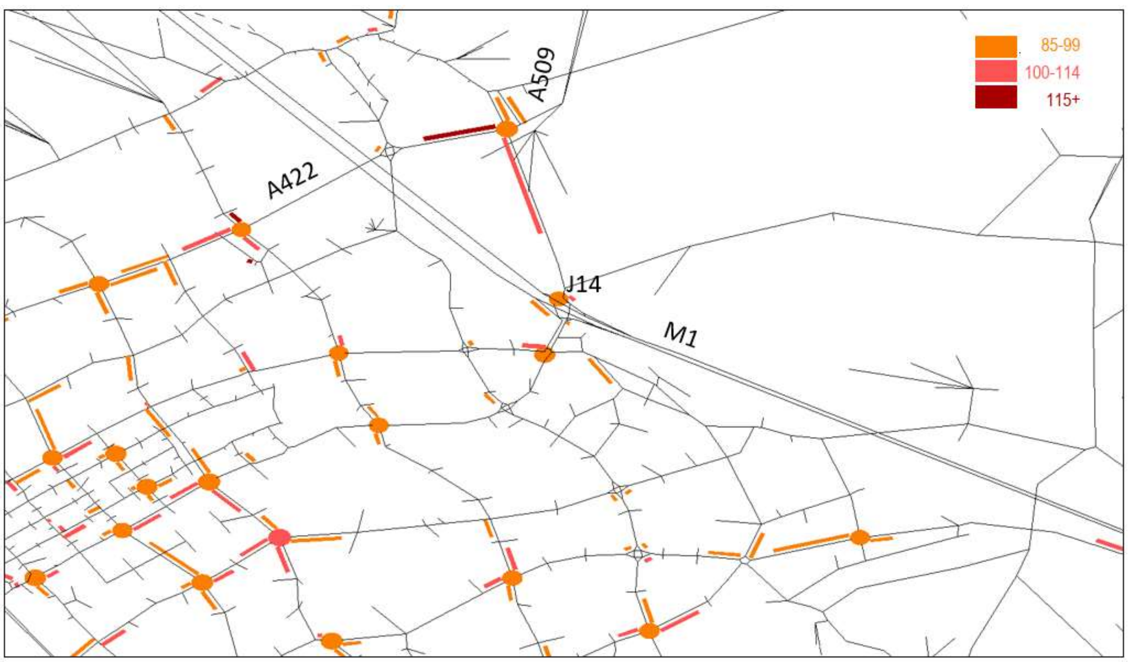

Figure 12. Reference Case – MK East, link and junction V/C over 85%, 2031 PM Peak

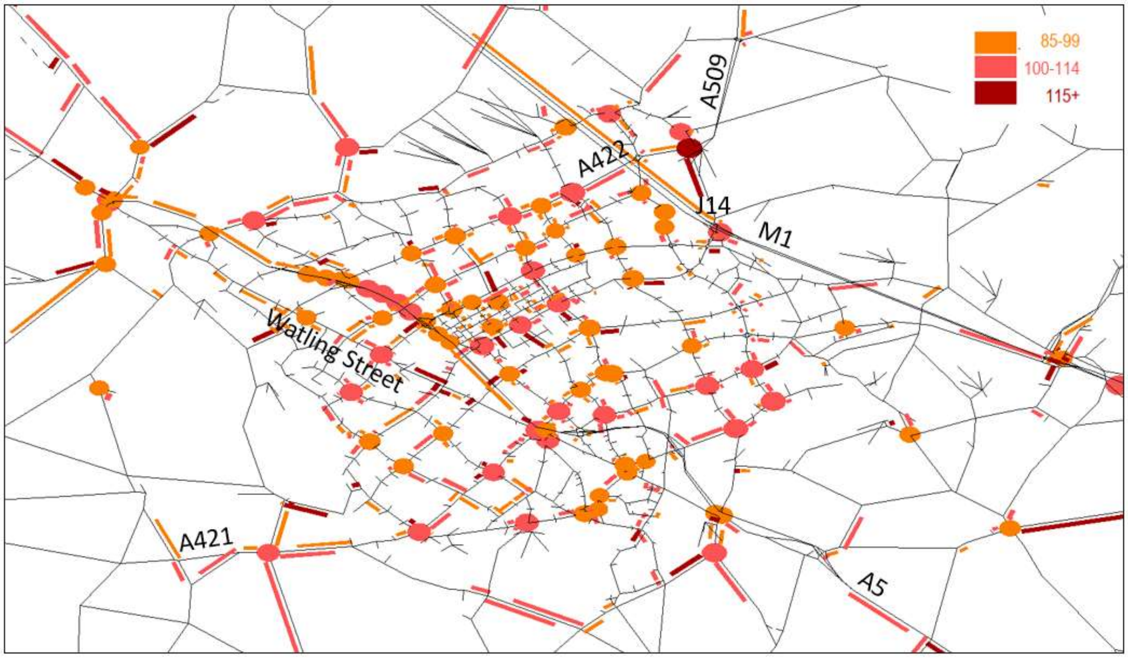

Figure 13. Reference Case, link and junction V/C over 85%, 2048 AM Peak

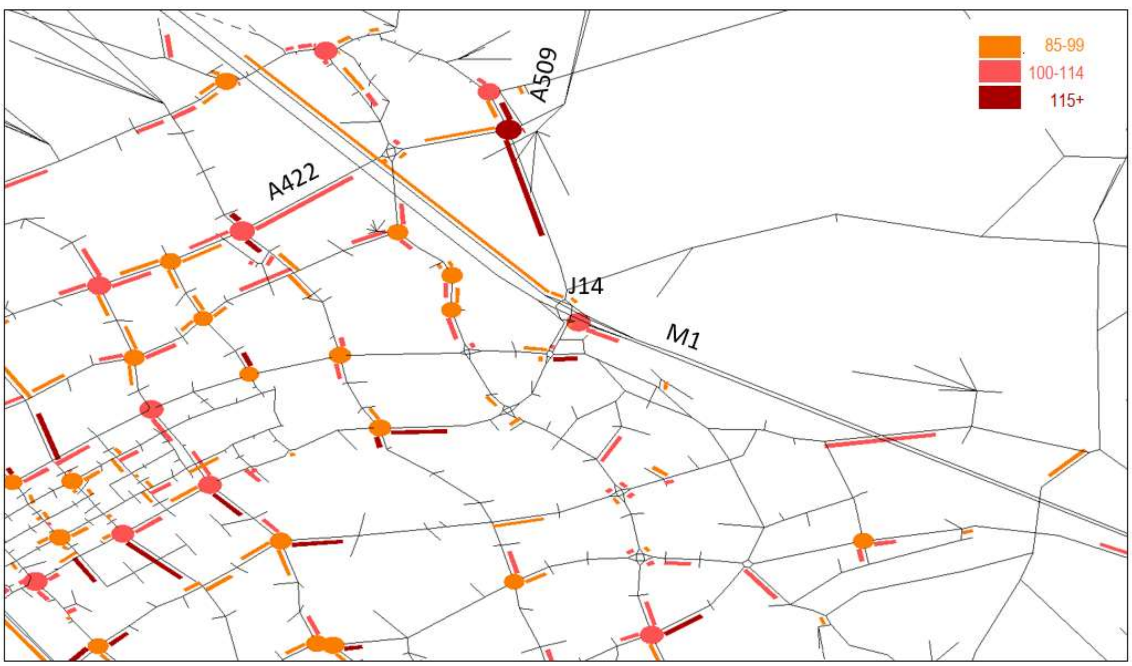

Figure 14. Reference Case – MK East, link and junction V/C over 85%, 2048 AM Peak

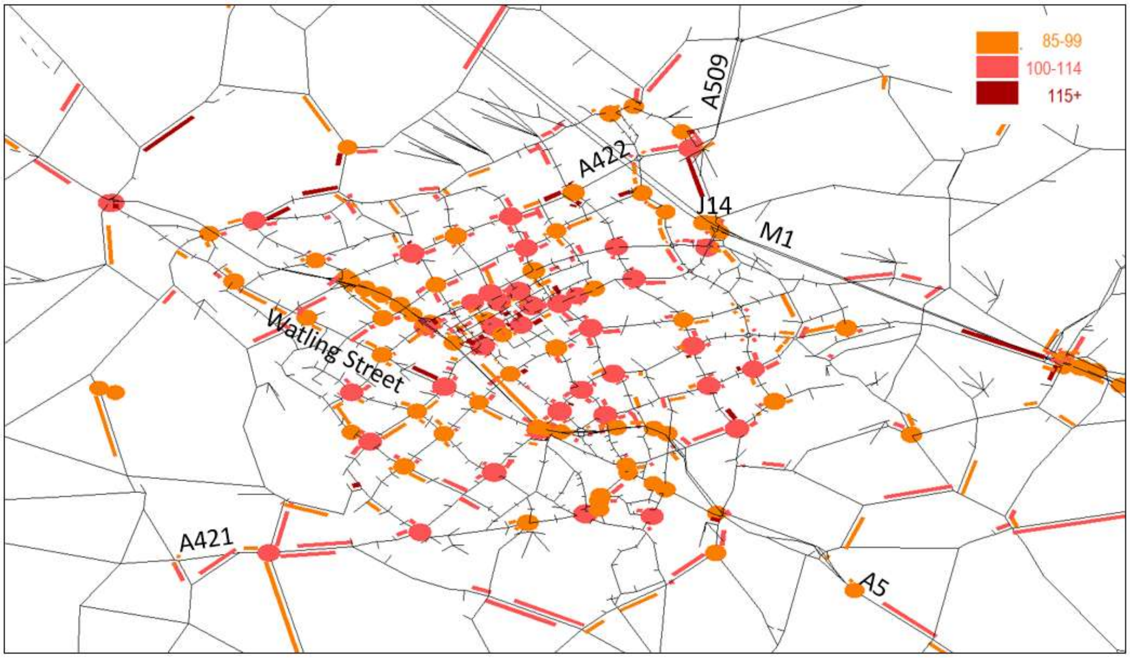

Figure 15. Reference Case, link and junction V/C over 85%, 2048 PM Peak

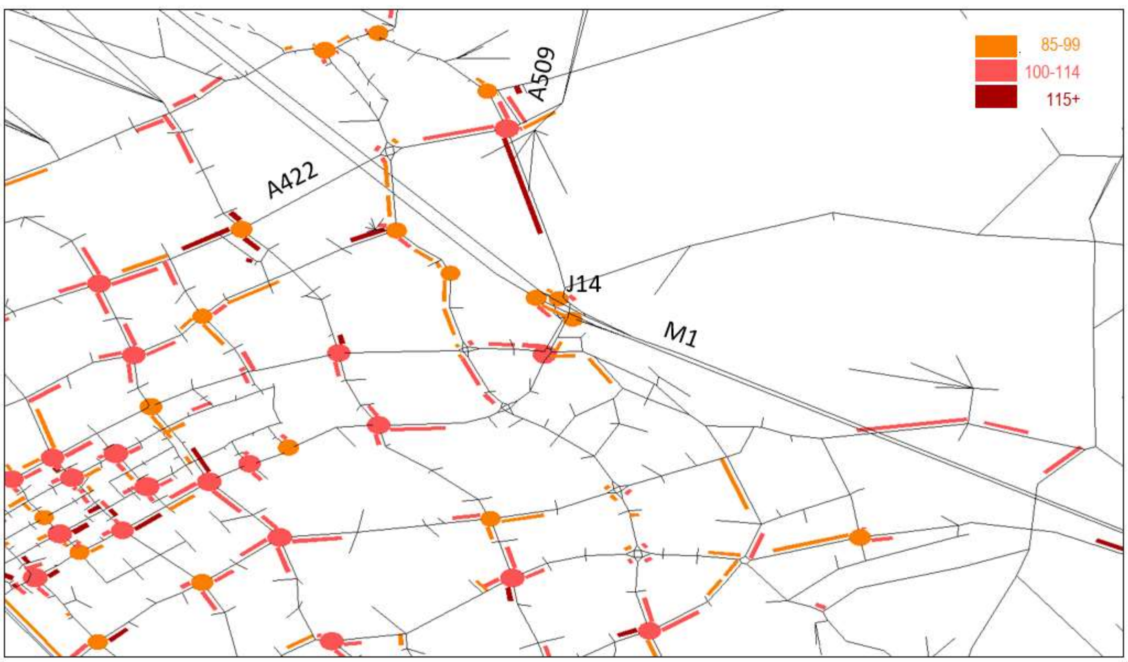

Figure 16. Reference Case – MK East, link and junction V/C over 85%, 2048 PM Peak

3.9 Junction Delays

3.9.1 The observations made from the V/C analysis are reflected in Figure 17 to Figure 24 which show the extent of delays in the Reference Case. The plots display the average delay (in seconds) per vehicle for junctions across the MK Urban area as well as the MKE development area in the AM and PM peak periods in 2031 and 2048.

3.9.2 The absolute average junction delay is represented by the diameter of the circle and a colour coding system to represent a range of delays is shown in a key in each figure.

3.9.3 In the 2031 AM and PM peak period at Tickford Roundabout the average delay time (per vehicle) is greater than 90 seconds.

3.9.4 In the AM peak period the delay at the southbound and northbound off-slip at junction 14 of the M1 exceeds 90 seconds per vehicle. In the PM peak period delay at the southbound M1 junction 14 off-slip is approximately 60 to 89 seconds per vehicle.

3.9.5 In the 2048 AM peak period the average delay times at the Marsh End Roundabout, Tickford Roundabout and Tongwell Roundabout are all above 90 seconds per vehicle. The northbound and southbound off-slips at junction 14 on the M1 also increase to above 90 seconds per vehicle.

3.9.6 In the PM peak period, the average delay times are broadly consistent with the AM in the MKE development area.

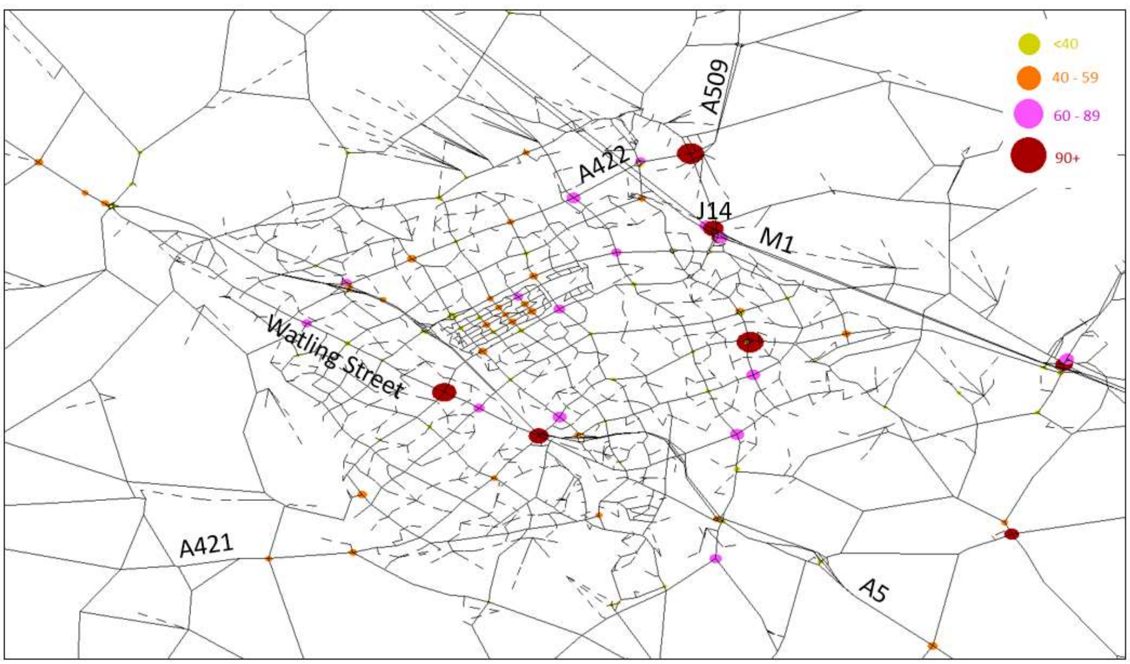

Figure 17. Reference Case, Average Junction Delay (Seconds), 2031 AM Peak

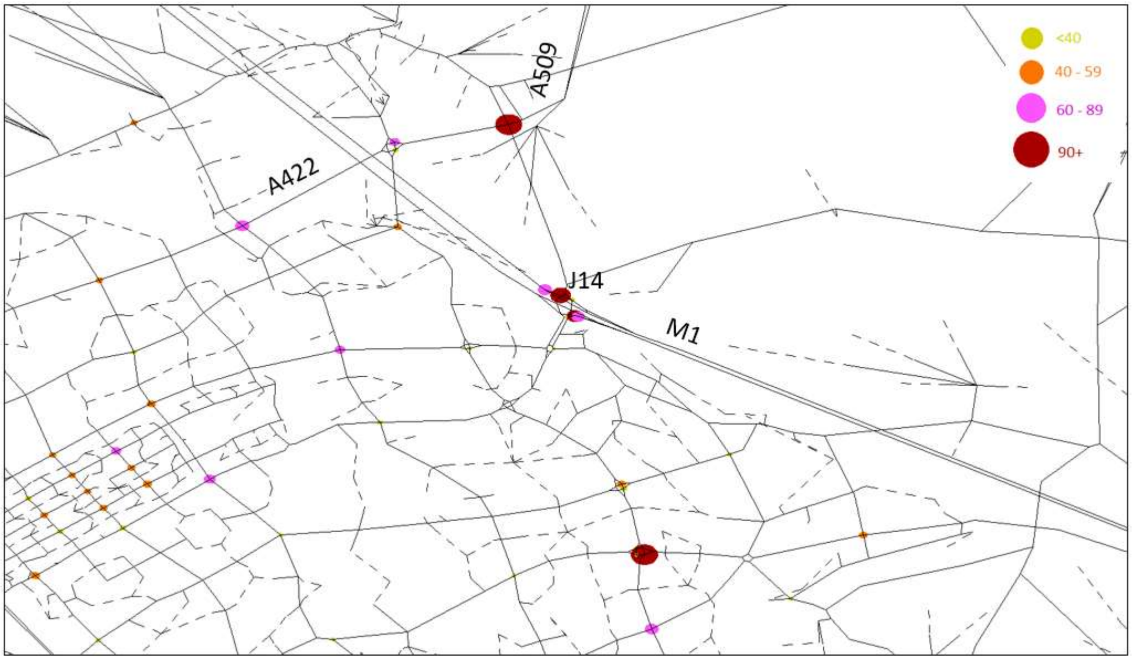

Figure 18. Reference Case – MK East, Average Junction Delay (Seconds), 2031 AM Peak

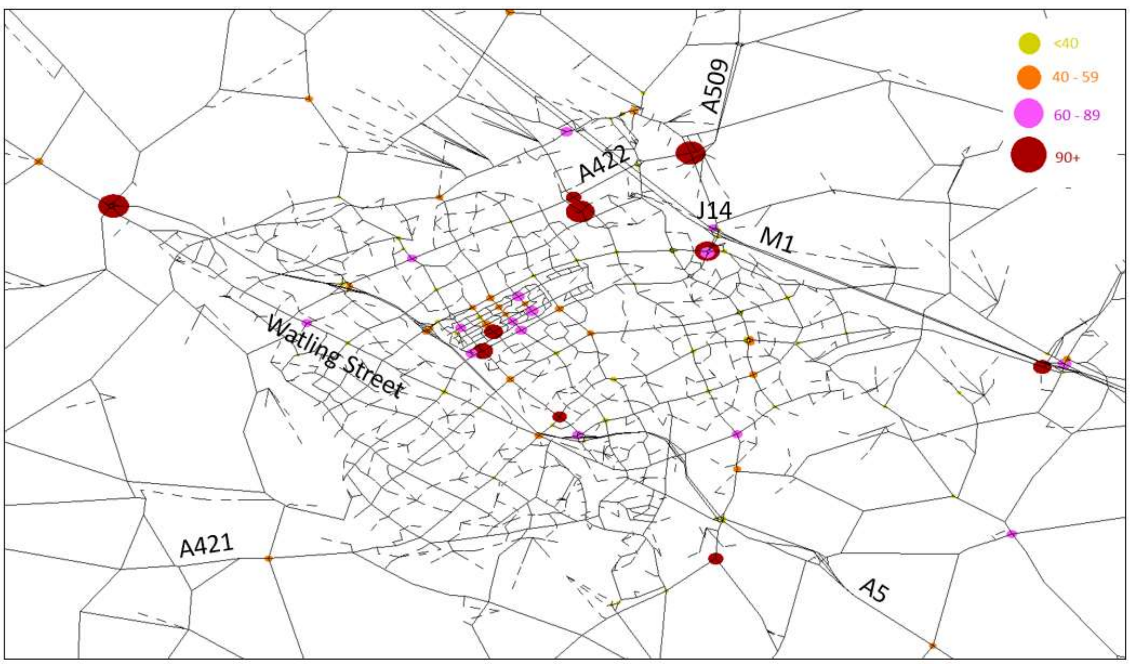

Figure 19. Reference Case, Average Junction Delay (Seconds), 2031 PM Peak

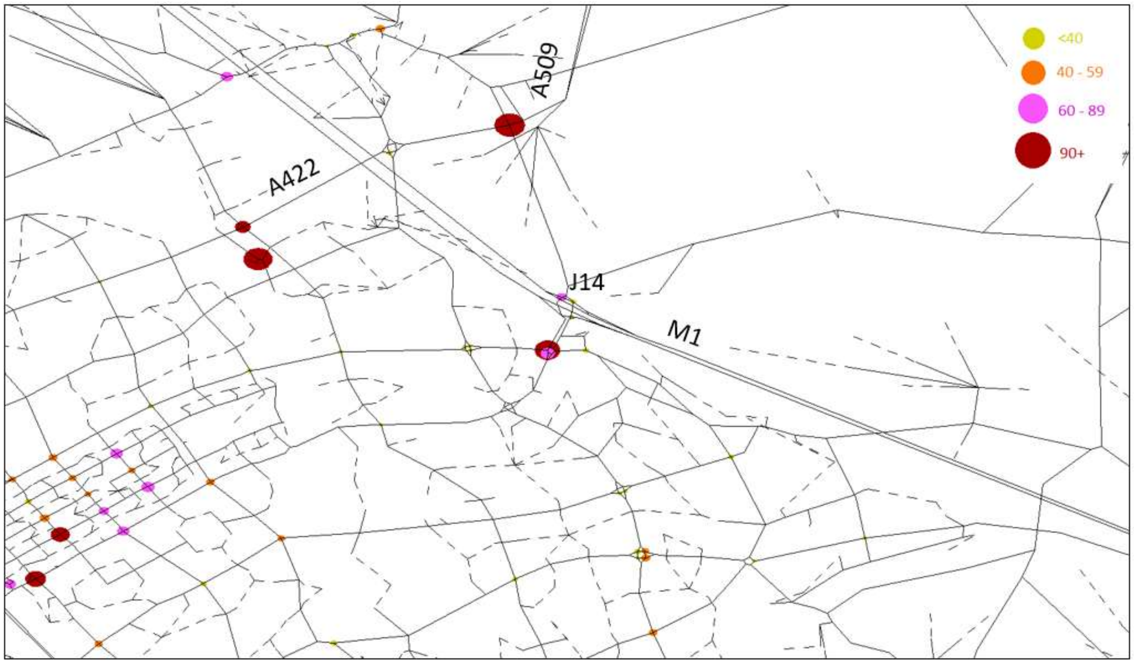

Figure 20. Reference Case – MK East, Average Junction Delay (Seconds), 2031 PM Peak

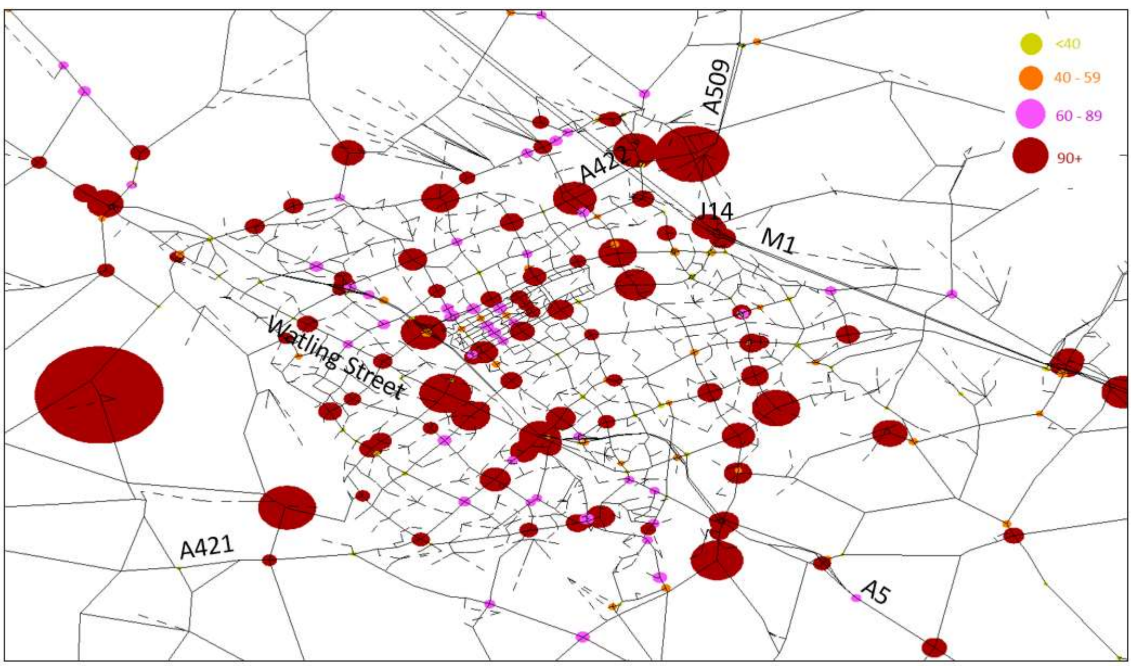

Figure 21. Reference Case, Average Junction Delay (Seconds), 2048 AM Peak

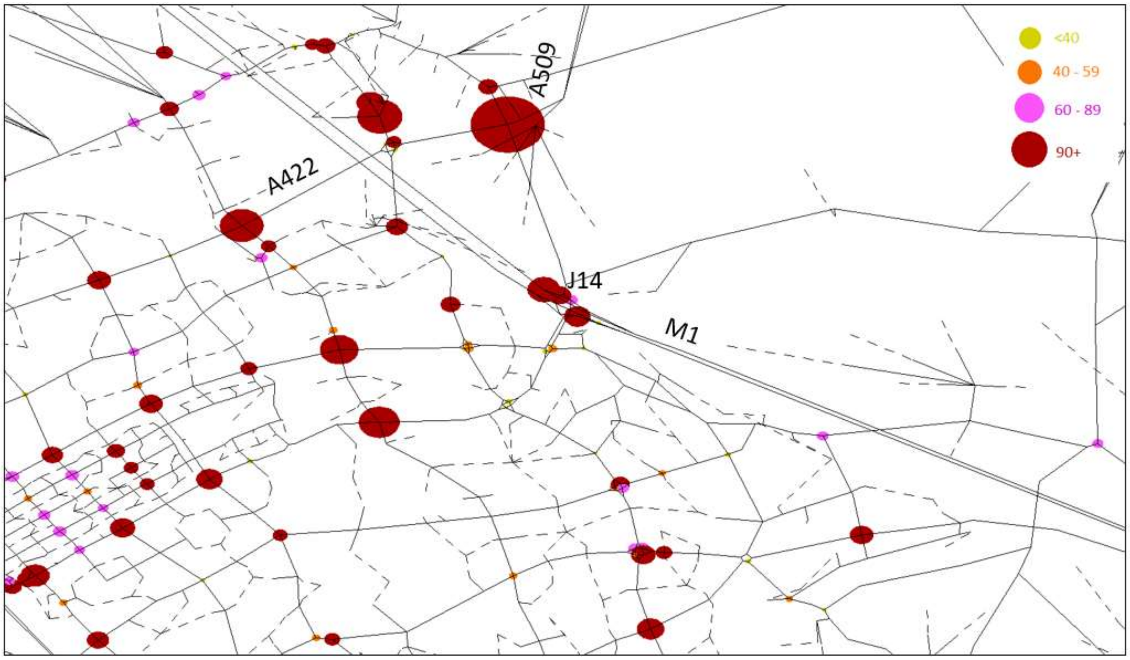

Figure 22. Reference Case – MK East, Average Junction Delay (Seconds), 2048 AM Peak

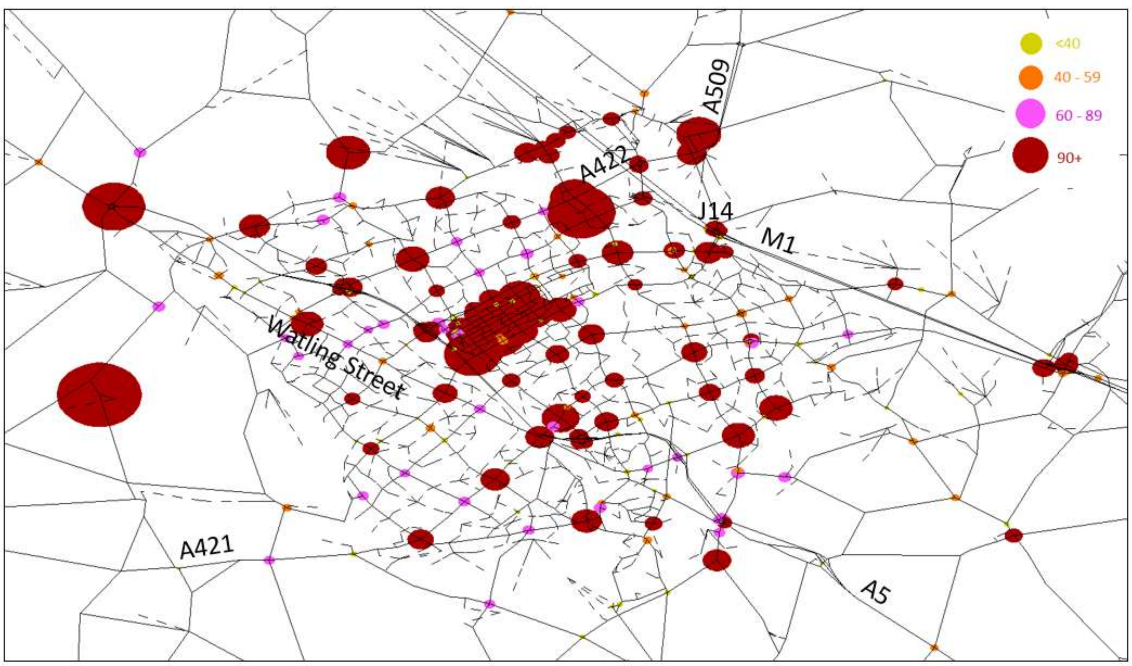

Figure 23. Reference Case, Average Junction Delay (Seconds), 2048 PM Peak

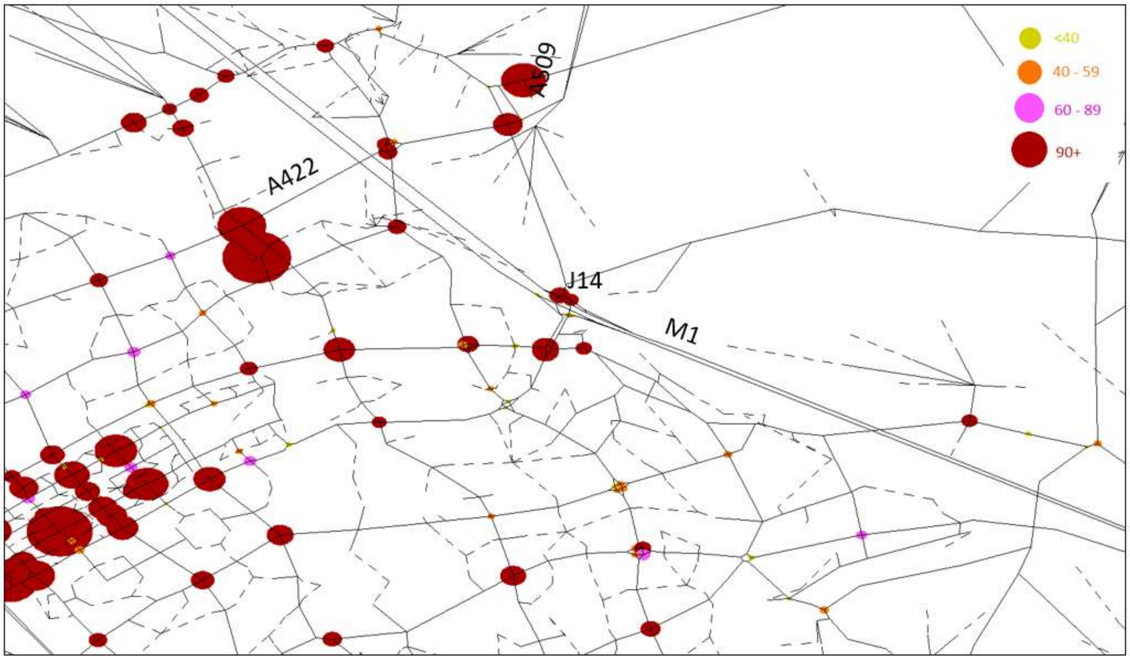

Figure 24. Reference Case – MK East, Average Junction Delay (Seconds), 2048 PM Peak

4. Milton Keynes East (MKE)

4.1 MKE Growth and Infrastructure

4.1.1 The planned location of the Milton Keynes East development lies to the south-east of Newport Pagnell and directly east of the M1. The MKE area covers an area of approximately 461 hectares on the eastern edge of Milton Keynes.

4.1.2 MKE includes the same growth as the Reference Case plus an additional 5,419 jobs and 1,450 additional dwellings by 2031 and an additional 10,637 jobs and 5,750 dwellings by 2048. This is slightly greater than the agreed development framework in order to reflect the uncertainty around different landholder developments.

4.1.3 The scenario also includes additional infrastructure which supports the above developments. Further information regarding this can be found in Section 4.5.

4.1.4 Figure 25 to Figure 28 show the dwellings and jobs growth associated with the MKE development labelled by zone.

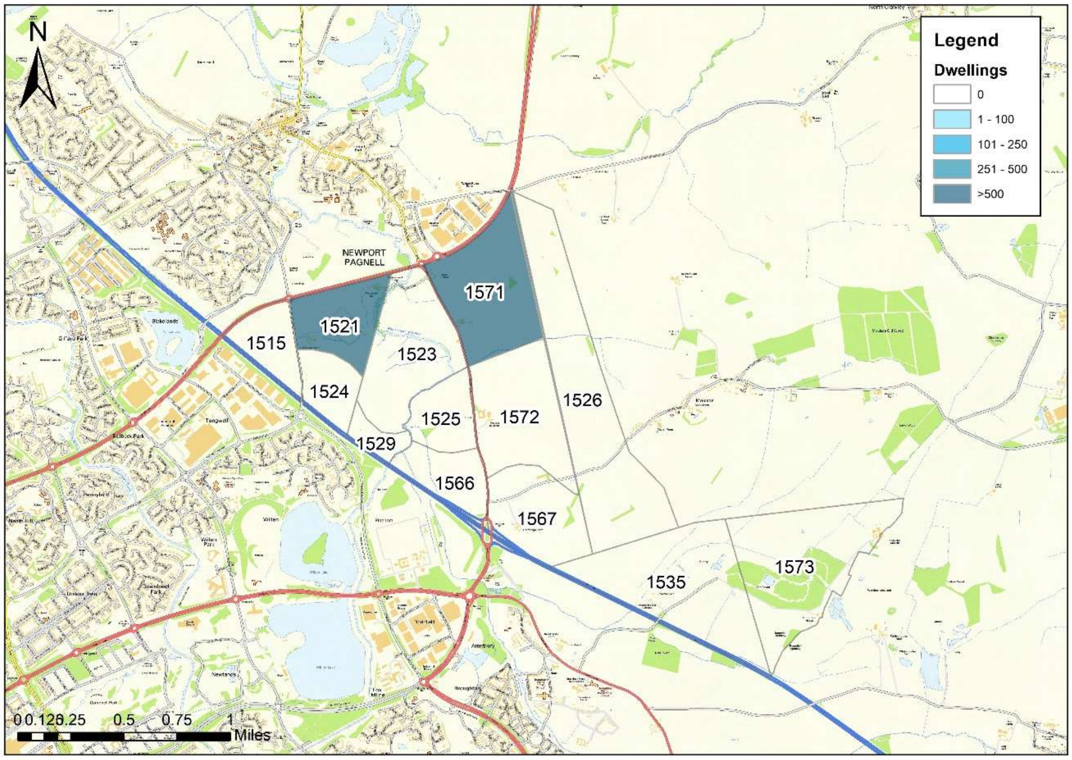

Figure 25. MKE Development Zones - Additional Dwellings Growth to 2031

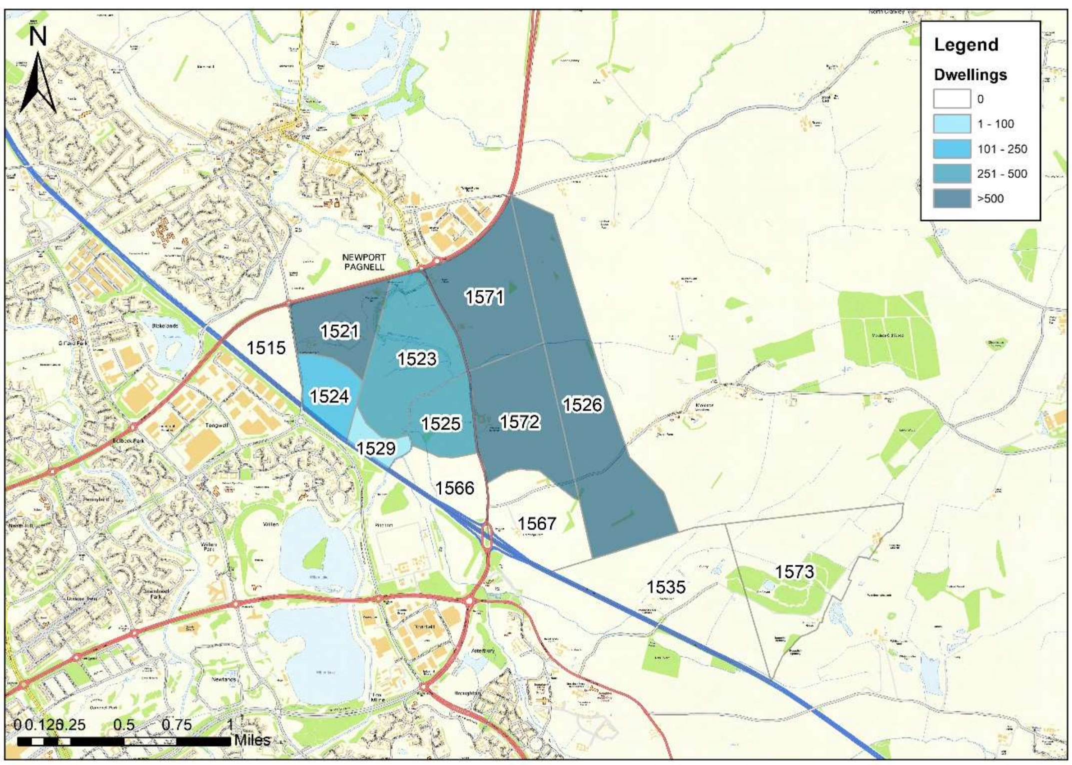

Figure 26. MKE Development Zones - Additional Dwellings Growth to 2048

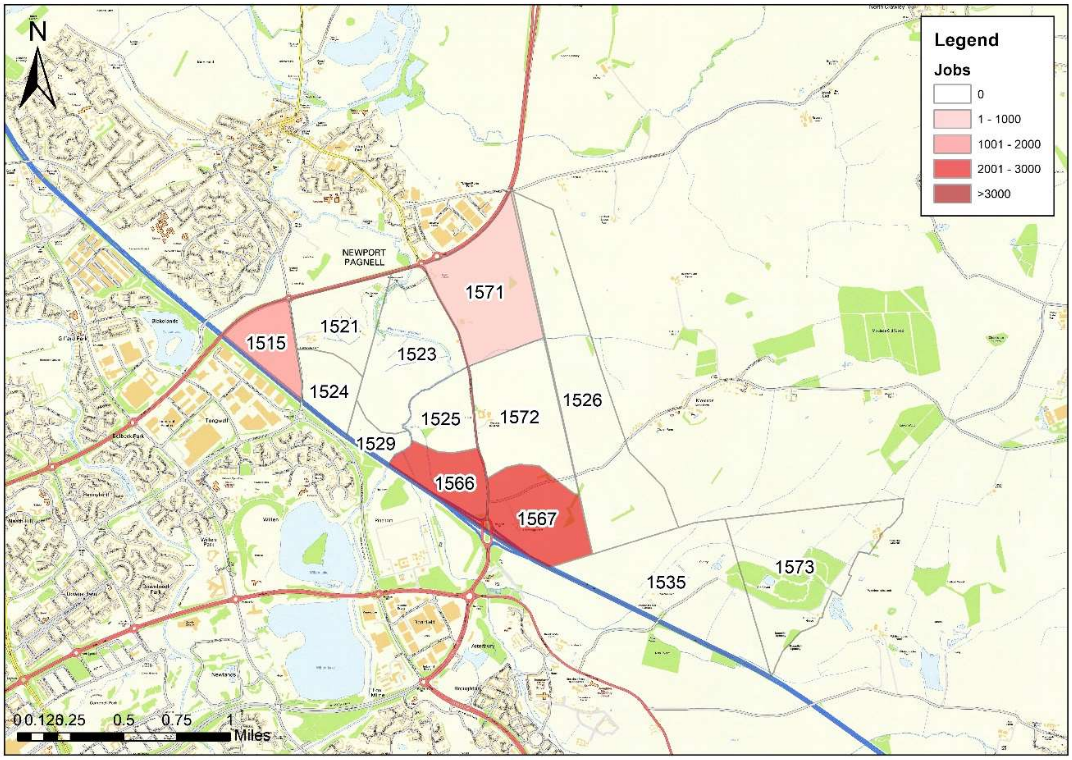

Figure 27. MKE Development Zones - Additional Jobs Growth to 2031

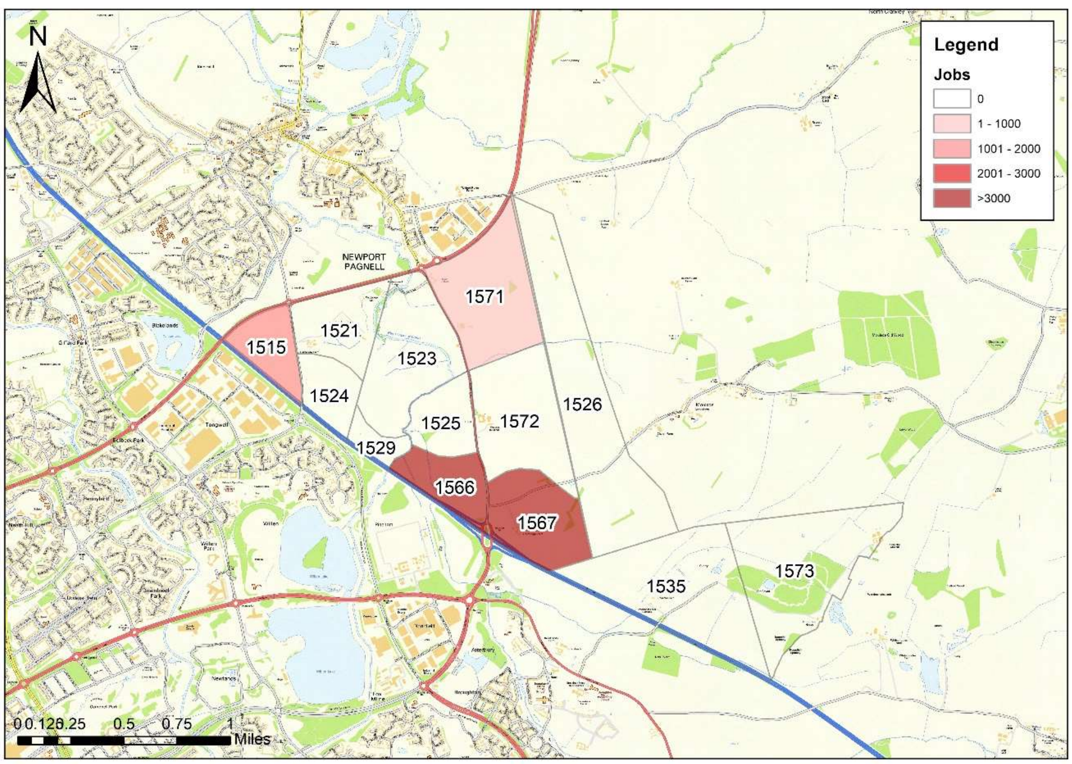

Figure 28. MKE Development Zones - Additional Jobs Growth to 2048

4.2 Zone Adjustments

4.2.1 In 2048, 1,500 dwellings were allocated to zone 1531 which lies immediately to the east of zones 1571, 1572 and 1567. Zone 1531 currently contains the small village of Moulsoe which is on the border of Buckinghamshire and Bedfordshire. Local traffic travelling from/to Moulsoe would either travel via Newport Road to the west or Cranfield Road to the east.

4.2.2 It was therefore decided to move zone 1526, an existing and empty development zone, to the east of the MKE expansion area, reducing the size of zone 1531 in the Do-Something. Zone 1526 can then contain the proposed dwellings and would allow more flexibility in model loading points.

4.3 Trip End Adjustments

4.3.1 WSP have provided AECOM with a set of target Origin and Destination trip-ends for each development zone within MKE, which they believe better reflects the likely travel patterns that will be generated by the development and provide a higher-level accuracy than the model average rates. These can be found in Appendix A. In addition, WSP have also provided a set of intra-development zone matrices (Residential trips made up of Car and LGV only); essentially a set of mini matrices specifying Origin and Destination totals for movements between development zones. These can be found in Appendix A and further information can be found in the WSP technical note TTN3 – Trip Generation.

4.3.2 It must be noted that additional trips were added for the Community Centre and Secondary School to zone 1571 which has not be outlined in TTN3.

4.3.3 To meet the trip end targets the variable demand model was first run to produce a set of “post VDM” final matrices. These matrices were then furnessed using the trip ends provided as well as ensuring the intra-development zone matrices met the targets provided.

4.3.4 This was achieved by furnessing the post VDM matrices using the trip ends provided (less the total given for intra-development movements for each zone). Following the furnessing the intra-development trip totals were loaded back into the matrix to satisfy both trip end targets and intra-development zone OD targets.

4.3.5 Finally, a network assignment was run using this matrix.

4.3.6 It should be noted that before furnessing the HGV matrices (UC5), the UC5 distribution from the Tongwell trading estate (Zone 1087) was applied to development zones 1566, 1567 and 1571. This followed a review of the UC5 distribution in the Do-Something scenario, where it was determined that the existing employment type was not suitable for the planned development. It was also necessary to facilitate furnessing of the UC5 matrix.

4.4 Trip End Model Outputs

4.4.1 The trip end model produces 24 hour trip ends by mode:

- Car,
- Public transport and
- Active Mode,

4.4.2 and by purpose:

- Home based employers business (HBEB)
- Home based other (HBO)
- Home based work (HBW)
- Non-home based employers business (NHBEB)
- Non-home based Other (NHBO)

4.4.3 The Trip ends within the 'Urban' Area, as shown in Figure 1, for 2031 and 2048 are presented below in Table 19 and Table 20. Within the internal area in the Do-Something scenario, the growth in attractions is higher than productions, however UK wide the growth in productions is equal to the growth in attractions. The imbalance within the Urban Area suggests a greater number of trips are being produced from within the internal area in the Do-Something scenario. This can be expected as the housing growth is higher in both the 2031 and 2048 Do-Something scenarios when compared to employment growth in the Urban Area.

Mode	Purpose	Total Daily Productions				Total Daily Attractions			
		Ref Case 2031	DS 2031	DS less Ref Case	% Diff	Ref Case 2031	DS 2031	DS less Ref Case	% Diff
Car	**TOTAL**	**563,057**	**569,499**	**6,442**	**1.14%**	**835,268**	**840,164**	**4,896**	**0.59%**
	HBEB	16,721	16,929	208	1.24%	26,969	27,572	603	2.24%
	HBO	315,085	319,075	3,990	1.27%	517,257	520,818	3,561	0.69%
	HBW	131,238	132,791	1,553	1.18%	180,107	180,175	68	0.04%
	NHBEB	17,700	17,875	175	0.99%	16,054	16,331	277	1.73%
	NHBO	82,314	82,829	515	0.63%	94,882	95,268	386	0.41%
PT	**TOTAL**	**49,220**	**49,626**	**406**	**0.82%**	**96,836**	**97,207**	**371**	**0.38%**
	HBEB	1,470	1,484	14	0.95%	960	966	6	0.63%
	HBO	26,791	27,029	238	0.89%	76,100	76,453	353	0.46%
	HBW	13,302	13,415	113	0.85%	13,099	13,099	0	0.00%
	NHBEB	699	704	5	0.72%	647.6385	650.7933	3	0.49%
	NHBO	6,958	6,995	37	0.53%	6,030	6,037	7	0.12%
Active Mode	**TOTAL**	**172,935**	**174,471**	**1,536**	**0.89%**	**231,570**	**232,809**	**1,239**	**0.54%**
	HBEB	1,192	1,204	12	1.01%	1,096	1,109	13	1.19%
	HBO	118,841	119,997	1,156	0.97%	195,622	196,790	1,168	0.60%
	HBW	21,568	21,753	185	0.86%	15,833	15,836	3	0.02%
	NHBEB	1,737	1,751	14	0.81%	2,297	2,317	20	0.87%
	NHBO	29,597	29,766	169	0.57%	16,723	16,757	34	0.20%

Table 19 Comparison of Reference Case and MKE trip ends within Internal Area - 2031

Mode	Purpose	Total Daily Productions				Total Daily Attractions			
		Ref Case 2048	DS 2048	DS less Ref Case	% Diff	Ref Case 2048	DS 2048	DS less Ref Case	% Diff
Car	**TOTAL**	**1,107,016**	**1,130,939**	**23,923**	**2.16%**	**1,626,446**	**1,646,081**	**19,635**	**1.21%**
	HBEB	32,298	33,099	801	2.48%	52,690	54,027	1,337	2.54%
	HBO	632,962	648,058	15,096	2.38%	1,014,914	1,022,403	7,489	0.74%
	HBW	246,750	252,264	5,514	2.23%	344,508	353,650	9,142	2.65%
	NHBEB	34,453	35,257	804	2.33%	30,924	31,531	607	1.96%
	NHBO	160,553	162,260	1,707	1.06%	183,409	184,470	1,061	0.58%
PT	**TOTAL**	**86,499**	**87,885**	**1,386**	**1.60%**	**173,572**	**174,588**	**1,016**	**0.59%**
	HBEB	2,594	2,645	51	1.97%	1,678	1,692	14	0.83%
	HBO	47,791	48,660	869	1.82%	137,032	137,748	716	0.52%
	HBW	21,977	22,333	356	1.62%	22,945	23,185	240	1.05%
	NHBEB	1295.197	1316.719	22	1.66%	1145.76	1152.404	7	0.58%
	NHBO	12,843	12,929	86	0.67%	10,771	10,810	39	0.36%
Active Mode	**TOTAL**	**317,474**	**322,608**	**5,134**	**1.62%**	**434,370**	**437,315**	**2,945**	**0.68%**
	HBEB	2,063	2,102	39	1.89%	1,971	1,999	28	1.42%
	HBO	220,341	224,226	3,885	1.76%	367,988	370,222	2,234	0.61%
	HBW	35,577	36,136	559	1.57%	28,631	29,109	478	1.67%
	NHBEB	3,288	3,356	68	2.07%	4,269	4,311	42	0.98%
	NHBO	56,205	56,788	583	1.04%	31,511	31,674	163	0.52%

Table 20 Comparison of Reference Case and MKE trip ends within Internal Area - 2048

4.5 Highway Network

4.5.1 Figure 29 below shows the proposed network layout with junction type, speed limit and zone connectors, as provided by WSP.

4.5.2 Following discussions with MKC and WSP an appropriate model network was agreed with reduced zone connectors. This can be seen in Figure 30.

4.5.3 Both the 2031 and 2048 networks are consistent, excluding signal configuration which varies between peak period.

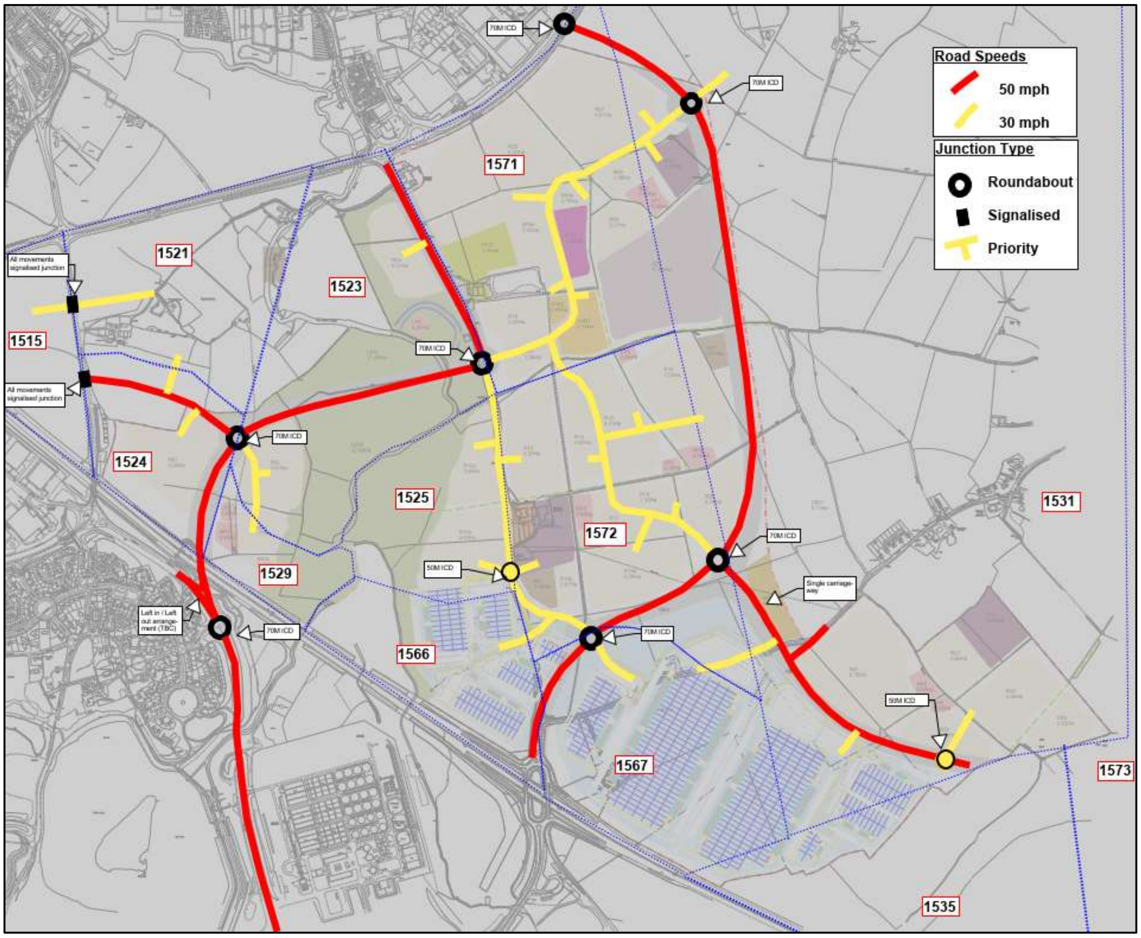

Figure 29: Proposed Infrastructure layout with zone connectors

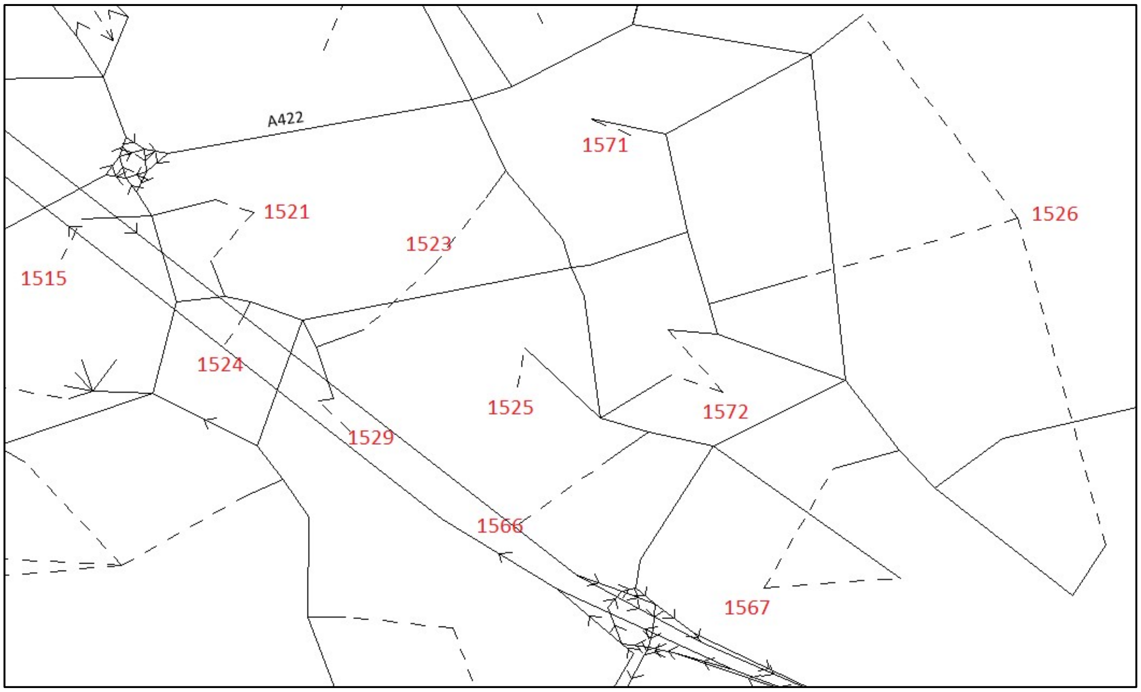

Figure 30: Final SATURN Network

4.6 MKE DS Convergence Summary

4.6.1 Table 21 shows a summary of convergence results for the 2031 and 2048 Do-Something model runs. The %Gap figures are all well below 0.1. All highway runs converged within 260 loops with %Flows above 99. The TAG convergence criteria can be seen in Table 17.

	%GAP		Loops		%Flows	
	2031	2048	2031	2048	2031	2048
AM	0.00044	0.0014	254	132	99.29	99.66
IP	0.00006	0.00054	27	51	99.25	99.59
PM	0.00099	0.0011	55	89	99.27	99.92

Table 21: Summary of DS VDM Convergence Results

4.7 Traffic Flows

4.7.1 The future year traffic flows presented in this report are considered to provide a robust estimate of the traffic flows likely to occur in the proposed MKE development in 2031 and 2048.

4.7.2 Figure 31 to Figure 34 show the actual flow (in PCU) for the MK Urban Area and specifically the MKE development area in the Do-Something scenario in 2031 in the AM and PM peak period.

4.7.3 In 2031 approximately 650 vehicles (PCU) travel on the eastern perimeter road (southbound towards the M1) in the AM peak period and approximately 200 vehicles (PCU) in the PM peak period.

4.7.4 Approximately 250 vehicles (PCU) travel on the eastern perimeter road (northbound towards the A422) in the AM peak period and approximately 700 vehicles (PCU) in the PM peak period.

4.7.5 The new link road which connects the A509 to the proposed new bridge is used by approximately 500 vehicles (PCU) travelling eastbound in the AM peak period and approximately 1500 vehicles (PCU) in the PM peak period.

4.7.6 Approximately 1200 vehicles (PCU) travel westbound on the same link in the AM peak period and 800 vehicles (PCU) in the PM peak period.

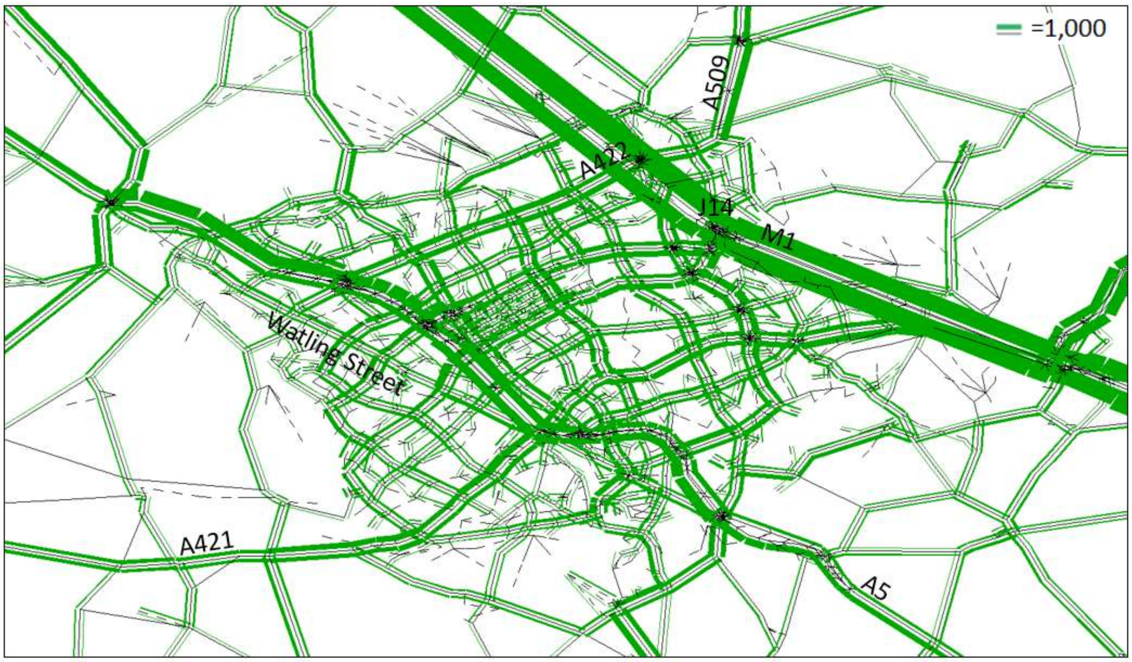

Figure 31. Actual Flow – 2031 AM Peak

Figure 32. Actual Flow – MKE Development 2031 AM Peak

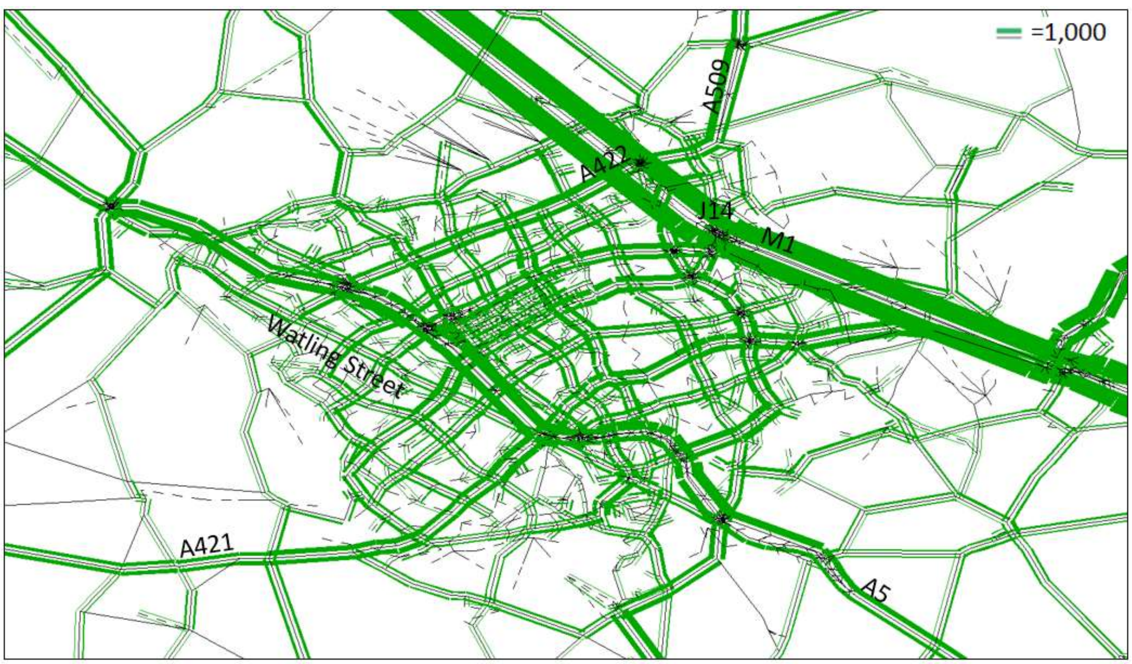

Figure 33. Actual Flow – 2031 PM Peak

Figure 34. Actual Flow – MKE Development 2031 PM Peak

4.7.7 Figure 35 to Figure 38 below show the actual flow (in PCU) for the MK Urban Area and specifically the MKE development area in the Do-Something scenario in 2048 in the AM and PM peak period.

4.7.8 In 2048 there is an expected increase in traffic using the roads within the MKE development. Approximately 1100 vehicles (PCU) travel on the eastern perimeter road (southbound towards the M1) in the AM peak period and approximately 300 vehicles (PCU) in the PM peak period.

4.7.9 Approximately 600 vehicles (PCU) travel on the eastern perimeter road (northbound towards the A422) in the AM peak period and approximately 700 vehicles (PCU) in the PM peak period.

4.7.10 The new link road which connects the A509 to the proposed new bridge is used by approximately 350 vehicles (PCU) travelling eastbound in the AM peak period and approximately 1500 vehicles (PCU) in the PM peak period.

4.7.11 Approximately 1650 vehicles (PCU) travel westbound on the same link in the AM peak period and 1100 vehicles (PCU) in the PM peak period.

4.7.12 Further detail regarding the level of traffic using the A422, Willen Road, the new proposed bridge and the M1 J14 bridge can be found in section 5.4.

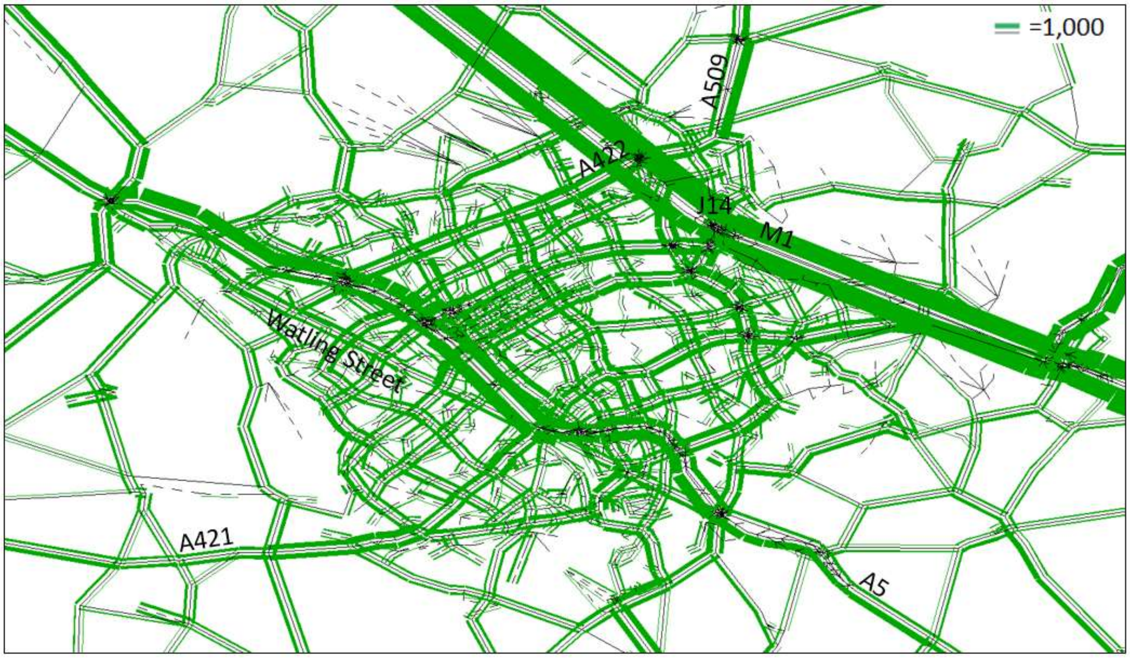

Figure 35. Actual Flow – 2048 AM Peak

Figure 36. Actual Flow – MKE Development 2048 AM Peak

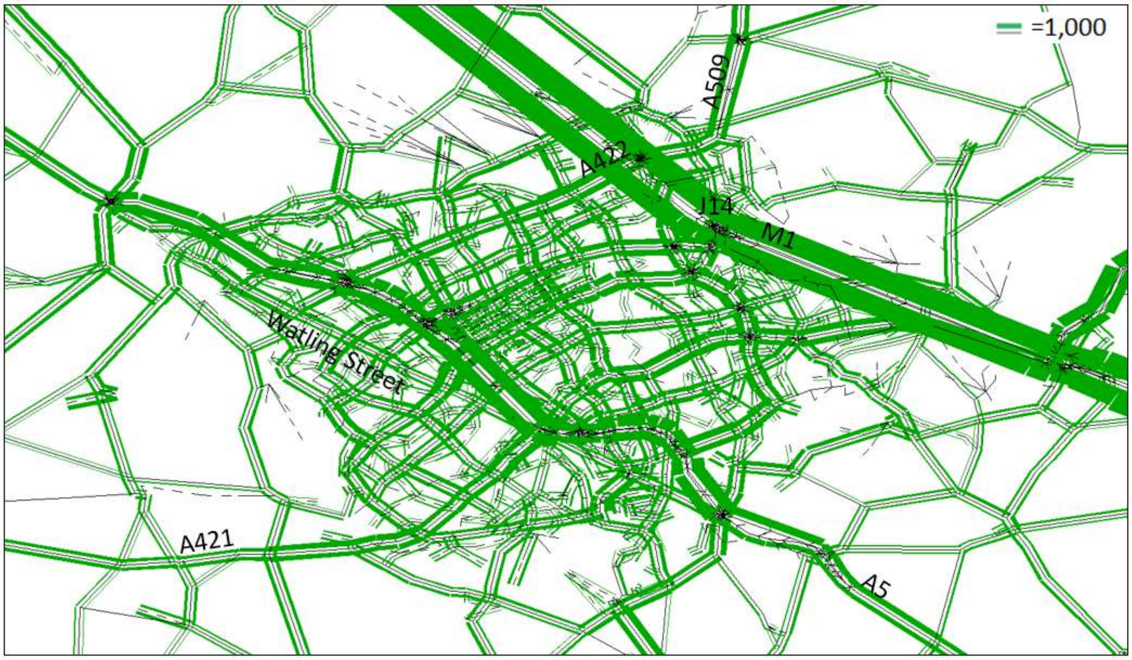

Figure 37. Actual Flow – 2048 PM Peak

Figure 38. Actual Flow – MKE Development 2048 PM Peak

4.8 Volume Over Capacity

4.8.1 Figure 39 to Figure 46 show the average junction V/C ratio over 85%, weighted by the turn flows, and link V/C over 85% in 2031 and 2048 in the AM and PM peak periods. The link and junction data has been displayed separately on the plots to give a clearer indication of where junctions and links are approaching or at capacity. Link delays are shown as line bandwidths and junctions delays are shown as circular 'hotspots'.

4.8.2 In 2031 AM the Tickford Roundabout including the southbound, northbound and westbound approaches are approximately 85% to 114% V/C. In the 2031 PM peak period the Renny Lodge Roundabout and southbound approach road is between 85% to 99% capacity. The A422 approach to Tickford Roudnabout and Renny Lodge Roundabout is approximately 100% to 114% capacity.

4.8.3 On Willen Road between Tongwell Roundabout and the Bloor southern access road the V/C is above 85% on the northbound link in the 2031 AM and PM peak periods.

4.8.4 The M1 northbound off-slip at junction 14 is at approximately 100% capacity in the 2031 AM peak period. In the PM peak period, the northbound on-slip is between 85% to 114% capacity.

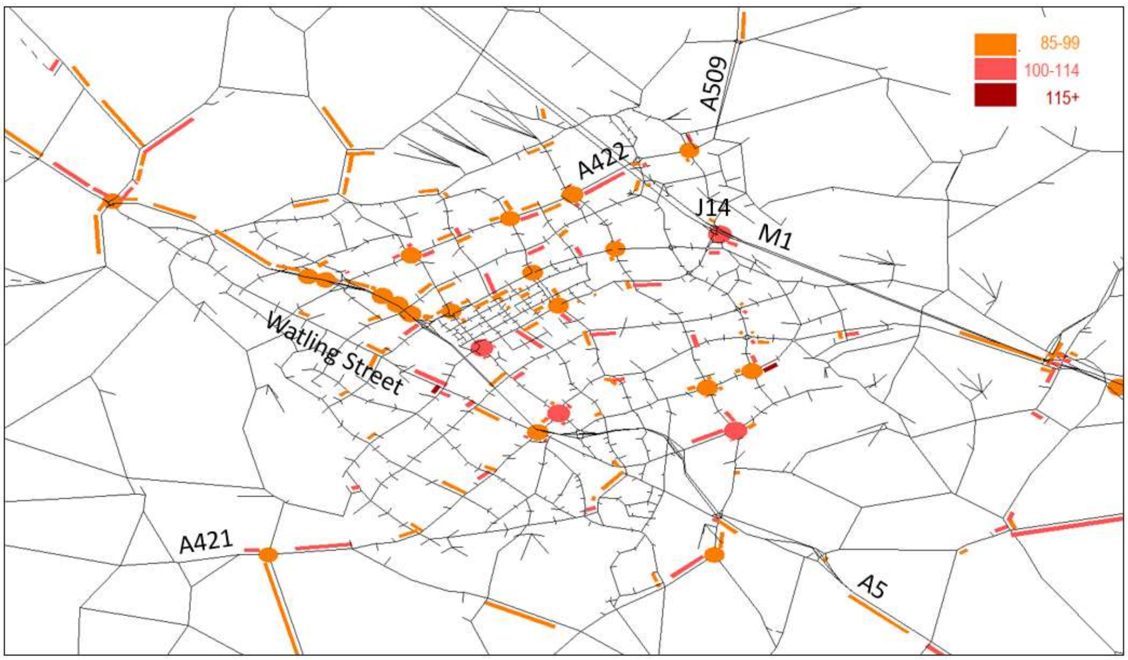

Figure 39. MK Urban Area, link and junction V/C over 85%, 2031 AM Peak

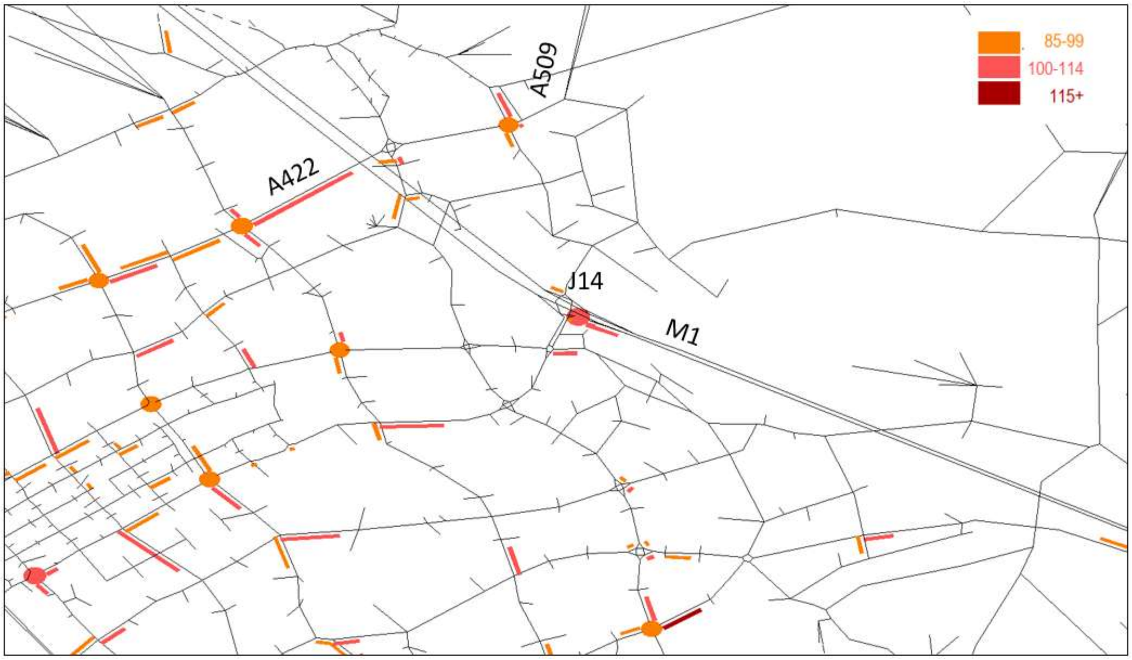

Figure 40. MK Development, link and junction V/C over 85%, 2031 AM Peak

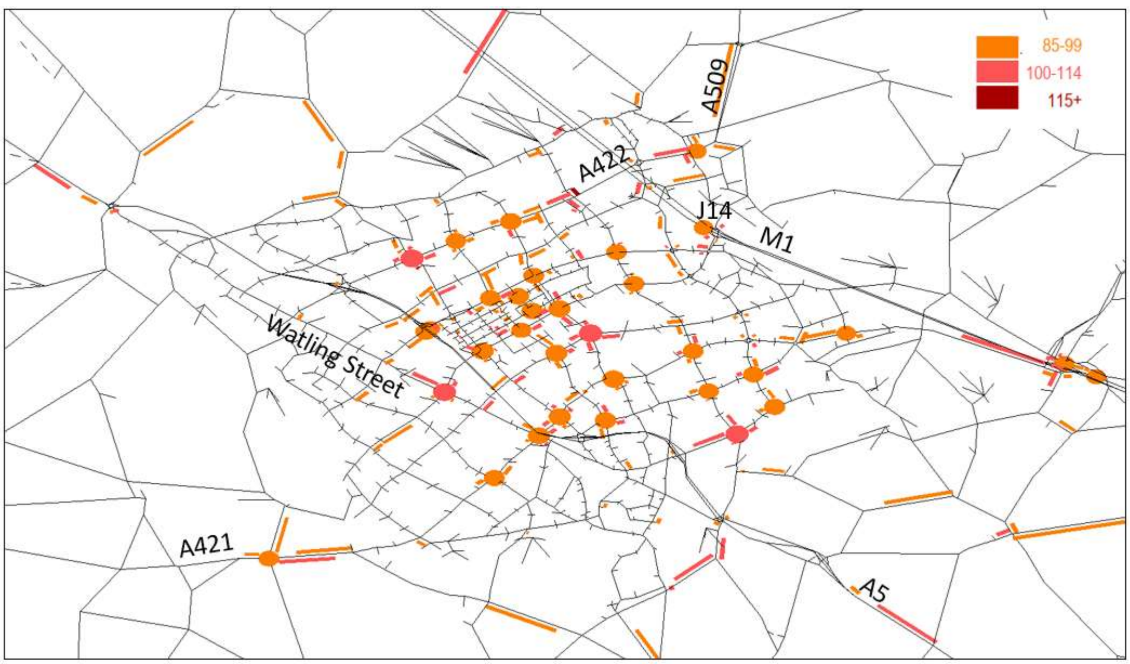

Figure 41. MK Urban Area, link and junction V/C over 85%, 2031 PM Peak

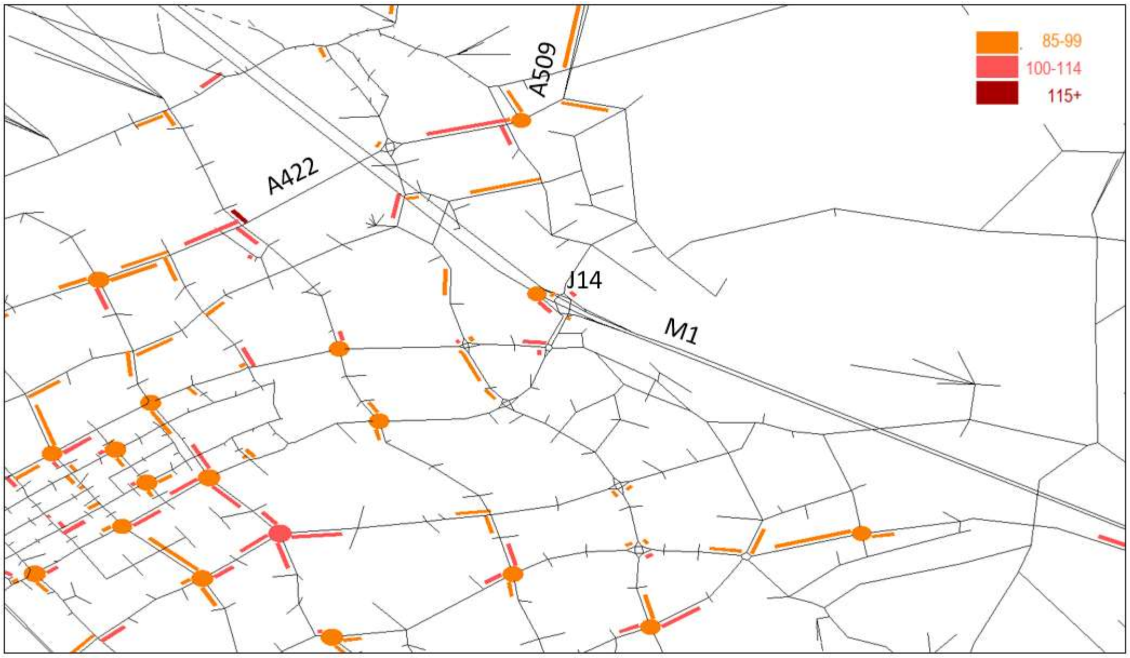

Figure 42. MK Development, link and junction V/C over 85%, 2031 PM Peak

4.8.5 In 2048 the V/C expectedly increases at junctions across the Milton Keynes urban area as well as MKE development.

4.8.6 Tickford Roundabout is at approximately 100% to 114% V/C in the AM peak period and both the Tickford Roundabout and Renny Lodge Roundabout are above 100% V/C in the PM peak period.

4.8.7 The eastbound Tickford Roundabout approach is above 85% V/C in both the AM and PM peak periods.

4.8.8 The MKE eastern perimeter road is above 85% V/C close to the A509 for northbound and southbound traffic in the AM peak periods. In the PM peak periods only the northbound is above capacity; approximately between 100 to 114% V/C.

4.8.9 The M1 northbound and southbound approaches to junction 14 are above 85% V/C in the AM peak period. In the PM peak period both the northbound on and off-slips at junction 14 are above 85% V/C as well as southbound approach on the existing A509.

4.8.10 The proposed new bridge is above 85% V/C in the AM and PM peak periods for southbound traffic approaching the Tongwell Street junction.

4.8.11 On Willen road both the northern and southern access junctions to the Boor development are at approximately 85% to 99% V/C in the AM peak period.

4.8.12 Additionally; Willen Road between Tongwell Roundabout and the Bloor southern access road the V/C is above 85% on the northbound link in the 2031 AM and PM peak periods.

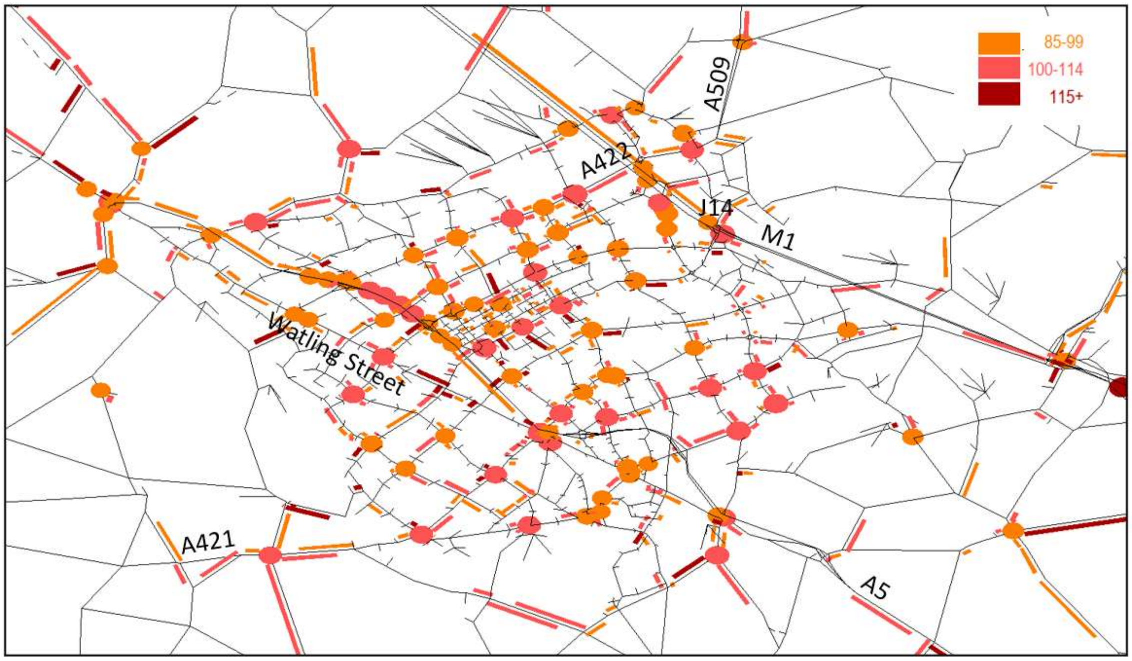

Figure 43. MK Urban Area, link and junction V/C over 85%, 2048 AM Peak

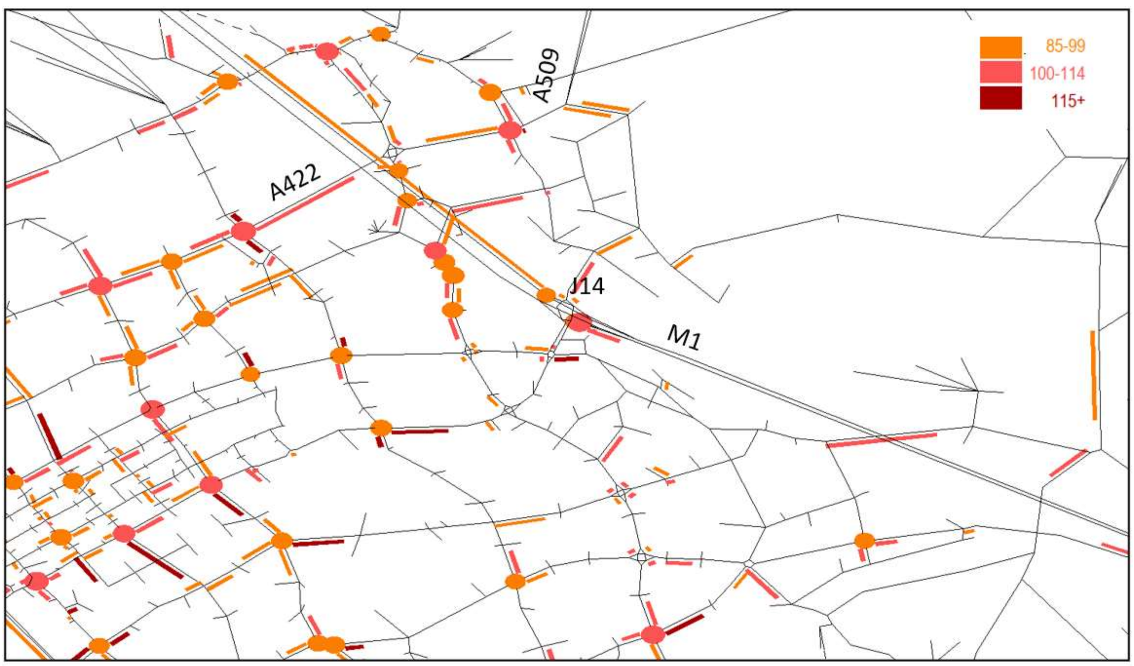

Figure 44. MK Development, link and junction V/C over 85%, 2048 AM Peak

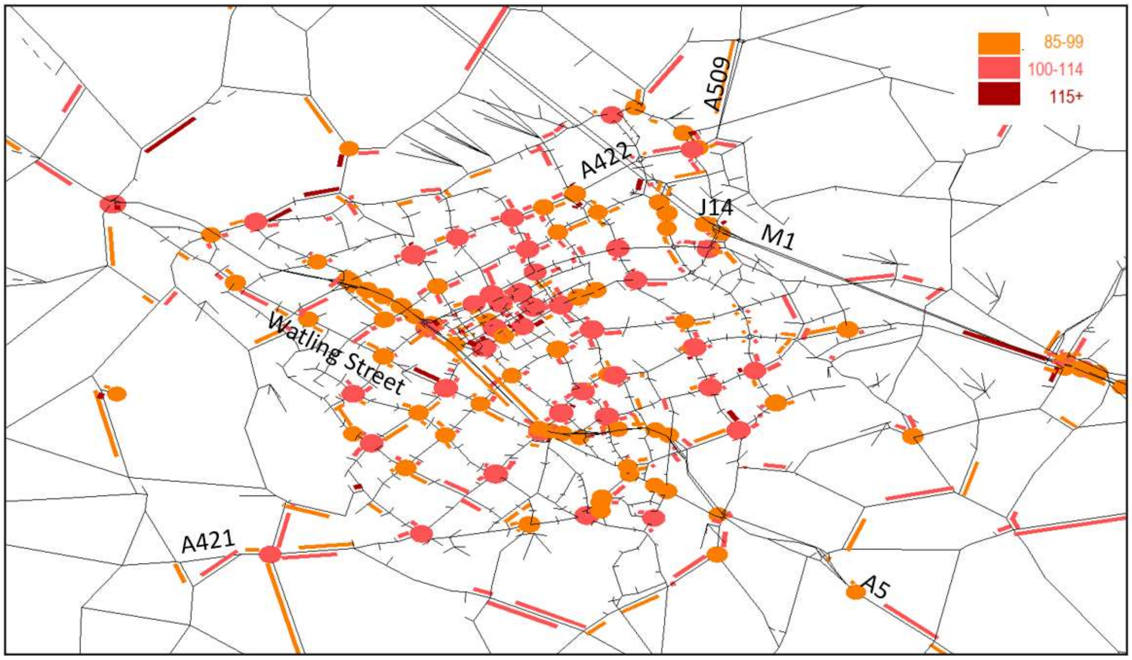

Figure 45. MK Urban Area, link and junction V/C over 85%, 2048 PM Peak

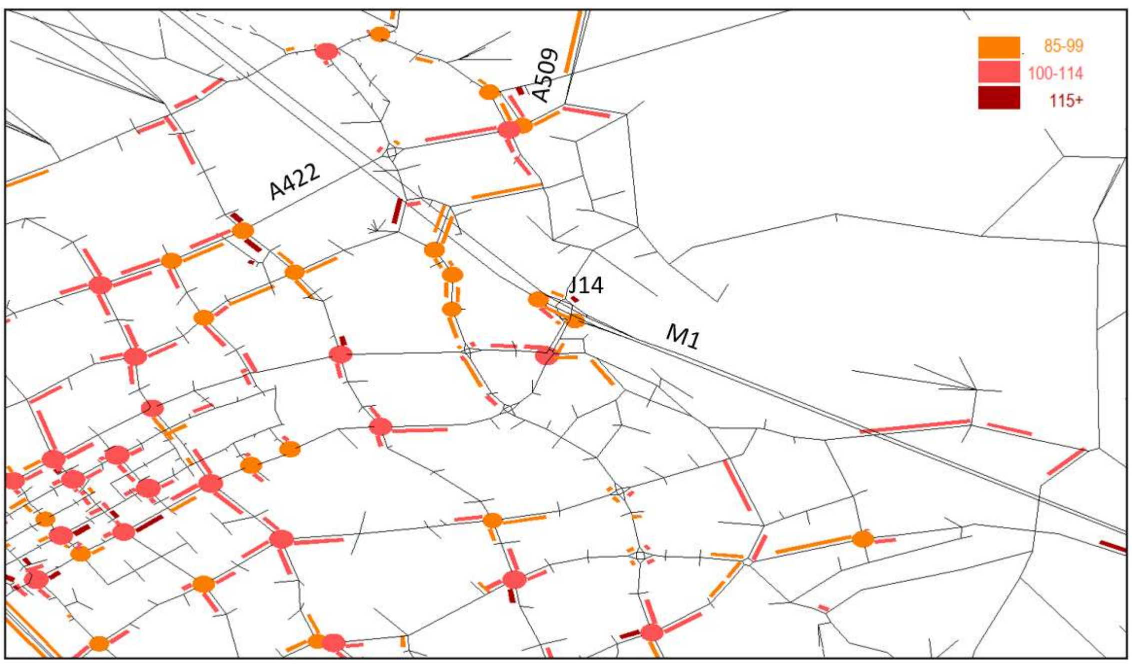

Figure 46. MK Development, link and junction V/C over 85%, 2048 PM Peak

4.9 Delays

4.9.1 The observations made from the V/C analysis are reflected in Figure 47 to Figure 54 which show the extent of delays in the Do-Something scenario. The plots display the average delay (in seconds) per vehicle for junctions across the MK Urban area as well as the MKE development in the AM and PM peak periods in 2031 and 2048.

4.9.2 In the 2031 AM peak period both the Bloor northern access junction and M1 northbound and southbound off-slip delay times are above 90 seconds per vehicle.

4.9.3 The new Bloor southern access road and the Tickford Roundabout has an average delay time of approximately 40 to 59 seconds per vehicle in the AM peak period.

4.9.4 In the 2031 PM peak period the average delay time at the Bloor southern access road on Willen Road and the Tickford Roundabout has an average delay time of approximately 60 to 89 seconds. The M1 junction 14 has a delay time of approximately 40 to 89 seconds per vehicle on the northern section of the circulatory at the southbound off-slip traffic signals and the exit on to the southbound on-slip.

4.9.5 In the 2048 AM peak period the average delay times at the Marsh End Roundabout, Bloor northern and southern access roads and Tickford Roundabout are all above 90 seconds per vehicle. The northbound and southbound off-slips at junction 14 on the M1 also increase to above 90 seconds per vehicle.

4.9.6 In the PM peak period the average delay times are broadly consistent with the AM in the MKE development area, excluding the Bloor northern access junction on Willen Road which has an average delay time of 40 to 59 seconds per vehicle.

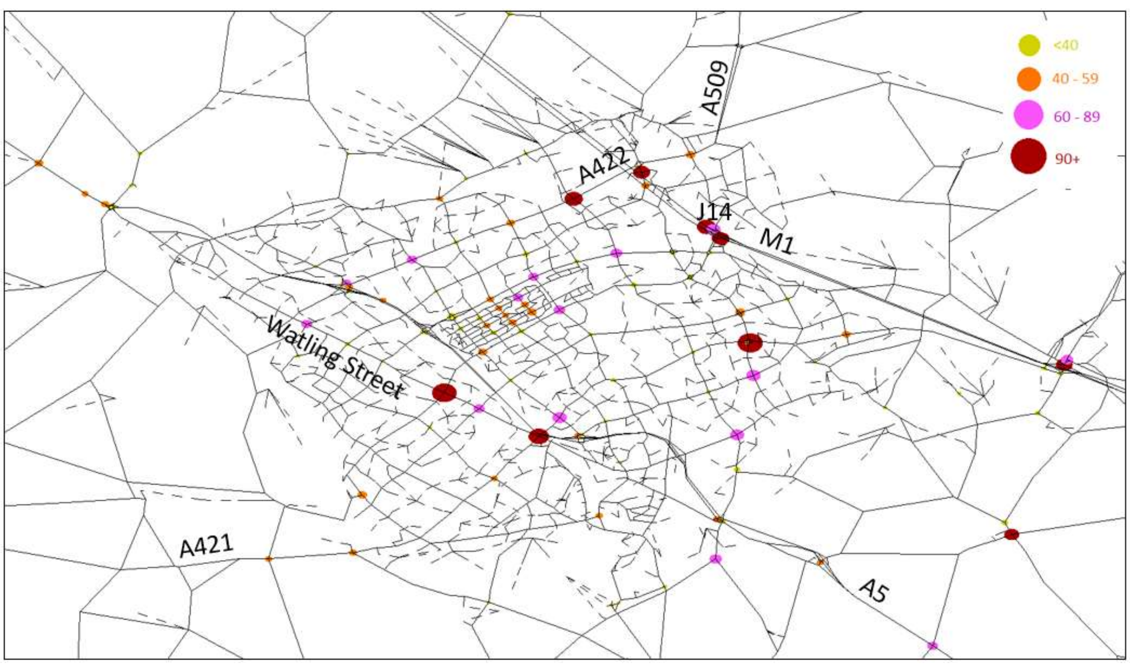

Figure 47. MKE, Average Junction Delay (Seconds), 2031 AM Peak

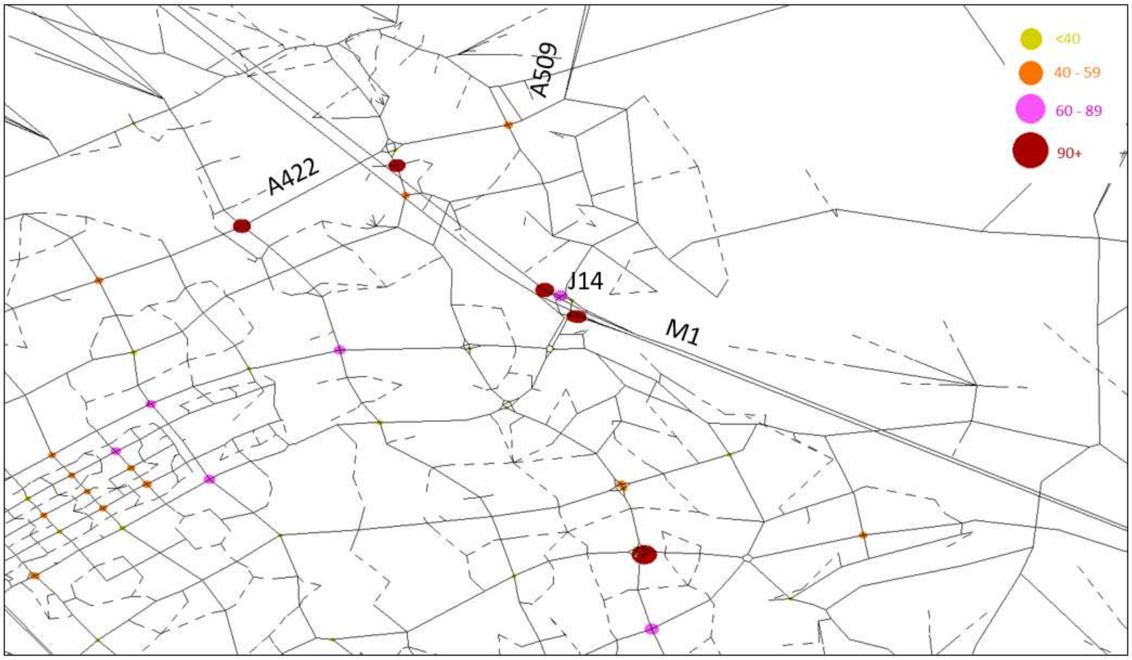

Figure 48. MKE Development, Average Junction Delay (Seconds), 2031 AM Peak

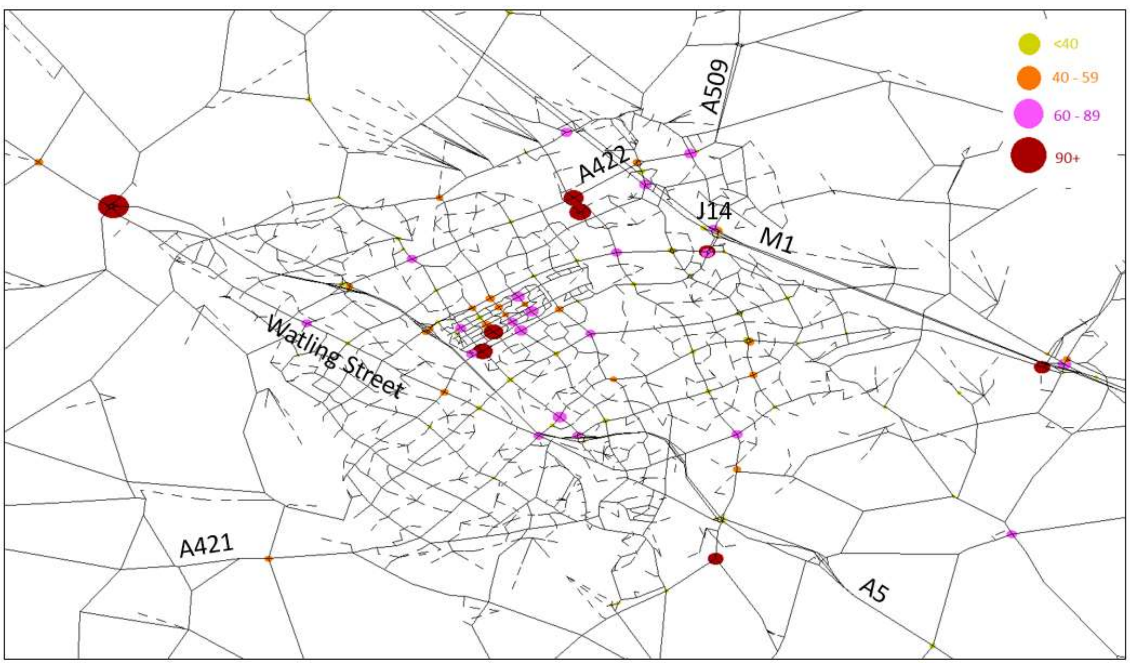

Figure 49. MK, Average Junction Delay (Seconds), 2031 PM Peak

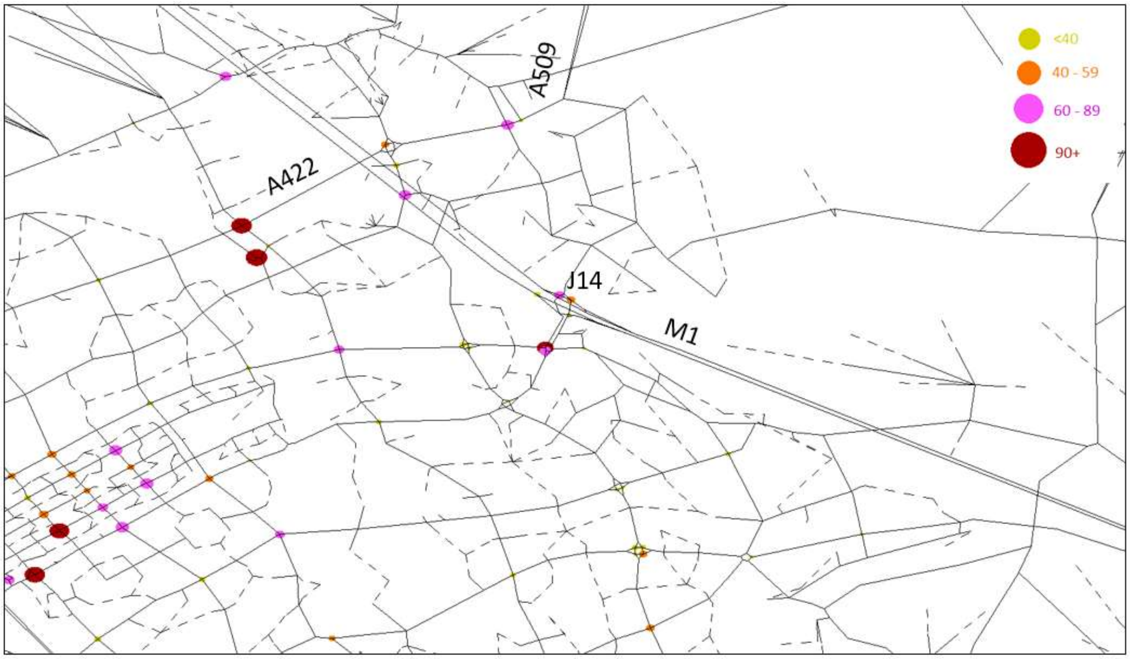

Figure 50. MKE Development, Average Junction Delay (Seconds), 2031 PM Peak

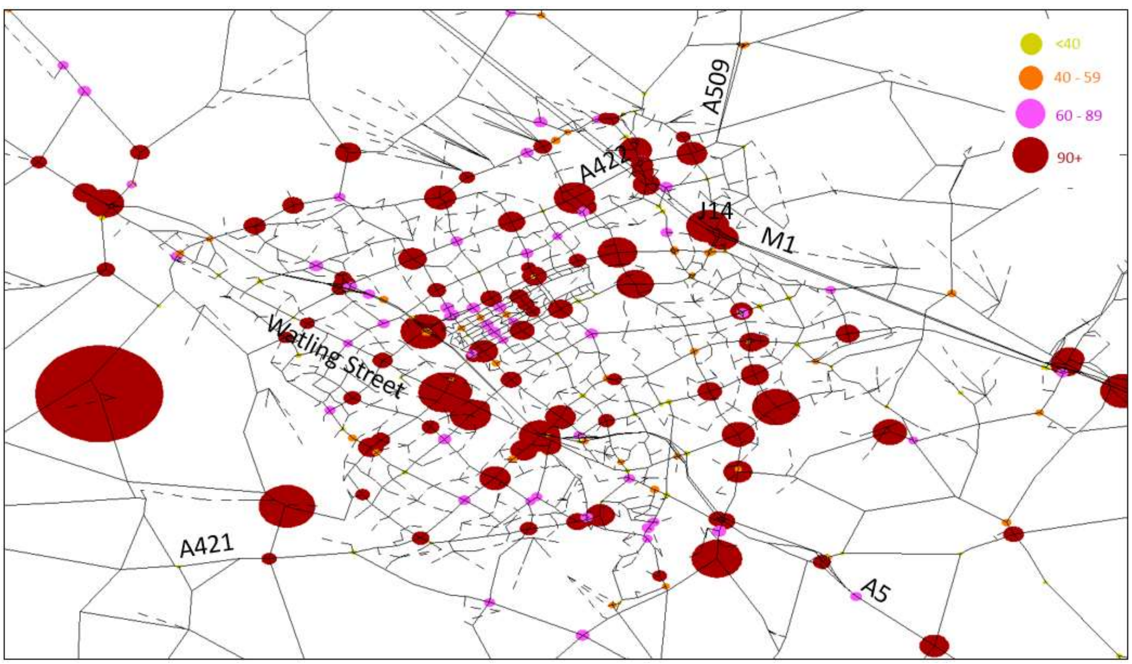

Figure 51. MK, Average Junction Delay (Seconds), 2048 AM Peak

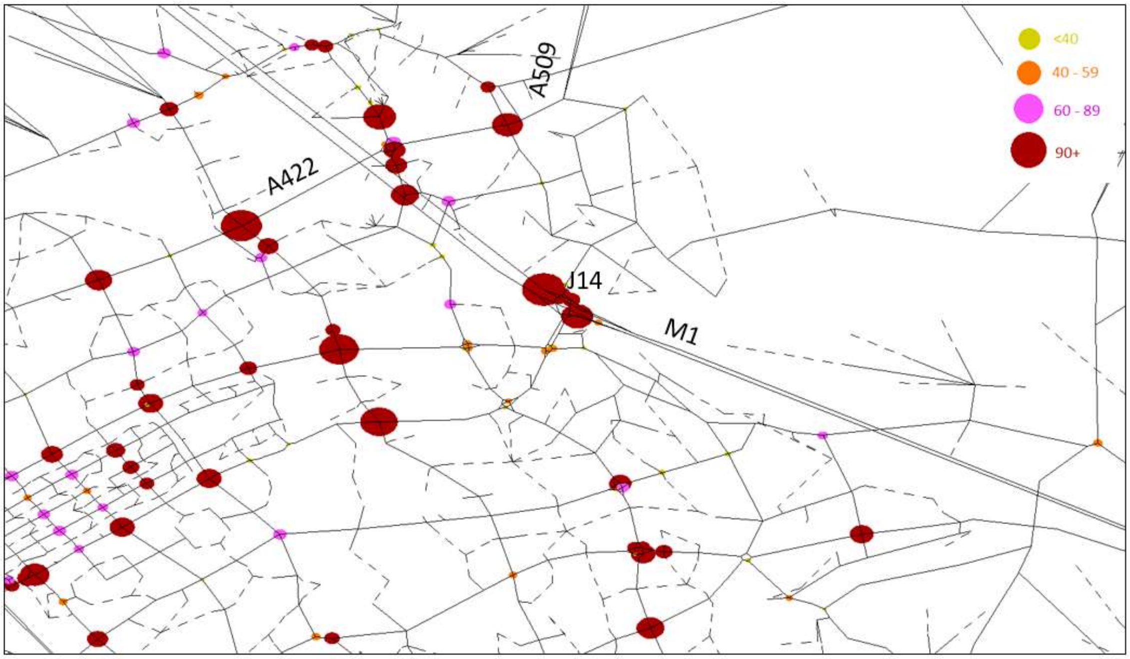

Figure 52. MKE Development, Average Junction Delay (Seconds), 2048 AM Peak

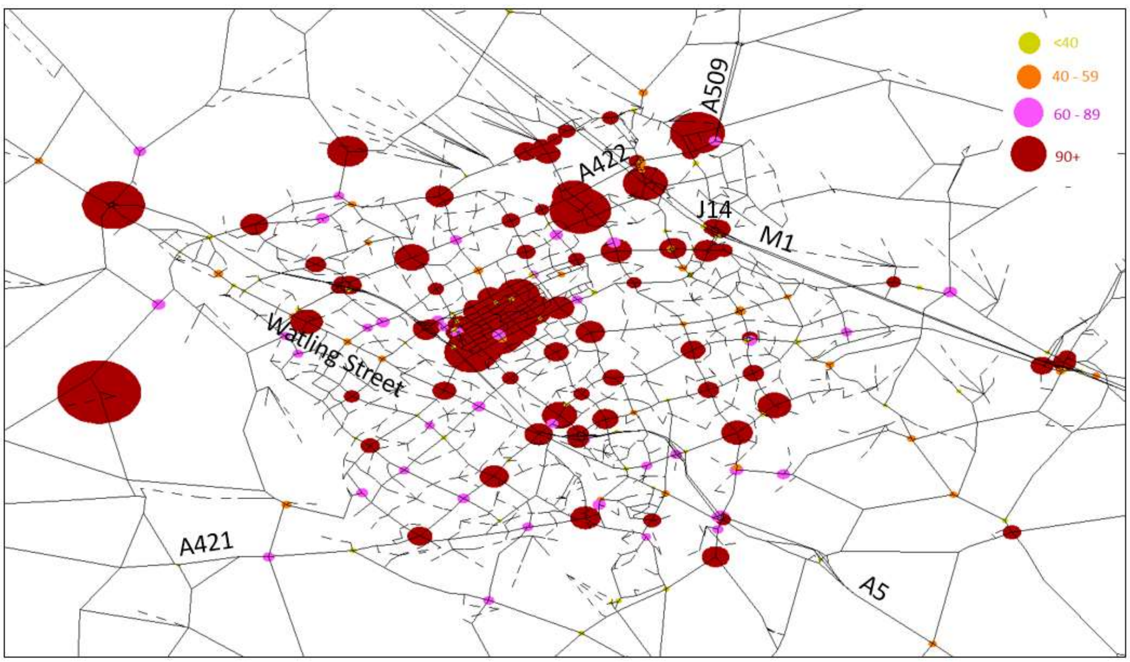

Figure 53. MK, Average Junction Delay (Seconds), 2048 PM Peak

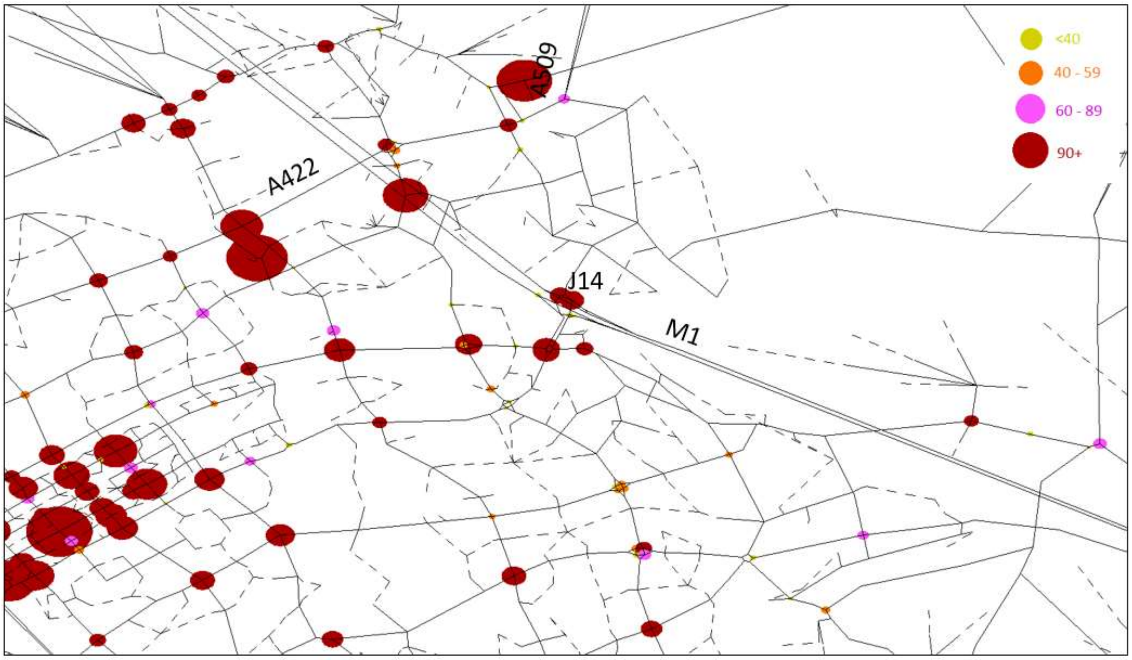

Figure 54. MKE Development, Average Junction Delay (Seconds), 2048 PM Peak

5. Milton Keynes East Impact

5.1 Introduction

5.1.1 This chapter summarises the impact of the MKE development on links and junctions close to or within the MKE development. This chapter focuses on the AM and PM peak periods and presents the flow difference (PCU), junction delay difference (Seconds) and total traffic flow (PCU) using either the A422, Willen Road, the proposed new bridge or the M1 junction 14 circulatory to cross the M1.

5.2 Traffic Flows

5.2.1 This section compares the 2031 and 2048 Do-Something flows with those of the Reference Case. The flow difference is plotted as bandwidths to the left side of each link by direction, with an increase in actual flow (PCU) between the Do-Something and Reference Case shown in green and a decrease in blue. It is also important to note that where links have been changed to code in the MKE infrastructure then no comparison can be plotted.

5.2.2 In the 2031 and 2048 AM peak period there is an increase in flow travelling towards Milton Keynes via the A509; approximately 400 vehicles (PCUs) in 2031 and 900 vehicles (PCUs) in 2048. Likewise, there is a decrease in traffic continuing on the A422 (via Tickford Roundabout) in the AM peak period; approximately 300 vehicles (PCUs) in 2031 and 400 vehicles (PCUs) in 2048. This decrease can be attributed to vehicles travelling via the eastern perimeter of the MKE development, towards junction 14 on the M1 and via the proposed new bridge causing an increase in traffic on Tongwell Street as well as an increase in traffic travelling towards Milton Keynes through Moulsoe on Newport Road.

5.2.3 On the A422 between Marsh End Roundabout and the A509 there is also a decrease in flow travelling away from Milton Keynes in the AM peak period in 2031 and 2048; approximately 200 vehicles (PCUs) in 2031 and 150 vehicles (PCUs) in 2048.

5.2.4 At junction 14 of the M1 there is a moderate increase in traffic accessing the M1 southbound; approximately 30 vehicles (PCUs) in 2031 and 50 vehicles (PCUs) in 2048.

5.2.5 In the 2031 and 2048 PM peak period there is an is an increase in flow travelling away from Milton Keynes via the A509; approximately 600 vehicles (PCUs) in 2031 and 300 vehicles (PCUs) in 2048.

5.2.6 Similar to the AM peak period, there is a decrease in traffic on the A422 between the Marsh End Roundabout and the A509. Travelling eastbound approximately 400 vehicles (PCUs) in 2031 and approximately 350 vehicles (PCUs) in 2048 and approximately 200 vehicles (PCUs) in the 2031 and 250 vehicles (PCUs) in 2048 travelling westbound.

5.2.7 In both the AM and PM peak periods in 2031 and 2048 there is a decrease in traffic using Willen Road in the Do-Something scenario and an increase in traffic using Tongwell Street. This can be attributed to the proposed new bridge which Tongwell Street adjoins to. Further detail regarding traffic crossing over the M1 can be found in section 5.4.

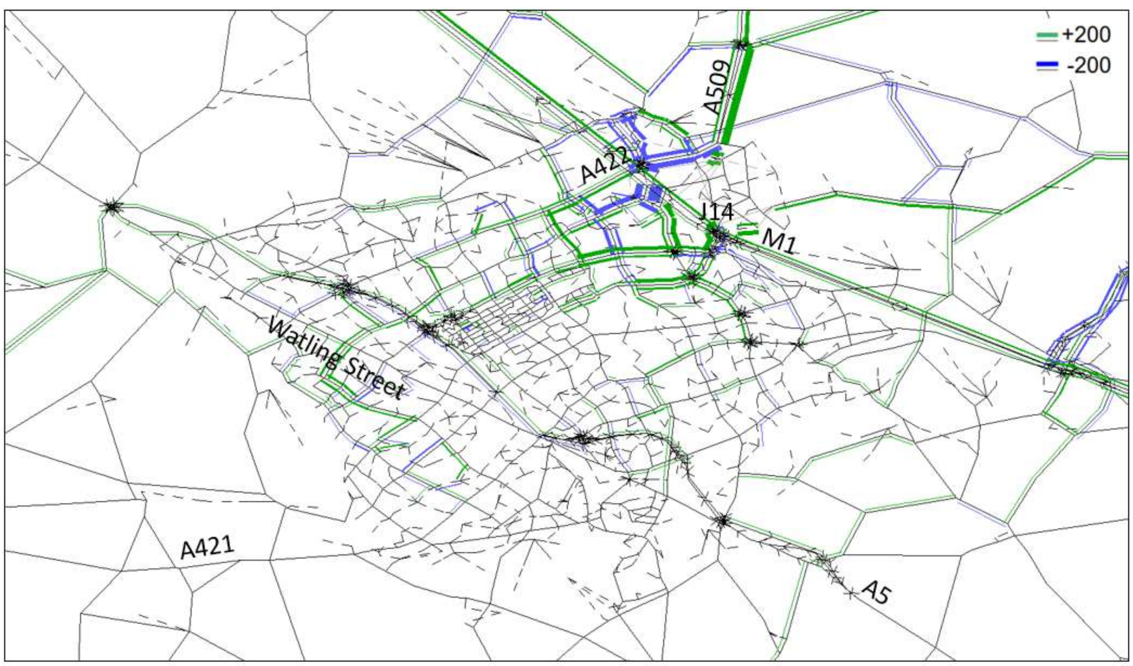

Figure 55. Change in Modelled flow, MKE less Reference Case 2031 AM Peak

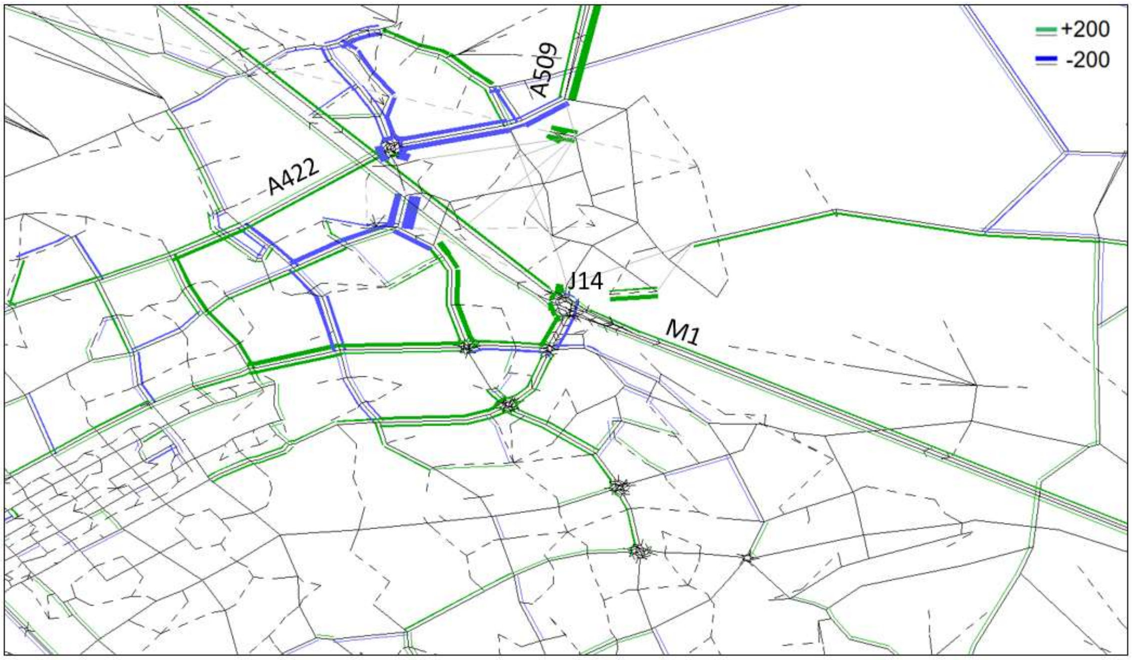

Figure 56. Change in Modelled flow, MKE less Reference Case 2031 AM Peak (MKE Development Area)

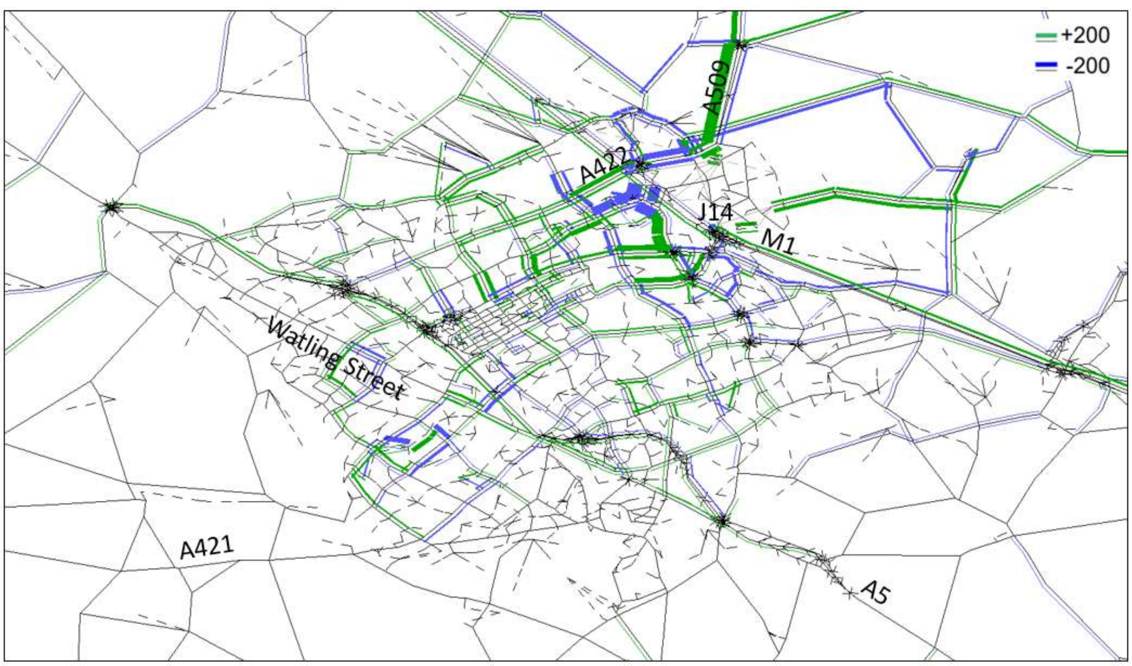

Figure 57. Change in Modelled flow, MKE less Reference Case 2031 PM Peak – MK

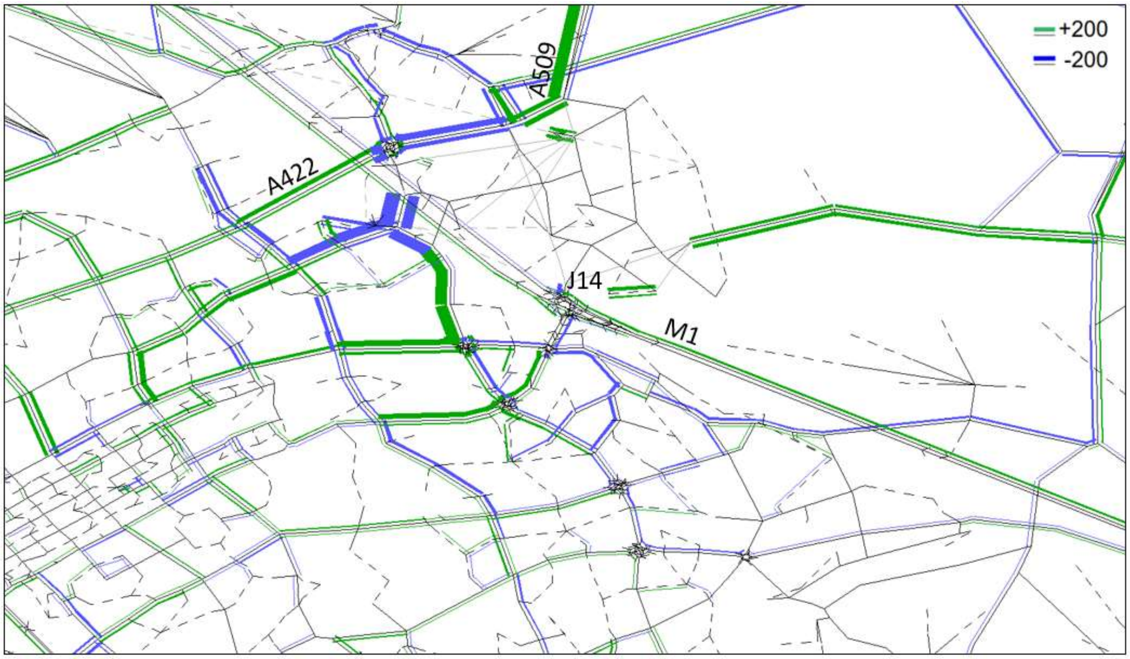

Figure 58. Change in Modelled flow, MKE less Reference Case 2031 PM Peak (MKE Development Area)

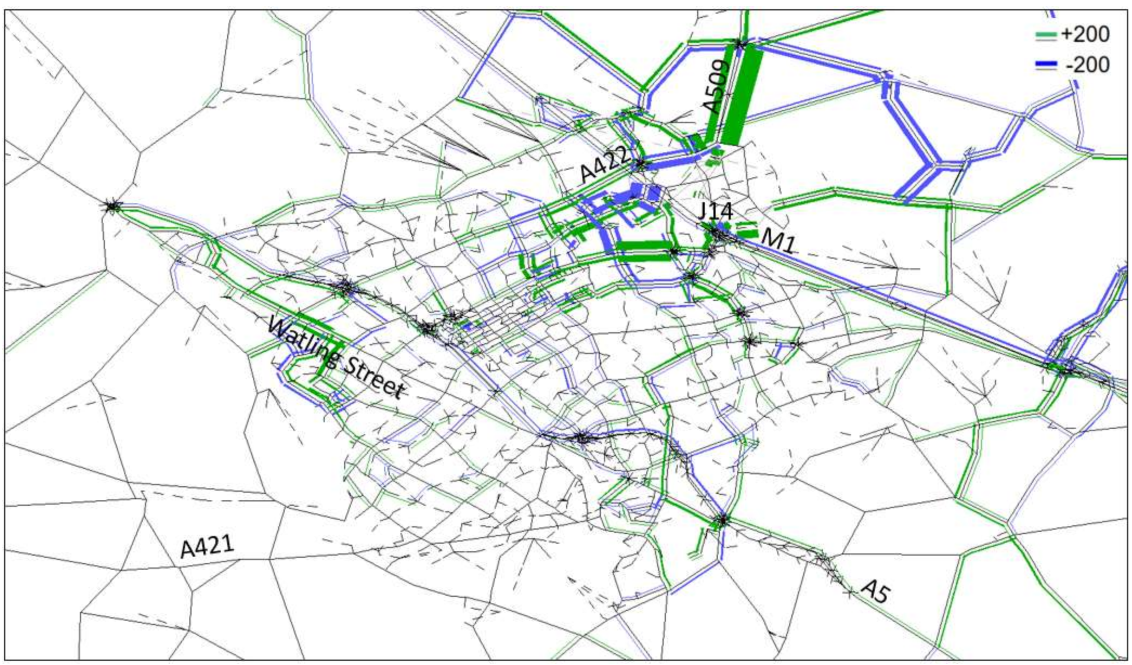

Figure 59. Change in Modelled flow, MKE less Reference Case 2048 AM Peak

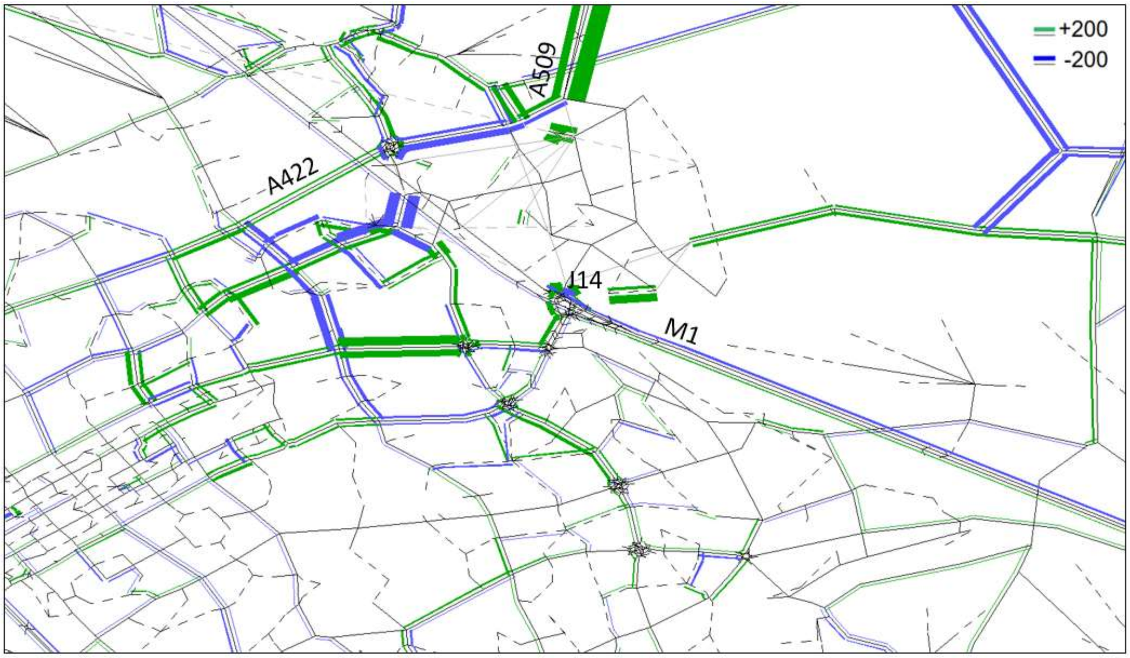

Figure 60. Change in Modelled flow, MKE less Reference Case 2048 AM Peak (MKE Development Area)

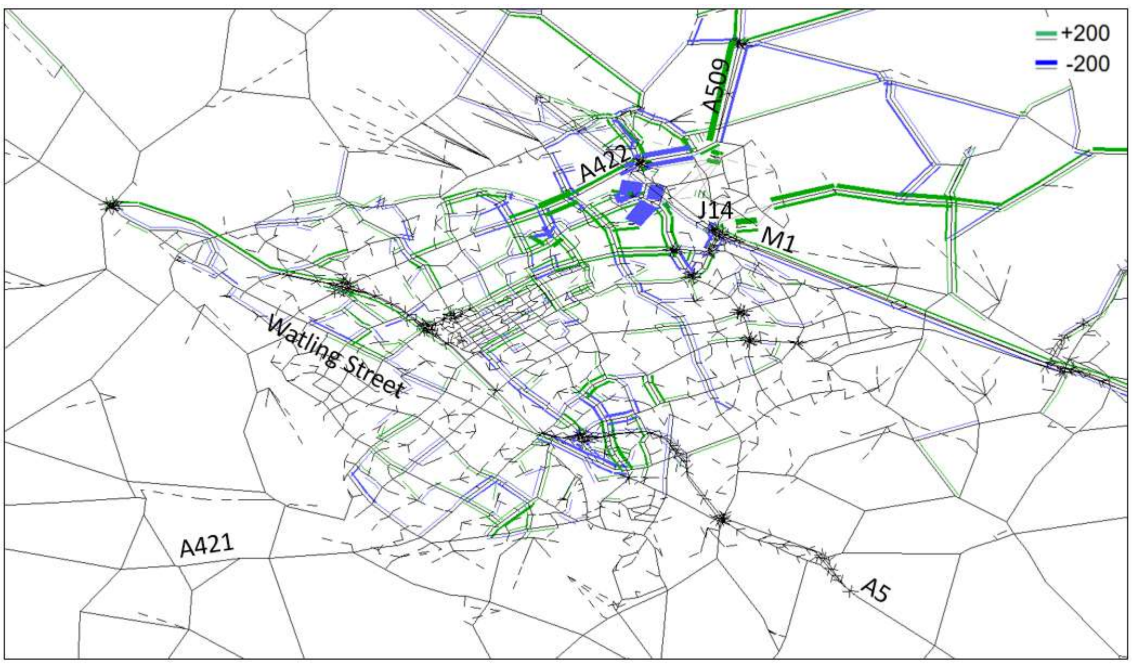

Figure 61. Change in Modelled flow, MKE less Reference Case 2048 PM Peak

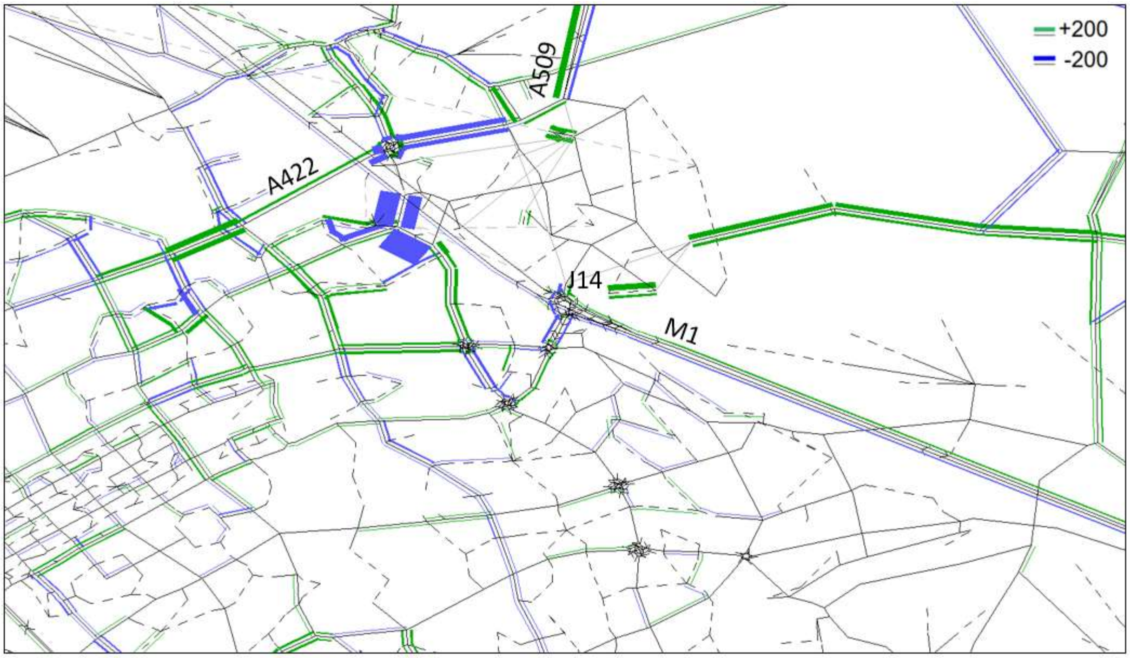

Figure 62. Change in Modelled flow, MKE less Reference Case 2048 PM Peak (MKE Development Area)

5.3 Delay Differences

5.3.1 This section compares the Do-Something average junction delay times (per vehicle) with those of the Reference Case. The delay difference is plotted as bandwidths, with yellow and orange denoting an increase in delay time in the Do-Something scenario and pink denoting a decrease in average delay time.

5.3.2 Figure 63 to Figure 70 shows the change in average delay (in seconds) per vehicle in the Do-Something scenario.

5.3.3 In 2031 in both the AM and PM peak periods there is an approximate 60 second reduction in delay (per vehicle) at Tickford Roundabout. In the AM peak there is also a reduction of approximately 60 seconds (per vehicle) at the southbound approach on the Marsh End Roundabout and approximately 30 seconds (per vehicle) at Tongwell Roundabout.

5.3.4 In the 2031 PM peak period there is an increase in delay time at Marsh End Roundabout; approximately 30 seconds (per vehicle) at the eastbound approach.

5.3.5 There is an increase in delay time of approximately 30 seconds (per vehicle) at the M1 southbound junction 14 off-slip in the 2031 AM peak period and approximately 30 seconds on the northbound on-slip in the PM peak period.

5.3.6 In 2048 in the AM peak period there is an increase in delay at both the southbound and northbound off-slips on the M1 at junction 14; approximately 70 seconds (per vehicle) southbound and approximately 30 seconds (per vehicle) northbound. There is also a reduction in delay time greater than 60 seconds (per vehicle) at Tickford Roundabout in both the AM and PM peak periods.

5.3.7 In the PM peak period, there is an increase in delay time, approximately 30 to 60 seconds (per vehicle) on the M1 junction 14 circulatory at the southbound off-slip exit.

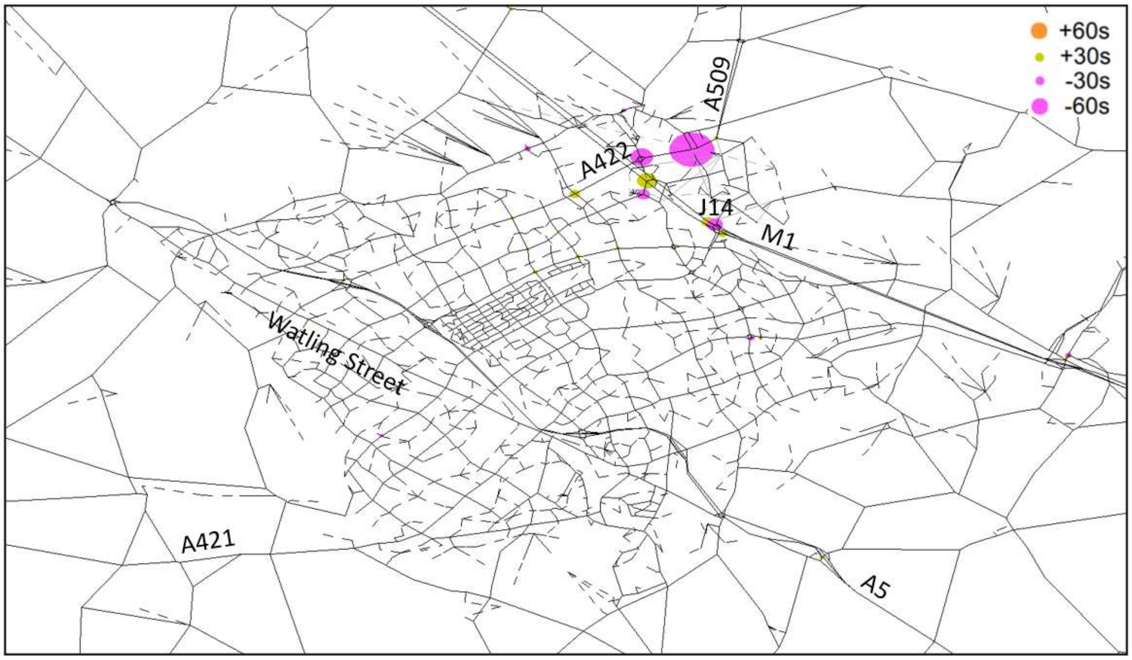

Figure 63: Change in Average Junction Delay (seconds), MKE less Reference Case 2031 AM Peak

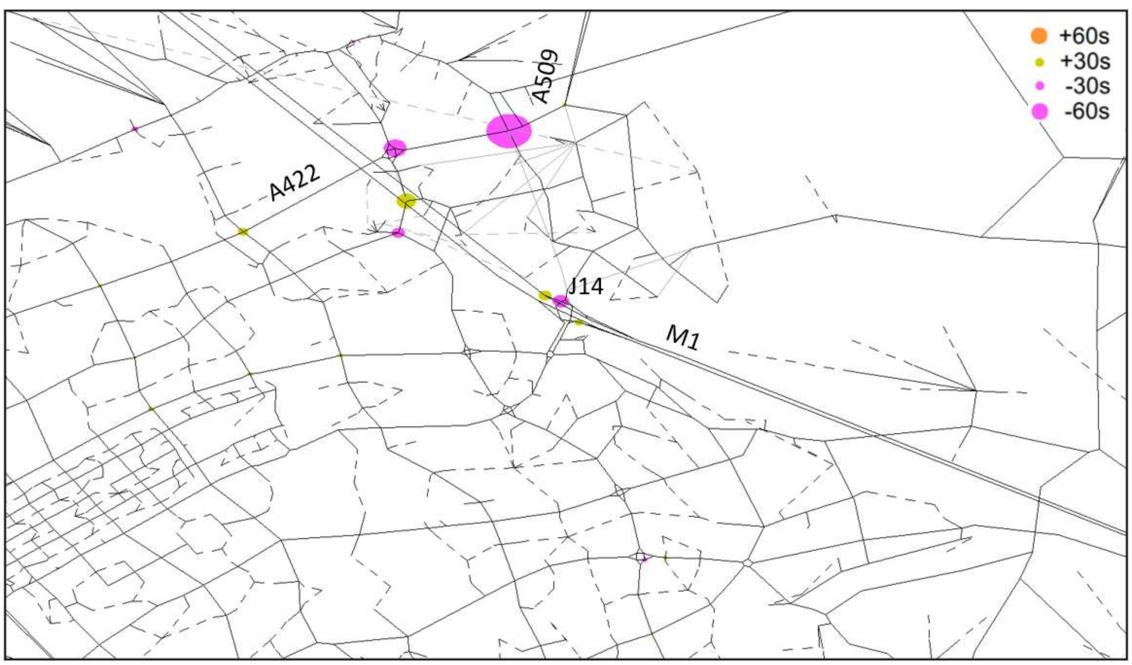

Figure 64: Change in Average Junction Delay (seconds), MKE less Reference Case 2031 AM Peak – MKE Development

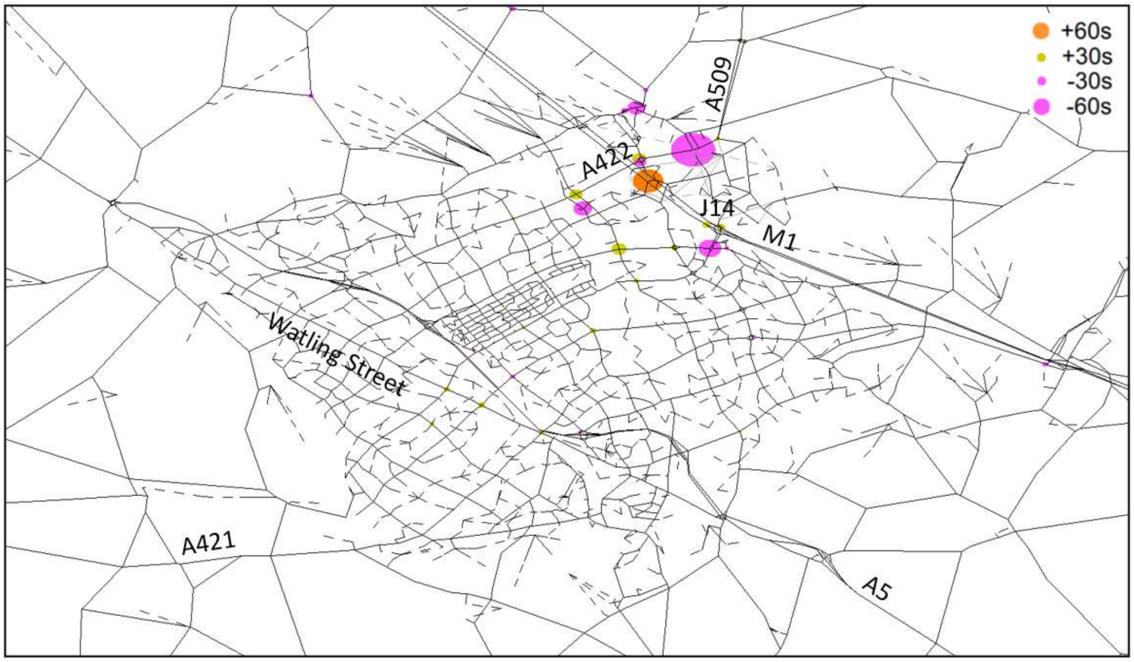

Figure 65: Change in Average Junction Delay (seconds), MKE less Reference Case 2031 PM Peak

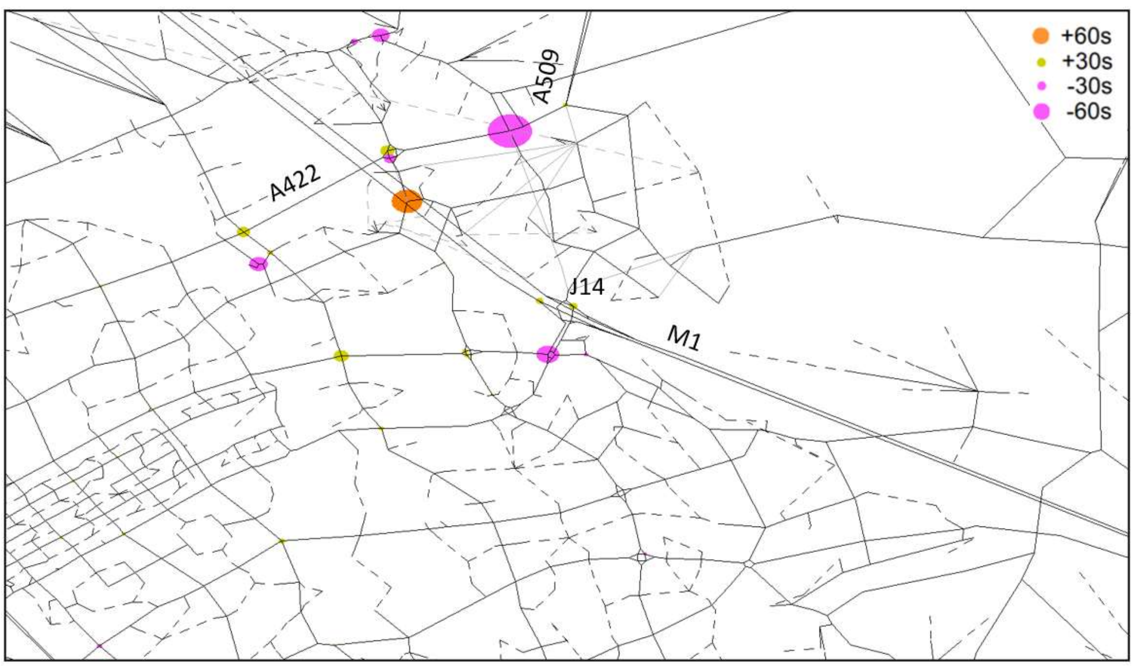

Figure 66: Change in Average Junction Delay (seconds), MKE less Reference Case 2031 PM Peak – MKE Development

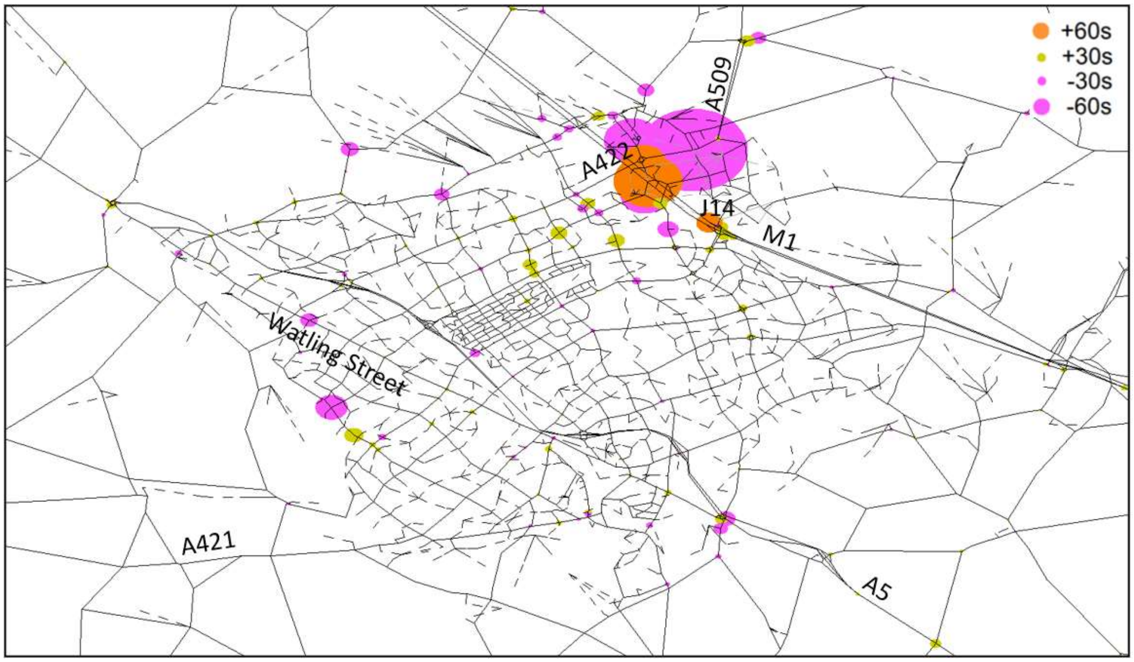

Figure 67: Change in Average Junction Delay (seconds), MKE less Reference Case 2048 AM Peak

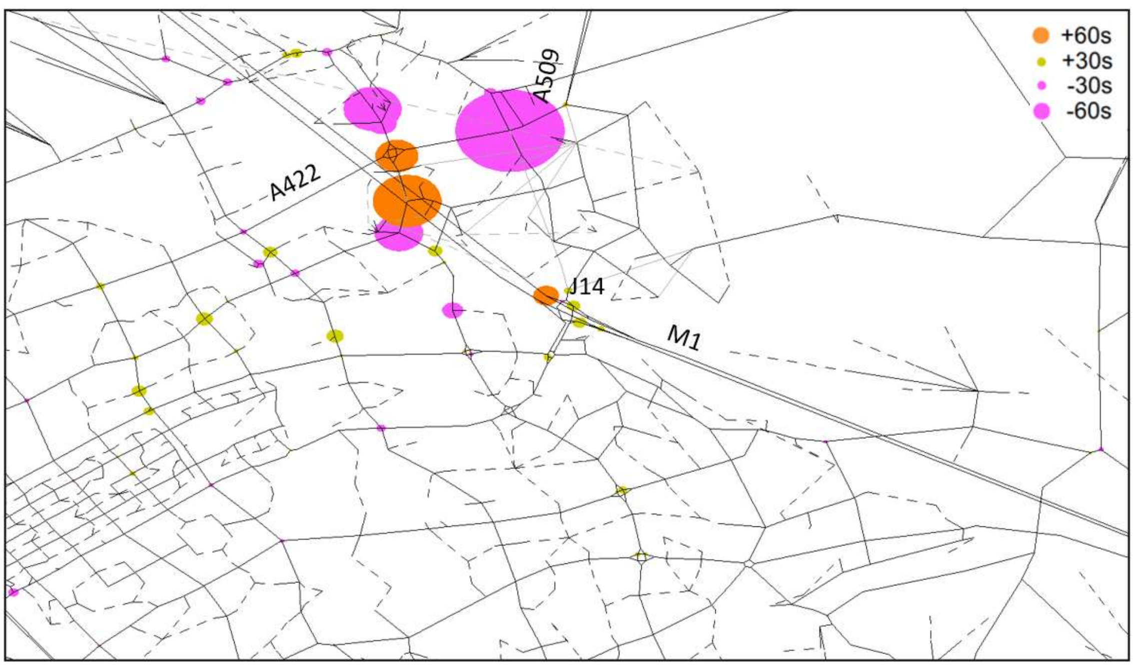

Figure 68: Change in Average Junction Delay (seconds), MKE less Reference Case 2048 AM Peak – MKE Development

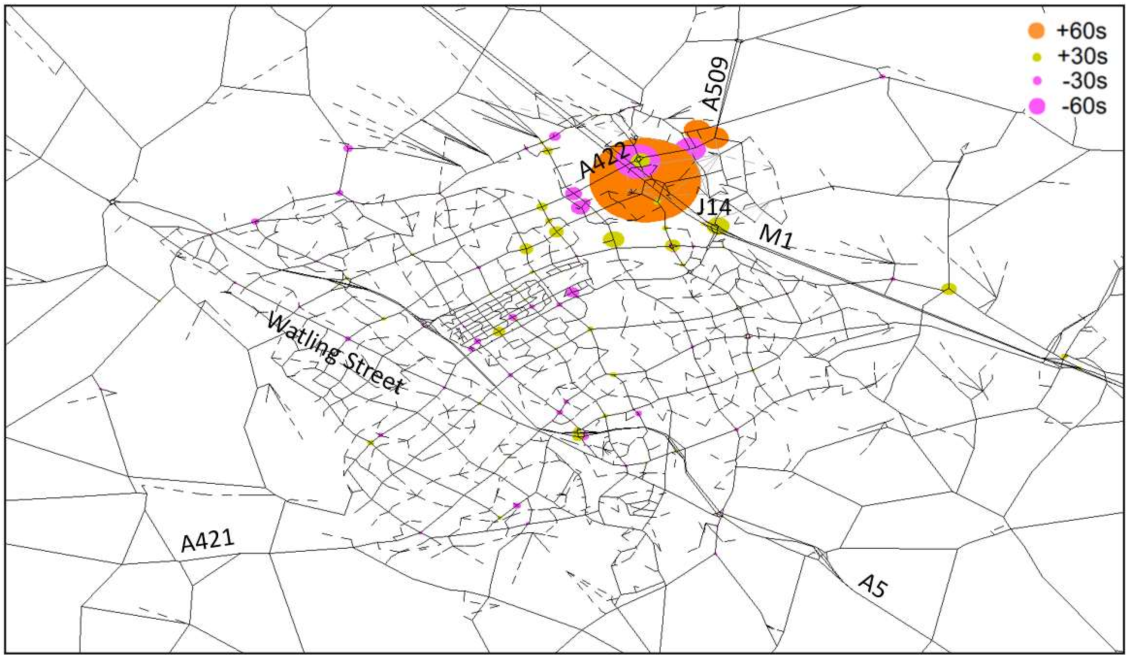

Figure 69: Change in Average Junction Delay (seconds), MKE less Reference Case 2031 PM Peak

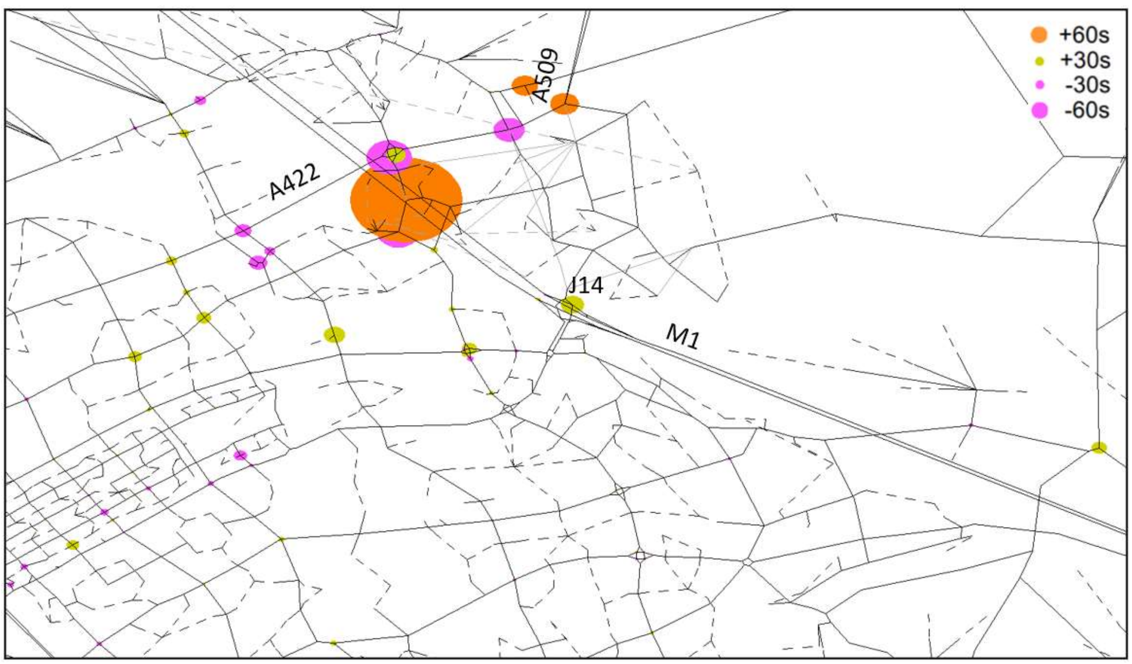

Figure 70: Change in Average Junction Delay (seconds), MKE less Reference Case 2048 PM Peak – MKE Development

5.4 Vehicle Trips Crossing the M1

5.4.1 Table 22 to Table 25 below show the total flow (PCU) travelling inbound and outbound of Milton Keynes via the A422, Willen Road, the proposed new bridge (DS only) and junction 14 on the M1 in the AM and PM peak periods in 2031 and 2048.

5.4.2 In both the AM and PM peak periods in 2031 and 2048 there is a reduction in traffic travelling towards Milton Keynes and travelling east of Milton Keynes via Willen Road.

5.4.3 In the Reference Case and Do-Something scenarios the A422 attracts the highest level of flow, followed by Willen Road in the Reference Case and the proposed new bridge in the Do-Something scenario.

5.4.4 In the Do-Something scenario there is a reduction in both the AM and PM peak periods in traffic travelling through junction 14 towards Milton Keynes. In the Do-Something AM peak period (only) there is an increase in traffic travelling towards the east of Milton Keynes in 2031 and 2048.

Time Period	Scenario	A422	Willen Road	New Bridge	J14 through Traffic	Total
AM	Ref Case	1500	1406	--------	665	**3571**
	DS	1618	808	1144	578	**4148**
	Difference	**118**	**-598**	**1144**	**-87**	**577**
PM	Ref Case	1181	657	--------	364	**2202**
	DS	1248	131	1026	259	**2664**
	Difference	**67**	**-526**	**1026**	**-105**	**462**

Table 22: Comparison of flows from East of M1 towards Milton Keynes (PCU) in 2031

Time Period	Scenario	A422	Willen Road	New Bridge	J14 through Traffic	Total
AM	Ref Case	1089	608	--------	128	**1825**
	DS	1125	265	379	298	**2067**
	Difference	**36**	**-343**	**379**	**170**	**242**
PM	Ref Case	1797	1115	--------	273	**3185**
	DS	2044	377	1263	86	**3770**
	Difference	**247**	**-738**	**1263**	**-187**	**585**

Table 23: Comparison of flows from Milton Keynes towards East of M1 (PCU) in 2031

Time Period	Scenario	A422	Willen Road	New Bridge	J14 through Traffic	Total
AM	Ref Case	1996	1180	--------	996	**4172**
	DS	2083	607	1648	795	**5133**
	Difference	**87**	**-573**	**1648**	**-201**	**961**
PM	Ref Case	1715	961	--------	471	**3147**
	DS	1706	247	1436	383	**3772**
	Difference	**-9**	**-714**	**1436**	**-88**	**625**

Table 24: Comparison of flows from East of M1 towards Milton Keynes (PCU) in 2048

Time Period	Scenario	A422	Willen Road	New Bridge	J14 through Traffic	Total
AM	Ref Case	1562	784	--------	281	**2627**
	DS	1647	220	644	799	**3310**
	Difference	**85**	**-564**	**644**	**518**	**683**
PM	Ref Case	2073	1475	--------	310	**3858**
	DS	2218	421	1576	151	**4366**
	Difference	**145**	**-1054**	**1576**	**-159**	**508**

Table 25: Comparison of flows from Milton Keynes towards East of M1 (PCU) in 2048

6. Summary

6.1.1 AECOM updated the Milton Keynes Multi-Modal Model (MKMMM) to assess the impact of the MKE development on current and proposed infrastructure.

6.1.2 The base year model has been calibrated according to TAG standards and converges to an acceptable level. The model is suitable for use in forecasting of future year scenarios.

6.1.3 The Reference Case models include all committed developments and planning data within Milton Keynes, and TEMPRO growth outside of Milton Keynes. Committed proposed infrastructure schemes are also included.

6.1.4 The ‘with MKE development’ Do-Something model includes the proposed MKE development infrastructure and trip assumptions.

6.1.5 The MKE development and the associated changes to surrounding infrastructure result in a re-routing of Milton Keynes bound trips from the east of Milton Keynes. There is a reduction in the number of trips using Willen Road to cross the M1, instead preferring to use the new M1 crossing. The impact on M1 junction 14 is minimal in terms of traffic flows and delays.

7. Sensitivity Test 1

7.1 Introduction

7.1.1 The strategic highways model outputs were used to inform a Paramics microsimulation model developed by WSP. This microsimulation model focused primarily on junction 14 of the M1, however it also included a portion of the proposed eastern parameter road (in the Do-Something scenario) and Northfield Roundabout, which lies to the south of junction 14.

7.1.2 Following a review of the Do Something outputs in comparison with the microsimulation model, it was noted by WSP that the capacity, delay time and queue lengths in the Paramics model were significantly greater.

7.1.3 Therefore, at the request of WSP, a sensitivity test has been conducted to specifically assess the wider impacts on routing as well as impacts to junction 14, including throughput and delay time per vehicle if the capacity at junction 14 is reduced.

7.1.4 The Outputs were then used to inform a second Paramics model developed by WSP.

7.1.5 The following assumptions have been agreed and modelled for the 2031 and 2048 AM peak only, in the Do-Something and Reference Case scenarios:

- M1 junction 14 - A509 Southbound Approach: Turn saturation reduced by 50%
- M1 junction 14 - A509 Northbound Approach: Turn saturation reduced by 25%

7.1.6 Although it was advised that the trip end model and variable model is run, it is not unreasonable to assume that the difference in final matrices between the core scenario and the sensitivity test would not be significant, and therefore it is reasonable to use the final demand matrix from the core scenario in this instance.

7.1.7 It must be noted that caution must be taken when using the results in conjunction with the core modelling.

7.2 Traffic Flow

7.2.1 This section compares the 2031 and 2048 Do-Something flows with those of the Reference Case, both with the reduction in turn saturation (capacity). The flow difference is plotted as bandwidths to the left side of each link by direction, with an increase in actual flow (PCU) between the Do-Something and Reference Case shown in green and a decrease in blue.

7.2.2 The general pattern of flow difference is broadly similar to the that of the core Do Something scenario, detailed in Chapter 5.

7.2.3 In the 2031 AM peak period there is an increase of approximately 250 vehicles (PCUs) in flow travelling towards Milton Keynes via the A509. There is a decrease in traffic continuing on the A422 (via Tickford Roundabout) in the AM peak period; approximately 250 vehicles (PCUs).

7.2.4 On the A422 between Marsh End Roundabout and Tickford roundabout there is a marginal increase in flow travelling away from Milton Keynes in the AM peak period in 2031; approximately 50 vehicles (PCUs) with a decrease of approximately 100 vehicles (PCUs) between Tickford roundabout and the A509.

7.2.5 In the AM peak period there is an increase in traffic travelling towards the Milton Keynes East development and a negligible decrease in traffic travelling away from the Milton Keynes East development via Newport Road. Approximately 300 vehicles (PCUs) travelling towards Milton Keynes East and approximately 5 vehicles (PCUs) less travelling eastbound, away from the Milton Keynes East Development.

7.2.6 At junction 14 of the M1 there is a moderate increase in traffic accessing the M1; approximately 60 vehicles (PCUs) southbound and 80 vehicles (PCUs) northbound.

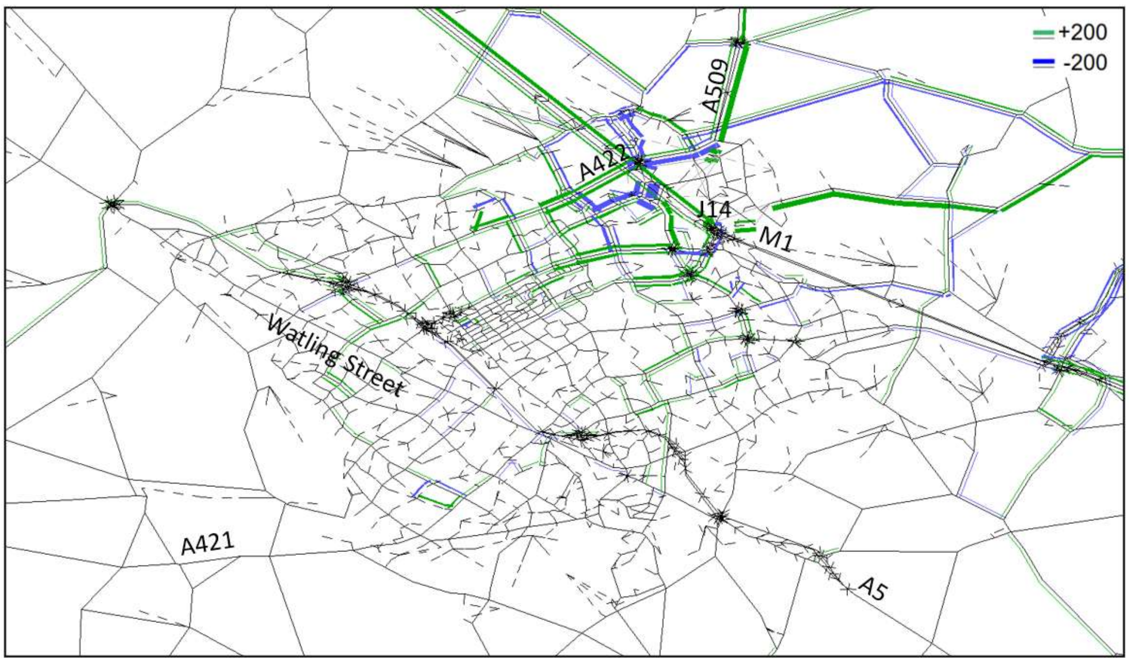

Figure 71: Sensitivity Test 1: Change in Modelled flow, MKE less Reference Case 2031 AM Peak

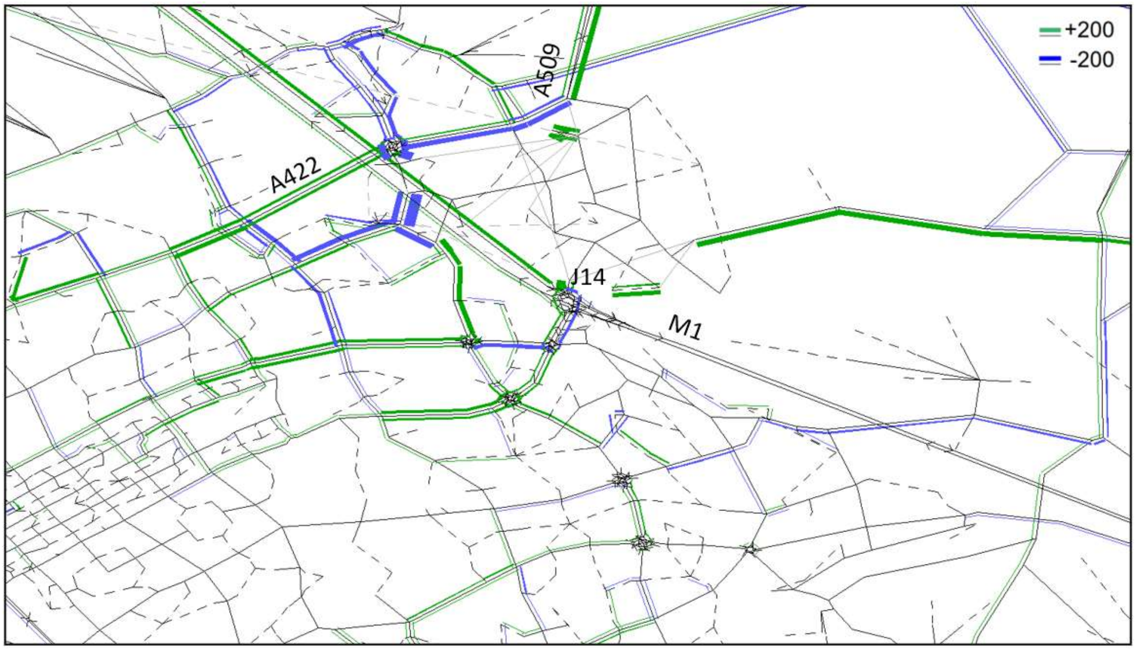

Figure 72: Sensitivity Test 1: Change in Modelled flow, MKE less Reference Case 2031 AM Peak (MKE Development Area)

7.2.7 In the 2048 AM peak period there is an increase in flow travelling towards Milton Keynes via the A509; approximately 700 vehicles (PCUs). Likewise, there is a decrease in traffic continuing on the A422 (via Tickford Roundabout) in the AM peak period; approximately 200 vehicles (PCUs).

7.2.8 On the A422 between Marsh End Roundabout and the A509 there is also a decrease in flow travelling away from Milton Keynes in the AM peak period in 2048; approximately 150 vehicles (PCUs).

7.2.9 In the AM peak period there is an increase in traffic travelling towards and away from the Milton Keynes East development via Newport Road. Approximately 380 vehicles (PCUs) travelling towards Milton Keynes and approximately 130 vehicles (PCUs) travelling eastbound, away from the Milton Keynes East Development.

7.2.10 At junction 14 of the M1 there is however a decrease in traffic accessing the M1 southbound; approximately 30 vehicles (PCUs) in the 2048 AM peak period which can be attributed to the increase in delay time.

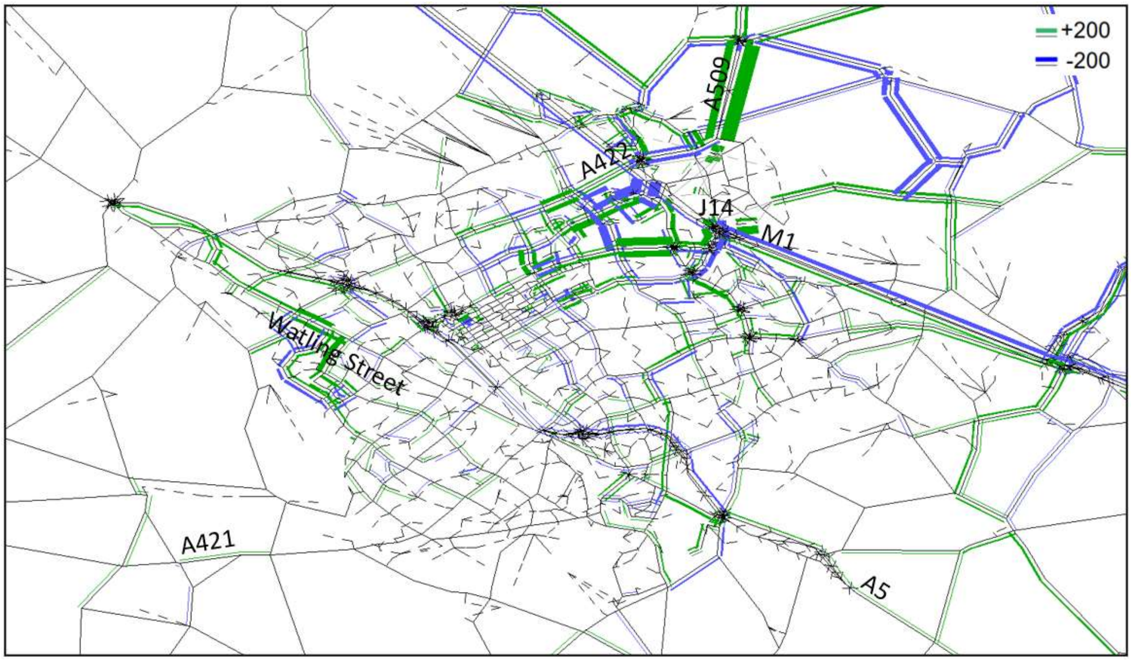

Figure 73: Sensitivity Test 1: Change in Modelled flow, MKE less Reference Case 2048 AM Peak

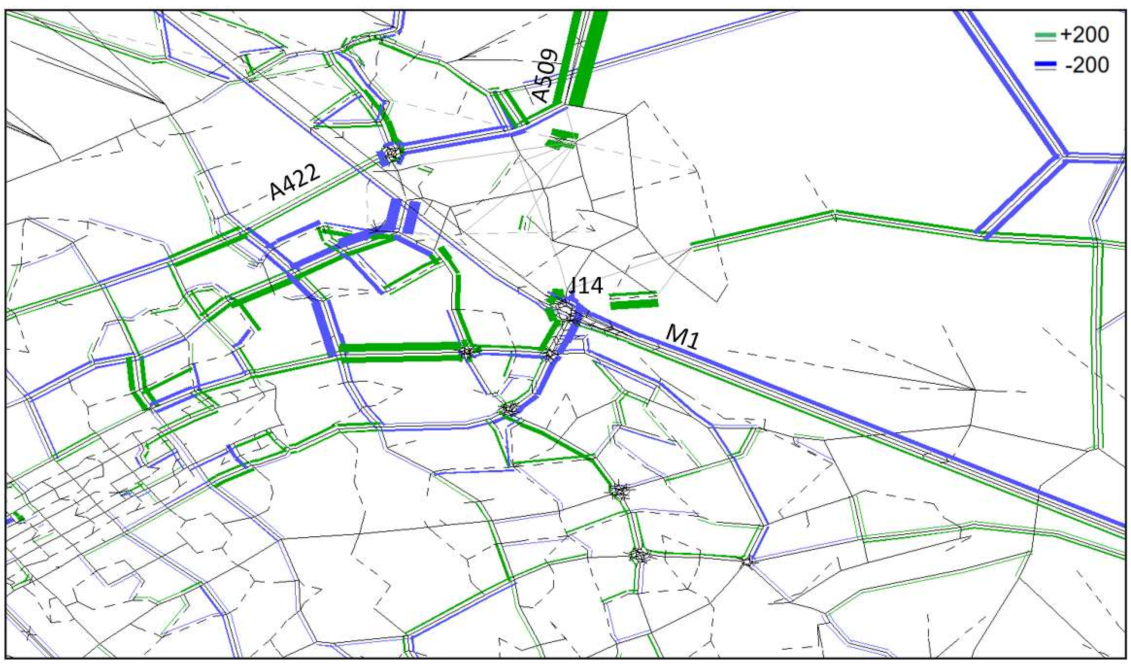

Figure 74: Sensitivity Test 1: Change in Modelled flow, MKE less Reference Case 2048 AM Peak (MKE Development Area)

7.3 Delay Differences

7.3.1 This section compares the 2031 and 2048 Do-Something delay times with those of the Reference Case, both with the reduction in turn saturation (capacity).

7.3.2 The delay difference is plotted as bandwidths, with yellow and orange denoting an increase in delay time in the Do-Something scenario and pink denoting a decrease in average delay time.

7.3.3 In 2031 AM there is a reduction in delay time of approximately 100 seconds (per vehicle) at the M1 southbound off-slip at junction 14. There is also a reduction of approximately 90 seconds (per vehicle) at the westbound approach of the Marsh End roundabout with an increase of approximately 40 seconds delay time (per vehicle) on Willen Road at the southbound approach of the Marsh End Roundabout.

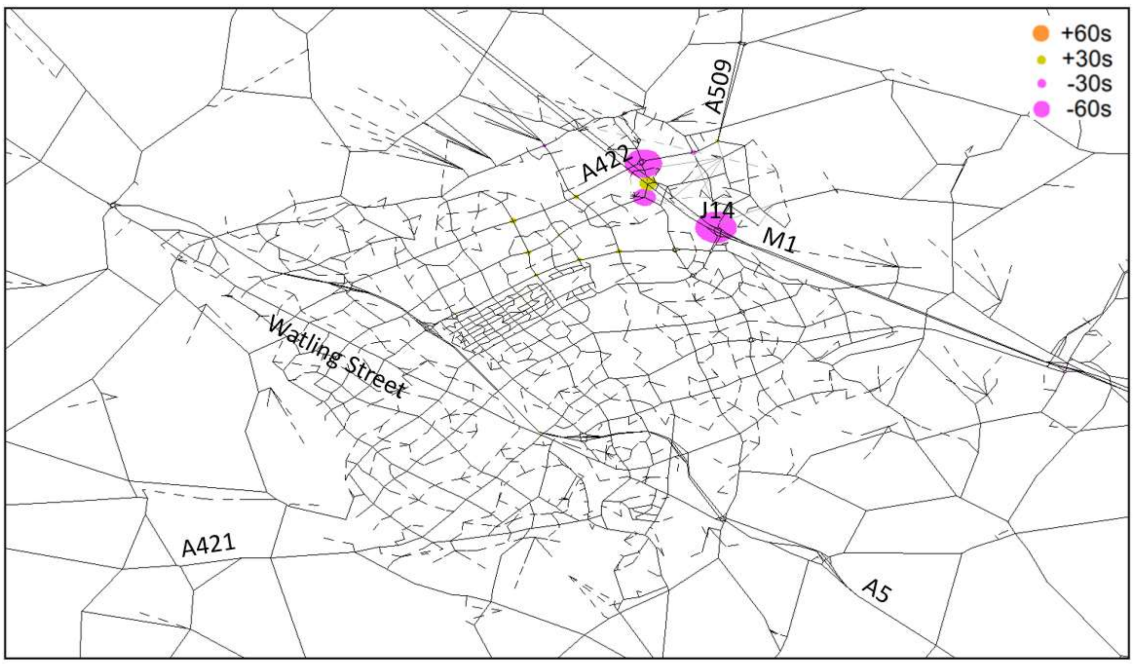

Figure 75: Sensitivity Test 1: Change in Average Junction Delay (seconds), MKE less Reference Case 2031 AM Peak

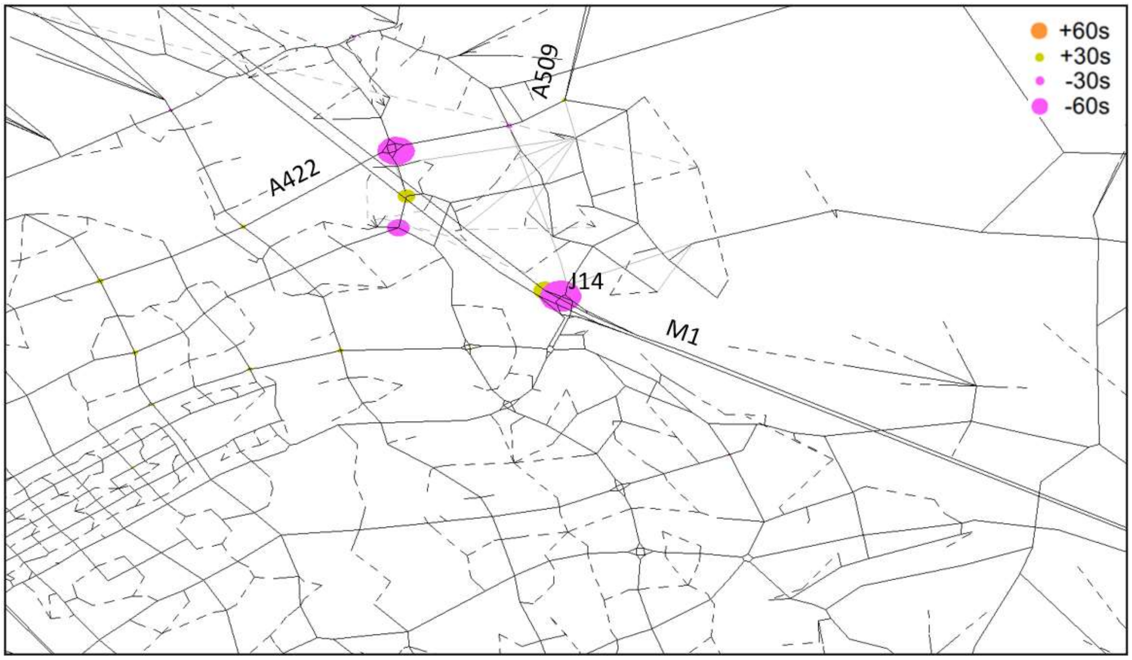

Figure 76: Sensitivity Test 1: Change in Average Junction Delay (seconds), MKE less Reference Case 2031 AM Peak – MKE Development

7.3.4 The general pattern of 2048 AM delay difference is broadly similar to the that of the core Do Something scenario, detailed in Chapter 5.

7.3.5 As expected, by reducing the turn saturation on the southbound and northbound approaches the delay time at junction 14 has increased to approximately 85 seconds on the southbound approach in 2048 AM. This can be attributed to the increased traffic approaching the circulatory from the north and giving way to vehicles accessing the M1 southbound.

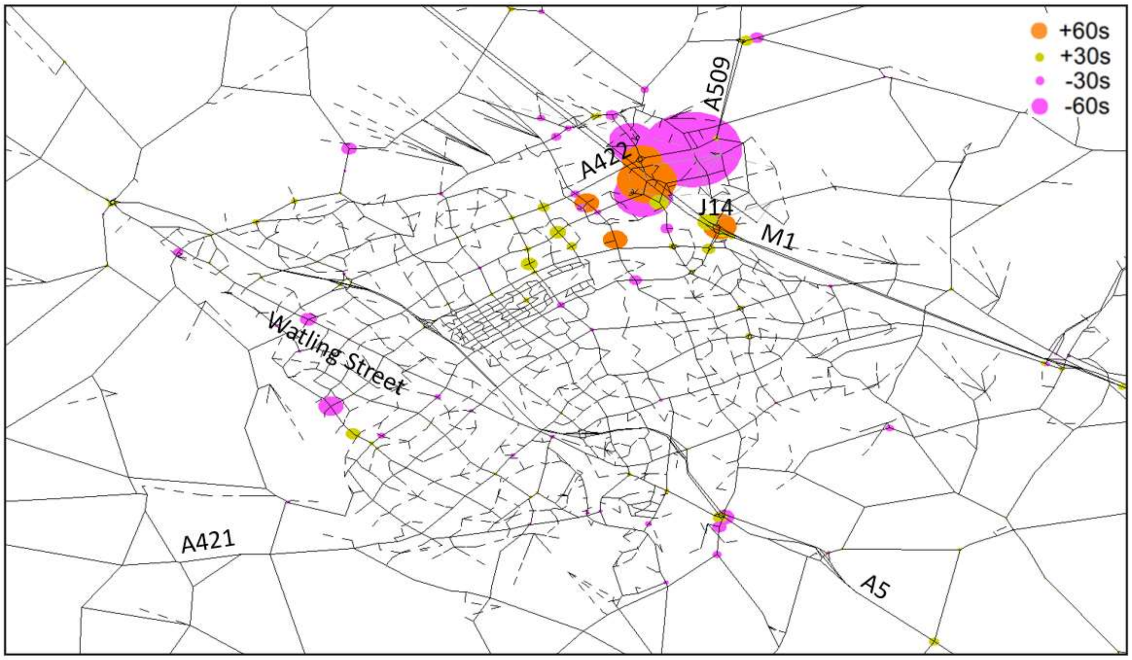

Figure 77: Sensitivity Test 1: Change in Average Junction Delay (seconds), MKE less Reference Case 2048 AM Peak

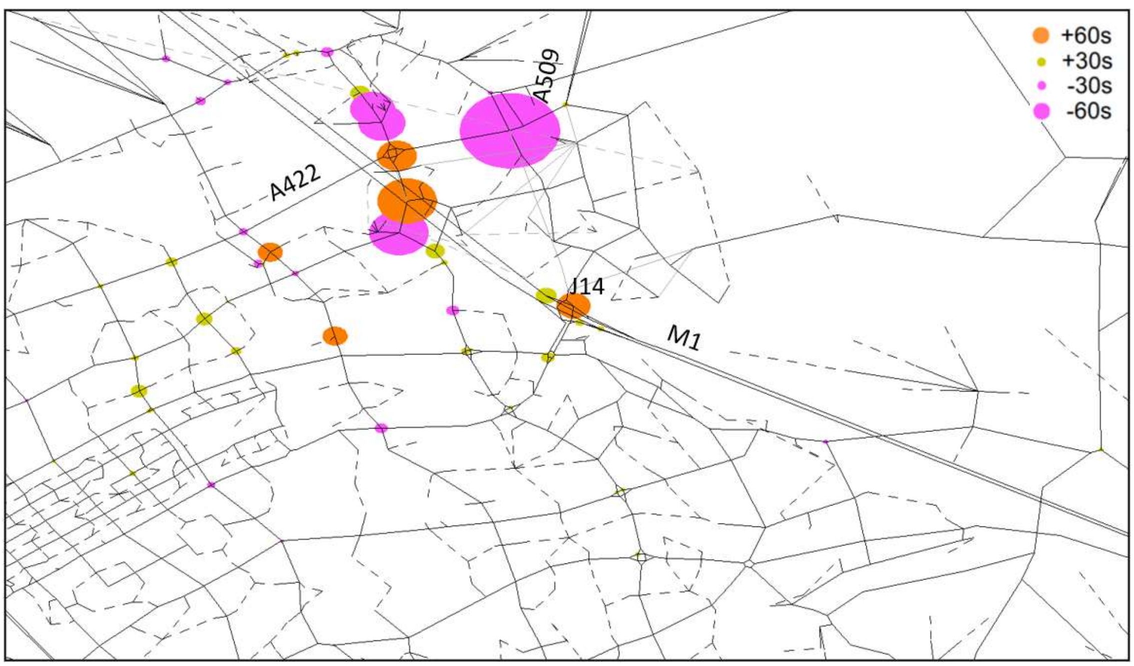

Figure 78: Sensitivity Test 1: Change in Average Junction Delay (seconds), MKE less Reference Case 2048 AM Peak – MKE Development

7.4 Vehicle Trips Crossing the M1

7.4.1 Table 26 to Table 29 below show the total flow (PCU) travelling inbound and outbound of Milton Keynes via the A422, Willen Road, the proposed new bridge (DS only) and junction 14 on the M1 in the AM peak period in 2031 and 2048.

7.4.2 In both the AM and PM peak periods in 2031 and 2048 there is a reduction in traffic travelling towards Milton Keynes and travelling east of Milton Keynes via Willen Road.

7.4.3 In the Reference Case and Do-Something scenarios the A422 attracts the highest level of flow, followed by Willen Road in the Reference Case and the proposed new bridge in the Do-Something scenario (for inbound traffic only) in both 2031 and 2048.

7.4.4 In the Do-Something AM peak period there is an increase in traffic travelling towards the east of the M1 via junction 14 in 2031 and 2048.

7.4.5 It must be noted that the reduction in turn saturation impacts mainly southbound approaching traffic, i.e. traffic travelling towards Milton Keynes, where the percentage of vehicles using junction 14 to access Milton Keynes drops from approximately 15% to 7% in the Do Something scenario. The difference in flow is then broadly redistributed via the A422, Willen Road and the New Bridge.

Time Period	Scenario	A422	Willen Road	New Bridge	J14 through Traffic	**Total**
AM	Ref Case (Mitigation 2a)	1458	1421	---------	271	**3150**
	DS (Mitigation 2a)	1606	860	1262	239	**3967**
	Difference	**148**	**-561**	**1262**	**-32**	**817**

Table 26: Comparison of flows from East of M1 towards Milton Keynes (PCU) in 2031

Time Period	Scenario	A422	Willen Road	New Bridge	J14 through Traffic	**Total**
AM	Ref Case (Mitigation 2a)	981	575	---------	146	**1702**
	DS (Mitigation 2a)	1111	294	377	295	**2077**
	Difference	**130**	**-281**	**377**	**149**	**375**

Table 27: Comparison of flows from Milton Keynes towards East of M1 (PCU) in 2031

Time Period	Scenario	A422	Willen Road	New Bridge	J14 through Traffic	**Total**
AM	Ref Case (Sensitivity Test)	1944	1174	--------	528	**3646**
	DS (Sensitivity Test)	2054	624	1733	307	**4718**
	Difference	**110**	**-550**	**1733**	**-221**	**1072**

Table 28: Comparison of flows from East of M1 towards Milton Keynes (PCU) in 2048

Time Period	Scenario	A422	Willen Road	New Bridge	J14 through Traffic	**Total**
AM	Ref Case (Sensitivity Test)	1497	689	--------	219	**2405**
	DS (Sensitivity Test)	1612	216	547	839	**3214**
	Difference	**115**	**-473**	**547**	**620**	**809**

Table 29: Comparison of flows from Milton Keynes towards East of M1 (PCU) in 2048

7.5 Sensitivity Test 1 Summary

7.5.1 The reduction in turn saturation has a relatively negligible impact on traffic travelling towards the east of the M1 in the 2048 AM peak period.

7.5.2 Traffic travelling across junction 14 towards Milton Keynes centre is reduced by approximately 50%, with flow redistributing across the A422, Willen Road and the New Bridge. It must be noted that flow is also redistributed in the Reference Case when reducing the turn saturation.

7.5.3 There is some redistribution of flows travelling on the local roads to the west of the eastern parameter road, however these are negligible.

7.5.4 Delay times (per vehicle) is increased at junction 14 for southbound approaching traffic on the A509 in both the Reference Case and Do-Something.

8. Sensitivity Test 2

8.1 Introduction

8.1.1 Following discussions with Highways England, WSP requested that a second sensitivity test is completed, focused on testing the impact of the full development in the Local Plan period of 2031.

8.1.2 WSP have requested that the trip ends (provided) and demand/infrastructure assumptions used for the 2048 DS are used in conjunction with the 2031 DM matrices, to produce a basic set of demand matrices.

8.1.3 Although it was advised that the trip end model and variable model is run, it is not unreasonable to assume that the difference in final matrices between the two methodologies would not be significant, and therefore the results of the demand used in the Sensitivity Test is reasonable.

8.1.4 The following assumptions have been agreed and modelled for the 2031 AM and PM peak:

A. 2031 DS Alt (Full Dev Demand) with Core Network
B. 2031 DS Alt (Full Dev Demand) with Sensitivity Test 1 Network

8.2 Traffic Flow

8.2.1 This section compares the 2031 (with Full Development) Do-Something flows with those of the core Reference Case in Test 2a and Sensitivity Test 1 Reference Case scenario in Test 2b.

8.2.2 Test 2a is completed using the core network and Test 2b using the Sensitivity Test1 network.

8.2.3 The flow difference is plotted as bandwidths to the left side of each link by direction, with an increase in actual flow (PCU) between the Do-Something and Reference Case shown in green and a decrease in blue.

Test 2a

8.2.4 In the 2031 AM peak period there is an increase of approximately 360 vehicles (PCUs) in flow travelling towards Milton Keynes via the A509. There is a decrease in traffic continuing on the A422 (via Tickford Roundabout) in the AM peak period; approximately 350 vehicles (PCUs).

8.2.5 In the 2031 PM peak period there is a marginal decrease of approximately 90 vehicles (PCUs) travelling towards Milton Keynes via the A509 and an increase of approximately 500 vehicles (PCUs) travelling northbound on the A509, away from Milton Keynes.

8.2.6 On the A422 between Marsh End Roundabout and Tickford roundabout there is a marginal decrease in flow travelling away from Milton Keynes in the AM peak period; approximately 10 vehicles (PCUs) with an increase of approximately 5 vehicles (PCUs) between Tickford roundabout and the A509.

8.2.7 In the PM peak period, there is a decrease of approximately 280 vehicles (PCUs) travelling between Marsh End Roundabout and Tickford roundabout, with an increase of approximately 160 vehicles (PCUs) between Tickford roundabout and the A509.

8.2.8 At junction 14 of the M1 there is an increase in traffic accessing the M1; approximately 200 vehicles (PCUs) southbound and 360 vehicles (PCUs) northbound in the AM peak period.

8.2.9 In the PM peak period, there is a marginal increase of approximately 40 vehicles (PCUs) southbound and a marginal decrease in approximately 80 vehicles (PCUs) northbound.

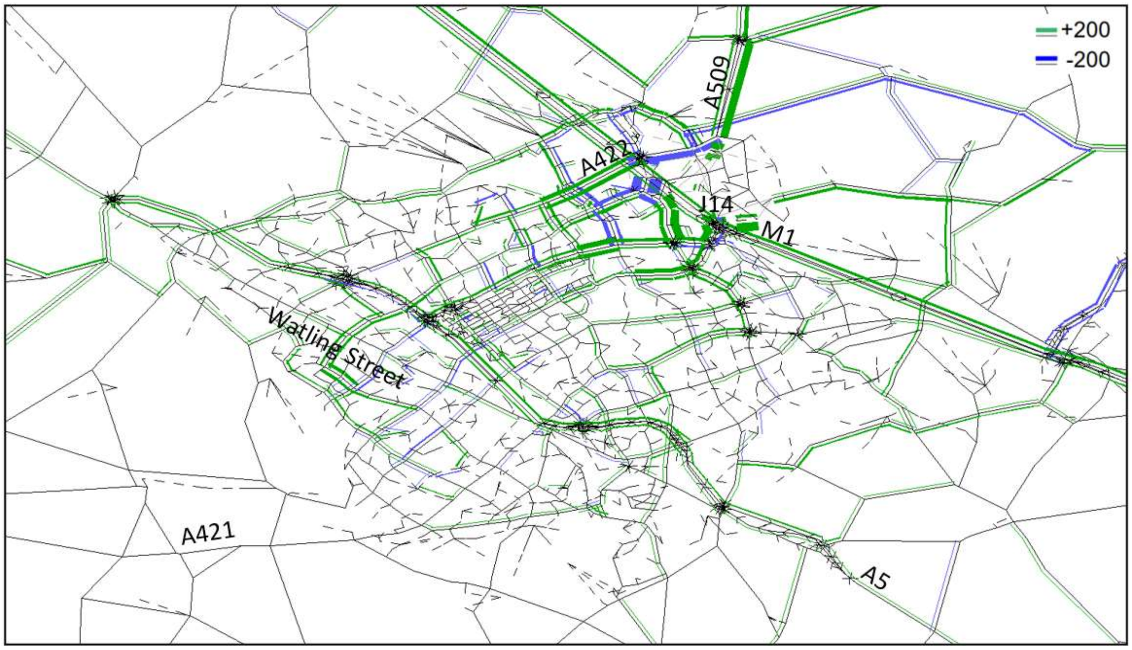

Figure 79: Sensitivity Test 2a: Change in Modelled flow, MKE less Core Reference Case 2031 AM Peak

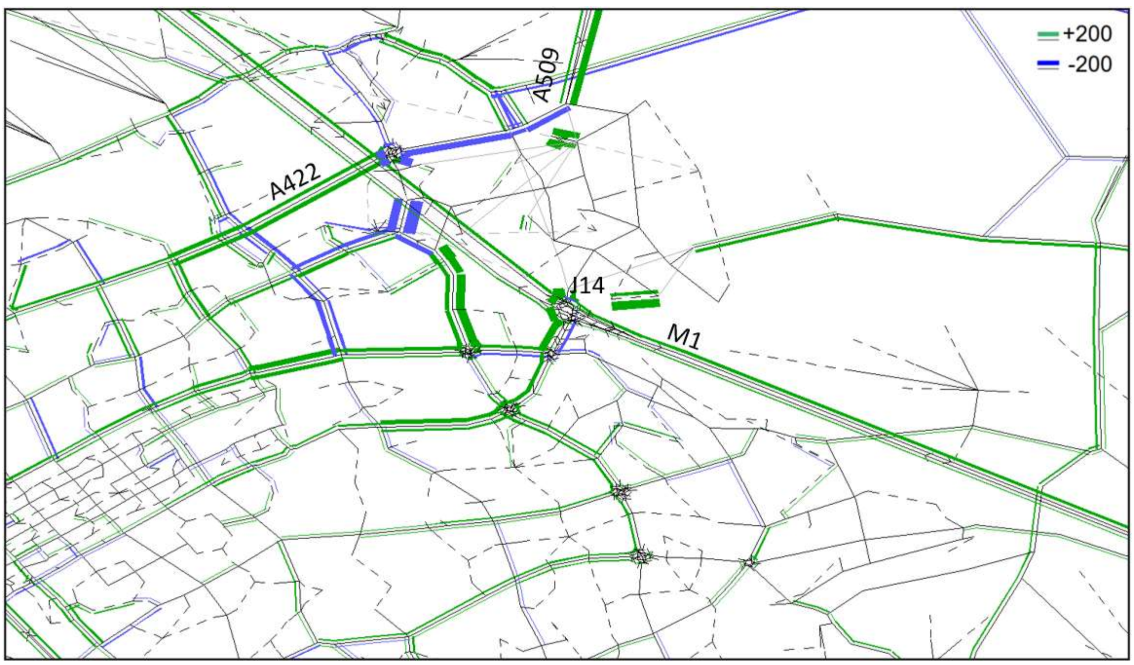

Figure 80: Sensitivity Test 2b: Change in Modelled flow, MKE less Core Reference Case 2031 AM Peak (MKE Development Area)

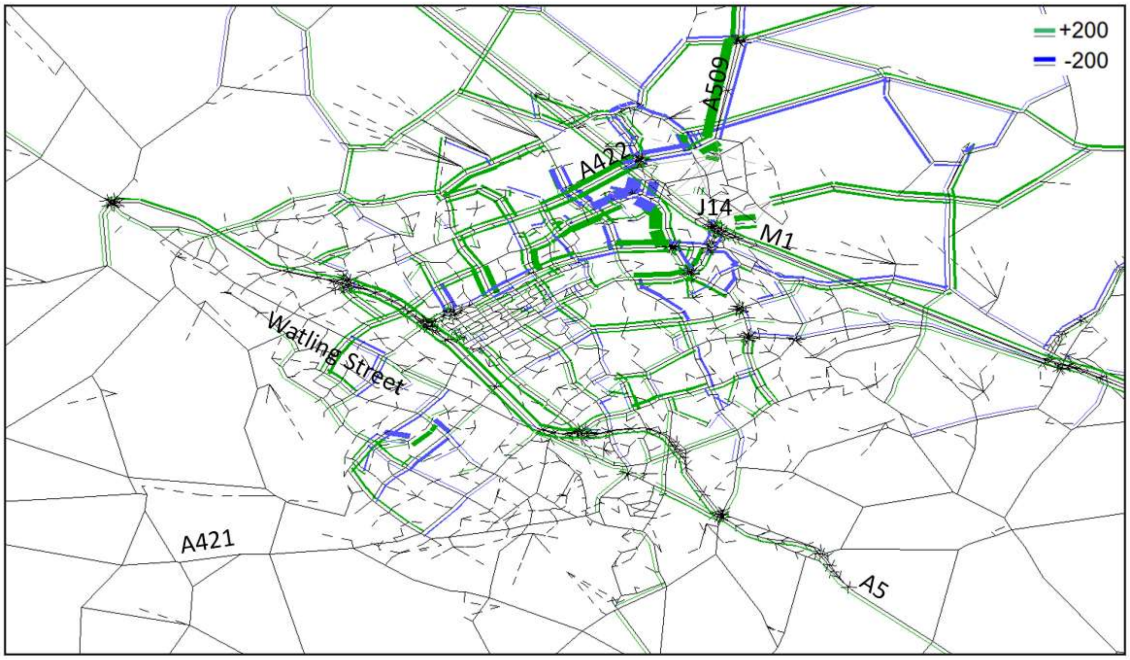

Figure 81: Sensitivity Test 2a: Change in Modelled flow, MKE less Core Reference Case 2031 PM Peak

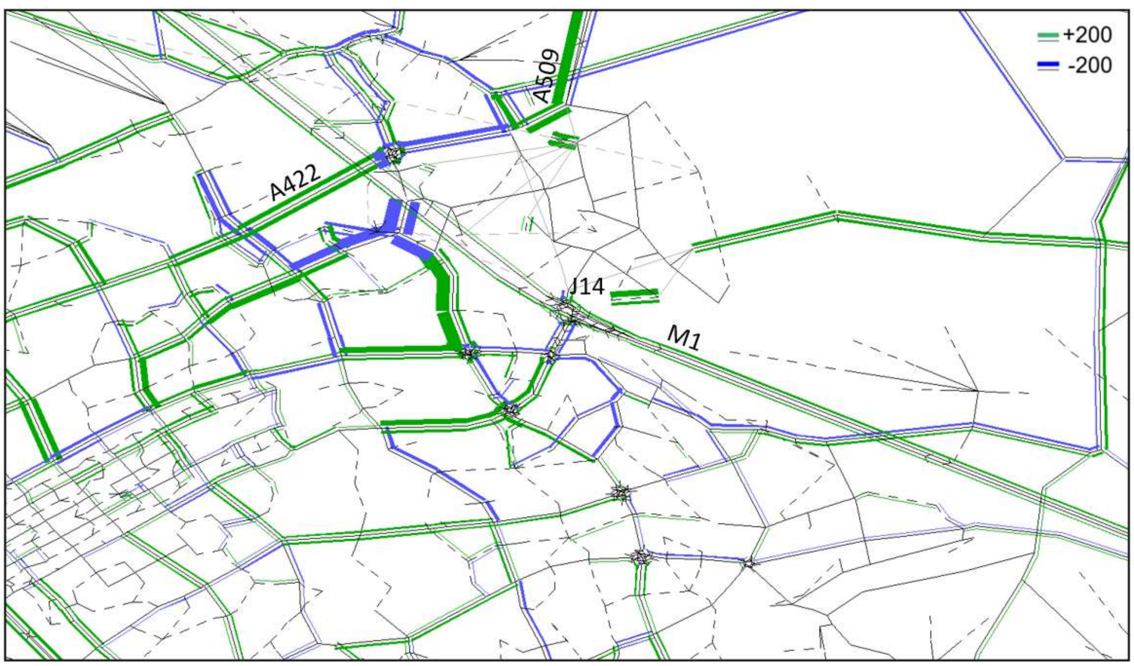

Figure 82: Sensitivity Test 2b: Change in Modelled flow, MKE less Core Reference Case 2031 PM Peak (MKE Development Area)

Test 2b

8.2.10 The general pattern of flow difference is broadly similar to that of Test 2a, detailed above.

8.2.11 In the 2031 AM peak period there is an increase of approximately 190 vehicles (PCUs) in flow travelling towards Milton Keynes via the A509, with a decrease in traffic continuing on the A422 (via Tickford Roundabout); approximately 330 vehicles (PCUs).

8.2.12 In the 2031 PM peak period there is a marginal decrease of approximately 70 vehicles (PCUs) travelling towards Milton Keynes via the A509 and an increase of approximately 450 vehicles (PCUs) travelling northbound on the A509, away from Milton Keynes.

8.2.13 On the A422 between Marsh End Roundabout and Tickford roundabout there is an increase in flow travelling away from Milton Keynes in the AM peak period; approximately 210 vehicles (PCUs) with a decrease of approximately 50 vehicles (PCUs) between Tickford roundabout and the A509.

8.2.14 In the PM peak period, there is a decrease of approximately 350 vehicles (PCUs) travelling between Marsh End Roundabout and Tickford roundabout, with an increase of approximately 100 vehicles (PCUs) between Tickford roundabout and the A509.

8.2.15 In both the AM and PM peak periods there is an increase in traffic travelling towards and away from the Milton Keynes East via Newport Road. Approximately 350 vehicles (PCUs) in the AM peak period and approximately 170 vehicles (PCUs) in the PM peak period travelling towards Milton Keynes East; and approximately 40 vehicles (PCUs) in the AM peak period and approximately 180 vehicles (PCUs) in the PM peak period travelling eastbound, away from the Milton Keynes East development.

8.2.16 At junction 14 of the M1 there is an increase in traffic accessing the M1; approximately 120 vehicles (PCUs) southbound and 250 vehicles (PCUs) northbound in the AM peak period.

8.2.17 In the PM peak period, there is a marginal increase of approximately 10 vehicles (PCUs) approaching southbound and a decrease in approximately 100 vehicles (PCUs) approaching northbound.

8.2.18 It can be expected that junction 14 would experience a reduction in traffic passing through via the A509 northbound and southbound approach due to the reduction in effective capacity.

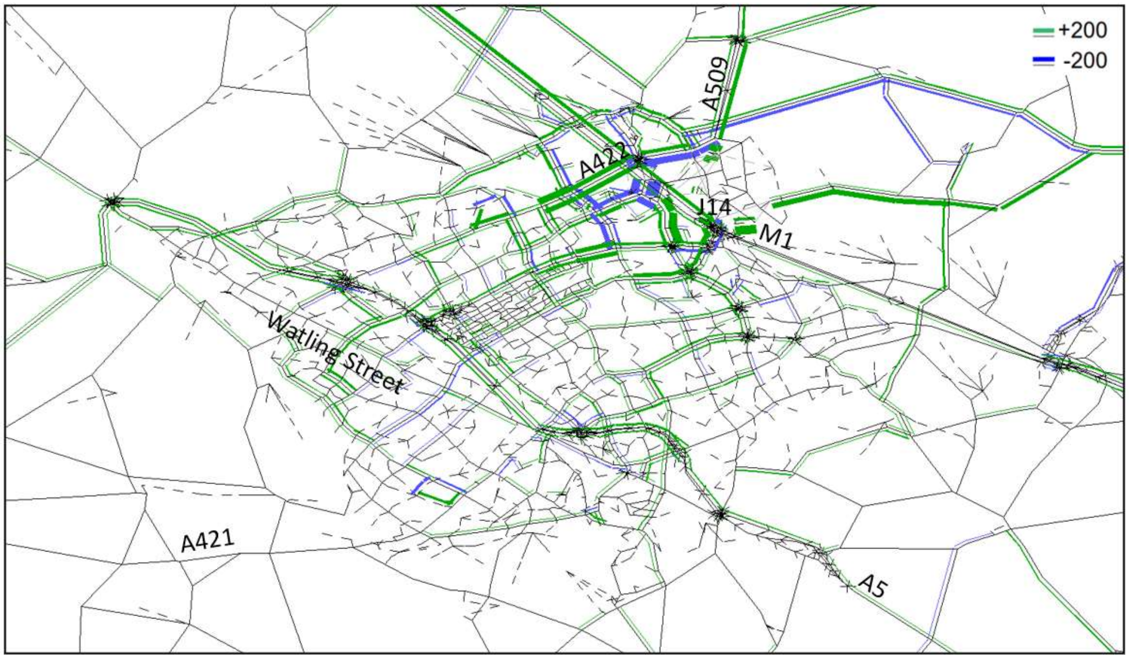

Figure 83: Sensitivity Test 2b: Change in Modelled flow, MKE less Sensitivity Test 1 Reference Case 2031 AM Peak

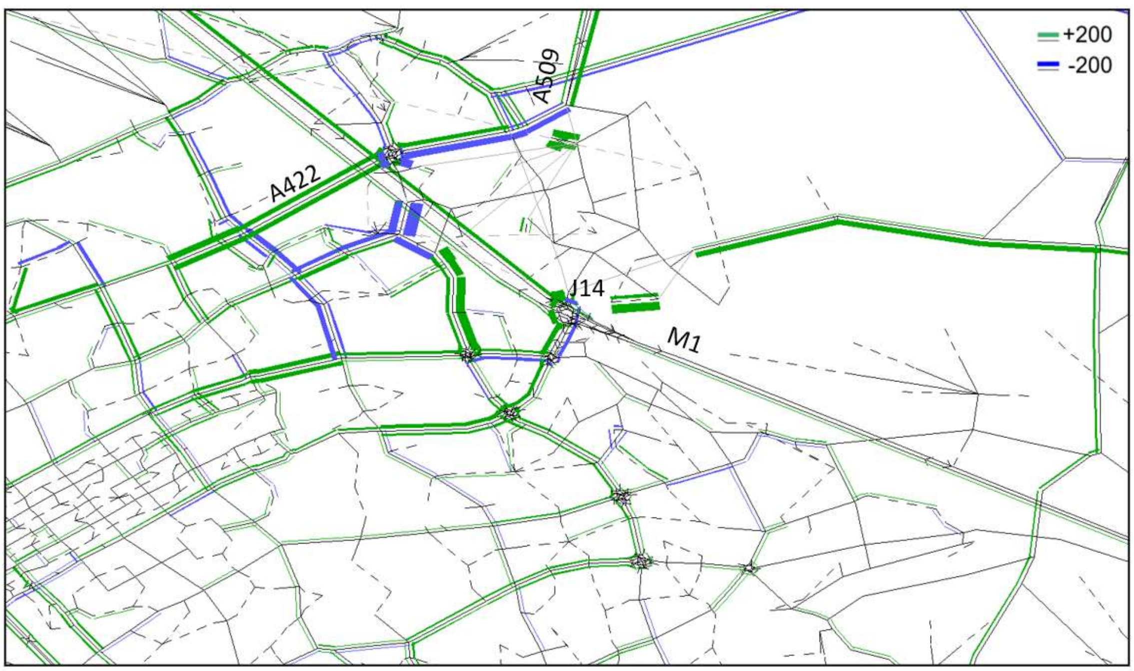

Figure 84: Sensitivity Test 2b: Change in Modelled flow, MKE less Sensitivity Test 1 Reference Case 2031 AM Peak (MKE Development Area)

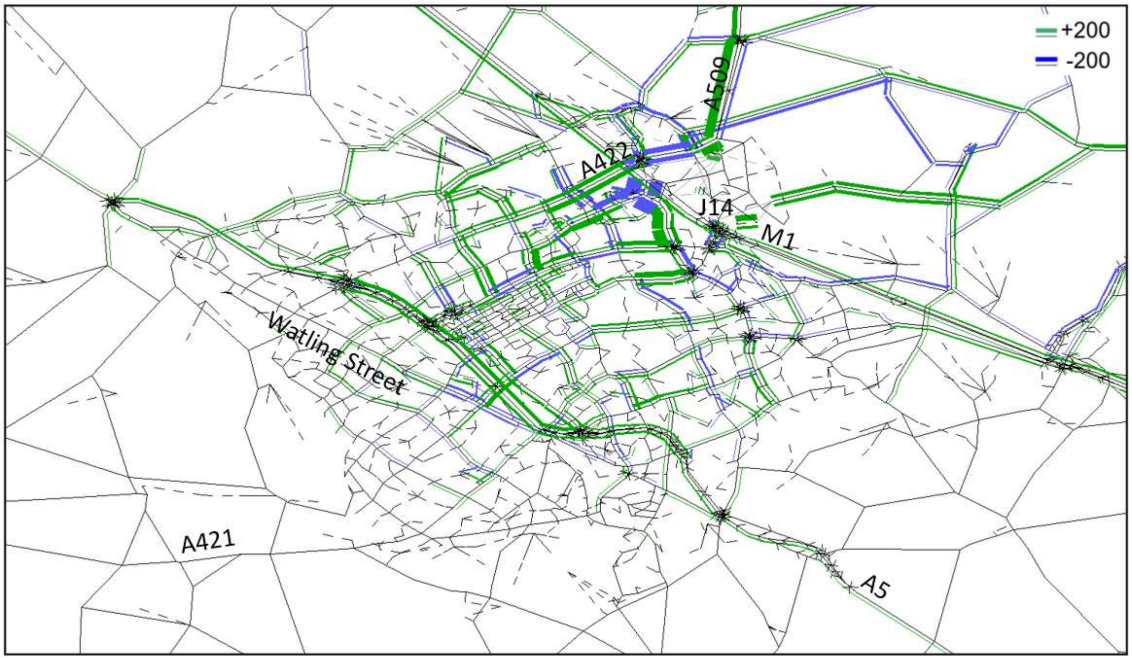

Figure 85: Sensitivity Test 2b: Change in Modelled flow, MKE less Sensitivity Test 1 Reference Case 2031 PM Peak

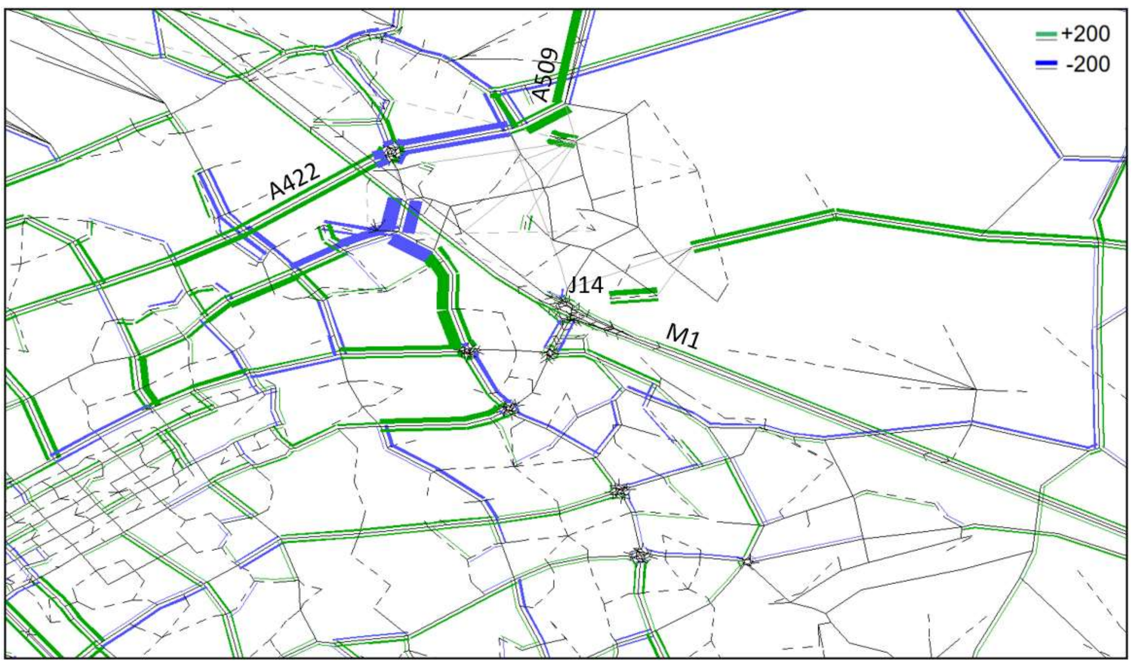

Figure 86: Sensitivity Test 2b: Change in Modelled flow, MKE less Sensitivity Test 1 Reference Case 2031 PM Peak (MKE Development Area)

8.3 Delay Differences

8.3.1 This section compares the Do-Something average junction delay times (per vehicle) with those of the Reference Case for both Test 2a and 2b. The delay difference is plotted as bandwidths, with yellow and orange denoting an increase in delay time in the Do-Something scenario and pink denoting a decrease in average delay time.

Test 2a

8.3.2 In the 2031 Do-Something scenario in both the AM and PM peak periods there is an approximate 60 second reduction in delay (per vehicle) at Tickford Roundabout. In the AM peak there is also a reduction of approximately 60 seconds (per vehicle) at the southbound approach on the Marsh End Roundabout and approximately 30 seconds (per vehicle) at Tongwell Roundabout.

8.3.3 In the 2031 PM peak period there is an increase in delay time at Marsh End Roundabout; approximately 30 seconds (per vehicle) at the eastbound approach.

8.3.4 There is an increase in delay time of approximately 30 seconds (per vehicle) at both the northbound and southbound off-slips at junction 14 of the M1. In the PM peak period, there is also an increase of approximately 60 seconds at the A509 southbound approach.

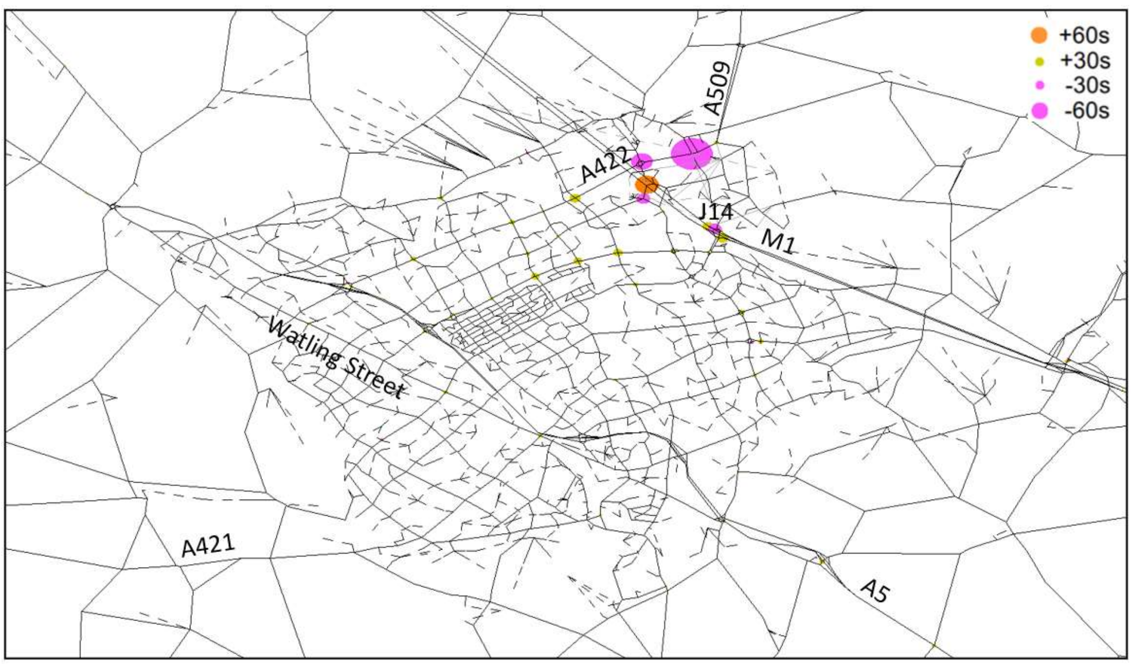

Figure 87: Sensitivity Test 2a: Change in Average Junction Delay (seconds), MKE less Reference Case 2031 AM Peak

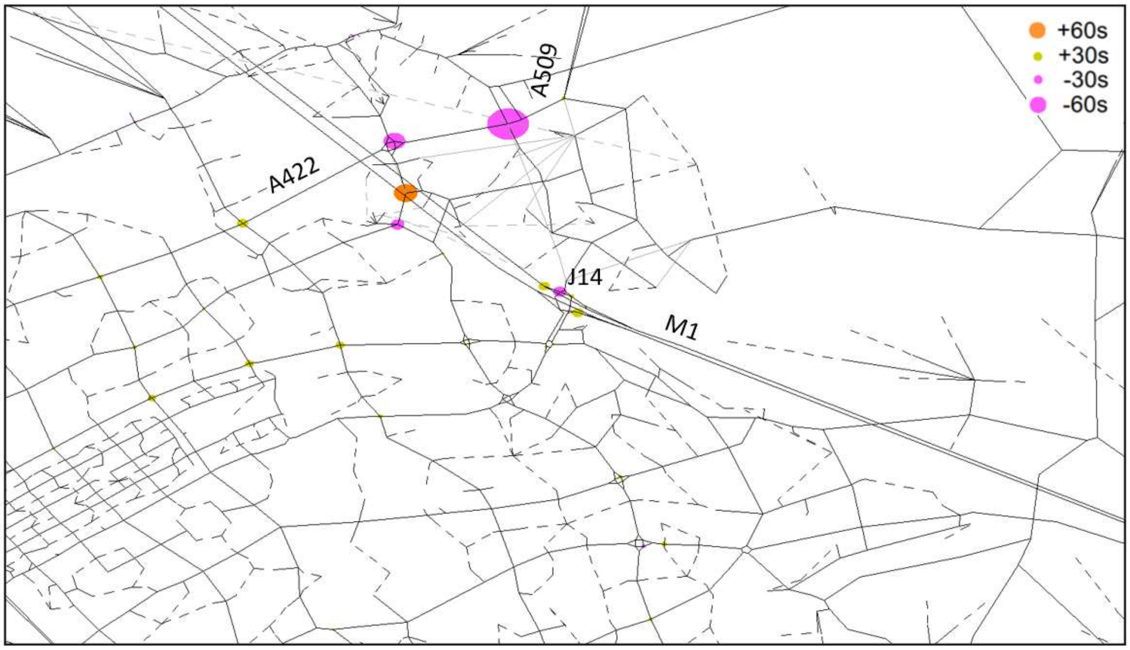

Figure 88: Sensitivity Test 2a: Change in Average Junction Delay (seconds), MKE less Reference Case 2031 AM Peak (MKE Development)

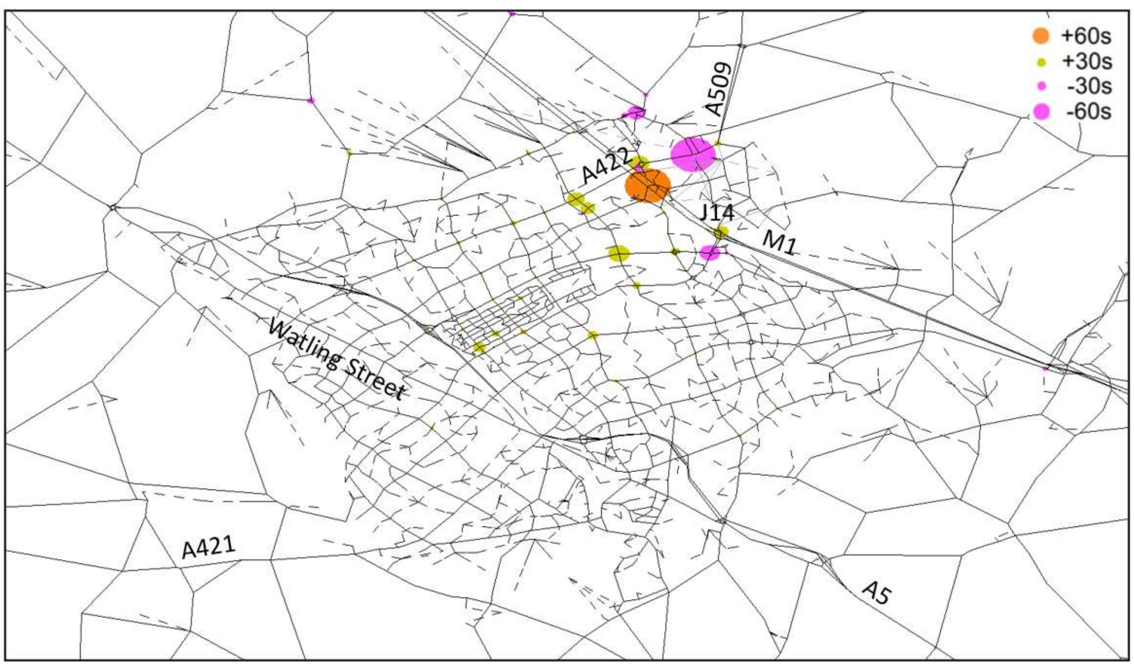

Figure 89: Sensitivity Test 2a: Change in Average Junction Delay (seconds), MKE less Reference Case 2031 PM Peak

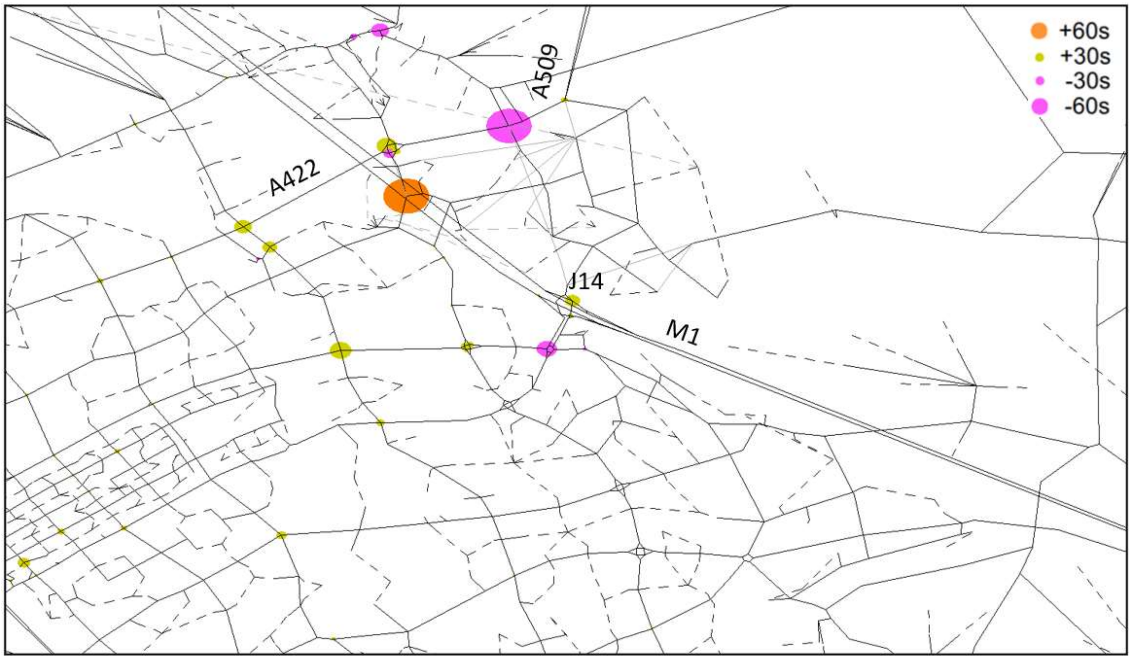

Figure 90: Sensitivity Test 2a: Change in Average Junction Delay (seconds), MKE less Reference Case 2031 PM Peak (MKE Development)

Test 2b

8.3.5 The general pattern of 2048 AM delay difference is broadly similar to the that of the core Test 2a, detailed above.

8.3.6 In 2031 AM there is a reduction in delay time of approximately 100 seconds (per vehicle) at the M1 southbound off-slip at junction 14. There is also a reduction of approximately 90 seconds (per vehicle) at the westbound approach of the Marsh End roundabout with an increase of approximately 40 seconds delay time (per vehicle) on Willen Road at the southbound approach of the Marsh End Roundabout.

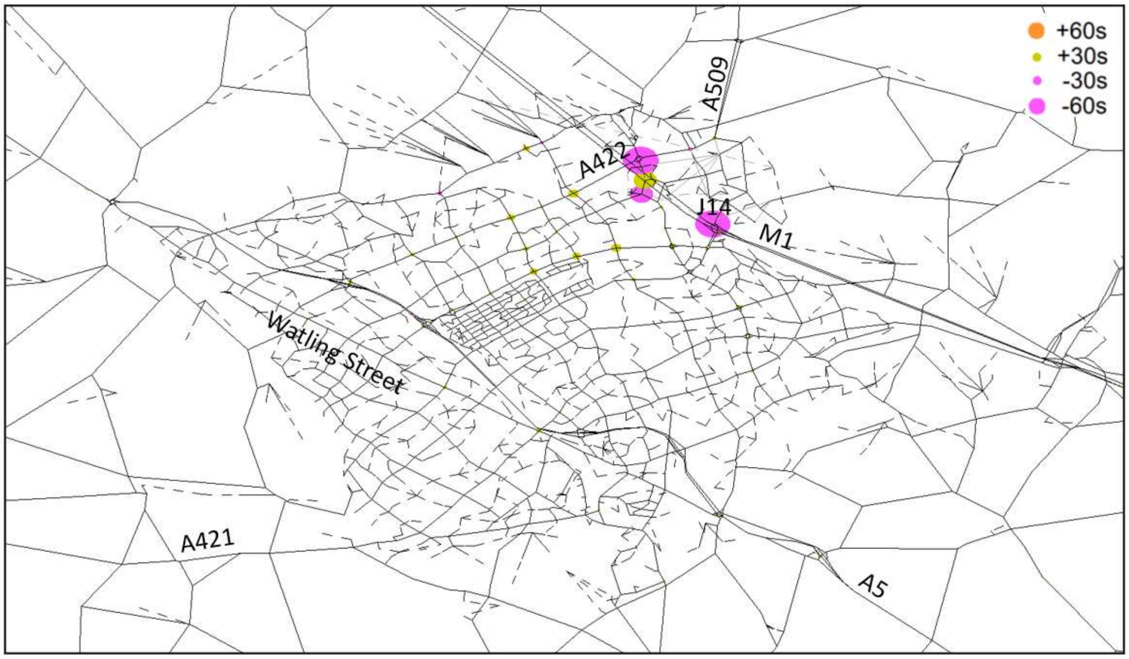

Figure 91: Sensitivity Test 2b: Change in Average Junction Delay (seconds), MKE less Reference Case 2031 AM Peak

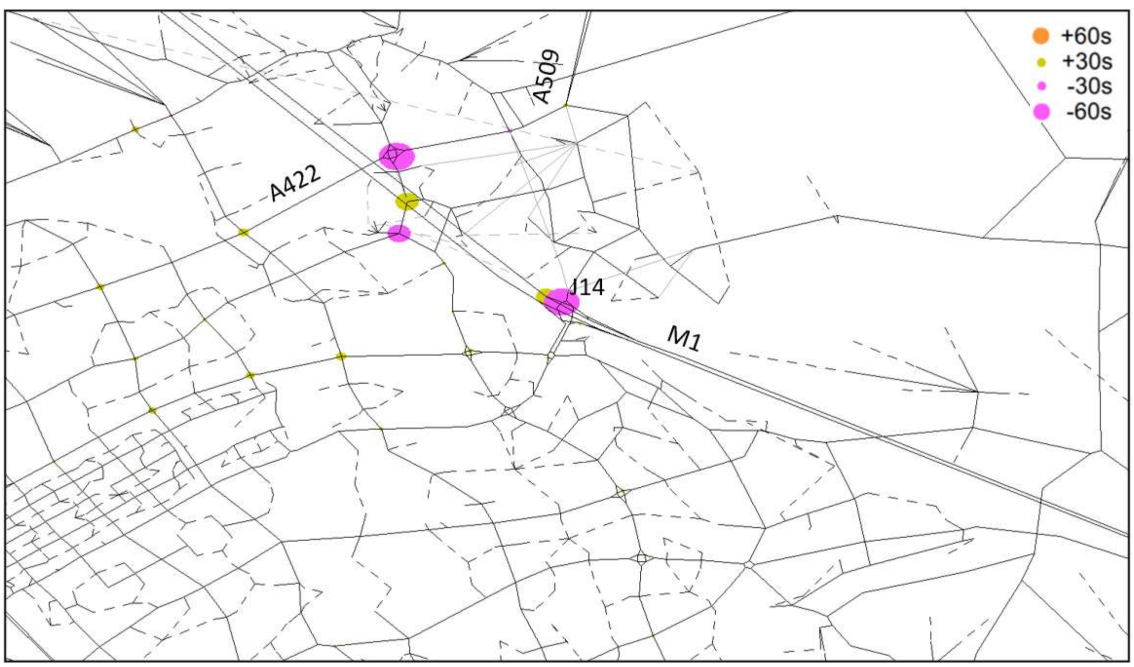

Figure 92: Sensitivity Test 2b: Change in Average Junction Delay (seconds), MKE less Reference Case 2031 AM Peak (MKE Development)

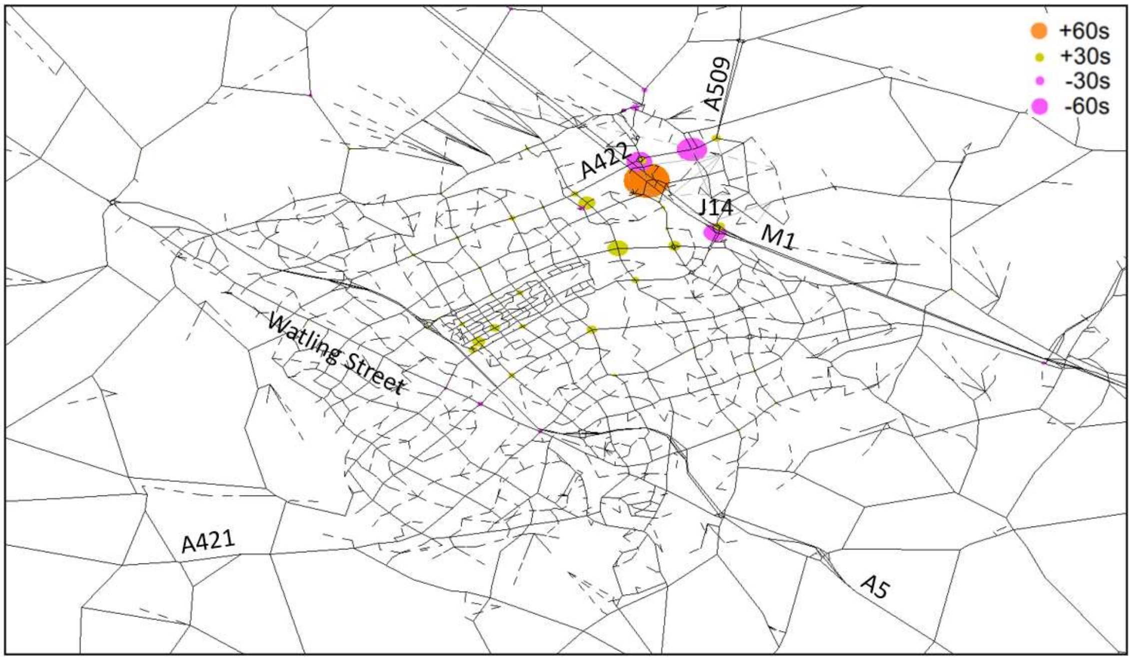

Figure 93: Sensitivity Test 2b: Change in Average Junction Delay (seconds), MKE less Reference Case 2031 PM Peak

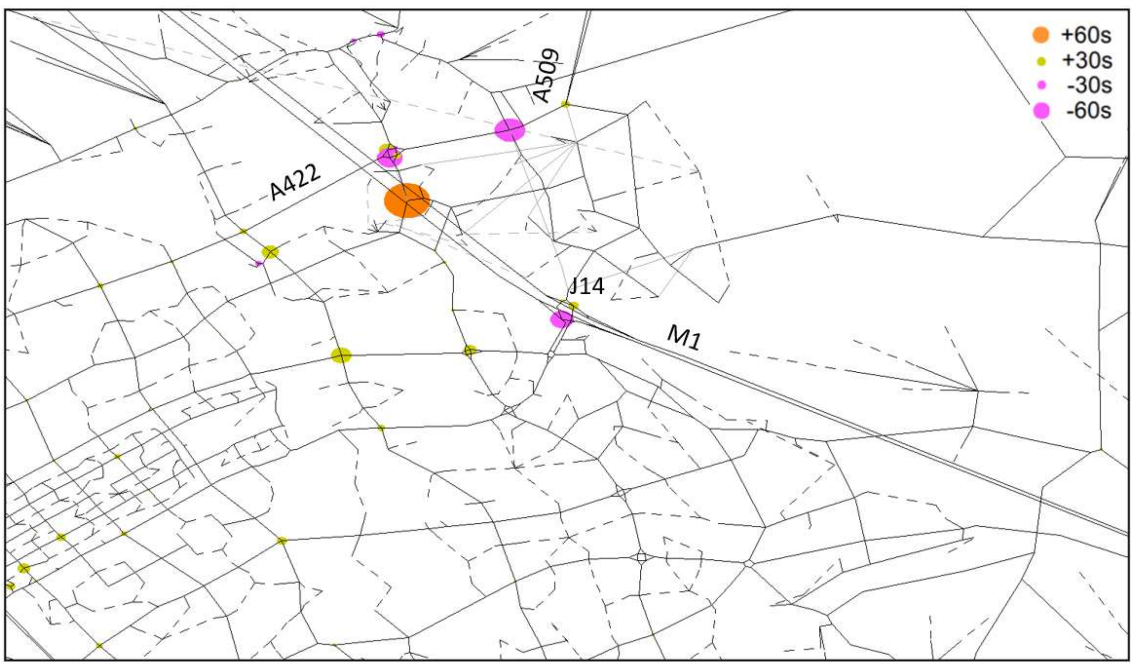

Figure 94: Sensitivity Test 2b: Change in Average Junction Delay (seconds), MKE less Reference Case 2031 PM Peak (MKE Development)

8.4 Vehicle Trips Crossing the M1

8.4.1 Table 30 to Table 33 below show the total flow (PCU) travelling inbound and outbound of Milton Keynes via the A422, Willen Road, the proposed new bridge (DS only) and junction 14 on the M1 in the 2031 AM and PM peak periods for both Test 2a and 2b.

8.4.2 In both the AM and PM peak periods in Test 2a and 2b there is a reduction in traffic travelling towards Milton Keynes and travelling east of Milton Keynes via Willen Road.

8.4.3 In the Reference Case and Do-Something scenarios the A422 attracts the highest level of flow, followed by Willen Road in the Reference Case and the proposed new bridge in the Do-Something scenario (for inbound traffic only).

8.4.4 In the Do-Something AM peak period in both Test 2a and 2b there is an increase in traffic travelling east of Milton Keynes via junction 14, approximately 50% of which is travelling into the south of the MKE development in Test 2a and 2b.

Time Period	Scenario	A422	Willen Road	New Bridge	J14 through Traffic	**Total**
AM	Ref Case (Core)	1500	1406	--------	665	**3571**
	DS (Sensitivity Test 2a)	1730	791	1337	599	4457
	Difference	**230**	**-615**	**1337**	**-66**	**886**
PM	Ref Case (Core)	1181	657	--------	364	**2202**
	DS (Sensitivity Test 2a)	1426	185	1164	284	3059
	Difference	**245**	**-472**	**1164**	**-80**	**857**

Table 30: Sensitivity Test 2a: Comparison of flows from East of M1 towards Milton Keynes (PCU) in 2031

Time Period	Scenario	A422	Willen Road	New Bridge	J14 through Traffic	**Total**
AM	Ref Case (Core)	1089	608	--------	128	**1825**
	DS (Sensitivity Test 2a)	1270	167	543	547	2527
	Difference	**181**	**-441**	**543**	**419**	**702**
PM	Ref Case (Core)	1797	1115	--------	273	**3185**
	DS (Sensitivity Test 2a)	2084	393	1356	149	3982
	Difference	**287**	**-722**	**1356**	**-124**	**797**

Table 31: Sensitivity Test 2a: Comparison of flows from Milton Keynes towards East of M1 (PCU) in 2031

Time Period	Scenario	A422	Willen Road	New Bridge	J14 through Traffic	**Total**
AM	Ref Case (Sensitivity Test 1)	1458	1421	--------	271	**3150**
	DS (Sensitivity Test 2b With Sensitivity Test 1 Network)	1729	794	1474	251	4248
	Difference	**271**	**-627**	**1474**	**-20**	**1098**
PM	Ref Case (Sensitivity Test 1)	1203	818	--------	172	**2193**
	DS (Sensitivity Test 2b With Sensitivity Test 1 Network)	1455	191	1386	84	3116
	Difference	**252**	**-627**	**1386**	**-88**	**923**

Table 32: Sensitivity Test 2b: Comparison of flows from East of M1 towards Milton Keynes (PCU) in 2031

Time Period	Scenario	A422	Willen Road	New Bridge	J14 through Traffic	**Total**
AM	Ref Case (Sensitivity Test 1)	981	575	--------	146	**1702**
	DS (Sensitivity Test 2b With Sensitivity Test 1 Network)	1247	173	173	541	2134
	Difference	**266**	**-402**	**173**	**395**	**432**
PM	Ref Case (Sensitivity Test 1)	1857	1160	--------	82	**3099**
	DS (Sensitivity Test 2b With Sensitivity Test 1 Network)	2073	400	1444	48	3965
	Difference	**216**	**-760**	**1444**	**-34**	**866**

Table 33: Sensitivity Test 2b: Comparison of flows from Milton Keynes towards East of M1 (PCU) in 2031

8.5 Sensitivity Test 2 Summary

Test 2a

8.5.1 The full MKE development and the associated changes to surrounding infrastructure result in a re-routing of Milton Keynes bound trips from the east of Milton Keynes, similar to that in the core scenario.

8.5.2 There is also a reduction in the number of trips using Willen Road to cross the M1, instead preferring to use the new M1 crossing.

8.5.3 There is an increase in traffic accessing the south of the MKE development from via junction 14, the A509 and Willen Road when comparing with the core 2031 Do-Something scenario. This can be attributed to the additional employment and jobs to the south of the development.

Test 2b

8.5.4 Similar to Sensitivity Test, the reduction in turn saturation has a relatively negligible impact on traffic travelling towards the east of the M1 in the AM peak period.

8.5.5 Traffic travelling across junction 14 towards Milton Keynes centre is reduced by approximately 50%, with flow redistributing across the A422, Willen Road and the New Bridge.

8.5.6 There is some redistribution of flows travelling on the local roads to the west of the eastern parameter road within the development.

Appendix A

Figure 95: 2031 AM Intra-Development Zone Matrix

	1515	1521	1523	1524	1525	1529	1566	1567	1571	1572	1526*
1515	0	1	0	0	0	0	0	0	1	0	0
1521	4	17	0	0	0	0	4	4	24	0	0
1523	0	0	0	0	0	0	0	0	0	0	0
1524	0	0	0	0	0	0	0	0	0	0	0
1525	0	0	0	0	0	0	0	0	0	0	0
1529	0	0	0	0	0	0	0	0	0	0	0
1566	0	1	0	0	0	0	0	0	1	0	0
1567	0	1	0	0	0	0	0	0	1	0	0
1571	5	22	0	0	0	0	5	5	31	0	0
1572	0	0	0	0	0	0	0	0	0	0	0
1526*	0	0	0	0	0	0	0	0	0	0	0

**Planning data was originally assigned to 1531, however subsequently moved due to existing developments in 1531*

Figure 96: 2031 IP Intra-Development Zone Matrix

	1515	1521	1523	1524	1525	1529	1566	1567	1571	1572	1526*
1515	0	2	0	0	0	0	0	0	2	0	0
1521	1	5	0	0	0	0	1	1	14	0	0
1523	0	0	0	0	0	0	0	0	0	0	0
1524	0	0	0	0	0	0	0	0	0	0	0
1525	0	0	0	0	0	0	0	0	0	0	0
1529	0	0	0	0	0	0	0	0	0	0	0
1566	0	2	0	0	0	0	0	0	2	0	0
1567	0	2	0	0	0	0	0	0	2	0	0
1571	2	15	0	0	0	0	2	2	28	0	0
1572	0	0	0	0	0	0	0	0	0	0	0
1526*	0	0	0	0	0	0	0	0	0	0	0

**Planning data was originally assigned to 1531, however subsequently moved due to existing developments in 1531*

Figure 97: 2031 PM Intra-Development Zone Matrix

	1515	1521	1523	1524	1525	1529	1566	1567	1571	1572	1526*
1515	0	4	0	0	0	0	0	0	5	0	0
1521	2	5	0	0	0	0	2	2	12	0	0
1523	0	0	0	0	0	0	0	0	0	0	0
1524	0	0	0	0	0	0	0	0	0	0	0
1525	0	0	0	0	0	0	0	0	0	0	0
1529	0	0	0	0	0	0	0	0	0	0	0
1566	0	4	0	0	0	0	0	0	5	0	0
1567	0	4	0	0	0	0	0	0	5	0	0
1571	3	16	0	0	0	0	3	3	25	0	0
1572	0	0	0	0	0	0	0	0	0	0	0
1526*	0	0	0	0	0	0	0	0	0	0	0

**Planning data was originally assigned to 1531, however subsequently moved due to existing developments in 1531*

Figure 98: 2048 AM Intra-Development Zone Matrix

	1515	1521	1523	1524	1525	1529	1566	1567	1571	1572	1526*
1515	0	1	1	0	1	0	0	0	2	2	2
1521	4	8	1	1	1	0	4	4	17	9	9
1523	2	3	0	0	0	0	2	2	6	3	3
1524	1	1	0	0	0	0	1	1	2	1	1
1525	2	3	0	0	0	0	2	2	6	3	3
1529	0	1	0	0	0	0	0	0	1	1	1
1566	0	1	1	0	1	0	0	0	2	2	2
1567	0	1	1	0	1	0	0	0	2	2	2
1571	8	17	2	1	2	1	8	8	34	19	19
1572	6	12	1	1	1	0	6	6	25	13	13
1526*	6	12	1	1	1	0	6	6	25	13	13

**Planning data was originally assigned to 1531, however subsequently moved due to existing developments in 1531*

Figure 99: 2048 IP Intra-Development Zone Matrix

	1515	1521	1523	1524	1525	1529	1566	1567	1571	1572	1526*
1515	0	4	2	1	2	0	0	0	7	6	6
1521	2	8	2	1	3	0	2	2	16	11	11
1523	1	1	0	0	0	0	1	1	2	1	1
1524	0	1	0	0	0	0	0	0	1	1	1
1525	1	1	0	0	0	0	1	1	3	1	1
1529	0	0	0	0	0	0	0	0	1	0	0
1566	0	4	2	1	2	0	0	0	7	6	6
1567	0	4	2	1	2	0	0	0	7	6	6
1571	3	16	5	2	5	1	3	3	33	23	23
1572	2	9	3	1	3	1	2	2	19	13	13
1526*	2	9	3	1	3	1	2	2	19	13	13

**Planning data was originally assigned to 1531, however subsequently moved due to existing developments in 1531*

Figure 100: 2048 PM Intra-Development Zone Matrix

	1515	1521	1523	1524	1525	1529	1566	1567	1571	1572	1526*
1515	0	2	1	0	1	0	0	0	4	4	4
1521	1	6	2	1	2	0	1	1	11	8	8
1523	1	1	0	0	0	0	1	1	2	1	1
1524	0	0	0	0	0	0	0	0	1	1	1
1525	1	1	0	0	0	0	1	1	2	1	1
1529	0	0	0	0	0	0	0	0	1	0	0
1566	0	2	1	0	1	0	0	0	4	4	4
1567	0	2	1	0	1	0	0	0	4	4	4
1571	2	12	3	1	4	1	2	2	23	16	16
1572	2	7	2	1	2	0	2	2	14	9	9
1526*	2	7	2	1	2	0	2	2	14	9	9

**Planning data was originally assigned to 1531, however subsequently moved due to existing developments in 1531*

Figure 101: 2031 Car and LGV Trip End Totals by zone

	Arrive (Dest)	Depart (Origin)		Arrive (Dest)	Depart (Origin)		Arrive (Dest)	Depart (Origin)	
	AM	AM	Total	PM	PM	Total	IP	IP	Total
1515	172	25	198	49	174	223	68	77	145
1521	73	162	235	145	86	231	84	76	160
1523	0	0	0	0	0	0	0	0	0
1524	0	0	0	0	0	0	0	0	0
1525	0	0	0	0	0	0	0	0	0
1529	0	0	0	0	0	0	0	0	0
1526	0	0	0	0	0	0	0	0	0
1535	0	0	0	0	0	0	0	0	0
1566	227	28	255	48	245	293	89	101	191
1567	227	28	255	48	245	293	89	101	191
1571	223	287	510	213	149	362	146	145	292
1572	0	0	0	0	0	0	0	0	0

Figure 102: 2048 Car and LGV Trip End Totals by zone

	Arrive (Dest)	Depart (Origin)		Arrive (Dest)	Depart (Origin)		Arrive (Dest)	Depart (Origin)	
	AM	AM	Total	PM	PM	Total	IP	IP	Total
1515	189	31	219	53	177	230	74	97	171
1521	93	173	266	144	98	242	116	110	226
1523	21	68	89	55	31	87	42	31	73
1524	9	27	36	22	13	35	17	13	30
1525	22	72	94	59	33	92	45	32	77
1529	5	12	17	10	6	16	8	6	14
1526	119	262	381	217	139	355	171	149	321
1535	0	0	0	0	0	0	0	0	0
1566	498	63	561	103	525	628	198	239	437
1567	498	63	561	103	525	628	198	239	437
1571	311	421	732	304	218	522	252	251	503
1572	119	264	384	218	140	358	173	150	323

Figure 103: 2031 HGV Trip End Totals by zone

	Arrive (Dest)	Depart (Origin)		Arrive (Dest)	Depart (Origin)		Arrive (Dest)	Depart (Origin)	
	AM	AM	Total	PM	PM	Total	IP	IP	Total
1515	42	34	76	14	15	29	23	29	53
1521	0	0	0	0	0	0	0	0	0
1523	0	0	0	0	0	0	0	0	0
1524	0	0	0	0	0	0	0	0	0
1525	0	0	0	0	0	0	0	0	0
1529	0	0	0	0	0	0	0	0	0
1526	0	0	0	0	0	0	0	0	0
1535	0	0	0	0	0	0	0	0	0
1566	34	27	61	13	14	27	19	24	43
1567	34	27	61	13	14	27	19	24	43
1571	0	0	0	0	0	0	0	0	0
1572	0	0	0	0	0	0	0	0	0

Figure 104: 2048 HGV Trip End Totals by zone

	Arrive (Dest)	Depart (Origin)		Arrive (Dest)	Depart (Origin)		Arrive (Dest)	Depart (Origin)	
	AM	AM	Total	PM	PM	Total	IP	IP	Total
1515	41	33	74	13	15	28	23	28	51
1521	0	0	0	0	0	0	0	0	0
1523	0	0	0	0	0	0	0	0	0
1524	0	0	0	0	0	0	0	0	0
1525	0	0	0	0	0	0	0	0	0
1529	0	0	0	0	0	0	0	0	0
1526	0	0	0	0	0	0	0	0	0
1535	0	0	0	0	0	0	0	0	0
1566	74	61	135	29	30	59	43	52	95
1567	74	61	135	29	30	59	43	52	95
1571	0	0	0	0	0	0	0	0	0
1572	0	0	0	0	0	0	0	0	0

Appendix B

PROVIDED IN K.2

Appendix L

PARAMICS MICROSIMULATION TECHNICAL NOTES

Appendix L.1

WSP - LOCAL MODEL VALIDATION REPORT

Berkeley St James

MILTON KEYNES EAST

Micro-simulation Modelling Local Model Validation Report (LMVR)

APRIL 2020

PUBLIC

Berkeley St James

MILTON KEYNES EAST

Micro-simulation Modelling Local Model Validation Report (LMVR)

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70057521

DATE: APRIL 2020

Berkeley St James

MILTON KEYNES EAST

Micro-simulation Modelling Local Model Validation Report (LMVR)

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks				
Date	28 April 2020			
Prepared by	S Thomas / J Cowley			
Signature				
Checked by	D Gooding			
Signature				
Authorised by	S Biggs			
Signature				
Project number	70057521			
Report number	PM01			
File reference	200428 LMVR_Issue.docx			

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QUEUE CALIBRATION GRAPHS

APPENDIX D

JOURNEY TIME VALIDATION

1 INTRODUCTION

1.1 INTRODUCTION

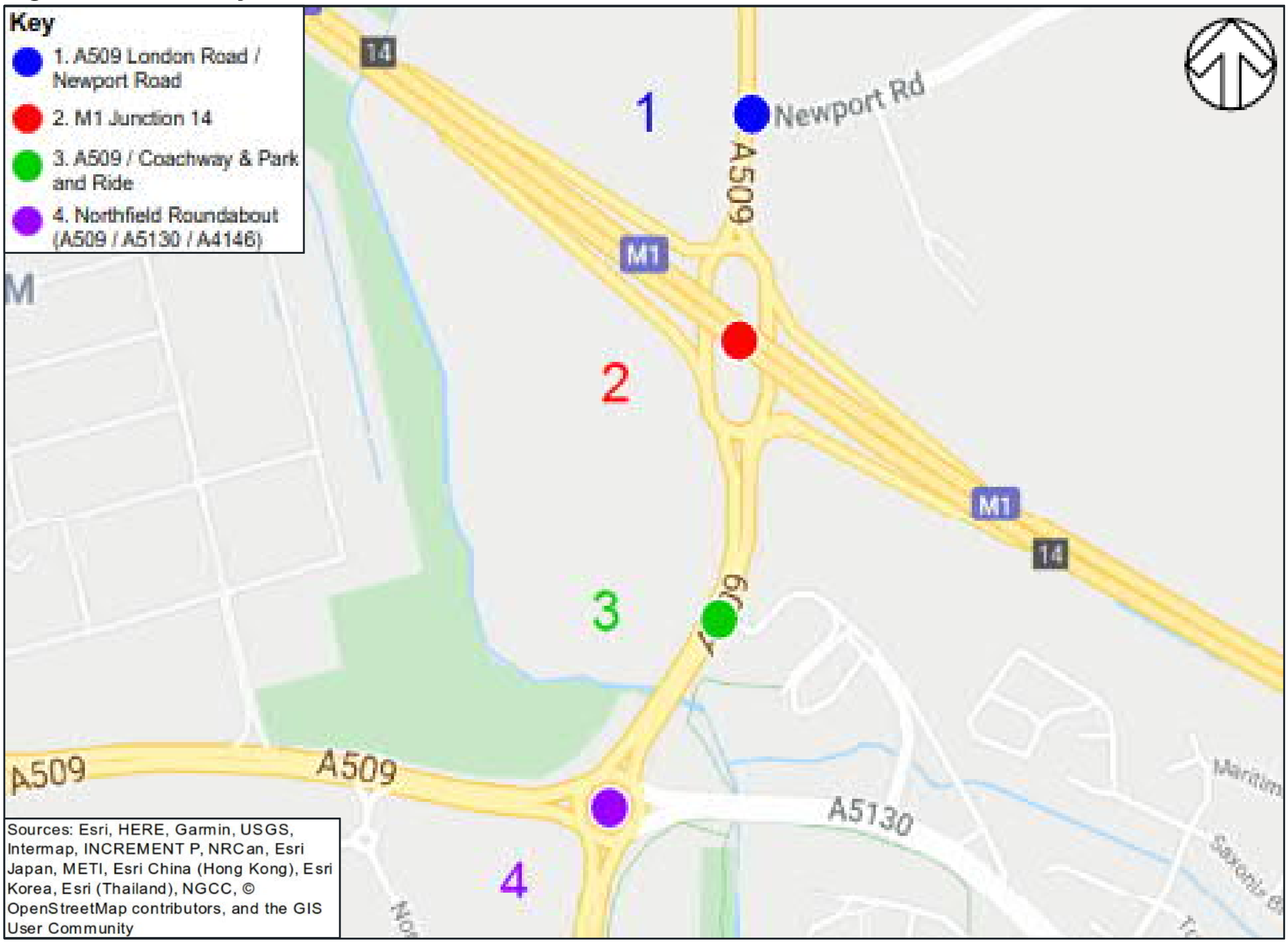
1.1.1. This Local Model Validation Report (LMVR) has been prepared to describe the development, calibration and validation of the Paramics Discovery model that has been developed on behalf of Berkeley St. James to model the impact of proposed development of part of the land to the northeast of Milton Keynes, referred to as 'Milton Keynes East'.

1.1.2. The purpose of the Paramics Discovery Model is to provide an accurate representation of typical traffic conditions in the vicinity of the M1, Junction 14 near Milton Keynes. The aim of this piece of work is to produce a micro-simulation model to assess the impact of the proposed development, and any proposed infrastructure improvements that may be delivered as part of the development proposals.

1.1.3. The model covers key junctions in the area surrounding the M1, Junction 14 near Milton Keynes, as shown in Figure 1-1 below, focusing in particular on the assessment of the following junctions:

1. A509 London Road / Newport Road priority junction;
2. M1 Junction 14 signalised roundabout junction (M1 / A509);
3. A509 / Coachway & Park and Ride; and
4. Northfield signalised roundabout junction (A509 Portway / A5130 / A4146 Childs Way).

Figure 1-1 – Study Area and Junctions



1.1.4. The first stage of the modelling work has been to prepare a calibrated and validated base model, using criteria from the Department for Transport (DfT) Transport Appraisal Guidance (TAG). The second stage will be to prepare forecast models to include background traffic growth along with the development related traffic and any highway improvement schemes.

1.2 PREVIOUS MODELLING WORK

1.2.1. A model of the area was previously prepared by WSP with a base year of 2011 using S-Paramics software. This latest work has taken the previous S-Paramics model and converted it into Paramics Discovery using the SYSTRA model conversion service. Paramics Discovery supersedes S-Paramics software and is the recommended software for the development of new and updates to old Paramics models.

1.3 ADDITIONAL MODELLING

1.3.1. During 2016 and 2017, Milton Keynes Council (MKC) updated the Milton Keynes Multi-Modal Model (MKMMM) for a 2016 base year. Highway trips were modelled using the SATURN modelling software package, and public transport trips were modelled using the Emme modelling software package.

1.4 REPORT STRUCTURE

1.4.1. This report is structured as follows:

- Section 2 sets out the background data that was collected and used during the model build;
- Section 3 describes the development of the model;
- Section 4 describes the development of the traffic flow matrices used in the model from the observed ANPR and traffic count data;
- Section 5 describes the calibration and validation of the model against DfT TAG criteria; and
- Section 6 summarises the calibration and validation of the model and the suitability of the model for forecasting and scheme assessment.

2 DATA COLLECTION AND MODEL SPECIFICATION

2.1 INTRODUCTION

2.1.1. This section describes the base data that has been used to develop the model. A variety of different data sources have been used to develop the model, including:

- Observed traffic count data, including:
  - Automatic Number Plate Recognition (ANPR) (8 sites);
  - Queue length counts (3 sites);
  - Automatic traffic counts (ATC) (3 sites).
- Bus routing and timetable information; and

2.2 ANPR SURVEYS

2.2.1. Automatic Number Plate Recognition (ANPR) surveys were undertaken on Thursday 27 June 2019 at eight locations across the area. The locations of the ANPR surveys are illustrated in Figure 2-1 and detailed in Table 2-1.

Figure 2-1 - ANPR Survey Locations

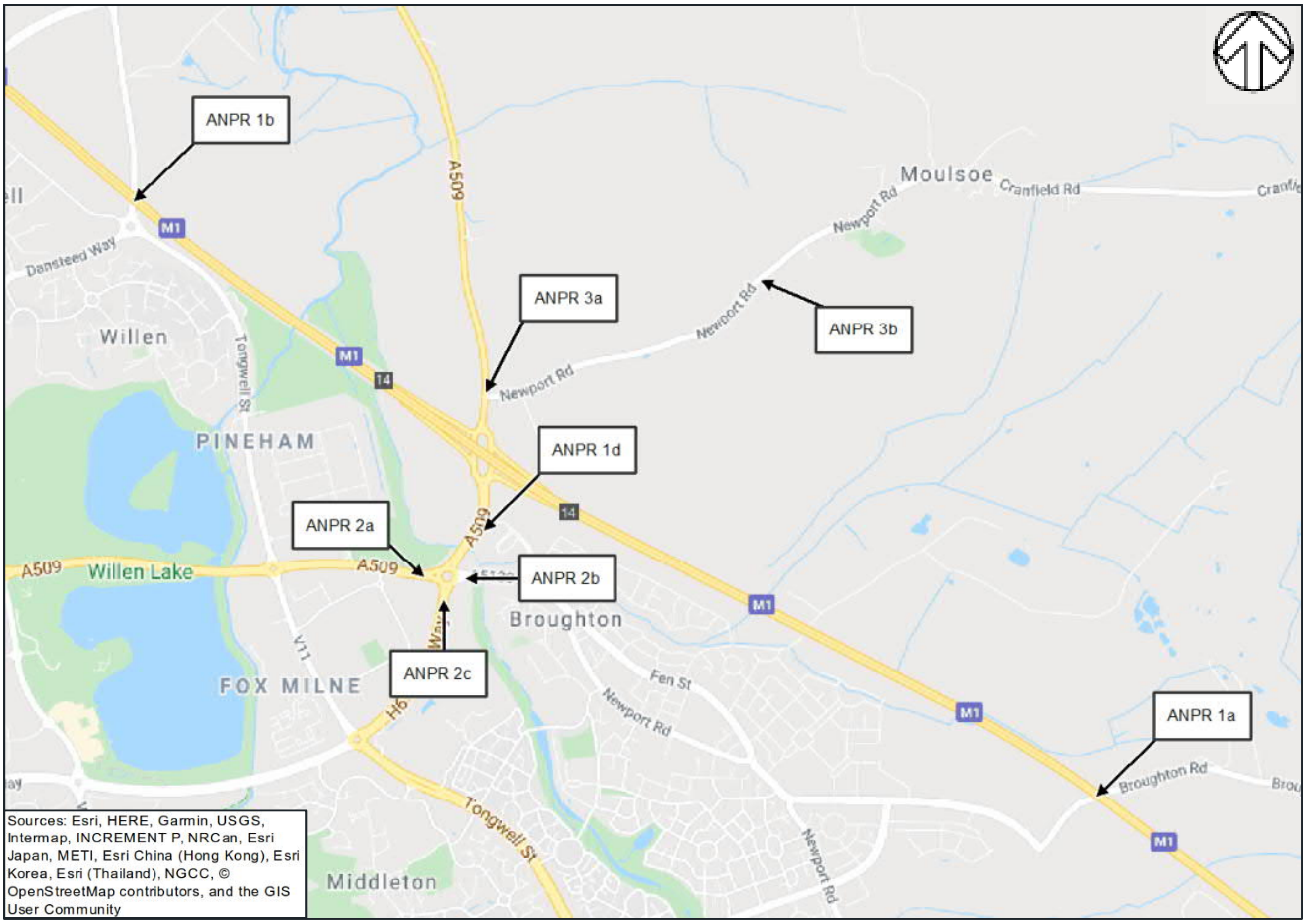


Table 2-1 – ANPR Site Locations

ID	Description	Easting	Northing
ANPR 1a	M1 (South East)	491683	239537
ANPR 1b	M1 (North West)	487809	241833
ANPR 1d	Coachway & Park and Ride	489233	240528
ANPR 2a	A509 Portway (W)	488980	240358
ANPR 2b	A5130 Fen Street (E)	489154	240356
ANPR 2c	A4146 Childs Way	489067	240259
ANPR 3a	A509 London Road	489218	241070
ANPR 3b	Newport Road	490270	241534

2.2.2. The ANPR data was collected between 07:00 and 19:00 in 15-minute intervals and was classified into the following vehicle classes:

- Cars;
- Light Goods Vehicles (LGVs) - vans up to 3.5T;
- Other Goods Vehicles (OGV1s) - vans >3.5T, rigid trucks with up to three axles;
- Other Goods Vehicles (OGV2s) - rigid trucks with more than three axles, articulated vehicles;
- Public Service Vehicles (PSVs) - buses and coaches; and
- Motorcycles.

2.2.3. The ANPR surveys were used to extract journey time data for a number of specific routes in the study area as follows:

- **Route 1: M1 WB** (From the location of the Broughton Road overpass, westbound along the M1 to the location of the Willen Road overpass);
- **Route 2: M1 E to A509 W** (From the location of the Broughton Road overpass, westbound along the M1, leaving the M1 at Junction 14 (M1 / A509), travelling southbound along the A509, exiting the Northfield Roundabout onto the A509 Portway);
- **Route 3: M1 E to A509 N (**From the location of the Broughton Road overpass, westbound along the M1, leaving the M1 at Junction 14 (M1 / A509), travelling northbound along the A509 London Road, as far as the junction with Newport Road);
- **Route 4: M1 EB** (From the location of the Willen Road overpass, eastbound along the M1 to the location of the Broughton Road overpass);
- **Route 5: M1 W to A4146** (From the location of the Willen Road overpass, eastbound along the M1, leaving the M1 at Junction 14 (M1 / A509), travelling southbound along the A509, exiting the Northfield Roundabout onto A4146 Childs Way).
- **Route 6: M1 W to A509 (N)** (From the location of the Willen Road overpass, westbound along the M1, leaving the M1 at Junction 14 (M1 / A509), travelling northbound along the A509 London Road, as far as the junction with Newport Road);
- **Route 7: A509(N) to M1 E** (From the A509 London Road, at the junction with Newport Road, southbound along the A509, joining the M1 at Junction 14, and travelling eastbound to the location of the Broughton Road overpass);
- **Route 8: A509(N) to M1 W** (From the A509 London Road, at the junction with Newport Road, southbound along the A509, joining the M1 at Junction 14, and travelling westbound along the M1, to the point where Broughton Road passes over the M1);

- **Route 9: A509(N) to A4146** (From the A509 London Road, at the junction with Newport Road, southbound along the A509 to the Northfield Roundabout, A4146 Childs Way);
- **Route 10: A4146 to M1 E (**From the A4146 Childs Way arm of the Northfield Roundabout, travelling northbound along the A509 to the M1 Junction 14, joining the M1 and travelling eastbound to the point where Broughton Road passes over the M1);
- **Route 11: A4146 to M1 W (**From the A4146 Childs Way arm of the Northfield Roundabout, travelling northbound along the A509 to the M1 Junction 14, joining the M1 and travelling westbound to the point where Willen Road passes over the M1); and
- **Route 12: A4146 to A509 N (**From the A4146 Childs Way arm of the Northfield Roundabout, travelling northbound along the A509 London Road, as far as the junction with Newport Road).

2.2.4. The journey time routes that have been included in the assessment of model validation are shown on Figures 1 to 6, contained in **Appendix A.**

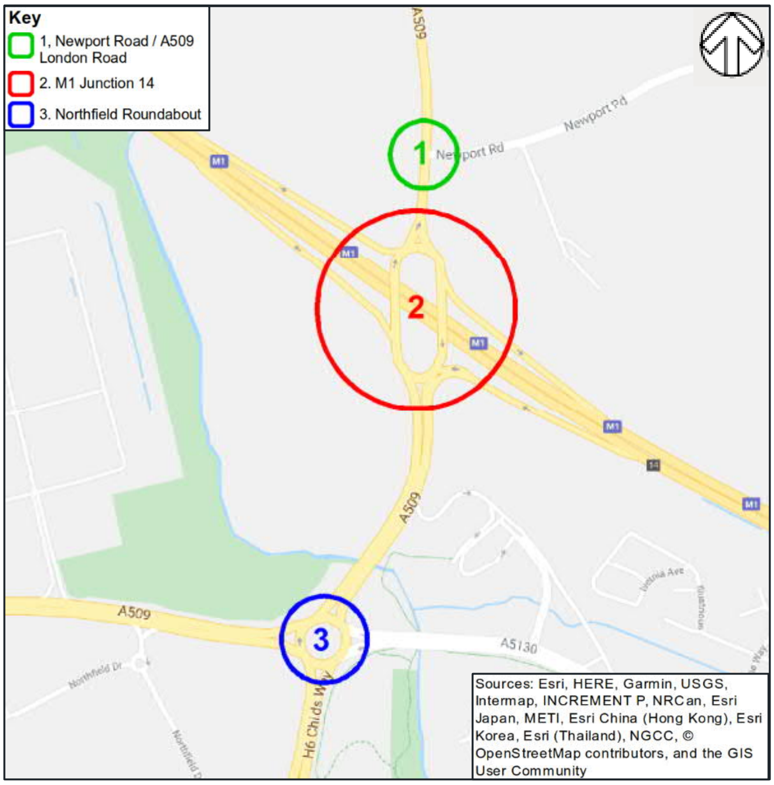
2.3 QUEUE LENGTH SURVEYS

2.3.1. Queue length surveys were undertaken at the three key junctions within the study area. The queue length data was collected in 15-minute intervals on 27 June 2019 between 07:00 and 19:00 on each of the approaches at the junctions shown in Table 2-2, illustrated in Figure 2-2.

Table 2-2 – Queue Data Survey Locations

ID	Description	Easting	Northing
1	Newport Road / A509 London Road	489218	241070
2	M1 Junction 14	489207	240851
3	Northfield Roundabout	489077	240356

Figure 2-2 - Queue Length Survey Locations



2.4 ATC DATA

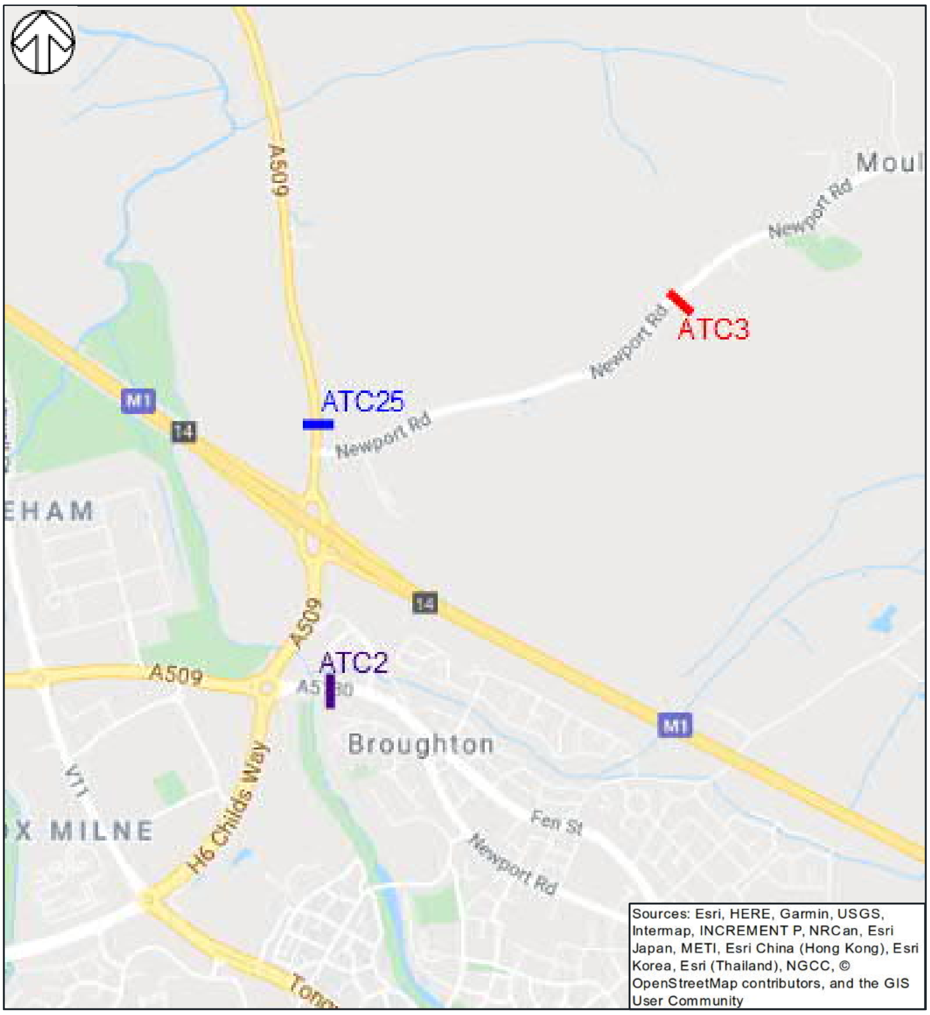
2.4.1. ATC surveys were undertaken over a twelve-day period between 26 June 2019 and 8 July 2019, to verify the ANPR and queue survey data as being typical of traffic conditions in the area. Table 2-3 sets out the ATC survey locations.

Table 2-3 – ATC Site Locations

Description	Easting	Northing
A509 London Road (ATC 25)	489220	241145
Newport Road (ATC 3)	490299	241555
A5130 Fen Street (ATC 2)	489276	240351

2.4.2. Figure 2-3 indicates the locations of the three ATC surveys.

Figure 2-3 - ATC Survey Locations



2.5 BUS ROUTES

2.5.1. A full audit has been undertaken of the existing buses operating within the study area highway network. Bus timetables and route information has been downloaded from 'Traveline' website to ensure that the bus information contained in the model reflects the bus services operating in the study area at the time of the traffic surveys.

2.5.2. Only buses which operate at least once during one of the peak hours have been included in the model. These routes have been individually coded into the Paramics Discovery model on a fixed trip schedule according to the published timetables. A summary of the bus routes that have been coded into the base model is provided in Table 2-4 below.

Table 2-4 – Paramics Model Bus Routes

Route Number	Operator	Route Description	AM Peak (08:00-09:00)	PM Peak (17:00-18:00)
230	National Express	Derby – Gatwick	1	0
425	National Express	London – Northumberland	1	1
426	National Express	London – Southshields	0	1
440	National Express	London – Derby	0	1
450	National Express	Retford – London	1	0
455	National Express	London – Corby	0	1
541	National Express	Whitehaven – London	0	1
550	National Express	London – Southport	0	1
707	National Express	Gatwick Airport – Northampton	0	1
777	National Express	Stansted Airport – Birmingham	1	1
C1	Uno	Milton Keynes – Moulsoe – Cranfield – Wootton – Kempston – Bedford	1	1
	Uno	Bedford – Kempston – Wootton – Cranfield – Moulsoe – Milton Keynes	1	1
24	Z&S Buses	Bletchley – Newport Pagnell – Central Milton Keynes – Bletchley (Circular)	0	1
25	Z&S Buses	Bletchley – Central Milton Keynes – Newport Pagnell – Bletchley (Circular)	1	1
X5	Stagecoach in Bedford	Cambridge – Bedford – Milton Keynes – Oxford	2	1
	Stagecoach in Bedford	Oxford – Milton Keynes – Bedford – Cambridge	1	2
300	Arriva (in Beds and Bucks)	Tattenhoe Park – Westcroft – Central Milton Keynes – Magna Park – Eagle Farm	2	3
	Arriva (in Beds and Bucks)	Eagle Farm – Magna Park – Central Milton Keynes – Westcroft – Tattenhoe Park	4	3

2.6 TRAFFIC SIGNAL DATA

2.6.1. Traffic signal specifications were obtained from Milton Keynes Council for the signal-controlled junction at Northfield Roundabout. For M1 Junction 14, traffic signal data was limited so the traffic signal settings for this junction are based on a previous WSP model. These signal plans have been used to identify the staging and approximate stage times of the junctions in the study network.

2.6.2. The signal plans for M1 Junction 14 and the Northfield Roundabout indicate that both junctions are operating under MOVA control. As PC-MOVA is not currently available for Paramics Discovery, Python scripts have been created in Paramics Discovery to mimic some of the operations undertaken by the MOVA algorithm. It should be noted that these scripts provide a degree of Vehicle Actuated control to model, considering some of the factors used by MOVA in its algorithm. However, it is impossible to fully reflect all of the optimisation functions of MOVA, meaning that the signal operation in the model is likely to be less efficient than that seen on street.

3 BASE MODEL DEVELOPMENT

3.1 INTRODUCTION

3.1.1. The model has been developed using Paramics Discovery (Version 22.0.3). A screenshot of the model network in Paramics Discovery is shown in Figure 3-1 below.

Figure 3-1 - Paramics Model Network

3.2 MODEL PERIODS AND SOFTWARE VERSIONS

3.2.1. The model has been developed to assess the impacts of transport schemes in the morning and evening peak hours. The modelled peak hours have been chosen to align with the SATURN model peak hours:

- Weekday AM Peak (08:00-09:00); and
- Weekday PM Peak (17:00-18:00).

3.2.2. Paramics Discovery requires both a warm up and cool down period in order to ensure the network is suitably loaded with traffic at the start of the peak hour assessment and to allow the completion of trips which start before the end of the peak hour so they can be included in the model statistics. To assess the peak hours set out above, the following time periods have therefore been modelled:

- Weekday AM (07:00-10:00); and
- Weekday PM (16:00-19:00).

3.2.3. This model has been calibrated and validated with 15 randomly seeded runs being carried out to represent daily variability in traffic conditions and provide an average to represent typical traffic conditions.

3.3 MODEL STRUCTURE

3.3.1. As discussed in the introduction to this LMVR, a micro-simulation model of the area was previously built for a base year of 2011 using S-Paramics. This model has been converted into Paramics Discovery software using the SYSTRA model conversion service. This converted model network has been retained, with the following elements reviewed as part of this base model update:

- Nodes, links, kerbs and lane points;
- Route choice;
- Bus stops; and
- Junctions.

3.3.2. The geometric layout of nodes, links, kerbs and lane points is important to achieve the correct operation of the model and to ensure that the layout of the model is consistent with the layout on the ground. The nodes, links, kerbs and lane points have been adjusted where necessary so that vehicle behaviour is consistent with the observed vehicle behaviour on the ground, whilst achieving calibration and validation criteria.

3.3.3. Bus stops in the model have been included in positions where actual bus stops are located and where bus laybys are provided except for the Coachway stops which have been included on the closest available link. These are reflected in the model in order to reflect the behaviours associated with buses stopping within the network and any associated traffic implications this may have.

3.3.4. All junctions have been reviewed to ensure that the lane usage and give way movements are set up correctly for all priority junctions, roundabouts and signalised junctions.

3.4 GENERALISED COST EQUATION

3.4.1. The default generalised cost equation within Paramics Discovery is set as:

- ***Generalised Cost = (1.0 * Time) + (0.0 * Distance) + (0.0 * Toll Cost)***

3.4.2. The equation within the model for all vehicle types has been adjusted to:

- ***Generalised Cost = (1.0 * Time) + (0.25 * Distance) + (0.0 * Toll Cost)***

3.4.3. Due to the scope of the model, there is no route choice available. The default generalised cost equation has however been adjusted, with a distance factor of 0.25 selected. If time is the sole parameter, then a vehicle would take a route 100 times longer in distance if it saved as little as one second in total time required, which is unrealistic. By applying a distance factor within the equation, a vehicle will not take an unrealistic route in order to save very small amounts of time.

3.4.4. Due to the lack of route choice in the model, dynamic assignment has not been enabled. If the model was to be extended, and an element of route choice introduced, then dynamic assignment should be enabled.

3.5 PERTURBATION

3.5.1. Perturbation controls how drivers re-route though the model; specifically affecting their perception of how long a diversion is compared to the shortest route available. As discussed above, there is no route choice in the model, and adjusting the perturbation factor will therefore have no impact in the model. Perturbation factors have been set at a value of 5% to ensure that if the model is extended, and there is an element of route choice available to drivers, each vehicle's perceived cost of any given route to vary by a factor of ±5%.

3.6 FAMILIARITY

3.6.1. Vehicles within the Paramics network are assigned a familiarity level to determine how well they know the network area. Familiarity levels are set on a per vehicle type basis, as listed below. Five vehicle types have been included in this model, with the buses being on fixed routes in the model.

- Vehicle Type – Cars (60% familiarity);
- Vehicle Type – LGVs (40% familiarity);
- Vehicle Type – OGV1 (20% familiarity);
- Vehicle Type – OGV2 (20% familiarity); and
- Vehicle Type – Single Decker Bus (fixed route).

3.6.2. The default familiarity value for vehicles within Paramics is 85%. Cars have had their familiarity reduced to 60%, LGVs have been reduced to 40%, and OGV1 and OGV2 have been reduced to 20%.

3.7 DYNAMICS

3.7.1. All vehicle types use the default value of 0 for drag and inertia.

3.8 LINK COST FACTORS

3.8.1. Further structuring of the road hierarchy can be achieved by using category and link cost factors. Category and link cost factors have left at the default value of 1.0.hazard overrides

3.8.2. The model uses the hazard override functionality that is available in Paramics Discovery to enable the model to replicate observed lane use behaviour where it is not otherwise possible. Hazard overrides have been used to force vehicles to accept a different lane choice to the default behaviour. This was required on both the M1 junction 14 roundabout and the Northfield roundabout where the model lane choice did not reflect reality.

3.9 DEFINED ROUTES

3.9.1. Four defined routes have been included in the model to prevent odd routing behaviour which can sometimes occur as a result of perturbation levels.

3.9.2. Defined routes have been included on the M1 eastbound and westbound mainlines to prevent vehicles in the model from exiting the M1 and re-joining the M1.

3.9.3. Defined routes have also been included on the segregated left turn lanes at the M1 Junction 14 roundabout.

3.10 TRAFFIC SIGNALS

3.10.1. The traffic signal junctions at the following locations have been set up in Paramics Discovery to reflect 'as-built' drawings and signal staging and phasing obtained from Milton Keynes Council (MKC):

- M1 Junction 14; and
- Northfield Roundabout.

3.10.2. The signal junctions have been set up using detector loops in order to maximise the traffic flow through the junctions in the same way as happens on the ground through vehicle actuation (VA) to extend the green times on the busiest approaches. In the absence of observed average signal timings for these junctions, the following maximum green timings have been made to ensure the observed journey times and delays at these junctions are reflected in the model.

Table 3-1 – M1 Junction 14 Maximum Green Times (seconds)

Signalised Section	AM		PM	
	Stage 1	Stage 2	Stage 1	Stage 2
WB off-slip (node 19)	38	27	35	17
EB off-slip (node 103y)	38	27	32	20
NB A509 (node 16)	19	46	23	29

Table 3-2 – Northfield Roundabout Maximum Green Times (seconds)

Signalised Section	AM		PM	
	Stage 1	Stage 2	Stage 1	Stage 2
A5130 WB (node 10)	18	42	12	48
A509 SB (node 8)	30	30	30	30
A509 EB (node 0)	42	18	48	12
A4146 NB (node 12)	30	30	30	30

3.11 JUNCTION SPECIFIC PARAMETER MODIFICATIONS

3.11.1. As part of the calibration process, a number of variables can be modified for the links and nodes to help better reflect the observed operation of junctions as listed below:

- Gap acceptance;
- Visibility;
- Headway; and
- Target End Speed.

3.11.2. Gap acceptance dictates the size of gap that vehicles at give way junctions will allow to pull out. The gap acceptance parameter is input in seconds. There are three gap acceptance scenarios for each link: Lane Cross, Lane Merge and Path Cross. The parameters have been adjusted on a link by link basis where required to calibrate the turning movements and validate the journey times.

3.11.3. Visibilities have been adjusted so that vehicles can see correctly at each approach. Visibilities across the model were have been adjusted using on site observations from the default setting of 0m.

3.11.4. The headway, which controls how close vehicles travel to the vehicle in front, has left at the default value of 1 second.

3.11.5. The modification of the parameters set out above can be used to control the workings of a specific link, allowing for the model network to be adjusted in order to model accurate behaviour throughout the network. This is undertaken at the calibration stage for all nodes in the network and parameters set out above have been modified to provide a better representation of the observed traffic patterns and routing as necessary.

3.12 SPEED LIMITS

3.12.1. Speed limits set an average maximum speed for vehicles in the model. Vehicle speeds along each link in the model are then based on this speed, with a variance depending on the behavioural characteristics of the specific vehicle as would be expected to occur in the real world. Just because a speed limit is set on a link does not mean vehicles will travel at this speed – they will still obey the standard acceleration / deceleration parameters and will adjust their speed for the hazard presented to them. Vehicles also adjust their maximum speed and acceleration / deceleration depending on their individual behaviour parameters, such that not every vehicle travels at the same speed along each link.

3.12.2. Speed limits within the model have generally been set at the signed speed limits for the roads i.e. 30mph in a 30mph area.

3.12.3. The speed limit along the M1 has been adjusted from the signed speed limit of 70 mph to 50mph to reflect the temporary speed restriction that is currently in place as part of the upgrade of the M1 between Junction 13 to Junction 16 to an all-lane running (ALR) smart motorway.

4 MATRIX DEVELOPMENT

4.1 MODEL ZONES

4.1.1. The model contains 8 zones that release and attract traffic:

- Zone 1: M1 West
- Zone 2: A509 London Road
- Zone 3: M1 East
- Zone 4: A5130 Fen Street
- Zone 5: A4146
- Zone 6: A509 Portway
- Zone 7: Coachway & Park and Ride
- Zone 8: Newport Road.

4.2 TRAFFIC COUNT BALANCING

4.2.1. ANPR data has been used for the matrix building process and there has been no need to balance traffic count data between junctions.

4.3 MATRIX DEVELOPMENT

4.3.1. Matrices have been constructed on a direct basis from the traffic survey data, with one matrix per vehicle class. Matrix estimation has not been carried out as part of this process as a result of the direct nature of matrix construction.

4.4 PROFILES

4.4.1. In Paramics profiles are used to control the release of vehicles over the 3-hour period into the network over the modelled period, in order to ensure the correct level of traffic is included in the central peak hour. This is important to allow traffic to fluctuate at the correct rate throughout the period, allowing build up and dissipation of queues at junctions to match observations.

4.4.2. Profiles have been generated to reflect the traffic count information in 15-minute intervals. Profiles have been derived from the traffic counts for the entry zones. Profiles have been split into the three vehicle types (Cars, LGVs and HGVs) to provide as good a representation of traffic flows throughout each period as possible.

4.4.3. In total there are 27 profiles which have been developed from the traffic count data in 15-minute intervals. These have then been assigned to the different zone to zone pairs in the model. A generic 'general' profile has been created for each vehicle type and used for zones where either traffic flows were very low or no observed data was available.

4.4.4. As stated in the SIAS 'Using Demand Release Profiles' guidance note, "*Observed counts can vary over the peak periods [which]... can lead to large 'steps' in the calculated profile… To reflect more appropriate average conditions, it is considered good practice to apply a smoothing process to the calculated profiles. This involves manually adjusting the profile so that large steps are smoothed out*". Profile smoothing has been undertaken where considered appropriate.

5 MODEL CALIBRATION AND VALIDATION

5.1 INTRODUCTION

5.1.1. Calibration and validation of the model has been carried out to DfT TAG criteria as explained in each of the sub-headings within this section. Calibration has been carried out for turning counts, and validation has been carried out on the journey time routes.

5.1.2. This model has been run for the AM and PM period, and 15 runs of each period have been carried out with average values used for calibration and validation purposes.

5.2 TURNING COUNT CALIBRATION

5.2.1. DfT TAG criteria with regard to link / turning count analysis are summarised in Table 5-1 below. These criteria are for assigned hourly flows for links or turning movements.

Table 5-1 – DMRB Flow Count Criteria

Criteria and Measures		Acceptability Guidance
1	Individual flows within 15% for flows 700 to 2700 vehicles per hour (vph)	>85% of cases
	Individual flows within 100 vph for flows <700 vph	
	Individual flows within 400 vph for flows >2700 vph	
3	GEH Statistics: i) Individual flows: GEH <5	>85% of cases

5.2.2. The calculation sheets in **Appendix B** of this report provide full details of the baseline Paramics Discovery model performance against the above criteria for both peak hours. The following paragraphs and tables provide a summary of the results. All of the turning count statistics presented in this section are for the peak hours (08:00 to 09:00 and 17:00 to 18:00).

5.2.3. The summary statistics for the first three points of the DfT TAG criteria for the AM peak hour and PM peak hour are displayed in the Tables 5-2 and 5-3 respectively.

Table 5-2 – AM Peak Hour (08:00-09:00) Turning Count Calibration

Criteria	Count	No. Pass	%
Flow <700	28	28	100.0%
700 < Flow <2700	7	7	100.0%
Flow >2700	1	1	100.0%
Overall	**36**	**36**	**100.0%**

Table 5-3 – PM Peak Hour (17:00-18:00) Turning Count Calibration

Criteria	Count	No. Pass	%
Flow <700	27	27	100.0%
700 < Flow <2700	8	8	100.0%
Flow >2700	1	1	100.0%
Overall	**36**	**36**	**100.0%**

5.2.4. Tables 5-2 and 5-3 show that both the AM and PM peak hours pass all of the specified DfT TAG criteria. The overall pass rate is significantly better than that required, being 100% in the AM peak hour, and 100% in the PM peak hour, compared to the 85% required. This pass rate provides confidence in both the network and the matrix for the model.

5.2.5. DfT TAG specifies that 85% of modelled movements should obtain a G.E.H score of less than 5 when compared to observed values. The G.E.H statistic is a summary statistic used as a measure of the goodness in fit of observed data to modelled data. It is defined by the formula below.

$$\text{G.E.H} = \sqrt{\frac{(\text{observed flow} - \text{modelled flow})^2}{0.5 \times (\text{observed flow} + \text{modelled flow})}}$$

5.2.6. A G.E.H value of 0 represents a perfect fit, a value up to and including 5 reflects a good fit, a value between 5 and 10 represents an acceptable fit, and values over 10 represent a poor fit. The tables provided in **Appendix B** of this report provide full data for every turning movement in the model.

5.2.7. Tables 5-4 and 5-5 provide a summary of the turning count assessments for the AM and PM peaks respectively.

Table 5-4 – AM Peak (08:00-09:00) G.E.H Summary

Count	G.E.H <5		G.E.H <6		G.E.H <8		G.E.H <10	
	No. Pass	%	No. Pass	%	No. Pass	%	No. Pass	%
36	36	100.0%	36	100.0%	36	100.0%	36	100.0%

5.2.8. Table 5-4 shows that the AM peak hour has a very good turning count fit, with 100% of counts having a G.E.H of 5 or less. This satisfies the DfT TAG requirements whereby 85% of modelled movements should obtain a G.E.H score of less than 5. The average G.E.H across all turning movements in the AM peak hour is 0.7.

Table 5-5 – PM Peak (17:00-18:00) G.E.H Summary

Count	G.E.H <5		G.E.H <6		G.E.H <8		G.E.H <10	
	No. Pass	%	No. Pass	%	No. Pass	%	No. Pass	%
36	36	100.0%	36	100.0%	36	100.0%	36	100.0%

5.2.9. Table 5-4 shows that the PM peak hour also has a very good turning count fit, with 100% of counts having a G.E.H of 5 or less. This satisfies the DfT TAG requirements whereby 85% of modelled movements should obtain a G.E.H score of less than 5. The average G.E.H across all turning movements in the PM peak hour is 0.7.

5.2.10. Tables 5-4 and 5-5 show that the model fits the observed data very well based on the turning count information. The average G.E.H values being 0.7 in both the AM peak hour the PM peak hour shows that there is generally a very close fit between the observed and modelled data.

5.3 QUEUE LENGTH CALIBRATION

5.3.1. The model has also been calibrated to compare observed and modelled queue lengths and profiles. It should be noted that there is normally a difference between how Paramics records the length of a queue and what a human observer would perceive as a queue being formed - in Paramics, the queue length measurement uses accurate parameters to assess whether a vehicle is queued or not, namely:

- A vehicle is in a queue when its speed falls below 4.47mph and it comes within 10m of the vehicle in front; and

- A vehicle is no longer in a queue when its speed rises above 6.71mph or it is not within 15m of the vehicle in front.

5.3.2. It would be impossible for a human observer to judge these parameters exactly, and therefore the observed queue length would be based on the observer's best judgement as to whether a vehicle is queued or not. This could mean that the same length queue in Paramics would be recorded differently by the model and by a human observer. It can also be difficult for a human observer to record the full length of a very long queue, meaning that traffic surveys can be under-report observed queue lengths.

5.3.3. The observed queue lengths have been plotted against the averaged queue lengths from multiple runs of the model, as shown in **Appendix C** for the AM peak and PM peak. It should be noted that, because the modelled queue length is based on the averaged result of the 15 model runs, the modelled queue would be expected to have a much flatter profile than a single day queue count – this means that the modelled queue will not always show the small peaks and troughs that are evident in the observed queue data.

5.3.4. The queue graphs show that in general, the modelled queues are of a similar order of magnitude to the observed queues and that they generally follow a similar, although often flatter profile.

5.3.5. Within the calibration and validation process, there is a fine balance between ensuring that both the modelled journey time paths and the queue lengths provide a good reflection of the observed data. As the journey times feed into the validation statistics, there has been a focus to ensure that the modelled journey times reflect the observed journey times as far as possible. In some cases, this has been in detriment to the modelled queue lengths fully reflecting the observed queue lengths, but the journey times on these approaches are generally a good fit to the surveyed journey time data.

5.3.6. For Junction 1 on the approach from the A509 north of the M1 J14 the queue data was collected up to the junction with Newport Road, hence the differentiation between the observed and modelled queue length at this location. It is understood from Google typical traffic conditions that the queue usually extends beyond this which is reflected in the model.

5.4 JOURNEY TIME VALIDATION

5.4.1. The validation of the model has been undertaken using journey time data extracted from the ANPR surveys for the AM and PM peak hours. This section outlines a comparison between the modelled and observed journey times and provides validation statistics indicating how well the model reflects observed journey time data.

5.4.2. The twelve journey time routes are shown in Figures 1-6 contained in **Appendix A**:

- **Route 1: M1 WB** (From the location of the Broughton Road overpass, westbound along the M1 to the location of the Willen Road overpass);
- **Route 2: M1 E to A509 W** (From the location of the Broughton Road overpass, westbound along the M1, leaving the M1 at Junction 14 (M1 / A509), travelling southbound along the A509, exiting the Northfield Roundabout onto the A509 Portway);
- **Route 3: M1 E to A509 N (**From the location of the Broughton Road overpass, westbound along the M1, leaving the M1 at Junction 14 (M1 / A509), travelling northbound along the A509 London Road, as far as the junction with Newport Road);
- **Route 4: M1 EB** (From the location of the Willen Road overpass, eastbound along the M1 to the location of the Broughton Road overpass);

- **Route 5: M1 W to A4146** (From the location of the Willen Road overpass, eastbound along the M1, leaving the M1 at Junction 14 (M1 / A509), travelling southbound along the A509, exiting the Northfield Roundabout onto A4146 Childs Way).
- **Route 6: M1 W to A509 (N)** (From the location of the Willen Road overpass, westbound along the M1, leaving the M1 at Junction 14 (M1 / A509), travelling northbound along the A509 London Road, as far as the junction with Newport Road);
- **Route 7: A509(N) to M1 E** (From the A509 London Road, at the junction with Newport Road, southbound along the A509, joining the M1 at Junction 14, and travelling eastbound to the location of the Broughton Road overpass);
- **Route 8: A509(N) to M1 W** (From the A509 London Road, at the junction with Newport Road, southbound along the A509, joining the M1 at Junction 14, and travelling westbound along the M1, to the point where Broughton Road passes over the M1);
- **Route 9: A509(N) to A4146** (From the A509 London Road, at the junction with Newport Road, southbound along the A509 to the Northfield Roundabout, A4146 Childs Way);
- **Route 10: A4146 to M1 E (**From the A4146 Childs Way arm of the Northfield Roundabout, travelling northbound along the A509 to the M1 Junction 14, joining the M1 and travelling eastbound to the point where Broughton Road passes over the M1);
- **Route 11: A4146 to M1 W (**From the A4146 Childs Way arm of the Northfield Roundabout, travelling northbound along the A509 to the M1 Junction 14, joining the M1 and travelling westbound to the point where Willen Road passes over the M1); and
- **Route 12: A4146 to A509 N (**From the A4146 Childs Way arm of the Northfield Roundabout, travelling northbound along the A509 London Road, as far as the junction with Newport Road).

5.4.3. Modelled journey times have been recorded through the use of paths within Paramics Discovery, which records every vehicle trip along a specified route that starts within the set time period. All trips in the periods 08:00 - 09:00 and 17:00 - 18:00 have been analysed, and the data has been averaged across 10 runs. Journey time graphs are provided in **Appendix D**.

5.4.4. Modelled journey times have been compared to the observed ANPR journey time using the following criteria defined by DfT TAG, “Average modelled journey time along routes should be within 15% of surveyed times (or 60 seconds, if higher than 15% for 85% of routes)”.

5.4.5. Tables 5-6 and 5-7 show the 12 main routes for the AM and PM peak hours of the baseline model respectively, stating the mean observed time against the mean modelled time. A summary of whether the route passes DfT TAG criteria is also provided.

Table 5-6 – AM Peak Hour (08:00-09:00) Journey Time Validation

Route	Observed Mean	Modelled Mean	% Difference	Difference	DfT TAG
Route 1: M1 WB	215	195	-9.3%	-20	TRUE
Route 2: M1 EB	208	193	-7.1%	-15	TRUE
Route 3: M1 E to A509 N	271	283	4.7%	13	TRUE
Route 4: M1 E to A509 W	245	245	0%	0	TRUE
Route 5: M1 W to A4146	237	243	2.6%	6	TRUE
Route 6: M1 W to A509 (N)	128	117	-8.1%	-10	TRUE
Route 7: A509(N) to M1 E	197	187	-5.2%	-10	TRUE
Route 8: A509(N) to M1 W	221	236	6.7%	15	TRUE
Route 9: A509(N) to A4146	202	228	12.4%	25	TRUE
Route 10: A509 (W) to M1 E	241	243	-0.9%	2	TRUE
Route 11: A4146 to M1 W	168	150	-10.5%	-18	TRUE
Route 12: A4146 to A509 N	130	156	20.6%	27	TRUE

Table 5-7 – PM Peak Hour (17:00-18:00) Journey Time Validation

Route	Observed Mean	Modelled Mean	% Difference	Difference	DfT TAG
Route 1: M1 WB	206	192	-7.2%	-15	TRUE
Route 2: M1 EB	206	192	-6.8%	-14	TRUE
Route 3: M1 E to A509 N	257	273	-6.3%	16	TRUE
Route 4: M1 E to A509 W	193	184	-4.7%	-9	TRUE
Route 5: M1 W to A4146	190	175	-8%	-15	TRUE
Route 6: M1 W to A509 (N)	117	100	-14.9%	-17	TRUE
Route 7: A509(N) to M1 E	174	185	6.1%	11	TRUE
Route 8: A509(N) to M1 W	197	219	10.8%	21	TRUE
Route 9: A509(N) to A4146	148	161	9.2%	14	TRUE
Route 10: A509 (W) to M1 E	272	267	-1.9%	-5	TRUE
Route 11: A4146 to M1 W	212	170	-20%	-42	TRUE
Route 12: A4146 to A509 N	173	297	13.9%	24	TRUE

5.4.6. The results shown in Tables 5-6 and 5-7, show that all 12 journey time routes exceed the DfT TAG criteria in the AM peak hour and PM peak hour, with 100% of routes passing DfT TAG criteria, in excess of the 85% required.

6 SUMMARY AND CONCLUSIONS

6.1.1. This Local Model Validation Report (LMVR) has been prepared to describe the development, calibration and validation of the Paramics Discovery model that has been developed on behalf of Berkeley St. James to model the impact of proposed development of land to the northeast of Milton Keynes, referred to as 'Milton Keynes East'.

6.1.2. The validation model has a base year of 2019 and has been validated against traffic counts and journey times, which demonstrates that the model replicates the observed traffic conditions in the local area well.

6.1.3. With regards to the model calibration and validation, the AM peak hour has an excellent turning count fit, with 100.0% of counts having a G.E.H of 5 or less, and an average G.E.H across all turning movements of 0.7. The PM peak hour also has an excellent turning count fit, with 100.0% of counts having a G.E.H of 5 or less, and an average G.E.H across all turning movements of 0.7.

6.1.4. The journey time validation shows that 100.0% of routes pass DfT TAG criteria in the AM peak hour, and 91.7% of modelled journey time routes being within 15% of the observed journey time. In the PM peak hour, 100.0% of routes pass DfT TAG criteria, with 91.7% of modelled journey time routes being within 15% of the observed journey time.

6.1.5. It is considered that the performance of the model against observed data is very good, with all DfT TAG traffic count and journey time validation criteria met in both the AM and PM peaks. The model is therefore suitable for forecasting and assessing the impact of proposed development of the land to the northeast of Milton Keynes, referred to as 'Milton Keynes East'.

Appendix A

JOURNEY TIME ROUTES PLANS

TITLE:

JOURNEY TIME ROUTES 1 AND 2

FIGURE No:

FIGURE 1

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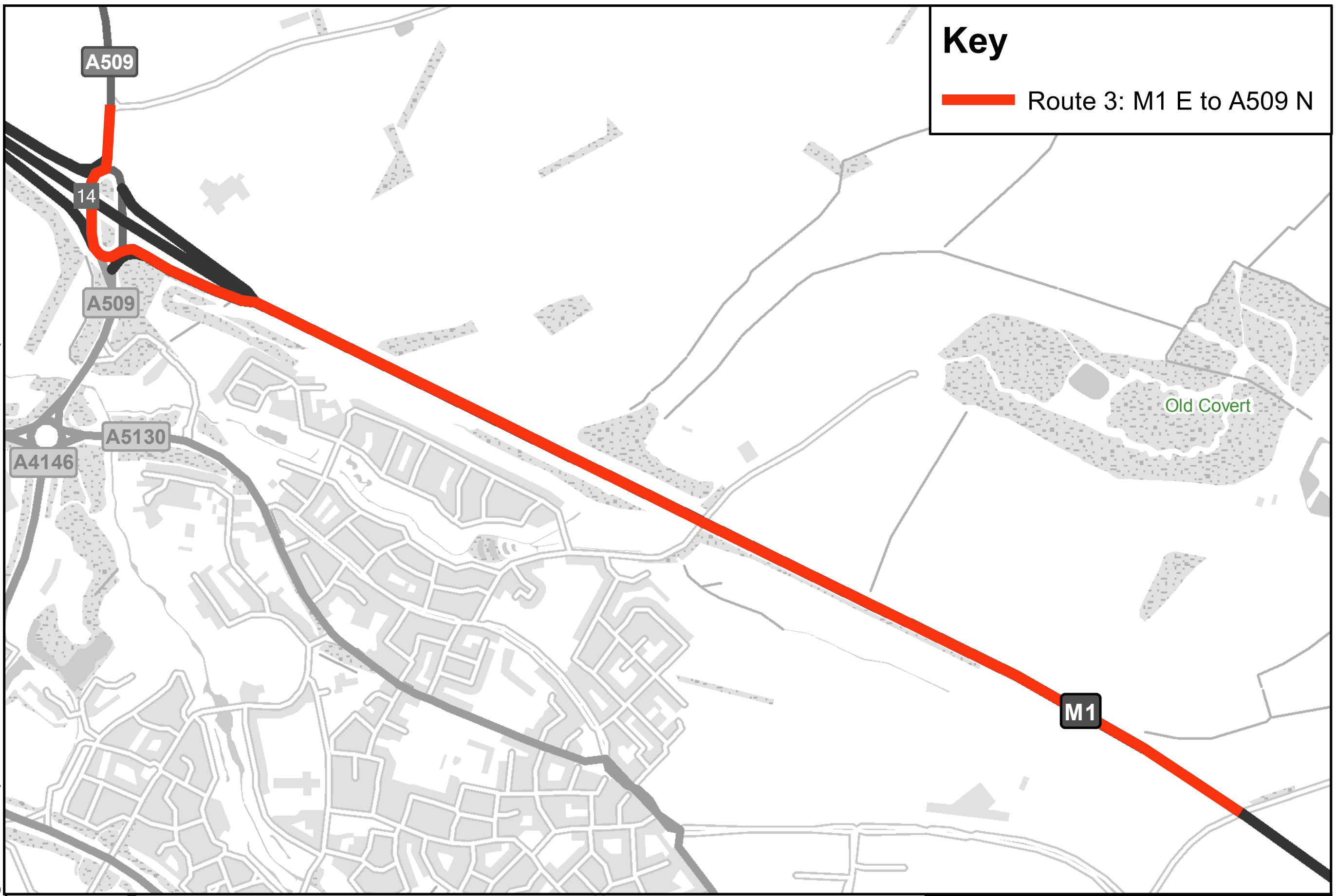

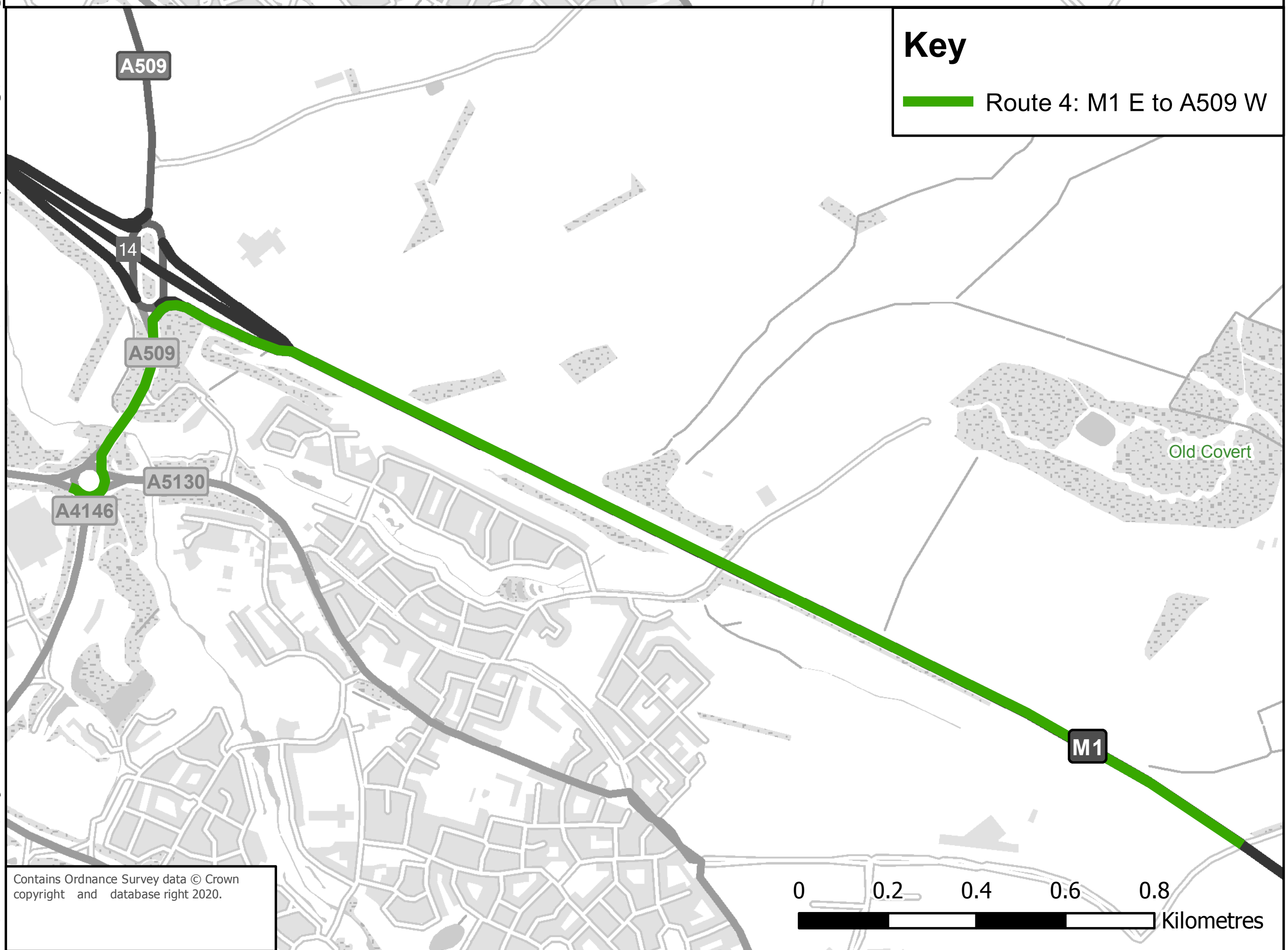

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TITLE:

JOURNEY TIME ROUTES 3 AND 4

FIGURE No:

FIGURE 2

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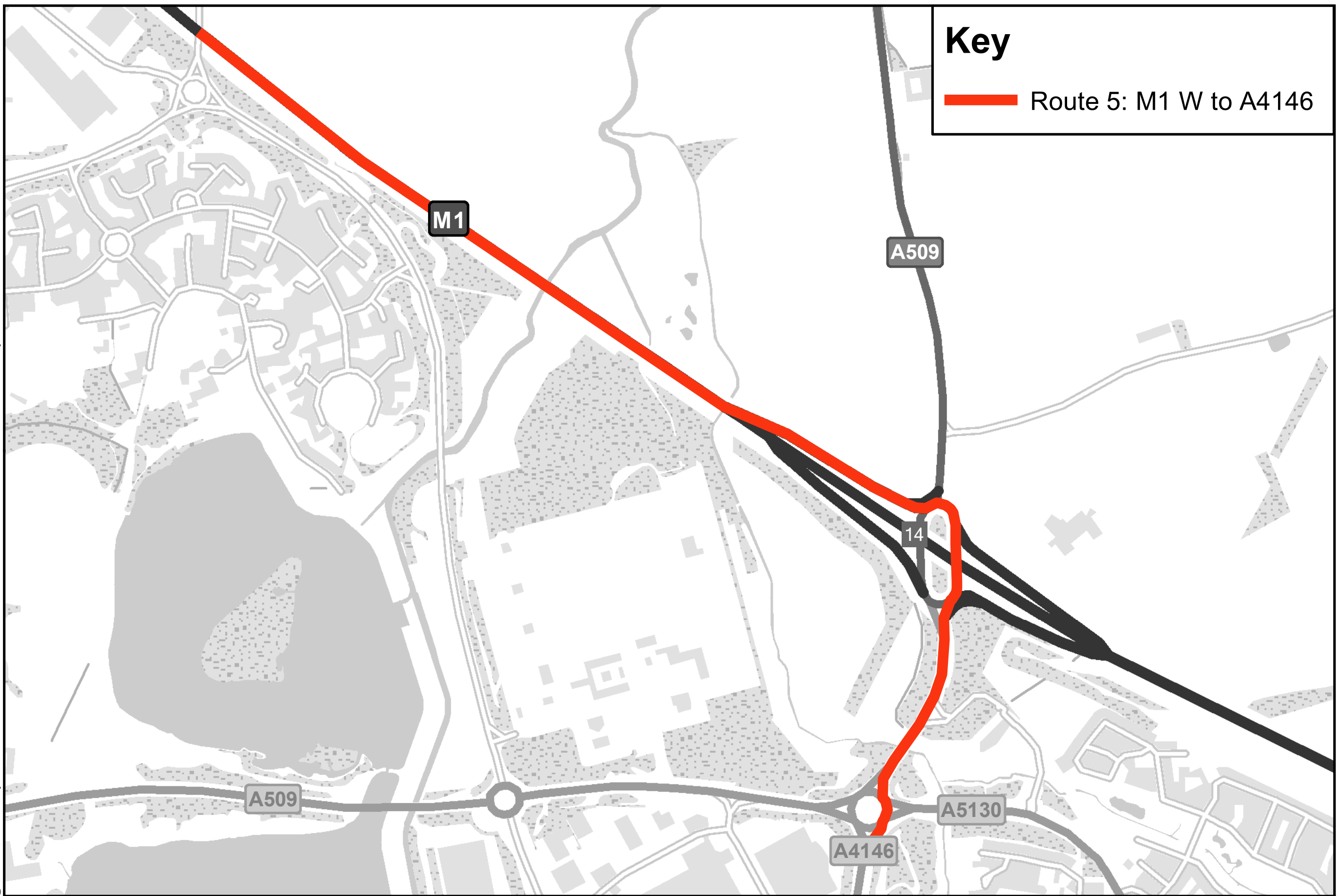
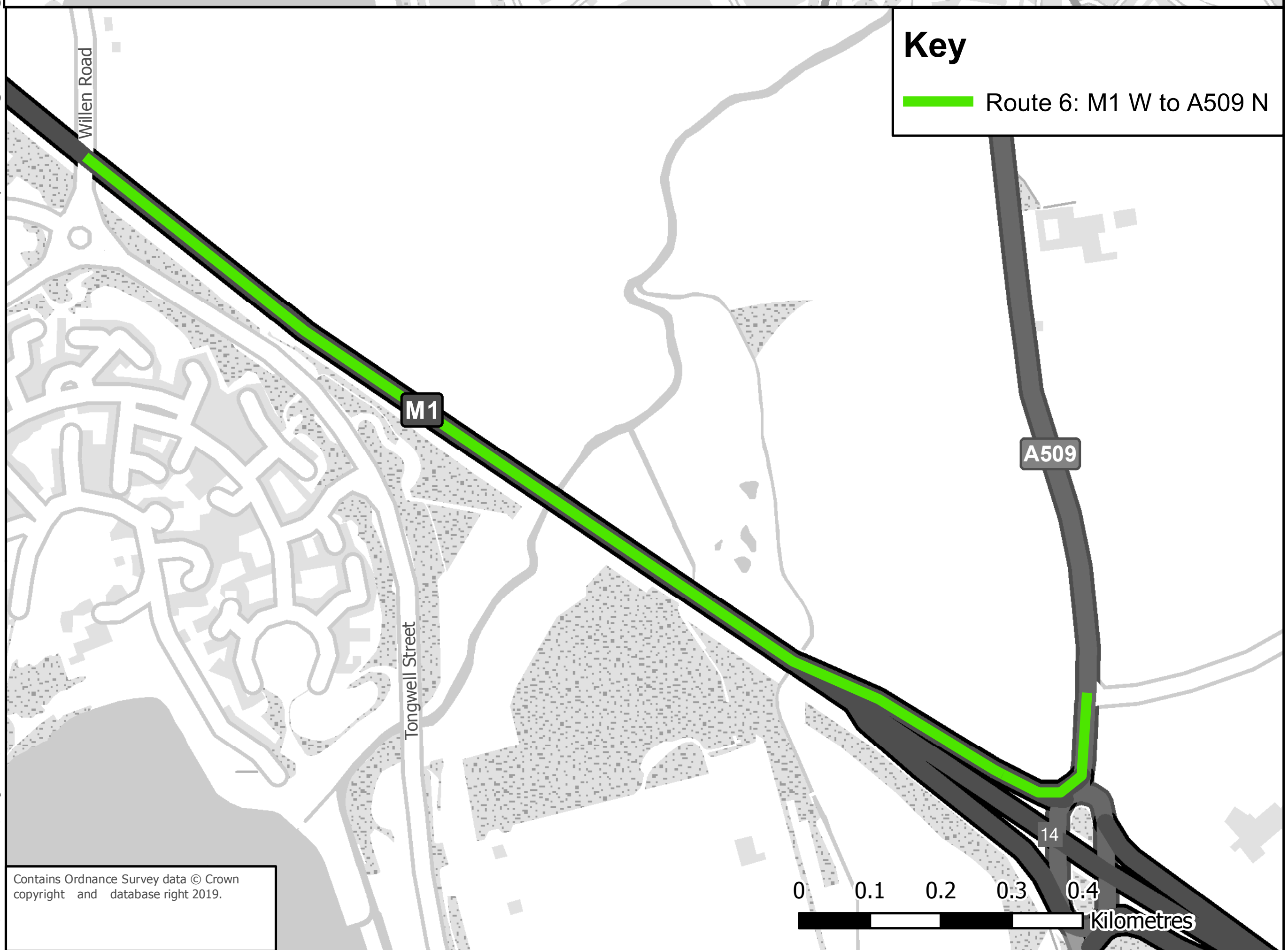


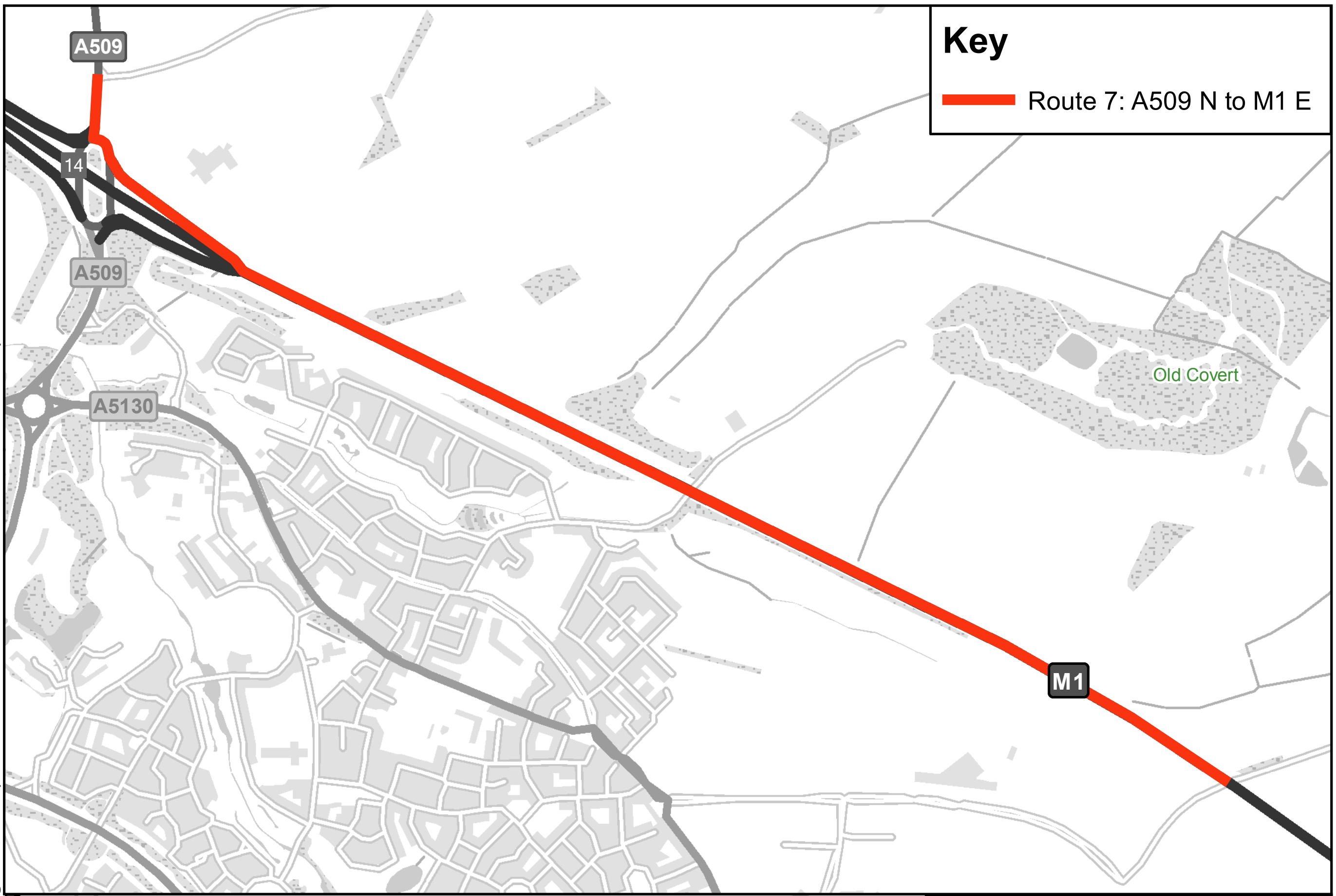


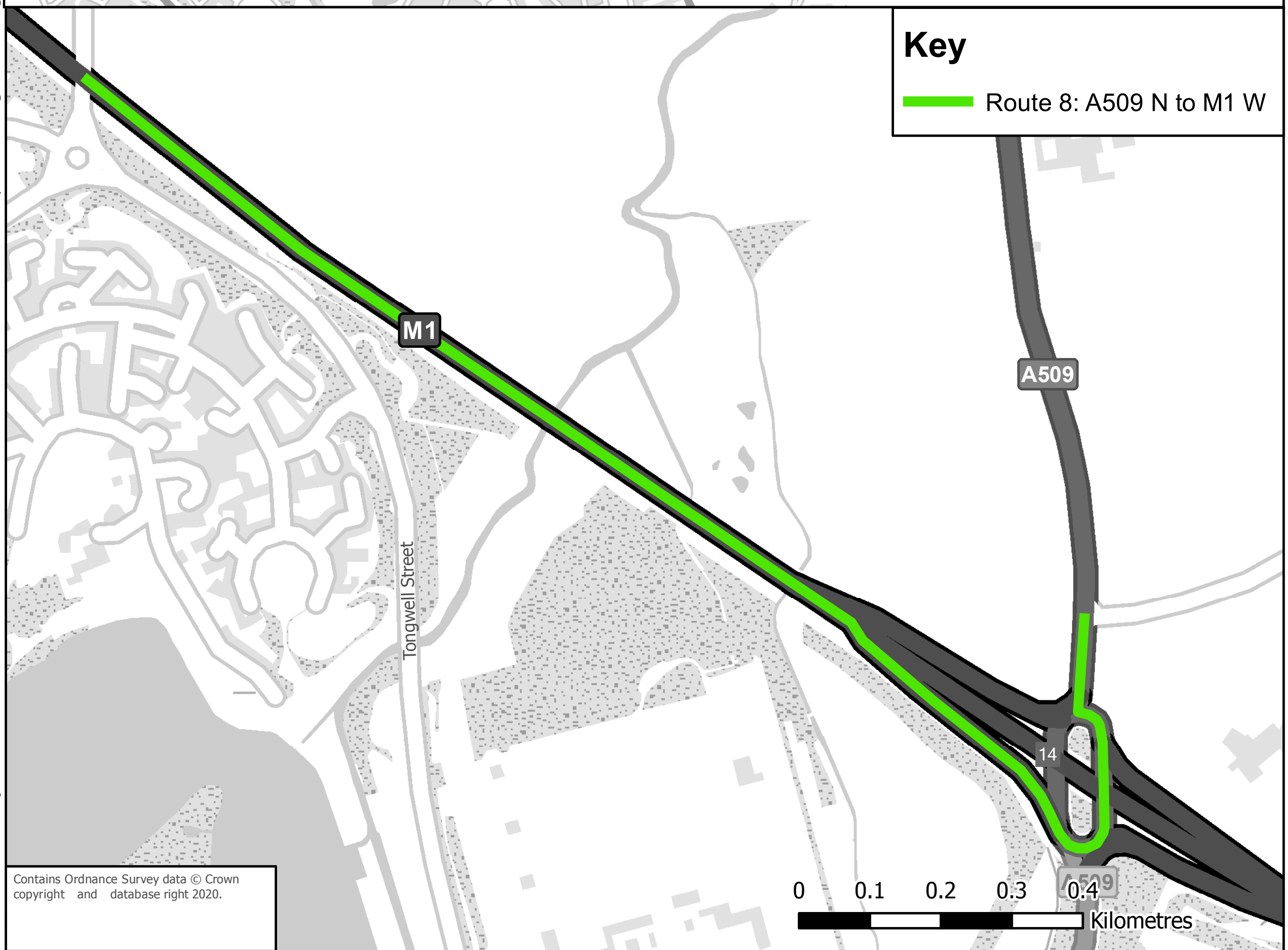
TITLE:

JOURNEY TIME ROUTES 5 AND 6

FIGURE No:

FIGURE 3





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TITLE:

JOURNEY TIME ROUTES 7 AND 8

FIGURE No:

FIGURE 4

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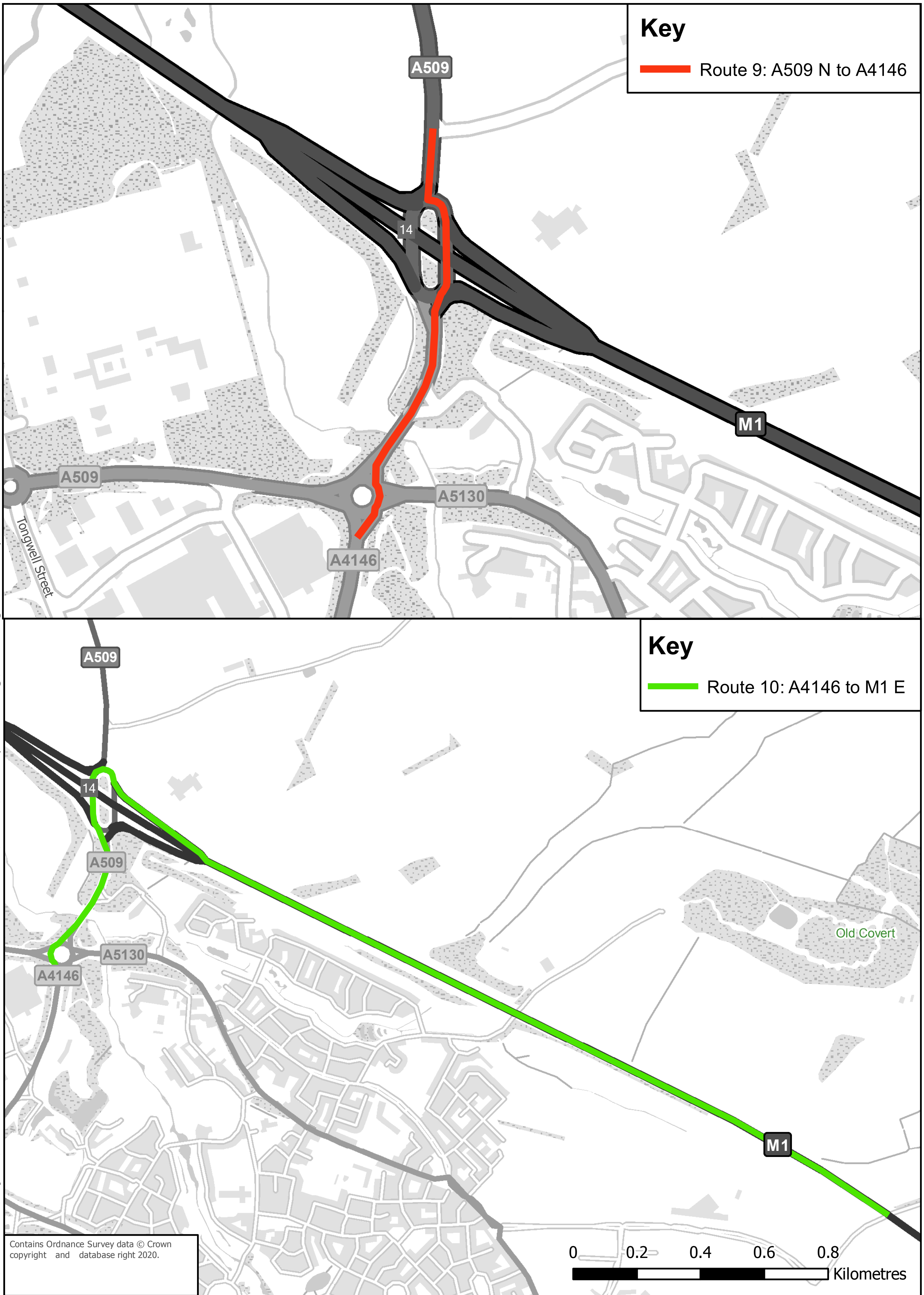

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TITLE:

JOURNEY TIME ROUTES 9 AND 10

FIGURE No:

FIGURE 5

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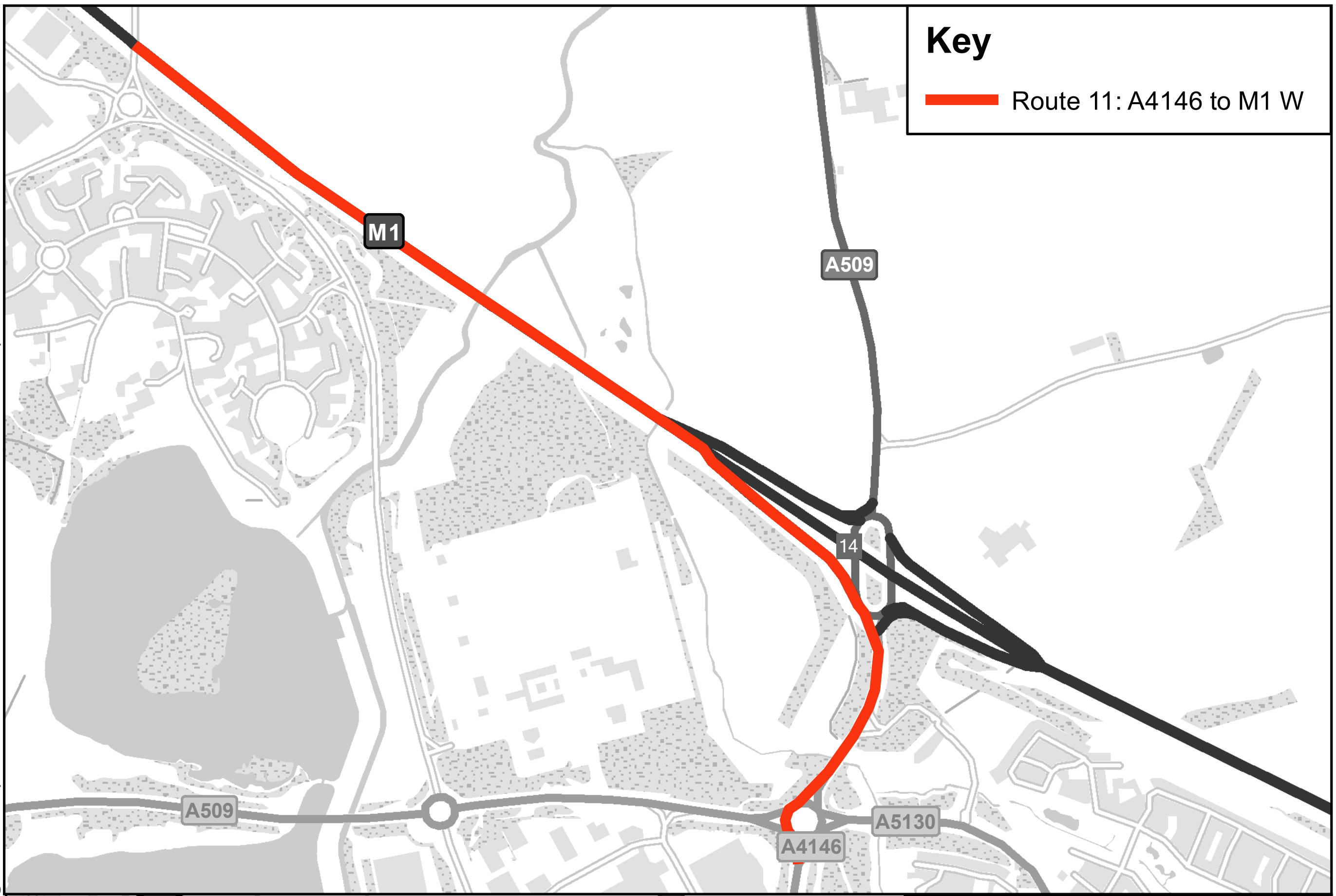

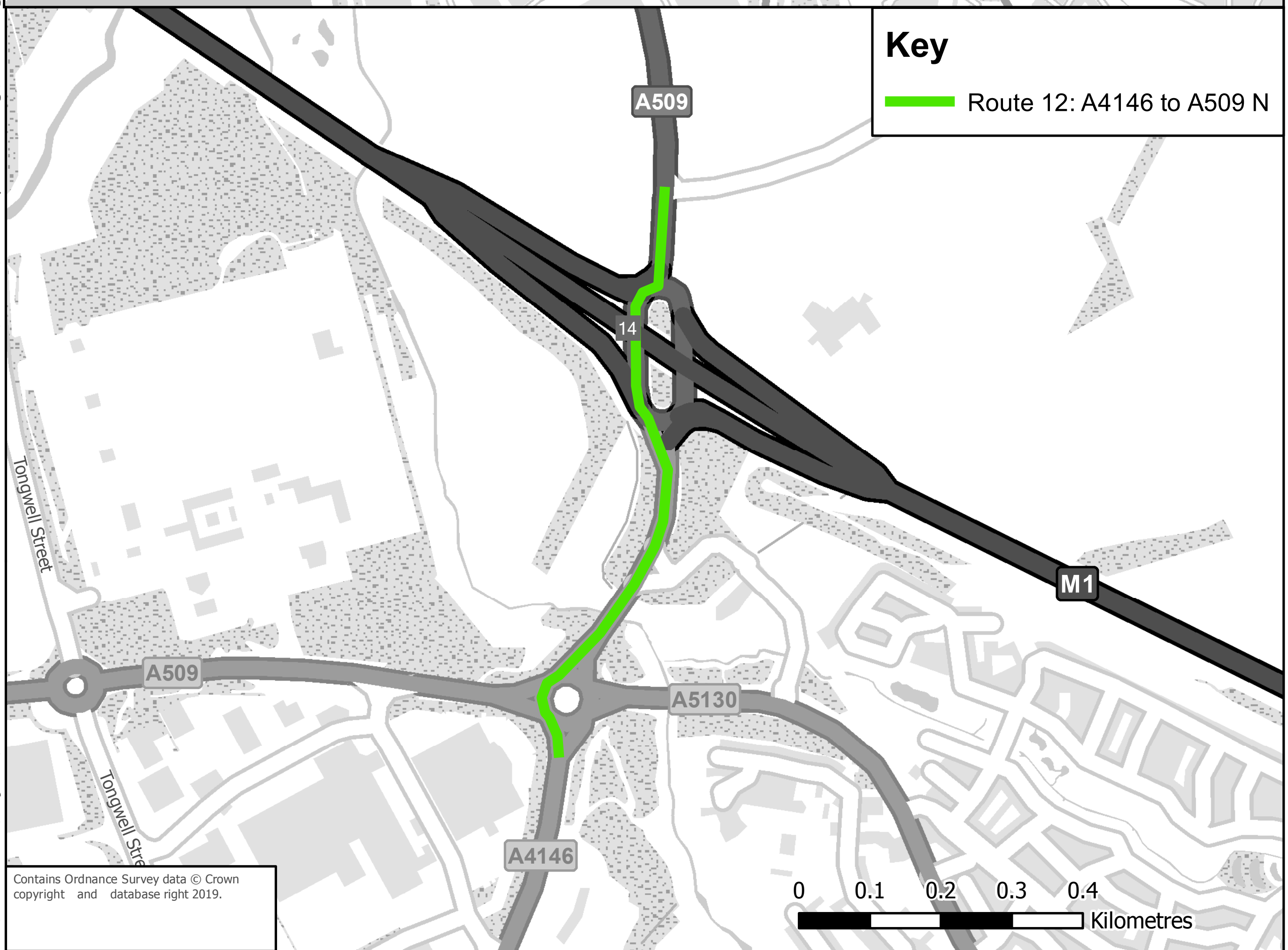

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TITLE:

JOURNEY TIME ROUTES 11 AND 12

FIGURE No:

FIGURE 6

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Appendix B

TURNING COUNT CALIBRATION STATISTICS

Vehicle Flow Information
Calibration Statistics
All Vehicles
AM Peak

Index	Junction	Name	Origin	Destination	Reference	Observed Flow	Modelled Flow	Difference	% Difference	G.E.H. Value (using hourly flows)	Flow Test (using hourly flows)
1	1	M1 Junction 14	A509 N	A509 N	J1) M1 J14 A-A	7	9	2	30.9%	0.8	Pass Low
2	1	M1 Junction 14	A509 N	M1 E	J1) M1 J14 A-B	284	227	-58	-20.4%	3.6	Pass Low
3	1	M1 Junction 14	A509 N	A509 S	J1) M1 J14 A-C	556	490	-66	-11.8%	2.9	Pass Low
4	1	M1 Junction 14	A509 N	M1 W	J1) M1 J14 A-D	90	76	-13	-14.8%	1.5	Pass Low
5	1	M1 Junction 14	M1 E	A509 N	J1) M1 J14 B-A	187	181	-7	-3.6%	0.5	Pass Low
7	1	M1 Junction 14	M1 E	A509 S	J1) M1 J14 B-C	1254	1251	-2	-0.2%	0.1	Pass Mid
8	1	M1 Junction 14	M1 E	M1 W	J1) M1 J14 B-D	2467	2502	35	1.4%	0.7	Pass Mid
9	1	M1 Junction 14	A509 S	A509 N	J1) M1 J14 C-A	258	259	1	0.5%	0.1	Pass Low
10	1	M1 Junction 14	A509 S	M1 E	J1) M1 J14 C-B	396	395	-1	-0.3%	0.1	Pass Low
11	1	M1 Junction 14	A509 S	A509 S	J1) M1 J14 C-C	1	1	0	-1.1%	0.0	Pass Low
12	1	M1 Junction 14	A509 S	M1 W	J1) M1 J14 C-D	451	446	-5	-1.1%	0.2	Pass Low
13	1	M1 Junction 14	M1 W	A509 N	J1) M1 J14 D-A	142	143	1	0.5%	0.1	Pass Low
14	1	M1 Junction 14	M1 W	M1 E	J1) M1 J14 D-B	2302	2331	29	1.2%	0.6	Pass Mid
15	1	M1 Junction 14	M1 W	A509 S	J1) M1 J14 D-C	970	988	18	1.9%	0.6	Pass Mid
17	2	A509 / P&R	A509 N	P&R	28::103::105	22	23	1	3.2%	0.1	Pass Low
18	2	A509 / P&R	A509 N	A509 S	28::103::26	2758	2736	-22	-0.8%	0.4	Pass High
19	2	A509 / P&R	P&R	A509 S	128::26::24	0	0	0		0.0	Pass Low
20	2	A509 / P&R	A509 S	A509 N	101::25::27	1107	1101	-5	-0.5%	0.2	Pass Mid
21	3	A509 / A5130 / A4146	A509 N	A509 N	J3) A509/A5130 A-A	0	4	4		2.9	Pass Low
22	3	A509 / A5130 / A4146	A509 N	A5130	J3) A509/A5130 A-B	123	155	32	25.6%	2.7	Pass Low
23	3	A509 / A5130 / A4146	A509 N	A4146	J3) A509/A5130 A-C	1328	1322	-6	-0.5%	0.2	Pass Mid
24	3	A509 / A5130 / A4146	A509 N	A509 W	J3) A509/A5130 A-D	1307	1255	-52	-4.0%	1.5	Pass Mid
25	3	A509 / A5130 / A4146	A5130	A509 N	J3) A509/A5130 B-A	218	184	-35	-15.9%	2.4	Pass Low
27	3	A509 / A5130 / A4146	A5130	A4146	J3) A509/A5130 B-C	135	134	-1	-0.8%	0.1	Pass Low
28	3	A509 / A5130 / A4146	A5130	A509 W	J3) A509/A5130 B-D	375	379	4	1.0%	0.2	Pass Low
29	3	A509 / A5130 / A4146	A4146	A509 N	J3) A509/A5130 C-A	515	549	34	6.7%	1.5	Pass Low
30	3	A509 / A5130 / A4146	A4146	A5130	J3) A509/A5130 C-B	47	48	1	1.7%	0.1	Pass Low
32	3	A509 / A5130 / A4146	A4146	A509 W	J3) A509/A5130 C-D	1	3	2	196.6%	1.4	Pass Low
33	3	A509 / A5130 / A4146	A509 W	A509 N	J3) A509/A5130 D-A	373	360	-14	-3.6%	0.7	Pass Low
34	3	A509 / A5130 / A4146	A509 W	A5130	J3) A509/A5130 D-B	165	148	-18	-10.6%	1.4	Pass Low
35	3	A509 / A5130 / A4146	A509 W	A4146	J3) A509/A5130 D-C	13	13	0	-1.7%	0.1	Pass Low
37	4	Newport Road / A509	A509 N	A509 S	40::39::105x	690	591	-99	-14.4%	3.9	Pass Low
38	4	Newport Road / A509	A509 N	Newport Road	40::39::149	24	30	6	25.2%	1.2	Pass Low
39	4	Newport Road / A509	Newport Road	A509 S	150::149::105x	247	211	-36	-14.6%	2.4	Pass Low
40	4	Newport Road / A509	A509 S	A509 N	38::105x::39	416	409	-7	-1.8%	0.4	Pass Low
41	4	Newport Road / A509	A509 S	Newport Road	38::105x::149	178	174	-4	-2.3%	0.3	Pass Low

	Sum Obs.	Sum Mod.	Diff	% Diff	Ave. GEH
Overall Stats	19410	19127	-282	-1.5%	1.0

Vehicle Flow Information
Calibration Statistics
All Vehicles
PM Peak

Index	Junction	Name	Origin	Destination	Reference	Observed Flow	Modelled Flow	Difference	% Difference	G.E.H. Value (using hourly flows)	Flow Test (using hourly flows)
1	1	M1 Junction 14	A509 N	A509 N	J1) M1 J14 A-A	29	31	2	8.2%	0.4	Pass Low
2	1	M1 Junction 14	A509 N	M1 E	J1) M1 J14 A-B	333	306	-27	-8.1%	1.5	Pass Low
3	1	M1 Junction 14	A509 N	A509 S	J1) M1 J14 A-C	549	533	-16	-2.8%	0.7	Pass Low
4	1	M1 Junction 14	A509 N	M1 W	J1) M1 J14 A-D	197	188	-9	-4.5%	0.6	Pass Low
5	1	M1 Junction 14	M1 E	A509 N	J1) M1 J14 B-A	273	269	-3	-1.2%	0.2	Pass Low
7	1	M1 Junction 14	M1 E	A509 S	J1) M1 J14 B-C	522	523	1	0.3%	0.1	Pass Low
8	1	M1 Junction 14	M1 E	M1 W	J1) M1 J14 B-D	2740	2748	8	0.3%	0.2	Pass High
9	1	M1 Junction 14	A509 S	A509 N	J1) M1 J14 C-A	472	498	25	5.3%	1.1	Pass Low
10	1	M1 Junction 14	A509 S	M1 E	J1) M1 J14 C-B	718	719	1	0.1%	0.0	Pass Mid
11	1	M1 Junction 14	A509 S	A509 S	J1) M1 J14 C-C	1	1	0	-19.1%	0.2	Pass Low
12	1	M1 Junction 14	A509 S	M1 W	J1) M1 J14 C-D	649	589	-61	-9.3%	2.4	Pass Low
13	1	M1 Junction 14	M1 W	A509 N	J1) M1 J14 D-A	117	114	-3	-2.3%	0.3	Pass Low
14	1	M1 Junction 14	M1 W	M1 E	J1) M1 J14 D-B	2562	2528	-34	-1.3%	0.7	Pass Mid
15	1	M1 Junction 14	M1 W	A509 S	J1) M1 J14 D-C	519	508	-10	-2.0%	0.5	Pass Low
17	2	A509 / P&R	A509 N	P&R	28::103::105	25	18	-7	-29.0%	1.6	Pass Low
18	2	A509 / P&R	A509 N	A509 S	28::103::26	1566	1540	-26	-1.7%	0.7	Pass Mid
19	2	A509 / P&R	P&R	A509 S	128::26::24	0	0	0		0.0	Pass Low
20	2	A509 / P&R	A509 S	A509 N	101::25::27	1842	1806	-36	-2.0%	0.8	Pass Mid
21	3	A509 / A5130 / A4146	A509 N	A509 N	J3) A509/A5130 A-A	0	1	1		1.3	Pass Low
22	3	A509 / A5130 / A4146	A509 N	A5130	J3) A509/A5130 A-B	204	188	-15	-7.6%	1.1	Pass Low
23	3	A509 / A5130 / A4146	A509 N	A4146	J3) A509/A5130 A-C	860	844	-16	-1.9%	0.6	Pass Mid
24	3	A509 / A5130 / A4146	A509 N	A509 W	J3) A509/A5130 A-D	503	507	4	0.8%	0.2	Pass Low
25	3	A509 / A5130 / A4146	A5130	A509 N	J3) A509/A5130 B-A	399	393	-6	-1.6%	0.3	Pass Low
27	3	A509 / A5130 / A4146	A5130	A4146	J3) A509/A5130 B-C	116	119	3	2.9%	0.3	Pass Low
28	3	A509 / A5130 / A4146	A5130	A509 W	J3) A509/A5130 B-D	161	165	4	2.5%	0.3	Pass Low
29	3	A509 / A5130 / A4146	A4146	A509 N	J3) A509/A5130 C-A	800	719	-81	-10.2%	3.0	Pass Mid
30	3	A509 / A5130 / A4146	A4146	A5130	J3) A509/A5130 C-B	49	59	10	19.9%	1.3	Pass Low
32	3	A509 / A5130 / A4146	A4146	A509 W	J3) A509/A5130 C-D	3	2	-2	-52.3%	1.1	Pass Low
33	3	A509 / A5130 / A4146	A509 W	A509 N	J3) A509/A5130 D-A	642	689	47	7.4%	1.8	Pass Low
34	3	A509 / A5130 / A4146	A509 W	A5130	J3) A509/A5130 D-B	239	241	1	0.5%	0.1	Pass Low
35	3	A509 / A5130 / A4146	A509 W	A4146	J3) A509/A5130 D-C	7	7	0	-5.3%	0.1	Pass Low
37	4	Newport Road / A509	A509 N	A509 S	40::39::105x	728	711	-17	-2.3%	0.6	Pass Mid
38	4	Newport Road / A509	A509 N	Newport Road	40::39::149	45	35	-11	-24.0%	1.7	Pass Low
39	4	Newport Road / A509	Newport Road	A509 S	150::149::105x	378	349	-29	-7.8%	1.5	Pass Low
40	4	Newport Road / A509	A509 S	A509 N	38::105x::39	787	793	6	0.8%	0.2	Pass Mid
41	4	Newport Road / A509	A509 S	Newport Road	38::105x::149	102	96	-7	-6.6%	0.7	Pass Low

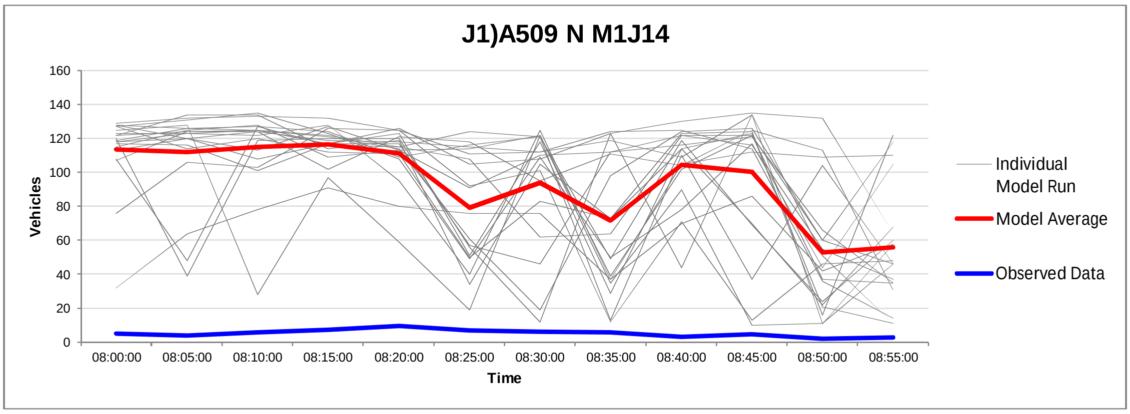
	Sum Obs.	Sum Mod.	Diff	% Diff	Ave. GEH
Overall Stats	19138	18836	-302	-1.6%	0.8

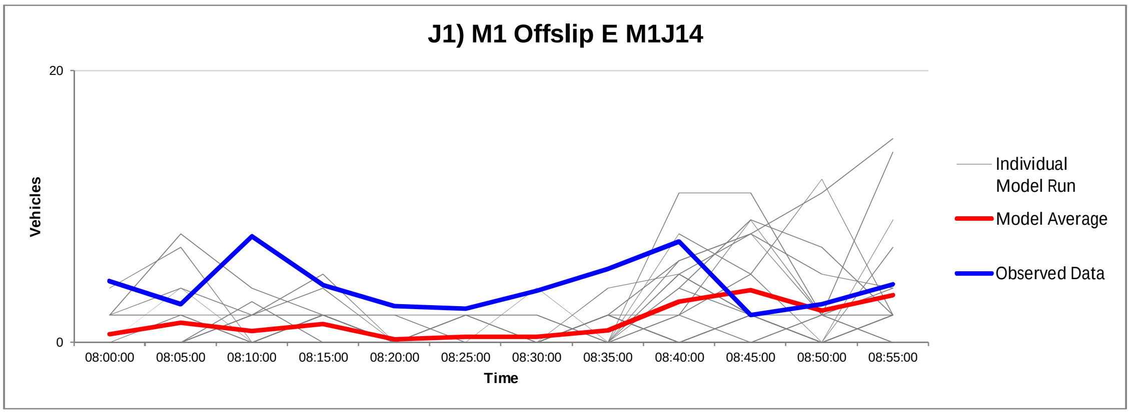
Appendix C

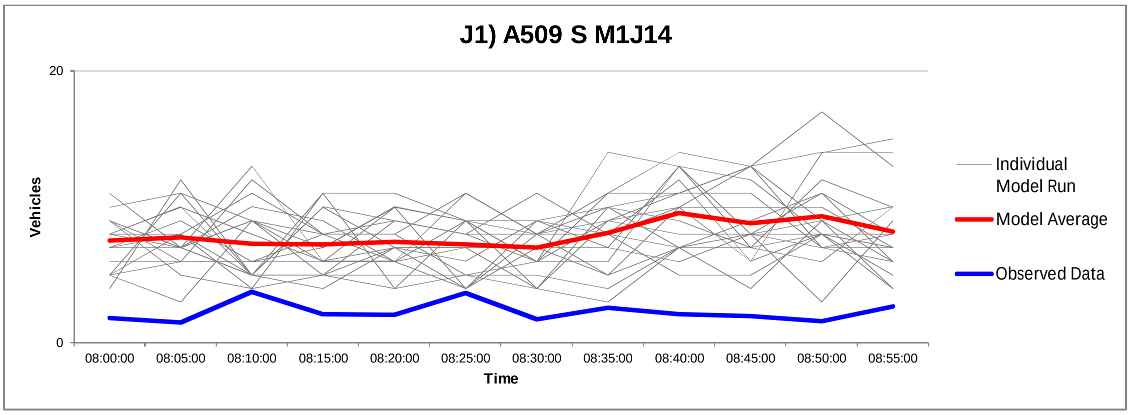
QUEUE CALIBRATION GRAPHS

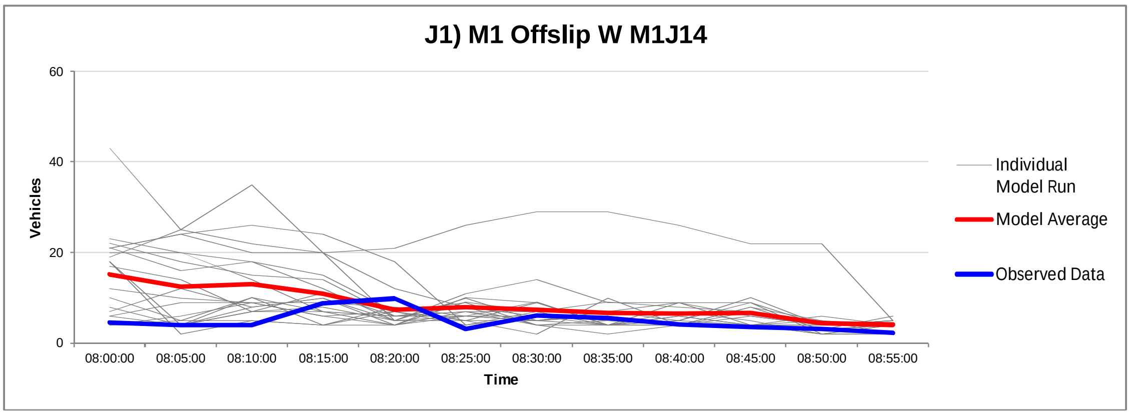
Queue Graphs

Junction Number 1
AM Peak



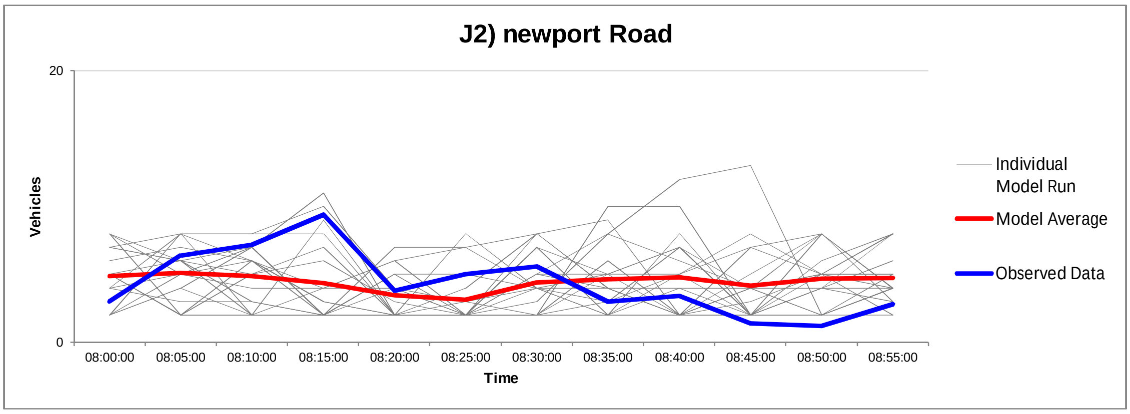


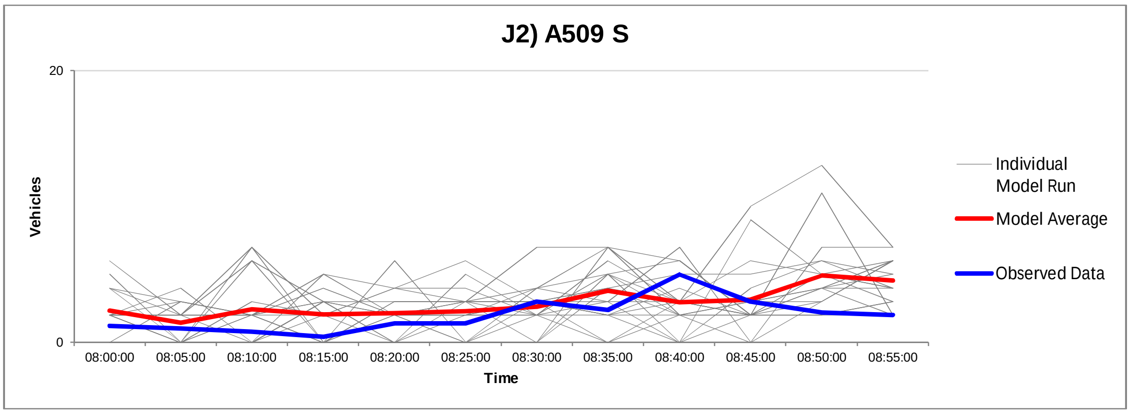




Queue Graphs

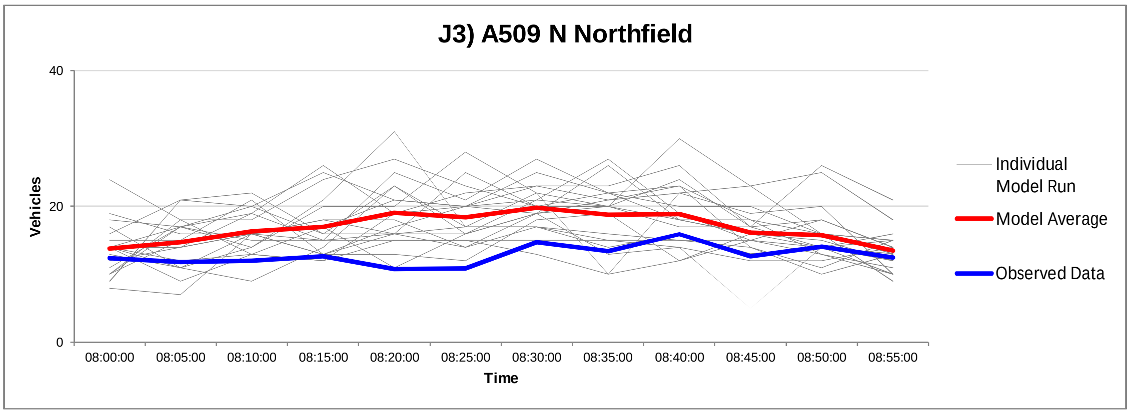
Junction Number 2
AM Peak

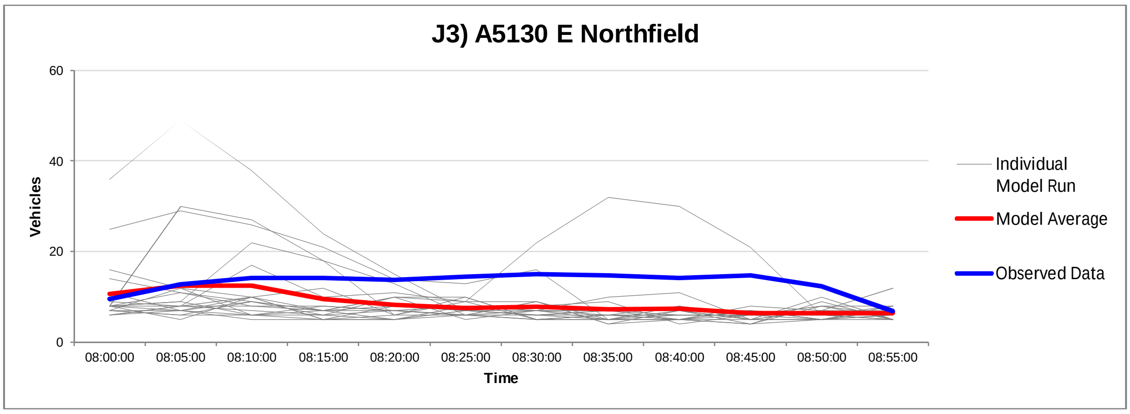


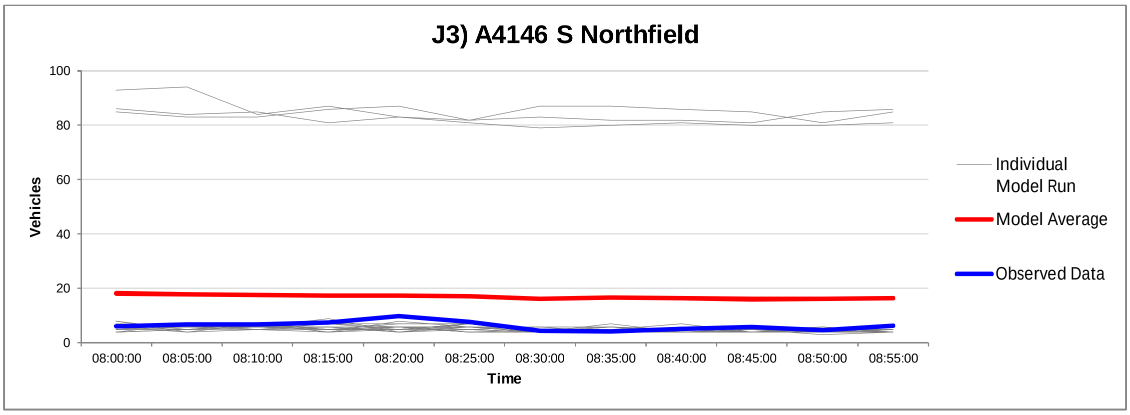


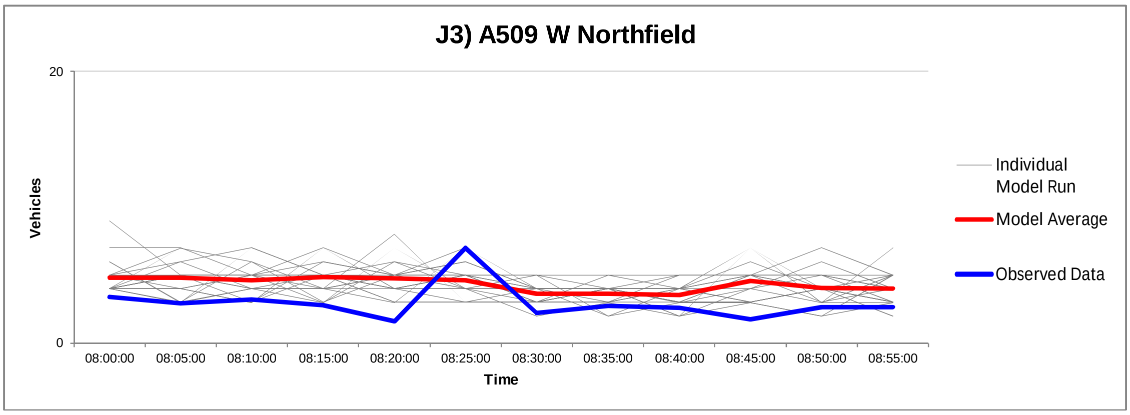
Queue Graphs

Junction Number 3
AM Peak



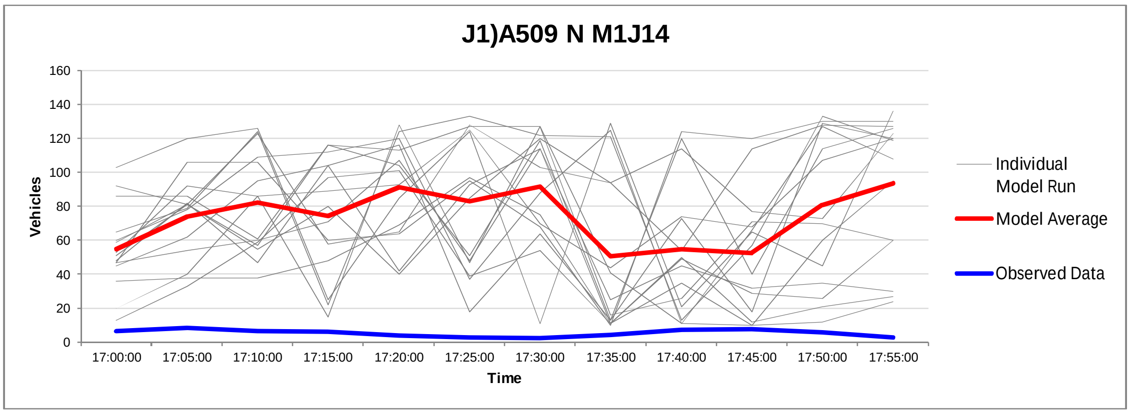


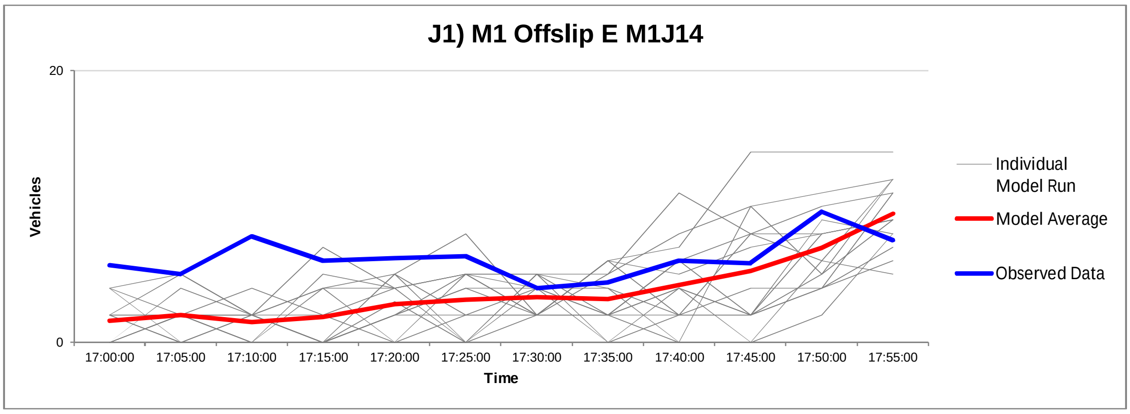


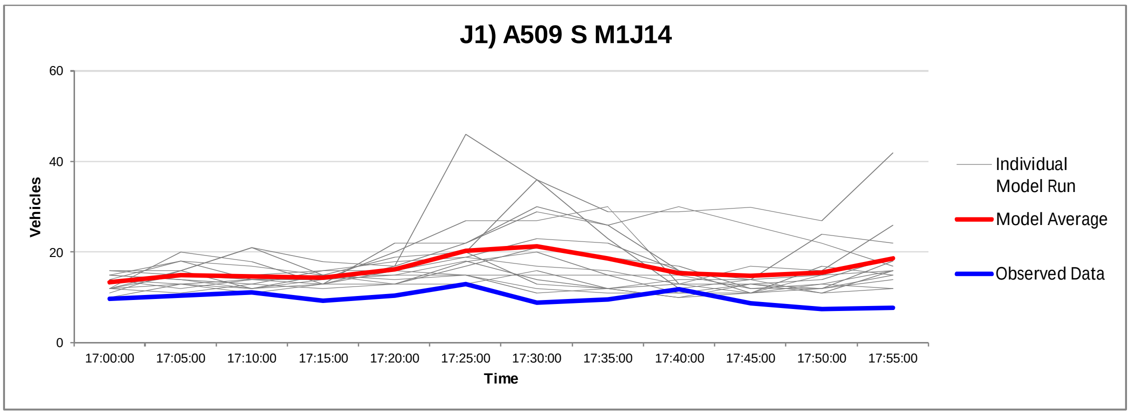


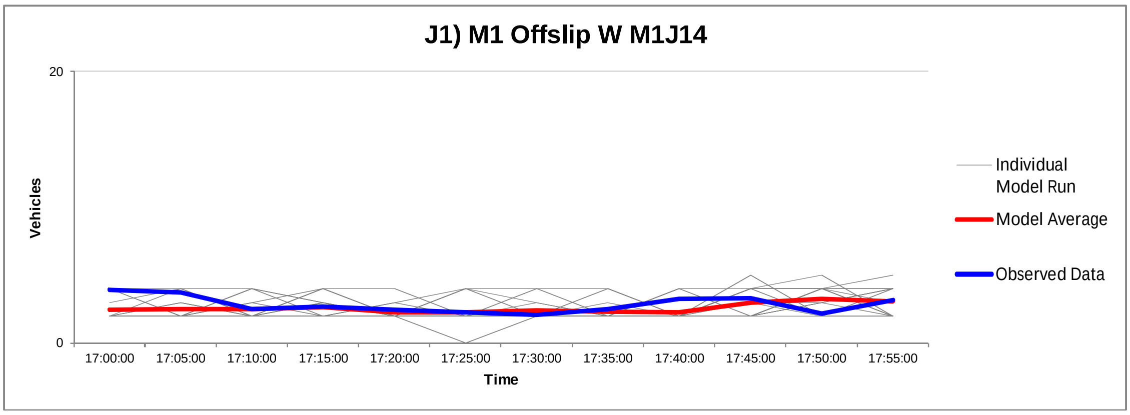
Queue Graphs

Junction Number 1
PM Peak



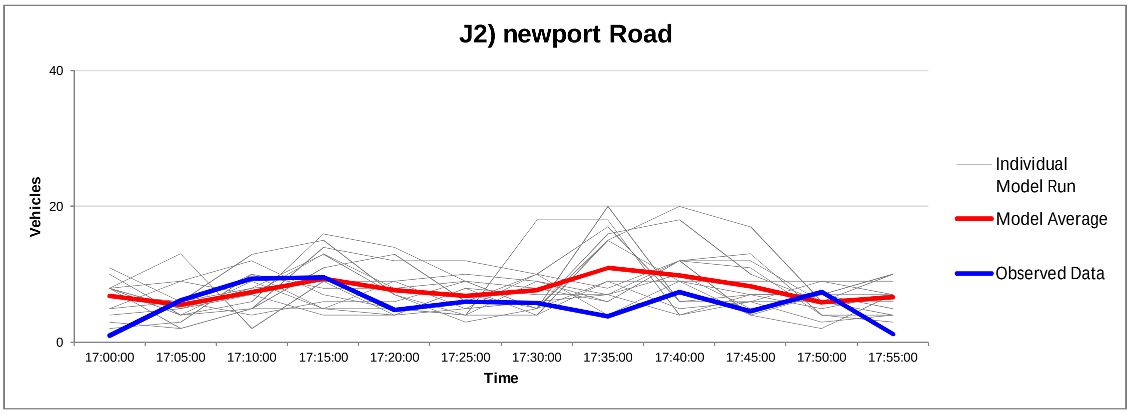


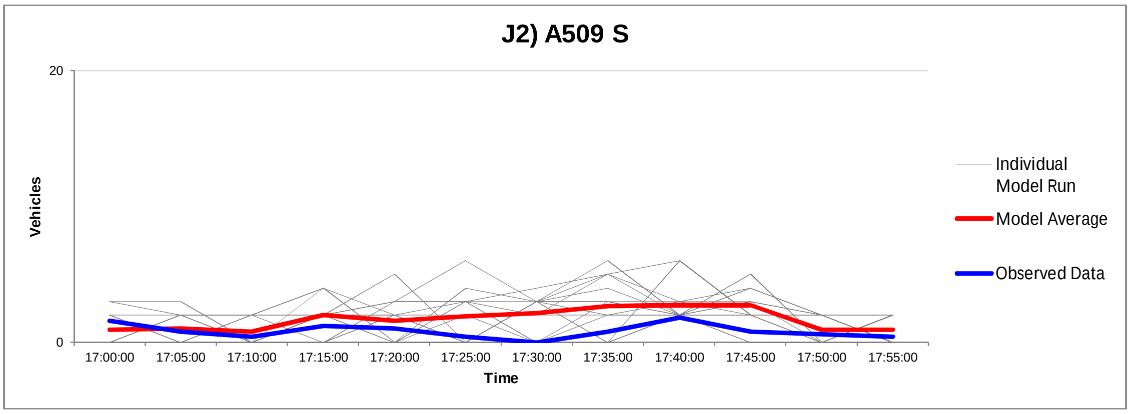




Queue Graphs

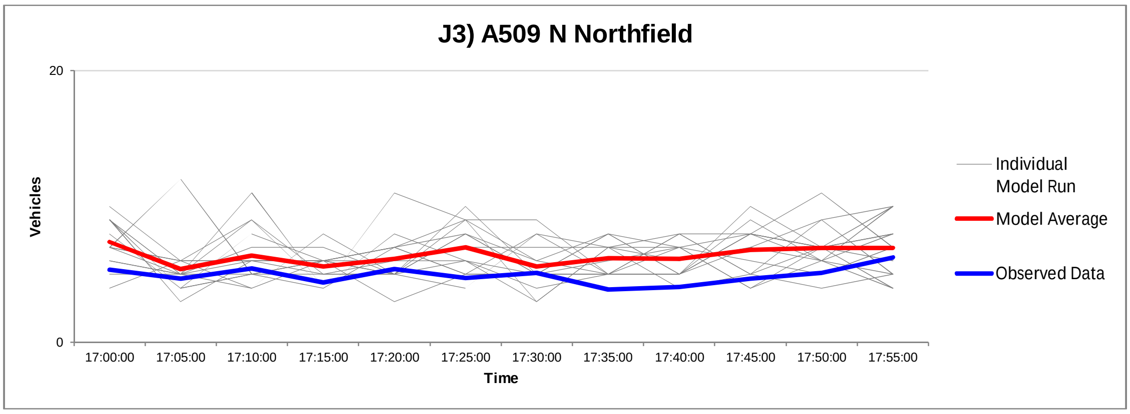
Junction Number 2
PM Peak

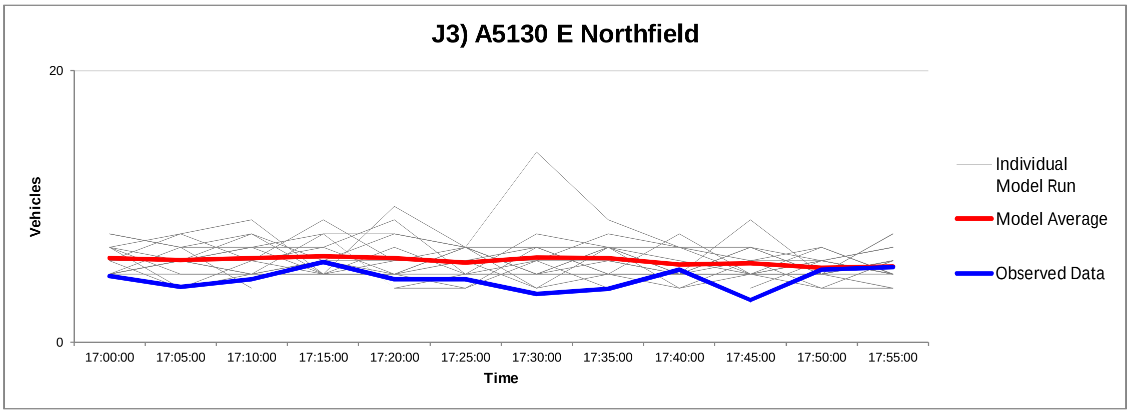


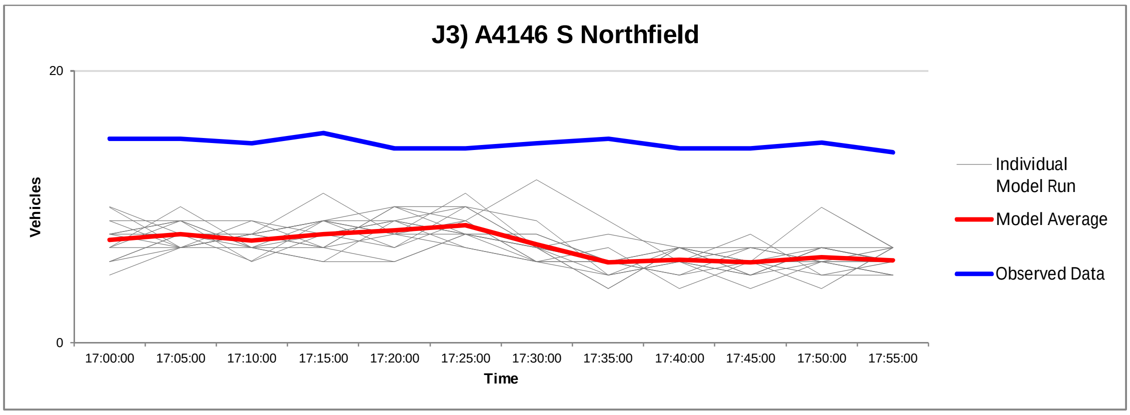


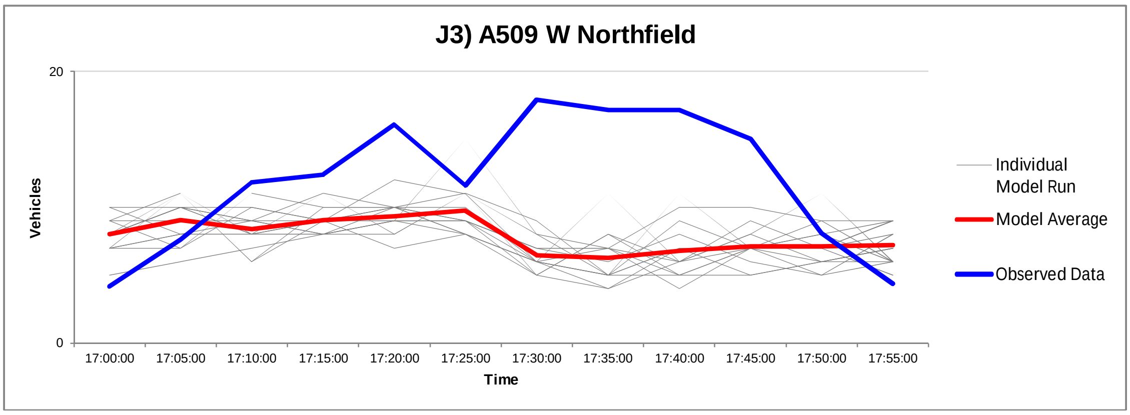
Queue Graphs

Junction Number 3
PM Peak









Appendix D

JOURNEY TIME VALIDATION

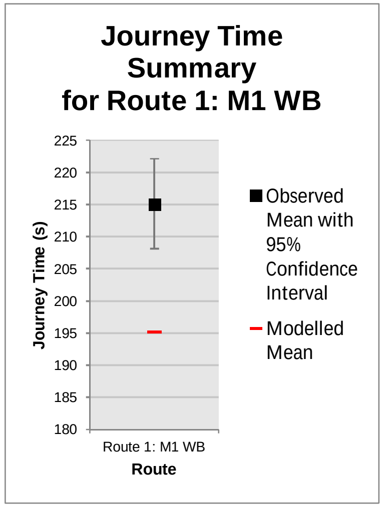
Journey Times
Validation Statistics

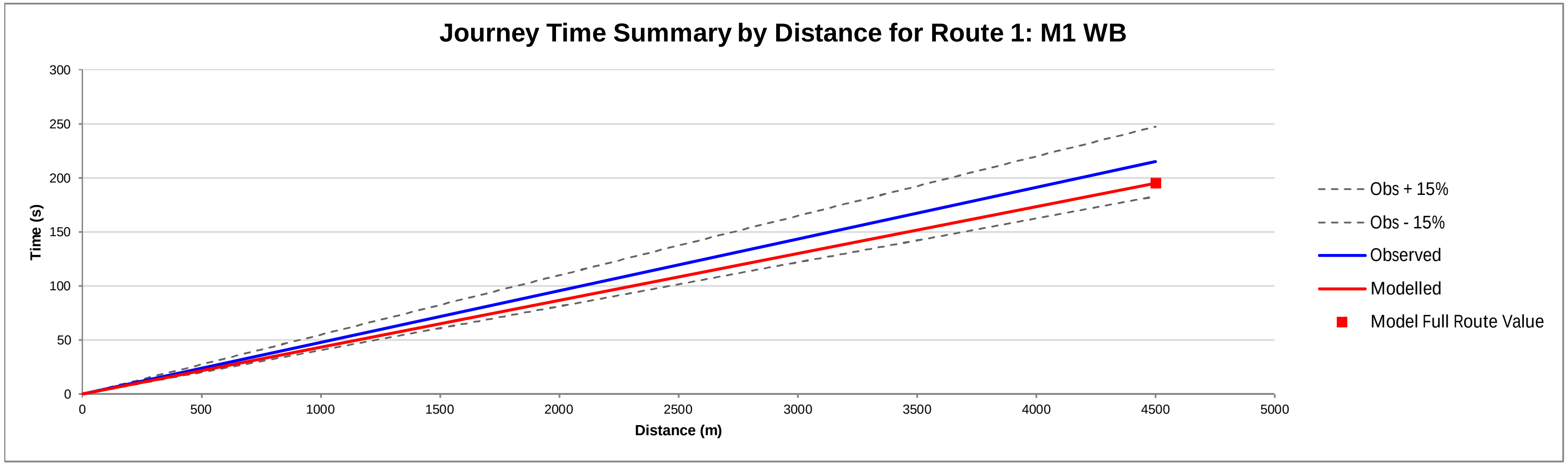
AM Peak

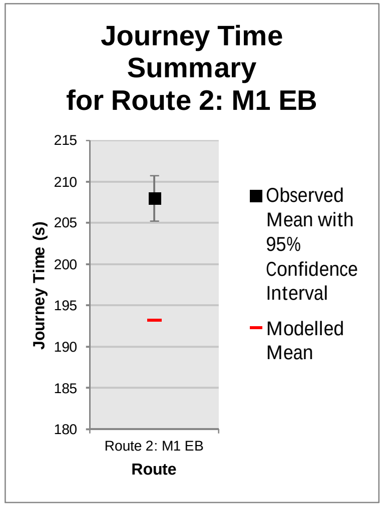
Route:	Segment	Graph Group	Observed Average	Observed 95% Conf	Modelled Average	Modelled 95% Conf	Var Chk	% Diff	Diff	Conf?	15%	60s	WebTAG	Distance (m)
Route 1: M1 WB	Full	1	215	7	195	0	TRUE	-9.3%	-20	FALSE	TRUE	TRUE	TRUE	4500
Route 2: M1 EB	Full	2	208	3	193	1	TRUE	-7.1%	-15	FALSE	TRUE	TRUE	TRUE	4498
Route 3: M1 E to A509 N	Full	3	271	18	283	22	FALSE	4.7%	13	TRUE	TRUE	TRUE	TRUE	3109
Route 4: M1 E to A509 W	Full	4	245	21	245	9	TRUE	0.0%	0	TRUE	TRUE	TRUE	TRUE	3269
Route 5: M1 W to A4146	Full	5	237	28	243	18	FALSE	2.6%	6	TRUE	TRUE	TRUE	TRUE	2382
Route 6: M1 W to A509 (N)	Full	6	128	14	117	10	FALSE	-8.1%	-10	TRUE	TRUE	TRUE	TRUE	1792
Route 7: A509(N) to M1 E	Full	7	197	41	187	2	TRUE	-5.2%	-10	TRUE	TRUE	TRUE	TRUE	2978
Route 8: A509(N) to M1 W	Full	8	221	27	236	7	TRUE	6.7%	15	TRUE	TRUE	TRUE	TRUE	2365
Route 9: A509(N) to A4146	Full	9	202	48	228	8	TRUE	12.4%	25	TRUE	TRUE	TRUE	TRUE	822
Route 10: A4146 to M1 E	Full	10	241	15	243	7	TRUE	0.9%	2	TRUE	TRUE	TRUE	TRUE	3595
Route 11: A4146 to M1 W	Full	11	168	9	150	7	TRUE	-10.5%	-18	FALSE	TRUE	TRUE	TRUE	2534
Route 12: A4146 to A509 N	Full	12	130	17	156	11	FALSE	20.6%	27	FALSE	FALSE	TRUE	TRUE	860

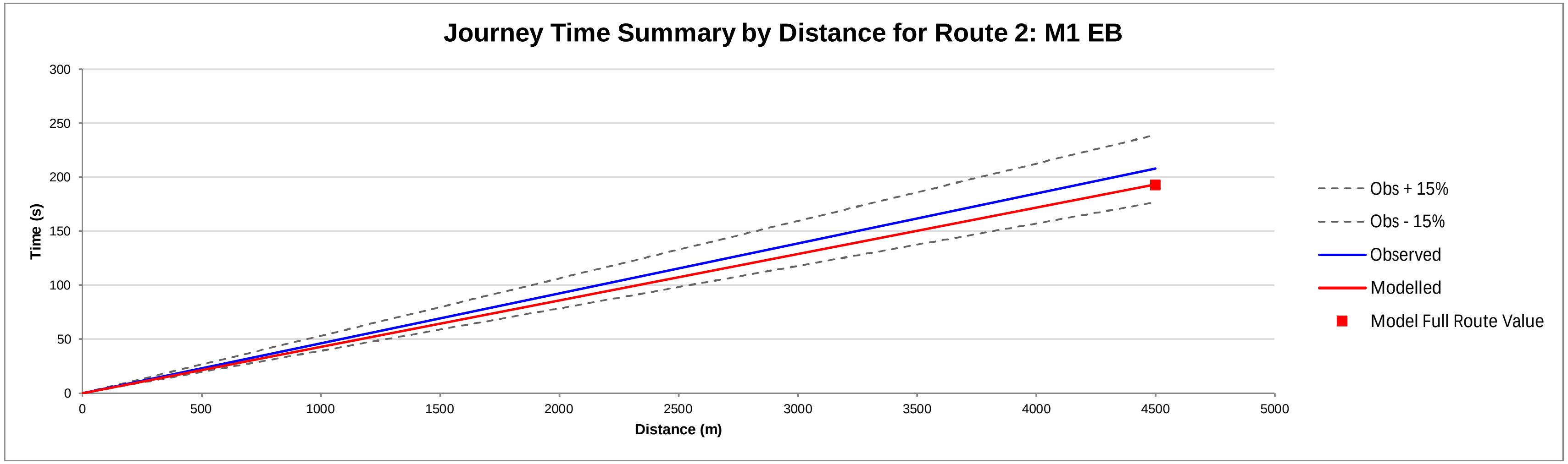
Journey Times
Validation Statistics

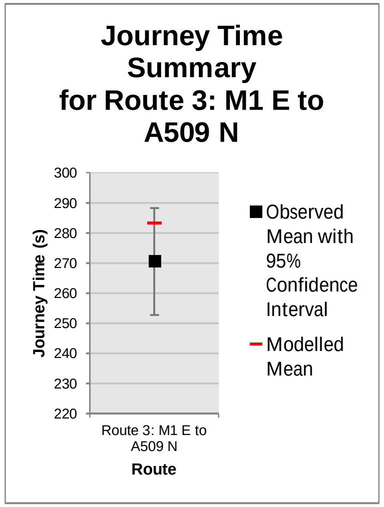
AM Peak

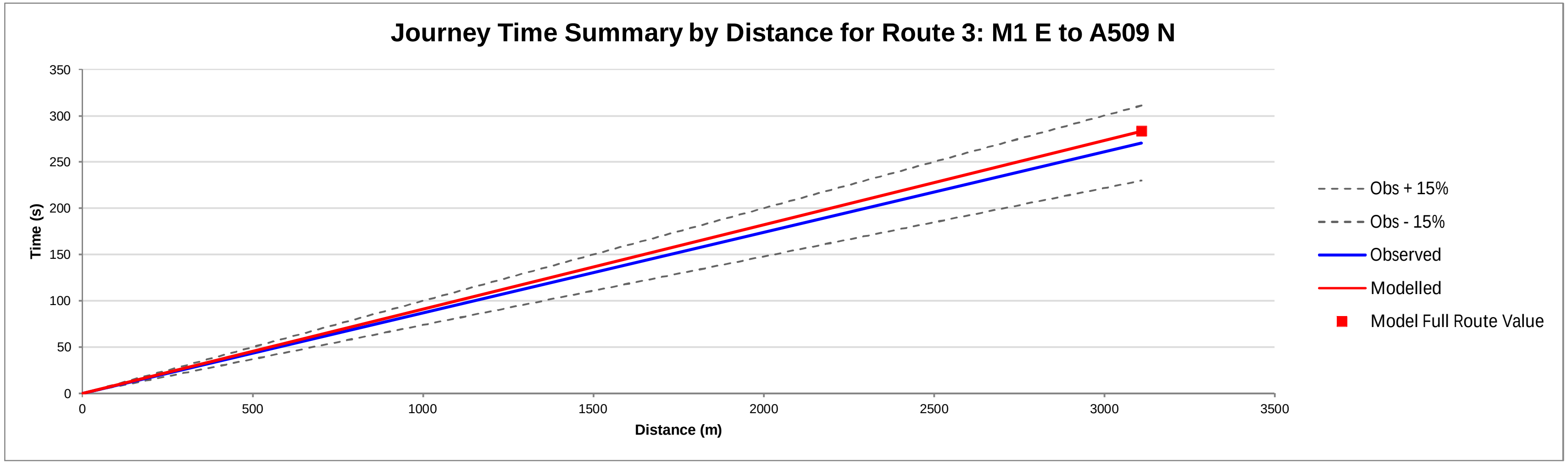


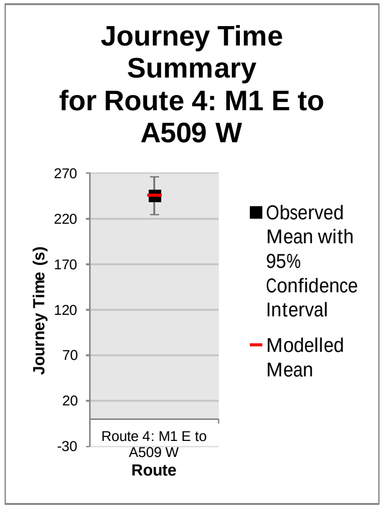


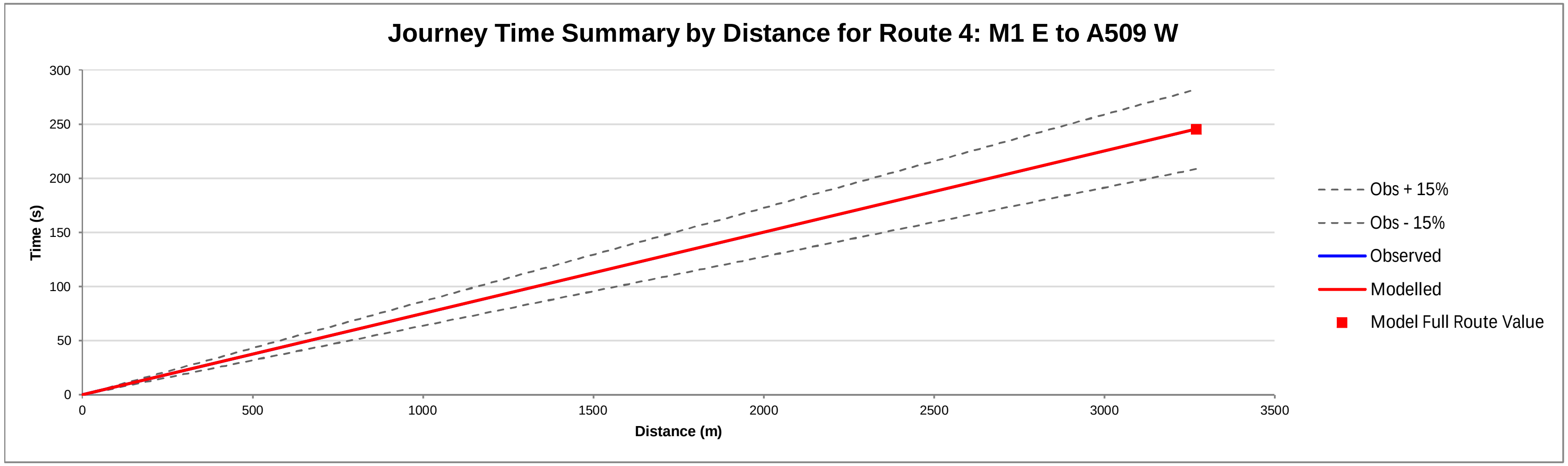

Journey Time Summary for Route 2: M1 EB
Journey Time (s)
215
210
205
200
195
190
185
180
Route 2: M1 EB
Route
Observed Mean with 95% Confidence Interval
Modelled Mean

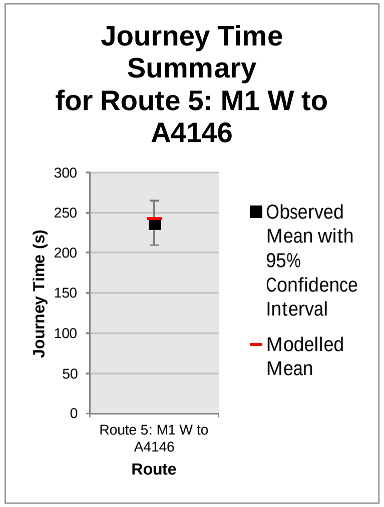

Journey Time Summary by Distance for Route 2: M1 EB
Time (s)
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Distance (m)
Obs + 15%
Obs - 15%
Observed
Modelled
Model Full Route Value

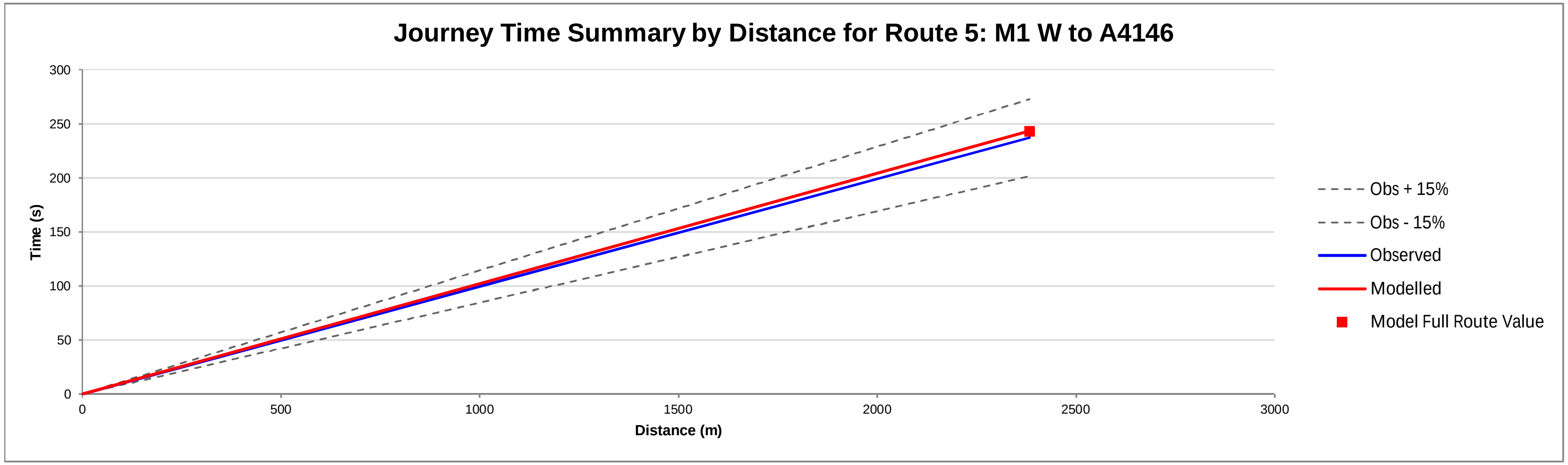

Journey Time Summary
for Route 3: M1 E to A509 N
Journey Time (s)
300
290
280
270
260
250
240
230
220
Route 3: M1 E to A509 N
Route
Observed Mean with 95% Confidence Interval
Modelled Mean

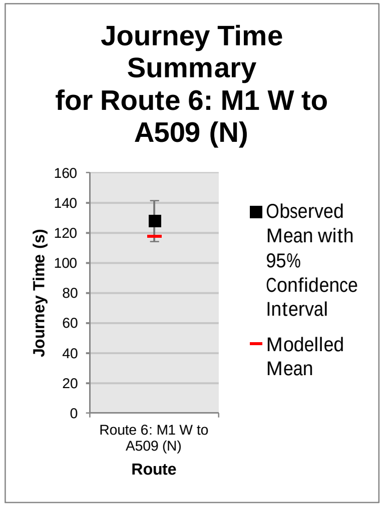

Journey Time Summary by Distance for Route 3: M1 E to A509 N
Time (s)
350
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000
3500
Distance (m)
Obs + 15%
Obs - 15%
Observed
Modelled
Model Full Route Value

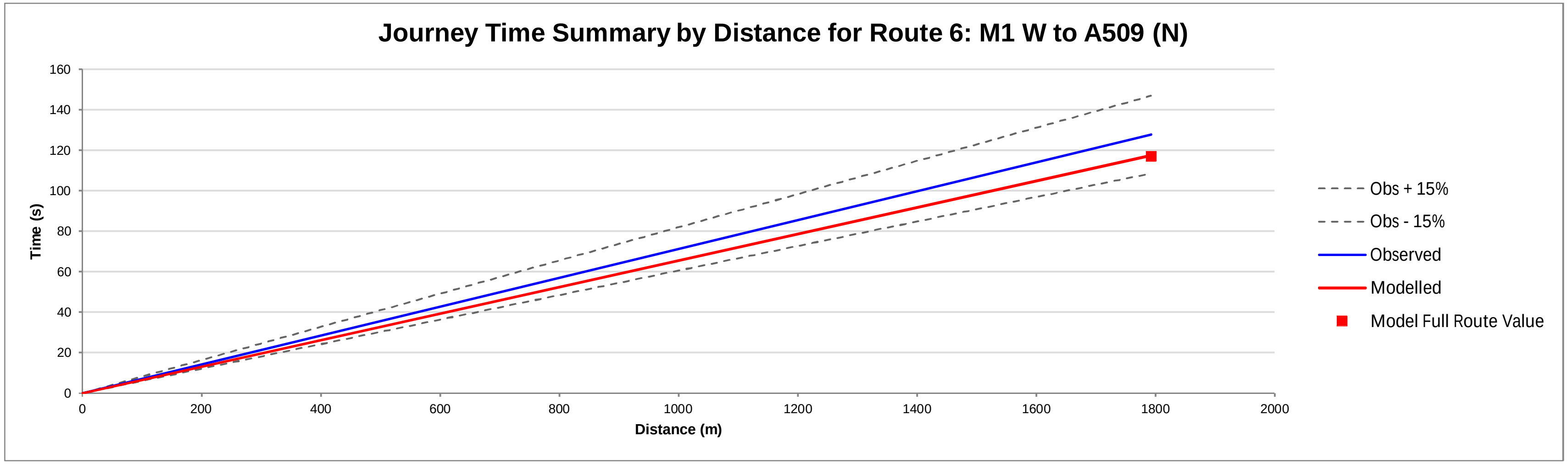

Journey Time Summary
for Route 4: M1 E to A509 W
270
220
170
120
70
20
-30
Journey Time (s)
Route 4: M1 E to A509 W
Route
Observed Mean with 95% Confidence Interval
Modelled Mean

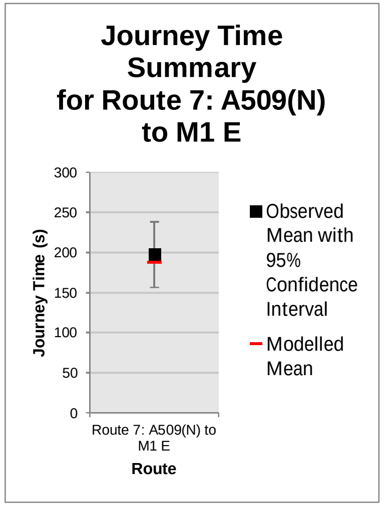

Journey Time Summary by Distance for Route 4: M1 E to A509 W
300
250
200
150
100
50
0
Time (s)
0
500
1000
1500
2000
2500
3000
3500
Distance (m)
Obs + 15%
Obs - 15%
Observed
Modelled
Model Full Route Value

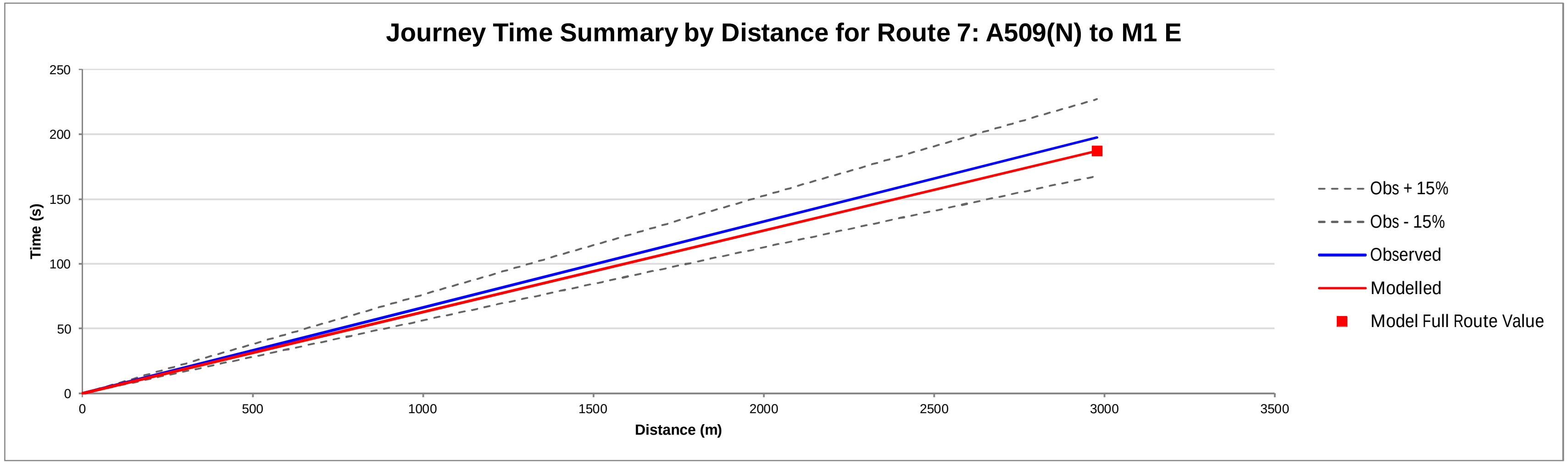

Journey Time Summary
for Route 5: M1 W to A4146
300
250
200
150
100
50
0
Journey Time (s)
Route 5: M1 W to A4146
Route
Observed Mean with 95% Confidence Interval
Modelled Mean


Journey Time Summary by Distance for Route 5: M1 W to A4146
300
250
200
150
100
50
0
Time (s)
0
500
1000
1500
2000
2500
3000
Distance (m)
Obs + 15%
Obs - 15%
Observed
Modelled
Model Full Route Value


Journey Time Summary for Route 6: M1 W to A509 (N)
Journey Time (s)
160
140
120
100
80
60
40
20
0
Observed Mean with 95% Confidence Interval
Modelled Mean
Route 6: M1 W to A509 (N)
Route

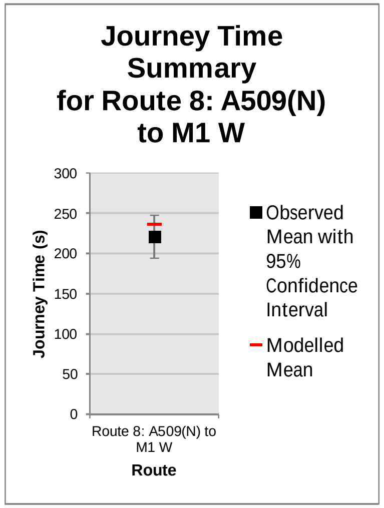

Journey Time Summary by Distance for Route 6: M1 W to A509 (N)
Time (s)
160
140
120
100
80
60
40
20
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Distance (m)
Obs + 15%
Obs - 15%
Observed
Modelled
Model Full Route Value

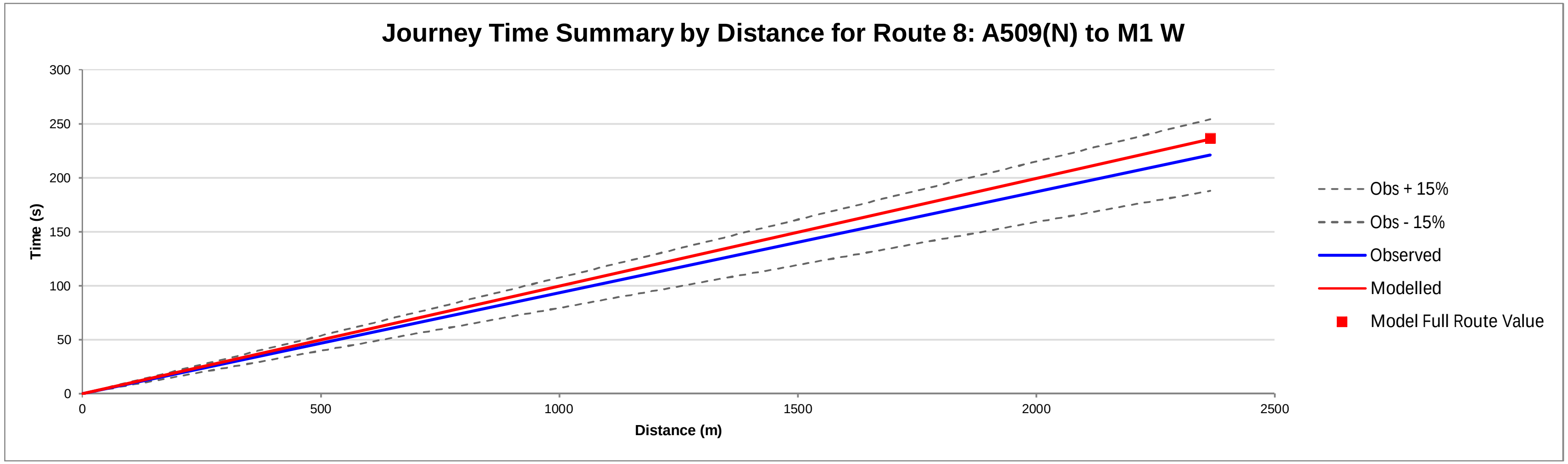

Journey Time Summary for Route 7: A509(N) to M1 E
Journey Time (s)
300
250
200
150
100
50
0
Route 7: A509(N) to M1 E
Route
Observed Mean with 95% Confidence Interval
Modelled Mean


Journey Time Summary by Distance for Route 7: A509(N) to M1 E
Time (s)
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000
3500
Distance (m)
Obs + 15%
Obs - 15%
Observed
Modelled
Model Full Route Value

Journey Times
Validation Statistics

AM Peak

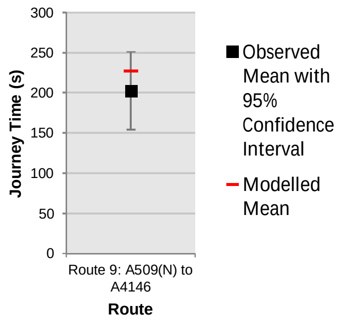




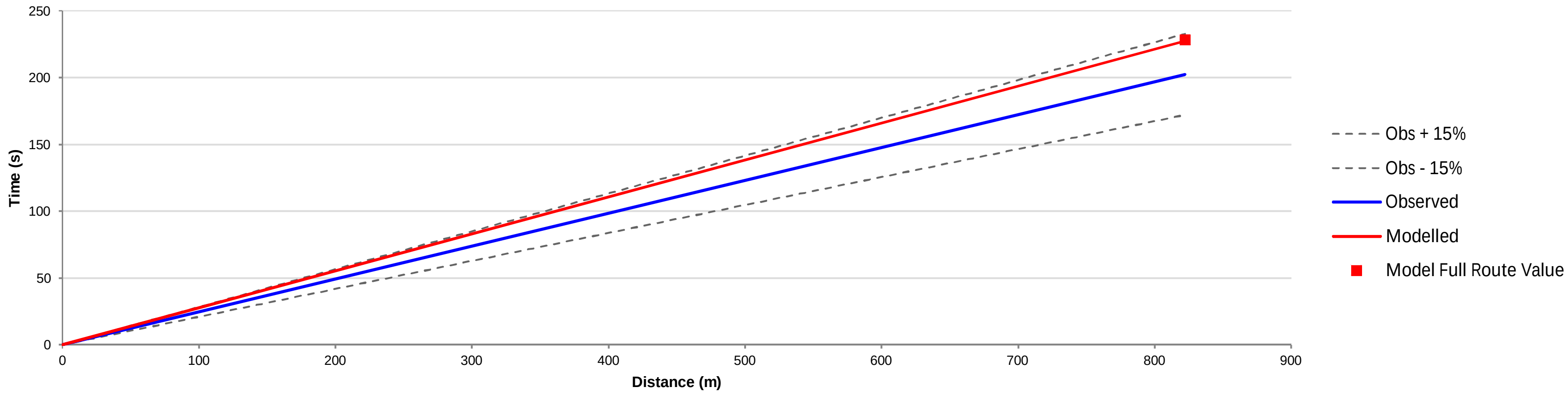
Journey Times
Validation Statistics

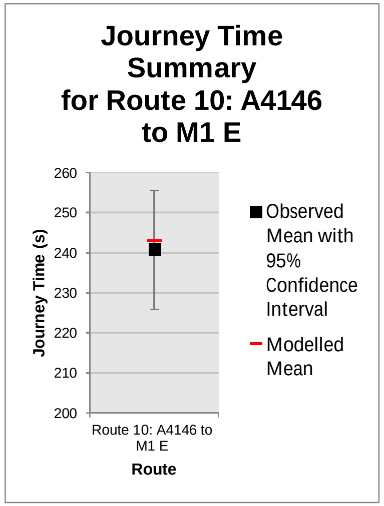
AM Peak

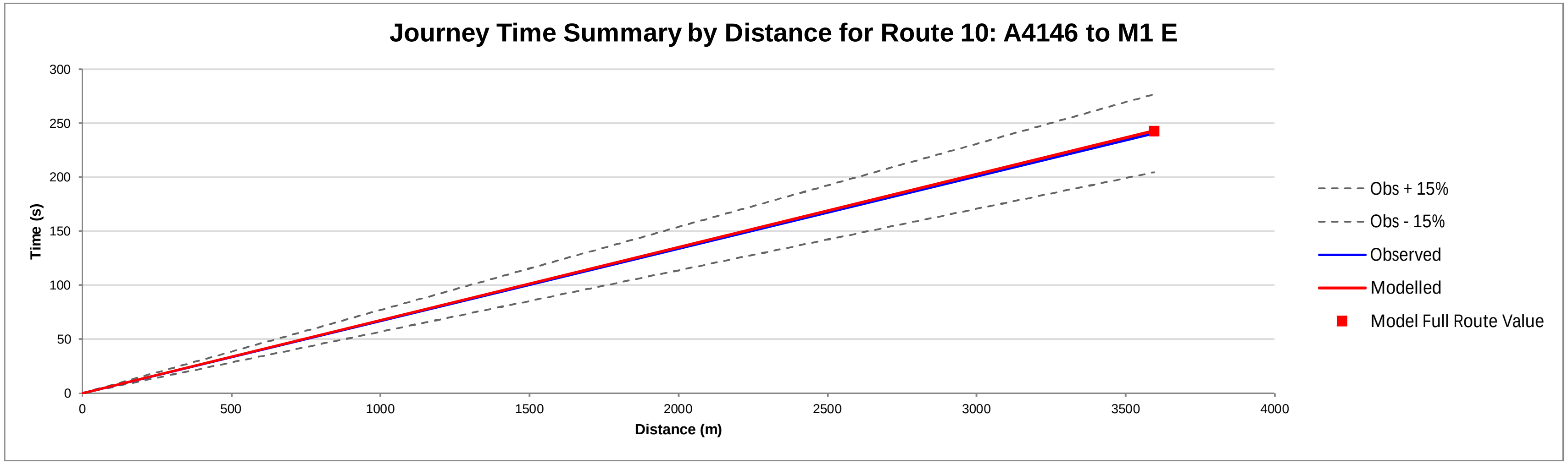
Journey Time Summary for Route 9: A509(N) to A4146



Journey Time Summary by Distance for Route 9: A509(N) to A4146

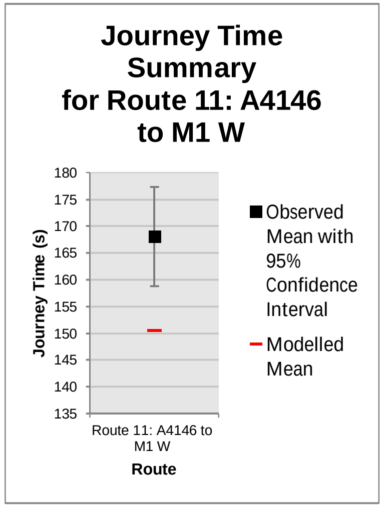


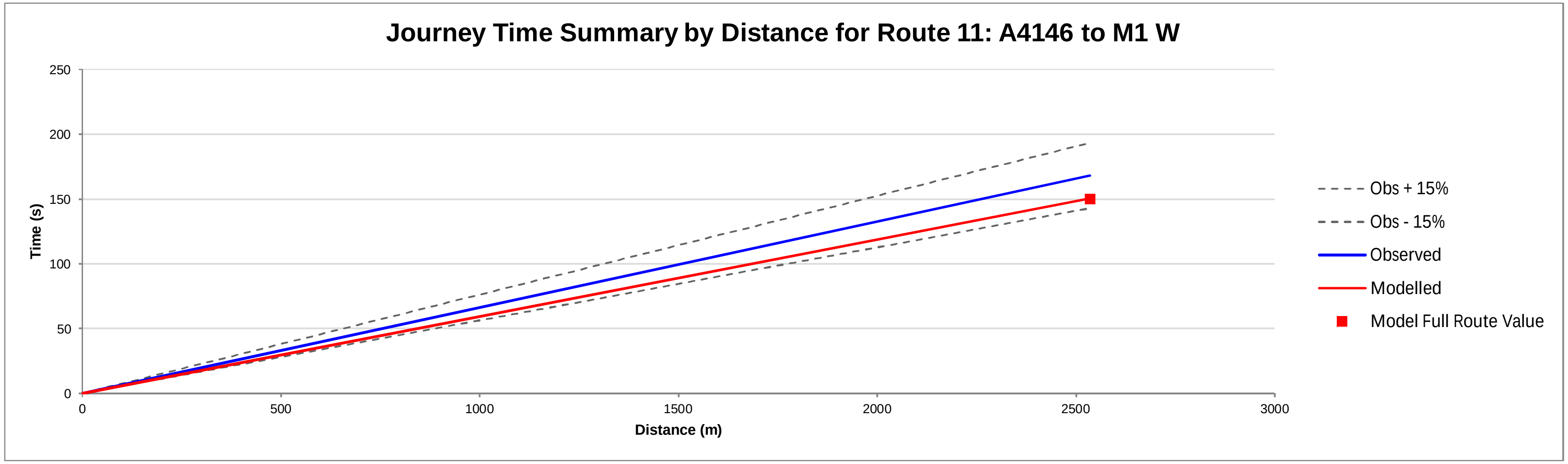

Journey Time Summary
for Route 10: A4146 to M1 E
260
250
240
230
220
210
200
Journey Time (s)
Route 10: A4146 to M1 E
Route
Observed Mean with 95% Confidence Interval
Modelled Mean


Journey Time Summary by Distance for Route 10: A4146 to M1 E
300
250
200
150
100
50
0
Time (s)
0
500
1000
1500
2000
2500
3000
3500
4000
Distance (m)
Obs + 15%
Obs - 15%
Observed
Modelled
Model Full Route Value

Journey Times
Validation Statistics

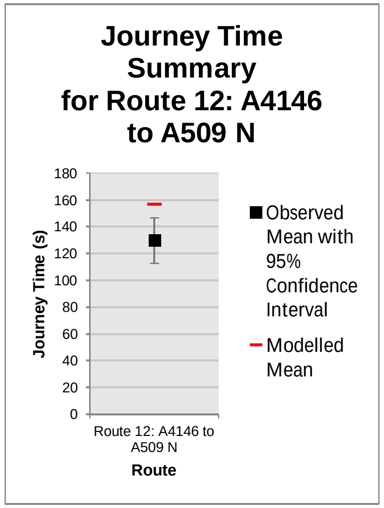
AM Peak

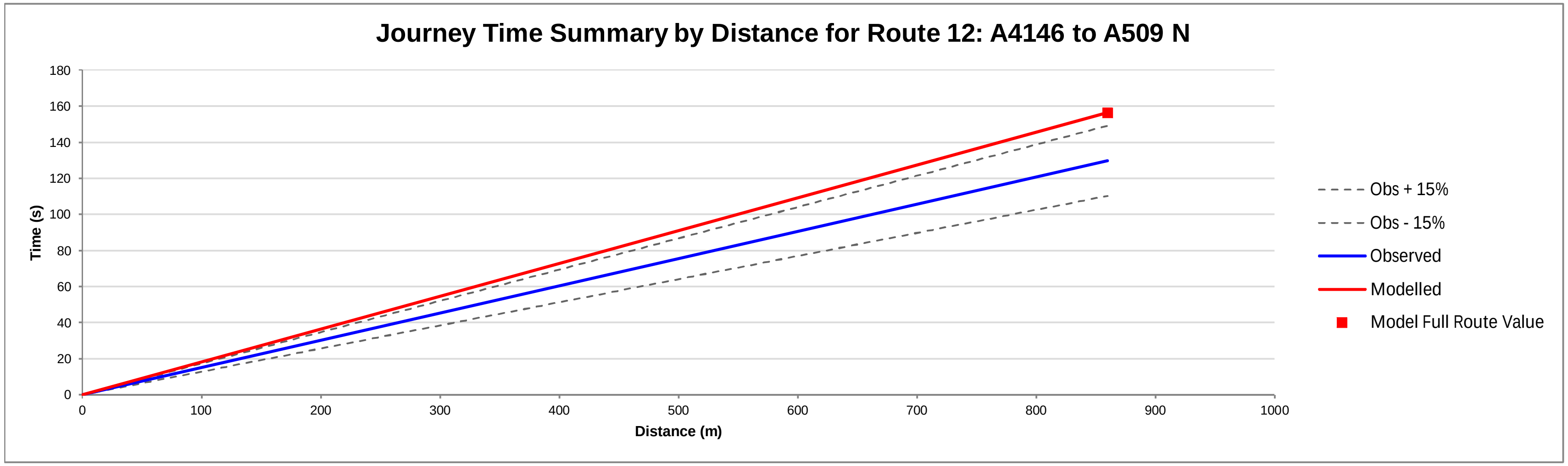


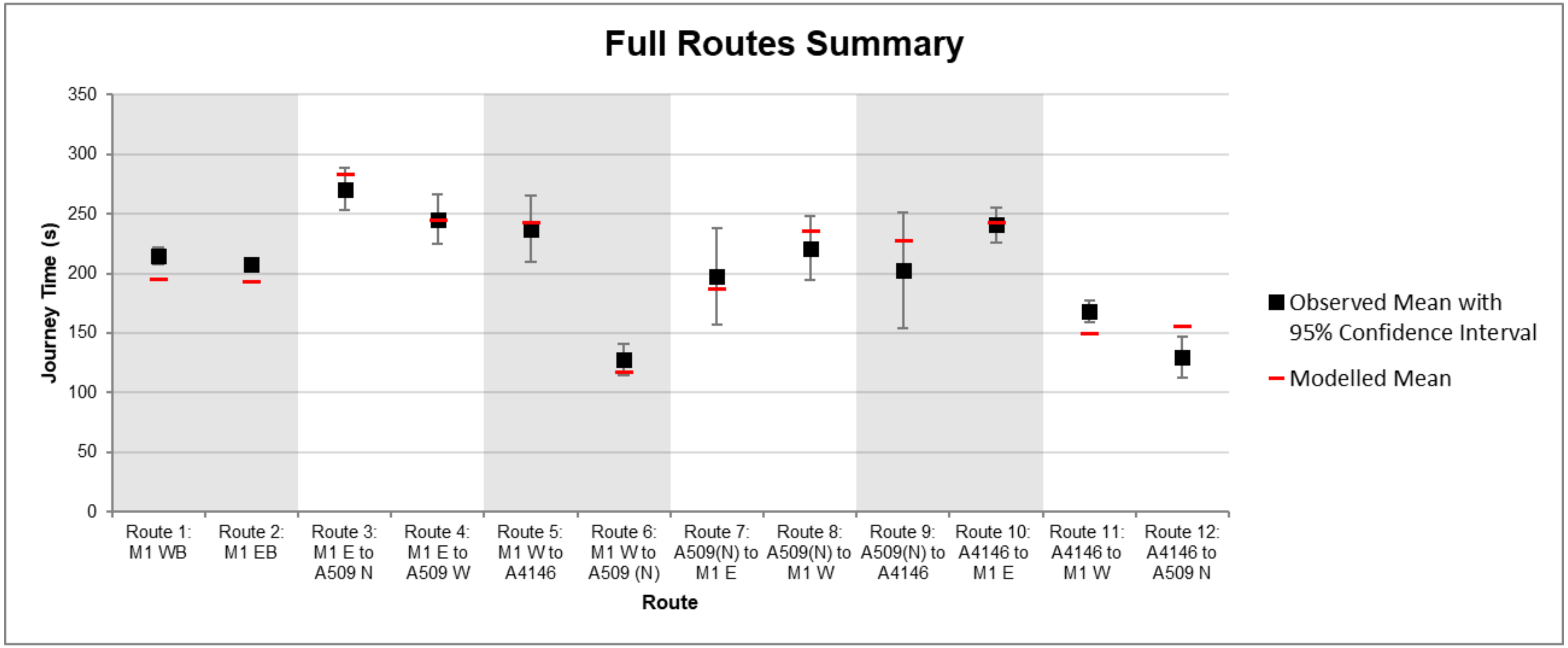


Journey Times
Validation Statistics

AM Peak





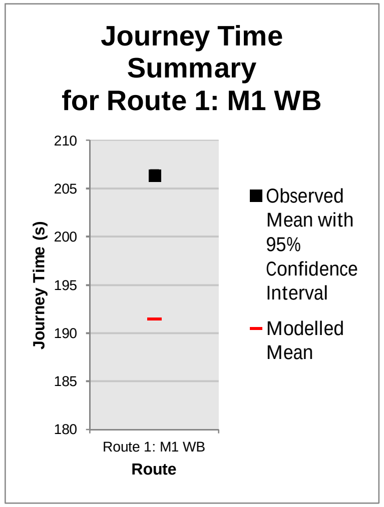


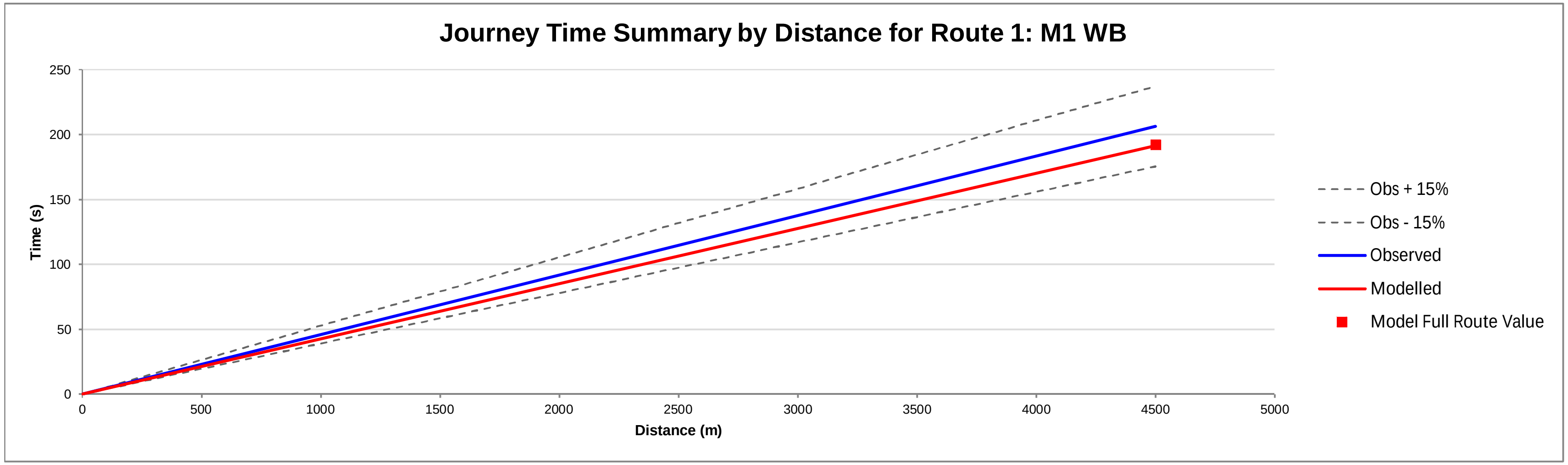
Full Routes Summary
Journey Time (s)
350
300
250
200
150
100
50
0
Route 1: M1 WB
Route 2: M1 EB
Route 3: M1 E to A509 N
Route 4: M1 E to A509 W
Route 5: M1 W to A4146
Route 6: M1 W to A509 (N)
Route 7: A509(N) to M1 E
Route 8: A509(N) to M1 W
Route 9: A509(N) to A4146
Route 10: A4146 to M1 E
Route 11: A4146 to M1 W
Route 12: A4146 to A509 N
Route
Observed Mean with 95% Confidence Interval
Modelled Mean

Journey Times
Validation Statistics

PM Peak

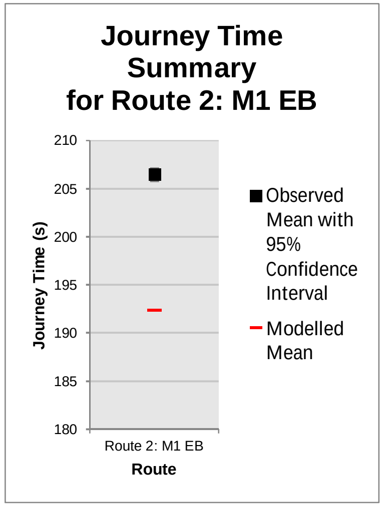
Route:	Segment	Graph Group	Observed Average	Observed 95% Conf	Modelled Average	Modelled 95% Conf	Var Chk	% Diff	Diff	Conf?	15%	60s	WebTAG	Distance (m)
Route 1: M1 WB	Full	1	206	1	192	0	TRUE	-7.2%	-15	FALSE	TRUE	TRUE	TRUE	4500
Route 2: M1 EB	Full	2	206	1	192	0	TRUE	-6.8%	-14	FALSE	TRUE	TRUE	TRUE	4498
Route 3: M1 E to A509 N	Full	3	257	5	273	12	TRUE	6.3%	16	FALSE	TRUE	TRUE	TRUE	3109
Route 4: M1 E to A509 W	Full	4	193	2	184	1	TRUE	-4.7%	-9	FALSE	TRUE	TRUE	TRUE	3269
Route 5: M1 W to A4146	Full	5	190	2	175	2	TRUE	-8.0%	-15	FALSE	TRUE	TRUE	TRUE	2382
Route 6: M1 W to A509 (N)	Full	6	117	2	100	1	TRUE	-14.9%	-17	FALSE	TRUE	TRUE	TRUE	1792
Route 7: A509(N) to M1 E	Full	7	174	8	185	2	TRUE	6.1%	11	FALSE	TRUE	TRUE	TRUE	2978
Route 8: A509(N) to M1 W	Full	8	197	17	219	6	TRUE	10.8%	21	FALSE	TRUE	TRUE	TRUE	2365
Route 9: A509(N) to A4146	Full	9	148	17	161	5	TRUE	9.2%	14	TRUE	TRUE	TRUE	TRUE	822
Route 10: A4146 to M1 E	Full	10	272	8	267	7	TRUE	-1.9%	-5	TRUE	TRUE	TRUE	TRUE	3595
Route 11: A4146 to M1 W	Full	11	212	12	170	6	TRUE	-20.0%	-42	FALSE	FALSE	TRUE	TRUE	2534
Route 12: A4146 to A509 N	Full	12	173	14	197	12	FALSE	13.9%	24	FALSE	TRUE	TRUE	TRUE	860

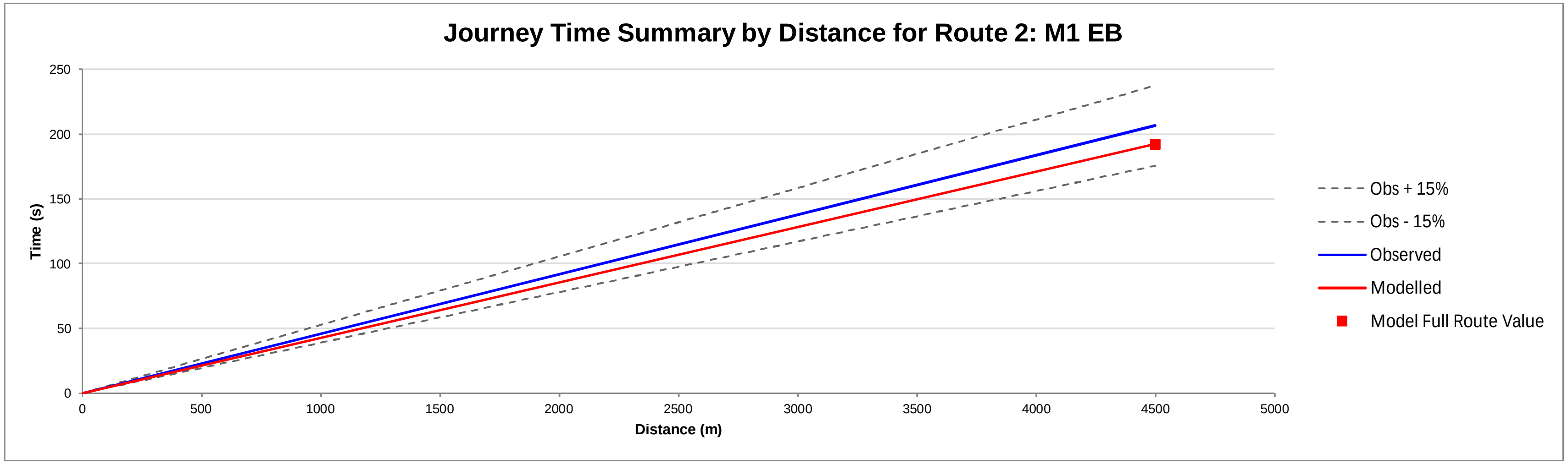

Journey Time Summary for Route 1: M1 WB
Journey Time (s)
210
205
200
195
190
185
180
Route 1: M1 WB
Route
Observed Mean with 95% Confidence Interval
Modelled Mean


Journey Time Summary by Distance for Route 1: M1 WB
Time (s)
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Distance (m)
Obs + 15%
Obs - 15%
Observed
Modelled
Model Full Route Value

Journey Times
Validation Statistics

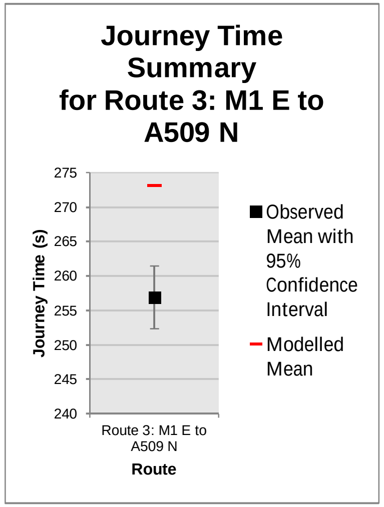
PM Peak

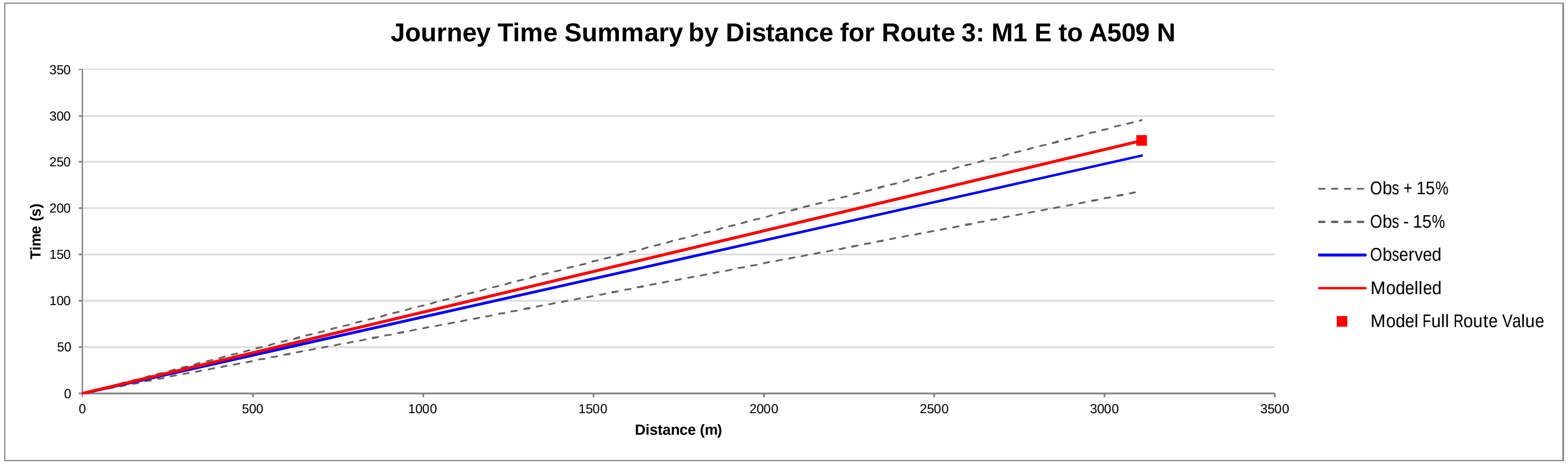


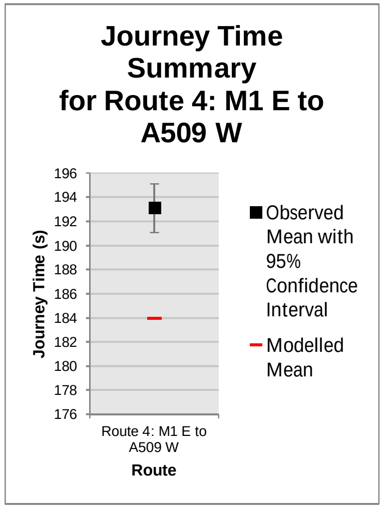


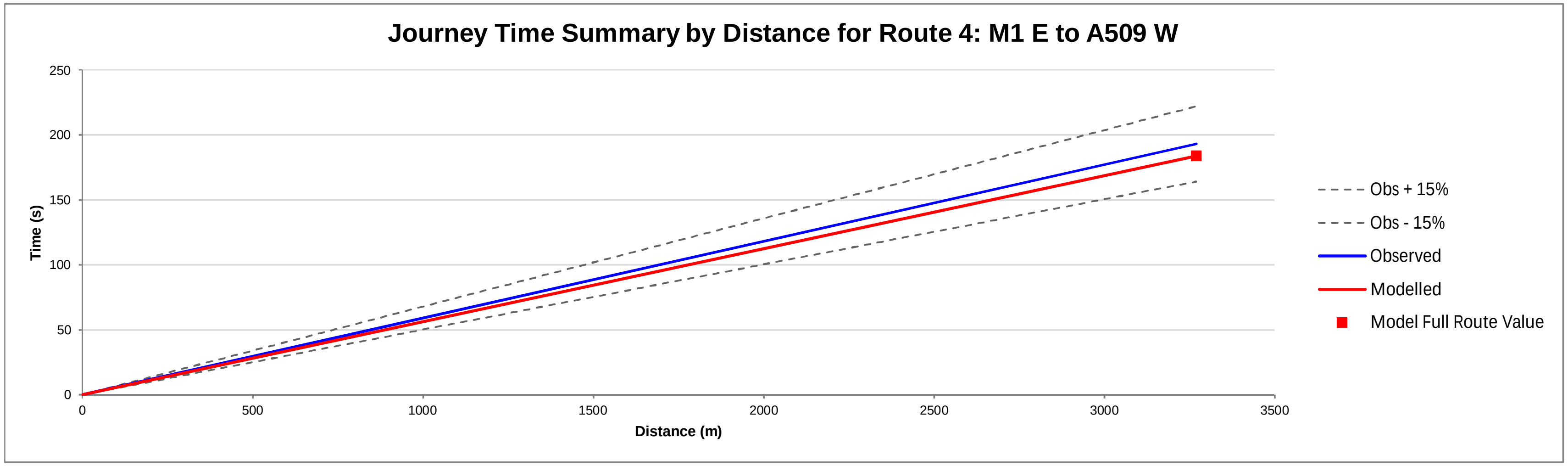
Journey Times
Validation Statistics

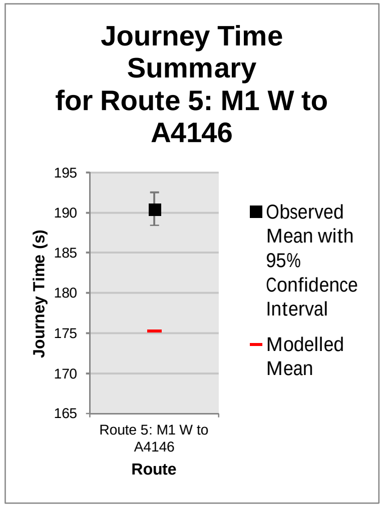
PM Peak

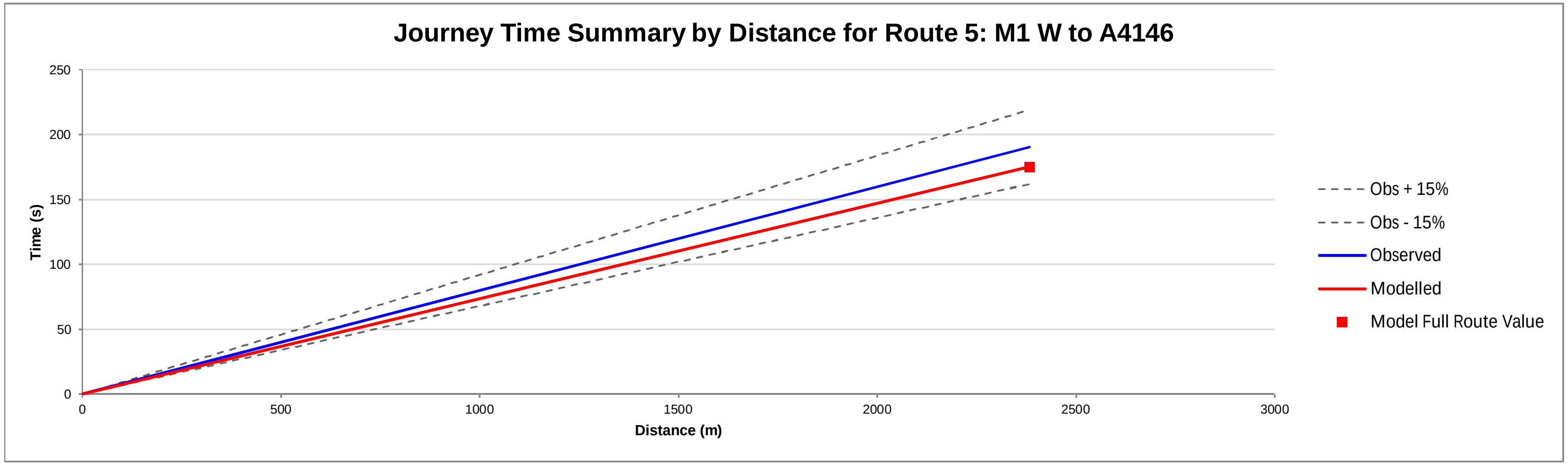


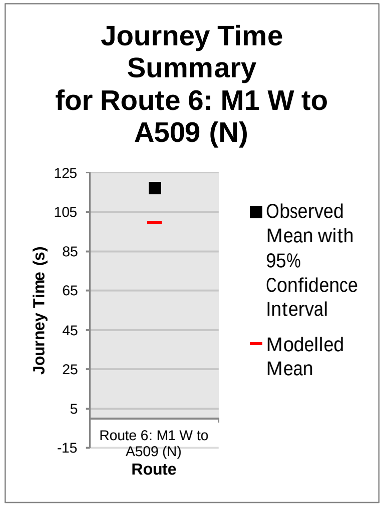


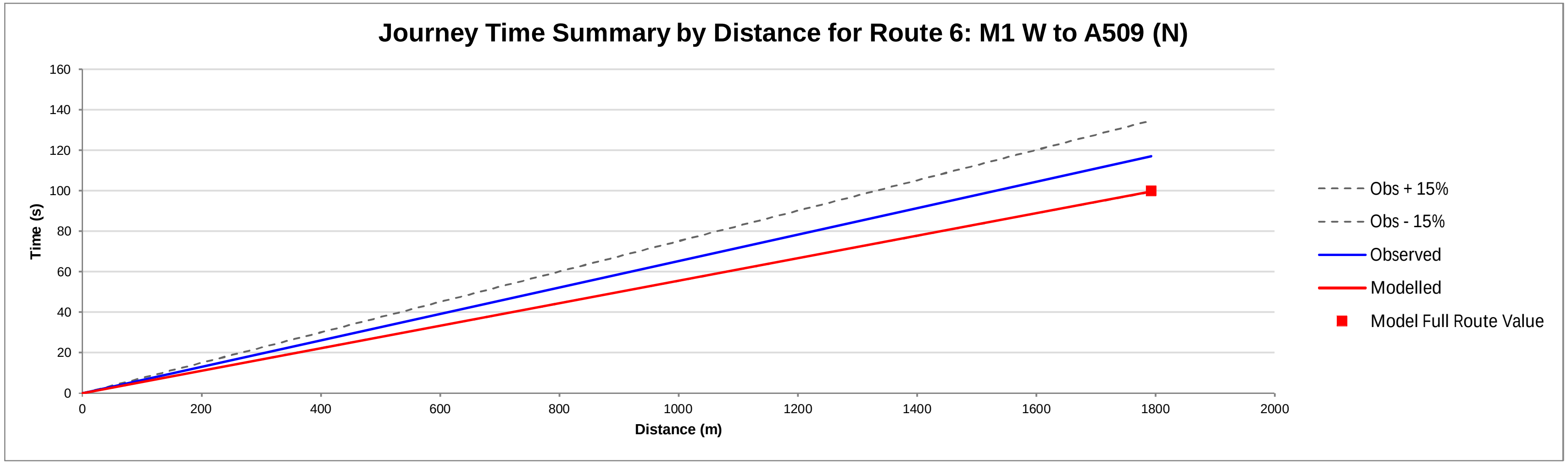

Journey Time Summary
for Route 4: M1 E to A509 W
196
194
192
190
188
186
184
182
180
178
176
Journey Time (s)
Observed Mean with 95% Confidence Interval
Modelled Mean
Route 4: M1 E to A509 W
Route


Journey Time Summary by Distance for Route 4: M1 E to A509 W
250
200
150
100
50
0
Time (s)
0
500
1000
1500
2000
2500
3000
3500
Distance (m)
Obs + 15%
Obs - 15%
Observed
Modelled
Model Full Route Value


Journey Time Summary for Route 5: M1 W to A4146
Journey Time (s)
195
190
185
180
175
170
165
Route 5: M1 W to A4146
Route
Observed Mean with 95% Confidence Interval
Modelled Mean

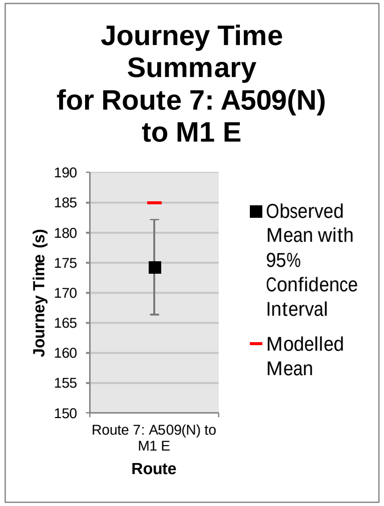

Journey Time Summary by Distance for Route 5: M1 W to A4146
Time (s)
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000
Distance (m)
Obs + 15%
Obs - 15%
Observed
Modelled
Model Full Route Value

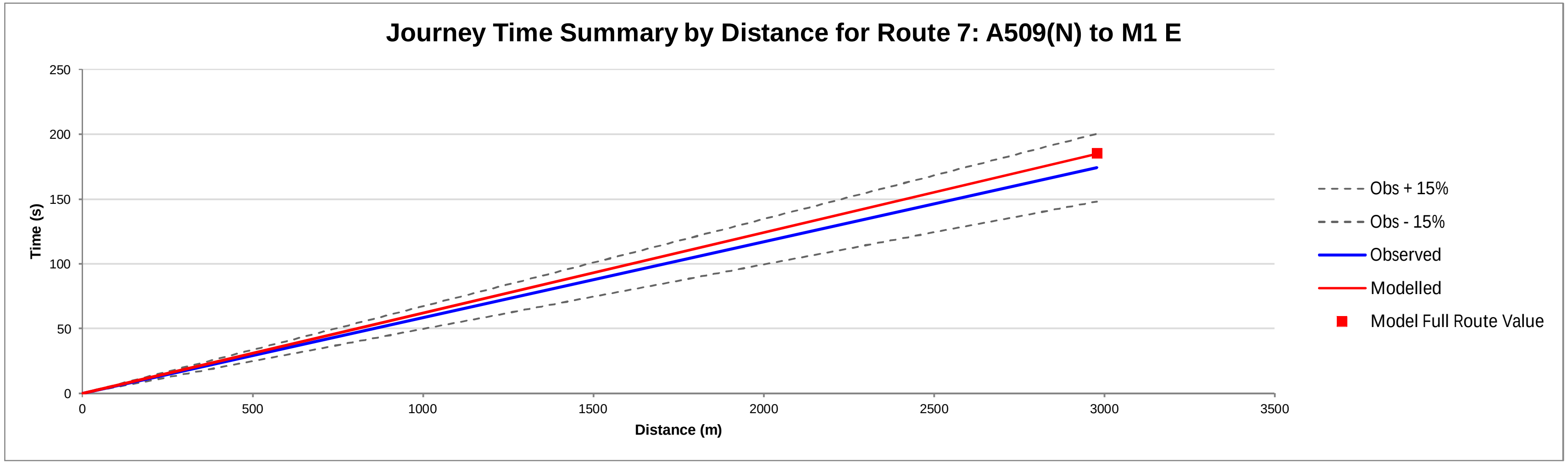

Journey Time Summary for Route 6: M1 W to A509 (N)
125
105
85
65
45
25
5
-15
Journey Time (s)
Route 6: M1 W to A509 (N)
Route
Observed Mean with 95% Confidence Interval
Modelled Mean

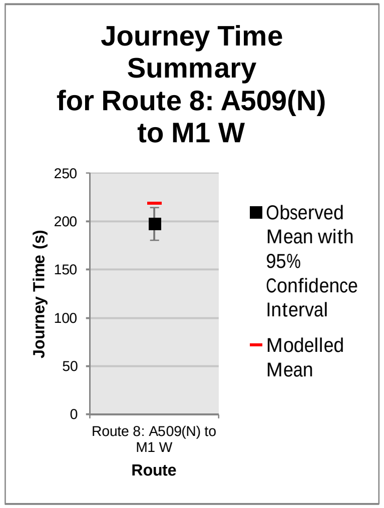

Journey Time Summary by Distance for Route 6: M1 W to A509 (N)
160
140
120
100
80
60
40
20
0
Time (s)
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Distance (m)
Obs + 15%
Obs - 15%
Observed
Modelled
Model Full Route Value

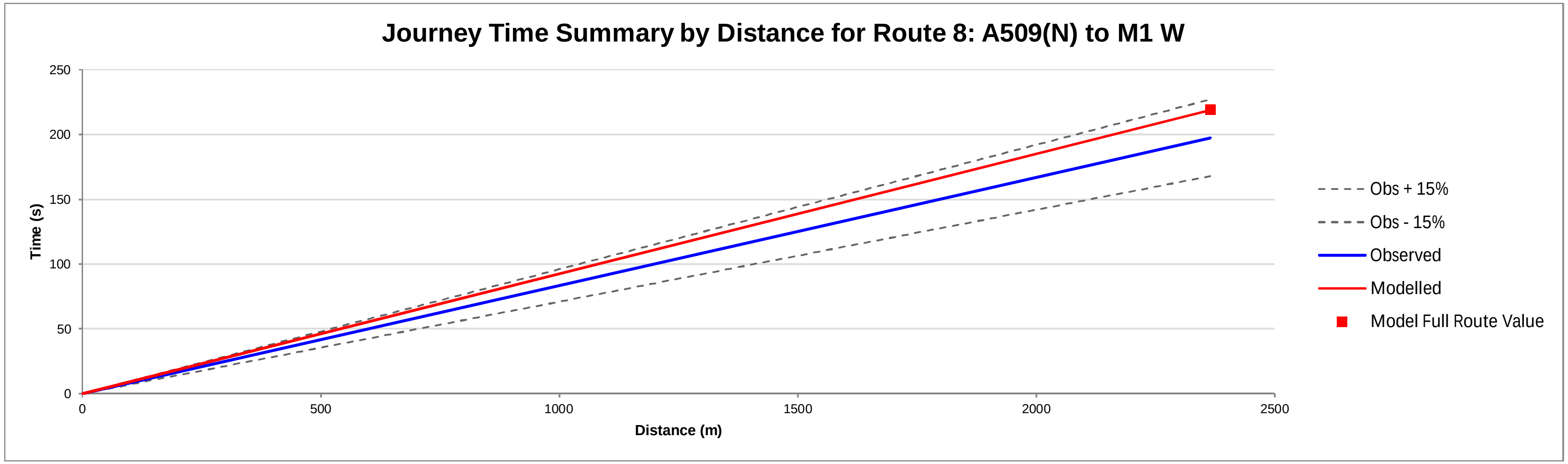
Journey Times
Validation Statistics

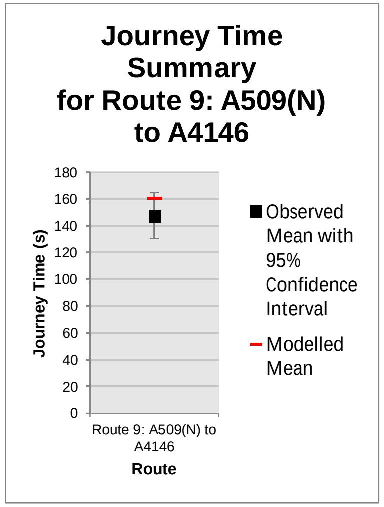
PM Peak

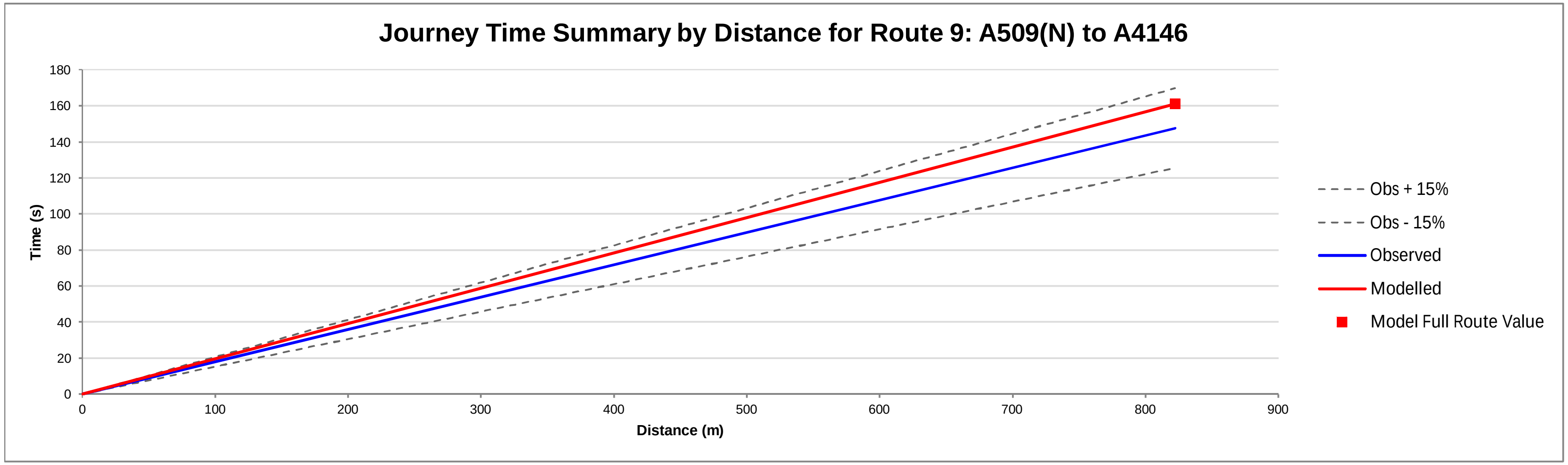





Journey Time Summary for Route 8: A509(N) to M1 W
Journey Time (s)
250
200
150
100
50
0
Route 8: A509(N) to M1 W
Route
Observed Mean with 95% Confidence Interval
Modelled Mean

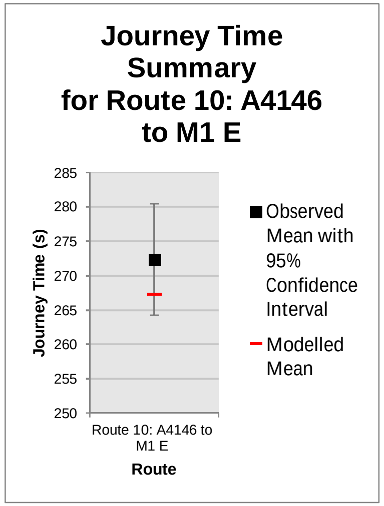

Journey Time Summary by Distance for Route 8: A509(N) to M1 W
Time (s)
250
200
150
100
50
0
0
500
1000
1500
2000
2500
Distance (m)
Obs + 15%
Obs - 15%
Observed
Modelled
Model Full Route Value

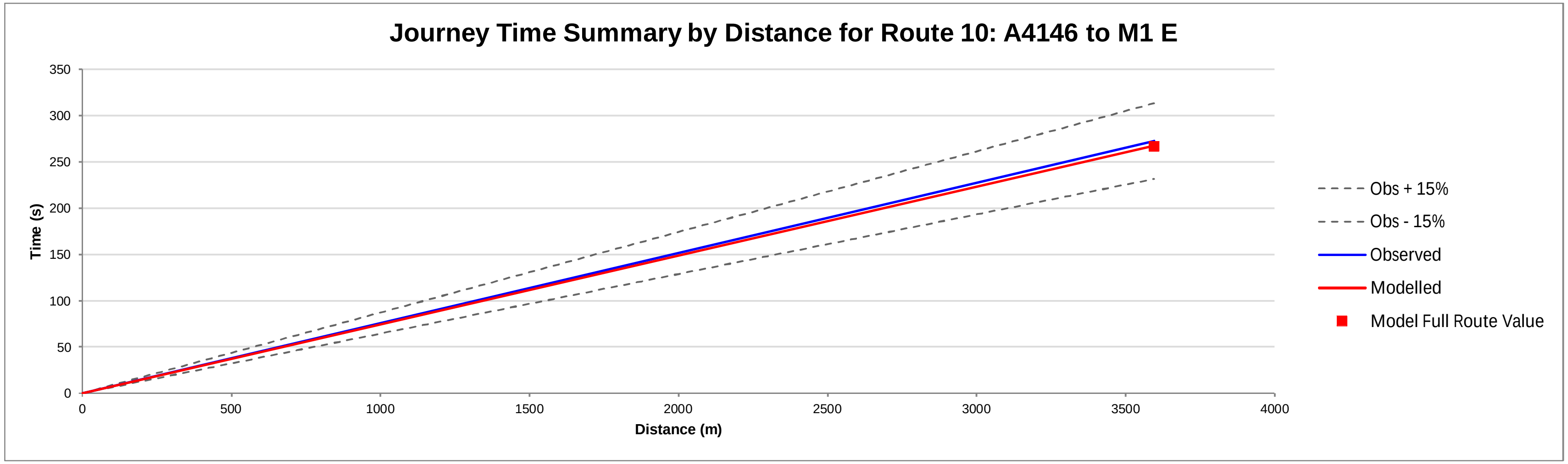

Journey Time Summary for Route 9: A509(N) to A4146
Journey Time (s)
180
160
140
120
100
80
60
40
20
0
Observed Mean with 95% Confidence Interval
Modelled Mean
Route 9: A509(N) to A4146
Route

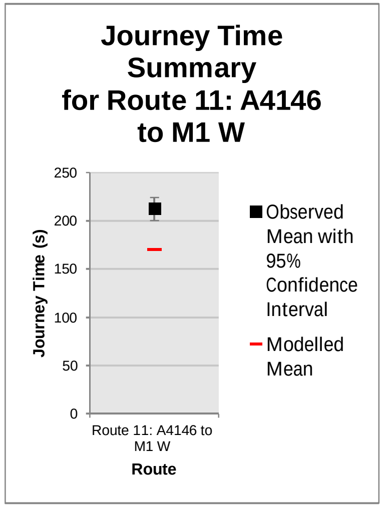

Journey Time Summary by Distance for Route 9: A509(N) to A4146
Time (s)
180
160
140
120
100
80
60
40
20
0
0
100
200
300
400
500
600
700
800
900
Distance (m)
Obs + 15%
Obs - 15%
Observed
Modelled
Model Full Route Value

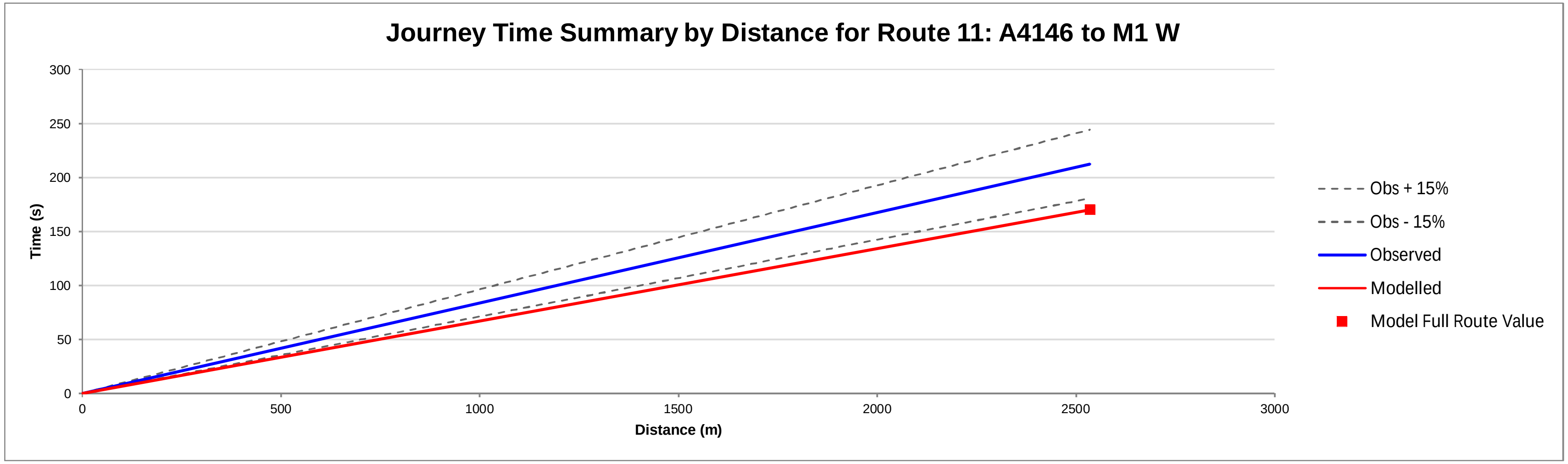
Journey Times
Validation Statistics

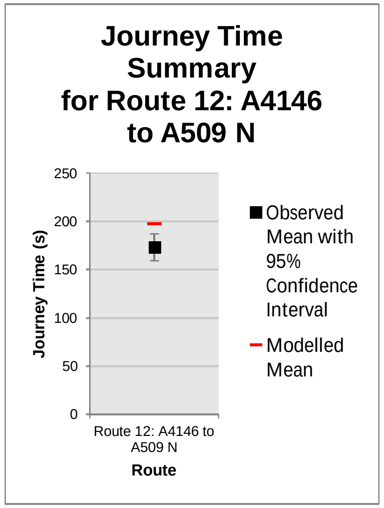
PM Peak

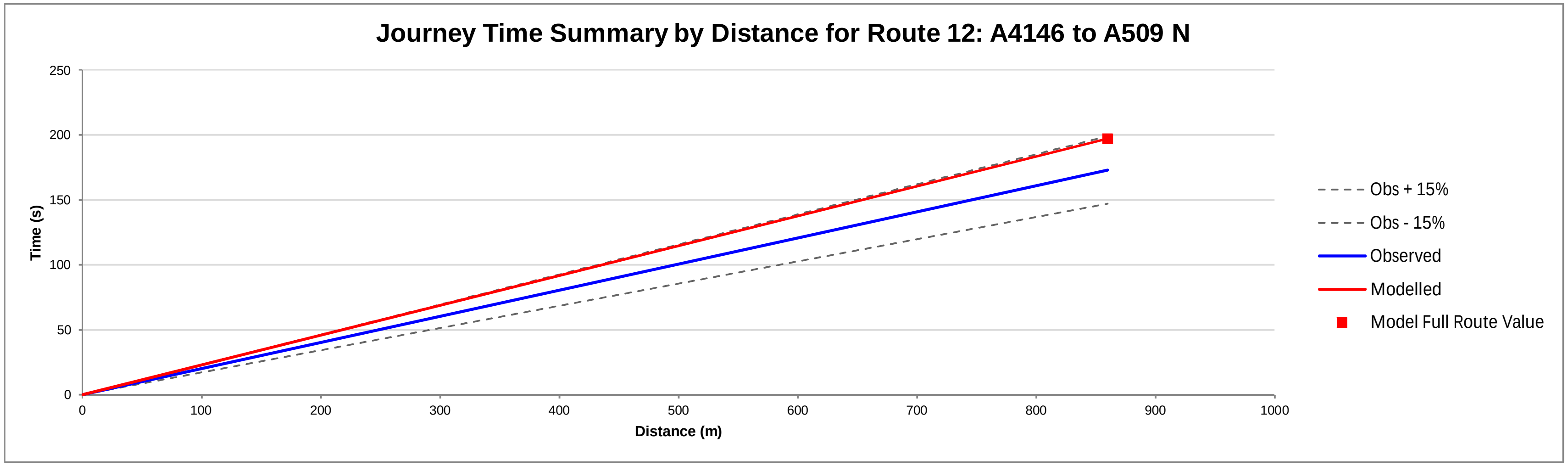


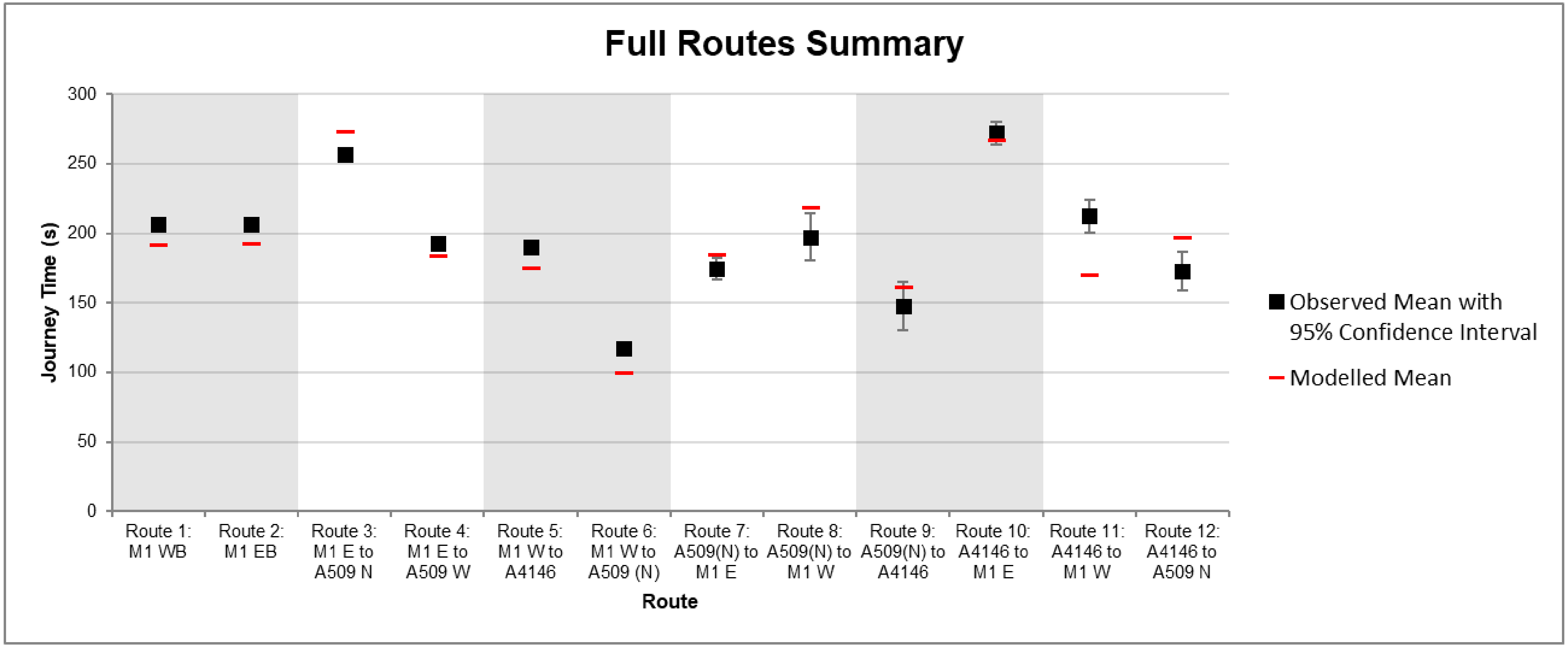



Journey Time Summary for Route 11: A4146 to M1 W
Journey Time (s)
250
200
150
100
50
0
Observed Mean with 95% Confidence Interval
Modelled Mean
Route 11: A4146 to M1 W
Route


Journey Time Summary by Distance for Route 11: A4146 to M1 W
Time (s)
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000
Distance (m)
Obs + 15%
Obs - 15%
Observed
Modelled
Model Full Route Value


Journey Time Summary for Route 12: A4146 to A509 N
Journey Time (s)
250
200
150
100
50
0
Observed Mean with 95% Confidence Interval
Modelled Mean
Route 12: A4146 to A509 N
Route


Journey Time Summary by Distance for Route 12: A4146 to A509 N
Time (s)
250
200
150
100
50
0
0
100
200
300
400
500
600
700
800
900
1000
Distance (m)
Obs + 15%
Obs - 15%
Observed
Modelled
Model Full Route Value


Full Routes Summary
300
250
200
150
100
50
0
Journey Time (s)
Route 1: M1 WB
Route 2: M1 EB
Route 3: M1 E to A509 N
Route 4: M1 E to A509 W
Route 5: M1 W to A4146
Route 6: M1 W to A509 (N)
Route 7: A509(N) to M1 E
Route 8: A509(N) to M1 W
Route 9: A509(N) to A4146
Route 10: A4146 to M1 E
Route 11: A4146 to M1 W
Route 12: A4146 to A509 N
Route
Observed Mean with 95% Confidence Interval
Modelled Mean

Unit 9, The Chase
John Tate Road, Foxholes Business Park
Hertford
SG13 7NN

wsp.com

Appendix L.2

LMVR ADDENDUM / FURTHER NOTES

Berkeley St James

MILTON KEYNES EAST

Response to MKE Paramics LMVR Comments

LMVR_RESPONSE1
SEPTEMBER 2020

PUBLIC

Berkeley St James

MILTON KEYNES EAST

Response to MKE Paramics LMVR Comments

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70051078

OUR REF. NO. LMVR_RESPONSE1

DATE: SEPTEMBER 2020

WSP

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WSP.com

QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	P01			
Date	04/09/2020			
Prepared by	D Gooding			
Signature	 Gooding, David (UKDXG016) 2020.09.04 12:13:55 +01'00'			
Checked by	S Biggs			
Signature				
Authorised by	S Biggs			
Signature				
Project number	70057521			
Report number	LMVR_Response1			
File reference				

CONTENTS

APPENDICES

1 INTRODUCTION

1.1 FOREWORD

1.1.1. This report has been prepared on behalf of Berkeley St James in response to the comments raised following the submission of the Paramics Local Model Validation Report (LMVR). The WSP Paramics LMVR was issued on 29 April 2020 to Milton Keynes Council officers and Highways England for review.

1.1.2. The Paramics Discovery models LMVR has been prepared to provide a basis for assessing the impact of the proposed Milton Keynes East (MKE) development on M1 Junction 14 and the Northfield Roundabout to the south of the motorway.

1.1.3. The comments received have been as follows:

- Minor comments from Milton Keynes Council (14 May 2020); and
- AECOM Review of Paramics LMVR Report (TN05) that has an approved date of 6 July 2020.

1.1.4. It should be noted that Milton Keynes Council has found that the Paramics LMVR to be acceptable and have confirmed via email on 21 May 2020 that they are *"satisfied that the validation is to a good standard and acceptable as the basis for future testing in connection with the MKE planning application."*

1.1.5. The comments received from MKC are minor and the information below provides further detail that addresses the points of clarification. As such, this report primarily covers the response to the AECOM review note. A copy of the AECOM report is contained in Appendix A of this report.

1.1.6. This report forms an addendum to the Local Model Validation Report dated 28 April 2020 to ensure that the points of clarification/ explanation sought by AECOM are easy to find and review.

1.1.7. In total, AECOM has made 15 main comments relating to the model, which are summarised in Table 1 of their report. These comments are then classified as Minor, Medium or Major, which AECOM defines as follows:

- Minor – advisory items that can be accommodated/ changed or clarified with additional information
- Medium – items that require remediation or an additional explanation for further consideration by AECOM
- Major – items that require correction before they can be reconsidered for review by AECOM.

1.1.8. In addition to Table 1, which summarises the items for clarification, the AECOM report also provides more details of the basis for their comments.

1.2 REPORT STRUCTURE

1.2.1. Table 1 of the AECOM report summarises the comments into five groups, which will form the main chapters of this report as follows:

- Chapter 2 addresses the comments relating to the base network development and peak hours;
- Chapter 3 addresses the comments relating to data collection
- Chapter 4 addresses the comment relating to base model development
- Chapter 5 addresses comments relating to Model demand and matrix development
- Chapter 6 addresses comments relating to model calibration and validation.

2 BASE NETWORK DEVELOPMENT

2.1 INTRODUCTION

2.1.1. Comment 1 from Table 1 of the AECOM report set out requests for further evidence relating to the model set up. This comment is summarised in Table 2-1 below

Table 2-1 – AECOM comments relating to model demand and matrix development

ID	Classification	Description	Required Evidence/ Changes
1	Medium	Unclear how peak hour was determined	Additional information regarding how peak hour was chosen would be helpful in determining validity of approach

2.1.2. The response to these comments is provided below.

2.2 ITEM 1: PEAK HOURS

2.2.1. The modelled peak hours for the MKE Paramics model are as follows:

- AM Peak 08:00-09:00
- PM Peak 17:00-18:00

2.2.2. In addition to these peak hours, one-hour warm-up and one-hour cooldown periods have been included in the model to ensure that the traffic conditions are the start of the model period are appropriate. The reasons for selecting the above assessment hours is described in more detail below.

Observed Peak Hours

2.2.3. Table 2-2 shows the sum all the link counts on the eight entries to the ANPR cordon to identify the peak hourly traffic flows for hour periods during the model assessment period for each hour period in the model. Only periods that would allow at least 30 minutes warm-up and cooldown of the model within the modelled three hours have been included. The data used to create this table is contained in Appendix B.

Table 2-2 – AM and PM Peak Flows at ANPR Cordon (All Vehicles, hourly flows)

Hour beginning	Flow		Hour Beginning	Flow
07:30	8324		**16:30**	**9297**
07:45	**8487**		16:45	9167
08:00	8476		17:00	9003
08:15	7920		17:15	8622
08:30	7590		17:30	8344

2.2.4. Based on the sum of the link flows at the ANPR cordon, the traffic peaks are as follows:

- AM Peak (traffic) 07:45 to 08:45
- PM Peak (traffic) 16:30 to 17:30.

2.2.5. It is noted that both these traffic peaks start in the warmup period of the model and continue through part of the peak hours that have been calibrated and validated. However, the traffic peak hour is not the only consideration when selecting the assessment hours of the model, the purpose for which the model will be used also needs to be considered.

Purpose of the model

2.2.6. When determining the assessment periods of the model it is important to understand the purpose of the study that the model has been prepared for to avoid unnecessarily calibrating and validating the model for a time period that is of no use to the study. The MKE Paramics model has been prepared to assess the impacts of the proposed MKE development on M1 junction 14 and the Northfield roundabout, and it is therefore important that the model can to assess the peak demands from the proposed development.

2.2.7. The trip generation exercise that has been undertaken for the MKE development's Transport Assessment has identified that the peak trip generations would be:

- AM Peak (trip generation) 08:00-09:00
- PM Peak (trip generation) 17:00-18:00

2.2.8. Additionally, it is understood that a strategic model will be used to identify the forecast growth in the model study area and that the assessment periods of the strategic model are 08:00 to 09:00 and 17:00 to 18:00. Consequently, the modelled peak hours were selected to match those of the development trip generation and traffic growth forecasts.

Suitability of Modelled Peak Hour

2.2.9. Based on the purpose of the model and the fact that the model is validated for the peak hours of the trip generation for the proposed development and the peak hours of the strategic model that will be used to identify traffic growth forecasts, it is therefore considered that the 08:00-09:00 and 17:00-18:00 peaks that have been calibrated and validated in the Paramics model are appropriate.

3 DATA COLLECTION

3.1 INTRODUCTION

3.1.1. Comments 2 to 5 of Table 1 of the AECOM report set out requests for further evidence relating to data collection. These comments and requests are summarised in Table 3-1 below

Table 3-1 – AECOM comments relating to model demand and matrix development

ID	Classification	Description	Required Evidence/ Changes
2	Major	ANPR data collection, reliability and verification process unclear	Information to help determine that the data collected on 27th June 2019 is a representative day. Evidence of ATC data used to verify the profile should be provided to show representative day and verify ANPR data. Capture rate of ANPR data not provided to support use of this data.
3	Major	Ongoing roadworks during data collection	Reassurances should be provided regarding use of data collected during ongoing works on the A421 and M1 Smart motorway schemes. Details of how any future changes in traffic flows arising from these roadworks coming to an end will be considered in forecast scenarios should be provided.
4	Medium	Journey times are based on ANPR data, number of journey time samples and assessment of reliability not provided.	Journey time reliability reliant on quality of ANPR data. Is supplementary data required?
5	Medium	Methodology for queue length measurement unclear	Methodology for queue length surveys should be clarified to show that the data is suitable for calibration of the model. Was this collected manually on site, using traffic cameras or an alternative method?

3.1.2. The remainder of this chapter responds to the requests in the table above.

3.2 ITEM 2: ANPR DATA COLLECTION

3.2.1. Before undertaking the traffic surveys, WSP, MKC and Highways England undertook lengthy discussions relating to modelling and data collection methodology for the strategic modelling and the Paramics model.

3.2.2. Numerous meetings were held with MKC in 2019 to discuss the modelling required for the MKE site. This informed the survey strategy and the conclusion of these discussions was set out in TN1 Modelling Approach Note, which was issued to MKC and HE in March 2019 (with minor updates re-issued in May 2019).

3.2.3. AECOM on behalf of Highways England this was issued 21 June 2019, as confirmed by Highways England, *"The review confirms that your approach to traffic survey is sensible".*

3.2.4. Before the confirmation on the strategy outlined in AECOM's June '19 TN, the intended dates of the traffic surveys were discussed with all stakeholders to ensure that they captured conditions accurately. This was particularly needed given the ongoing road works along the M1 and A421 at the time. This included discussions with MKC's Streetworks team to ensure the necessary permits were provided for the traffic surveys, as well as officers from MKC and Highways England.

3.2.5. Discussions with Highways England SMART motorway team and Highways England's road space booking teams also occurred to ensure that the impacts from the on-going roads works were minimised. This is discussed further in Section 3.3 below.

3.2.6. Discussions with the road space teams were also held over the suitability of ANPR camera placement and locations. Liaison between the survey company and the road space team, combined with limitations for safe implementation of the equipment resulted in the need for ANPR camera locations to be set out as identified in the Paramics LMVR. The method statement from the survey company was issued to the appropriate contacts at MKC, Kier / HE and Central Bedfordshire before the surveys were undertaken. This set out the placement and camera locations for all of the survey's, including the ANPR cameras. No issues were raised with the method statement.

3.2.7. The following data was collected during the ANPR Surveys:

- OD movement matrices for matched number plates
- Link counts at the entries to the ANPR cordon
- Details of the proportion of matched number plates
- OD journey times
- Trip chains

3.2.8. There are no long term count sites available in the vicinity of the model study area, and the only data that is available to review the suitability of the assessed area are the ATC count sites that are relevant to the Paramics model study area as follows:

- Site 2 A5130, east of the Northfield Roundabout
- Site 25 A509, north of Newport Road.

3.2.9. Table 3-2 summarises the AM and PM peak hour traffic flows (08:00 and 17:00) at the two ATC sites

Table 3-2 – Two-Way link Counts on edge of model study area

Count Date	Site 25 – A5130		Site 2 – A509	
	08:00-09:00	17:00-18:00	08:00-09:00	17:00-18:00
Thurs 27/6/19	1318	1837	1181	1284
Fri 28/6/19	1202	1837	1063	1176
Sat 29/6/19	981	1244	452	611
Sun 30/6/19	593	1277	224	659
Mon 1/7/19	1106	1830	1110	1244
Tue 2/7/19	1132	1880	1211	1258
Wed 3/7/19	1001	1888	1129	1240
Weekday Mean	1151.8	1854.4	1138.8	1240.4

3.2.10. Table 3-2 shows that the modelled day (27/6/19) is generally close to or above the average weekday peak hour flow at the two ATC sites. It is therefore considered that the traffic data is representative of typical traffic conditions in the network.

3.2.11. The capture rate information that was provided by Intelligent Data for the ANPR is provided in Appendix C. The data shows a reasonably good level of plate matching across all sites.

3.2.12. It should be noted that following completion of the 2019 surveys, further liaison between WSP and MKC / AECOM teams occurred to assist with the inclusion of that data into the updated strategic MKMMM modelling.

3.2.13. As part of these discussions, a review of the 2016 traffic data provided by MKC against the 2019 surveys at comparable locations was completed. Whilst this review did not include surveys on J14, it included a comparison of links counts on two of the approaches to the Northfield Roundabout. This indicated that the results for the AM and PM peak hours indicate that 2019 flows were, on average, higher than in 2016. This provides further comfort that traffic conditions in 2019 are representative of standard network operations and are appropriate for use in the modelling going forwards. While this report was prepared for a different purpose, it is considered that it contains relevant information and is contained in Appendix D.

3.3 ITEM 3: ROADWORKS DURING DATA COLLECTION

3.3.1. As mentioned in the AECOM note there were two sets of roadworks in progress on the day that the traffic survey data was collected, including:

- roadworks on the M1 to install smart motorway infrastructure; and
- roadworks associated with widening the A421.

3.3.2. These roadworks are both long term schemes spanning several years of works, meaning that it would be impossible to avoid collecting data during the works without delaying planning applications across the entire sub-region that is affected by the works.

3.3.3. Liaison between, MKC, Highways England and the survey company, identified the date of 27 June 2019 to undertake the bulk to the MCCs. This required equipment to be installed on the 26 June. The ATCs / weeklong surveys on the local links were then planned to run for a full week (covering the MCC period) and finish 3rd July unless extensions were required.

3.3.4. Both WSP and the survey company undertook a check for any roadworks within that period and did not identify anything (other than the long term works) which would materially affect the survey or traffic conditions.

3.3.5. The M1 SMART motorway project team provided the traffic management lookahead for the intended survey period. The information provided outlined that there were no TM closures from the 10 June to 01 July, which aligned with the intended survey dates. This was confirmed by the SMART team via email that no carriageway closures were in place between J13-J14 on the survey dates.

3.3.6. Further liaison with Highways England's road space booking team provided information on the construction activities within the period surveys were being considered.

3.3.7. The extract from the road space booking system covered the reporting period between 26 June to 3 July and identified that other than an M1 closure in the Northbound direction on 1 July and 2 July from Jct 14 to Jct 15 there were no other planned closures of the network.

3.3.8. WSP were also present on site on the day of the surveys to review conditions in the tail end of the PM peak. On site observations outlined that Junctions 13 and J14 were operating well with no issues that could be identified on site. It was noted that the mainline was also free-flowing. Whilst the SMART motorways works were visible and in place, there were three lanes of clear moving traffic throughout site observations.

3.3.9. Before the surveys, the survey company liaised with MKC, Highways England and Central Bedfordshire Council over the surveys / permits for installation. Method statements were set out and the dates surveyed were considered acceptable given the window of opportunity between the long term road works.

3.3.10. The impact of the roadworks will, however, be addressed in the modelling. For example, in the validation model the speed limit on the M1 has been reduced to around 50mph to account for the reduced speed limit within the roadworks. Once the validation model is acceptable, a "base" model will be created that reinstates the proper motorway speed limit and includes the impact of the smart motorway on the number of lanes available on the M1 and on the slip roads to Junction 14.

3.3.11. The A421 widening scheme is more remote from the model study area and is considered not to significantly impact the study area.

3.3.12. With regards to the impact of the roadworks on traffic volumes, it is unknown what this impact is as the Highways England monitoring sites on the M1 around Milton Keynes are currently inactive.

3.3.13. However, a review of WebTRIS data on the A421 (northbound and southbound on link A421 between M1 and A428) indicates that using data from w/c 15 October 2018 and w/c 14 October 2019 that 2019 flows are broadly higher than 2018. This is consistent for both directions and indicates that the variability between the two years is not large. This would demonstrate that the long term road works do not appear to have materially altered the traffic flows on the A421. Arguably, it is therefore likely that the M1 does not suffer from large variance in traffic flows due to the road works.

3.3.14. Consequently, the forecast year traffic flows for the Paramics model will be identified from the strategic model of the area as this will include all demands for trips in the local area. As such, the impacts from road works in 2019 flows will not materially affect the future year demand matrices.

3.3.15. WSP liaised with all stakeholders to ensure that the timings of the surveys were as appropriate as could be given the long term nature of the road works in the vicinity. The liaison identified a survey window which minimised the impact of the roadworks. The methodology, including placement of camera locations, was also shared with stakeholders during the survey discussions and were considered appropriate. WSP, therefore, believes that the impact of the roadworks will be properly accounted for in any forecast year and development case models.

3.4 ITEM 4: JOURNEY TIME DATA

3.4.1. The use of ANPR to obtain journey time data was agreed as part of the initial data collection discussions with MKC and Highways England. When processing the raw ANPR data for use in the model, filtering was applied that:

- Remove all routes where only small samples of observations were recorded (generally <10 observations, with a few exceptions)
- Remove any abnormally long journey times that could include vehicles that have either stopped in the middle of the study area or have left the study area and returned within a short space of time.

3.4.2. It is considered that the ANPR journey time data is suitable and that supplementary data is not required. The data used in the validation is summarised in Appendix E.

3.5 ITEM 5: QUEUE LENGTHS

3.5.1. The queue length surveys used for this study were collected using video cameras. The reason for using this approach was that the speed and types of the roads being modelled meant that it was unsafe for human observers to be present on site to measure the queues. When collecting queue data there are always compromises concerning how to collect the data, which can include:

- It is impossible to know where the back of a queue will be on the day of the survey;
- On motorways and rural roads it can be difficult to find suitable locations to monitor queue cameras; and
- Human observers should not stand on the motorway verge without suitable traffic management which would interfere with the survey results.

3.5.2. Additionally, Paramics Discovery model uses specific criteria to judge if a vehicle has entered, and left, a queued state, as follows

- For a vehicle entering a queue:
  - If the vehicle speed drops below a defined speed (normally 5mph); and
  - The gap to the vehicle in front drops below a defined distance (normally 20m).
- For a vehicle to leave a queued state:
  - The speed of the vehicle rises above a defined speed (normally 7mph); and
  - The gap to the vehicle in front rises above a defined distance (normally 15m)

3.5.3. These parameters are nearly impossible to measure accurately in the field, and instead whether or not a vehicle is deemed “queued” is based on the judgement of the enumerator.

3.5.4. The use of video cameras is a standard method of collecting queue data and, as long as the limitations of the data are understood (as is the case with all traffic data collection), the data is considered suitable for use in the validation of a microsimulation model.

4 BASE MODEL DEVELOPMENT

4.1 INTRODUCTION

4.1.1. Comments 6 to 9 of Table 1 of the AECOM report set out requests for further evidence relating to the development of the base model. These comments and requests are summarised in Table 4-1 below.

Table 4-1 – AECOM comments relating to model demand and matrix development

ID	Classification	Description	Required Evidence/ Changes
6	Minor	Evidence to support network is suitable with appropriate kerbs, junctions and links not provided	Evidence to support how modellers know that the vehicle behaviour is consistent should be provided. For example, if a site visit was conducted or video footage was used to verify.
7	Minor	Unclear how maximum traffic signal timings were determined for use in the model at vehicle actuated signals.	Some evidence could be provided to support this if site-based observations or video footage was used.
8	Minor	Changes to headway settings at junctions are not supported, these have been changed from the 2 second gap recommended.	Modeller should justify use of smaller time gap between vehicles given no site visit was conducted.
9	Medium	Unjustified changes to generalised cost parameters and degrees of familiarity	Modeller should provide justification for changing the generalised cost parameters. Evidence should be provided to justify changes to levels of familiarity by user class.

4.1.2. The remainder of this chapter responds to the requests in the table above.

4.2 ITEM 6: NETWORK CONSTRUCTION/ BEHAVIOUR

4.2.1. The model is based on an S-Paramics model that was originally calibrated and validated in 2012. This model was subsequently used several times (sometimes with further revalidation) to assess the impacts of several schemes on M1 Junction 14 and the Northfield roundabout. It is understood that the network coding, calibration and validation of the original model was accepted at the time it was prepared.

4.2.2. However, the long life and use of the model means that the reasoning behind some of the coding decisions is unknown, however it is understood that the lane widths/ alignments etc were based on OS CAD mapping of the study area. The current Paramics Discovery model was converted from the original S-Paramics model by Systra, however the differences between modelling approaches in Paramics Discovery and S-Paramics meant that some small changes were required to the network coding to respond to those differences and to improve some vehicle behaviours (such as vehicles randomly weaving at nodes). Many of these decisions to make changes to the model were made based on the modeller's professional judgement, which was based on their experience of building Paramics models and information taken from the survey videos, as the location and type of roads in the study area made it difficult to safely undertake a site visit.

4.2.3. In the modeller's opinion, none of the changes made to the model are significant adjustments.

4.3 ITEM 7: TRAFFIC SIGNAL TIMINGS

4.3.1. Traffic signal timings are based upon the stage maximums identified in the traffic signal plans that were provided for the junctions by MKC officers. The original S-Paramics model was linked to PC-MOVA and latterly the signals ran as a fixed time plan.

4.3.2. As Paramics Discovery cannot be linked to PC-MOVA, scripts were created to, as far as possible, mirror some of the behaviour of the signals original S-Paramics model, including the linking of signals contained in different stage streams. The stage maximum times were derived from the S-Paramics model, the video surveys and traffic signal plan information provided by Highways England and MKC.

4.4 ITEM 8: HEADWAYS

4.4.1. Most junctions within the model study area are traffic signal controlled junctions. As is common when calibrating a Paramics model, the headways on approach to the traffic signals have been amended to increase/ decrease the saturation flow to allow sufficient vehicles to pass through the traffic signals every cycle. The headways on approach to these junctions were therefore amended during calibration to ensure that the model operated satisfactorily.

4.4.2. It is noted that the 2007 Highways Agency Guidelines for the Use of Microsimulation Software identifies at Table 2 that the guidance for time headway between vehicles is based on a headway of one second. It is therefore considered that the headway parameters used in the model are suitable.

4.5 ITEM 9: GENERALISED COST PARAMETERS/ FAMILIARITY

4.5.1. This comment is split into two parts relating to the generalised cost formula and to the familiarity of vehicles in the model.

Generalised Costs

4.5.2. The generalised cost formula in Paramics is used by the model to select the routes of vehicles in the model, but requires route choice in the model for changes in the cost values to have any significant impact on the routing of traffic. The MKE Paramics model contains the following potential route choices:

- M1 east to M1 West via mainline or via junction
- M1 west to M1 east via mainline or via junction
- M1 south- eastbound diverge to A509 north via bypass lane or via roundabout
- M1 north-westbound diverge to A509 north via bypass lane or via roundabout.

4.5.3. However, it would be expected that most vehicles for these route choices would use the freely flowing alternative (the mainline or a bypass lane) and as such the model is coded with defined routes to force vehicles to use the free-flow option. Although it is possible for a vehicle to disobey a defined route, when these routes are short it only happens rarely.

4.5.4. This means that the model has no route choice and that the time/ distance parts of the generalised cost formula will not have any impact on routeing in the model. Consequently, the values that are used in the model are irrelevant.

Familiarity Percentages

4.5.5. The familiarity parameter in Paramics is used to define the proportion of vehicles that perceive minor links to be more expensive than major links and choose their route accordingly. This means that for familiarity to have any effect, a model must have:

a) Major **and** minor links; and

b) Route choice between an origin and a destination with options that are both major and minor. If a destination can only be reached using minor links, familiarity has no effect on the section of route where there is no choice but to use a minor link.

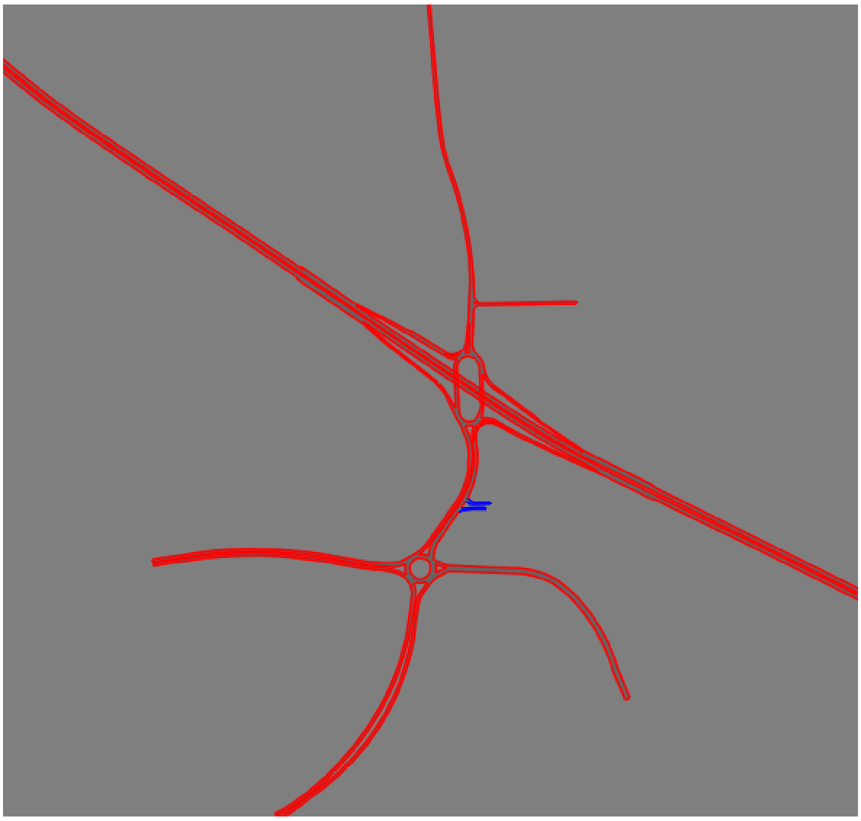
4.5.6. Table 4-2 summarises the familiarity parameters used in the MKE Paramics model and compares them to the default values. Bus vehicle types have been excluded from the table because they are following fixed routes in the model.

Table 4-2 – Default vs Model Familiarity

Vehicle Type	Default Familiarity	Model Familiarity
Car	0%	60%
Light Goods Vehicle	0%	40%
Heavy Goods Vehicle	0%	20%
Coach	0%	20%

4.5.7. The vehicle familiarities were set in the original S-Paramics model, so the exact reasoning behind the selection of the familiarity percentages is not known. Figure 4-1 below shows a screenshot of the model which highlights the major and minor links in red and blue respectively.

Figure 4-1 - Major and minor Links



4.5.8. Figure 4-1 shows that the Paramics model only contains one road that is coded using minor links, representing the access to the coach park to the east of the link road between the Northfield Roundabout and M1 Junction 14. There model contains no alternative routes to the zone served by those minor links; consequently, the familiarity parameter will have having no impact on routing in the model. As such, no further justification of the familiarity parameters is required.

4.5.9. WSP does not anticipate any of the development measures that may be coded into the model introducing any major/ minor route choice.

5 MODEL DEMAND AND MATRIX DEVELOPMENT

5.1 INTRODUCTION

5.1.1. Comment 10 from Table 1 of the AECOM report set out requests for further evidence relating to model calibration/ validation. These comments and requests are summarised in Table 5-1 below

Table 5-1 – AECOM comments relating to model demand and matrix development

ID	Classification	Description	Required Evidence/ Changes
10	Major	Demand methodology provided is not detailed enough to assess whether it is suitable	Greater transparency/ information required to determine demand methodology. This should include ANPR validity, ATC verification and capture rate for the data.

5.1.2. The rest of this section responds to the above comments.

5.2 ITEM 10: MODEL DEMANDS

5.2.1. Comments relating to the ANPR validity, ATC and capture rates are set out in chapter 3 of this response and have not been repeated here. The method used to develop the demand matrices used in the Paramics model is described in more detail below.

5.2.2. The demand matrices used in the Paramics models are entirely based on the observed ANPR data, because there is a one to one match between Paramics Zones and ANPR cordon zones, as shown in Table 5-2 below.

Table 5-2 – ANPR Site to Paramics Zone Number

ANPR Site	Paramics Zone
01b	1
03a	2
01a	3
02b	4
02c	5
02a	6
01d	7
03b	8
01b	1

5.2.3. The ANPR data observations were provided as matches for the following vehicle classes:

- Cars
- Light Goods Vehicles
- OGV1
- OGV2

5.2.4. The matrices for these vehicle classes were expanded from the sample matrix to a full population matrix using the match rate data provided by the survey company and were then compared to the observed link counts at the ANPR cordon sites to ensure that the resultant flows at the zone entries/ exits were appropriate. Following expansion of the matrices, the differences between the totals of the original sample matrices and the expanded full population matrices are as set out in Table 5-3 below.

Table 5-3 – Difference between sample and population matrices from ANPR

	AM Period	PM Period
ANPR Matrix (Sample)	26285	27601
Matrix (full population)	28065	29715
Difference	+1780	+2114
% Difference	6.8%	7.7%

5.2.5. The expanded ANPR matrices were then reorganised into the Paramics zoning system and the OGV1 and OGV2 matrices were summed to create an OGV matrix. These matrices were then used in the Paramics model, which has three vehicle classes as follows:

- Cars
- LGV
- HGV

5.2.6. WSP has used this method for other models and the method has been accepted by the reviewing authority. It is therefore considered that the demand matrix used in the model is appropriate.

6 MODEL CALIBRATION AND VALIDATION

6.1 INTRODUCTION

6.1.1. Items 11 to 15 from Table 1 of the AECOM report relate to model calibration and validation. The comments are summarised in Table 6-1 below.

Table 6-1 – AECOM comments relating to model calibration and validation.

ID	Classification	Description	Required Evidence/ Changes
11	Medium	It is unclear how many runs are used to validate and calibrate this model.	The final runs used for reporting should be consistent across all calibration and validation exercises. Any model results considered outliers should be excluded and justified where necessary.
12	Minor	Latent demand unreleased as a result of congestion has not been mentioned.	Latent demand should be discussed if vehicles are unreleased, especially if queues may affect the release onto the network.
13	Major	Queue length graphs presented in Appendix C show significant over and under estimation. Model instability clear on some routes.	Greater detail required on queue length data collection. Model runs should be excluded with justification if an unrealistic result is observed.
14	Major	Journey time data is unreliable since it is collected from ANPR and the journey time route excludes a significant portion of queueing on approach to some junctions. Therefore, there may be some delays that are not represented well in the model.	Greater detail required for journey time validation, with mitigation measures to account for queue lengths not included in routes. Supplementary data to support use of ANPR should be considered.
15	Major	Turning count data is unreliable since it is collected from ANPR	Turning counts from ANPR are unlikely to be reliable, supplementary data, using video MCC's may be required.

6.1.2. The remainder of this section responds to each of these comments in turn.

6.2 ITEM 11: NUMBER OF MODEL RUNS

6.2.1. As stated in the LMVR the model has been run 15 times to obtain an average result from multiple seeded runs, which is considered to be sufficient for a model of this size.

6.3 ITEM 12: LATENT DEMAND

6.3.1. There is very limited numbers of unreleased vehicles in the model, with the main sources being the A509 southbound towards M1 Junction 14 and Childs Way towards the Northfield Roundabout. In most runs, while there are unreleased vehicles at the end of the validation hour, the number of unreleased vehicles dissipates in the cool down period to a point where there are no unreleased vehicles when the model ends.

6.4 ITEM 13: QUEUE LENGTHS

6.4.1. The modelled queue lengths are based on the average queue length observed by the model in each five minute period during the assessment hours. The magnitude and profiles of these queues were then plotted on queue graphs to compare them with the observed data.

6.4.2. Firstly, it is evident that the queue length observations on the A509 southbound approach to the north of M1 junction 14 must not have recorded the full extent of queuing, as it is only possible to pass the journey time validation if the queues are of the length that is predicted in the model.

6.4.3. With regards to the queues shown on the westbound slip road and A4146 northbound, it is agreed that there appears to be outlier runs that were not apparent in the other model statistics. Removing these runs from the queue graphs would move the average modelled queue profile much closer to the observed line and would be unlikely to change the overall results.

6.4.4. While the Typical Traffic conditions shown in Google Maps does not provide the full extent of queuing in the model area, it does provide information about where traffic is moving more slowly than normal, which could be either as a queue or just slowly moving traffic. This information shows significantly longer A509 approach from the north.

6.5 ITEM 14: JOURNEY TIMES

6.5.1. Although the AECOM review describes the ANPR journey time data as “unreliable”, both HE and MKC agreed to this approach to collecting the journey time data and the cordon that would be used for the ANPR survey. Section 12, specifically 12.4 of the June 2019 AECOM note identifies the following;

If the model is to be re-validated in the current version of Paramics Discovery the network should be imported and reviewed completely, then re-calibrated against new turn data and queue data collected in the 2019 surveys, if this is appropriate. The model can then be validated against the journey time surveys completed; ANPR data should be suitable, providing the routes used are appropriate. This could then provide a suitable basis for the Do Min and future year models to be constructed.

6.5.2. The ANPR journey times are based on a large sample rate of many vehicles and, as there are no locations within the cordon where vehicles would seek to stop, will be more reliable record of the average journey times across the peak hour than the small sample of observations that would be possible to record using moving observers. It is also noted that the ANPR journey times will take account of vehicles that are stopped by a red traffic signal and vehicles that pass straight through on green, which will be similar to the journey times reported by the model. Moving observer journey times occasionally present the risk of only including one of the two traffic signal behaviours.

6.5.3. It is therefore considered that the ANPR journey times are suitable for use in validation of the model.

6.6 ITEM 15: TURNING COUNTS

6.6.1. While the AECOM note describes the use of ANPR derived turning counts as “unreliable”, both HE and MKC agreed to this approach to collecting the data during the detailed data collection discussions. There is no suitable historic count data available, and it is considered that the observations from the ANPR are more likely to be reliable than a new traffic count.

6.6.2. The reliability of the turning count data was discussed earlier in this report. It is noted that the model is showing an excellent level of calibration against the observed turning count data from the ANPR data.

6.6.3. Furthermore, there is no opportunity to undertake supplementary traffic surveys at this time. The combination of further road works, plus Covid-19 pandemic conditions would result in surveys which are not reflective of network conditions. As such, the capture rate outlined in the ANPR analysis, plus the review outlined above provides evidence that the surveys captured are appropriate.

Appendix A

AECOM REVIEW OF PARAMICS LMVR REPORT

Technical Note 05

AECOM

Project:	**Milton Keynes East**	Job No:	**60600479** **DM016.002**
Subject:	**Review of Paramics LMVR Report**		
Prepared by:	**Tara Tanoz-Sargeant**	Date:	**26/06/2020**
Checked by:	**Phil Arnold**	Date:	**29/06/2020**
Verified by:	**Colin Hardie/Liz Judson**	Date:	**30/06/2020**
Approved by:	**John Alderman**	Date:	**06/07/2020**

1 Introduction

1.1.1 Highways England (HE) has requested that AECOM undertake a review of the Local Model Validation Report (LMVR) produced by WSP for Milton Keynes East modelling. The LMVR documents the development, calibration and validation of the Paramics Discovery model that will be used as a base to test the impact of a proposed development "Milton Keynes East".

2 Structure

2.1.1 The structure of this report follows the structure of the LMVR produced by WSP.

- Overview of model purpose and specification;
- Review of data collection;
- Model periods and demand;
- Review of base model development;
- Review of calibration and validation processes; and
- Conclusions and recommendations.

3 Overview of Model and Specification

3.1.1 The Milton Keynes East model has been developed to assess the impact of the proposed development and its associated infrastructure improvements.

3.1.2 WSP took a S-Paramics model previously built with a base year of 2011, and recalibrated and validated to a 2019 base while updating the software to Paramics Discovery.

The model covers Junction 14 of the M1 and key junctions in the vicinity as shown in

3.1.3 Figure 1 below.

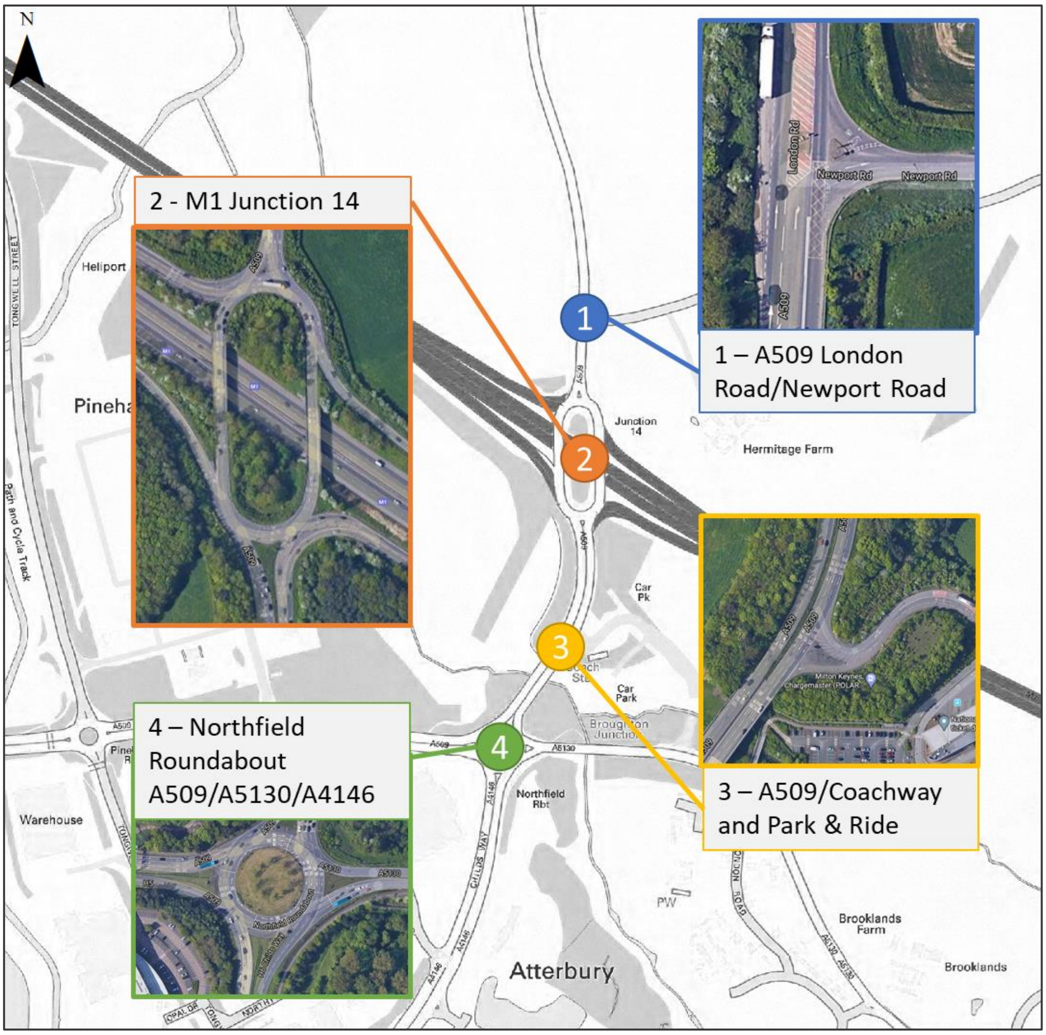


Figure 1 - Diagram showing the key junctions modelled

3.1.4 The two key junctions in this model are the grade separated M1 Junction 14 roundabout and the Northfield A509/A5130 roundabout, these are both signal controlled junctions.

3.1.5 Two peak hours have been assessed which are:

- Weekday AM Peak (08:00 – 09:00); and
- Weekday PM Peak (17:00 – 18:00).

4 Data Collection Review

4.1.1 The base year model was built using the following survey data:

- Automatic Number Plate Recognition (ANPR) from 27th June 2019;
- Queue Length counts from 27th June 2019; and
- Automatic Traffic Counts (ATCs) taken between 26 June 2019 – 8th July 2019.

4.1.2 ANPR data from only one day is used as a basis for journey time data. No analysis is provided to establish that the day in which the ANPR data was collected represents a typical weekday. This data is used for calibrating and validating journey times in the base year model.

4.1.3 The ANPR day should be highlighted within the ATC profile to provide evidence that the ANPR data is collected on a typical day.

4.1.4 Similarly, queue length counts are used for the same day as the ANPR counts. Without evidence that the 27th June 2019 is representative of an average weekday, the reliability of these queue counts for calibration cannot be assessed.

4.1.5 The ATC counts only provide 6 neutral days as defined by the DfT's TAG criteria. For any further applications of the model it is recommended that a larger sample period is used.

4.1.6 ATC data is sparse and only collected at three locations, which do not cover all cordon points. There is no reference made to what the ATC counts are used for in this model. No evidence is provided in any part of the report to show how ATC counts are used for the Milton Keynes East model.

4.1.7 The number of journey time samples used to validate the models are not presented.

4.1.8 Confidence intervals should be provided to demonstrate that the data is reliable and that outliers have been identified and removed if necessary.

4.1.9 The data used to build this base model may not be typical due to ongoing works with A421 widening and M1 J13 to J16 SMART motorway works. WSP should provide reassurances regarding the validity of the count data and how representative the junction operation will be once these roadworks are complete and traffic conditions return to typical conditions. WSP should outline how this would be considered in forecast scenarios.

5 Model Periods

5.1.1 Paramics models require a warm-up and cool down period to be included so that traffic conditions, and congestion build up is representative in the peak hour of the model. These have been run to cover the periods below:

- Weekday AM 07:00 – 10:00 (Peak: 08:00 – 09:00)
- Weekday PM 16:00 – 19:00 (Peak: 17:00 – 18:00)

5.1.2 Paragraph 3.2.3 of the LMVR states that 15 randomly seeded runs are used to assess calibration and validation of the model.

5.1.3 It is unclear how the peak hours were established. The method for identifying the peak hours should be detailed in the LMVR. It is recommended that journey times and queue lengths are also used to help inform the selection of the peak hour.

5.1.4 Each peak hour has a build-up period of 1 hour to populate the network prior to the assessment of the peak hour, followed by a 1 hour cool down period. This is acceptable, given the extents of the network.

6 Base Model Development

6.1.1 The Paramics Discovery model itself has not been audited as part of this report. The following subsections review the approach and methodology described in the LMVR.

6.2 Model Structure and Parameters

6.2.1 There is no discussion about the existing Paramics model used to develop the new base year, and no comparison of the network has been provided.

6.2.2 Paragraph 3.3.2 of the LMVR states that *"Nodes, kerbs and links have been adjusted where necessary so that vehicle behaviour is consistent with the observed vehicle behaviour on the ground"*. It is unclear how this was verified without video footage, or a site visit to help inform the modelling.

6.2.3 The generalised cost changes may be justified if it is to prevent vehicles rerouting through Junction 14 to avoid congestion on the M1. Since defined routes are used in the modelling, additional explanation should be provided to justify the changes to distance factors. Adding a distance multiplier to prevent vehicles routing via the off slip, to return onto the M1 due to minimal journey time changes may be an appropriate measure, however this should be explicitly stated.

6.2.4 Section 3.6 in the LMVR outlines changes made to the default familiarity parameters, these affect driver route choice in a model, no evidence or justification has been provided for these changes. While the base model has no route choice, these changes may affect the results if new route choice is introduced in forecast year models.

6.2.5 Section 3.8 of the LMVR discusses link cost factors and hazard override functionality. This functionality allows more realistic movements to be included in the model, especially in large junctions with complex behaviour or where lane allocations vary from defaults set in Paramics. In this case, these parameters are used for the M1 J14 Roundabout and Northfield Roundabout to ensure realistic lane use in the model. However, whether these measures are appropriate or effective cannot be determined without further information, or a review of the model.

6.2.6 Defined routes appear to be used appropriately to prevent traffic routing through J14 to avoid congestion on the M1.

6.3 Traffic Signals

6.3.1 Section 3.10 details signal methodology employed in the base year model. Signals at both the M1 Junction 14 and Northfield Roundabout are built into the Discovery model as detector loops to approximate vehicle actuation (MOVA) at these junctions.

6.3.2 Tables 3.1 and 3.2 provide maximum green times at each roundabout, these effectively cap the amount of time that a single stage could remain on green. These are used in lieu of average signal timings: however, how these maximums are determined is unclear and requires further comment within the LMVR.

6.3.3 Reference is made to calibration of journey times, a review of the methodology of this is outlined in Section 8 below.

6.4 Junction Specific Parameters

6.4.1 Junction specific parameters have been considered and applied where relevant. Based on the information provided in the LMVR these are appropriate.

6.4.2 The headway, which controls how close vehicles travel to the vehicle in front, has been left at the default value of 1 second. It should be noted that drivers are recommended to keep a 2 second safety gap from the vehicle in front. Given that no site observations were undertaken, the modeller should justify the use of the smaller time gap between vehicles.

6.5 Speed Limits

6.5.1 Changes to the speed limit on the M1 in the model are appropriate for the Smart Motorway upgrades taking place between January 2018 and March 2022.

6.5.2 There is no evidence of speed profiling for the M1, so the speed distribution of traffic may not be represented if a blanket speed reduction was applied. Profiling could be undertaken using ANPR data collected for this study.

7 Model Demand and Matrix Development

7.1.1 Paragraph 4.2.1 of the LMVR states that *"ANPR data has been used for the matrix building process"*. ANPR data is only collected for the 26th June 2019. It is not recommended that a single day's ANPR data is used to derive matrices.

7.1.2 It is expected that the ANPR data will not capture all vehicles on the network, and therefore it is difficult to understand how demand matrices have been established. Further information is required on capture rate and the development of the demand matrices. Generally, ANPR data is accompanied by Manual Classified Counts (using the camera footage) to ascertain the capture rate - however based on the information provided this does not seem to be the case. Given that ANPR data has been collected via video, vehicle count data could still be obtained to inform matrix development, and it is recommended that this is undertaken.

7.1.3 Section 4.4 of the LMVR describes the use of profiles; however, it does not explicitly state the type of traffic counts used to derive the profiles. There are several different methodologies that could be used to produce these profiles. It is difficult to comment on the profiles without supporting evidence to show that profiles from the ANPR data are representative and that the capture rate is sufficient.

7.1.4 This model is built and validated to atypical conditions, some reference to how these will be mitigated for forecasting should be provided. This is especially important given the model will be used to test the impact of new development in the area.

7.1.5 A clearer demand development methodology is needed to assess whether this model is suitable for the purpose of this modelling exercise.

8 Model Calibration and Validation

8.1 Turning Count Calibration

8.1.1 The data used for calibration of turning counts is not explicitly stated, however it is assumed that this is based on ANPR data, as apart from the ATC data, no other data was collected to enable this. As discussed above, the ANPR data will not represent the full volume of vehicles as it is likely that a proportion of vehicles are not captured.

8.1.2 The comparison of modelled and observed turning counts provided in Tables 5-2 and 5-3 show that 100% of counts meet the criteria; however, this is to be expected if the data used to develop the matrices are also used for calibration and there is no route choice in the network. No evidence has been provided to verify that 'observed turning counts' are accurate since no evidence has been provided, but these may have been based on ANPR data.

8.2 Queue Length Calibration

8.2.1 Paragraph 3.2.3 of the LMVR states that 15 randomly seeded runs are used to assess calibration and validation of the model. It is unclear whether this is per peak period, or in total. Graphs presented in Appendix C suggest that more than 15 runs were used for the calibration of queues. If runs were dismissed on incomplete model runs or other reasons, these should be clearly explained.

8.2.2 No comment has been provided within the LMVR regarding any latent demand that cannot be released from zones as a result of congestion.

8.2.3 Queue length graphs presented in Appendix C appear very different from observed queue lengths. Overestimation of the base year queues may result in unrealistically long queue lengths in the forecast years, and therefore suggest a greater impact from a development, while an underestimation of queues in the base year would result in potential queues as a result of a development to be underrepresented in the forecast year. Some examples are provided in figures 2 to 3 below.

8.2.4 Graph below shows some major differences, with the model showing longer queues than that of the surveyed queues by 100 vehicles (around 600m).

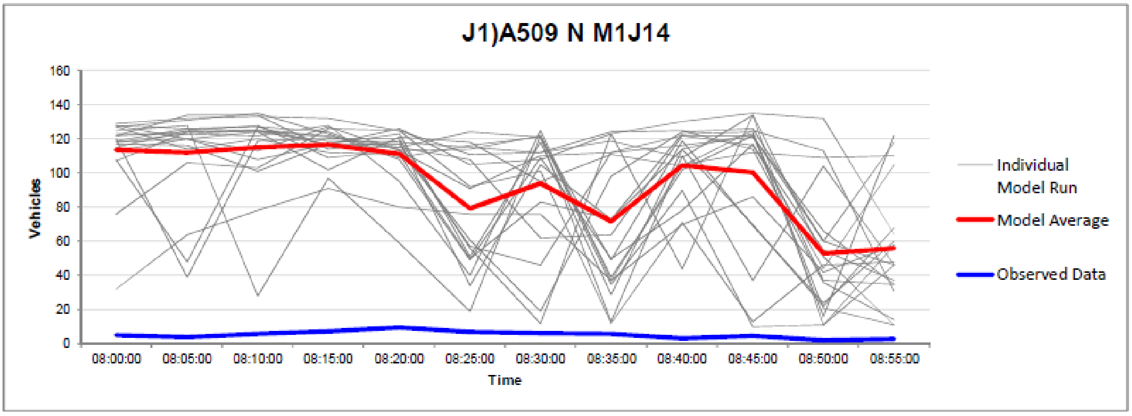


Figure 2 Graph taken from Appendix C showing major differences between the queue lengths observed and the queue lengths modelled.

8.2.5 Similarly, the graph below shows three model runs where queue lengths are substantially longer than others visible under the blue observed data line. If these model runs are producing unrealistic queues or journey times, then these should be excluded from all results.

8.2.6 For example, these three runs may skew results to present favourable calibration conditions in other queue length checks and journey time validation. Given this disparity between seed runs, it would be helpful to provide information on the confidence level and intervals of the base model results.

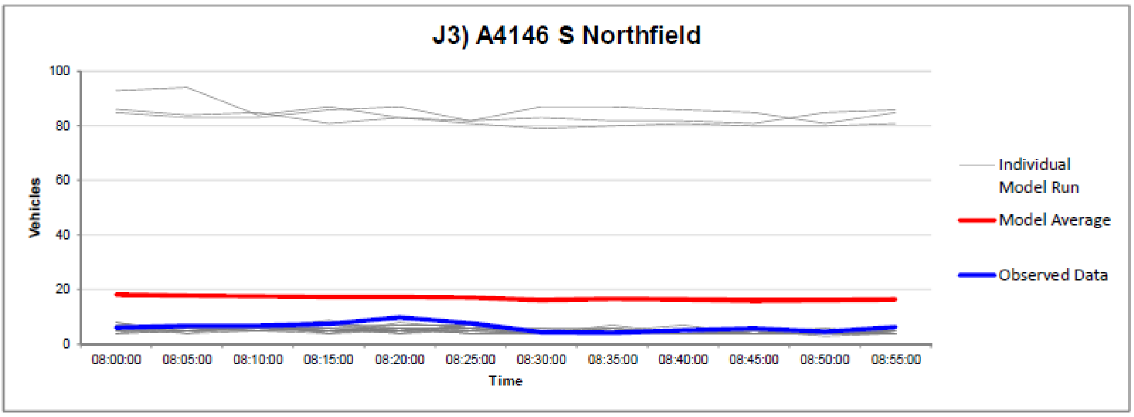


Figure 3 Graph taken from Appendix C showing three model runs with significantly different model results.

8.3 Journey Time Validation

8.3.1 The DfT TAG criteria are only appropriate for routes with distances between 3 and 15km. Many of the journey time routes presented are shorter than 3 km. It is recommended that only the 15% criteria are used since a 60 second variation is too long for a very short route. The model still appears to meet the 85% criteria using only the 15% criteria.

8.3.2 Journey times are validated using the ANPR data from 26th June 2019. This is acceptable given that the journey time data has not been used to develop the demand matrices.

8.3.3 Journey time profiles would be helpful to determine whether queueing and delays are in correct locations and the modelled peak hour is representative of the actual peak hour in this area. The modellers have not completed any journey time profiling.

8.3.4 It is unclear why the results for turning count and queue length calibration are based on different numbers of model runs compared to the journey time validation.

8.3.5 The table in Appendix D summarising results of the journey time validation does not present the confidence intervals for Routes 1-6, so it is difficult to determine where the model averages fall.

8.3.6 Queue lengths do not include full length of queues on approach to junctions, this is limited by ANPR site locations. The modellers should provide commentary or additional supporting information where queue data indicates queues extend past the ANPR, to provide greater confidence that the delay at each junction is captured.

9 Conclusions and Recommendations

9.1.1 To simplify the technical aspects of the audit each issue above has been aligned to the following rating, **MINOR**, **MEDIUM** and **MAJOR**.

9.1.2 A **MINOR** item is an advisory and can either be accommodated / changed or clarified with additional information, a **MEDIUM** item requires remediation or an additional explanation on why it has been done, which will then be re-considered, and **MAJOR** item requires correction before it can be reconsidered for review.

9.1.3 Issues or errors found during this LMVR audit are classified into three categories:

Table 1 below shows a summary of the status of the issues identified during the audit.

Table 1: Audit Summary Table

ID	Description	Classification	Required Evidence or Changes
Model Specification			
1	Unclear how peak hour was determined	**MEDIUM**	Additional information regarding how peak hour was chosen would be helpful in determining validity of approach.
Data Collection Review			
2	ANPR data collection, reliability and verification process unclear	**MAJOR**	Information to help determine that the data collected on 27th June 2019 is a representative day. Evidence of ATC data used to verify the profile should be provided to show representative day and verify ANPR data. Capture rate of ANPR data not provided to support use of this data.
3	Ongoing roadworks during data collection	**MAJOR**	Reassurances should be provided regarding use of data collected during ongoing works on the A421 and M1 Smart motorway schemes. Details of how any future changes in traffic flows arising from these roadworks coming to an end will be considered in forecast scenarios should be provided.
4	Journey times are based on ANPR data, number of journey time samples and assessment of reliability not provided.	**MEDIUM**	Journey time reliability reliant on quality of ANPR data. Is supplementary data required?
5	Methodology for queue length measurement unclear	**MEDIUM**	Methodology for queue length surveys should be clarified to show that the data is suitable for calibration of the model. Was this collected manually on site, using traffic cameras or an alternative method?
Base Model Development			

6	Evidence to support network is suitable with appropriate kerbs, junctions and links not provided	**MINOR**	Evidence to support how modellers know that the vehicle behaviour is consistent should be provided. For example, if a site visit was conducted or video footage was used to verify.
7	Unclear how maximum traffic signal timings were determined for use in the model at vehicle actuated signals.	**MINOR**	Some evidence could be provided to support this if site-based observations or video footage was used.
8	Changes to headway settings at junctions are not supported, these have been changed from the 2 second gap recommended.	**MINOR**	Modeller should justify use of smaller time gap between vehicles given no site visit was conducted.
9	Unjustified changes to generalised cost parameters and degrees of familiarity	**MEDIUM**	Modeller should provide justification for changing the generalised cost parameters. Evidence should be provided to justify changes to levels of familiarity by user class.
Model Demand and Matrix Development			
10	Demand methodology provided is not detailed enough to assess whether it is suitable	**MAJOR**	Greater transparency/ information required to determine demand methodology. This should include ANPR validity, ATC verification and capture rate for the data.
Model Calibration and Validation			
11	It is unclear how many runs are used to validate and calibrate this model.	**MEDIUM**	The final runs used for reporting should be consistent across all calibration and validation exercises. Any mode results considered outliers should be excluded and justified where necessary.
12	Latent demand unreleased as a result of congestion has not been mentioned.	**MINOR**	Latent demand should be discussed if vehicles are unreleased, especially if queues may affect the release onto the network.
13	Queue length graphs presented in Appendix C show significant over and under estimation. Model	**MAJOR**	Greater detail required on queue length data collection. Model runs should be excluded with justification if an unrealistic result is observed.

	instability clear on some routes.		
14	Journey time data is unreliable since it is collected from ANPR and the journey time route excludes a significant portion of queueing on approach to some junctions. Therefore, there may be some delays that are not represented well in the model.	**MAJOR**	Greater detail required for journey time validation, with mitigation measures to account for queue lengths not included in routes. Supplementary data to support use of ANPR should be considered.
15	Turning count data is unreliable since it is collected from ANPR	**MAJOR**	Turning counts from ANPR are unlikely to be reliable, supplementary data, using video MCC's may be required.

9.1.4 Modelling issues considered to be **MAJOR** are:

- Insufficient evidence of checks and verification of ANPR data collected and no detail of capture rate;
- Ongoing roadworks during data collection mean data may not be 'typical';
- There is insufficient supporting information provided on matrix development;
- Modelled queue lengths are not representative of the onsite observations;
- Journey time data is unreliable and excludes significant portions of queueing observed on some routes; and
- Turning count data is unreliable since it is collected from ANPR.

9.1.5 AECOM has reviewed the LMVR provided by WSP for the Paramics model of Milton Keynes J14 and the vicinity.

9.1.6 The evidence and detail provided on model development does not provide enough justification for model demand development. Therefore, based on issues highlighted in the table above, further information is required for AECOM to conclude whether this base model is representative of the current conditions in the area and provides a reliable basis to estimate any forecast year scenarios. However, AECOM cannot fully verify the model without reviewing the Paramics model itself.

Appendix B

ANPR CORDON LINK COUNT DATA

By 15 Min

		NB/EB	SB/WB	Total
01a	07:30	661	921	1582
	07:45	881	759	1640
	08:00	1040	685	1725
	08:15	1003	821	1824
	08:30	958	797	1755
	08:45	939	692	1631
	09:00	784	681	1465
01b	07:30	1138	671	1809
	07:45	845	679	1524
	08:00	872	846	1718
	08:15	963	855	1818
	08:30	887	694	1581
	08:45	713	683	1396
	09:00	698	628	1326
01d	07:30	0	9	9
	07:45	0	3	3
	08:00	0	10	10
	08:15	0	7	7
	08:30	0	5	5
	08:45	0	6	6
	09:00	0	4	4
02a	07:30	164	316	480
	07:45	175	388	563
	08:00	169	437	606
	08:15	144	482	626
	08:30	118	442	560
	08:45	125	390	515
	09:00	85	258	343
02b	07:30	184	122	306
	07:45	180	115	295
	08:00	188	120	308
	08:15	195	79	274
	08:30	189	73	262
	08:45	172	77	249
	09:00	108	63	171
02c	07:30	196	353	549
	07:45	177	388	565
	08:00	159	376	535
	08:15	146	384	530
	08:30	125	403	528
	08:45	136	361	497
	09:00	133	284	417
03a	07:30	202	106	308
	07:45	168	101	269
	08:00	173	110	283
	08:15	140	73	213
	08:30	198	116	314
	08:45	206	133	339
	09:00	192	105	297
03b	07:30	60	100	160
	07:45	77	99	176
	08:00	78	57	135
	08:15	65	69	134
	08:30	63	62	125
	08:45	44	76	120
	09:00	30	52	82

By Hour

		NB/EB	SB/WB	Total
01a	07:30	3585	3186	6771
	07:45	3882	3062	6944
	08:00	3940	2995	6935
	08:15	3684	2991	6675
01b	07:30	3818	3051	6869
	07:45	3567	3074	6641
	08:00	3435	3078	6513
	08:15	3261	2860	6121
01d	07:30	0	29	29
	07:45	0	25	25
	08:00	0	28	28
	08:15	0	22	22
02a	07:30	652	1623	2275
	07:45	606	1749	2355
	08:00	556	1751	2307
	08:15	472	1572	2044
02b	07:30	747	436	1183
	07:45	752	387	1139
	08:00	744	349	1093
	08:15	664	292	956
02c	07:30	678	1501	2179
	07:45	607	1551	2158
	08:00	566	1524	2090
	08:15	540	1432	1972
03a	07:30	683	390	1073
	07:45	679	400	1079
	08:00	717	432	1149
	08:15	736	427	1163
03b	07:30	280	325	605
	07:45	283	287	570
	08:00	250	264	514
	08:15	202	259	461

Total

	NB/EB	SB/WB	Total
07:30	10443	10541	20984
07:45	10376	10535	20911
08:00	10208	10421	20629
08:15	9559	9855	19414

By 15 Min

		NB/EB	SB/WB	Total
01a	16:30	939	965	1904
	16:45	932	1017	1949
	17:00	925	980	1905
	17:15	934	945	1879
	17:30	842	929	1771
	17:45	861	779	1640
	18:00	798	849	1647
01b	16:30	801	1055	1856
	16:45	890	1058	1948
	17:00	848	907	1755
	17:15	792	1023	1815
	17:30	780	956	1736
	17:45	801	923	1724
	18:00	785	828	1613
01d	16:30	0	2	2
	16:45	0	6	6
	17:00	0	6	6
	17:15	0	6	6
	17:30	0	3	3
	17:45	0	11	11
	18:00	0	8	8
02a	16:30	215	144	359
	16:45	196	162	358
	17:00	211	153	364
	17:15	222	173	395
	17:30	260	144	404
	17:45	202	172	374
	18:00	179	164	343
02b	16:30	153	94	247
	16:45	146	116	262
	17:00	177	143	320
	17:15	177	109	286
	17:30	172	123	295
	17:45	162	129	291
	18:00	155	113	268
02c	16:30	228	199	427
	16:45	244	212	456
	17:00	220	245	465
	17:15	200	243	443
	17:30	231	219	450
	17:45	204	269	473
	18:00	193	224	417
03a	16:30	214	106	320
	16:45	236	101	337
	17:00	203	110	313
	17:15	201	73	274
	17:30	182	116	298
	17:45	190	133	323
	18:00	181	105	286
03b	16:30	57	40	97
	16:45	67	25	92
	17:00	104	40	144
	17:15	94	36	130
	17:30	103	36	139
	17:45	80	51	131
	18:00	71	57	128

By Hour

		NB/EB	SB/WB	Total
01a	16:30	3730	3907	7637
	16:45	3633	3871	7504
	17:00	3562	3633	7195
	17:15	3435	3502	6937
01b	16:30	3331	4043	7374
	16:45	3310	3944	7254
	17:00	3221	3809	7030
	17:15	3158	3730	6888
01d	16:30	0	20	20
	16:45	0	21	21
	17:00	0	26	26
	17:15	0	28	28
02a	16:30	844	632	1476
	16:45	889	632	1521
	17:00	895	642	1537
	17:15	863	653	1516
02b	16:30	653	462	1115
	16:45	672	491	1163
	17:00	688	504	1192
	17:15	666	474	1140
02c	16:30	892	899	1791
	16:45	895	919	1814
	17:00	855	976	1831
	17:15	828	955	1783
03a	16:30	854	390	1244
	16:45	822	400	1222
	17:00	776	432	1208
	17:15	754	427	1181
03b	16:30	322	141	463
	16:45	368	137	505
	17:00	381	163	544
	17:15	348	180	528

Total

	NB/EB	SB/WB	Total
16:30	10626	10494	21120
16:45	10589	10415	21004
17:00	10378	10185	20563
17:15	10052	9949	20001

Appendix C

ANPR CAPTURE RATE INFORMATION

Intelligent Data Collection Limited
Milton Keynes East

Client:	WSP
Project Number:	ID04688
Date of Survey:	27.06.2019
Survey Type:	ANPR Sample Rates

Quality Assurance and Issue Record

Quality Assurance

Revision	Rev A			
Date	29.07.2019			
Prepared by	Emma Douglas			
Signature				
Checked by	Luke Martin			
Signature				
Project Director	Paul O'Neill			
Signature				
Project number	ID04688			
File Ref	ID04688 Milton Keynes East - ANPR Sample Rate Report - 27_06_2019.xlsx			

Issue Sheet

Issued to	Date			
	30.07.2019			
Alex Smith	Email			

Contents Page

Intelligent Data Collection Limited

intelligentdata

Client:	WSP
Project Number:	ID04688
Date of Survey:	27.06.2019
Project Name:	Milton Keynes East

Coordinates	Google Maps Link
52.058823, -0.700232	Click Here

Location Plan

ANPR Terminology

ANPR sites are either assumed to be 'external' or 'internal'. This affects the way in which the OD matching process works in relation to each site. The differences between the two types are as follows:

External - these are sites which are assumed to be on the periphery of the study area and hence vehicles passing through these sites will be be starting or ending their OD trip. Directions at these sites are set to Inbound and Outbound, and for sites that have vehicles travelling into the study area (i.e. they are not a one-way outbound site) a ANPR match rate statistic is presented.

Internal - these are sites that are considered to be possible through traffic sites for longer distance OD movements - i.e. they may be an intermediate capture point for vehicles seen entering and exiting the study area elsewhere. In this instance, the OD movement is assigned to the initial and final capture locations. Internal sites can be the origin of a trip (if it is not captured elsewhere before) or the destination of a trip (if it is not captured again after). However, as the majority of vehicles passing these locations will have both the origin and destination assigned elsewhere, match rates are not presented for these points. Directions at these sites will be given as N and S (effectively meaning NB and SB), for example, as opposed to Inbound and Outbound.

Even though the OD movements will not show when a vehicle has also been captured at any internal sites (or intermediate points), the trip chain reports will show a full record of each individual capture of each vehicle in addition to summaries for each unique trip chain observed.

Additional Notes (Factors which may impact on survey results such as accidents, roadworks, special events)

ANPR underperformance at Site 2a in the Inbound direction.
ANPR underperformance at Site 3a in the Outbound direction.

Intelligent Data Collection Limited

Client: WSP
Project Number: ID04688
Date of Survey: 27.06.2019
Project Name: Milton Keynes East

Capture / Matching Overview

Site	Overall Sample Rates			Inbound Sample Rates			Outbound Sample Rates			Inbound Match Rates		
	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Matched Plates	Match Rate
01a	85251	76940	90%	43599	39487	91%	41652	37453	90%	43599	35928	82%
01b	81690	75082	92%	39020	36700	94%	42670	38382	90%	39020	34448	88%
01d	331	275	83%	-	-	-	331	275	83%	-	-	-
02a	19370	13724	71%	9633	5950	62%	9737	7774	80%	9633	5606	58%
02b	10221	9212	90%	6114	5316	87%	4107	3896	95%	6114	4343	71%
02c	22521	19125	85%	10280	8228	80%	12241	10897	89%	10280	7031	68%
03a	17358	13681	79%	8829	8519	96%	8529	5162	61%	8829	7924	90%
03b	3996	3843	96%	2118	2078	98%	1878	1765	94%	2118	1791	85%
Total	240738	211882	88%	119593	106278	89%	121145	105604	87%	119593	97071	81%

External Site
Internal Site

*Inbound match rates are only shown for the external sites that have traffic inbound to the study area
*For internal sites, the MCC and capture data will relate to EB and WB or NB and SB as opposed to Inbound and Outbound

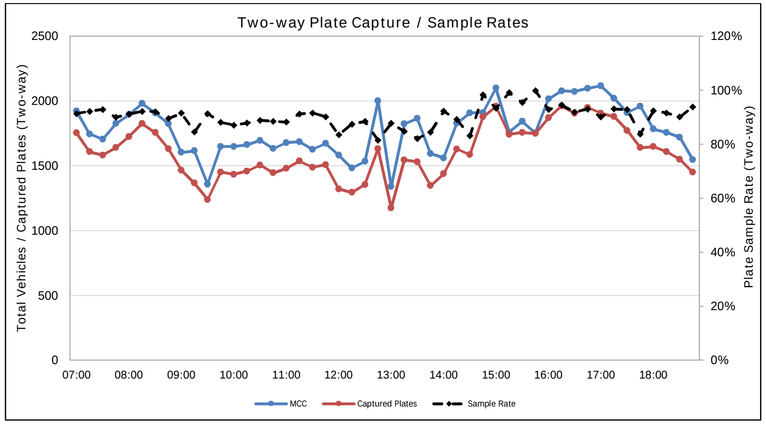
Intelligent Data Collection Limited

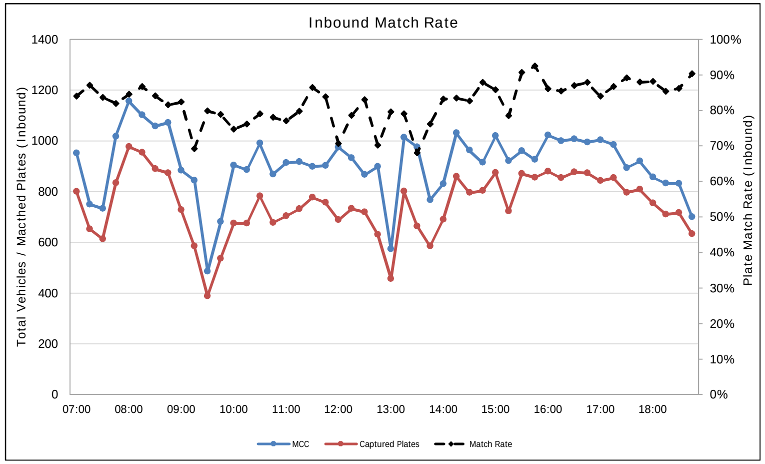
Client: WSP
Project Number: ID04688
Date of Survey: 27.06.2019
Project Name: Milton Keynes East
Road Name: M1
Site Number: 01a

Prepared by: Emma Douglas
Checked by: Luke Martin

Site Sample and Match Rates

	Overall Sample Rates			Inbound Sample Rates			Outbound Sample Rates			Inbound Match Rates		
Time Period	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Match Rate
07:00	1920	1753	91%	951	853	90%	969	900	93%	951	799	84%
07:15	1744	1607	92%	749	685	91%	995	922	93%	749	652	87%
07:30	1704	1582	93%	733	661	90%	971	921	95%	733	613	84%
07:45	1824	1640	90%	1017	881	87%	807	759	94%	1017	833	82%
08:00	1893	1725	91%	1155	1040	90%	738	685	93%	1155	976	85%
08:15	1980	1824	92%	1101	1003	91%	879	821	93%	1101	954	87%
08:30	1907	1755	92%	1057	958	91%	850	797	94%	1057	889	84%
08:45	1823	1631	89%	1071	939	88%	752	692	92%	1071	873	82%
09:00	1602	1465	91%	883	784	89%	719	681	95%	883	727	82%
09:15	1615	1365	85%	844	654	77%	771	711	92%	844	584	69%
09:30	1357	1239	91%	485	427	88%	872	812	93%	485	387	80%
09:45	1648	1451	88%	680	584	86%	968	867	90%	680	536	79%
10:00	1648	1434	87%	903	751	83%	745	683	92%	903	674	75%
10:15	1661	1458	88%	885	747	84%	776	711	92%	885	674	76%
10:30	1695	1505	89%	990	869	88%	705	636	90%	990	782	79%
10:45	1632	1444	88%	868	760	88%	764	684	90%	868	677	78%
11:00	1678	1479	88%	913	792	87%	765	687	90%	913	703	77%
11:15	1685	1536	91%	917	817	89%	768	719	94%	917	731	80%
11:30	1626	1488	92%	898	874	97%	728	614	84%	898	776	86%
11:45	1672	1507	90%	902	839	93%	770	668	87%	902	756	84%
12:00	1582	1320	83%	974	780	80%	608	540	89%	974	688	71%
12:15	1481	1294	87%	932	804	86%	549	490	89%	932	732	79%
12:30	1533	1355	88%	866	805	93%	667	550	82%	866	719	83%
12:45	2000	1629	81%	898	705	79%	1102	924	84%	898	630	70%
13:00	1338	1173	88%	573	523	91%	765	650	85%	573	456	80%
13:15	1822	1544	85%	1013	904	89%	809	640	79%	1013	800	79%
13:30	1864	1530	82%	975	764	78%	889	766	86%	975	663	68%
13:45	1594	1346	84%	767	660	86%	827	686	83%	767	584	76%
14:00	1559	1437	92%	830	771	93%	729	666	91%	830	690	83%
14:15	1827	1628	89%	1030	946	92%	797	682	86%	1030	859	83%
14:30	1907	1585	83%	962	902	94%	945	683	72%	962	795	83%
14:45	1909	1876	98%	914	902	99%	995	974	98%	914	803	88%
15:00	2098	1957	93%	1019	970	95%	1079	987	91%	1019	874	86%
15:15	1759	1742	99%	920	908	99%	839	834	99%	920	722	78%
15:30	1842	1757	95%	960	957	100%	882	800	91%	960	870	91%
15:45	1752	1748	100%	925	922	100%	827	826	100%	925	855	92%
16:00	2014	1869	93%	1021	955	94%	993	914	92%	1021	879	86%
16:15	2077	1961	94%	999	921	92%	1078	1040	96%	999	853	85%
16:30	2072	1904	92%	1007	939	93%	1065	965	91%	1007	876	87%
16:45	2097	1949	93%	994	932	94%	1103	1017	92%	994	873	88%
17:00	2116	1905	90%	1003	925	92%	1113	980	88%	1003	842	84%
17:15	2020	1879	93%	984	934	95%	1036	945	91%	984	853	87%
17:30	1909	1771	93%	893	842	94%	1016	929	91%	893	796	89%
17:45	1959	1640	84%	919	861	94%	1040	779	75%	919	808	88%
18:00	1783	1647	92%	856	798	93%	927	849	92%	856	754	88%
18:15	1756	1607	92%	832	772	93%	924	835	90%	832	710	85%
18:30	1720	1549	90%	831	775	93%	889	774	87%	831	716	86%
18:45	1547	1450	94%	700	692	99%	847	758	89%	700	632	90%
Total	85251	76940	90%	43599	39487	91%	41652	37453	90%	43599	35928	82%





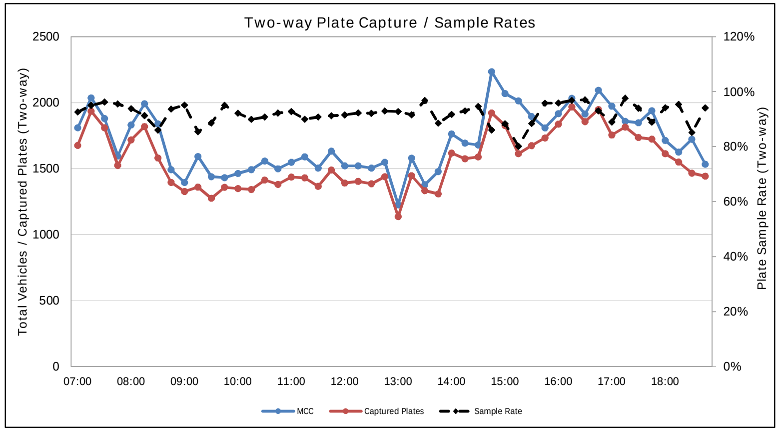
Intelligent Data Collection Limited

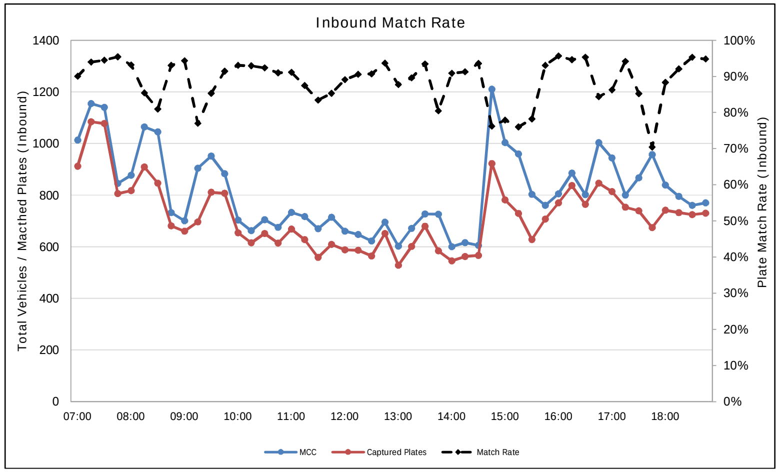
Client: WSP
Project Number: ID04688
Date of Survey: 27.06.2019
Project Name: Milton Keynes East
Road Name: M1
Site Number: 01b

Prepared by: Emma Douglas
Checked by: Luke Martin

Site Sample and Match Rates

	Overall Sample Rates			Inbound Sample Rates			Outbound Sample Rates			Inbound Match Rates		
Time Period	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Match Rate
07:00	1809	1675	93%	1013	949	94%	796	726	91%	1013	912	90%
07:15	2036	1934	95%	1154	1128	98%	882	806	91%	1154	1084	94%
07:30	1880	1809	96%	1140	1138	100%	740	671	91%	1140	1077	94%
07:45	1595	1524	96%	845	845	100%	750	679	91%	845	806	95%
08:00	1831	1718	94%	877	872	99%	954	846	89%	877	817	93%
08:15	1991	1818	91%	1064	963	91%	927	855	92%	1064	909	85%
08:30	1839	1581	86%	1045	887	85%	794	694	87%	1045	846	81%
08:45	1491	1396	94%	732	713	97%	759	683	90%	732	681	93%
09:00	1394	1326	95%	700	698	100%	694	628	90%	700	660	94%
09:15	1592	1360	85%	904	744	82%	688	616	90%	904	696	77%
09:30	1439	1275	89%	951	860	90%	488	415	85%	951	811	85%
09:45	1431	1359	95%	883	875	99%	548	484	88%	883	807	91%
10:00	1464	1349	92%	703	697	99%	761	652	86%	703	654	93%
10:15	1493	1342	90%	662	658	99%	831	684	82%	662	615	93%
10:30	1557	1413	91%	705	695	99%	852	718	84%	705	651	92%
10:45	1498	1381	92%	675	670	99%	823	711	86%	675	614	91%
11:00	1548	1436	93%	733	726	99%	815	710	87%	733	668	91%
11:15	1590	1430	90%	717	672	94%	873	758	87%	717	627	87%
11:30	1504	1365	91%	670	613	91%	834	752	90%	670	559	83%
11:45	1632	1489	91%	714	661	93%	918	828	90%	714	609	85%
12:00	1520	1391	92%	660	631	96%	860	760	88%	660	588	89%
12:15	1521	1403	92%	647	631	98%	874	772	88%	647	586	91%
12:30	1504	1385	92%	622	610	98%	882	775	88%	622	564	91%
12:45	1548	1439	93%	695	693	100%	853	746	87%	695	651	94%
13:00	1226	1137	93%	602	577	96%	624	560	90%	602	528	88%
13:15	1580	1447	92%	671	632	94%	909	815	90%	671	601	90%
13:30	1378	1333	97%	727	727	100%	651	606	93%	727	679	93%
13:45	1478	1308	88%	726	642	88%	752	666	89%	726	584	80%
14:00	1763	1617	92%	600	590	98%	1163	1027	88%	600	545	91%
14:15	1693	1575	93%	616	607	99%	1077	968	90%	616	562	91%
14:30	1679	1589	95%	605	603	100%	1074	986	92%	605	566	94%
14:45	2234	1922	86%	1210	981	81%	1024	941	92%	1210	922	76%
15:00	2068	1827	88%	1003	827	82%	1065	1000	94%	1003	781	78%
15:15	2014	1613	80%	959	789	82%	1055	824	78%	959	729	76%
15:30	1894	1674	88%	803	671	84%	1091	1003	92%	803	628	78%
15:45	1808	1732	96%	760	756	99%	1048	976	93%	760	707	93%
16:00	1917	1837	96%	805	803	100%	1112	1034	93%	805	770	96%
16:15	2033	1968	97%	885	883	100%	1148	1085	95%	885	837	95%
16:30	1913	1856	97%	802	801	100%	1111	1055	95%	802	764	95%
16:45	2094	1948	93%	1003	890	89%	1091	1058	97%	1003	846	84%
17:00	1973	1755	89%	944	848	90%	1029	907	88%	944	814	86%
17:15	1859	1815	98%	800	792	99%	1059	1023	97%	800	753	94%
17:30	1847	1736	94%	867	780	90%	980	956	98%	867	739	85%
17:45	1939	1724	89%	957	801	84%	982	923	94%	957	674	70%
18:00	1713	1613	94%	839	785	94%	874	828	95%	839	741	88%
18:15	1625	1550	95%	795	763	96%	830	787	95%	795	732	92%
18:30	1722	1466	85%	760	756	99%	962	710	74%	760	724	95%
18:45	1533	1442	94%	770	767	100%	763	675	88%	770	730	95%
Total	81690	75082	92%	39020	36700	94%	42670	38382	90%	39020	34448	88%





Intelligent Data Collection Limited

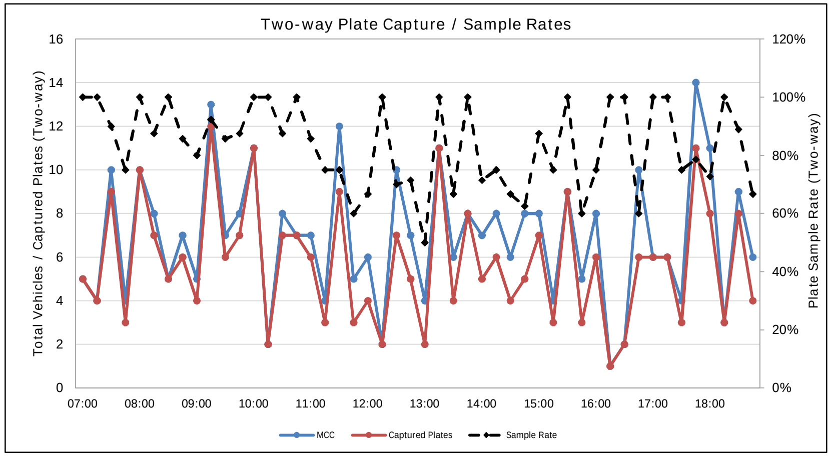
intelligentdata

Client: WSP
Project Number: ID04688
Date of Survey: 27.06.2019
Project Name: Milton Keynes East
Road Name: Park and Ride Access
Site Number: 01d

Prepared by: Emma Douglas
Checked by: Luke Martin

Site Sample and Match Rates

	Overall Sample Rates			Inbound Sample Rates			Outbound Sample Rates		
Time Period	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate
07:00	5	5	100%			0%	5	5	100%
07:15	4	4	100%			0%	4	4	100%
07:30	10	9	90%			0%	10	9	90%
07:45	4	3	75%			0%	4	3	75%
08:00	10	10	100%			0%	10	10	100%
08:15	8	7	88%			0%	8	7	88%
08:30	5	5	100%			0%	5	5	100%
08:45	7	6	86%			0%	7	6	86%
09:00	5	4	80%			0%	5	4	80%
09:15	13	12	92%			0%	13	12	92%
09:30	7	6	86%			0%	7	6	86%
09:45	8	7	88%			0%	8	7	88%
10:00	11	11	100%			0%	11	11	100%
10:15	2	2	100%			0%	2	2	100%
10:30	8	7	88%			0%	8	7	88%
10:45	7	7	100%			0%	7	7	100%
11:00	7	6	86%			0%	7	6	86%
11:15	4	3	75%			0%	4	3	75%
11:30	12	9	75%			0%	12	9	75%
11:45	5	3	60%			0%	5	3	60%
12:00	6	4	67%			0%	6	4	67%
12:15	2	2	100%			0%	2	2	100%
12:30	10	7	70%			0%	10	7	70%
12:45	7	5	71%			0%	7	5	71%
13:00	4	2	50%			0%	4	2	50%
13:15	11	11	100%			0%	11	11	100%
13:30	6	4	67%			0%	6	4	67%
13:45	8	8	100%			0%	8	8	100%
14:00	7	5	71%			0%	7	5	71%
14:15	8	6	75%			0%	8	6	75%
14:30	6	4	67%			0%	6	4	67%
14:45	8	5	63%			0%	8	5	63%
15:00	8	7	88%			0%	8	7	88%
15:15	4	3	75%			0%	4	3	75%
15:30	9	9	100%			0%	9	9	100%
15:45	5	3	60%			0%	5	3	60%
16:00	8	6	75%			0%	8	6	75%
16:15	1	1	100%			0%	1	1	100%
16:30	2	2	100%			0%	2	2	100%
16:45	10	6	60%			0%	10	6	60%
17:00	6	6	100%			0%	6	6	100%
17:15	6	6	100%			0%	6	6	100%
17:30	4	3	75%			0%	4	3	75%
17:45	14	11	79%			0%	14	11	79%
18:00	11	8	73%			0%	11	8	73%
18:15	3	3	100%			0%	3	3	100%
18:30	9	8	89%			0%	9	8	89%
18:45	6	4	67%			0%	6	4	67%
Total	331	275	83%	0	0	0%	331	275	83%



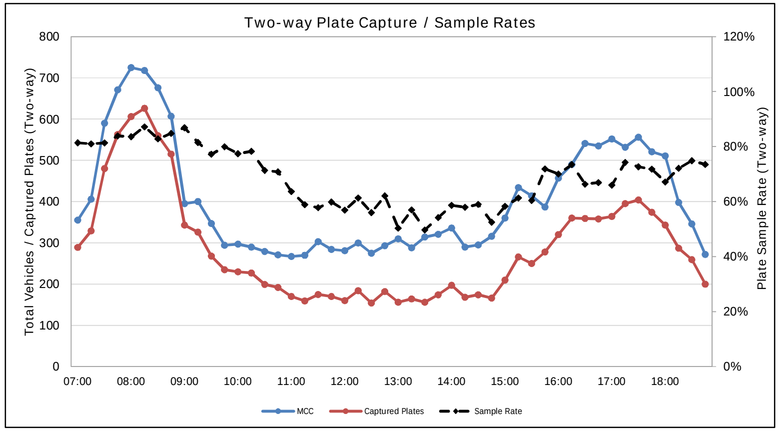
Intelligent Data Collection Limited

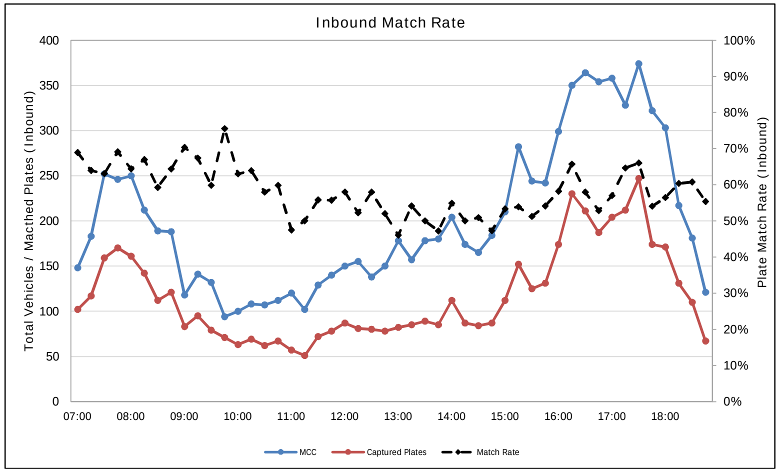
Client: WSP
Project Number: ID04688
Date of Survey: 27.06.2019
Project Name: Milton Keynes East
Road Name: A509 Portway
Site Number: 02a

Prepared by: Emma Douglas
Checked by: Luke Martin

Site Sample and Match Rates

	Overall Sample Rates			Inbound Sample Rates			Outbound Sample Rates			Inbound Match Rates		
Time Period	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Match Rate
07:00	355	289	81%	148	105	71%	207	184	89%	148	102	69%
07:15	406	329	81%	183	120	66%	223	209	94%	183	117	64%
07:30	590	480	81%	252	164	65%	338	316	93%	252	159	63%
07:45	671	563	84%	246	175	71%	425	388	91%	246	170	69%
08:00	725	606	84%	250	169	68%	475	437	92%	250	161	64%
08:15	718	626	87%	212	144	68%	506	482	95%	212	142	67%
08:30	676	560	83%	189	118	62%	487	442	91%	189	112	59%
08:45	607	515	85%	188	125	66%	419	390	93%	188	121	64%
09:00	395	343	87%	118	85	72%	277	258	93%	118	83	70%
09:15	400	326	82%	141	100	71%	259	226	87%	141	95	67%
09:30	347	268	77%	132	83	63%	215	185	86%	132	79	60%
09:45	294	235	80%	94	74	79%	200	161	81%	94	71	76%
10:00	297	230	77%	100	71	71%	197	159	81%	100	63	63%
10:15	290	227	78%	108	73	68%	182	154	85%	108	69	64%
10:30	279	199	71%	107	65	61%	172	134	78%	107	62	58%
10:45	271	192	71%	112	72	64%	159	120	75%	112	67	60%
11:00	267	170	64%	120	62	52%	147	108	73%	120	57	48%
11:15	270	159	59%	102	55	54%	168	104	62%	102	51	50%
11:30	303	175	58%	129	78	60%	174	97	56%	129	72	56%
11:45	284	170	60%	140	90	64%	144	80	56%	140	78	56%
12:00	281	160	57%	150	95	63%	131	65	50%	150	87	58%
12:15	300	184	61%	155	96	62%	145	88	61%	155	81	52%
12:30	275	154	56%	138	87	63%	137	67	49%	138	80	58%
12:45	293	182	62%	150	84	56%	143	98	69%	150	78	52%
13:00	310	156	50%	178	87	49%	132	69	52%	178	82	46%
13:15	288	164	57%	157	90	57%	131	74	56%	157	85	54%
13:30	314	156	50%	178	95	53%	136	61	45%	178	89	50%
13:45	321	174	54%	180	95	53%	141	79	56%	180	85	47%
14:00	336	197	59%	204	114	56%	132	83	63%	204	112	55%
14:15	290	168	58%	174	99	57%	116	69	59%	174	87	50%
14:30	295	174	59%	165	93	56%	130	81	62%	165	84	51%
14:45	316	166	53%	184	95	52%	132	71	54%	184	87	47%
15:00	360	210	58%	210	117	56%	150	93	62%	210	112	53%
15:15	434	266	61%	282	162	57%	152	104	68%	282	152	54%
15:30	414	250	60%	244	130	53%	170	120	71%	244	125	51%
15:45	387	278	72%	242	148	61%	145	130	90%	242	131	54%
16:00	457	320	70%	299	186	62%	158	134	85%	299	174	58%
16:15	490	360	73%	350	236	67%	140	124	89%	350	230	66%
16:30	541	359	66%	364	215	59%	177	144	81%	364	211	58%
16:45	535	358	67%	354	196	55%	181	162	90%	354	187	53%
17:00	552	364	66%	358	211	59%	194	153	79%	358	204	57%
17:15	532	395	74%	328	222	68%	204	173	85%	328	212	65%
17:30	556	404	73%	374	260	70%	182	144	79%	374	247	66%
17:45	521	374	72%	322	202	63%	199	172	86%	322	174	54%
18:00	511	343	67%	303	179	59%	208	164	79%	303	171	56%
18:15	398	287	72%	217	139	64%	181	148	82%	217	131	60%
18:30	346	259	75%	181	118	65%	165	141	85%	181	110	61%
18:45	272	200	74%	121	71	59%	151	129	85%	121	67	55%
Total	19370	13724	71%	9633	5950	62%	9737	7774	80%	9633	5606	58%





Intelligent Data Collection Limited

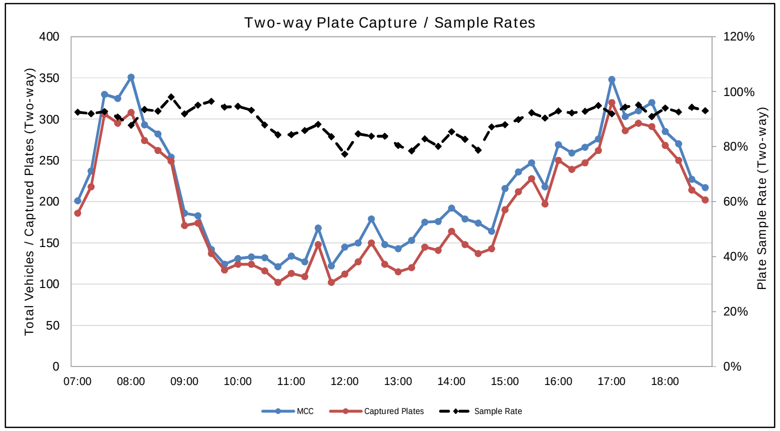
intelligentdata

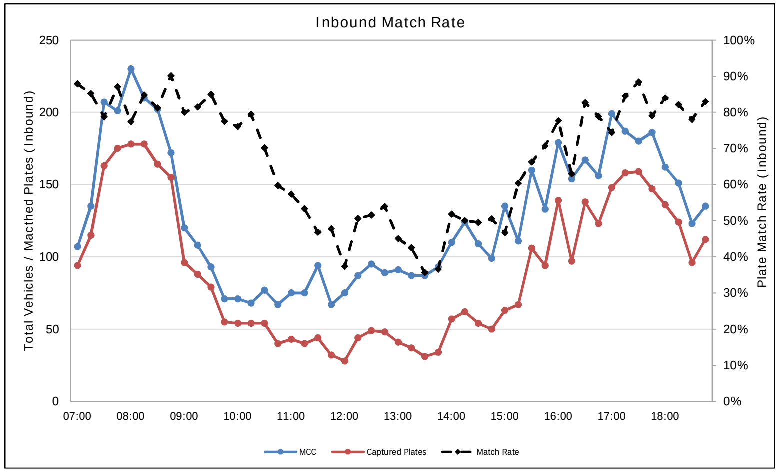
Client: WSP
Project Number: ID04688
Date of Survey: 27.06.2019
Project Name: Milton Keynes East
Road Name: A5130
Site Number: 02b

Prepared by: Emma Douglas
Checked by: Luke Martin

Site Sample and Match Rates

	Overall Sample Rates			Inbound Sample Rates			Outbound Sample Rates			Inbound Match Rates		
Time Period	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Match Rate
07:00	201	186	93%	107	101	94%	94	85	90%	107	94	88%
07:15	237	218	92%	135	123	91%	102	95	93%	135	115	85%
07:30	330	306	93%	207	184	89%	123	122	99%	207	163	79%
07:45	325	295	91%	201	180	90%	124	115	93%	201	175	87%
08:00	351	308	88%	230	188	82%	121	120	99%	230	178	77%
08:15	293	274	94%	210	195	93%	83	79	95%	210	178	85%
08:30	282	262	93%	202	189	94%	80	73	91%	202	164	81%
08:45	254	249	98%	172	172	100%	82	77	94%	172	155	90%
09:00	186	171	92%	120	108	90%	66	63	95%	120	96	80%
09:15	183	174	95%	108	103	95%	75	71	95%	108	88	81%
09:30	142	137	96%	93	89	96%	49	48	98%	93	79	85%
09:45	124	117	94%	71	65	92%	53	52	98%	71	55	77%
10:00	131	124	95%	71	66	93%	60	58	97%	71	54	76%
10:15	133	124	93%	68	63	93%	65	61	94%	68	54	79%
10:30	132	116	88%	77	62	81%	55	54	98%	77	54	70%
10:45	121	102	84%	67	51	76%	54	51	94%	67	40	60%
11:00	134	113	84%	75	55	73%	59	58	98%	75	43	57%
11:15	127	109	86%	75	57	76%	52	52	100%	75	40	53%
11:30	168	148	88%	94	75	80%	74	73	99%	94	44	47%
11:45	122	102	84%	67	52	78%	55	50	91%	67	32	48%
12:00	145	112	77%	75	46	61%	70	66	94%	75	28	37%
12:15	150	127	85%	87	66	76%	63	61	97%	87	44	51%
12:30	179	150	84%	95	75	79%	84	75	89%	95	49	52%
12:45	148	124	84%	89	68	76%	59	56	95%	89	48	54%
13:00	143	115	80%	91	66	73%	52	49	94%	91	41	45%
13:15	153	120	78%	87	62	71%	66	58	88%	87	37	43%
13:30	175	145	83%	87	61	70%	88	84	95%	87	31	36%
13:45	176	141	80%	93	63	68%	83	78	94%	93	34	37%
14:00	192	164	85%	110	85	77%	82	79	96%	110	57	52%
14:15	179	148	83%	124	98	79%	55	50	91%	124	62	50%
14:30	174	137	79%	109	79	72%	65	58	89%	109	54	50%
14:45	164	143	87%	99	81	82%	65	62	95%	99	50	51%
15:00	216	190	88%	135	109	81%	81	81	100%	135	63	47%
15:15	236	212	90%	111	96	86%	125	116	93%	111	67	60%
15:30	247	228	92%	160	143	89%	87	85	98%	160	106	66%
15:45	218	197	90%	133	113	85%	85	84	99%	133	94	71%
16:00	269	250	93%	179	165	92%	90	85	94%	179	139	78%
16:15	259	239	92%	154	137	89%	105	102	97%	154	97	63%
16:30	266	247	93%	167	153	92%	99	94	95%	167	138	83%
16:45	276	262	95%	156	146	94%	120	116	97%	156	123	79%
17:00	348	320	92%	199	177	89%	149	143	96%	199	148	74%
17:15	303	286	94%	187	177	95%	116	109	94%	187	158	84%
17:30	310	295	95%	180	172	96%	130	123	95%	180	159	88%
17:45	320	291	91%	186	162	87%	134	129	96%	186	147	79%
18:00	285	268	94%	162	155	96%	123	113	92%	162	136	84%
18:15	270	250	93%	151	142	94%	119	108	91%	151	124	82%
18:30	227	214	94%	123	116	94%	104	98	94%	123	96	78%
18:45	217	202	93%	135	125	93%	82	77	94%	135	112	83%
Total	10221	9212	90%	6114	5316	87%	4107	3896	95%	6114	4343	71%





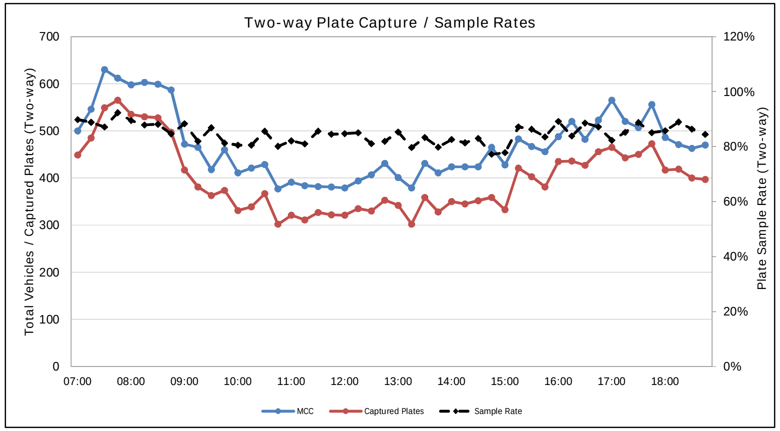
Intelligent Data Collection Limited

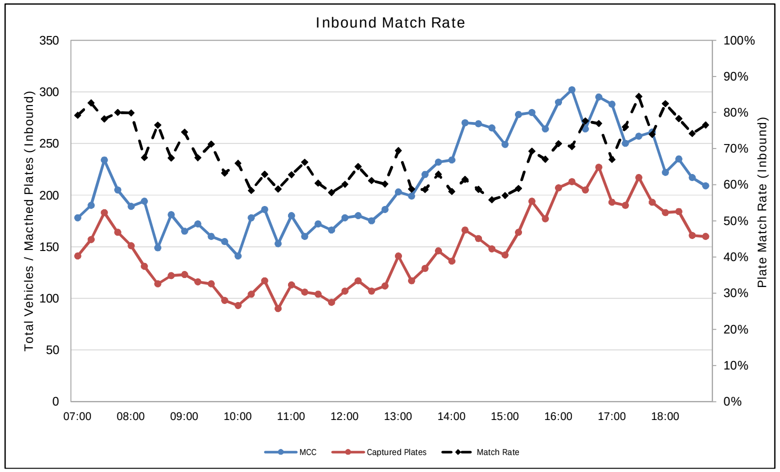
Client: WSP
Project Number: ID04688
Date of Survey: 27.06.2019
Project Name: Milton Keynes East
Road Name: A4146 Childs way
Site Number: 02c

Prepared by: Emma Douglas
Checked by: Luke Martin

Site Sample and Match Rates

	Overall Sample Rates			Inbound Sample Rates			Outbound Sample Rates			Inbound Match Rates		
Time Period	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Match Rate
07:00	500	449	90%	178	148	83%	322	301	93%	178	141	79%
07:15	546	485	89%	190	169	89%	356	316	89%	190	157	83%
07:30	630	549	87%	234	196	84%	396	353	89%	234	183	78%
07:45	612	565	92%	205	177	86%	407	388	95%	205	164	80%
08:00	598	535	89%	189	159	84%	409	376	92%	189	151	80%
08:15	603	530	88%	194	146	75%	409	384	94%	194	131	68%
08:30	599	528	88%	149	125	84%	450	403	90%	149	114	77%
08:45	587	497	85%	181	136	75%	406	361	89%	181	122	67%
09:00	472	417	88%	165	133	81%	307	284	93%	165	123	75%
09:15	465	381	82%	172	133	77%	293	248	85%	172	116	67%
09:30	418	363	87%	160	130	81%	258	233	90%	160	114	71%
09:45	460	374	81%	155	117	75%	305	257	84%	155	98	63%
10:00	411	331	81%	141	111	79%	270	220	81%	141	93	66%
10:15	421	339	81%	178	134	75%	243	205	84%	178	104	58%
10:30	429	367	86%	186	148	80%	243	219	90%	186	117	63%
10:45	377	302	80%	153	115	75%	224	187	83%	153	90	59%
11:00	391	321	82%	180	139	77%	211	182	86%	180	113	63%
11:15	384	311	81%	160	123	77%	224	188	84%	160	106	66%
11:30	382	327	86%	172	137	80%	210	190	90%	172	104	60%
11:45	381	322	85%	166	123	74%	215	199	93%	166	96	58%
12:00	379	321	85%	178	149	84%	201	172	86%	178	107	60%
12:15	394	335	85%	180	146	81%	214	189	88%	180	117	65%
12:30	407	330	81%	175	130	74%	232	200	86%	175	107	61%
12:45	431	353	82%	186	142	76%	245	211	86%	186	112	60%
13:00	401	342	85%	203	177	87%	198	165	83%	203	141	69%
13:15	379	302	80%	199	145	73%	180	157	87%	199	117	59%
13:30	431	359	83%	220	176	80%	211	183	87%	220	129	59%
13:45	411	328	80%	232	181	78%	179	147	82%	232	146	63%
14:00	424	350	83%	234	182	78%	190	168	88%	234	136	58%
14:15	424	345	81%	270	219	81%	154	126	82%	270	166	61%
14:30	424	352	83%	269	212	79%	155	140	90%	269	158	59%
14:45	465	359	77%	265	188	71%	200	171	86%	265	148	56%
15:00	428	333	78%	249	180	72%	179	153	85%	249	142	57%
15:15	483	421	87%	278	226	81%	205	195	95%	278	164	59%
15:30	467	403	86%	280	227	81%	187	176	94%	280	194	69%
15:45	456	381	84%	264	216	82%	192	165	86%	264	177	67%
16:00	488	435	89%	290	238	82%	198	197	99%	290	207	71%
16:15	520	436	84%	302	236	78%	218	200	92%	302	213	71%
16:30	482	427	89%	264	228	86%	218	199	91%	264	205	78%
16:45	523	456	87%	295	244	83%	228	212	93%	295	227	77%
17:00	565	465	82%	288	220	76%	277	245	88%	288	193	67%
17:15	520	443	85%	250	200	80%	270	243	90%	250	190	76%
17:30	507	450	89%	257	231	90%	250	219	88%	257	217	84%
17:45	556	473	85%	261	204	78%	295	269	91%	261	193	74%
18:00	486	417	86%	222	193	87%	264	224	85%	222	183	82%
18:15	471	419	89%	235	198	84%	236	221	94%	235	184	78%
18:30	463	400	86%	217	169	78%	246	231	94%	217	161	74%
18:45	470	397	84%	209	172	82%	261	225	86%	209	160	77%
Total	22521	19125	85%	10280	8228	80%	12241	10897	89%	10280	7031	68%





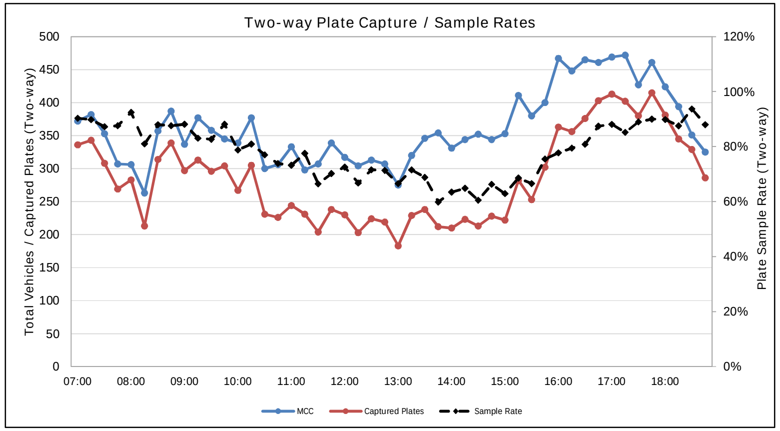
Intelligent Data Collection Limited

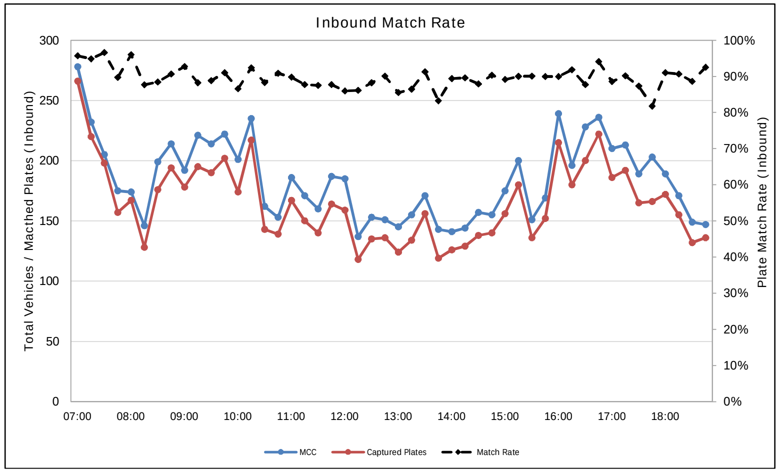
Client: WSP
Project Number: ID04688
Date of Survey: 27.06.2019
Project Name: Milton Keynes East
Road Name: A509 London Road
Site Number: 03a

Prepared by: Emma Douglas
Checked by: Luke Martin

Site Sample and Match Rates

	Overall Sample Rates			Inbound Sample Rates			Outbound Sample Rates			Inbound Match Rates		
Time Period	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Match Rate
07:00	372	336	90%	278	275	99%	94	61	65%	278	266	96%
07:15	382	343	90%	232	231	100%	150	112	75%	232	220	95%
07:30	353	308	87%	205	202	99%	148	106	72%	205	198	97%
07:45	307	269	88%	175	168	96%	132	101	77%	175	157	90%
08:00	306	283	92%	174	173	99%	132	110	83%	174	167	96%
08:15	263	213	81%	146	140	96%	117	73	62%	146	128	88%
08:30	357	314	88%	199	198	99%	158	116	73%	199	176	88%
08:45	387	339	88%	214	206	96%	173	133	77%	214	194	91%
09:00	337	297	88%	192	192	100%	145	105	72%	192	178	93%
09:15	377	313	83%	221	212	96%	156	101	65%	221	195	88%
09:30	358	296	83%	214	207	97%	144	89	62%	214	190	89%
09:45	345	304	88%	222	222	100%	123	82	67%	222	202	91%
10:00	339	267	79%	201	190	95%	138	77	56%	201	174	87%
10:15	377	305	81%	235	233	99%	142	72	51%	235	217	92%
10:30	300	231	77%	162	155	96%	138	76	55%	162	143	88%
10:45	306	226	74%	153	148	97%	153	78	51%	153	139	91%
11:00	333	244	73%	186	181	97%	147	63	43%	186	167	90%
11:15	298	231	78%	171	165	96%	127	66	52%	171	150	88%
11:30	307	204	66%	160	147	92%	147	57	39%	160	140	88%
11:45	339	238	70%	187	178	95%	152	60	39%	187	164	88%
12:00	317	230	73%	185	176	95%	132	54	41%	185	159	86%
12:15	304	203	67%	137	130	95%	167	73	44%	137	118	86%
12:30	313	224	72%	153	145	95%	160	79	49%	153	135	88%
12:45	307	219	71%	151	146	97%	156	73	47%	151	136	90%
13:00	275	183	67%	145	139	96%	130	44	34%	145	124	86%
13:15	320	229	72%	155	150	97%	165	79	48%	155	134	86%
13:30	346	238	69%	171	170	99%	175	68	39%	171	156	91%
13:45	354	212	60%	143	132	92%	211	80	38%	143	119	83%
14:00	331	210	63%	141	134	95%	190	76	40%	141	126	89%
14:15	344	223	65%	144	136	94%	200	87	44%	144	129	90%
14:30	352	213	61%	157	150	96%	195	63	32%	157	138	88%
14:45	344	228	66%	155	148	95%	189	80	42%	155	140	90%
15:00	353	222	63%	175	167	95%	178	55	31%	175	156	89%
15:15	411	282	69%	200	188	94%	211	94	45%	200	180	90%
15:30	380	253	67%	151	146	97%	229	107	47%	151	136	90%
15:45	400	302	76%	169	165	98%	231	137	59%	169	152	90%
16:00	467	363	78%	239	227	95%	228	136	60%	239	215	90%
16:15	448	356	79%	196	192	98%	252	164	65%	196	180	92%
16:30	465	376	81%	228	214	94%	237	162	68%	228	200	88%
16:45	461	403	87%	236	236	100%	225	167	74%	236	222	94%
17:00	469	413	88%	210	203	97%	259	210	81%	210	186	89%
17:15	472	402	85%	213	201	94%	259	201	78%	213	192	90%
17:30	427	380	89%	189	182	96%	238	198	83%	189	165	87%
17:45	461	415	90%	203	190	94%	258	225	87%	203	166	82%
18:00	424	381	90%	189	181	96%	235	200	85%	189	172	91%
18:15	394	345	88%	171	163	95%	223	182	82%	171	155	91%
18:30	351	329	94%	149	140	94%	202	189	94%	149	132	89%
18:45	325	286	88%	147	145	99%	178	141	79%	147	136	93%
Total	17358	13681	79%	8829	8519	96%	8529	5162	61%	8829	7924	90%





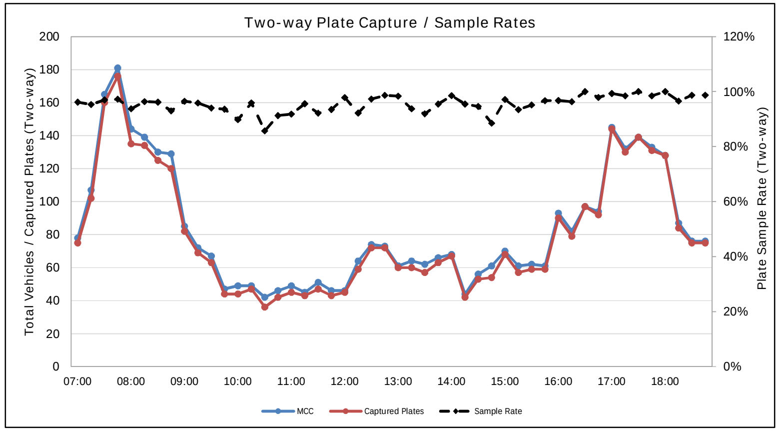
Intelligent Data Collection Limited

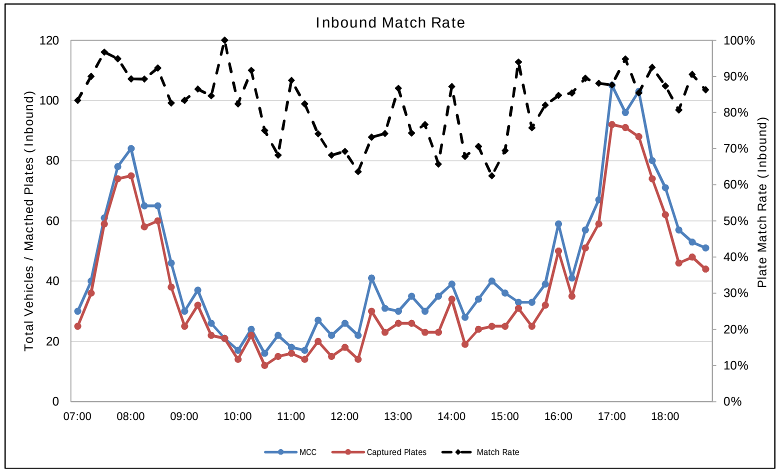
Client: WSP
Project Number: ID04688
Date of Survey: 27.06.2019
Project Name: Milton Keynes East
Road Name: Newport Road
Site Number: 03b

Prepared by: Emma Douglas
Checked by: Luke Martin

Site Sample and Match Rates

	Overall Sample Rates			Inbound Sample Rates			Outbound Sample Rates			Inbound Match Rates		
Time Period	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Match Rate
07:00	78	75	96%	30	30	100%	48	45	94%	30	25	83%
07:15	107	102	95%	40	39	98%	67	63	94%	40	36	90%
07:30	165	160	97%	61	60	98%	104	100	96%	61	59	97%
07:45	181	176	97%	78	77	99%	103	99	96%	78	74	95%
08:00	144	135	94%	84	78	93%	60	57	95%	84	75	89%
08:15	139	134	96%	65	65	100%	74	69	93%	65	58	89%
08:30	130	125	96%	65	63	97%	65	62	95%	65	60	92%
08:45	129	120	93%	46	44	96%	83	76	92%	46	38	83%
09:00	85	82	96%	30	30	100%	55	52	95%	30	25	83%
09:15	72	69	96%	37	37	100%	35	32	91%	37	32	86%
09:30	67	63	94%	26	26	100%	41	37	90%	26	22	85%
09:45	47	44	94%	21	21	100%	26	23	88%	21	21	100%
10:00	49	44	90%	17	17	100%	32	27	84%	17	14	82%
10:15	49	47	96%	24	24	100%	25	23	92%	24	22	92%
10:30	42	36	86%	16	15	94%	26	21	81%	16	12	75%
10:45	46	42	91%	22	21	95%	24	21	88%	22	15	68%
11:00	49	45	92%	18	18	100%	31	27	87%	18	16	89%
11:15	45	43	96%	17	17	100%	28	26	93%	17	14	82%
11:30	51	47	92%	27	26	96%	24	21	88%	27	20	74%
11:45	46	43	93%	22	21	95%	24	22	92%	22	15	68%
12:00	46	45	98%	26	25	96%	20	20	100%	26	18	69%
12:15	64	59	92%	22	19	86%	42	40	95%	22	14	64%
12:30	74	72	97%	41	41	100%	33	31	94%	41	30	73%
12:45	73	72	99%	31	30	97%	42	42	100%	31	23	74%
13:00	61	60	98%	30	30	100%	31	30	97%	30	26	87%
13:15	64	60	94%	35	33	94%	29	27	93%	35	26	74%
13:30	62	57	92%	30	29	97%	32	28	88%	30	23	77%
13:45	66	63	95%	35	35	100%	31	28	90%	35	23	66%
14:00	68	67	99%	39	39	100%	29	28	97%	39	34	87%
14:15	44	42	95%	28	28	100%	16	14	88%	28	19	68%
14:30	56	53	95%	34	32	94%	22	21	95%	34	24	71%
14:45	61	54	89%	40	38	95%	21	16	76%	40	25	63%
15:00	70	68	97%	36	35	97%	34	33	97%	36	25	69%
15:15	61	57	93%	33	33	100%	28	24	86%	33	31	94%
15:30	62	59	95%	33	33	100%	29	26	90%	33	25	76%
15:45	61	59	97%	39	38	97%	22	21	95%	39	32	82%
16:00	93	90	97%	59	57	97%	34	33	97%	59	50	85%
16:15	82	79	96%	41	40	98%	41	39	95%	41	35	85%
16:30	97	97	100%	57	57	100%	40	40	100%	57	51	89%
16:45	94	92	98%	67	67	100%	27	25	93%	67	59	88%
17:00	145	144	99%	105	104	99%	40	40	100%	105	92	88%
17:15	132	130	98%	96	94	98%	36	36	100%	96	91	95%
17:30	139	139	100%	103	103	100%	36	36	100%	103	88	85%
17:45	133	131	98%	80	80	100%	53	51	96%	80	74	93%
18:00	128	128	100%	71	71	100%	57	57	100%	71	62	87%
18:15	87	84	97%	57	55	96%	30	29	97%	57	46	81%
18:30	76	75	99%	53	52	98%	23	23	100%	53	48	91%
18:45	76	75	99%	51	51	100%	25	24	96%	51	44	86%
Total	3996	3843	96%	2118	2078	98%	1878	1765	94%	2118	1791	85%





Appendix D

2019-2016 TRAFFIC FLOW COMPARISON

Public

TECHNICAL NOTE – Review of Growth between 2016 and 2019 – Traffic Data (version 2)

DATE:	04 February 2020	**CONFIDENTIALITY:**	Public
SUBJECT:	Milton Keynes East – Review of 2016 and 2019 Traffic Data		
PROJECT:	Milton Keynes East	**AUTHOR:**	R O'Boyle / Filip Imramovsky
CHECKED:	A Smith / Filip Imramovsky	**APPROVED:**	A Norcutt

1 INTRODUCTION

1.1.1. WSP have been commissioned by Berkley St James to provide transportation and highways advice in respect of the proposed development of part of the land to the northeast of Milton Keynes ('Milton Keynes East' or MKE).

1.1.2. To assess the impact of MKE and the associated infrastructure sought to be delivered as part of the recent Housing Infrastructure Funding (HIF) bid, the Milton Keynes Multi-Modal Model (MKMMM) was used. The MKMMM is held by MKC and managed by AECOM (Milton Keynes Council's consultants) on MKC's behalf.

1.1.3. As part of the modelling required to support the planning application now, updates to the MKMMM have been set out to assess the impact of the development on the surrounding highway network in greater detail than has been undertaken to date.

1.1.4. Discussions over the proposed modelling approached have been held with MKC and Highways England and an area of focus, surrounding the site has been agreed for an upgrade.

1.1.5. As part of the data required for the planning application and the analysis supporting the planning updates to the MKMMM, a suite of traffic surveys was undertaken on junctions and links around MKE.

1.1.6. The current MKMMM base year is 2016. There is a need to review the differences between 2016 and 2019 to allow the inclusion of the new data into the MKMMM model. This approach was set out in a separate Transport Technical Note: Modelling Approach for MKE Planning Application, which was updated following further discussions with MKC and HE in May 2019.

1.1.7. This note prepares a summary of the reviews undertaken and suggests an approach for factoring the 2019 data to be then included in the updated MKMMM for MKE.

2 DATA REVIEWED

2.1.1. Figure 2.1 below illustrates the available survey sites for 2016 and their 2019 counterparts.

2.1.2. MKC provided the 2016 ATC data that was used in the MKMMM base model analysis to enable a review. The 2016 data was captured in across multiple time periods, including June, September, October and November.

TECHNICAL NOTE – Review of Growth between 2016 and 2019 – Traffic Data (version 2)

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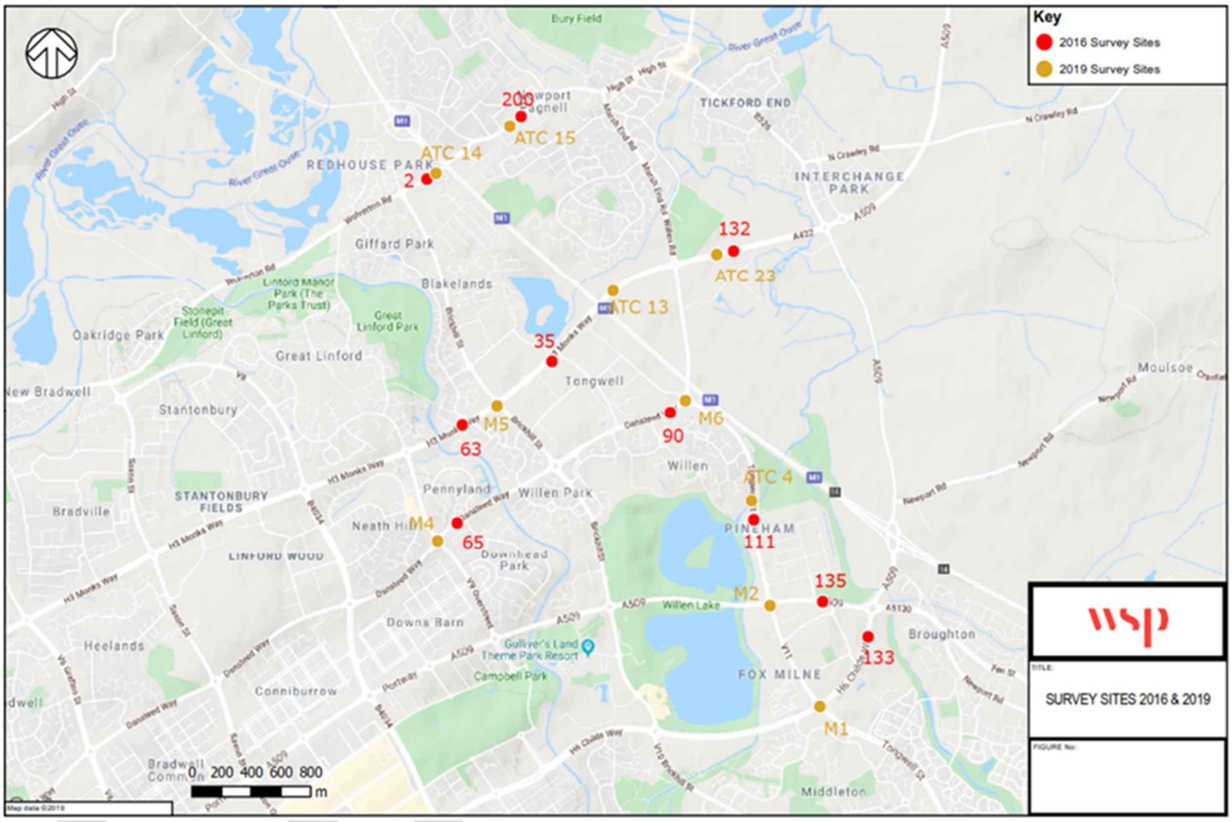
2.1.3. As part of the surveys commissioned for MKE, ATC, MCC and Two-Way Link Count data was recorded in June 2019[1]. This data was a subject to comparison to determine the change in traffic on selected links in Milton Keynes.

Figure 2.1 – 2016 and 2019 Survey Locations



2.1.4. The sites were matched, based on the links they provide flow data for. The following pairings were used for the analysis, as shown in Table 2.1:

Table 2.1 – 2016 and 2019 Site Pairings

Year	Survey Location / Number								
2016 Site:	2	35	63	65	90	111	132	135	133	200
2019 Site:	ATC 14	ATC 13	M5	M4	M6	MCC-2W 4*	MCC-2W 23*	M2	M1	ATC 15

*MCC two-way link count

[1] Please note, Pineham Roundabout (M2) was also resurveyed in October 2019 to re-capture the PM period.

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CHECKED:	A Smith / Filip Imramovsky	**APPROVED:**	A Norcutt

3 ANALYSIS

3.1.1. Please see **Annex A** containing the supporting spreadsheet with the analysis.

3.1.2. Once the appropriate survey pairings were identified, as illustrated in Figure 2.1 above, the flows at these sites were compared for both directions of travel, as well as combined two-way movements.

3.1.3. An average flow at each location was calculated using the data. These average flows formed a basis of a Mon-Thu average, a 5-day average (Weekday) or a 7-day average (Mon-Sun) calculations. The calculations were completed for both 2016 and 2019 datasets to allow for direct comparison and a factor illustrating the differences between the flows to be determined.

3.1.4. Recent discussions with MKC and their MKMMM consultants AECOM considered the appropriate methodology of including the 2019 counts into the revised MKMMM model. It was agreed that any new counts (i.e. 2019) could be factored down to the 2016 levels to present a consistent base year model.

3.1.5. As demonstrated in the spreadsheet provided in **Annex A**, data for some of the sites indicate that the 2019 flows are higher than that recorded in 2016 and the vice versa. It is considered that the 2019 flows are, on average, relatively similar to previously (i.e. 2016) recorded volumes.

3.1.6. Average two-way factors were computed using the two datasets. The factors were calculated by dividing the 2016 counts by the 2019 values, resulting in values that could be used to factor the 2019 flows (either down or up) to 2016 levels.

3.1.7. These factors across all sites and directions were then averaged to produce Peak Hour/Period and Inter Peak Period factors for Mon-Thu average a 5-day average and a 7-day Average. It is understood that the MKMMM uses hourly flows in the AM peak hour of 08:00-09:00, PM peak hour of 17:00-18:00 and average of 10:00-16:00 flows for the inter-peak (IP). The model also works only with the Mon-Thur data as the Friday flows tend to differ from the rest of the weekdays. However, the spreadsheet provides factors for other periods for completeness.

3.1.8. During the review of the traffic survey information, where it was identified that the data may contain errors (such as a direction missing, or a noticeable differing in traffic volumes potentially indicating a tube malfunction) this data was excluded from the analysis - the spreadsheet provided in **Annex A** highlights where this is the case. Averages by direction and two-way were calculated for each site pair individually as well as for all sites combined.

3.1.9. Table 3-1 below summarises the calculated average two-way factors enabling the 2019 flows to be recalculated to 2016 values. The factors are provided across the time periods required by MKMMM as outlined above. This is a blanket factor that can be applied to the 2019 data set. A value of above 1 would indicate that the 2019 flows are lower than 2016, whereas a value below 1 would indicate that 2019 flows are higher than 2016 flows.

Table 3-1 – Average two-way factors for AM, Inter and PM periods

Time Period	Hours	Mon – Thu Average
AM Peak hour	08:00 - 09:00	0.993
IP (average hour)	10:00 - 16:00*****	1.027
PM Peak Hour	17:00 - 18:00	0.954

******The 2019 MCC data is only available between 11:00 and 13:00 and such, the calculated factor is based only on sites with the full data available. Sites 63-M5, 65-M4, 90-M6, 133-M1 and 135-M2 were excluded from the IP calculation.*

3.1.10. As shown in Table 3-1 above, the results for the AM and PM peak hours indicate that 2019 flows were, on average, higher than 2016 and as such would require to be factored down to match the 2016 baseline. Conversely, the factor calculated for the IP exceeds 1, which suggests a decrease in the traffic volume in 2019 relative to 2016. However, it should be highlighted that five sites were removed from the analysis due to missing data.

3.1.11. Notwithstanding the above, the changes in the traffic volumes between 2016 and 2019 range from -2.7% in the IP to +0.7% in the AM and +4.6% in the PM peak hour.

4 REVIEW AGAINST PLANNED GROWTH IN THE AREA

4.1.1. A further high-level review of TEMPRO growth data was undertaken to ascertain whether the average reduction in traffic volumes (comparing 2019 to 2016 across all sites) outlined above is consistent with the forecast trip ends.

4.1.2. The results of the TEMPRO analysis were used as a comparison for the analysis. Data from the entire Milton Keynes region were extracted for 2016 to 2019, alongside MSOA Milton Keynes 002 (which represents where the site is located), MSOA Milton Keynes 007 and MSOA Milton Keynes 017 (which represents areas alongside Newport Road and Tongwell Street as a proxy for residential and employment areas). National Trip End Model (NTEM) adjustments were also applied, selecting 'urban' area types and 'all' road types.

4.1.3. Table 4-1 below summarises the factors generated by TEMPRO:

Table 4-1 – Review of TEMPRO / NTEM Growth factors for 2016 to 2019

Time Period	Milton Keynes	MSOA MK – 002	MSOA MK – 007	MSOA MK – 017
AM Period	1.0483	1.0471	1.0503	1.0360
INTER Period	1.0576	1.0587	1.0576	1.0442
PM Period	1.0478	1.0477	1.0484	1.0368

4.1.4. The TEMPRO analysis shows that the NTEM forecasts an increase of approximately 4-6% between 2016 and 2019. The growth in MSOA 017 is forecast to be lower compared to the other MSOAs or the general Milton Keynes area reviewed.

4.1.5. From the forecast growth outlined in Table 4-1 above is evident that the NTEM expects an increase in the traffic volume between 2016 and 2019 higher than that calculated based on the observed survey results discussed in Section 3 above.

4.1.6. Given that the factors provided in Section 3 above are based on the actual traffic surveys rather than a model, it is considered appropriate to apply the blanket factors as provided in Table 3-1 above instead the TEMPRO/NTEM adjustment to the 2019 data. Reducing 2019 flows by 4-6% (if adopting TEMPRO) to 2016 numbers would likely underestimate the volume of traffic currently on the network. The factors derived as part of this exercise are considered to be more robust.

5 SUMMARY

5.1.1. Factors were developed to enable the integration of the 2019 survey data in the MKMMMM to correspond with the 2016 base year flows.

5.1.2. The survey data analysis indicates that 2019 flows slightly vary from 2016 flows and that a reduction of 2.7% and 4.6% in the AM and PM peak hour respectively would be required. Conversely, the traffic in the interpeak period decreased in 2019 compared to 2016, and a modest increase of 0.7% would be required.

5.1.3. A review of planned forecast growth using TEMPRO (and NTEM) was undertaken to ascertain whether a higher factor should be adopted. The factors derived from TEMPRO suggest that more significant reductions, in order of 4-6%, would be required to get 2019 values to 2016 base year levels.

5.1.4. It is therefore suggested that a blanket factor, as shown in Table 3-1, is applied to the 2019 survey data (already provided to MKC and AECOM) and implemented in the MKMMM.

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ANNEX A – SPREADSHEET ANALYSIS

Milton Keynes East - 2016 to 2019 Survey comparison

DISCLAIMER

This spreadsheet model and any information contained within it has been prepared for the named Client and strictly for the purpose of the titled project and has been developed by WSP based on certain data sources and assumptions. No third parties shall have a right to rely on the model without the written permission of WSP .

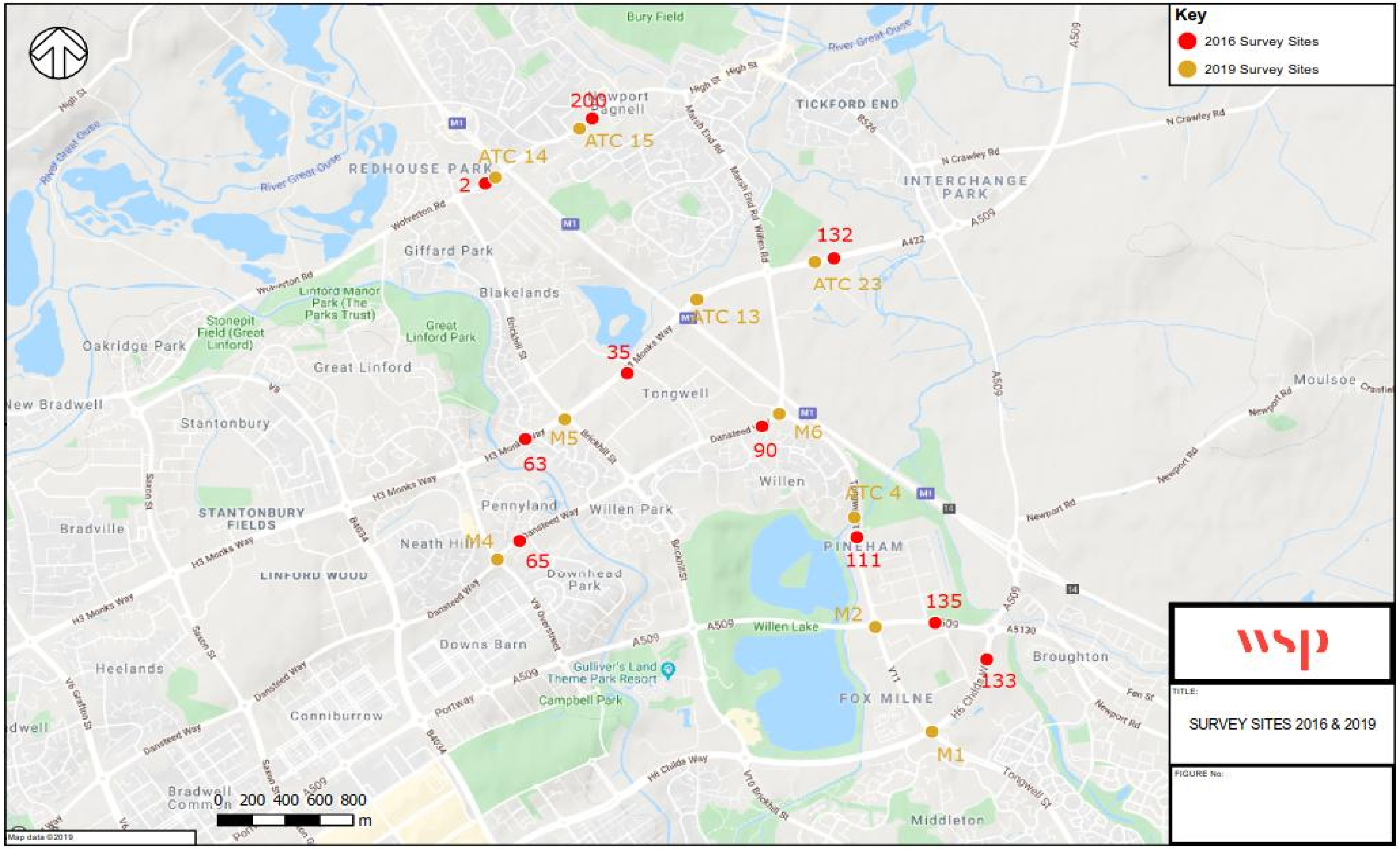
WSP accepts no liability [to any third party] whatsoever for any use of the model and gives no warranty express or implied as to the adequacy, accuracy, completeness, or reasonableness of the model or the information used or contained within it. The recipient of the model should make (and will be deemed to have made) its own review of the model. In no event will WSP be liable for any decision made or action taken as a result of any use or reliance of the model that is not expressly

Quality Management

	Version	Name	Date	Level of Checking	Comments	Linked Spreadsheets
Prepared by	1	*Rachel O'Boyle*	13-16/01/2020	*Created/Cross-check*		*Linked to survey data. Survey results provided separately*
Checked by		*Alex Smith*	17-21/01/2020	*Check of logic*		
Approved By		*Alex Smith*	22/01/2020	*Review of data*	*Please see supporting information and emails with additional data*	
Prepared by	2	*Rachel O'Boyle*	03/02/2020	*Formulas updated*		*Linked to survey data provided previously*
Checked by		*Filip Imramovsky*	03/02/2020	*Formulas checked*		
Approved By		*Filip Imramovsky*	03/02/2020	*General review*	*Please see supporting information and emails with additional data*	
Prepared by	3					
Checked by						
Approved By						

Notes:
Use of Factors to be agreed with MKC
2016 Survey data provided by MKC
Please note some 2019 MCCs are a single day and have been compared against the ATC average
The factor shows what would be required to get the 2019 counts to 2016 values.
- if a factor is below 1.00 then this indicates that 2019 counts are higher than the corresponding 2016 counts
- if a factor is above 1.00 then this indicates that 2019 counts are lower than the corresponding 2016 counts
An average whole area factor has been analysed for the AM, Inter and PM time periods
Note that the MCC's only surveyed between 11:00 - 13:00 and the factor has used that time period only.
Site 135 did not have any Westbound data for 2016

2016	2019
2	ATC14
35	ATC13
63	M5
65	M4
90	M6
111	MCC Link Count 4
132	ATC23
135	M2
133	M1
200	ATC15



EASTBOUND

Two-Way

2016 SITE 2

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	30	35	30	33	42	63	83	34	45	32
01:00	9	9	8	7	22	29	39	11	18	8
02:00	1	5	5	1	12	16	19	5	8	3
03:00	4	3	4	3	9	11	10	5	6	4
04:00	8	11	4	7	5	5	9	7	7	8
05:00	37	29	40	35	42	29	22	37	33	35
06:00	85	97	96	95	82	46	35	91	77	93
07:00	289	288	268	270	268	90	62	277	219	279
08:00	477	505	515	520	540	189	112	511	408	504
09:00	289	282	300	294	302	278	157	293	272	291
10:00	287	261	299	318	313	345	274	296	300	291
11:00	323	321	327	333	363	413	333	333	345	326
12:00	395	414	326	425	387	432	389	389	395	390
13:00	363	348	392	472	396	390	399	394	394	394
14:00	430	458	473	437	515	387	355	463	436	450
15:00	553	545	568	492	597	393	383	551	504	540
16:00	660	703	677	621	768	406	376	686	602	665
17:00	1023	1065	1031	872	867	397	332	972	798	998
18:00	591	643	622	688	577	359	290	624	539	636
19:00	378	390	412	401	438	274	243	404	362	395
20:00	310	246	236	274	286	198	187	270	248	267
21:00	238	187	190	207	187	162	121	202	185	206
22:00	136	147	140	139	152	147	104	143	138	141
23:00	69	67	51	73	92	97	46	70	71	65

2019 ATC 14

Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
24	28	25	21	20	52	74	24	35	25
14	9	17	15	15	26	38	14	19	14
5	11	7	12	9	25	24	9	13	9
5	11	15	8	7	16	12	9	11	10
11	10	8	14	14	18	16	11	13	11
35	38	42	36	32	26	23	37	33	38
103	82	99	73	82	55	34	88	75	89
221	272	260	252	241	92	72	249	201	251
396	436	465	454	463	229	97	443	363	438
324	278	338	279	314	330	156	307	288	305
327	304	320	322	319	427	282	318	329	318
336	320	377	329	372	463	333	347	361	341
384	392	358	382	456	482	431	394	412	379
385	361	418	375	461	421	405	400	404	385
459	488	482	531	531	397	371	498	466	490
559	559	548	535	647	378	386	570	516	550
749	847	759	829	884	364	321	814	679	796
915	1012	1046	932	800	348	340	941	770	976
600	576	663	608	573	300	271	604	513	612
391	431	419	404	396	260	231	408	362	411
257	280	291	305	293	202	164	285	256	283
182	163	231	232	183	144	117	198	179	202
117	158	156	147	165	167	90	149	143	145
51	67	86	71	117	97	58	78	78	69

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	-6	-7	-5	-12	-22	-11	-9	-10	-10	-8
01:00	5	0	9	8	-7	-3	-1	3	1	6
02:00	4	6	2	11	-3	9	5	4	5	6
03:00	1	8	11	5	-2	5	2	4	5	6
04:00	3	-1	4	7	9	13	7	4	6	3
05:00	-2	9	2	1	-10	-3	1	0	0	3
06:00	18	-15	3	-22	0	9	-1	-3	-2	-4
07:00	-68	-16	-8	-18	-27	2	10	-28	-18	-28
08:00	-81	-69	-50	-66	-77	40	-15	-68	-45	-67
09:00	35	-4	38	-15	12	52	-1	14	16	14
10:00	40	43	21	4	6	82	8	22	29	27
11:00	13	-1	50	-4	9	50	0	14	16	15
12:00	-11	-22	32	-43	69	50	42	5	17	-11
13:00	22	13	26	-97	65	31	6	6	10	-9
14:00	29	30	9	94	16	10	16	35	30	41
15:00	6	14	-20	43	50	-15	3	19	12	11
16:00	89	144	82	208	116	-42	-55	128	77	131
17:00	-108	-53	15	60	-67	-49	8	-31	-28	-22
18:00	9	-67	41	-80	-4	-59	-19	-20	-26	-24
19:00	13	41	7	3	-42	-14	-12	4	0	16
20:00	-53	34	55	31	7	4	-23	15	8	17
21:00	-56	-24	41	25	-4	-18	-4	-4	-6	-4
22:00	-19	11	16	8	13	20	-14	6	5	4
23:00	-18	0	35	-2	25	0	12	8	7	4

2016/2019

5-Day Av	7-Day Av	Mon-Thu
1.44	1.29	1.31
0.79	0.94	0.60
0.57	0.60	0.34
0.54	0.57	0.36
0.61	0.54	0.70
1.01	1.00	0.93
1.04	1.02	1.04
1.11	1.09	1.11
1.15	1.12	1.15
0.96	0.94	0.96
0.93	0.91	0.92
0.96	0.95	0.96
0.99	0.96	1.03
0.99	0.98	1.02
0.93	0.94	0.92
0.97	0.98	0.98
0.84	0.89	0.84
1.03	1.04	1.02
1.03	1.05	1.04
0.99	1.00	0.96
0.95	0.97	0.94
1.02	1.03	1.02
0.96	0.97	0.97
0.89	0.91	0.95

2016/2019 (Two-Way)

5-Day Av	7-Day Av	Mon-Thu
1.34	1.21	1.22
0.88	0.92	0.70
0.69	0.78	0.63
0.69	0.76	0.53
0.64	0.56	0.64
0.97	0.97	0.94
1.00	1.00	1.01
0.93	0.93	0.93
1.08	1.06	1.07
1.01	0.99	1.00
0.95	0.93	0.95
0.95	0.95	0.95
0.98	0.98	1.00
0.99	0.98	1.02
0.93	0.95	0.93
0.99	0.98	0.98
0.93	0.96	0.93
1.04	1.04	1.03
1.05	1.06	1.04
0.99	1.02	0.95
0.98	0.99	0.99
1.02	1.02	1.04
1.00	1.01	1.03
0.90	0.90	0.92

WESTBOUND

2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	23	19	19	18	30	45	70	22	32	20
01:00	8	12	5	9	15	19	50	10	17	9
02:00	11	7	5	10	9	22	22	8	12	8
03:00	4	9	10	9	13	17	22	9	12	8
04:00	16	13	13	20	20	7	5	16	13	16
05:00	75	75	75	66	77	44	27	74	63	73
06:00	201	218	227	223	197	71	47	213	169	217
07:00	741	774	757	726	676	153	94	735	560	750
08:00	1082	1096	1096	1071	935	288	150	1056	817	1086
09:00	551	501	543	524	564	413	271	537	481	530
10:00	346	341	365	361	380	437	392	359	375	353
11:00	301	336	311	389	375	429	372	342	359	334
12:00	349	325	345	387	365	431	402	354	372	352
13:00	362	354	363	419	397	412	335	379	377	375
14:00	372	368	342	316	379	398	326	355	357	350
15:00	532	568	514	460	584	358	330	532	478	519
16:00	443	452	471	502	506	381	310	475	438	467
17:00	489	482	497	441	497	328	313	481	435	477
18:00	413	437	440	448	463	325	255	440	397	435
19:00	302	350	345	326	399	273	248	344	320	331
20:00	285	205	212	204	234	186	197	228	218	227
21:00	200	140	140	143	157	131	117	156	147	156
22:00	102	115	112	103	125	121	97	111	111	108
23:00	51	47	47	52	94	102	45	58	63	49

2019

Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
22	16	21	13	19	49	62	18	29	18
13	9	13	6	8	37	45	10	19	10
9	9	11	8	13	14	23	10	12	9
11	9	16	12	8	20	15	11	13	12
26	22	33	19	23	22	13	25	23	25
78	77	78	76	81	44	25	78	66	77
202	208	226	239	208	68	45	217	171	219
837	869	878	831	770	165	96	837	635	854
1003	1076	1066	1034	871	362	149	1010	794	1045
519	463	554	513	528	460	277	515	473	512
371	350	384	346	420	482	406	374	394	363
340	373	351	364	380	436	399	362	378	357
377	339	359	381	379	418	368	367	374	364
358	365	395	362	424	384	378	381	381	370
370	363	378	362	424	376	334	379	372	368
509	530	526	534	538	388	403	527	490	525
420	401	431	439	466	331	369	431	408	423
486	439	433	472	480	286	291	462	412	458
358	405	459	458	386	277	252	413	371	420
310	370	365	359	332	202	222	347	309	351
193	192	253	230	234	194	205	220	214	217
132	122	177	156	172	147	122	152	147	147
75	99	114	103	134	127	73	105	104	98
44	51	57	71	96	110	64	64	70	56

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	-1	-3	2	-5	-11	4	-8	-4	-3	-2
01:00	5	-3	8	-3	-7	18	-5	0	2	2
02:00	-2	2	6	-2	4	-8	1	2	0	1
03:00	7	0	6	3	-5	3	-7	2	1	4
04:00	10	9	20	-1	3	15	8	9	10	10
05:00	3	2	3	10	4	0	-2	4	3	5
06:00	1	-10	-1	16	11	-3	-2	4	2	2
07:00	96	95	121	105	94	12	2	102	75	104
08:00	-79	-20	-30	-37	-64	74	-1	-46	-23	-42
09:00	-32	-38	11	-11	-36	47	6	-22	-8	-18
10:00	25	9	19	-15	40	45	14	15	19	10
11:00	39	37	40	-25	5	7	27	20	19	23
12:00	28	14	14	-6	14	-13	-34	13	2	13
13:00	-4	11	32	-57	27	-28	43	2	4	-5
14:00	-2	-5	36	46	45	-22	8	24	15	19
15:00	-23	-38	12	74	-46	30	73	-5	12	6
16:00	-23	-51	-40	-63	-40	-50	59	-44	-30	-44
17:00	-3	-43	-64	31	-17	-42	-22	-19	-23	-20
18:00	-55	-32	19	10	-77	-48	-3	-27	-26	-15
19:00	8	20	20	33	-67	-71	-26	3	-11	20
20:00	-92	-13	41	26	0	8	8	-8	-4	-10
21:00	-68	-18	37	13	15	16	5	-4	0	-9
22:00	-27	-16	2	0	9	6	-24	-6	-7	-10
23:00	-7	4	10	19	2	8	19	6	7	7

2016/2019

5-Day Av	7-Day Av	Mon-Thu
1.21	1.11	1.10
1.02	0.91	0.83
0.80	0.97	0.89
0.80	0.92	0.67
0.65	0.58	0.62
0.95	0.96	0.94
0.98	0.99	0.99
0.88	0.88	0.88
1.05	1.03	1.04
1.04	1.02	1.03
0.96	0.95	0.97
0.95	0.95	0.94
0.96	0.99	0.97
1.00	0.99	1.01
0.94	0.96	0.95
1.01	0.98	0.99
1.10	1.07	1.10
1.04	1.05	1.04
1.06	1.07	1.03
0.99	1.04	0.94
1.03	1.02	1.04
1.03	1.00	1.06
1.06	1.07	1.10
0.91	0.89	0.88

EASTBOUND

2016 SITE 200

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	14	12	14	12	19	45	55	14	24	13
01:00	6	5	5	6	9	22	28	6	12	6
02:00	4	4	4	4	6	13	15	4	7	4
03:00	5	4	5	4	6	9	10	5	6	5
04:00	7	6	6	6	8	7	7	7	7	6
05:00	29	31	31	31	30	18	15	30	26	31
06:00	82	88	89	87	81	36	22	85	69	87
07:00	266	271	273	269	256	88	48	267	210	270
08:00	374	393	399	392	385	196	91	389	319	390
09:00	262	271	279	286	289	276	155	277	260	275
10:00	255	258	256	261	278	331	217	262	265	258
11:00	264	269	271	272	304	355	251	276	284	269
12:00	275	285	279	287	308	342	276	287	293	282
13:00	290	293	295	306	318	324	263	300	298	296
14:00	319	324	329	336	357	300	254	333	317	327
15:00	359	375	380	377	399	291	245	378	347	373
16:00	396	413	414	419	438	275	230	416	369	411
17:00	494	513	519	532	471	277	221	506	432	515
18:00	334	374	385	403	359	250	197	371	329	374
19:00	228	268	259	273	290	219	165	264	243	257
20:00	142	157	160	175	188	148	117	164	155	159
21:00	99	118	114	128	123	104	77	116	109	115
22:00	70	78	81	87	95	92	54	82	80	79
23:00	36	40	42	46	72	77	35	47	50	41

2019 ATC15

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	13	9	18	15	15	47	57	14	25	14
01:00	3	4	5	14	7	20	31	7	12	7
02:00	5	6	7	6	4	18	19	6	9	6
03:00	2	3	4	8	5	8	10	4	6	4
04:00	9	12	7	12	13	14	12	11	11	10
05:00	35	34	40	41	30	23	16	36	31	38
06:00	92	94	99	89	84	47	26	92	76	94
07:00	242	277	245	254	243	102	65	252	204	255
08:00	316	356	296	316	364	212	98	330	280	321
09:00	285	296	295	272	315	272	131	293	267	287
10:00	280	246	267	275	286	340	259	271	279	267
11:00	265	256	308	269	311	364	268	282	292	275
12:00	271	278	258	305	293	352	281	281	291	278
13:00	310	294	308	302	342	349	293	311	314	304
14:00	306	310	340	353	344	272	249	331	311	327
15:00	356	377	368	345	382	277	266	366	339	362
16:00	435	438	417	439	477	271	214	441	384	432
17:00	485	502	503	506	492	239	222	498	421	499
18:00	354	372	423	366	385	205	195	380	329	379
19:00	283	301	319	276	284	180	170	293	259	295
20:00	172	144	167	200	188	154	131	174	165	171
21:00	123	111	160	146	132	116	88	134	125	135
22:00	57	98	98	93	99	126	54	89	89	87
23:00	33	44	54	50	75	68	34	51	51	45

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	-1	-3	4	3	-4	2	2	0	1	1
01:00	-3	-1	0	8	-2	-2	3	1	0	1
02:00	1	2	3	2	-2	5	4	2	2	2
03:00	-3	-1	-1	4	-1	-1	0	-1	0	0
04:00	2	6	1	6	5	7	5	4	4	4
05:00	6	3	9	10	0	5	1	6	5	7
06:00	10	6	10	2	3	11	4	7	7	7
07:00	-24	6	-28	-15	-13	14	17	-15	-6	-15
08:00	-58	-37	-103	-76	-21	16	7	-59	-39	-69
09:00	23	25	16	-14	26	-4	-24	16	7	13
10:00	25	-12	11	14	8	9	42	9	14	10
11:00	1	-13	37	-3	7	9	17	6	8	6
12:00	-4	-7	-21	18	-15	10	5	-6	-2	-4
13:00	20	1	13	-4	24	25	30	11	16	8
14:00	-13	-14	11	17	-13	-28	-5	-2	-6	0
15:00	-3	2	-12	-32	-17	-14	21	-12	-8	-11
16:00	39	25	3	20	39	-4	-16	25	15	22
17:00	-9	-11	-16	-26	21	-38	1	-8	-11	-16
18:00	20	-2	38	-37	26	-45	-2	9	0	5
19:00	55	33	60	3	-6	-39	5	29	16	38
20:00	30	-13	7	25	0	6	14	10	10	12
21:00	24	-7	46	18	9	12	11	18	16	20
22:00	-13	20	17	6	4	34	0	7	9	8
23:00	-3	4	12	4	3	-9	-1	4	1	4

2016/2019

Time Begin	5-Day Av	7-Day Av	Mon-Thu
00:00	1.00	0.97	0.95
01:00	0.91	1.00	0.85
02:00	0.71	0.75	0.67
03:00	1.14	1.05	1.06
04:00	0.66	0.62	0.63
05:00	0.83	0.83	0.81
06:00	0.93	0.91	0.93
07:00	1.06	1.03	1.06
08:00	1.18	1.14	1.21
09:00	0.95	0.98	0.96
10:00	0.97	0.95	0.96
11:00	0.98	0.97	0.98
12:00	1.02	1.01	1.01
13:00	0.96	0.95	0.98
14:00	1.01	1.02	1.00
15:00	1.03	1.02	1.03
16:00	0.94	0.96	0.95
17:00	1.02	1.03	1.03
18:00	0.98	1.00	0.99
19:00	0.90	0.94	0.87
20:00	0.94	0.94	0.93
21:00	0.86	0.87	0.85
22:00	0.92	0.90	0.91
23:00	0.92	0.98	0.91

Two-Way

2016/2019

Time Begin	5-Day Av	7-Day Av	Mon-Thu
00:00	1.06	0.99	1.08
01:00	0.97	1.01	0.85
02:00	0.76	0.85	0.73
03:00	0.73	0.83	0.65
04:00	0.68	0.69	0.65
05:00	0.87	0.88	0.88
06:00	0.92	0.92	0.92
07:00	0.98	0.96	0.98
08:00	1.16	1.11	1.19
09:00	0.96	0.96	0.96
10:00	0.98	0.96	0.98
11:00	0.98	0.98	0.98
12:00	1.00	1.01	0.99
13:00	0.99	0.98	1.00
14:00	1.00	1.01	1.00
15:00	1.02	1.01	1.01
16:00	0.99	0.99	0.99
17:00	1.04	1.04	1.04
18:00	1.00	1.02	1.00
19:00	0.91	0.95	0.88
20:00	0.93	0.93	0.93
21:00	0.87	0.88	0.86
22:00	0.89	0.89	0.90
23:00	0.97	0.98	0.94

WESTBOUND

2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	16	13	14	15	22	48	59	16	27	15
01:00	6	6	6	7	10	25	33	7	13	6
02:00	5	4	5	5	6	14	16	5	8	5
03:00	5	3	4	3	6	9	11	4	6	4
04:00	8	7	7	8	9	9	9	8	8	8
05:00	34	38	38	37	36	20	13	37	31	37
06:00	86	92	92	92	85	37	25	89	73	91
07:00	303	323	331	327	303	71	45	317	243	321
08:00	383	400	408	403	393	168	77	397	319	399
09:00	284	304	305	293	311	260	145	299	272	297
10:00	259	271	270	270	289	331	236	272	275	268
11:00	273	276	280	287	297	350	270	283	290	279
12:00	295	289	295	296	327	366	294	300	309	294
13:00	297	305	307	304	328	336	262	308	306	303
14:00	311	317	328	321	343	327	255	324	315	319
15:00	386	399	411	394	432	302	251	404	368	398
16:00	378	406	415	408	430	307	251	407	371	402
17:00	440	476	487	476	464	295	228	469	409	470
18:00	340	370	377	389	375	262	208	370	332	369
19:00	249	279	273	284	293	226	178	276	255	271
20:00	168	180	184	202	208	165	137	188	178	184
21:00	104	123	123	126	131	114	88	121	116	119
22:00	69	83	81	88	99	98	63	84	83	80
23:00	34	36	42	50	76	76	33	48	50	41

2019

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	15	9	12	11	24	51	66	14	27	12
01:00	6	10	6	7	5	26	30	7	13	7
02:00	5	6	8	5	7	10	17	6	8	6
03:00	7	10	9	8	6	12	9	8	9	9
04:00	10	8	17	9	13	9	8	11	11	11
05:00	40	40	41	36	46	18	15	41	34	39
06:00	91	104	95	106	96	33	23	98	78	99
07:00	366	372	321	327	334	76	63	344	266	347
08:00	328	372	303	371	376	227	91	350	295	344
09:00	310	279	341	313	307	296	163	310	287	311
10:00	281	268	269	255	294	358	249	273	282	268
11:00	256	293	288	295	311	348	252	289	292	283
12:00	324	286	292	309	316	345	282	305	308	303
13:00	290	294	299	292	354	311	270	306	301	294
14:00	288	318	329	332	353	336	261	324	317	317
15:00	388	381	404	422	417	280	317	402	373	399
16:00	386	373	387	399	396	259	325	388	361	386
17:00	438	462	461	444	415	251	242	444	388	451
18:00	325	343	403	375	353	227	215	360	320	362
19:00	270	309	326	316	286	183	179	301	267	305
20:00	172	176	225	211	231	163	166	203	192	196
21:00	125	112	158	147	152	125	96	139	131	136
22:00	59	98	113	95	122	122	50	97	94	91
23:00	25	43	41	56	69	90	30	47	51	41

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	-1	-4	-2	-4	2	3	7	-2	0	-3
01:00	0	4	0	0	-5	1	-3	0	0	1
02:00	0	2	3	0	1	-4	1	1	0	1
03:00	2	7	5	5	0	3	-2	4	3	5
04:00	2	1	10	1	4	0	-1	3	3	4
05:00	6	2	3	-1	10	-2	2	4	3	3
06:00	5	12	3	14	11	-4	-2	9	5	9
07:00	63	49	-10	0	31	5	18	27	23	26
08:00	-55	-28	-105	-32	-17	59	14	-47	-24	-55
09:00	26	-25	36	20	-4	36	18	11	15	14
10:00	22	-3	-1	-15	5	27	13	1	7	1
11:00	-17	17	8	8	14	-2	-18	6	2	4
12:00	29	-3	-3	13	-11	-21	-12	5	-1	9
13:00	-7	-11	-8	-12	26	-25	8	-2	-5	-10
14:00	-23	1	1	11	10	9	6	0	2	-3
15:00	2	-18	-7	28	-15	-22	66	-2	5	1
16:00	8	-33	-28	-9	-34	-48	74	-19	-10	-16
17:00	-2	-14	-26	-32	-49	-44	14	-25	-21	-19
18:00	-15	-27	26	-14	-22	-35	7	-10	-12	-8
19:00	21	30	53	32	-7	-43	1	25	12	34
20:00	4	-4	41	9	23	-2	29	15	14	13
21:00	21	-11	35	21	21	11	8	18	15	17
22:00	-10	15	32	7	23	24	-13	13	11	11
23:00	-9	7	-1	6	-7	14	-3	-1	1	1

2016/2019

Time Begin	5-Day Av	7-Day Av	Mon-Thu
00:00	1.13	1.01	1.23
01:00	1.03	1.01	0.86
02:00	0.81	0.97	0.79
03:00	0.50	0.69	0.44
04:00	0.70	0.76	0.68
05:00	0.91	0.92	0.94
06:00	0.90	0.93	0.91
07:00	0.92	0.92	0.93
08:00	1.13	1.08	1.16
09:00	0.96	0.95	0.95
10:00	0.99	0.98	1.00
11:00	0.98	0.99	0.99
12:00	0.98	1.00	0.97
13:00	1.01	1.02	1.03
14:00	1.00	0.99	1.01
15:00	1.00	0.99	1.00
16:00	1.05	1.03	1.04
17:00	1.06	1.06	1.04
18:00	1.03	1.04	1.02
19:00	0.92	0.96	0.89
20:00	0.93	0.93	0.94
21:00	0.87	0.89	0.88
22:00	0.86	0.88	0.88
23:00	1.03	0.99	0.98

EASTBOUND

2016 SITE 132

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	36	38	34	28	22	54	60	32	39	34
01:00	28	31	21	38	34	52	40	30	35	30
02:00	32	37	39	31	34	33	28	35	33	35
03:00	89	76	75	73	77	42	29	78	66	78
04:00	306	283	281	286	303	129	82	292	239	289
05:00	558	618	562	563	515	195	116	563	447	575
06:00	984	1057	1032	1054	1019	331	192	1029	810	1032
07:00	983	1042	1066	1086	1038	485	255	1043	851	1044
08:00	732	674	793	744	782	696	482	745	700	736
09:00	719	559	608	609	681	786	495	635	637	624
10:00	740	733	690	666	837	807	653	733	732	707
11:00	829	783	791	805	851	933	742	812	819	802
12:00	840	794	811	820	964	957	709	846	842	816
13:00	903	1000	984	1000	1164	849	706	1010	944	972
14:00	1112	1128	1186	1176	1248	839	741	1170	1061	1151
15:00	1603	1689	1683	1667	1635	834	797	1655	1415	1661
16:00	1725	1723	1747	1700	1665	850	660	1712	1439	1724
17:00	1251	1371	1281	1307	1083	577	433	1259	1043	1303
18:00	648	714	703	722	664	474	354	690	611	697
19:00	409	450	425	517	438	357	423	448	431	450
20:00	300	310	321	368	314	236	297	323	307	325
21:00	202	309	257	257	291	283	173	263	253	256
22:00	81	99	104	103	166	181	86	111	117	97
23:00	41	71	66	70	101	126	41	70	74	62

2019 ATC23

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	39	52	59	55	59	126	145	53	76	51
01:00	34	39	43	33	45	77	79	39	50	37
02:00	31	24	18	19	33	59	55	25	34	23
03:00	33	22	39	29	33	33	47	31	34	31
04:00	74	72	66	68	62	53	39	68	62	70
05:00	251	257	254	264	259	120	41	257	207	257
06:00	491	537	572	534	518	226	160	530	434	534
07:00	989	965	935	993	932	322	183	963	760	971
08:00	889	944	980	961	875	559	262	930	781	944
09:00	715	799	746	791	813	785	440	773	727	763
10:00	682	625	661	660	699	910	641	665	697	657
11:00	684	699	723	758	809	990	754	735	774	716
12:00	777	785	759	773	949	943	820	809	829	774
13:00	757	794	837	853	949	942	855	838	855	810
14:00	935	944	968	962	984	831	764	959	913	952
15:00	1062	1112	1106	1132	1226	765	725	1128	1018	1103
16:00	1557	1553	1594	1697	1559	731	730	1592	1346	1600
17:00	1630	1706	1689	1777	1547	682	730	1670	1394	1701
18:00	1132	1203	1467	1144	1109	616	528	1211	1028	1237
19:00	682	828	763	746	753	481	418	754	667	755
20:00	313	373	345	381	384	305	229	359	333	353
21:00	313	373	345	381	384	305	229	359	333	353
22:00	256	247	283	297	314	324	182	279	272	271
23:00	120	130	171	157	226	207	106	161	160	145

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	3	14	25	27	37	72	85	21	37	17
01:00	6	8	22	-5	11	25	39	9	15	8
02:00	-1	-13	-21	-12	-1	26	27	-10	1	-12
03:00	-56	-54	-36	-44	-44	-9	18	-47	-32	-48
04:00	-232	-211	-215	-218	-241	-76	-43	-224	-177	-219
05:00	-307	-361	-308	-299	-256	-75	-75	-306	-240	-319
06:00	-493	-520	-460	-520	-501	-105	-32	-499	-376	-498
07:00	6	-77	-131	-93	-106	-163	-72	-80	-91	-74
08:00	157	270	187	217	93	-137	-220	185	81	208
09:00	-4	240	138	182	132	-1	-55	138	90	139
10:00	-58	-108	-29	-6	-138	103	-12	-68	-35	-50
11:00	-145	-84	-68	-47	-42	57	12	-77	-45	-86
12:00	-63	-9	-52	-47	-15	-14	111	-37	-13	-43
13:00	-146	-206	-147	-147	-215	93	149	-172	-89	-162
14:00	-177	-184	-218	-214	-264	-8	23	-211	-148	-198
15:00	-541	-577	-577	-535	-409	-69	-72	-527	-397	-558
16:00	-168	-170	-153	-3	-106	-119	70	-120	-93	-124
17:00	379	335	408	470	464	105	297	411	351	398
18:00	484	489	764	422	445	142	174	521	417	540
19:00	273	378	338	229	315	124	-5	306	236	305
20:00	13	63	24	13	70	69	-68	36	26	28
21:00	111	64	88	124	93	22	56	96	80	97
22:00	175	148	179	194	148	143	96	168	155	174
23:00	79	59	105	87	125	81	65	91	86	83

2016/2019

Time Begin	5-Day Av	7-Day Av	Mon-Thu
00:00	0.61	0.51	0.66
01:00	0.77	0.70	0.79
02:00	1.40	0.97	1.51
03:00	2.50	1.96	2.54
04:00	4.27	3.85	4.13
05:00	2.19	2.16	2.24
06:00	1.94	1.87	1.93
07:00	1.08	1.12	1.08
08:00	0.80	0.90	0.78
09:00	0.82	0.88	0.82
10:00	1.10	1.05	1.08
11:00	1.11	1.06	1.12
12:00	1.05	1.02	1.06
13:00	1.21	1.10	1.20
14:00	1.22	1.16	1.21
15:00	1.47	1.39	1.51
16:00	1.08	1.07	1.08
17:00	0.75	0.75	0.77
18:00	0.57	0.59	0.56
19:00	0.59	0.65	0.60
20:00	0.90	0.92	0.92
21:00	0.73	0.76	0.73
22:00	0.40	0.43	0.36
23:00	0.44	0.46	0.43

Two-Way

2016/2019

Time Begin	5-Day Av	7-Day Av	Mon-Thu
00:00	0.55	0.49	0.60
01:00	0.70	0.66	0.66
02:00	1.14	0.89	1.17
03:00	1.89	1.60	1.92
04:00	4.25	3.77	4.16
05:00	2.56	2.52	2.64
06:00	2.16	2.09	2.13
07:00	1.02	1.06	1.02
08:00	0.75	0.83	0.73
09:00	0.78	0.86	0.77
10:00	1.01	1.02	0.99
11:00	1.07	1.05	1.09
12:00	1.04	1.02	1.05
13:00	1.15	1.08	1.15
14:00	1.16	1.10	1.15
15:00	1.35	1.28	1.38
16:00	1.12	1.09	1.12
17:00	0.76	0.76	0.76
18:00	0.60	0.64	0.59
19:00	0.59	0.64	0.60
20:00	0.87	0.89	0.88
21:00	0.71	0.73	0.71
22:00	0.43	0.46	0.38
23:00	0.45	0.48	0.44

WESTBOUND

2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	30	25	28	27	18	56	68	26	36	28
01:00	16	20	24	25	30	41	53	23	30	21
02:00	28	30	25	27	33	27	19	29	27	28
03:00	53	53	54	56	56	47	37	54	51	54
04:00	220	243	241	222	228	91	67	231	187	232
05:00	665	714	686	663	583	182	126	662	517	682
06:00	1702	1704	1750	1773	1681	315	170	1722	1299	1732
07:00	1808	1722	1863	1874	1754	729	244	1804	1428	1817
08:00	1051	1282	1228	1047	1116	840	505	1145	1010	1152
09:00	782	788	827	840	888	928	758	825	830	809
10:00	712	729	715	731	784	965	891	734	790	722
11:00	802	736	801	734	796	1010	795	774	811	768
12:00	791	770	820	733	824	898	768	788	801	779
13:00	784	786	787	837	873	814	735	813	802	799
14:00	783	776	861	849	906	684	550	835	773	817
15:00	977	962	1028	989	994	634	570	990	879	989
16:00	1163	1213	1242	1223	1210	626	556	1210	1033	1210
17:00	809	898	922	942	871	516	496	888	779	893
18:00	498	580	523	550	562	425	498	543	519	538
19:00	319	290	302	312	343	332	297	313	314	306
20:00	229	222	222	262	259	251	208	239	236	234
21:00	160	217	184	216	211	200	163	198	193	194
22:00	83	110	85	119	166	201	82	113	121	99
23:00	48	55	40	77	100	121	52	64	70	55

2019

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	46	51	63	43	60	114	165	53	77	51
01:00	31	57	39	31	26	65	92	37	49	40
02:00	22	41	32	25	35	34	43	31	33	30
03:00	23	45	43	42	40	46	38	39	40	38
04:00	44	57	66	54	53	41	42	55	51	55
05:00	214	224	218	220	228	94	29	221	175	219
06:00	765	768	772	753	663	198	110	744	576	765
07:00	1826	1878	1859	1820	1757	333	191	1828	1381	1846
08:00	1648	1789	1589	1612	1348	655	303	1597	1278	1660
09:00	1104	1100	1109	1051	1094	810	541	1092	973	1091
10:00	760	744	835	806	775	860	789	784	796	786
11:00	707	696	729	787	785	967	827	741	785	730
12:00	739	753	723	753	824	892	767	758	779	742
13:00	677	754	740	759	831	813	743	752	760	733
14:00	746	749	760	770	852	739	716	775	762	756
15:00	756	859	785	873	884	692	568	831	774	818
16:00	975	1027	1017	1055	1066	647	600	1028	912	1019
17:00	1121	1201	1170	1211	1097	600	522	1160	989	1176
18:00	820	843	879	816	816	499	536	835	744	840
19:00	486	507	515	519	610	420	402	527	494	507
20:00	231	308	289	311	289	270	235	286	276	285
21:00	231	308	289	311	289	270	235	286	276	285
22:00	201	266	255	241	267	298	161	246	241	241
23:00	118	115	138	126	190	217	100	137	143	124

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	16	26	35	16	42	58	97	27	41	23
01:00	15	37	15	6	-4	24	39	14	19	18
02:00	-6	11	7	-2	2	7	24	2	6	3
03:00	-30	-8	-11	-14	-16	-1	1	-15	-11	-16
04:00	-176	-186	-175	-168	-175	-50	-25	-176	-136	-176
05:00	-451	-490	-468	-443	-355	-88	-97	-441	-342	-463
06:00	-937	-936	-978	-1020	-1018	-117	-60	-978	-723	-968
07:00	18	156	-4	-54	3	-396	-53	24	-47	29
08:00	597	507	361	565	232	-185	-202	452	268	508
09:00	322	312	282	211	206	-118	-217	267	143	282
10:00	48	15	120	75	-9	-105	-102	50	6	65
11:00	-95	-40	-72	53	-11	-43	32	-33	-26	-39
12:00	-52	-17	-97	20	0	-6	-1	-30	-22	-37
13:00	-107	-32	-47	-78	-42	-1	8	-61	-42	-66
14:00	-37	-27	-101	-79	-54	55	166	-60	-11	-61
15:00	-221	-103	-243	-116	-110	58	-2	-159	-105	-171
16:00	-188	-186	-225	-168	-144	21	44	-182	-121	-192
17:00	312	303	248	269	226	84	26	272	210	283
18:00	322	263	356	266	254	74	38	292	225	302
19:00	167	217	213	207	267	88	105	214	180	201
20:00	2	86	67	49	30	19	27	47	40	51
21:00	71	91	105	95	78	70	72	88	83	91
22:00	118	156	170	122	101	97	79	133	120	142
23:00	70	60	98	49	90	96	48	73	73	69

2016/2019

Time Begin	5-Day Av	7-Day Av	Mon-Thu
00:00	0.49	0.46	0.54
01:00	0.63	0.62	0.54
02:00	0.94	0.81	0.92
03:00	1.40	1.29	1.41
04:00	4.22	3.67	4.19
05:00	3.00	2.95	3.11
06:00	2.31	2.26	2.27
07:00	0.99	1.03	0.98
08:00	0.72	0.79	0.69
09:00	0.76	0.85	0.74
10:00	0.94	0.99	0.92
11:00	1.04	1.03	1.05
12:00	1.04	1.03	1.05
13:00	1.08	1.06	1.09
14:00	1.08	1.01	1.08
15:00	1.19	1.14	1.21
16:00	1.18	1.13	1.19
17:00	0.77	0.79	0.76
18:00	0.65	0.70	0.64
19:00	0.59	0.64	0.60
20:00	0.84	0.85	0.82
21:00	0.69	0.70	0.68
22:00	0.46	0.50	0.41
23:00	0.47	0.49	0.44

NORTH - EASTBOUND

2016 SITE 35

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	0	65	46	57	60	90	128	57	74	42
01:00	2	23	42	37	31	73	61	33	45	26
02:00	1	38	37	41	45	35	45	40	40	29
03:00	1	41	38	31	42	48	32	38	39	28
04:00	3	94	88	81	67	49	34	83	69	67
05:00	38	294	327	268	250	110	79	285	221	232
06:00	84	497	512	482	417	155	104	477	361	394
07:00	261	1022	1071	933	838	302	171	966	723	822
08:00	828	1211	1362	1140	1045	452	224	1190	906	1135
09:00	1747	828	907	734	742	647	403	803	710	1054
10:00	140	1793	673	654	635	735	449	939	823	815
11:00	141	181	703	648	691	818	578	556	603	418
12:00	195	210	798	766	866	866	706	660	702	492
13:00	190	190	853	777	911	791	766	683	715	503
14:00	1037	280	932	961	1045	787	684	805	782	803
15:00	4942	339	1083	1050	1260	714	675	933	854	1854
16:00	6201	681	1618	1584	1541	769	749	1356	1157	2521
17:00	3275	770	1755	1815	1703	857	627	1511	1255	1904
18:00	440	540	1289	1328	1167	657	459	1081	907	899
19:00	194	214	707	766	724	505	367	603	547	470
20:00	69	92	476	526	493	313	327	397	371	291
21:00	38	1702	346	370	343	194	219	690	529	614
22:00	39	493	236	286	287	231	161	326	282	264
23:00	2370	111	118	113	183	157	88	131	128	678

data seems too high, has been removed from averages

2019 ATC 13

Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
47	57	57	53	55	119	135	54	75	54
33	39	40	34	12	84	92	32	48	37
28	23	21	16	0	55	59	18	29	22
30	22	41	23	0	33	41	23	27	29
67	70	61	59	0	45	31	51	48	64
199	204	202	218	0	111	64	165	143	206
391	444	467	409	0	174	134	342	288	428
806	812	803	836	0	274	154	651	526	814
840	935	876	869	483	482	255	880	710	880
662	725	673	689	750	667	389	700	651	687
633	593	586	593	621	759	560	605	621	601
638	657	664	682	731	793	688	674	693	660
726	761	734	726	900	947	750	769	792	737
750	730	812	759	832	902	797	777	797	763
839	903	884	912	956	781	716	899	856	885
974	1010	1040	1017	1164	724	664	1041	942	1010
1485	1520	1436	1584	1508	698	658	1507	1270	1506
1684	1694	1609	1709	1495	590	702	1638	1355	1674
985	1073	1226	1093	1060	598	474	1087	930	1094
643	755	698	709	699	447	399	701	621	701
315	370	378	378	380	321	225	364	338	360
315	370	378	378	380	321	225	364	338	360
247	250	279	286	316	303	174	276	265	266
106	127	165	172	232	201	115	160	160	143

Appears to be a partial hour (removed from average)

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	47	-8	11	-4	-5	29	7	-3	0	12
01:00	31	16	-2	-3	-19	11	31	-2	3	11
02:00	27	-15	-16	-25	-45	20	14	-23	-11	-7
03:00	29	-19	3	-8	-42	-15	9	-15	-12	1
04:00	64	-24	-27	-22	-67	-4	-3	-31	-21	-2
05:00	161	-90	-125	-50	-250	1	-15	-120	-79	-26
06:00	307	-53	-45	-73	-417	19	30	-135	-73	34
07:00	545	-210	-268	-97	-838	-28	-17	-315	-196	-8
08:00	12	-276	-486	-271	-562	30	31	-310	-196	-255
09:00	-1085	-103	-234	-45	8	20	-14	-103	-59	-367
10:00	493	-1200	-87	-61	-14	24	111	-334	-202	-214
11:00	497	476	-39	34	40	-25	110	119	90	242
12:00	531	551	-64	-40	34	81	44	109	90	245
13:00	560	540	-41	-18	-79	111	31	94	83	260
14:00	-198	623	-48	-49	-89	-6	32	94	74	82
15:00	-3968	671	-43	-33	-96	10	-11	108	88	-843
16:00	-4716	839	-182	0	-33	-71	-91	151	113	-1015
17:00	-1591	924	-146	-106	-208	-267	75	127	100	-230
18:00	545	533	-63	-235	-107	-59	15	6	23	195
19:00	449	541	-9	-57	-25	-58	32	98	74	231
20:00	246	278	-98	-148	-113	8	-102	-33	-33	70
21:00	277	-1332	32	8	37	127	6	-326	-191	-254
22:00	208	-243	43	0	29	72	13	-50	-17	2
23:00	-2264	16	47	59	49	44	27	29	31	-536

2016/2019

5-Day Av	7-Day Av	Mon-Thu
1.06	0.99	0.79
1.05	0.93	0.71
2.29	1.39	1.33
1.64	1.42	0.96
1.61	1.45	1.04
1.73	1.55	1.13
1.39	1.25	0.92
1.48	1.37	1.01
1.35	1.28	1.29
1.15	1.09	1.53
1.55	1.33	1.36
0.82	0.87	0.63
0.86	0.89	0.67
0.88	0.90	0.66
0.90	0.91	0.91
0.90	0.91	1.83
0.90	0.91	1.67
0.92	0.93	1.14
0.99	0.98	0.82
0.86	0.88	0.67
1.09	1.10	0.81
1.90	1.56	1.70
1.18	1.07	0.99
0.82	0.80	4.76

Two-Way

2016/2019

5-Day Av	7-Day Av	Mon-Thu
0.98	0.97	0.84
1.05	0.94	0.78
1.74	1.30	1.15
1.18	1.09	0.80
1.41	1.29	1.01
1.53	1.43	1.10
1.21	1.15	0.91
1.32	1.26	0.98
1.15	1.13	1.12
1.14	1.10	1.32
1.29	1.18	1.20
0.92	0.96	0.83
0.94	0.97	0.84
0.98	0.99	0.86
0.94	0.97	0.95
0.98	1.01	1.52
0.94	0.96	1.45
0.98	0.99	1.12
1.03	1.02	0.93
0.94	0.94	0.83
1.16	1.16	1.00
1.51	1.30	1.41
1.06	0.97	0.95
0.84	0.83	3.04

SOUTH - WESTBOUND

2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	46	48	47	49	49	89	142	48	67	48
01:00	29	30	31	34	31	62	77	31	42	31
02:00	24	24	24	28	27	41	39	25	30	25
03:00	23	23	25	33	23	29	25	25	26	26
04:00	60	49	49	38	41	40	31	47	44	49
05:00	205	221	238	220	206	103	46	218	177	221
06:00	533	587	577	543	485	167	117	545	430	560
07:00	1212	1234	1306	1260	1280	278	143	1258	959	1253
08:00	1015	1286	1386	1335	1300	476	223	1264	1003	1256
09:00	1107	1076	998	998	926	707	402	1021	888	1045
10:00	724	709	733	735	729	749	664	726	720	725
11:00	694	641	656	685	733	957	677	682	720	669
12:00	696	707	700	719	812	825	785	727	749	706
13:00	711	713	699	748	796	805	688	733	737	718
14:00	659	669	697	701	789	778	605	703	700	682
15:00	763	801	844	823	933	624	560	833	764	808
16:00	816	864	922	840	875	577	500	863	771	861
17:00	1033	1030	1011	1015	998	560	465	1017	873	1022
18:00	776	832	694	833	746	476	428	776	684	784
19:00	478	547	471	526	570	348	306	518	464	506
20:00	311	337	330	350	366	240	272	339	315	332
21:00	220	279	271	292	258	195	196	264	244	266
22:00	162	187	187	243	224	170	144	201	188	195
23:00	76	90	110	132	150	169	87	112	116	102

2019

Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
40	58	73	39	55	97	137	53	71	53
30	48	37	31	3	67	91	30	44	37
21	36	25	18	0	33	44	20	25	25
26	45	42	39	0	43	31	30	32	38
34	58	59	50	0	39	40	40	40	50
202	213	202	203	0	84	50	164	136	205
636	619	633	612	0	184	100	500	398	625
1279	1309	1314	1284	0	283	174	1037	806	1297
1243	1286	1267	1255	545	565	267	1263	981	1263
876	913	964	834	885	723	452	894	807	897
669	648	711	685	699	763	632	682	687	678
644	666	648	660	719	804	696	667	691	655
676	701	696	676	749	819	658	700	711	687
674	653	598	677	723	731	625	665	669	651
636	683	734	657	786	645	578	699	674	678
672	773	730	768	854	595	246	759	663	736
815	857	839	817	894	584	343	844	736	832
938	948	902	939	926	536	432	931	803	932
725	707	726	688	706	432	441	710	632	712
467	442	469	502	579	366	340	492	452	470
221	282	277	280	287	239	202	269	255	265
221	282	277	280	287	239	202	269	255	265
177	249	229	204	238	273	162	219	219	215
106	110	111	131	184	206	86	128	133	115

Appears to be a partial hour (removed from average)

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	-6	10	26	-10	6	8	-5	5	4	5
01:00	1	18	6	-3	-28	5	14	-1	2	6
02:00	-3	12	1	-10	-27	-8	5	-5	-5	0
03:00	3	22	17	6	-23	14	6	5	6	12
04:00	-26	9	10	12	-41	-1	9	-7	-4	1
05:00	-3	-8	-36	-17	-206	-19	4	-54	-41	-16
06:00	103	32	56	69	-485	17	-17	-45	-32	65
07:00	67	75	8	24	-1280	5	31	-221	-153	44
08:00	228	0	-119	-80	-755	89	44	-1	-23	7
09:00	-231	-163	-34	-164	-41	16	50	-127	-81	-148
10:00	-55	-61	-22	-50	-30	14	-32	-44	-33	-47
11:00	-50	25	-8	-25	-14	-153	19	-15	-29	-15
12:00	-20	-6	-4	-43	-63	-6	-127	-27	-38	-18
13:00	-37	-60	-101	-71	-73	-74	-63	-68	-68	-67
14:00	-23	14	37	-44	-3	-133	-27	-4	-26	-4
15:00	-91	-28	-114	-55	-79	-29	-314	-74	-101	-72
16:00	-1	-7	-83	-23	19	7	-157	-19	-35	-29
17:00	-95	-82	-109	-76	-72	-24	-33	-86	-70	-91
18:00	-51	-125	32	-145	-40	-44	13	-66	-52	-72
19:00	-11	-105	-2	-24	9	18	34	-26	-12	-36
20:00	-90	-55	-53	-70	-79	-1	-70	-70	-60	-67
21:00	1	3	6	-12	29	44	6	5	11	-1
22:00	15	62	42	-39	14	103	18	18	31	20
23:00	30	20	1	-1	34	37	-1	16	17	13

2016/2019

5-Day Av	7-Day Av	Mon-Thu
0.91	0.94	0.90
1.04	0.96	0.85
1.25	1.19	1.00
0.82	0.81	0.68
1.17	1.10	0.98
1.33	1.30	1.08
1.09	1.08	0.90
1.21	1.19	0.97
1.00	1.02	0.99
1.14	1.10	1.17
1.06	1.05	1.07
1.02	1.04	1.02
1.04	1.05	1.03
1.10	1.10	1.10
1.01	1.04	1.01
1.10	1.15	1.10
1.02	1.05	1.03
1.09	1.09	1.10
1.09	1.08	1.10
1.05	1.03	1.08
1.26	1.23	1.25
0.98	0.96	1.00
0.92	0.86	0.91
0.87	0.87	0.89

NORTH - EASTBOUND

2016 SITE 63

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	41	61	58	79	78	124	163	63	86	60
01:00	43	27	35	41	47	97	82	39	53	37
02:00	24	43	46	42	48	54	66	41	46	39
03:00	57	49	55	40	51	55	38	50	49	50
04:00	75	75	92	93	83	57	41	84	74	84
05:00	346	357	365	326	307	157	119	340	282	349
06:00	556	531	581	579	537	234	137	557	451	562
07:00	1158	1165	1203	1309	1199	357	216	1207	944	1209
08:00	1677	1731	1780	1678	1697	640	242	1713	1349	1717
09:00	1057	1050	1054	990	937	884	391	1018	909	1038
10:00	812	820	795	815	828	893	526	814	784	811
11:00	830	822	821	886	915	1000	651	855	846	840
12:00	937	966	953	976	1054	1064	840	977	970	958
13:00	1064	1109	1078	1102	1186	1025	961	1108	1075	1088
14:00	1099	1213	1202	1101	1374	929	866	1198	1112	1154
15:00	1295	1391	1410	1301	1567	944	902	1393	1259	1349
16:00	1790	1811	1776	1760	1892	975	949	1806	1565	1784
17:00	1961	1939	1984	1902	1890	901	848	1935	1632	1947
18:00	1334	1493	1416	1471	1295	753	629	1402	1199	1429
19:00	812	918	876	934	890	561	423	886	773	885
20:00	516	582	594	685	640	421	376	603	545	594
21:00	388	501	521	546	431	319	259	477	424	489
22:00	271	345	352	330	344	296	176	328	302	325
23:00	113	123	132	136	258	252	97	152	159	126

2019 M5

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00								0	0	
01:00								0	0	
02:00								0	0	
03:00								0	0	
04:00								0	0	
05:00								0	0	
06:00								0	0	
07:00				1183				1183	1183	1183
08:00				1438				1438	1438	1438
09:00				955				955	955	955
10:00								0	0	
11:00				831				831	831	831
12:00				946				946	946	946
13:00								0	0	
14:00								0	0	
15:00								0	0	
16:00				1853				1853	1853	1853
17:00				1954				1954	1954	1954
18:00				1379				1379	1379	1379
19:00								0	0	
20:00								0	0	
21:00								0	0	
22:00								0	0	
23:00								0	0	

Difference

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	-	-	-	-	-	-	-	-	-	-
01:00	-	-	-	-	-	-	-	-	-	-
02:00	-	-	-	-	-	-	-	-	-	-
03:00	-	-	-	-	-	-	-	-	-	-
04:00	-	-	-	-	-	-	-	-	-	-
05:00	-	-	-	-	-	-	-	-	-	-
06:00	-	-	-	-	-	-	-	-	-	-
07:00	-	-	-	-126	-	-	-	-24	239	-126
08:00	-	-	-	-240	-	-	-	-275	89	-240
09:00	-	-	-	-35	-	-	-	-63	46	-35
10:00	-	-	-	-	-	-	-	-	-	-
11:00	-	-	-	-55	-	-	-	-24	-15	-55
12:00	-	-	-	-30	-	-	-	-31	-24	-30
13:00	-	-	-	-	-	-	-	-	-	-
14:00	-	-	-	-	-	-	-	-	-	-
15:00	-	-	-	-	-	-	-	-	-	-
16:00	-	-	-	93	-	-	-	47	288	93
17:00	-	-	-	52	-	-	-	19	322	52
18:00	-	-	-	-92	-	-	-	-23	180	-92
19:00	-	-	-	-	-	-	-	-	-	-
20:00	-	-	-	-	-	-	-	-	-	-
21:00	-	-	-	-	-	-	-	-	-	-
22:00	-	-	-	-	-	-	-	-	-	-
23:00	-	-	-	-	-	-	-	-	-	-

2016/2019 (North - Eastbound), with Two-Way 2016/2019

Time Begin	5-Day Av	7-Day Av	Mon-Thu	Two-Way 5-Day Av	Two-Way 7-Day Av	Two-Way Mon-Thu
00:00	-	-	-	-	-	-
01:00	-	-	-	-	-	-
02:00	-	-	-	-	-	-
03:00	-	-	-	-	-	-
04:00	-	-	-	-	-	-
05:00	-	-	-	-	-	-
06:00	-	-	-	-	-	-
07:00	1.02	0.80	1.02	0.99	0.77	1.00
08:00	1.19	0.94	1.19	1.12	0.89	1.13
09:00	1.07	0.95	1.09	1.16	1.03	1.18
10:00	-	-	-	-	-	-
11:00	1.03	1.02	1.01	1.04	1.06	1.03
12:00	1.03	1.03	1.01	1.06	1.07	1.04
13:00	-	-	-	-	-	-
14:00	-	-	-	-	-	-
15:00	-	-	-	-	-	-
16:00	0.97	0.84	0.96	1.01	0.88	1.00
17:00	0.99	0.84	1.00	1.00	0.84	1.01
18:00	1.02	0.87	1.04	1.06	0.91	1.07
19:00	-	-	-	-	-	-
20:00	-	-	-	-	-	-
21:00	-	-	-	-	-	-
22:00	-	-	-	-	-	-
23:00	-	-	-	-	-	-

SOUTH - WESTBOUND

2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	48	52	51	48	70	100	144	54	73	50
01:00	23	33	31	32	41	69	81	32	44	30
02:00	12	19	15	28	22	57	39	19	27	19
03:00	21	27	24	18	35	44	35	25	29	23
04:00	53	43	47	57	51	43	35	50	47	50
05:00	229	238	238	214	189	94	79	222	183	230
06:00	645	646	663	628	628	220	125	642	508	646
07:00	1454	1503	1542	1513	1479	418	190	1498	1157	1503
08:00	1675	1714	1685	1684	1647	715	261	1681	1340	1690
09:00	1336	1342	1317	1218	1247	1006	470	1292	1134	1303
10:00	963	865	989	896	937	1085	886	930	946	928
11:00	894	847	842	890	878	1048	926	870	904	868
12:00	931	894	922	978	1039	1103	937	953	972	931
13:00	896	924	897	899	1105	980	853	944	936	904
14:00	952	941	1065	984	1062	907	770	1001	954	986
15:00	1047	1067	1055	1057	1251	800	704	1095	997	1057
16:00	1166	1288	1305	1262	1282	831	654	1261	1113	1255
17:00	1398	1385	1408	1456	1350	739	552	1399	1184	1412
18:00	1055	1083	1125	1081	1132	590	494	1095	937	1086
19:00	648	687	711	790	685	481	391	704	628	709
20:00	393	434	472	508	501	307	288	462	415	452
21:00	272	326	321	377	348	252	217	329	302	324
22:00	266	315	282	311	301	240	192	295	272	294
23:00	102	130	133	154	201	175	98	144	142	130

2019

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00								0	0	
01:00								0	0	
02:00								0	0	
03:00								0	0	
04:00								0	0	
05:00								0	0	
06:00								0	0	
07:00				1539				1539	1539	1539
08:00				1579				1579	1579	1579
09:00				1031				1031	1031	1031
10:00								0	0	
11:00				824				824	824	824
12:00				874				874	874	874
13:00								0	0	
14:00								0	0	
15:00								0	0	
16:00				1194				1194	1194	1194
17:00				1379				1379	1379	1379
18:00				976				976	976	976
19:00								0	0	
20:00								0	0	
21:00								0	0	
22:00								0	0	
23:00								0	0	

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	-	-	-	-	-	-	-	-	-	
01:00	-	-	-	-	-	-	-	-	-	
02:00	-	-	-	-	-	-	-	-	-	
03:00	-	-	-	-	-	-	-	-	-	
04:00	-	-	-	-	-	-	-	-	-	
05:00	-	-	-	-	-	-	-	-	-	
06:00	-	-	-	-	-	-	-	-	-	
07:00	-	-	-	26	-	-	-	41	382	26
08:00	-	-	-	-105	-	-	-	-102	239	-105
09:00	-	-	-	-187	-	-	-	-261	-103	-187
10:00	-	-	-	-	-	-	-	-	-	
11:00	-	-	-	-66	-	-	-	-46	-80	-66
12:00	-	-	-	-104	-	-	-	-79	-98	-104
13:00	-	-	-	-	-	-	-	-	-	
14:00	-	-	-	-	-	-	-	-	-	
15:00	-	-	-	-	-	-	-	-	-	
16:00	-	-	-	-68	-	-	-	-67	81	-68
17:00	-	-	-	-77	-	-	-	-20	195	-77
18:00	-	-	-	-105	-	-	-	-119	39	-105
19:00	-	-	-	-	-	-	-	-	-	
20:00	-	-	-	-	-	-	-	-	-	
21:00	-	-	-	-	-	-	-	-	-	
22:00	-	-	-	-	-	-	-	-	-	
23:00	-	-	-	-	-	-	-	-	-	

2016/2019

Time Begin	5-Day Av	7-Day Av	Mon-Thu
00:00	-	-	
01:00	-	-	
02:00	-	-	
03:00	-	-	
04:00	-	-	
05:00	-	-	
06:00	-	-	
07:00	0.97	0.75	0.98
08:00	1.06	0.85	1.07
09:00	1.25	1.10	1.26
10:00	-	-	
11:00	1.06	1.10	1.05
12:00	1.09	1.11	1.07
13:00	-	-	
14:00	-	-	
15:00	-	-	
16:00	1.06	0.93	1.05
17:00	1.01	0.86	1.02
18:00	1.12	0.96	1.11
19:00	-	-	
20:00	-	-	
21:00	-	-	
22:00	-	-	
23:00	-	-	

NORTH - EASTBOUND

2016 SITE 65

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	17	22	19	22	23	60	62	21	32	20
01:00	7	8	5	12	14	47	45	9	20	8
02:00	9	7	5	9	9	24	15	8	11	8
03:00	12	12	12	10	7	22	18	11	13	12
04:00	27	24	26	21	23	13	17	24	22	25
05:00	94	75	91	84	88	40	18	86	70	86
06:00	123	128	132	147	132	62	34	132	108	133
07:00	400	401	391	422	413	85	46	405	308	404
08:00	664	709	678	673	679	189	64	681	522	681
09:00	362	305	332	363	312	240	145	335	294	341
10:00	294	308	269	254	307	304	208	286	278	281
11:00	339	337	334	320	362	352	252	338	328	333
12:00	395	400	418	385	408	389	352	401	392	400
13:00	430	372	457	435	455	352	347	430	407	424
14:00	396	418	419	420	453	349	325	421	397	413
15:00	492	448	464	488	522	331	311	483	437	473
16:00	719	534	539	708	696	375	314	639	555	625
17:00	781	646	610	785	699	374	278	704	596	706
18:00	437	477	456	521	477	301	173	474	406	473
19:00	317	313	337	309	327	219	157	321	283	319
20:00	215	218	193	280	251	138	117	231	202	227
21:00	142	154	178	164	169	129	153	161	156	160
22:00	109	139	109	137	133	99	71	125	114	124
23:00	56	39	48	55	105	80	40	61	60	50

2019 M4

Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	
			489				489	489	489
			766				766	766	766
			410				410	410	410
							0	0	
			334				334	334	334
			420				420	420	420
							0	0	
							0	0	
							0	0	
			582				582	582	582
			518				518	518	518
			438				438	438	438
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	-	-	-	-	-	-	-	-	-	
01:00	-	-	-	-	-	-	-	-	-	
02:00	-	-	-	-	-	-	-	-	-	
03:00	-	-	-	-	-	-	-	-	-	
04:00	-	-	-	-	-	-	-	-	-	
05:00	-	-	-	-	-	-	-	-	-	
06:00	-	-	-	-	-	-	-	-	-	
07:00	-	-	-	67	-	-	-	84	181	67
08:00	-	-	-	93	-	-	-	85	244	93
09:00	-	-	-	47	-	-	-	75	116	47
10:00	-	-	-	-	-	-	-	-	-	
11:00	-	-	-	14	-	-	-	-4	6	14
12:00	-	-	-	35	-	-	-	19	28	35
13:00	-	-	-	-	-	-	-	-	-	
14:00	-	-	-	-	-	-	-	-	-	
15:00	-	-	-	-	-	-	-	-	-	
16:00	-	-	-	-126	-	-	-	-57	27	-126
17:00	-	-	-	-267	-	-	-	-186	-78	-267
18:00	-	-	-	-83	-	-	-	-36	32	-83
19:00	-	-	-	-	-	-	-	-	-	
20:00	-	-	-	-	-	-	-	-	-	
21:00	-	-	-	-	-	-	-	-	-	
22:00	-	-	-	-	-	-	-	-	-	
23:00	-	-	-	-	-	-	-	-	-	

2016/2019 / Two-Way 2016/2019

5-Day Av	7-Day Av	Mon-Thu	Two-Way 5-Day Av	Two-Way 7-Day Av	Two-Way Mon-Thu
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
0.83	0.63	0.83	0.80	0.61	0.81
0.89	0.68	0.89	0.91	0.70	0.90
0.82	0.72	0.83	0.89	0.78	0.91
-	-		-	-	-
1.01	0.98	1.00	0.87	0.86	0.86
0.95	0.93	0.95	0.85	0.83	0.85
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
1.10	0.95	1.07	0.99	0.84	0.96
1.36	1.15	1.36	1.22	1.00	1.24
1.08	0.93	1.08	0.97	0.83	0.97
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-

SOUTH - WESTBOUND

2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	16	14	29	22	26	68	63	21	34	20
01:00	6	10	8	7	13	53	40	9	20	8
02:00	4	8	8	8	10	58	27	8	18	7
03:00	8	5	10	9	6	22	20	8	11	8
04:00	16	8	20	10	14	10	19	14	14	14
05:00	50	43	50	53	51	29	11	49	41	49
06:00	162	184	178	192	157	64	40	175	140	179
07:00	590	614	580	575	543	110	59	580	439	590
08:00	958	865	914	949	1003	289	79	938	722	922
09:00	599	574	534	524	500	408	183	546	475	558
10:00	385	367	332	370	369	429	346	365	371	364
11:00	341	361	349	387	371	436	319	362	366	360
12:00	471	419	490	455	459	469	372	459	448	459
13:00	446	421	445	426	473	398	347	442	422	435
14:00	441	418	440	406	513	398	380	444	428	426
15:00	495	463	483	506	543	355	314	498	451	487
16:00	585	593	597	639	722	302	248	627	527	604
17:00	952	924	892	1003	837	296	223	922	732	943
18:00	474	565	526	573	543	299	200	536	454	535
19:00	271	266	322	298	346	240	165	301	273	289
20:00	154	159	172	190	228	150	118	181	167	169
21:00	106	123	107	132	149	133	80	123	119	117
22:00	101	113	133	111	145	91	72	121	109	115
23:00	46	43	39	55	92	82	29	55	55	46

2019

Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	
			740				740	740	740
			1015				1015	1015	1015
			575				575	575	575
							0	0	
			472				472	472	472
			592				592	592	592
							0	0	
							0	0	
							0	0	
			703				703	703	703
			811				811	811	811
			598				598	598	598
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	-	-	-	-	-	-	-	-	-	
01:00	-	-	-	-	-	-	-	-	-	
02:00	-	-	-	-	-	-	-	-	-	
03:00	-	-	-	-	-	-	-	-	-	
04:00	-	-	-	-	-	-	-	-	-	
05:00	-	-	-	-	-	-	-	-	-	
06:00	-	-	-	-	-	-	-	-	-	
07:00	-	-	-	165	-	-	-	160	301	165
08:00	-	-	-	66	-	-	-	77	293	66
09:00	-	-	-	51	-	-	-	29	100	51
10:00	-	-	-	-	-	-	-	-	-	
11:00	-	-	-	85	-	-	-	110	106	85
12:00	-	-	-	137	-	-	-	133	144	137
13:00	-	-	-	-	-	-	-	-	-	
14:00	-	-	-	-	-	-	-	-	-	
15:00	-	-	-	-	-	-	-	-	-	
16:00	-	-	-	64	-	-	-	76	176	64
17:00	-	-	-	-192	-	-	-	-111	79	-192
18:00	-	-	-	25	-	-	-	62	144	25
19:00	-	-	-	-	-	-	-	-	-	
20:00	-	-	-	-	-	-	-	-	-	
21:00	-	-	-	-	-	-	-	-	-	
22:00	-	-	-	-	-	-	-	-	-	
23:00	-	-	-	-	-	-	-	-	-	

2016/2019

5-Day Av	7-Day Av	Mon-Thu
-	-	
-	-	
-	-	
-	-	
-	-	
-	-	
-	-	
0.78	0.59	0.80
0.92	0.71	0.91
0.95	0.83	0.97
-	-	
0.77	0.78	0.76
0.78	0.76	0.77
-	-	
-	-	
-	-	
0.89	0.75	0.86
1.14	0.90	1.16
0.90	0.76	0.89
-	-	
-	-	
-	-	
-	-	
-	-	

EASTBOUND

2016 SITE 90

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	15	24	24	31	34	37	60	26	32	24
01:00	7	16	9	8	13	29	22	11	15	10
02:00	2	10	14	11	9	12	22	9	11	9
03:00	10	10	14	15	12	12	21	12	13	12
04:00	20	20	20	24	18	12	14	20	18	21
05:00	126	122	129	127	114	42	28	124	98	126
06:00	136	157	132	153	157	73	52	147	123	145
07:00	339	327	347	351	389	118	53	351	275	341
08:00	440	428	430	448	437	159	84	437	347	437
09:00	253	279	286	284	283	249	152	277	255	276
10:00	235	256	259	278	302	312	242	266	269	257
11:00	306	301	335	316	320	347	238	316	309	315
12:00	434	397	401	444	496	339	316	434	404	419
13:00	436	389	398	424	479	313	299	425	391	412
14:00	385	444	433	432	486	347	260	436	398	424
15:00	481	482	456	475	528	361	290	484	439	474
16:00	627	680	636	635	711	335	351	658	568	645
17:00	626	591	616	483	578	293	226	579	488	579
18:00	481	517	480	534	438	265	168	490	412	503
19:00	282	350	332	323	286	180	130	315	269	322
20:00	175	195	208	216	217	112	98	202	174	199
21:00	162	186	164	193	143	99	74	170	146	176
22:00	100	105	120	133	123	119	58	116	108	115
23:00	46	55	50	47	97	68	35	59	57	50

2019 M6

Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	
			367				367	367	367
			432				432	432	432
			310				310	310	310
							0	0	
			332				332	332	332
			434				434	434	434
							0	0	
							0	0	
							0	0	
			727				727	727	727
			650				650	650	650
			460				460	460	460
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	-	-	-	-	-	-	-	-	-	
01:00	-	-	-	-	-	-	-	-	-	
02:00	-	-	-	-	-	-	-	-	-	
03:00	-	-	-	-	-	-	-	-	-	
04:00	-	-	-	-	-	-	-	-	-	
05:00	-	-	-	-	-	-	-	-	-	
06:00	-	-	-	-	-	-	-	-	-	
07:00	-	-	-	16	-	-	-	16	92	16
08:00	-	-	-	-16	-	-	-	-5	85	-16
09:00	-	-	-	26	-	-	-	33	55	26
10:00	-	-	-	-	-	-	-	-	-	
11:00	-	-	-	16	-	-	-	16	23	16
12:00	-	-	-	-10	-	-	-	0	30	-10
13:00	-	-	-	-	-	-	-	-	-	
14:00	-	-	-	-	-	-	-	-	-	
15:00	-	-	-	-	-	-	-	-	-	
16:00	-	-	-	92	-	-	-	69	159	92
17:00	-	-	-	167	-	-	-	71	162	167
18:00	-	-	-	-74	-	-	-	-30	48	-74
19:00	-	-	-	-	-	-	-	-	-	
20:00	-	-	-	-	-	-	-	-	-	
21:00	-	-	-	-	-	-	-	-	-	
22:00	-	-	-	-	-	-	-	-	-	
23:00	-	-	-	-	-	-	-	-	-	

2016/2019

5-Day Av	7-Day Av	Mon-Thu
-	-	
-	-	
-	-	
-	-	
-	-	
-	-	
-	-	
0.96	0.75	0.93
1.01	0.80	1.01
0.89	0.82	0.89
-	-	
0.95	0.93	0.95
1.00	0.93	0.97
-	-	
-	-	
-	-	
0.91	0.78	0.89
0.89	0.75	0.89
1.07	0.90	1.09
-	-	
-	-	
-	-	
-	-	
-	-	

Two-Way

2016/2019

5-Day Av	7-Day Av	Mon-Thu
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
0.90	0.68	0.89
1.04	0.79	1.04
0.95	0.82	0.97
-	-	-
0.86	0.87	0.84
0.94	0.90	0.91
-	-	-
-	-	-
-	-	-
0.91	0.80	0.89
0.93	0.78	0.94
1.01	0.86	1.02
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-

WESTBOUND

2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	15	15	17	28	22	39	52	19	27	19
01:00	8	8	10	11	19	26	39	11	17	9
02:00	6	11	10	12	13	8	16	10	11	10
03:00	13	14	15	16	16	10	24	15	15	15
04:00	22	19	23	25	32	17	17	24	22	22
05:00	80	92	86	86	73	43	30	83	70	86
06:00	210	238	231	235	227	96	47	228	183	229
07:00	783	805	849	810	798	150	69	809	609	812
08:00	1501	1502	1509	1512	1451	326	101	1495	1129	1506
09:00	629	696	613	612	560	352	201	622	523	638
10:00	351	353	374	391	376	399	373	369	374	367
11:00	322	306	316	356	365	426	336	333	347	325
12:00	398	382	395	413	455	445	335	409	403	397
13:00	507	463	458	479	496	404	329	481	448	477
14:00	455	455	409	446	480	429	320	449	428	441
15:00	425	409	471	453	466	343	308	445	411	440
16:00	473	451	471	519	521	291	287	487	430	479
17:00	569	658	594	635	547	280	247	601	504	614
18:00	423	444	398	461	429	279	202	431	377	432
19:00	240	284	232	305	304	198	153	273	245	265
20:00	172	157	176	150	169	129	118	165	153	164
21:00	109	127	129	147	134	111	81	129	120	128
22:00	91	109	129	139	124	123	60	118	111	117
23:00	36	36	57	46	56	74	29	46	48	44

2019

Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	
			926				926	926	926
			1427				1427	1427	1427
			635				635	635	635
							0	0	
			425				425	425	425
			467				467	467	467
							0	0	
							0	0	
							0	0	
			528				528	528	528
			617				617	617	617
			455				455	455	455
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	-	-	-	-	-	-	-	-	-	
01:00	-	-	-	-	-	-	-	-	-	
02:00	-	-	-	-	-	-	-	-	-	
03:00	-	-	-	-	-	-	-	-	-	
04:00	-	-	-	-	-	-	-	-	-	
05:00	-	-	-	-	-	-	-	-	-	
06:00	-	-	-	-	-	-	-	-	-	
07:00	-	-	-	116	-	-	-	117	317	116
08:00	-	-	-	-85	-	-	-	-68	298	-85
09:00	-	-	-	23	-	-	-	13	112	23
10:00	-	-	-	-	-	-	-	-	-	
11:00	-	-	-	69	-	-	-	92	78	69
12:00	-	-	-	54	-	-	-	58	64	54
13:00	-	-	-	-	-	-	-	-	-	
14:00	-	-	-	-	-	-	-	-	-	
15:00	-	-	-	-	-	-	-	-	-	
16:00	-	-	-	9	-	-	-	41	98	9
17:00	-	-	-	-18	-	-	-	16	113	-18
18:00	-	-	-	-6	-	-	-	24	78	-6
19:00	-	-	-	-	-	-	-	-	-	
20:00	-	-	-	-	-	-	-	-	-	
21:00	-	-	-	-	-	-	-	-	-	
22:00	-	-	-	-	-	-	-	-	-	
23:00	-	-	-	-	-	-	-	-	-	

2016/2019

5-Day Av	7-Day Av	Mon-Thu
-	-	
-	-	
-	-	
-	-	
-	-	
-	-	
-	-	
0.87	0.66	0.88
1.05	0.79	1.06
0.98	0.82	1.00
-	-	
0.78	0.82	0.76
0.88	0.86	0.85
-	-	
-	-	
-	-	
0.92	0.81	0.91
0.97	0.82	1.00
0.95	0.83	0.95
-	-	
-	-	
-	-	
-	-	
-	-	

SOUTHBOUND

2016 SITE 111

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	20	44	32	18	24	45	38	28	32	29
01:00	10	32	18	16	24	24	25	20	21	19
02:00	11	38	15	20	13	14	8	19	17	21
03:00	17	46	15	13	12	13	9	21	18	23
04:00	36	28	29	38	28	26	20	32	29	33
05:00	125	142	128	132	138	65	53	133	112	132
06:00	201	230	224	234	220	85	54	222	178	222
07:00	564	587	616	539	577	120	75	577	440	577
08:00	768	851	783	746	735	261	101	777	606	787
09:00	395	634	434	478	410	335	167	470	408	485
10:00	282	306	286	272	337	342	289	297	302	287
11:00	310	278	287	311	307	356	261	299	301	297
12:00	397	389	377	419	399	351	332	396	381	396
13:00	355	347	361	389	379	327	271	366	347	363
14:00	354	317	328	320	355	312	273	335	323	330
15:00	341	374	380	382	419	264	197	379	337	369
16:00	425	432	433	430	519	274	204	448	388	430
17:00	729	691	661	668	607	240	199	671	542	687
18:00	430	440	436	426	394	215	172	425	359	433
19:00	219	256	245	267	249	165	136	247	220	247
20:00	149	251	153	166	149	90	84	174	149	180
21:00	154	256	109	124	111	70	78	151	129	161
22:00	156	193	82	80	92	85	45	121	105	128
23:00	85	107	54	53	53	44	30	70	61	75

2019 TWO WAY LINK COUNT 4

Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
16	24	17	19	26	40	36	20	25	19
12	15	21	16	9	26	23	15	17	16
12	9	13	11	0	13	16	9	11	11
8	17	17	11	0	18	11	11	12	13
25	36	31	26	0	15	10	24	20	30
93	100	103	111	0	55	35	81	71	102
209	242	228	220	0	79	45	180	146	225
670	729	696	647	530	162	75	686	497	686
808	913	807	798	659	260	82	797	618	832
404	429	474	407	358	337	206	414	374	429
317	291	330	300	328	372	246	313	312	310
289	302	305	289	335	344	284	304	307	296
352	396	380	410	427	356	280	393	372	385
315	377	345	365	379	301	276	356	337	351
378	387	362	347	375	277	298	370	346	369
381	388	393	455	401	255	234	404	358	404
552	568	571	569	598	257	178	572	470	565
761	835	823	754	625	254	177	760	604	793
421	414	425	439	335	200	199	407	348	425
244	268	262	266	254	145	144	259	226	260
122	115	135	139	147	103	62	132	118	128
122	115	135	139	147	103	62	132	118	128
78	104	89	89	115	84	52	95	87	90
51	30	48	46	71	63	39	49	50	44

Appears to be a partial hour (removed from average)

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	-4	-20	-15	1	2	-5	-2	-8	-7	-10
01:00	2	-17	3	0	-15	2	-2	-5	-4	-3
02:00	1	-29	-2	-9	-13	-1	8	-10	-6	-10
03:00	-9	-29	2	-2	-12	5	2	-10	-6	-10
04:00	-11	8	2	-12	-28	-11	-10	-8	-9	-3
05:00	-32	-42	-25	-21	-138	-10	-18	-52	-41	-30
06:00	8	12	4	-14	-220	-6	-9	-42	-32	3
07:00	106	142	80	108	-47	42	0	109	57	109
08:00	40	62	24	52	-76	-1	-19	20	12	45
09:00	9	-205	40	-71	-52	2	39	-56	-34	-57
10:00	35	-15	44	28	-9	30	-43	16	10	23
11:00	-21	24	18	-22	28	-12	23	5	6	0
12:00	-45	7	3	-9	28	5	-52	-3	-9	-11
13:00	-40	30	-16	-24	0	-26	5	-10	-10	-13
14:00	24	70	34	27	20	-35	25	35	23	39
15:00	40	14	13	73	-18	-9	37	25	21	35
16:00	127	136	138	139	79	-17	-26	124	82	135
17:00	32	144	162	86	18	14	-22	89	62	106
18:00	-9	-26	-11	13	-59	-15	27	-18	-11	-8
19:00	25	12	17	-1	5	-20	8	12	6	13
20:00	-27	-136	-18	-27	-2	13	-22	-42	-31	-52
21:00	-32	-141	26	15	36	33	-16	-19	-11	-33
22:00	-78	-89	7	9	23	-1	7	-26	-18	-38
23:00	-34	-77	-6	-7	18	19	9	-21	-11	-31

2016/2019

5-Day Av	7-Day Av	Mon-Thu
1.37	1.26	1.50
1.37	1.20	1.19
2.11	1.61	1.87
1.98	1.54	1.72
1.36	1.42	1.11
1.63	1.58	1.29
1.23	1.22	0.99
0.84	0.89	0.84
0.97	0.98	0.95
1.13	1.09	1.13
0.95	0.97	0.93
0.98	0.98	1.00
1.01	1.03	1.03
1.03	1.03	1.04
0.91	0.93	0.89
0.94	0.94	0.91
0.78	0.82	0.76
0.88	0.90	0.87
1.04	1.03	1.02
0.95	0.97	0.95
1.32	1.27	1.41
1.15	1.10	1.26
1.27	1.20	1.42
1.42	1.23	1.71

Two-Way

2016/2019

5-Day Av	7-Day Av	Mon-Thu
1.27	1.12	1.39
1.70	1.34	1.50
2.00	1.54	1.70
1.72	1.46	1.43
1.30	1.34	1.04
1.50	1.45	1.18
1.20	1.18	0.97
0.85	0.90	0.85
1.00	1.00	0.97
1.07	1.05	1.07
0.98	0.99	0.98
0.96	0.96	0.95
1.01	1.00	1.02
1.06	1.04	1.07
1.00	1.01	1.00
0.99	0.99	0.98
1.02	1.05	1.03
0.97	0.98	0.96
1.08	1.07	1.06
0.99	1.01	1.00
1.45	1.35	1.52
1.34	1.23	1.48
1.64	1.50	1.83
1.62	1.40	1.95

NORTHBOUND

2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	14	77	26	35	25	47	44	35	38	38
01:00	14	71	15	19	30	17	26	30	27	30
02:00	12	42	17	15	19	18	16	21	20	22
03:00	12	44	14	13	20	23	9	21	19	21
04:00	31	43	32	39	42	21	24	37	33	36
05:00	85	87	84	92	97	45	38	89	75	87
06:00	132	133	145	127	125	59	32	132	108	134
07:00	426	421	461	434	427	91	34	434	328	436
08:00	993	995	1019	924	939	195	51	974	731	983
09:00	366	447	468	378	358	263	115	403	342	415
10:00	255	260	317	261	279	279	175	274	261	273
11:00	306	241	330	264	329	324	248	294	292	285
12:00	382	362	366	400	395	302	331	381	363	378
13:00	441	444	417	434	509	336	296	449	411	434
14:00	434	430	457	517	503	371	321	468	433	460
15:00	454	440	546	522	534	314	304	499	445	491
16:00	651	641	760	774	627	371	317	691	592	707
17:00	665	700	714	685	584	319	247	670	559	691
18:00	477	536	562	540	520	253	199	527	441	529
19:00	302	310	304	339	293	223	185	310	279	314
20:00	304	243	211	219	214	129	115	238	205	244
21:00	290	388	167	159	157	98	92	232	193	251
22:00	461	380	144	152	154	109	84	258	212	284
23:00	193	150	76	55	78	78	32	110	95	119

2019

Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
33	39	18	26	30	52	62	29	37	29
12	20	16	18	8	22	33	15	18	17
12	15	16	12	0	16	23	11	13	14
11	20	18	20	0	14	12	14	14	17
38	43	39	28	0	18	14	30	26	37
73	81	86	93	0	37	34	67	58	83
135	136	156	146	0	69	33	115	96	143
477	536	510	484	430	101	50	502	360	502
975	1017	997	1014	793	175	66	959	720	1001
394	442	414	410	361	240	121	404	340	415
275	245	291	245	288	290	183	269	260	264
287	293	346	330	313	341	258	314	310	314
353	358	401	372	410	415	284	379	370	371
366	395	407	410	474	360	334	410	392	395
397	396	433	465	462	361	316	431	404	423
451	484	475	476	534	290	290	484	429	472
517	556	529	542	556	283	261	540	463	536
636	652	684	602	547	288	209	624	517	644
404	453	647	433	427	245	193	473	400	484
268	308	322	314	315	179	172	305	268	303
138	121	166	177	165	145	99	153	144	151
138	121	166	177	165	145	99	153	144	151
124	136	124	158	139	112	79	136	125	136
58	52	59	53	87	82	43	62	62	56

Appears to be a partial hour (removed from average)

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	19	-38	-8	-9	5	5	18	-6	-1	-9
01:00	-2	-51	1	-1	-22	5	7	-15	-9	-13
02:00	0	-27	-1	-3	-19	-2	7	-10	-7	-8
03:00	-1	-24	4	7	-20	-9	3	-7	-5	-4
04:00	7	0	7	-11	-42	-3	-10	-7	-7	1
05:00	-12	-6	2	1	-97	-8	-4	-22	-17	-4
06:00	3	3	11	19	-125	10	1	-17	-12	9
07:00	51	115	49	50	3	10	16	68	32	66
08:00	-18	22	-22	90	-146	-20	15	-15	-11	18
09:00	28	-5	-54	32	3	-23	6	1	-2	0
10:00	20	-15	-26	-16	9	11	8	-5	-1	-9
11:00	-19	52	16	66	-16	17	10	20	18	29
12:00	-29	-4	35	-28	15	113	-47	-2	7	-7
13:00	-75	-49	-10	-24	-35	24	38	-39	-19	-40
14:00	-37	-34	-24	-52	-41	-10	-5	-37	-29	-37
15:00	-3	44	-71	-46	0	-24	-14	-15	-16	-19
16:00	-134	-85	-231	-232	-71	-88	-56	-151	-129	-171
17:00	-29	-48	-30	-83	-37	-31	-38	-46	-42	-48
18:00	-73	-83	85	-107	-93	-8	-6	-54	-41	-45
19:00	-34	-2	18	-25	22	-44	-13	-5	-11	-11
20:00	-166	-122	-45	-42	-49	16	-16	-85	-61	-94
21:00	-152	-267	-1	18	8	47	7	-79	-49	-101
22:00	-337	-244	-20	6	-15	3	-5	-122	-87	-149
23:00	-135	-98	-17	-2	9	4	11	-48	-33	-63

2016/2019

5-Day Av	7-Day Av	Mon-Thu
1.20	1.02	1.31
2.03	1.47	1.80
1.91	1.49	1.56
1.52	1.40	1.20
1.25	1.28	0.98
1.34	1.30	1.05
1.15	1.12	0.94
0.86	0.91	0.87
1.02	1.02	0.98
1.00	1.01	1.00
1.02	1.01	1.04
0.94	0.94	0.91
1.01	0.98	1.02
1.09	1.05	1.10
1.09	1.07	1.09
1.03	1.04	1.04
1.28	1.28	1.32
1.07	1.08	1.07
1.11	1.10	1.09
1.02	1.04	1.04
1.55	1.42	1.62
1.51	1.34	1.67
1.89	1.70	2.10
1.78	1.53	2.14

No Westbound data
Two-Way
Not to be used.

EASTBOUND

2016 SITE 135

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	41	65	71	67	81	96	110	65	76	61
01:00	24	39	42	35	54	74	68	39	48	35
02:00	20	34	43	39	35	50	45	34	38	34
03:00	40	43	46	43	41	53	43	43	44	43
04:00	73	69	72	88	91	60	57	79	73	76
05:00	257	253	263	273	239	117	96	257	214	262
06:00	405	394	400	423	388	186	117	402	330	406
07:00	710	810	817	765	739	228	147	768	602	776
08:00	747	835	644	706	763	299	200	739	599	733
09:00	497	606	616	586	555	409	274	572	506	576
10:00	423	450	477	507	503	471	401	472	462	464
11:00	496	486	464	545	591	547	508	516	520	498
12:00	551	578	620	624	632	612	648	601	609	593
13:00	597	604	680	665	704	688	644	650	655	637
14:00	658	706	679	687	734	799	688	693	707	683
15:00	706	814	756	889	803	838	759	794	795	791
16:00	869	853	720	752	1014	941	834	842	855	799
17:00	889	890	859	919	926	994	692	897	881	889
18:00	855	849	823	893	736	711	402	831	753	855
19:00	536	480	577	552	558	512	338	541	508	536
20:00	392	338	374	464	395	271	271	393	358	392
21:00	279	275	265	297	297	266	239	283	274	279
22:00	260	252	255	272	312	342	178	270	267	260
23:00	118	120	122	112	166	163	82	128	126	118

2019 M2

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00								0	0	
01:00								0	0	
02:00								0	0	
03:00								0	0	
04:00								0	0	
05:00								0	0	
06:00								0	0	
07:00				834				834	834	834
08:00				870				870	870	870
09:00				498				498	498	498
10:00								0	0	
11:00				469				469	469	469
12:00				566				566	566	566
13:00								0	0	
14:00								0	0	
15:00								0	0	
16:00				1415				1415	1415	1415
17:00				1511				1511	1511	1511
18:00				941				941	941	941
19:00								0	0	
20:00								0	0	
21:00								0	0	
22:00								0	0	
23:00								0	0	

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	-	-	-	-	-	-	-	-	-	
01:00	-	-	-	-	-	-	-	-	-	
02:00	-	-	-	-	-	-	-	-	-	
03:00	-	-	-	-	-	-	-	-	-	
04:00	-	-	-	-	-	-	-	-	-	
05:00	-	-	-	-	-	-	-	-	-	
06:00	-	-	-	-	-	-	-	-	-	
07:00	-	-	-	69	-	-	-	65.8	231.7143	69
08:00	-	-	-	164	-	-	-	131	270.8571	164
09:00	-	-	-	-88	-	-	-	-74	-8.14286	-88
10:00	-	-	-	-	-	-	-	-	-	
11:00	-	-	-	-76	-	-	-	-47.4	-50.5714	-76
12:00	-	-	-	-58	-	-	-	-35	-43.2857	-58
13:00	-	-	-	-	-	-	-	-	-	
14:00	-	-	-	-	-	-	-	-	-	
15:00	-	-	-	-	-	-	-	-	-	
16:00	-	-	-	663	-	-	-	573.4	560.2857	663
17:00	-	-	-	592	-	-	-	614.3333	629.6667	592
18:00	-	-	-	48	-	-	-	109.8	188.2857	48
19:00	-	-	-	-	-	-	-	-	-	
20:00	-	-	-	-	-	-	-	-	-	
21:00	-	-	-	-	-	-	-	-	-	
22:00	-	-	-	-	-	-	-	-	-	
23:00	-	-	-	-	-	-	-	-	-	

Time Begin	2016/2019 5-Day Av	2016/2019 7-Day Av	2016/2019 Mon-Thu	2016/2019 (Two-Way) 5-Day Av	2016/2019 (Two-Way) 7-Day Av	2016/2019 (Two-Way) Mon-Thu
00:00	-	-		-	-	-
01:00	-	-		-	-	-
02:00	-	-		-	-	-
03:00	-	-		-	-	-
04:00	-	-		-	-	-
05:00	-	-		-	-	-
06:00	-	-		-	-	-
07:00	0.92	0.72	0.93	0.34	0.27	0.35
08:00	0.85	0.69	0.84	0.26	0.21	0.26
09:00	1.15	1.02	1.16	0.37	0.33	0.38
10:00	-	-		-	-	-
11:00	1.10	1.11	1.06	0.48	0.48	0.46
12:00	1.06	1.08	1.05	0.53	0.54	0.53
13:00	-	-		-	-	-
14:00	-	-		-	-	-
15:00	-	-		-	-	-
16:00	0.59	0.60	0.56	0.39	0.40	0.37
17:00	0.59	0.58	0.59	0.39	0.38	0.39
18:00	0.88	0.80	0.91	0.50	0.45	0.52
19:00	-	-		-	-	-
20:00	-	-		-	-	-
21:00	-	-		-	-	-
22:00	-	-		-	-	-
23:00	-	-		-	-	-

WESTBOUND

2016 No westbound data provided

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00										
01:00										
02:00										
03:00										
04:00										
05:00										
06:00										
07:00										
08:00										
09:00										
10:00										
11:00										
12:00										
13:00										
14:00										
15:00										
16:00										
17:00										
18:00										
19:00										
20:00										
21:00										
22:00										
23:00										

2019

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00								0	0	
01:00								0	0	
02:00								0	0	
03:00								0	0	
04:00								0	0	
05:00								0	0	
06:00								0	0	
07:00				1407				1407	1407	1407
08:00				1941				1941	1941	1941
09:00				1036				1036	1036	1036
10:00								0	0	
11:00				614				614	614	614
12:00				561				561	561	561
13:00								0	0	
14:00								0	0	
15:00								0	0	
16:00				743				743	743	743
17:00				793				793	793	793
18:00				718				718	718	718
19:00								0	0	
20:00								0	0	
21:00								0	0	
22:00								0	0	
23:00								0	0	

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	-	-	-	-	-	-	-	-	-	
01:00	-	-	-	-	-	-	-	-	-	
02:00	-	-	-	-	-	-	-	-	-	
03:00	-	-	-	-	-	-	-	-	-	
04:00	-	-	-	-	-	-	-	-	-	
05:00	-	-	-	-	-	-	-	-	-	
06:00	-	-	-	-	-	-	-	-	-	
07:00	-	-	-	1407	-	-	-	1407	1407	1407
08:00	-	-	-	1941	-	-	-	1941	1941	1941
09:00	-	-	-	1036	-	-	-	1036	1036	1036
10:00	-	-	-	-	-	-	-	-	-	
11:00	-	-	-	614	-	-	-	614	614	614
12:00	-	-	-	561	-	-	-	561	561	561
13:00	-	-	-	-	-	-	-	-	-	
14:00	-	-	-	-	-	-	-	-	-	
15:00	-	-	-	-	-	-	-	-	-	
16:00	-	-	-	743	-	-	-	743	743	743
17:00	-	-	-	793	-	-	-	793	793	793
18:00	-	-	-	718	-	-	-	718	718	718
19:00	-	-	-	-	-	-	-	-	-	
20:00	-	-	-	-	-	-	-	-	-	
21:00	-	-	-	-	-	-	-	-	-	
22:00	-	-	-	-	-	-	-	-	-	
23:00	-	-	-	-	-	-	-	-	-	

2016/2019

Time Begin	5-Day Av	7-Day Av	Mon-Thu
00:00	-	-	
01:00	-	-	
02:00	-	-	
03:00	-	-	
04:00	-	-	
05:00	-	-	
06:00	-	-	
07:00	0.00	0.00	0.00
08:00	0.00	0.00	0.00
09:00	0.00	0.00	0.00
10:00	-	-	
11:00	0.00	0.00	0.00
12:00	0.00	0.00	0.00
13:00	-	-	
14:00	-	-	
15:00	-	-	
16:00	0.00	0.00	0.00
17:00	0.00	0.00	0.00
18:00	0.00	0.00	0.00
19:00	-	-	
20:00	-	-	
21:00	-	-	
22:00	-	-	
23:00	-	-	

NORTH - EASTBOUND

2016 SITE 133

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	72	86	116	109	118	199	203	100	129	96
01:00	58	60	73	72	98	128	129	72	88	66
02:00	55	59	58	83	77	103	88	66	75	64
03:00	70	70	81	84	74	103	79	76	80	76
04:00	127	127	126	129	140	92	61	130	115	127
05:00	327	323	299	281	298	169	113	306	259	308
06:00	543	555	570	565	480	231	153	543	442	558
07:00	766	852	876	830	829	328	216	831	671	831
08:00	416	692	361	562	546	541	280	515	485	508
09:00	595	629	654	648	646	589	421	634	597	632
10:00	610	569	672	678	703	806	551	646	656	632
11:00	628	652	704	676	770	800	700	686	704	665
12:00	720	766	743	832	895	909	788	791	808	765
13:00	810	861	848	902	946	926	876	873	881	855
14:00	935	999	1025	1020	953	938	988	986	980	995
15:00	1061	1036	1164	1157	973	1072	1028	1078	1070	1105
16:00	1036	908	922	971	596	1056	1148	887	948	959
17:00	799	737	573	781	544	1066	980	687	783	723
18:00	829	894	497	836	888	884	623	789	779	764
19:00	677	580	677	777	812	633	463	705	660	678
20:00	417	564	490	582	603	477	387	531	503	513
21:00	316	474	392	455	454	408	304	418	400	409
22:00	316	400	347	330	410	369	400	361	367	348
23:00	166	193	172	218	300	290	148	210	212	187

2019 M1

Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	
			816				816	816	816
			735				735	735	735
			672				672	672	672
							0	0	
			672				672	672	672
			731				731	731	731
							0	0	
							0	0	
							0	0	
			1168				1168	1168	1168
			1026				1026	1026	1026
			854				854	854	854
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	-	-	-	-	-	-	-	-	-	
01:00	-	-	-	-	-	-	-	-	-	
02:00	-	-	-	-	-	-	-	-	-	
03:00	-	-	-	-	-	-	-	-	-	
04:00	-	-	-	-	-	-	-	-	-	
05:00	-	-	-	-	-	-	-	-	-	
06:00	-	-	-	-	-	-	-	-	-	
07:00	-	-	-	-14	-	-	-	-15	145	-14
08:00	-	-	-	173	-	-	-	220	250	173
09:00	-	-	-	24	-	-	-	38	75	24
10:00	-	-	-	-	-	-	-	-	-	
11:00	-	-	-	-4	-	-	-	-14	-32	-4
12:00	-	-	-	-101	-	-	-	-60	-77	-101
13:00	-	-	-	-	-	-	-	-	-	
14:00	-	-	-	-	-	-	-	-	-	
15:00	-	-	-	-	-	-	-	-	-	
16:00	-	-	-	197	-	-	-	281	220	197
17:00	-	-	-	245	-	-	-	339	243	245
18:00	-	-	-	18	-	-	-	65	75	18
19:00	-	-	-	-	-	-	-	-	-	
20:00	-	-	-	-	-	-	-	-	-	
21:00	-	-	-	-	-	-	-	-	-	
22:00	-	-	-	-	-	-	-	-	-	
23:00	-	-	-	-	-	-	-	-	-	

2016/2019

5-Day Av	7-Day Av	Mon-Thu
-	-	
-	-	
-	-	
-	-	
-	-	
-	-	
-	-	
1.02	0.82	1.02
0.70	0.66	0.69
0.94	0.89	0.94
-	-	
1.02	1.05	0.99
1.08	1.11	1.05
-	-	
-	-	
-	-	
0.76	0.81	0.82
0.67	0.76	0.70
0.92	0.91	0.89
-	-	
-	-	
-	-	
-	-	
-	-	

Two-Way

2016/2019

5-Day Av	7-Day Av	Mon-Thu
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
1.06	0.83	1.08
0.94	0.78	0.95
1.02	0.92	1.04
-	-	-
0.99	1.05	0.98
1.00	1.05	0.99
-	-	-
-	-	-
-	-	-
0.85	0.86	0.89
0.82	0.82	0.85
0.97	0.92	0.96
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-

SOUTH - WESTBOUND

2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	136	96	126	116	144	204	256	124	154	119
01:00	81	72	77	82	93	130	143	81	97	78
02:00	64	77	76	86	92	87	94	79	82	76
03:00	55	70	68	67	83	94	74	69	73	65
04:00	84	98	100	80	104	77	83	93	89	91
05:00	258	261	250	284	272	178	132	265	234	263
06:00	699	679	716	690	614	229	157	680	541	696
07:00	1615	1627	1543	1566	1390	399	260	1548	1200	1588
08:00	1498	1795	1797	1729	1513	690	346	1666	1338	1705
09:00	1293	1263	1366	1263	1106	869	540	1258	1100	1296
10:00	888	950	939	965	902	1038	1023	929	958	936
11:00	850	902	845	809	813	1115	1097	844	919	852
12:00	853	883	830	894	821	1072	1099	856	922	865
13:00	798	864	844	826	837	1092	1027	834	898	833
14:00	792	806	812	829	752	1107	872	798	853	810
15:00	719	786	871	842	883	880	783	820	823	805
16:00	871	877	957	927	864	891	722	899	873	908
17:00	1160	1109	1151	1105	982	836	706	1101	1007	1131
18:00	987	1130	1010	1080	1003	712	811	1042	962	1052
19:00	606	765	678	756	845	630	652	730	705	701
20:00	393	475	556	487	597	462	461	502	490	478
21:00	298	342	366	404	439	343	384	370	368	353
22:00	265	261	273	287	337	299	361	285	298	272
23:00	157	156	169	177	278	274	213	187	203	165

2019

Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	
			1425				1425	1425	1425
			1592				1592	1592	1592
			1180				1180	1180	1180
							0	0	
			870				870	870	870
			917				917	917	917
							0	0	
							0	0	
							0	0	
			938				938	938	938
			1146				1146	1146	1146
			1037				1037	1037	1037
							0	0	
							0	0	
							0	0	
							0	0	
							0	0	

2019-2016

Time Begin	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Av	7-Day Av	Mon-Thu
00:00	-	-	-	-	-	-	-	-	-	
01:00	-	-	-	-	-	-	-	-	-	
02:00	-	-	-	-	-	-	-	-	-	
03:00	-	-	-	-	-	-	-	-	-	
04:00	-	-	-	-	-	-	-	-	-	
05:00	-	-	-	-	-	-	-	-	-	
06:00	-	-	-	-	-	-	-	-	-	
07:00	-	-	-	-141	-	-	-	-123	225	-141
08:00	-	-	-	-137	-	-	-	-74	254	-137
09:00	-	-	-	-83	-	-	-	-78	80	-83
10:00	-	-	-	-	-	-	-	-	-	
11:00	-	-	-	61	-	-	-	26	-49	61
12:00	-	-	-	23	-	-	-	61	-5	23
13:00	-	-	-	-	-	-	-	-	-	
14:00	-	-	-	-	-	-	-	-	-	
15:00	-	-	-	-	-	-	-	-	-	
16:00	-	-	-	11	-	-	-	39	65	11
17:00	-	-	-	41	-	-	-	45	139	41
18:00	-	-	-	-43	-	-	-	-5	75	-43
0.791667	-	-	-	-	-	-	-	-	-	
20:00	-	-	-	-	-	-	-	-	-	
21:00	-	-	-	-	-	-	-	-	-	
22:00	-	-	-	-	-	-	-	-	-	
23:00	-	-	-	-	-	-	-	-	-	

2016/2019

5-Day Av	7-Day Av	Mon-Thu
-	-	
-	-	
-	-	
-	-	
-	-	
-	-	
-	-	
1.09	0.84	1.11
1.05	0.84	1.07
1.07	0.93	1.10
-	-	
0.97	1.06	0.98
0.93	1.01	0.94
-	-	
-	-	
-	-	
0.96	0.93	0.97
0.96	0.88	0.99
1.00	0.93	1.01
-	-	
-	-	
-	-	
-	-	
-	-	

SUMMARY OF COMPARISON

2019-2016

Direction 1

Time Begin	SITE 2 AND ATC 14			SITE 200 AND ATC 15			SITE 132 AND ATC 23			SITE 35 AND ATC 13			SITE 63 AND M5			SITE 65 AND M4			SITE 90 AND M6			SITE 111 AND 2WLC 4			SITE 135 AND M2			SITE 133 AND M1			AVERAGE		
	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu
00:00	1.44	1.29	1.31	1.00	0.97	0.95	0.61	0.51	0.66	1.06	0.99	0.79	-	-	-	-	-	0.00	-	-	0.00	1.37	1.26	1.50	-	-	0.00	-	-	0.00	1.10	1.00	0.58
01:00	0.79	0.94	0.60	0.91	1.00	0.85	0.77	0.70	0.79	1.05	0.93	0.71	-	-	-	-	-	0.00	-	-	0.00	1.37	1.20	1.19	-	-	0.00	-	-	0.00	0.98	0.96	0.46
02:00	0.57	0.60	0.34	0.71	0.75	0.67	1.40	0.97	1.51	2.29	1.39	1.33	-	-	-	-	-	0.00	-	-	0.00	2.11	1.61	1.87	-	-	0.00	-	-	0.00	1.42	1.06	0.64
03:00	0.54	0.57	0.36	1.14	1.05	1.06	2.50	1.96	2.54	1.64	1.42	0.96	-	-	-	-	-	0.00	-	-	0.00	1.98	1.54	1.72	-	-	0.00	-	-	0.00	1.56	1.31	0.74
04:00	0.61	0.54	0.70	0.66	0.62	0.63	4.27	3.85	4.13	1.61	1.45	1.04	-	-	-	-	-	0.00	-	-	0.00	1.36	1.42	1.11	-	-	0.00	-	-	0.00	1.70	1.58	0.84
05:00	1.01	1.00	0.93	0.83	0.83	0.81	2.19	2.16	2.24	1.73	1.55	1.13	-	-	-	-	-	0.00	-	-	0.00	1.63	1.58	1.29	-	-	0.00	-	-	0.00	1.48	1.42	0.71
06:00	1.04	1.02	1.04	0.93	0.91	0.93	1.94	1.87	1.93	1.39	1.25	0.92	-	-	-	-	-	0.00	-	-	0.00	1.23	1.22	0.99	-	-	0.00	-	-	0.00	1.31	1.25	0.65
07:00	1.11	1.09	1.11	1.06	1.03	1.06	1.08	1.12	1.08	1.48	1.37	1.01	1.02	0.80	1.02	0.83	0.63	0.83	0.96	0.75	0.93	0.84	0.89	0.84	0.92	0.72	0.93	1.02	0.82	1.02	1.03	0.92	0.98
08:00	1.15	1.12	1.15	1.18	1.14	1.21	0.80	0.90	0.78	1.35	1.28	1.29	1.19	0.94	1.19	0.89	0.68	0.89	1.01	0.80	1.01	0.97	0.98	0.95	0.85	0.69	0.84	0.70	0.66	0.69	1.01	0.92	1.00
09:00	0.96	0.94	0.96	0.95	0.98	0.96	0.82	0.88	0.82	1.15	1.09	1.53	1.07	0.95	1.09	0.82	0.72	0.83	0.89	0.82	0.89	1.13	1.09	1.13	1.15	1.02	1.16	0.94	0.89	0.94	0.99	0.94	1.03
10:00	0.93	0.91	0.92	0.97	0.95	0.96	1.10	1.05	1.08	1.55	1.33	1.36	-	-	-	-	-	0.00	-	-	0.00	0.95	0.97	0.93	-	-	0.00	-	-	0.00	1.10	1.04	0.58
11:00	0.96	0.95	0.96	0.98	0.97	0.98	1.11	1.06	1.12	0.82	0.87	0.63	1.03	1.02	1.01	1.01	0.98	1.00	0.95	0.93	0.95	0.98	0.98	1.00	1.10	1.11	1.06	1.02	1.05	0.99	1.00	0.99	0.97
12:00	0.99	0.96	1.03	1.02	1.01	1.01	1.05	1.02	1.06	0.86	0.89	0.67	1.03	1.03	1.01	0.95	0.93	0.95	1.00	0.93	0.97	1.01	1.03	1.03	1.06	1.08	1.05	1.08	1.11	1.05	1.01	1.00	0.98
13:00	0.99	0.98	1.02	0.96	0.95	0.98	1.21	1.10	1.20	0.88	0.90	0.66	-	-	-	-	-	0.00	-	-	0.00	1.03	1.03	1.04	-	-	0.00	-	-	0.00	1.01	0.99	0.54
14:00	0.93	0.94	0.92	1.01	1.02	1.00	1.22	1.16	1.21	0.90	0.91	0.91	-	-	-	-	-	0.00	-	-	0.00	0.91	0.93	0.89	-	-	0.00	-	-	0.00	0.99	0.99	0.55
15:00	0.97	0.98	0.98	1.03	1.02	1.03	1.47	1.39	1.51	0.90	0.91	1.83	-	-	-	-	-	0.00	-	-	0.00	0.94	0.94	0.91	-	-	0.00	-	-	0.00	1.06	1.05	0.70
16:00	0.84	0.89	0.84	0.94	0.96	0.95	1.08	1.07	1.08	0.90	0.91	1.67	0.97	0.84	0.96	1.10	0.95	1.07	0.91	0.78	0.89	0.78	0.82	0.76	0.59	0.60	0.56	0.76	0.81	0.82	0.89	0.86	0.96
17:00	1.03	1.04	1.02	1.02	1.03	1.03	0.75	0.75	0.77	0.92	0.93	1.14	0.99	0.84	1.00	1.36	1.15	1.36	0.89	0.75	0.89	0.88	0.90	0.87	0.59	0.58	0.59	0.67	0.76	0.70	0.91	0.87	0.94
18:00	1.03	1.05	1.04	0.98	1.00	0.99	0.57	0.59	0.56	0.99	0.98	0.82	1.02	0.87	1.04	1.08	0.93	1.08	1.07	0.90	1.09	1.04	1.03	1.02	0.88	0.80	0.91	0.92	0.91	0.89	0.96	0.91	0.94
19:00	0.99	1.00	0.96	0.90	0.94	0.87	0.59	0.65	0.60	0.86	0.88	0.67	-	-	-	-	-	0.00	-	-	0.00	0.95	0.97	0.95	-	-	0.00	-	-	0.00	0.86	0.89	0.45
20:00	0.95	0.97	0.94	0.94	0.94	0.93	0.90	0.92	0.92	1.09	1.10	0.81	-	-	-	-	-	0.00	-	-	0.00	1.32	1.27	1.41	-	-	0.00	-	-	0.00	1.04	1.04	0.56
21:00	1.02	1.03	1.02	0.86	0.87	0.85	0.73	0.76	0.73	1.90	1.56	1.70	-	-	-	-	-	0.00	-	-	0.00	1.15	1.10	1.26	-	-	0.00	-	-	0.00	1.13	1.07	0.62
22:00	0.96	0.97	0.97	0.92	0.90	0.91	0.40	0.43	0.36	1.18	1.07	0.99	-	-	-	-	-	0.00	-	-	0.00	1.27	1.20	1.42	-	-	0.00	-	-	0.00	0.95	0.91	0.52
23:00	0.89	0.91	0.95	0.92	0.98	0.91	0.44	0.46	0.43	0.82	0.80	4.76	-	-	-	-	-	0.00	-	-	0.00	1.42	1.23	1.71	-	-	0.00	-	-	0.00	0.90	0.88	0.97

2019-2016

Direction 2

Time Begin	2016/2019			2016/2019			2016/2019			2016/2019			2016/2019			2016/2019			2016/2019			2016/2019			2016/2019			2016/2019			AVERAGE		
	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu
00:00	1.21	1.11	1.10	1.13	1.01	1.23	0.49	0.46	0.54	0.91	0.94	0.90	-	-	0.00	-	-	0.00	-	-	0.00	1.20	1.02	1.31	-	-	0.00	-	-	0.00	0.99	0.91	0.51
01:00	1.02	0.91	0.83	1.03	1.01	0.86	0.63	0.62	0.54	1.04	0.96	0.85	-	-	0.00	-	-	0.00	-	-	0.00	2.03	1.47	1.80	-	-	0.00	-	-	0.00	1.15	0.99	0.49
02:00	0.80	0.97	0.89	0.81	0.97	0.79	0.94	0.81	0.92	1.25	1.19	1.00	-	-	0.00	-	-	0.00	-	-	0.00	1.91	1.49	1.56	-	-	0.00	-	-	0.00	1.14	1.08	0.52
03:00	0.80	0.92	0.67	0.50	0.69	0.44	1.40	1.29	1.41	0.82	0.81	0.68	-	-	0.00	-	-	0.00	-	-	0.00	1.52	1.40	1.20	-	-	0.00	-	-	0.00	1.01	1.02	0.44
04:00	0.65	0.58	0.62	0.70	0.76	0.68	4.22	3.67	4.19	1.17	1.10	0.98	-	-	0.00	-	-	0.00	-	-	0.00	1.25	1.28	0.98	-	-	0.00	-	-	0.00	1.60	1.48	0.74
05:00	0.95	0.96	0.94	0.91	0.92	0.94	3.00	2.95	3.11	1.33	1.30	1.08	-	-	0.00	-	-	0.00	-	-	0.00	1.34	1.30	1.05	-	-	0.00	-	-	0.00	1.50	1.49	0.71
06:00	0.98	0.99	0.99	0.90	0.93	0.91	2.31	2.26	2.27	1.09	1.08	0.90	-	-	0.00	-	-	0.00	-	-	0.00	1.15	1.12	0.94	-	-	0.00	-	-	0.00	1.29	1.28	0.60
07:00	0.88	0.88	0.88	0.92	0.92	0.93	0.99	1.03	0.98	1.21	1.19	0.97	0.97	0.75	0.98	0.78	0.59	0.80	0.87	0.66	0.88	0.86	0.91	0.87	0.00	0.00	0.00	1.09	0.84	1.11	0.95	0.86	0.84
08:00	1.05	1.03	1.04	1.13	1.08	1.16	0.72	0.79	0.69	1.00	1.02	0.99	1.06	0.85	1.07	0.92	0.71	0.91	1.05	0.79	1.06	1.02	1.02	0.98	0.00	0.00	0.00	1.05	0.84	1.07	1.00	0.90	0.90
09:00	1.04	1.02	1.03	0.96	0.95	0.95	0.76	0.85	0.74	1.14	1.10	1.17	1.25	1.10	1.26	0.95	0.83	0.97	0.98	0.82	1.00	1.00	1.01	1.00	0.00	0.00	0.00	1.07	0.93	1.10	1.02	0.96	0.92
10:00	0.96	0.95	0.97	0.99	0.98	1.00	0.94	0.99	0.92	1.06	1.05	1.07	-	-	0.00	-	-	0.00	-	-	0.00	1.02	1.01	1.04	-	-	0.00	-	-	0.00	0.99	0.99	0.50
11:00	0.95	0.95	0.94	0.98	0.99	0.99	1.04	1.03	1.05	1.02	1.04	1.02	1.06	1.10	1.05	0.77	0.78	0.76	0.78	0.82	0.76	0.94	0.94	0.91	0.00	0.00	0.00	0.97	1.06	0.98	0.95	0.97	0.85
12:00	0.96	0.99	0.97	0.98	1.00	0.97	1.04	1.03	1.05	1.04	1.05	1.03	1.09	1.11	1.07	0.78	0.76	0.77	0.88	0.86	0.85	1.01	0.98	1.02	0.00	0.00	0.00	0.93	1.01	0.94	0.97	0.98	0.87
13:00	1.00	0.99	1.01	1.01	1.02	1.03	1.08	1.06	1.09	1.10	1.10	1.10	-	-	0.00	-	-	0.00	-	-	0.00	1.09	1.05	1.10	-	-	0.00	-	-	0.00	1.06	1.04	0.53
14:00	0.94	0.96	0.95	1.00	0.99	1.01	1.08	1.01	1.08	1.01	1.04	1.01	-	-	0.00	-	-	0.00	-	-	0.00	1.09	1.07	1.09	-	-	0.00	-	-	0.00	1.02	1.02	0.51
15:00	1.01	0.98	0.99	1.00	0.99	1.00	1.19	1.14	1.21	1.10	1.15	1.10	-	-	0.00	-	-	0.00	-	-	0.00	1.03	1.04	1.04	-	-	0.00	-	-	0.00	1.07	1.06	0.53
16:00	1.10	1.07	1.10	1.05	1.03	1.04	1.18	1.13	1.19	1.02	1.05	1.03	1.06	0.93	1.05	0.89	0.75	0.86	0.92	0.81	0.91	1.28	1.28	1.32	0.00	0.00	0.00	0.96	0.93	0.97	1.05	1.00	0.95
17:00	1.04	1.05	1.04	1.06	1.06	1.04	0.77	0.79	0.76	1.09	1.09	1.10	1.01	0.86	1.02	1.14	0.90	1.16	0.97	0.82	1.00	1.07	1.08	1.07	0.00	0.00	0.00	0.96	0.88	0.99	1.01	0.95	0.92
18:00	1.06	1.07	1.03	1.03	1.04	1.02	0.65	0.70	0.64	1.09	1.08	1.10	1.12	0.96	1.11	0.90	0.76	0.89	0.95	0.83	0.95	1.11	1.10	1.09	0.00	0.00	0.00	1.00	0.93	1.01	0.99	0.94	0.89
19:00	0.99	1.04	0.94	0.92	0.96	0.89	0.59	0.64	0.60	1.05	1.03	1.08	-	-	0.00	-	-	0.00	-	-	0.00	1.02	1.04	1.04	-	-	0.00	-	-	0.00	0.91	0.94	0.45
20:00	1.03	1.02	1.04	0.93	0.93	0.94	0.84	0.85	0.82	1.26	1.23	1.25	-	-	0.00	-	-	0.00	-	-	0.00	1.55	1.42	1.62	-	-	0.00	-	-	0.00	1.12	1.09	0.57
21:00	1.03	1.00	1.06	0.87	0.89	0.88	0.69	0.70	0.68	0.98	0.96	1.00	-	-	0.00	-	-	0.00	-	-	0.00	1.51	1.34	1.67	-	-	0.00	-	-	0.00	1.02	0.98	0.53
22:00	1.06	1.07	1.10	0.86	0.88	0.88	0.46	0.50	0.41	0.92	0.86	0.91	-	-	0.00	-	-	0.00	-	-	0.00	1.89	1.70	2.10	-	-	0.00	-	-	0.00	1.04	1.00	0.54
23:00	0.91	0.89	0.88	1.03	0.99	0.98	0.47	0.49	0.44	0.87	0.87	0.89	-	-	0.00	-	-	0.00	-	-	0.00	1.78	1.53	2.14	-	-	0.00	-	-	0.00	1.01	0.95	0.53

2WAY ANALYSIS

Time	SITE 2 AND ATC 14			SITE 200 AND ATC 15			SITE 132 AND ATC 23			SITE 35 AND ATC 13			SITE 63 AND M5		
Begin	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu
00:00	1.34	1.21	1.22	1.06	0.99	1.08	0.55	0.49	0.60	0.98	0.97	0.84	-	-	-
01:00	0.88	0.92	0.70	0.97	1.01	0.85	0.70	0.66	0.66	1.05	0.94	0.78	-	-	-
02:00	0.69	0.78	0.63	0.76	0.85	0.73	1.14	0.89	1.17	1.74	1.30	1.15	-	-	-
03:00	0.69	0.76	0.53	0.73	0.83	0.65	1.89	1.60	1.92	1.18	1.09	0.80	-	-	-
04:00	0.64	0.56	0.64	0.68	0.69	0.65	4.25	3.77	4.16	1.41	1.29	1.01	-	-	-
05:00	0.97	0.97	0.94	0.87	0.88	0.88	2.56	2.52	2.64	1.53	1.43	1.10	-	-	-
06:00	1.00	1.00	1.01	0.92	0.92	0.92	2.16	2.09	2.13	1.21	1.15	0.91	-	-	-
07:00	0.93	0.93	0.93	0.98	0.96	0.98	1.02	1.06	1.02	1.32	1.26	0.98	0.99	0.77	1.00
08:00	1.08	1.06	1.07	1.16	1.11	1.19	0.75	0.83	0.73	1.15	1.13	1.12	1.12	0.89	1.13
09:00	1.01	0.99	1.00	0.96	0.96	0.96	0.78	0.86	0.77	1.14	1.10	1.32	1.16	1.03	1.18
10:00	0.95	0.93	0.95	0.98	0.96	0.98	1.01	1.02	0.99	1.29	1.18	1.20	-	-	-
11:00	0.95	0.95	0.95	0.98	0.98	0.98	1.07	1.05	1.09	0.92	0.96	0.83	1.04	1.06	1.03
12:00	0.98	0.98	1.00	1.00	1.01	0.99	1.04	1.02	1.05	0.94	0.97	0.84	1.06	1.07	1.04
13:00	0.99	0.98	1.02	0.99	0.98	1.00	1.15	1.08	1.15	0.98	0.99	0.86	-	-	-
14:00	0.93	0.95	0.93	1.00	1.01	1.00	1.16	1.10	1.15	0.94	0.97	0.95	-	-	-
15:00	0.99	0.98	0.98	1.02	1.01	1.01	1.35	1.28	1.38	0.98	1.01	1.52	-	-	-
16:00	0.93	0.96	0.93	0.99	0.99	0.99	1.12	1.09	1.12	0.94	0.96	1.45	1.01	0.88	1.00
17:00	1.04	1.04	1.03	1.04	1.04	1.04	0.76	0.76	0.76	0.98	0.99	1.12	1.00	0.84	1.01
18:00	1.05	1.06	1.04	1.00	1.02	1.00	0.60	0.64	0.59	1.03	1.02	0.93	1.06	0.91	1.07
19:00	0.99	1.02	0.95	0.91	0.95	0.88	0.59	0.64	0.60	0.94	0.94	0.83	-	-	-
20:00	0.98	0.99	0.99	0.93	0.93	0.93	0.87	0.89	0.88	1.16	1.16	1.00	-	-	-
21:00	1.02	1.02	1.04	0.87	0.88	0.86	0.71	0.73	0.71	1.51	1.30	1.41	-	-	-
22:00	1.00	1.01	1.03	0.89	0.89	0.90	0.43	0.46	0.38	1.06	0.97	0.95	-	-	-
23:00	0.90	0.90	0.92	0.97	0.98	0.94	0.45	0.48	0.44	0.84	0.83	3.04	-	-	-

Time	SITE 65 AND M4			SITE 90 AND M6			SITE 111 AND 2WLC 4			SITE 135 AND M2			SITE 133 AND M1			AVERAGE		
Begin	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu	5-Day Av	7-Day Av	Mon-Thu
00:00	-	-	-	-	-	-	1.27	1.12	1.39	-	-	-	-	-	-	1.041	0.954	0.855
01:00	-	-	-	-	-	-	1.70	1.34	1.50	-	-	-	-	-	-	1.060	0.974	0.749
02:00	-	-	-	-	-	-	2.00	1.54	1.70	-	-	-	-	-	-	1.266	1.072	0.897
03:00	-	-	-	-	-	-	1.72	1.46	1.43	-	-	-	-	-	-	1.240	1.149	0.887
04:00	-	-	-	-	-	-	1.30	1.34	1.04	-	-	-	-	-	-	1.655	1.530	1.250
05:00	-	-	-	-	-	-	1.50	1.45	1.18	-	-	-	-	-	-	1.487	1.451	1.124
06:00	-	-	-	-	-	-	1.20	1.18	0.97	-	-	-	-	-	-	1.298	1.268	0.989
07:00	0.80	0.61	0.81	0.90	0.68	0.89	0.85	0.90	0.85	0.34	0.27	0.35	1.06	0.83	1.08	0.978	0.874	0.947
08:00	0.91	0.70	0.90	1.04	0.79	1.04	1.00	1.00	0.97	0.26	0.21	0.26	0.94	0.78	0.95	0.999	0.898	0.993
09:00	0.89	0.78	0.91	0.95	0.82	0.97	1.07	1.05	1.07	0.37	0.33	0.38	1.02	0.92	1.04	1.014	0.953	1.038
10:00	-	-	-	-	-	-	0.98	0.99	0.98	-	-	-	-	-	-	1.043	1.016	0.850
11:00	0.87	0.86	0.86	0.86	0.87	0.84	0.96	0.96	0.95	0.48	0.48	0.46	0.99	1.05	0.98	0.975	0.984	0.958
12:00	0.85	0.83	0.85	0.94	0.90	0.91	1.01	1.00	1.02	0.53	0.54	0.53	1.00	1.05	0.99	0.988	0.989	0.973
13:00	-	-	-	-	-	-	1.06	1.04	1.07	-	-	-	-	-	-	1.033	1.015	0.850
14:00	-	-	-	-	-	-	1.00	1.01	1.00	-	-	-	-	-	-	1.008	1.005	0.839
15:00	-	-	-	-	-	-	0.99	0.99	0.98	-	-	-	-	-	-	1.065	1.053	0.980
16:00	0.99	0.84	0.96	0.91	0.80	0.89	1.02	1.05	1.03	0.39	0.40	0.37	0.85	0.86	0.89	0.936	0.904	0.982
17:00	1.22	1.00	1.24	0.93	0.78	0.94	0.97	0.98	0.96	0.39	0.38	0.39	0.82	0.82	0.85	0.935	0.885	0.954
18:00	0.97	0.83	0.97	1.01	0.86	1.02	1.08	1.07	1.06	0.50	0.45	0.52	0.97	0.92	0.96	0.966	0.912	0.956
19:00	-	-	-	-	-	-	0.99	1.01	1.00	-	-	-	-	-	-	0.884	0.911	0.710
20:00	-	-	-	-	-	-	1.45	1.35	1.52	-	-	-	-	-	-	1.079	1.064	0.886
21:00	-	-	-	-	-	-	1.34	1.23	1.48	-	-	-	-	-	-	1.091	1.032	0.915
22:00	-	-	-	-	-	-	1.64	1.50	1.83	-	-	-	-	-	-	1.004	0.966	0.848
23:00	-	-	-	-	-	-	1.62	1.40	1.95	-	-	-	-	-	-	0.957	0.918	1.213

no westbound direction, the eastbound flows (Dir 1) is used in the average

		Average		
		5-Day Av	7-Day Av	Mon-Thu
AM Period	07:00 - 10:00	0.997	0.908	0.993
Inter Period	11:00 - 13:00	0.981	0.987	0.966
PM period	16:00 - 19:00	0.946	0.900	0.964

MKMMM

		Average		
		5-Day Av	7-Day Av	Mon-Thu
AM Peak Hr	08:00 - 09:00	0.999	0.898	0.993
Avg IP hour	(10:00-16:00)	1.020	1.010	1.027
PM Peak Hr	17:00 - 18:00	0.935	0.885	0.954
				0.67%
				-2.72%
				4.59%

Only surveys that contain data for whole period used

Sites with full data only (IP 10:00 - 16:00)

Time	AVERAGE		
Begin	5-Day Av	7-Day Av	Mon-Thu
00:00			
01:00			
02:00			
03:00			
04:00			
05:00			
06:00			
07:00			
08:00			
09:00			
10:00	1.043	1.016	1.019
11:00	0.978	0.980	0.959
12:00	0.994	0.994	0.981
13:00	1.033	1.015	1.020
14:00	1.008	1.005	1.007
15:00	1.065	1.053	1.176
16:00			
17:00			
18:00			
19:00			
20:00			
21:00			
22:00			
23:00			

2019 Raw Survey Data

	THURSDAY 27TH JUNE		FRIDAY 28TH JUNE		SATURDAY 29TH JUNE		SUNDAY 30TH JUNE		MONDAY 1ST JULY		TUESDAY 2ND JULY		WEDNESDAY 3RD JULY	
	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
00:00	16	14	16	21	37	38	47	41	9	14	14	19	21	20
00:15	19	9	14	14	33	31	45	46	12	7	15	13	15	15
00:30	11	12	15	13	31	22	27	41	12	13	7	11	12	12
00:45	9	8	14	12	25	23	26	37	6	12	16	8	11	16
01:00	4	7	12	5	23	16	17	28	7	10	6	19	5	12
01:15	12	6	8	6	17	18	19	29	6	8	11	9	15	7
01:30	10	9	15	6	24	14	22	22	10	10	12	13	7	15
01:45	7	9	10	9	13	17	21	13	11	3	10	16	16	5
02:00	7	4	12	6	17	5	23	12	8	10	3	5	3	7
02:15	4	5	3	11	17	10	12	14	12	4	5	11	8	4
02:30	4	5	8	10	12	12	11	7	6	3	4	11	2	9
02:45	4	11	10	8	13	7	9	10	5	5	12	14	5	12
03:00	6	12	7	8	8	15	11	7	5	7	6	8	5	11
03:15	9	7	13	8	5	15	9	10	10	2	5	12	11	9
03:30	10	14	5	12	8	6	9	9	7	10	5	10	12	9
03:45	4	9	8	12	12	10	18	12	11	4	6	15	11	14
04:00	7	5	15	12	10	18	13	8	9	10	14	10	10	16
04:15	8	12	11	7	11	5	10	12	26	4	15	15	12	21
04:30	23	15	16	18	13	7	11	9	17	12	20	18	15	15
04:45	30	22	20	16	19	11	5	13	22	18	23	14	29	14
05:00	38	19	36	21	24	10	9	3	33	29	45	29	32	29
05:15	47	42	61	56	20	23	0	0	47	47	37	48	59	53
05:30	90	76	83	69	38	29	11	6	87	65	80	59	68	63
05:45	89	83	79	82	38	32	21	20	84	73	95	88	95	73
06:00	98	99	98	103	43	37	22	28	83	107	86	97	110	105
06:15	126	156	103	103	53	53	36	26	117	130	109	159	148	139
06:30	134	203	141	197	55	52	61	27	136	223	167	209	138	200
06:45	176	295	176	260	75	56	41	29	155	305	175	303	176	328
07:00	191	342	196	276	73	59	46	36	218	313	215	351	200	354
07:15	277	446	240	410	72	68	38	48	253	440	242	458	267	479
07:30	270	581	229	530	87	103	53	57	266	566	260	563	247	554
07:45	255	451	267	541	90	103	46	50	252	507	248	506	221	472
08:00	237	459	230	393	96	126	62	64	226	452	241	472	227	413
08:15	249	429	231	391	138	148	69	54	230	447	241	472	280	467
08:30	248	374	165	225	149	186	49	86	218	431	230	468	238	374
08:45	227	350	249	339	176	195	82	99	215	318	232	377	235	335
09:00	229	291	246	313	152	173	94	99	196	314	242	280	214	267
09:15	198	276	209	254	206	194	99	134	210	302	237	313	196	308
09:30	186	261	187	290	208	212	98	139	155	243	153	270	171	280
09:45	178	223	171	237	219	231	149	169	154	245	167	237	165	254
10:00	171	215	172	208	225	199	139	148	149	188	149	191	151	195
10:15	160	206	175	189	219	222	153	245	163	193	173	189	175	213
10:30	160	190	167	202	219	201	164	196	211	198	145	172	162	231
10:45	169	195	185	176	247	238	185	200	159	181	158	192	173	196
11:00	171	200	203	189	248	254	189	242	153	185	164	186	178	185
11:15	203	229	203	193	257	209	182	211	160	180	160	178	192	183
11:30	188	175	193	209	243	250	195	172	178	175	192	177	156	177
11:45	196	183	210	194	242	254	188	202	193	167	183	155	197	184
12:00	192	203	235	201	245	234	196	178	193	204	204	212	178	190
12:15	189	178	233	208	245	223	195	206	180	186	198	183	191	172
12:30	192	202	228	218	235	235	217	177	201	195	191	188	195	185
12:45	200	170	253	197	218	200	212	206	203	154	192	170	195	176
13:00	200	198	237	219	244	216	208	178	192	197	203	209	216	163
13:15	208	186	255	203	251	199	230	193	182	189	201	171	212	196
13:30	217	202	220	220	250	210	196	207	195	164	202	192	212	203
13:45	228	173	237	189	197	188	221	165	188	127	188	182	197	178
14:00	241	197	237	213	209	220	191	175	215	184	250	179	227	176
14:15	223	181	224	208	204	165	208	187	202	179	215	191	242	210
14:30	245	193	255	198	217	183	180	174	247	189	243	202	257	196
14:45	253	199	268	233	201	171	185	180	271	194	236	177	242	178
15:00	274	239	256	219	198	157	192	142	218	177	246	199	227	187
15:15	285	225	312	179	197	186	182	129	273	197	298	188	268	180
15:30	277	211	329	247	192	191	181	125	288	184	277	232	293	187
15:45	296	198	329	239	178	158	170	172	283	198	291	240	318	231
16:00	421	232	376	279	193	166	206	140	340	220	336	209	360	221
16:15	410	252	377	239	176	160	193	153	416	214	404	236	422	236
16:30	431	300	388	277	181	170	167	162	429	283	423	302	392	261
16:45	435	271	418	271	181	151	164	145	372	258	390	280	420	299
17:00	440	277	408	252	169	134	204	132	451	265	450	311	428	290
17:15	452	280	415	273	198	169	221	125	396	287	443	289	413	297
17:30	463	327	357	312	166	150	176	134	402	298	433	284	408	312
17:45	422	327	367	260	149	147	129	131	381	271	380	317	440	271
18:00	335	238	327	232	193	128	156	131	394	237	373	233	433	259
18:15	325	200	269	212	142	124	138	125	301	222	332	227	418	220
18:30	259	194	269	177	152	126	112	132	241	201	274	201	349	214
18:45	225	184	244	195	129	121	122	148	196	160	224	182	267	186
19:00	217	153	207	156	117	117	114	113	206	148	231	140	220	155
19:15	205	135	216	183	136	99	120	100	175	130	247	150	213	150
19:30	171	118	179	157	121	124	99	113	150	95	189	119	172	109
19:45	153	113	151	114	107	80	85	76	151	113	161	98	158	101
20:00	151	108	149	108	88	84	97	80	132	80	141	91	166	102
20:15	162	107	129	110	76	82	97	100	108	88	121	104	118	105
20:30	130	96	117	75	94	90	97	69	92	71	114	69	115	93
20:45	101	83	97	81	67	59	66	60	97	84	92	60	120	91
21:00	118	76	117	82	87	95	64	55	92	56	93	81	89	74
21:15	90	86	97	73	71	61	54	59	84	67	109	84	88	76
21:30	92	69	83	70	79	66	57	65	73	66	93	66	83	75
21:45	81	80	87	64	68	48	54	56	64	42	78	77	85	64
22:00	91	74	89	62	88	78	55	41	111	58	91	86	88	56
22:15	92	71	95	91	96	73	60	44	58	62	70	66	71	60
22:30	56	54	68	66	62	79	27	44	45	40	51	63	75	69
22:45	58	42	62	48	78	68	40	32	42	41	35	51	49	70
23:00	43	39	78	48	72	54	46	39	33	36	44	33	48	52
23:15	55	30	57	52	52	58	24	19	33	32	36	28	73	29
23:30	32	39	45	42	39	59	15	21	30	29	33	30	30	30
23:45	27	18	46	48	44	46	21	21	24	21	17	24	20	27

	THURSDAY 27TH JUNE		FRIDAY 28TH JUNE		SATURDAY 29TH JUNE		SUNDAY 30TH JUNE		MONDAY 1ST JULY		TUESDAY 2ND JULY		WEDNESDAY 3RD JULY	
hourly	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
00:00	55	43	59	60	126	114	145	165	39	46	52	51	59	63
01:00	33	31	45	26	77	65	79	92	34	31	39	57	43	39
02:00	19	25	33	35	59	34	55	43	31	22	24	41	18	32
03:00	29	42	33	40	33	46	47	38	33	23	22	45	39	43
04:00	68	54	62	53	53	41	39	42	74	44	72	57	66	66
05:00	264	220	259	228	120	94	41	29	251	214	257	224	254	218
06:00	534	753	518	663	226	198	160	110	491	765	537	768	572	772
07:00	993	1820	932	1757	322	333	183	191	989	1826	965	1878	935	1859
08:00	961	1612	875	1348	559	655	262	303	889	1648	944	1789	980	1589
09:00	791	1051	813	1094	785	810	440	541	715	1104	799	1100	746	1109
10:00	660	806	699	775	910	860	641	789	682	760	625	744	661	835
11:00	758	787	809	785	990	967	754	827	684	707	699	696	723	729
12:00	773	753	949	824	943	892	820	767	777	739	785	753	759	723
13:00	853	759	949	831	942	813	855	743	757	677	794	754	837	740
14:00	962	770	984	852	831	739	764	716	935	746	944	749	968	760
15:00	1132	873	1226	884	765	692	725	568	1062	756	1112	859	1106	785
16:00	1697	1055	1559	1066	731	647	730	600	1557	975	1553	1027	1594	1017
17:00	1777	1211	1547	1097	682	600	730	522	1630	1121	1706	1201	1689	1170
18:00	1144	816	1109	816	616	499	528	536	1132	820	1203	843	1467	879
19:00	746	519	753	610	481	420	418	402	682	486	828	507	763	515
20:00	381	311	384	289	305	270	229	235	313	231	373	308	345	289
21:00	381	311	384	289	305	270	229	235	313	231	373	308	345	289
22:00	297	241	314	267	324	298	182	161	256	201	247	266	283	255
23:00	157	126	226	190	207	217	106	100	120	118	130	115	171	138

	MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
00:00	14	14	17	22	21	25	20	10	18	28	43	38	45	27
00:15	15	6	16	18	15	22	13	7	11	12	31	24	35	46
00:30	11	10	7	10	11	10	11	14	13	7	22	17	29	31
00:45	7	10	17	8	10	16	9	8	13	8	23	18	26	33
01:00	2	9	6	12	8	11	4	8	12	3	23	22	24	28
01:15	9	6	12	11	10	7	14	4	0	0	21	16	20	23
01:30	9	9	13	12	6	13	9	12	0	0	22	18	29	24
01:45	13	6	8	13	16	6	7	7	0	0	18	11	19	16
02:00	8	7	7	6	6	6	5	6	0	0	15	7	25	12
02:15	9	9	3	8	6	3	3	3	0	0	14	9	15	14
02:30	7	2	3	12	3	7	4	5	0	0	12	12	7	7
02:45	4	3	10	10	6	9	4	4	0	0	14	5	12	11
03:00	7	7	5	9	4	8	5	7	0	0	11	13	10	6
03:15	6	1	3	6	12	10	8	10	0	0	7	13	9	12
03:30	6	11	5	15	9	10	6	13	0	0	7	8	9	8
03:45	11	7	9	15	16	14	4	9	0	0	8	9	13	5
04:00	11	6	15	15	6	11	7	5	0	0	9	12	8	6
04:15	18	3	12	14	12	18	10	9	0	0	10	7	7	7
04:30	18	10	19	18	14	15	18	12	0	0	8	8	11	12
04:45	20	15	24	11	29	15	24	24	0	0	18	12	5	15
05:00	32	30	32	25	29	31	35	22	0	0	16	11	16	11
05:15	40	42	34	50	43	53	44	38	0	0	17	20	12	7
05:30	65	58	57	55	56	53	65	65	0	0	38	23	21	14
05:45	62	72	81	83	74	65	74	78	0	0	40	30	15	18
06:00	66	89	76	91	87	85	69	77	0	0	35	34	20	25
06:15	83	110	82	118	127	119	98	129	0	0	45	49	27	21
06:30	109	185	135	171	118	174	109	167	0	0	41	48	56	22
06:45	133	252	151	239	135	255	133	239	0	0	53	53	31	32
07:00	172	254	183	271	179	283	172	262	0	0	67	44	38	26
07:15	202	338	182	336	207	328	204	327	0	0	64	57	36	36
07:30	220	346	203	358	214	365	214	358	0	0	67	87	43	62
07:45	212	341	244	344	203	338	246	337	0	0	76	95	37	50
08:00	209	301	222	330	208	311	222	341	0	0	85	105	60	54
08:15	236	319	243	320	234	344	233	321	0	0	119	115	60	59
08:30	188	321	243	316	226	314	209	299	263	275	118	161	52	73
08:45	207	302	227	320	208	298	205	294	220	270	160	184	83	81
09:00	180	235	205	270	185	260	180	241	220	244	149	144	85	81
09:15	185	250	191	225	178	250	168	216	190	220	151	176	86	113
09:30	155	202	162	200	153	230	187	193	158	240	188	195	93	121
09:45	142	189	167	218	157	224	154	184	182	181	179	208	125	137
10:00	153	176	144	161	126	169	141	187	145	186	183	191	107	122
10:15	150	170	158	163	152	178	154	180	173	172	180	181	142	180
10:30	176	167	131	158	160	195	135	149	137	192	183	175	151	166
10:45	154	156	160	166	148	169	163	169	166	149	213	216	160	164
11:00	152	171	150	169	167	190	158	176	194	181	206	207	176	209
11:15	148	164	149	165	177	153	170	178	183	161	189	169	152	159
11:30	160	150	186	175	140	151	176	155	189	199	197	206	174	164
11:45	178	159	172	157	180	154	178	151	165	178	201	222	186	164
12:00	185	181	176	192	169	180	177	179	215	198	243	202	177	154
12:15	169	157	202	173	182	166	189	163	219	199	241	199	202	181
12:30	180	186	177	170	201	168	184	167	234	177	224	213	181	161
12:45	192	152	206	166	182	182	176	167	232	175	239	205	190	162
13:00	199	190	176	162	223	131	185	183	228	192	241	188	184	155
13:15	174	168	207	162	202	153	183	172	218	189	234	189	210	168
13:30	177	157	173	173	187	165	205	184	180	174	235	185	193	150
13:45	200	159	174	156	200	149	186	138	206	168	192	169	210	152
14:00	198	159	232	161	209	181	218	169	222	193	189	192	189	136
14:15	185	146	203	180	230	193	218	146	225	180	197	149	176	153
14:30	220	168	232	181	220	180	221	171	244	188	215	151	187	153
14:45	236	163	236	161	225	180	255	171	265	225	180	153	164	136
15:00	244	169	266	186	253	182	259	186	267	190	179	155	172	129
15:15	244	166	241	187	240	190	240	215	292	210	168	142	171	114
15:30	224	170	248	203	281	189	264	202	287	235	197	170	174	2
15:45	262	167	255	197	266	169	254	165	318	219	180	128	147	1
16:00	336	183	346	208	322	189	400	171	373	232	179	166	196	1
16:15	381	172	407	190	372	201	375	198	372	210	171	140	150	88
16:30	386	228	382	230	370	215	389	233	375	232	169	147	159	124
16:45	382	232	385	229	372	234	420	215	388	220	179	131	153	130
17:00	405	211	403	250	380	227	436	217	401	205	159	124	203	101
17:15	447	243	439	235	421	240	452	243	374	247	169	133	199	102
17:30	412	256	408	220	412	240	459	229	355	258	110	164	178	109
17:45	420	228	444	243	396	195	362	250	365	216	152	115	122	120
18:00	303	201	338	192	366	204	341	190	332	203	173	117	156	109
18:15	269	212	254	178	365	172	307	174	267	175	136	107	118	106
18:30	221	177	244	179	258	175	245	183	241	168	142	110	100	120
18:45	192	135	237	158	237	175	200	141	220	160	147	98	100	106
19:00	188	135	208	115	200	138	200	158	183	147	108	87	93	97
19:15	181	115	228	116	184	140	175	132	205	168	133	85	116	90
19:30	143	96	167	123	161	104	182	116	162	132	108	111	100	81
19:45	131	121	152	88	153	87	152	96	149	132	98	83	90	72
20:00	128	86	133	96	155	101	139	104	126	101	97	72	101	68
20:15	106	71	114	87	123	91	141	103	134	114	86	65	97	88
20:30	103	76	98	79	113	81	120	92	109	98	94	79	84	66
20:45	98	78	109	61	105	87	98	69	96	52	68	65	77	55
21:00	76	58	97	67	101	63	104	63	117	74	94	72	61	54
21:15	85	61	98	76	100	77	97	82	102	78	75	60	56	47
21:30	82	53	95	58	86	73	95	62	78	65	77	42	53	53
21:45	72	49	80	81	91	64	82	73	83	70	75	65	55	48
22:00	102	52	91	85	86	68	97	56	92	53	88	73	51	40
22:15	64	49	72	64	66	53	81	66	91	75	86	69	49	37
22:30	47	41	44	61	79	54	53	48	74	66	55	53	35	46
22:45	34	35	43	39	48	54	55	34	59	44	74	78	39	39
23:00	35	34	33	34	42	33	43	38	74	50	71	61	50	25
23:15	26	29	40	26	66	33	63	34	61	47	39	52	26	24
23:30	31	23	38	28	31	26	30	40	51	44	45	49	19	17
23:45	14	20	16	22	26	19	36	19	46	43	46	44	20	20

	MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
hourly	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
00:00	47	40	57	58	57	73	53	39	55	55	119	97	135	137
01:00	33	30	39	48	40	37	34	31	12	3	84	67	92	91
02:00	28	21	23	36	21	25	16	18	0	0	55	33	59	44
03:00	30	26	22	45	41	42	23	39	0	0	33	43	41	31
04:00	67	34	70	58	61	59	59	50	0	0	45	39	31	40
05:00	199	202	204	213	202	202	218	203	0	0	111	84	64	50
06:00	391	636	444	619	467	633	409	612	0	0	174	184	134	100
07:00	806	1279	812	1309	803	1314	836	1284	0	0	274	283	154	174
08:00	840	1243	935	1286	876	1267	869	1255	483	545	482	565	255	267
09:00	662	876	725	913	673	964	689	834	750	885	667	723	389	452
10:00	633	669	593	648	586	711	593	685	621	699	759	763	560	632
11:00	638	644	657	666	664	648	682	660	731	719	793	804	688	696
12:00	726	676	761	701	734	696	726	676	900	749	947	819	750	658
13:00	750	674	730	653	812	598	759	677	832	723	902	731	797	625
14:00	839	636	903	683	884	734	912	657	956	786	781	645	716	578
15:00	974	672	1010	773	1040	730	1017	768	1164	854	724	595	664	246
16:00	1485	815	1520	857	1436	839	1584	817	1508	894	698	584	658	343
17:00	1684	938	1694	948	1609	902	1709	939	1495	926	590	536	702	432
18:00	985	725	1073	707	1226	726	1093	688	1060	706	598	432	474	441
19:00	643	467	755	442	698	469	709	502	699	579	447	366	399	340
20:00	315	221	370	282	378	277	378	280	380	287	321	239	225	202
21:00	315	221	370	282	378	277	378	280	380	287	321	239	225	202
22:00	247	177	250	249	279	229	286	204	316	238	303	273	174	162
23:00	106	106	127	110	165	111	172	131	232	184	201	206	115	86

	THURSDAY 27TH JUNE		FRIDAY 28TH JUNE		SATURDAY 29TH JUNE		SUNDAY 30TH JUNE		MONDAY 1ST JULY		TUESDAY 2ND JULY		WEDNESDAY 3RD JULY	
	EB (Arm B exit)	WB (Arm B approach)	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
07:00	187	295												
07:15	196	338												
07:30	228	384												
07:45	205	408												
08:00	196	387												
08:15	189	395												
08:30	164	405												
08:45	186	405												
09:00	163	318												
09:15	172	288												
09:30	165	270												
09:45	172	304												
11:00	177	216												
11:15	161	221												
11:30	167	220												
11:45	167	213												
12:00	175	198												
12:15	185	228												
12:30	178	239												
12:45	193	252												
16:00	300	220												
16:15	275	229												
16:30	301	233												
16:45	292	256												
17:00	298	291												
17:15	267	283												
17:30	272	271												
17:45	189	301												
18:00	204	256												
18:15	231	262												
18:30	218	258												
18:45	201	261												

	THURSDAY 27TH JUNE		FRIDAY 28TH JUNE		SATURDAY 29TH JUNE		SUNDAY 30TH JUNE		MONDAY 1ST JULY		TUESDAY 2ND JULY		WEDNESDAY 3RD JULY	
hourly	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
07:00	816	1425	0	0	0	0	0	0	0	0	0	0	0	0
08:00	735	1592	0	0	0	0	0	0	0	0	0	0	0	0
09:00	672	1180	0	0	0	0	0	0	0	0	0	0	0	0
11:00	672	870	0	0	0	0	0	0	0	0	0	0	0	0
12:00	731	917	0	0	0	0	0	0	0	0	0	0	0	0
16:00	1168	938	0	0	0	0	0	0	0	0	0	0	0	0
17:00	1026	1146	0	0	0	0	0	0	0	0	0	0	0	0
18:00	854	1037	0	0	0	0	0	0	0	0	0	0	0	0

	THURSDAY 27TH JUNE		FRIDAY 28TH JUNE		SATURDAY 29TH JUNE		SUNDAY 30TH JUNE		MONDAY 1ST JULY		TUESDAY 2ND JULY		WEDNESDAY 3RD JULY	
	EB (B exit)	WB (B Approach	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
07:00	148	193												
07:15	184	226												
07:30	240	315												
07:45	248	406												
08:00	235	439												
08:15	205	473												
08:30	178	472												
08:45	169	451												
09:00	121	298												
09:15	149	274												
09:30	128	219												
09:45	98	198												
	0	0												
11:00	96	132												
11:15	100	162												
11:30	131	177												
11:45	134	147												
12:00	143	131												
12:15	153	155												
12:30	135	147												
12:45	144	137												
	0	0												
16:00	0	0												
16:15	0	0												
16:30	0	0												
16:45	0	0												
17:00	0	0												
17:15	0	0												
17:30	0	0												
17:45	0	0												
18:00	0	0												
18:15	0	0												
18:30	0	0												
18:45	0	0												

RESURVEY TUESDAY 08.10.2019

	EB (B exit)	WB (B Approach	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
07:00	121	218												
07:15	193	310												
07:30	245	407												
07:45	275	472												
08:00	256	476												
08:15	231	464												
08:30	210	524												
08:45	173	477												
09:00	147	340												
09:15	133	273												
09:30	110	221												
09:45	108	202												
11:00	114	160												
11:15	109	143												
11:30	115	163												
11:45	131	148												
12:00	137	141												
12:15	125	140												
12:30	149	144												
12:45	155	136												
16:00	346	173												
16:15	333	200												
16:30	376	195												
16:45	360	175												
17:00	394	201												
17:15	432	208												
17:30	345	186												
17:45	340	198												
18:00	299	206												
18:15	297	214												
18:30	199	165												
18:45	146	133												

	THURSDAY 27TH JUNE		FRIDAY 28TH JUNE		SATURDAY 29TH JUNE		SUNDAY 30TH JUNE		MONDAY 1ST JULY		TUESDAY 2ND JULY		WEDNESDAY 3RD JULY	
hourly	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
07:00	820	1140	0	0	0	0	0	0	0	0	0	0	0	0
08:00	787	1835	0	0	0	0	0	0	0	0	0	0	0	0
09:00	496	989	0	0	0	0	0	0	0	0	0	0	0	0
11:00	461	618	0	0	0	0	0	0	0	0	0	0	0	0
12:00	575	570	0	0	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0

hourly	EB	WB
07:00	834	1407
08:00	870	1941
09:00	498	1036
11:00	469	614
12:00	566	561
16:00	1415	743
17:00	1511	793
18:00	941	718

	THURSDAY 27TH JUNE		FRIDAY 28TH JUNE		SATURDAY 29TH JUNE		SUNDAY 30TH JUNE		MONDAY 1ST JULY		TUESDAY 2ND JULY		WEDNESDAY 3RD JULY	
	EB (B exit)	WB (B Approach)	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
07:00	54	129												
07:15	98	172												
07:30	134	216												
07:45	203	223												
08:00	172	239												
08:15	207	255												
08:30	196	257												
08:45	191	264												
09:00	128	158												
09:15	97	148												
09:30	94	135												
09:45	91	134												
11:00	73	115												
11:15	84	109												
11:30	89	128												
11:45	88	120												
12:00	97	160												
12:15	104	148												
12:30	108	124												
12:45	111	160												
16:00	123	179												
16:15	165	173												
16:30	153	191												
16:45	141	160												
17:00	130	231												
17:15	134	188												
17:30	132	198												
17:45	122	194												
18:00	120	172												
18:15	109	166												
18:30	111	129												
18:45	98	131												

hourly	THURSDAY 27TH JUNE		FRIDAY 28TH JUNE		SATURDAY 29TH JUNE		SUNDAY 30TH JUNE		MONDAY 1ST JULY		TUESDAY 2ND JULY		WEDNESDAY 3RD JULY	
	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
07:00	489	740	0	0	0	0	0	0	0	0	0	0	0	0
08:00	766	1015	0	0	0	0	0	0	0	0	0	0	0	0
09:00	410	575	0	0	0	0	0	0	0	0	0	0	0	0
11:00	334	472	0	0	0	0	0	0	0	0	0	0	0	0
12:00	420	592	0	0	0	0	0	0	0	0	0	0	0	0
16:00	582	703	0	0	0	0	0	0	0	0	0	0	0	0
17:00	518	811	0	0	0	0	0	0	0	0	0	0	0	0
18:00	438	598	0	0	0	0	0	0	0	0	0	0	0	0

	THURSDAY 27TH JUNE		FRIDAY 28TH JUNE		SATURDAY 29TH JUNE		SUNDAY 30TH JUNE		MONDAY 1ST JULY		TUESDAY 2ND JULY		WEDNESDAY 3RD JULY	
	EB (D approacl	WB (D Exit)	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
07:00	206	307												
07:15	273	367												
07:30	320	436												
07:45	384	429												
08:00	370	413												
08:15	354	428												
08:30	375	357												
08:45	339	381												
09:00	294	301												
09:15	236	272												
09:30	235	223												
09:45	190	235												
11:00	198	206												
11:15	214	216												
11:30	215	206												
11:45	204	196												
12:00	233	224												
12:15	259	213												
12:30	204	215												
12:45	250	222												
16:00	460	279												
16:15	442	262												
16:30	478	319												
16:45	473	334												
17:00	501	328												
17:15	522	350												
17:30	502	355												
17:45	429	346												
18:00	419	291												
18:15	378	249												
18:30	317	228												
18:45	265	208												

	THURSDAY 27TH JUNE		FRIDAY 28TH JUNE		SATURDAY 29TH JUNE		SUNDAY 30TH JUNE		MONDAY 1ST JULY		TUESDAY 2ND JULY		WEDNESDAY 3RD JULY	
hourly	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
07:00	1183	1539	0	0	0	0	0	0	0	0	0	0	0	0
08:00	1438	1579	0	0	0	0	0	0	0	0	0	0	0	0
09:00	955	1031	0	0	0	0	0	0	0	0	0	0	0	0
11:00	831	824	0	0	0	0	0	0	0	0	0	0	0	0
12:00	946	874	0	0	0	0	0	0	0	0	0	0	0	0
16:00	1853	1194	0	0	0	0	0	0	0	0	0	0	0	0
17:00	1954	1379	0	0	0	0	0	0	0	0	0	0	0	0
18:00	1379	976	0	0	0	0	0	0	0	0	0	0	0	0

	THURSDAY 27TH JUNE		FRIDAY 28TH JUNE		SATURDAY 29TH JUNE		SUNDAY 30TH JUNE		MONDAY 1ST JULY		TUESDAY 2ND JULY		WEDNESDAY 3RD JULY	
	EB (E approach)	WB (C Exit)	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
07:00	50	139												
07:15	84	200												
07:30	100	269												
07:45	133	318												
08:00	103	346												
08:15	120	365												
08:30	97	367												
08:45	112	349												
09:00	92	200												
09:15	82	159												
09:30	73	135												
09:45	63	141												
11:00	69	87												
11:15	80	107												
11:30	102	123												
11:45	81	108												
12:00	117	115												
12:15	118	113												
12:30	103	108												
12:45	96	131												
16:00	183	123												
16:15	188	138												
16:30	191	142												
16:45	165	125												
17:00	185	161												
17:15	163	142												
17:30	156	154												
17:45	146	160												
18:00	139	125												
18:15	116	131												
18:30	116	110												
18:45	89	89												

hourly	THURSDAY 27TH JUNE		FRIDAY 28TH JUNE		SATURDAY 29TH JUNE		SUNDAY 30TH JUNE		MONDAY 1ST JULY		TUESDAY 2ND JULY		WEDNESDAY 3RD JULY	
	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
07:00	367	926	0	0	0	0	0	0	0	0	0	0	0	0
08:00	432	1427	0	0	0	0	0	0	0	0	0	0	0	0
09:00	310	635	0	0	0	0	0	0	0	0	0	0	0	0
11:00	332	425	0	0	0	0	0	0	0	0	0	0	0	0
12:00	434	467	0	0	0	0	0	0	0	0	0	0	0	0
16:00	727	528	0	0	0	0	0	0	0	0	0	0	0	0
17:00	650	617	0	0	0	0	0	0	0	0	0	0	0	0
18:00	460	455	0	0	0	0	0	0	0	0	0	0	0	0

	MONDAY 1ST		TUESDAY 2ND		WEDNESDAY 3RD		THURSDAY 27TH		FRIDAY 28TH		SATURDAY 29TH		SUNDAY 30TH	
	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB
00:00	6	8	6	16	8	6	7	8	11	8	14	14	12	21
00:15	7	7	8	7	3	2	4	3	8	9	10	17	8	18
00:30	1	6	5	11	1	9	4	11	4	5	8	9	10	9
00:45	2	12	5	5	5	1	4	4	3	8	8	12	6	14
01:00	5	4	5	7	9	7	6	6	7	6	4	5	5	10
01:15	2	6	2	5	1	5	3	7	2	2	9	6	4	11
01:30	5	1	2	7	8	2	1	2	0	0	8	4	7	6
01:45	0	1	6	1	3	2	6	3	0	0	5	7	7	6
02:00	1	4	0	3	3	6	3	4	0	0	1	8	5	6
02:15	4	3	4	4	3	1	3	1	0	0	3	1	3	4
02:30	5	1	4	1	3	5	4	4	0	0	4	3	2	7
02:45	2	4	1	7	4	4	1	3	0	0	5	4	6	6
03:00	1	1	4	2	2	3	0	2	0	0	2	3	1	3
03:15	1	3	1	4	7	7	3	5	0	0	9	4	4	3
03:30	2	4	9	5	6	2	5	9	0	0	5	1	3	3
03:45	4	3	3	9	2	6	3	4	0	0	2	6	3	3
04:00	5	4	9	3	5	7	3	3	0	0	1	5	1	8
04:15	2	5	8	7	11	12	3	9	0	0	2	4	2	4
04:30	8	5	6	13	9	6	11	5	0	0	5	4	2	1
04:45	10	24	13	20	6	14	9	11	0	0	7	5	5	1
05:00	12	5	9	6	15	11	13	10	0	0	6	7	3	7
05:15	17	7	28	15	19	15	25	15	0	0	10	7	13	5
05:30	30	20	35	20	36	12	42	26	0	0	21	9	9	5
05:45	34	41	28	40	33	48	31	42	0	0	18	14	10	17
06:00	24	27	35	30	37	29	33	36	0	0	14	16	2	14
06:15	42	26	52	29	57	33	44	26	0	0	13	11	10	6
06:30	65	33	75	25	60	37	59	36	0	0	28	14	20	4
06:45	78	49	80	52	74	57	84	48	0	0	24	28	13	9
07:00	110	75	117	71	110	62	94	60	0	0	30	18	15	9
07:15	154	81	162	90	140	109	144	101	152	94	35	16	17	16
07:30	204	146	223	150	204	125	201	124	174	136	48	37	18	7
07:45	202	175	227	225	242	214	208	199	204	200	49	30	25	18
08:00	228	200	250	206	233	201	210	219	200	192	53	39	13	12
08:15	203	251	245	267	206	277	215	271	177	254	66	38	21	16
08:30	193	276	220	271	187	270	191	275	139	223	73	45	20	19
08:45	184	248	198	273	181	249	182	249	143	124	68	53	28	19
09:00	119	140	117	176	161	155	106	149	82	104	84	43	30	23
09:15	100	99	114	100	116	99	103	101	85	99	82	51	48	18
09:30	92	81	110	79	96	84	102	80	92	82	82	64	52	38
09:45	93	74	88	87	101	76	96	80	99	76	89	82	76	42
10:00	81	66	75	78	90	59	74	66	66	67	87	58	57	36
10:15	74	65	82	35	92	80	91	61	74	86	95	65	53	56
10:30	80	62	64	65	57	65	42	37	95	63	92	87	74	45
10:45	82	82	70	67	91	87	93	81	93	72	98	80	62	46
11:00	90	67	75	79	59	73	66	71	88	77	86	66	72	55
11:15	48	63	62	63	85	80	82	79	70	65	78	82	76	72
11:30	87	87	74	60	77	100	69	105	90	73	98	90	61	70
11:45	64	70	91	91	84	93	72	75	87	98	82	103	75	61
12:00	90	88	109	77	78	87	110	80	129	98	95	104	62	73
12:15	89	79	91	94	99	95	103	90	89	88	98	98	75	61
12:30	88	79	103	87	109	96	103	107	109	95	89	87	76	87
12:45	85	107	93	100	94	123	94	95	100	129	74	126	67	63
13:00	109	91	122	83	108	104	109	97	103	124	80	99	50	99
13:15	69	106	84	103	84	104	75	106	85	121	76	104	63	72
13:30	49	55	99	118	85	90	98	98	92	124	81	78	82	87
13:45	88	114	72	91	68	109	83	109	99	105	64	79	81	76
14:00	105	80	96	111	96	111	110	114	107	113	86	88	84	73
14:15	81	112	98	107	80	98	70	123	81	107	71	87	79	80
14:30	98	101	101	85	97	115	88	117	101	111	63	83	60	81
14:45	94	104	92	93	89	109	79	111	86	131	57	103	75	82
15:00	91	128	95	126	92	95	120	137	110	119	75	82	68	96
15:15	102	112	103	120	112	127	121	102	85	142	63	75	58	62
15:30	94	119	98	108	86	140	102	114	98	147	65	72	46	56
15:45	94	92	92	130	103	113	112	123	108	126	52	61	62	76
16:00	146	127	138	139	155	110	139	138	135	140	63	79	54	83
16:15	120	128	110	119	128	135	132	130	157	145	66	67	38	69
16:30	165	133	173	150	143	171	171	140	147	135	58	63	46	56
16:45	121	129	147	148	145	113	127	134	159	136	70	74	40	53
17:00	213	170	233	181	245	168	206	158	204	153	60	81	48	45
17:15	167	164	206	162	198	168	181	146	146	116	70	63	37	59
17:30	209	162	228	161	229	146	200	157	160	153	64	76	44	52
17:45	172	140	168	148	151	202	167	141	115	125	60	68	48	53
18:00	144	120	142	132	141	202	142	118	93	138	47	70	55	56
18:15	102	103	117	135	120	216	105	123	91	109	51	65	47	43
18:30	100	86	89	95	84	126	112	116	82	83	55	59	59	53
18:45	75	95	66	91	80	103	80	76	69	97	47	51	38	41
19:00	65	66	84	94	86	101	85	86	86	89	50	42	41	49
19:15	60	75	74	81	71	76	66	81	57	83	30	56	41	50
19:30	59	58	69	68	57	80	58	69	59	69	25	45	39	34
19:45	60	69	41	65	48	65	57	78	52	74	40	36	23	39
20:00	47	50	55	73	67	76	45	74	54	71	25	51	32	58
20:15	34	40	50	55	33	65	46	54	34	42	27	36	49	47
20:30	21	33	41	44	39	58	36	43	25	51	33	44	26	36
20:45	25	49	40	34	42	56	29	42	33	49	32	53	20	39
21:00	27	43	24	42	25	53	36	35	35	48	34	49	16	21
21:15	36	30	34	26	38	41	34	43	34	52	22	40	15	26
21:30	32	34	37	24	47	39	44	55	50	34	18	24	22	18
21:45	27	31	20	29	25	33	25	44	28	31	29	32	9	34
22:00	24	43	49	43	35	45	37	37	40	43	22	29	15	24
22:15	22	33	21	39	24	30	21	51	31	36	25	35	9	17
22:30	15	22	19	31	13	28	13	45	30	36	18	26	14	21
22:45	17	26	15	23	17	21	18	25	14	24	19	22	14	17
23:00	22	16	6	13	16	17	19	25	20	19	12	30	17	16
23:15	9	18	8	20	12	21	14	17	22	24	16	19	7	9
23:30	12	12	12	14	8	7	5	5	17	21	17	15	8	9
23:45	8	12	4	5	12	14	8	6	12	23	18	18	7	9

	MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
hourly	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB
00:00	16	33	24	39	17	18	19	26	26	30	40	52	36	62
01:00	12	12	15	20	21	16	16	18	9	8	26	22	23	33
02:00	12	12	9	15	13	16	11	12	0	0	13	16	16	23
03:00	8	11	17	20	17	18	11	20	0	0	18	14	11	12
04:00	25	38	36	43	31	39	26	28	0	0	15	18	10	14
05:00	93	73	100	81	103	86	111	93	0	0	55	37	35	34
06:00	209	135	242	136	228	156	220	146	0	0	79	69	45	33
07:00	670	477	729	536	696	510	647	484	530	430	162	101	75	50
08:00	808	975	913	1017	807	997	798	1014	659	793	260	175	82	66
09:00	404	394	429	442	474	414	407	410	358	361	337	240	206	121
10:00	317	275	291	245	330	291	300	245	328	288	372	290	246	183
11:00	289	287	302	293	305	346	289	330	335	313	344	341	284	258
12:00	352	353	396	358	380	401	410	372	427	410	356	415	280	284
13:00	315	366	377	395	345	407	365	410	379	474	301	360	276	334
14:00	378	397	387	396	362	433	347	465	375	462	277	361	298	316
15:00	381	451	388	484	393	475	455	476	401	534	255	290	234	290
16:00	552	517	568	556	571	529	569	542	598	556	257	283	178	261
17:00	761	636	835	652	823	684	754	602	625	547	254	288	177	209
18:00	421	404	414	453	425	647	439	433	335	427	200	245	199	193
19:00	244	268	268	308	262	322	266	314	254	315	145	179	144	172
20:00	122	138	115	121	135	166	139	177	147	165	103	145	62	99
21:00	122	138	115	121	135	166	139	177	147	165	103	145	62	99
22:00	78	124	104	136	89	124	89	158	115	139	84	112	52	79
23:00	51	58	30	52	48	59	46	53	71	87	63	82	39	43

Appendix E

ANPR JOURNEY TIME DATA

Public

				07:30 to 07:45		07:45 to 08:00		08:00 to 08:15		08:15 to 08:30		08:30 - 08:45		08:45 - 09:00		16:30 - 16:45		16:45 - 17:00		17:00 - 17:15		17:15 - 17:30		17:30 - 17:45		17:45 - 18:00	
No.	Path Reference	Origin	Destination	Mins	Seconds	Mins	Seconds	Mins	Seconds	Mins	Seconds	Mins	Seconds	Mins	Seconds	Mins	Seconds	Mins	Seconds	Mins	Seconds	Mins	Seconds	Mins	Seconds	Mins	Seconds
1	M1 (E) to M1 (W)	1a	1b	3.36	202	3.50	210	3.75	225	3.60	216	3.48	209	3.51	211	3.47	208	3.46	207	3.45	207	3.45	207	3.43	206	3.43	206
2	M1 (E) to P&R Site	1a	1d	2.72	163	2.97	178	3.37	202	2.99	179	-	-	3.22	193	2.54	152	2.42	145	2.70	162	-	-	-	-	2.66	159
3	M1 (E) to A509 (W)	1a	2a	3.23	194	3.62	217	4.55	273	4.12	247	3.97	238	3.71	223	3.24	194	3.20	192	3.23	194	3.19	192	3.19	191	3.26	196
4	M1 (E) to A5130	1a	2b	3.37	202	3.66	219	4.51	270	4.18	251	3.98	239	3.68	221	3.22	193	3.22	193	3.07	184	3.17	190	3.27	196	3.36	202
5	M1 (E) to A4146	1a	2c	3.21	193	3.39	203	4.05	243	3.80	228	3.59	216	3.57	214	3.18	191	3.17	190	3.16	190	3.14	188	3.17	190	3.14	188
6	M1 (E) to A509 (N)	1a	3a	4.41	265	4.26	256	4.85	291	4.58	275	4.48	269	4.12	247	3.80	228	4.14	248	4.31	258	4.35	261	4.17	250	4.30	258
7	M1 (W) to M1 (E)	1b	1a	3.54	212	3.44	207	3.46	208	3.53	212	3.45	207	3.42	205	3.46	207	3.49	209	3.44	207	3.45	207	3.43	206	3.44	206
8	M1 (W) to P&R Site	1b	1d	4.09	245	-	-	2.94	176	-	-	-	-	-	-	-	-	2.20	132	2.45	147	-	-	-	-	2.86	171
9	M1 (W) to A509 (W)	1b	2a	3.99	240	4.18	251	4.42	265	4.70	282	4.39	263	3.46	208	2.99	179	3.27	196	3.23	194	3.30	198	2.99	179	3.31	199
10	M1 (W) to A5130	1b	2b	4.40	264	4.06	244	3.93	236	4.27	256	4.10	246	3.29	198	3.02	181	3.46	208	3.37	202	3.29	198	3.46	208	3.45	207
11	M1 (W) to A4146	1b	2c	4.21	252	4.11	247	3.91	235	4.52	271	4.01	241	3.37	202	3.03	182	3.20	192	3.14	189	3.15	189	3.21	193	3.19	192
12	M1 (W) to A509 (N)	1b	3a	2.38	143	2.33	140	2.03	122	2.47	148	2.02	121	1.99	120	1.95	117	2.01	121	1.90	114	1.96	118	1.99	119	1.95	117
13	A509 (N) to M1 (E)	3a	1a	3.78	227	2.95	177	2.90	174	4.31	258	3.16	189	2.80	168	2.84	171	2.96	178	3.10	186	2.80	168	2.88	173	2.83	170
14	A509 (N) to M1 (W)	3a	1b	3.99	239	3.57	214	3.86	232	4.13	248	3.68	221	3.06	184	2.74	165	2.87	172	3.64	218	2.93	176	3.28	197	3.31	199
15	A509 (N) to A509 (W)	3a	2a	3.24	195	3.23	194	4.06	244	4.59	276	3.34	200	1.92	115	2.21	132	2.38	143	2.90	174	2.45	147	2.19	131	2.04	122
16	A509 (N) to A5130	3a	2b	3.47	208	2.89	174	3.21	193	4.89	294	3.11	187	2.33	140	1.84	110	2.61	157	2.63	158	2.29	137	2.74	164	2.51	151
17	A509 (N) to A4146	3a	2c	3.09	185	2.99	179	3.27	196	4.27	256	3.65	219	2.31	138	1.98	119	2.46	148	2.74	165	2.05	123	2.49	150	2.55	153
18	A509 (W) to M1 (E)	2a	1a	3.77	226	3.74	225	3.71	223	3.90	234	3.84	230	3.66	220	3.90	234	3.98	239	4.20	252	4.43	266	4.29	257	4.01	241
19	A509 (W) to M1 (W)	2a	1b	2.39	143	2.38	143	2.33	140	2.45	147	2.53	152	2.34	141	2.59	155	2.63	158	3.03	182	3.65	219	3.41	205	2.66	160
20	A509 (W) to A5130	2a	2b	0.98	59	1.13	68	1.05	63	1.03	62	1.18	71	1.09	65	0.82	49	0.93	56	0.79	47	0.82	49	0.78	47	0.74	45
21	A509 (W) to A4146	2a	2c	2.03	122	0.72	43	0.97	58	1.41	84	1.23	74	0.82	49	0.58	35	-	-	-	-	1.04	62	0.90	54	1.28	77
22	A509 (W) to A509 (N)	2a	3a	1.71	103	2.22	133	-	-	-	-	2.90	174	1.59	95	1.89	114	1.83	110	2.73	164	3.36	202	2.65	159	2.20	132
23	A5130 to M1 (E)	2b	1a	4.63	278	4.24	254	4.30	258	4.23	254	4.15	249	4.59	276	4.01	241	4.20	252	4.21	252	4.34	261	4.50	270	4.73	284
24	A5130 to M1 (W)	2b	1b	3.20	192	2.74	165	2.76	166	3.20	192	3.30	198	3.06	184	3.06	183	3.07	184	3.70	222	4.15	249	3.62	217	3.67	220
25	A5130 to A509 (W)	2b	2a	0.86	52	1.17	70	0.84	51	0.89	54	0.89	54	0.83	50	0.59	36	0.75	45	0.64	39	0.71	42	0.63	38	0.75	45
26	A5130 to A4146	2b	2c	0.95	57	0.88	53	0.95	57	1.00	60	0.98	59	1.03	62	0.63	38	0.55	33	0.65	39	0.66	40	0.77	46	0.81	49
27	A5130 to A509 (N)	2b	3a	3.20	192	2.68	161	2.34	140	2.97	178	2.54	153	2.44	146	2.27	136	2.43	146	3.23	194	3.37	202	2.85	171	2.77	166
23	A4146 to M1 (E)	2c	1a	4.27	256	3.96	238	3.68	221	4.23	254	4.20	252	3.94	237	4.21	253	4.30	258	4.53	272	4.67	280	4.60	276	4.35	261
24	A4146 to M1 (W)	2c	1b	2.67	160	2.65	159	2.69	161	2.86	171	3.00	180	2.66	160	3.10	186	2.92	175	3.36	201	3.81	229	3.58	215	3.41	205
25	A4146 to A509 (W)	2c	2a	-	-	0.19	11	-	-	-	-	0.20	12	-	-	-	-	-	-	-	-	-	-	0.70	42	0.85	51
26	A4146 to A5130	2c	2b	1.09	66	1.44	86	1.27	76	1.09	65	0.92	55	0.78	47	0.77	46	1.10	66	1.20	72	0.91	55	1.13	68	1.17	70
27	A4146 to A509 (N)	2c	3a	2.17	130	2.64	158	2.18	131	2.21	132	2.48	149	1.78	107	2.30	138	2.25	135	2.91	175	3.19	192	2.81	168	2.63	158
28	Newport Lane to M1 (E)	3b	1a	-	-	-	-	-	-	6.73	404	-	-	-	-	-	-	4.81	289	-	-	4.31	259	-	-	-	-
29	Newport Lane to M1 (W)	3b	1b	4.20	252	5.67	340	6.07	364	5.00	300	5.05	303	4.00	240	4.15	249	4.73	284	4.98	299	4.56	274	4.61	276	4.46	268
30	Newport Lane to A509 (W)	3b	2a	4.38	263	4.01	241	5.93	356	5.56	334	4.82	289	3.67	220	3.05	183	3.97	238	4.31	258	3.67	220	3.90	234	4.03	242
31	Newport Lane to A5130	3b	2b	4.39	263	4.61	276	4.95	297	-	-	4.84	290	3.19	191	2.80	168	3.50	210	5.19	311	4.17	250	3.98	239	3.37	202
32	Newport Lane to A4146	3b	2c	3.96	238	4.15	249	5.13	308	5.26	315	4.47	268	3.45	207	3.09	185	4.11	246	4.43	266	3.59	215	3.83	230	3.91	234

Unit 9, The Chase
John Tate Road, Foxholes Business Park
Hertford
SG13 7NN

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Berkeley St James

MILTON KEYNES EAST

Paramics Model Addendum to LMVR and Responses to AECOM Queries

JANUARY 2021

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Berkeley St James

MILTON KEYNES EAST

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TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70057521

DATE: JANUARY 2021

Berkeley St James

MILTON KEYNES EAST

Paramics Model Addendum to LMVR and Responses to AECOM Queries

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	V1.2			
Date	14/1/21			
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Project number	7005752			
Report number				
File reference	\\uk.wspgroup.com\central data\Projects\700575xx\70057521 - MKE - PLANNING APPLICATION\03 WIP\TP Transport Planning\03 Document\Paramics			

CONTENTS

APPENDICES

1 INTRODUCTION

1.1 FOREWORD

1.1.1. This report has been prepared for Berkeley St James regarding the Paramics modelling associated with the proposed Milton Keynes East development. The report responds to comments made by AECOM, reviewing the model on behalf of Highways England, in their Technical Note 08 dated 10 November 2020 (Appendix A) which in turn was a response to matters of clarification to a previous AECOM review.

1.1.2. Technical Note 8 refers to 15 Items, of which three are identified as resolved (Items 6, 7 and 10). Consequently, further response to those items is not required and none will be provided in this report. This report should be read in conjunction with the September 2020 response to understand the history of the responses.

1.1.3. The report also contains an Addendum to the LMVR, describing the revalidation of the model in light of AECOM's comments and against the additional journey time data.

1.2 REPORT STRUCTURE

1.2.1. Chapter 2 of this report responds to the comments made by AECOM on their Technical Note 08

1.2.2. Chapter 3 provides details of the revalidation of the Paramics model against an updated matrix from the ANPR and against the new Trafficmaster journey time data.

2 RESPONSES TO AECOM QUERIES

2.1 ITEM 1: PEAK HOUR SELECTION

2.1.1. Regarding the peak hours, TN08 requests further information to demonstrate that the modelled peak hours are appropriate.

2.1.2. As set out in the previous response, the Paramics model has been validated for the following peak hours:

- AM Peak 08:00 to 09:00
- PM Peak 17:00 to 18:00

2.1.3. The model also has warm-up and cool-down periods of 60 minutes, which means that the model also includes the shoulder peaks surrounding the main validation peak as well.

2.1.4. The above peaks have been chosen for the following reasons:

- The purpose of the model is to assess the impacts of the proposed Milton Keynes development for which the above times are predicted to be the peak hours for the Transport Assessment;
- The forecasting (years 2031, 2048) will be undertaken based on data extracted from the Saturn strategic model which has the same peak hours as those validated for the Paramics model; and
- The traffic forecasting for the proposed development is an hourly forecast and ties up with the peaks above.

2.1.5. As identified in the previous response, the network peaks are those set out in Table 2-1 along with the difference in total network flow between the modelled and network peak.

Table 2-1 – Network Peaks and Flow Difference to Validation Peak

	Time	Flow Difference to Validated Peak
AM Peak	07:45 – 08:45	+1
PM Peak	16:30 – 17:30	+294

2.1.6. It is evident that there is very little traffic difference between the two AM peaks meaning that choosing the 08:00 peak will have a negligible impact on the model. It is also noted that there is a three-quarter hour overlap between the model and network peaks meaning that the model should amply represent conditions in the marginally higher peak.

2.1.7. While the difference in flow between the PM peak is larger than in the AM peak, it is still the case that there is a 30 minute overlap between the two peaks, and that any issues evident in the earlier peak will be represented in the model warm up period (it is likely that by 16:30 traffic conditions will be representative).

2.1.8. Due to the purpose of the model and the other data that is being used for the model forecasts it is therefore considered that the model peak hours are appropriate for the purpose of the model.

2.2 ITEM 2: ANPR DATA SAMPLES

2.2.1. At paragraph 2.3.12 of TN08, AECOM requests evidence to demonstrate that the ANPR cameras are not underrepresenting certain traffic lanes. Appendix B contains images of the views from the ANPR cameras providing more detail of these camera views. It is evident from the camera views shown at Appendix B, that the ANPR cameras are well positioned and have a clear view of all traffic lanes, and that queuing would not have adversely impacted on turning proportions.

2.3 ITEM 3: FORECAST DEMAND METHODOLOGY

2.3.1. In their Technical Note 08, AECOM requests further details of the forecasting methodology to clarify how the modelling will take account of the development trips and the impact of the roadworks in the Paramics model.

2.3.2. The traffic forecasting for the Paramics model will be undertaken using data from the Saturn strategic model, based on a cordon of the strategic model that is commensurate with the Paramics model study area. It is understood that agreement of the Saturn model forecasts is subject to separate discussions between WSP, AECOM and Highways England.

2.3.3. With regards to the roadworks, the model will be amended to reflect the smart motorway that is currently under construction, including any associated speed limits (but not the automatic speed limit changes). It seems likely that the peak speed limit within the proposed smart motorway would be less than 70mph, but as a start the motorway will be recoded with a 70mph speed limit.

2.3.4. The forecast traffic inputs to the Paramics model will be identified by calculating the difference in flow between the base year Saturn model flows and the forecast year Saturn model flows for each scenario and then by adding the "difference matrix" to the base year Paramics model. In the "with development" scenarios this difference matrix will not only include traffic redistribution in the local area but also the development traffic. It is understood that the Saturn model already address the "roadworks" issue and that the flows from that model will be representative when added to the Paramics matrix.

2.4 ITEMS 4 AND 14: JOURNEY TIMES

2.4.1. Further to the concerns raised by AECOM regarding the use of the ANPR based journey times, WSP has obtained 2019 Trafficmaster, journey time data from the DfT for the area covered by Milton Keynes district. The data provided by the DfT was in a raw, unprocessed format that required the data to be processed into a usable format before it could then be used to calculate the journey times on links in the model study area.

2.4.2. Using the PANDAS data analysis functions in Python, WSP merged all of the raw data files into a single data table, and then filtered the data to:

- Remove non-neutral months
- Remove school holidays, bank holidays and any non-neutral days associated with those holidays
- Remove Friday, Saturday and Sunday (as per WebTAG) as a non-neutral days;
- Filter to ensure that the GMT based data took account of the clock change to BST during the summer months;
- Filtered to AM and PM peak data only (08:00 – 09:00 and 17:00 – 18:00)
- Filtered to only select links within or adjacent to the Paramics model study area.

2.4.3. Once the data had been filtered to remove non-neutral data, it was then processed to find the average link journey time for each ITN link.

2.4.4. The Trafficmaster data has then been processed to match 29 new journey paths in the Paramics model. This will provide more detailed information about the potential breakdown of journey times in the model. It should be noted that the ANPR data will be regarded as the main data source, while the Trafficmaster data will be treated as a secondary, supplementary data source.

2.4.5. Further comparisons between the Trafficmaster and ANPR journey times can be found in the addendum LMVR in Section 3.

2.5 ITEM 5 AND 13: QUEUE LENGTHS

2.5.1. As described in WSP's previous response, the queue length data was collected using cameras that had been installed at safe sites on the approaches to the junctions in the Paramics model study area. The queue length data was reported in two forms:

- Queues at the signal junctions shown as the maximum queue at green in each cycle
- Queues at the priority junctions shown as the maximum queue observed every minute through the peaks.

2.5.2. It is evident from the survey data outputs contained in Appendix B that there were instances when the on-street queue length exceeded the length that could be observed by the cameras – in this case highlighted using a coloured fill in the table cell. Reviewing these instances of excess queueing that could not be recorded by the cameras indicates that, in general, the queues only exceed the distance viewable from the survey cameras for a short time (normally up to six minutes/ cycles), suggesting that the queue is unlikely to be significantly longer than has been reported.

2.5.3. As suggested by AECOM, WSP has also reviewed the Google Traffic data for the local area for typical traffic conditions, but unfortunately the data is now showing "during-COVID" traffic conditions rather than the pre-COVID conditions, meaning that this data is not reliable.

2.5.4. WSP therefore believes that the queue length data obtained during the traffic surveys is reliable, and is the best source of data available for model calibration. Details of the queue length calibration are provided within the addendum LMVR in Section 3.

2.6 ISSUE 8: HEADWAY SETTINGS

2.6.1. During the model revalidation, the increased traffic flow through the network has allowed some of the higher gap times to be revisited.

2.6.2. In 2.4.11 in their TN, AECOM suggests that a saturation flow validation could be undertaken against either observed or RR67 based saturation flows. Firstly, as the surveys were not designed to collect saturation flows, many of the camera angles do not provide sufficient view to calculate observed saturation flows. WSP also believes that the MOVA operation of the junctions would increase the saturation flow above that predicted by RR67 meaning that using these estimates would be unreliable.

2.6.3. Additionally, Paramics Discovery does not automatically collect any files that allow saturation flows on individual links to be measured, meaning that they would have to be recorded from observations of the model visualisation, which can be subjective and potentially unreliable. Consequently, WSP believes that there is insufficient data to provide a Saturation Flow calibration for the model.

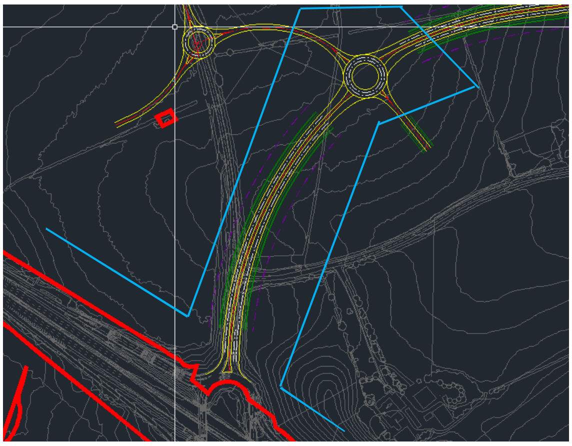
2.6.4. As there is no further evidence relating to the headway adjustments, the adjustments to headway have been made in an informed manner during model calibration to ensure that there is sufficient throughput of traffic at the signal junctions. This is a normal part of calibration in Paramics Discovery and it is considered that the headway factors used are within the normal range for calibration adjustments. It is therefore considered that these adjustments are appropriate.

2.7 ISSUE 9: COST FACTORS

2.7.1. As mentioned in WSP's previous response, the cost factors used in the model do not have any relevance as there is no route choice available. WSP acknowledges the comment that the cost factors should be considered in any forecast models, particularly if any minor route choices are implemented.

2.7.2. The proposals to be added into the model are the rerouting of the A509 to a new alignment, including closure of the existing A509/ Newport Road junction and the first new roundabout to the north of the M1 only. An indicative arrangement (which may be subject to change) is shown in Figure 2-1 below – the cordon of the development case model is shown as a blue line.

Figure 2-1 - Indicative Development Schemes Included in Model



2.7.3. The model will also include the smart motorway scheme on the M1, including the new slip road arrangements – these will also be present in the reference case models. It is evident that the additional development information to be added to the Paramics model will not introduce any additional route choice and therefore the current cost factors remain appropriate.

2.7.4. It is understood that if the model is later expanded to include route choice that this may require amended cost factors, but it is not anticipated that this would affect the model validation.

2.8 ISSUE 10: TRAFFIC DEMANDS

2.8.1. Changes have been made to the demand methodology after it was identified that the matrix had not been uplifted to match the full traffic sample, from the sample rate. The matrix has now been uplifted to match the full traffic sample, the remaining matrix build process remains as set out in the original response.

2.9 ISSUE 11: NUMBER OF RUNS

2.9.1. A total of 15 model runs has been undertaken for validation of the model, which is considered ample for a model of this size. Further details relating to model variability are provided in Section 3 covering the model revalidation.

2.10 ISSUE 12: LATENT DEMAND

2.10.1. Any latent demand (recorded in Paramics as unreleased vehicles) has been reported in the updated model validation, and the length of any links where this occurs has been extended as far as practicable.

2.10.2. It should be noted that the delay to unreleased vehicles is recorded for each vehicle until it's journey is completed.

3 ADDENDUM TO LMVR

3.1 FOREWORD

3.1.1. This section should be read in conjunction with the Local Model Validation Report dated April 2020. The purpose of this report is to set out the revalidation of the Paramics Discovery model of M1 Junction 14 and the Northfield Roundabout in Milton Keynes.

3.2 ADDITIONAL DATA

3.2.1. Following concerns raised by AECOM with regards to the journey times recorded by the ANPR surveys, it was agreed that a secondary data source of journey time data be used as verification. For this reason, WSP has obtained 2019 TrafficMaster data from the DFT for the Milton Keynes area.

3.2.2. The data provided by the DfT was unprocessed raw CSV tables containing millions of rows of data, far more than could be displayed in an Excel worksheet. Consequently, WSP has used the PANDAS data analysis functions in Python, WSP merged all of the raw data files into a single data table, and then filtered the data to:

- Remove non-neutral months
- Remove school holidays, bank holidays and any non-neutral days associated with those holidays
- Remove Friday, Saturday and Sunday (as per WebTAG) as a non-neutral days;
- Filter to ensure that the GMT based data took account of the clock change to BST during the summer months;
- Filtered to AM and PM peak data only
- Filtered to only select links within or adjacent to the Paramics model study area.

3.2.3. Once the data had been filtered to remove non-neutral data, it was then processed to find the average link journey time for each ITN link and journey time.

3.2.4. The Trafficmaster data has then been processed to match 30 new journey paths in the Paramics model. This will provide more detailed information about the potential breakdown of journey times in the model. It should be noted that the ANPR data will be regarded as the main data source, while the Trafficmaster data will be treated as a secondary, supplementary data source.

3.3 AMENDED MATRIX AND PROFILES

3.3.1. While reviewing AECOM's comments it became apparent that the ANPR matrix had been partly uplifted from the number of matches to the sample, but that it had not been uplifted to reflect the total vehicle count.

3.3.2. This change has mainly affected the larger flows in the network. The turning counts used in the validation had also only been partly uplifted so these have also been amended to reflect the total traffic flow.

3.4 TRAFFIC COUNT CALIBRATION

3.4.1. As in the LMVR, at least 85% of traffic counts must pass one of two tests, one based on GEH being <5, the other based on the flow magnitude. Table 3-1 summarises the performance of the model against these criteria – full details of the criteria can be found in the LMVR. One outlier run (the 15th

AM peak run) showing much longer queueing on the A509W than in other scenarios has been identified and has been removed from the model results).

Table 3-1 – Flow calibration summary (% Passing test)

	AM Peak	PM Peak
GEH < 5	80.6%	91.7
Flow < 700	78.6%	92.6
Flow 700-2700	85.7%	100
Flow > 700	100.0%	100
Passing Either Test	86.1%	94.4

3.4.2. The revised model is showing a good level calibration against the observed flow data, with 86% of traffic counts passing in the AM peak and 94% passing in the PM peak. Detailed flow calibration results are contained in Appendix D for the AM and PM Peaks

3.4.3. While the above flow calibration passes the TAG requirements for both peaks, it is noted that many of the modelled flows in the AM peak are higher than observed. WSP has reviewed the total demand in the matrix for each zone, which appears to be satisfactory – it is considered that these results could be improved upon with a few more model adjustments, and WSP will endeavour to do this prior to the meeting with Highways England.

3.5 QUEUE CALIBRATION

3.5.1. In general, the model shows a good level of queue calibration between observed and modelled queues. Queue graphs comparing modelled and observed queues are contained in Appendix E for the AM peak and Appendix F for the PM Peak

3.5.2. It is noted that the AM Peak A509 queue southbound towards Junction 14 is longer than observed because queue lengths were only collected to the Newport Road junction. It is noted that the sum of the two modelled journey times on this approach to the roundabout are very close to the sum of the two observed journey times, and this provides confidence that the level of delay being shown on the A509 southbound is appropriate.

3.6 JOURNEY TIME VALIDATION

3.6.1. As set out in the LMVR, 85% of modelled journey times must be within the greater of 15% of the observed or 60s of the observed. It is generally preferred to meet the 15% criteria, however for some short routes this can be as little as ±1 second, meaning that it cannot always be achieved.

3.6.2. Table 3-2 summarises the journey time performance of the model for the ANPR sites.

Table 3-2 – ANPR Journey Times (% passing)

	AM Peak	PM Peak
Within 15%	75.0%	75.0%

Within 60s	100.0%	91.6%
Total	100.0%	91.6%

3.6.3. The model also has a total of 29 Trafficmaster journey time routes. These are typically very short, which means that the 15% criteria will be very hard to achieve. The performance of the model against the Trafficmaster data is summarised in Table 3-3 below

Table 3-3 – Trafficmaster Journey Times (%passing)

	AM Peak	PM Peak
Within 15%	17.2%	10.3%
Within 60s	96.5%	93.1%
Total	96.5%	93.1%

3.6.4. The 15% performance is good for the ANPR data, and there is a good level of match between the model and Trafficmaster data, with it passing validation on the 60 second criteria. Table 3-4 shows the performance against the combined ANPR and Trafficmaster data.

Table 3-4 – Combined ANPR and Trafficmaster journey time performance (% passing)

	AM Peak	PM Peak
Within 15%	34.1%	29.3%
Within 60s	97.6%	92.7%
Total	97.6%	92.7%

3.6.5. Detailed tables showing the Trafficmaster and ANPR journey time validation are contained in Appendix G along with a plan showing the locations of each Trafficmaster journey time route.

3.6.6. Based on the tables above, it is considered that the model is showing a good level of performance against the observed journey time data and that the model is therefore suitable for testing the impacts of the proposed development.

3.7 MODEL/ JOURNEY TIME VARIABILITY

3.7.1. In terms of model variability, the main variance will be as result of traffic flow variation between runs, because the model has no route choice and cannot significantly vary between runs. This means that the main sources of variability are likely to be the traffic signals, which are responding to the traffic demand using scripts,

3.7.2. The journey time variability check in the model reports checks if the 95% confidence interval of the modelled journey time is within 5% of the modelled mean. This test is quite strict and does not always mean that the individual journey time suffers large swings of variability – very often it can be only a few seconds outside the window. In the AM peak 75.6% of journey times pass variability checks, but there is no evidence on the queue graphs of any significant outlier groups of runs, just a wider range of different journey times due to the interaction of the signal operation and release profile of traffic. In the PM peak 95% of journey times pass the variability check, showing that the PM peak model is less variable than the AM.

3.7.3. In addition, the confidence interval of the average travel time per vehicle across the whole network is just 6 seconds in the AM peak and 1 seconds in the PM peak, suggesting that the seeded runs are not significantly variable.

3.7.4. It is noted that the journey time on the Newport Road approach to the A509 is significantly longer than observed because traffic struggles to find sufficient gaps to join the major road. WSP has reviewed the input flow and traffic profiles on the A509 and on Newport Road and both reflect the observed traffic data. Additionally several tests, including the implementation of a dummy signal to allow courtesy let out behaviours (which remains in the model) have been used to assist vehicles exiting Newport Road but to prevent a full reversal of priority, which can sometimes happen in queued conditions.

3.8 LATENT DEMAND

3.8.1. Latent demand relates to vehicles queued outside the model that cannot enter the model due to downstream congestion. In Paramics, the model recognises the release of the individual vehicle, and while it is not recorded within the queue length, it's journey time (and hence delay) are recorded.

3.8.2. The model is generally showing queues within its boundaries and no queueing into zones, with the exception of some occasional latent demand on the M1 westbound entry (due to a rolling queue that typically dissipates before the end of the peak hour) and on Newport Road, during the AM peak – this queue normally dissipates within the validation peak, with a few exceptions where latent demand of around 50 vehicles can be seen at the end of the peak, however these trips can complete during the model cool down and their travel times are accounted for in the model results.

3.8.3. It is evident that the latent demand on Newport Road could be being caused by the traffic passing the end of the road being slightly too high in the AM peak, reducing the number of gaps available to traffic from Newport Road.

3.9 REVALIDATION CONCLUSION

3.9.1. The model revalidation has shown that over 85% of traffic counts and journey times meet the criteria set out in WebTAG in both AM and PM peaks. The queue graphs also show a good correlation between modelled and observed queues and do not indicate that there are any significant outlier runs contained in the model results. The model shows some latent demand on the A509N and occasionally on the M1 east.

3.9.2. While the model is passing all validation criteria, WSP is continuing to look at opportunities to refine the model operation to better represent turning flows in the AM peak, specifically at the following locations:

- A509 Southbound and Newport Road – to reduce queueing on Newport Road
- Traffic towards M1 eastbound – to reduce slight overprediction of flows in the AM peak in the model.

Appendix A

AECOM NOTE

Project:	**Milton Keynes East**	Job No:	**60600479** **DM016.007**
Subject:	**Review of WSP Response to MKE Paramics LMVR Comments**		
Prepared by:	**Jay Shah**	Date:	**02/11/2020**
Checked by:	**Phil Arnold**	Date:	**06/11/2020**
Verified by:	**Colin Hardie/Liz Judson**	Date:	**10/11/2020**
Approved by:	**John Alderman**	Date:	**10/11/2020**

1 Introduction

1.1.1 AECOM has previously been commissioned by Highways England (HE) to undertake a review of the Local Model Validation Report (LMVR) produced by WSP for Milton Keynes East (MKE) modelling. The LMVR documents the development, calibration and validation of the Paramics Discovery model that will be used as a base to test the impact of a proposed development "Milton Keynes East". The review did not include any audit of the Paramics model itself.

1.1.2 The findings of the review conducted by AECOM are documented in Technical Note 05 ("Review of Paramics LMVR Report"). The review indicated that there were a significant number of issues to which AECOM had requested further clarification and justification.

1.1.3 In order to respond to these findings from AECOM (TN 05), WSP have produced document (Ref: "Response to MKE Paramics LMVR Comments", dated September 2020). This document provides detailed clarification and additional information to provide better clarity on the issues identified by AECOM.

1.1.4 Highways England (HE) has requested that AECOM undertake a review of the document developed by WSP in response to AECOM's initial findings. This technical note (TN 08) documents the review of the response note from WSP and provides comments to conclude if the issues are resolved.

1.1.5 The purpose of this review is to verify if all the issues identified by AECOM in the previous review are resolved. Based on the documentation provided, the review will conclude whether the base model is likely to be representative of the current conditions in the area and provide a reliable basis for forecasting. It should again be noted that the models have not been audited by AECOM and therefore these cannot be fully verified.

2 Review of WSP Responses

2.1 Introduction

2.1.1 This section details the issue identified in the previous audit by AECOM and WSP's response to those issues. Based on the responses from WSP, AECOM has assessed whether the issue is resolved. AECOM has made further recommendations if the issues are unresolved.

2.1.2 Similar to the previous review, each issue is categorised into following categories:

MINOR – item is an advisory and can either be accommodated / changed or clarified with additional information;

MEDIUM – item requires remediation or an additional explanation on why it has been done, which will then be re-considered;

SIGNIFICANT – item requires correction before it can be reconsidered for review.

2.2 Model Specification Issues

Issue 1: Unclear how peak hour was determined

2.2.1 In the previous review AECOM requested the following:

"Additional information regarding how the peak hour was chosen would be helpful in determining validity of approach."

2.2.2 WSP in the response document has provided a table of hourly flows during AM and PM based on ANPR data. The ANPR data indicates that the peak hour in the AM starts at 07.45 and the peak hour in the PM starts at 16.30.

2.2.3 WSP stated that the purpose of the Paramics model is to assess the impact of the proposed MKE development on M1 Junction 14 and the Northfield roundabout. The peak trip generations based on the Transport Assessment for this proposed development are estimated to be between 08.00 – 09.00 in AM and between 17.00 – 18.00 in PM. The strategic model to be used to develop the forecast year models has the peak hours from 08.00 to 09.00 in AM and from 17.00 to 18.00 in PM. Thus, the peak hours selected for the base Paramics model are in accordance with the Transport Assessment and Strategic Model peak hours. It is noted that the AM calculated peak hour is similar to the peak hour selected, although the PM peak hour chosen is more distinct from the one calculated from ANPR data.

2.2.4 Based on the comments provided, AECOM understands that WSP has assumed the peak hours are consistent with those in the Transport Assessment. AECOM cannot verify the method in the Transport Assessment so cannot determine how peak hours were calculated. As WSP has shown, the Transport Assessment peak hours do not match with the peak hours calculated from the ANPR data. It is reasonable to consider the development trip generation, but ideally the combined profile of surveyed traffic and development trip generation would be assessed. The strategic model is based on data collected over a much wider network, so the choice of peak hour for that model is not relevant to the local microsimulation model. It is noted that the choice of peak hour may also be influenced by delay information, if there is significant congestion which causes a dip in the profiles of traffic counts, but that does not appear to be the case in the study area.

2.2.5 It is recommended that further information is provided, to show that traffic volumes in the peak hours calculated from the ANPR data are not significantly higher the surveyed traffic flows in the modelled peak hours. Although it is recognised that the peak development trip generation will be modelled, there is a risk that lower trip generation would have greater impact if base traffic conditions are more congested. This issue is therefore unresolved and is considered **MEDIUM**

2.2.6 It should be noted that the base model may not be suitable for other purposes, due to the peak hour being aligned to the peak development trip generation.

2.3 Data Collection Issues

Issue 2: ANPR data collection, reliability and verification process unclear

2.3.1 In the previous review AECOM requested the following:

"Information to help determine that the data collected on 27th June 2019 is a representative day.

Evidence of ATC data used to verify the profile should be provided to show representative day and verify ANPR data.

Capture rate of ANPR data not provided to support use of this data."

2.3.2 Section 3.2.3 of the WSP document states "AECOM on behalf of Highways England this was issued 21 June 2019, as confirmed by Highways England, "The review confirms that your approach to traffic survey is sensible"."

2.3.3 It should be noted that although AECOM considered that the approach of data collection was sensible, the LMVR developed by WSP did not fully demonstrate how this approach was implemented, so AECOM requested clarification during the previous review.

2.3.4 WSP stated that various discussions occurred between WSP and Highways England, Milton Keynes Council and Highways England SMART motorway team with regards to conducting the surveys. The following data was collected during the ANPR surveys:

- OD movement matrices for matched number plates;
- Link counts at the entries to the ANPR cordon;
- Details of the proportion of matched number plates;
- OD journey times; and
- Trip chains

2.3.5 The two-way link count data of two sites located on the edge of the model study area has been reviewed – Site 2 located at A5130, east of the Northfield Roundabout and Site 25 located at A509, north of Newport Road. Table 1 below shows the AM and PM peak hour data at these sites during the surveyed dates.

Table 1: Two-Way Link Counts Data

Count Date	Site 25 – A5130		Site 2 – A509	
	08:00-09:00	17:00-18:00	08:00-09:00	17:00-18:00
Thurs 27/6/19	1318	1837	1181	1284
Fri 28/6/19	1202	1837	1063	1176
Sat 29/6/19	981	1244	452	611
Sun 30/6/19	593	1277	224	659
Mon 1/7/19	1106	1830	1110	1244
Tue 2/7/19	1132	1880	1211	1258
Wed 3/7/19	1001	1888	1129	1240
Weekday Mean	1151.8	1854.4	1138.8	1240.4

Ref: WSP Document (Response to MKE Paramics LMVR Comments)

2.3.6 Based on the comparison it is seen that the modelled day (Thursday 27th June 2019) is reasonably close or higher than the average Weekday peak hour flows at these sites. It is also noted that the AM peak at Site 25 is considerably higher than the weekday average flows which must be considered in developing the forecast scenarios. However, AECOM notes that the sample size (one week) is not high, and it is best practice to consider at least two weeks of link count data for the comparison. However, as it is not possible to collect further data AECOM considers this issue to be resolved.

2.3.7 Furthermore, WSP has provided the capture rate information for the ANPR data based on MCC data comparison. Figure 1 shows the capture rate at all the sites where ANPR cameras were installed.

	Overall Sample Rates			Inbound Sample Rates			Outbound Sample Rates			Inbound Match Rates		
Site	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Matched Plates	Match Rate
01a	85251	76940	90%	43599	39487	91%	41652	37453	90%	43599	35928	82%
01b	81690	75082	92%	39020	36700	94%	42670	38382	90%	39020	34448	88%
01d	331	275	83%	-	-	-	331	275	83%	-	-	-
02a	19370	13724	71%	9633	5950	62%	9737	7774	80%	9633	5606	58%
02b	10221	9212	90%	6114	5316	87%	4107	3896	95%	6114	4343	71%
02c	22521	19125	85%	10280	8228	80%	12241	10897	89%	10280	7031	68%
03a	17358	13681	79%	8829	8519	96%	8529	5162	61%	8829	7924	90%
03b	3996	3843	96%	2118	2078	98%	1878	1765	94%	2118	1791	85%
Total	**240738**	**211882**	**88%**	**119593**	**106278**	**89%**	**121145**	**105604**	**87%**	**119593**	**97071**	**81%**

External Site
Internal Site

*Inbound match rates are only shown for the external sites that have traffic inbound to the study area
*For internal sites, the MCC and capture data will relate to EB and WB or NB and SB as opposed to Inbound and Outbound

Ref: WSP Document (Response to MKE Paramics LMVR Comments)

Figure 1 – ANPR Capture Rate

2.3.8 WSP in the response document has quoted in Section 3.2.11 "The data shows a reasonably good level of plate matching across all sites."

2.3.9 As seen in the data, there are a few locations where the capture rate shows a significant number of plates are not captured. For example, Site "02a" has an inbound capture rate of 62%. Similarly, Site "03a" has the outbound sample rate of 61%.

2.3.10 It is standard practice to uplift the volume of trips captured by ANPR cameras, based on the capture rate provided (calculated from an MCC conducted using the video footage) to provide the actual volume of vehicles passing each ANPR site.

2.3.11 WSP has confirmed in Section 5.2.4 that "The matrices for these vehicle classes were expanded from the sample matrix to a full population matrix using the match rate data provided by the survey company and were then compared to the observed link counts at the ANPR cordon sites to ensure that the resultant flows at the zone entries/exits were appropriate. Following expansion of the matrices, the differences between the totals of the original sample matrices and the expanded full population matrices are as set out in Table 5-3 below." Table 2 below shows the difference between the Sample and Population matrices from ANPR data.

Table 2: Difference between Sample and Population matrices from ANPR

	AM Period	PM Period
ANPR Matrix (Sample)	26285	27601
Matrix (full population)	28065	29715
Difference	+1780	+2114
% Difference	6.8%	7.7%

Ref: WSP Document (Response to MKE Paramics LMVR Comments)

2.3.12 Based on this evidence provided by WSP, AECOM can confirm that the approach to uplift the flows based on the capture rate information is sensible and valid. However, AECOM has concerns that low capture rates at some of the sites (as listed above) may impact the turning proportions at the roundabouts. There is a concern that some traffic lanes may be obscured by queuing or other factors and are therefore under-represented. It is therefore recommended that WSP provides evidence that the ANPR cameras at these sites did not underrepresent certain lanes/ movements and the vehicle turning proportions are not impacted. This issue is therefore considered as unresolved and is **SIGNIFICANT**.

Issue 3: Ongoing roadworks during data collection

2.3.13 In the previous review AECOM requested the following:

"Reassurances should be provided regarding use of data collected during ongoing works on the A421 and M1 Smart motorway schemes. Details of how any future changes in traffic flows arising from these roadworks coming to an end will be considered in forecast scenarios should be provided."

2.3.14 WSP has stated that the roadworks (on the M1 to install smart motorway infrastructure and roadworks associated with widening the A421) are long term, spanning several years, meaning that it would be impossible to avoid collecting data whilst they are ongoing, without delaying planning applications across the entire sub-region that is affected by the works. WSP has stated that they confirmed that there were no road closures during the survey period. It is further confirmed by WSP in Section 3.3.8 that "WSP were also present on site on the day of the surveys to review conditions in the tail end of the PM peak. On site observations outlined that Junctions 13 and 14 were operating well with no issues that could be identified on site. It was noted that the mainline was also free-flowing. Whilst the SMART motorways works were visible and in place, there were three lanes of clear moving traffic throughout site observations."

2.3.15 Section 3.3.10 of the WSP document states "The impact of the roadworks will, however, be addressed in the modelling. For example, in the validation model the speed limit on the M1 has been reduced to around 50mph to account for the reduced speed limit within the roadworks. Once the validation model is acceptable, a "base" model will be created that reinstates the proper motorway speed limit and includes the impact of the smart motorway on the number of lanes available on the M1 and on the slip roads to Junction 14."

2.3.16 WSP has further stated in Section 3.3.13 “A review of WebTRIS data on the A421 (northbound and southbound on link A421 between M1 and A428) indicates that using data from w/c 15 October 2018 and w/c 14 October 2019 that 2019 flows are broadly higher than 2018. This is consistent for both directions and indicates that the variability between the two years is not large. This would demonstrate that the long-term road works do not appear to have materially altered the traffic flows on the A421. Arguably, it is therefore likely that the M1 does not suffer from large variance in traffic flows due to the road works.”

2.3.17 Based on the provided information, AECOM understands that it was not possible for WSP to avoid the roadworks during the planned surveys as these are long-term. WSP has also sought to establish, as far as possible, that traffic conditions were not impacted significantly. Further, the approach to update the validated base model with the actual speed limits is deemed reasonable as that would mean there is a fair comparison with the forecast scenarios.

2.3.18 Further, WSP have stated that the forecast year traffic flows for the Paramics model will be derived from the Strategic model of the area as this will include all demands for trips in the local area. The impacts from road works in 2019 flows will not materially affect the future year demand matrices.

2.3.19 AECOM understands that taking an absolute growth from strategic models and applying to the base Paramics model flows (the base Paramics model flows could be lower than the actual flows due to roadworks) could result in lower forecast year flows. It is recommended that the forecast year demand methodology be documented to provide AECOM better clarity. This issue is considered as **MEDIUM**.

Issue 4: Journey times are based on ANPR data, number of journey time samples and assessment of reliability not provided.

2.3.20 In the previous review AECOM requested the following:

“Journey time reliability reliant on quality of ANPR data. Is supplementary data required?”

2.3.21 In the present response document, WSP has mentioned that when processing the raw ANPR data for use in the model, filtering was applied to:

- Remove all routes where only small samples of observations were recorded (generally <10 observations, with a few exceptions); and
- Remove any abnormally long journey times that could include vehicles that have either stopped in the middle of the study area or have left the study area and returned within a short space of time.

2.3.22 Figure 2 shows the location of the ANPR camera location sites.

Ref: WSP Document (Response to MKE Paramics LMVR Comments)

Figure 2 – ANPR Camera Location Sites

2.3.23 AECOM understands the approach adopted by WSP to calculate journey times from the raw ANPR data and this is acceptable. However, in the review document, AECOM did not question the reliability of using the ANPR data for journey time calculation, but whether the positions of the ANPR cameras would capture the full extent of network delay. There are concerns as some of these camera sites (Site 2a, 2c, 2b at the Northfield Roundabout, Site 3a on A509 London Road approach) are positioned in the middle of congested links and did not capture the full delay on approaches to the modelled junctions. Therefore, it is recommended that the journey time data should be validated/ cross checked with a secondary source of journey time data (e.g. TrafficMaster data). This issue is therefore unresolved and is considered **MEDIUM**.

Issue 5: Methodology for queue length measurement unclear

2.3.24 In the previous review AECOM requested the following:

"Methodology for queue length surveys should be clarified to show that the data is suitable for calibration of the model. Was this collected manually on site, using traffic cameras or an alternative method?"

2.3.25 WSP has clarified that the queue length surveys used for this study were collected using video cameras. The queue length calculations in Paramics model is further defined as follows:

- If the vehicle speed drops below a defined speed (normally 5mph); and
- The gap to the vehicle in front drops below a defined distance (normally 20m).

2.3.26 AECOM understands that the queue lengths measured on site using video cameras cannot be directly compared to those measured in the model (due to potential different definitions of what constitutes a queue). It is also agreed, as WSP state, that use of this data should consider the limitations in data collection. It is very difficult to reliably measure the back of queues - using a limited number of cameras it is unlikely there will be adequate views of queues which cannot be anticipated in advance of camera positioning. WSP do not state which cameras were used (the ANPR cameras do not appear to be sufficient)/ where these are on the network or give further details regarding when queue measurements were taken. AECOM cannot therefore verify the queue information is reliable. This issue therefore remains **MEDIUM**.

2.4 Base Model Development Issues

Issue 6: Evidence to support network is suitable with appropriate kerbs, junctions and links not provided

2.4.1 In the previous review AECOM requested the following:

"Evidence to support how modellers know that the vehicle behaviour is consistent should be provided. For example, if a site visit was conducted or video footage was used to verify."

2.4.2 In the response document, WSP stated that this Paramics model is based on an S-Paramics model that was originally calibrated and validated in 2012. The model was subsequently used several times (sometimes with further revalidation) to assess the impacts of several schemes on M1 Junction 14 and the Northfield roundabout.

2.4.3 WSP has stated in Section 4.2.2 – "The long life and use of the model means that the reasoning behind some of the coding decisions is unknown, however it is understood that the lane widths/ alignments etc. were based on OS CAD mapping of the study area. The current Paramics Discovery model was converted from the original S-Paramics model by Systra, however the differences between modelling approaches in Paramics Discovery and S-Paramics meant that some small changes were required to the network coding to respond to those differences and to improve some vehicle behaviours (such as vehicles randomly weaving at nodes). Many of these decisions to make changes to the model were made based on the modeller's professional judgement, which was based on their experience of building Paramics models and information taken from the survey videos, as the location and type of roads in the study area made it difficult to safely undertake a site visit."

2.4.4 Based on this response, AECOM understands that WSP has reviewed the survey videos and has implemented changes to the coding based on the professional judgement. It is understood that there are no significant adjustments made to the earlier validated model. WSP has considered video footage and adjusted the model where necessary: this is considered to be an acceptable approach and the issue is considered resolved.

Issue 7: Unclear how maximum traffic signal timings were determined for use in the model at vehicle actuated signals.

2.4.5 In the previous review AECOM requested the following:

"Some evidence could be provided to support this if site-based observations or video footage was used."

2.4.6 WSP has stated that the traffic signal timings are based upon the stage maximums identified in the traffic signal plans that were provided for the junctions by MKC.

2.4.7 The junction operates under MOVA control. AECOM understands that as the Paramics Discovery model cannot be linked to PC-MOVA, WSP attempted to replicate the signals behaviour as far as possible in the model and that the stage maximum times were derived from the S-Paramics model, the video surveys and traffic signal plans from Highways England and MKC.

2.4.8 AECOM can confirm that, in the absence of using PC-MOVA, using scripts to model the variable operation, based on available information such as signal plans and video footage is an acceptable approach. AECOM therefore consider the issue to be resolved – although it should be noted that the modelling itself cannot be verified since AECOM has not audited the model.

Issue 8: Changes to headway settings at junctions are not supported, these have been changed from the 2 second gap recommended.

2.4.9 In the previous review AECOM requested the following:

"Modeller should justify use of smaller time gap between vehicles given no site visit was conducted."

2.4.10 WSP has stated that the headways on approach to the traffic signals have been amended to increase/decrease the saturation flow to allow sufficient vehicles to pass through the traffic signals every cycle. WSP states in Section 4.4.2 – "It is noted that the 2007 Highways Agency Guidelines for the Use of Microsimulation Software identifies at Table 2 that the guidance for time headway between vehicles is based on a headway of one second. It is therefore considered that the headway parameters used in the model are suitable."

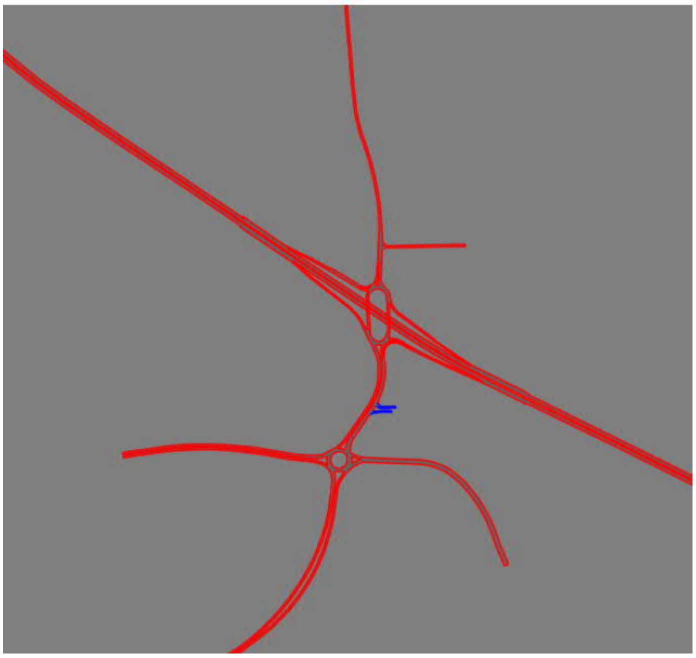
2.4.11 AECOM understands the that smaller time gaps between vehicles have been used to calibrate stop line capacity, to model observed throughput. However, it is possible that there is insufficient green time or other constraints to throughput, which are being masked by a higher saturation flow. It is therefore considered best practice to calibrate the saturation flows based on the survey data or RR67 calculated values, if the former is unavailable, to verify that modelled saturation flows are reasonable. It is therefore recommended that saturation flow calibration is provided to provide more confidence. This issue is therefore considered **MEDIUM**.

Issue 9: Unjustified changes to generalised cost parameters and degrees of familiarity

2.4.12 In the previous review AECOM requested the following:

"Modeller should provide justification for changing the generalised cost parameters. Evidence should be provided to justify changes to levels of familiarity by user class."

2.4.13 The generalised cost formula in Paramics is used by the model to select the routes of vehicles in the model but requires route choice in the model for changes in the cost values to have any significant impact on the routing of traffic. WSP has provided the Paramics model extent as shown in Figure 3.



Ref: WSP Document (Response to MKE Paramics LMVR Comments)

Figure 3 – MKE Paramics Model Extent

2.4.14 As seen in Figure 3, the model contains very limited route choices (1. using the M1 mainline or using the junction in east-west direction and 2. Using the bypass lane or the roundabout to travel towards A509 North). WSP has stated that the model is coded with defined routes to force vehicles to use the free-flow option (the mainline or a bypass lane).

2.4.15 AECOM understands that the generalised cost formula will not have any impact on routeing in the model.

2.4.16 WSP has provided the familiarity percentages coded in the model. The familiarity parameter in Paramics is used to define the proportion of vehicles that perceive minor links to be more expensive than major links and choose their route accordingly. WSP has confirmed that there are only two minor links in the model (shown in blue colour in Figure 3).

2.4.17 AECOM understands that these minor links will not impact any route choice in the models. Furthermore, WSP have confirmed that no development measures are anticipated to be coded into in that location which could have any impact on major/minor route choice.

2.4.18 Based on the justification and additional information provided by WSP, AECOM can consider the defined familiarly levels and generalised cost formula to be resolved, since they have no effect. However, WSP should illustrate that the proposals which will be tested in the models do not introduce any route choice, which would mean these parameters have an impact – this issue is considered **MINOR.**

2.5 Model Demand and Matrix Development Issues

Issue 10: Demand methodology provided is not detailed enough to assess whether it is suitable

2.5.1 In the previous review AECOM requested the following:

"Greater transparency/ information required to determine demand methodology. This should include ANPR validity, ATC verification and capture rate for the data."

2.5.2 In response to this, WSP has provided details regarding the demand development. The demand matrices used in the Paramics models are entirely based on the observed ANPR data.

2.5.3 Based on the details provided, AECOM understands the demand development methodology was as below:

- Step 1: ANPR data collected at all the eight cordon zones in Paramics model based on the matches for all vehicle classes (Cars, LGVs, OGV1 and OGV2).
- Step 2: Expansion of matrices for each vehicle classes from the sample matrix based upon the match rate data provided by the survey company.
- Step 3: Comparison of each zone's entries/exits from the matrices to the observed link counts at the ANPR cordon sites.
- Step 4: Expansion of the matrices based on the differences calculated in Step 3.
- Step 5: Summation of OGV1 and OGV2 matrices to develop HGV matrices.
- Step 6: Profiling of matrices in 15-minutes intervals based on traffic counts for the entry zones.

2.5.4 It must be noted that AECOM has not reviewed any demand spreadsheets as part of this review. However, based on the information provided AECOM can conclude that the approach to develop the base year model demand in Paramics models is appropriate. This issue is therefore considered to be resolved.

2.6 Model Calibration and Validation Issues

Issue 11: It is unclear how many runs are used to validate and calibrate this model.

2.6.1 In the previous review AECOM requested the following:

"The final runs used for reporting should be consistent across all calibration and validation exercises. Any mode results considered outliers should be excluded and justified where necessary."

2.6.2 WSP stated that the model was run 15 times to obtain an average result from multiple seeded runs, which is considered to be sufficient for a model of this size.

2.6.3 WSP has provided variability check information in the journey time validation tables in LMVR Appendix D, based on 95% confidence intervals. However, there are a few routes which do not pass the variability check. It is therefore recommended that WSP provides information which indicates what level of confidence they have in the average results presented – and details of when a route is considered to pass or fail the variability check. This issue is therefore considered to be unresolved and is **MINOR**.

Issue 12: Latent demand unreleased as a result of congestion has not been mentioned.

2.6.4 In the previous review AECOM requested the following:

"Latent demand should be discussed if vehicles are unreleased, especially if queues may affect the release onto the network."

2.6.5 In response to this issue, WSP stated in Section 6.3.1 that "There is very limited numbers of unreleased vehicles in the model, with the main sources being the A509 southbound towards M1 Junction 14 and Childs Way towards the Northfield Roundabout. In most runs, while there are unreleased vehicles at the end of the validation hour, the number of unreleased vehicles dissipates in the cool down period to a point where there are no unreleased vehicles when the model ends."

2.6.6 Based on the above information, AECOM cannot verify the number of remaining vehicles in the network at the end of the peak hour. It is therefore recommended that the total latent demand is reported.

2.6.7 The model extent covers the locations where the survey data was collected in the network. The input traffic data is based on this survey data and therefore the presence of latent demand in the base model indicates that congestion in the network may not be accurately represented. It is therefore recommended that the level of congestion along the links where the demand remains unreleased is reviewed and that the latent demand in the AM and PM is reported to provide a better understanding to the reviewers. It is recommended that these links are extended to capture the queues and include the latent demand, especially as it is suspected that the forecast models (with higher demand than base) may result in longer queues on these links. However, if the level of latent demand is low in the base models, then the links can be extended in future year models, to make sure the full impact of the development is captured. This issue is therefore considered **MEDIUM**.

Issue 13: Queue length graphs presented in Appendix C show significant over and under estimation. Model instability clear on some routes.

2.6.8 In the previous review AECOM requested the following:

"Greater detail required on queue length data collection. Model runs should be excluded with justification if an unrealistic result is observed."

2.6.9 In the response document, WSP state that the modelled queue lengths are based on the average queue length observed by the model in each five-minute period during the assessment hours. As discussed in the section of Issue 5, WSP has confirmed that the queue length survey was carried out using the video cameras.

2.6.10 WSP states that it is evident that the queue length observations on the A509 southbound approach to the north of M1 Junction 14 must have not recorded the full extent of queueing as the journey time validation is only possible with longer queues. Section 6.4.4 further states that "While the Typical Traffic conditions shown in Google Maps does not provide the full extent of queuing in the model area, it does provide information about where traffic is moving more slowly than normal, which could be either as a queue or just slowly moving traffic. This information shows significantly longer A509 approach from the north".

2.6.11 AECOM understands that the method to calculate the queue length based on video camera by the enumerators may not be aligned to the method to calculate the queue length in the Paramics models. As stated above, queue length information is useful additional validation of the model, but the focus should be robust journey time validation, including the full extent of congested areas. However, it is recommended that the modelled queue lengths must be compared and should approximately correlate to the queuing conditions in the images from the video cameras or Google Traffic Maps – this should be documented. This issue is therefore unresolved and is considered **MEDIUM**.

Issue 14: Journey time data is unreliable since it is collected from ANPR and the journey time route excludes a significant portion of queueing on approach to some junctions. Therefore, there may be some delays that are not represented well in the model.

2.6.12 In the previous review AECOM requested the following:

"Greater detail required for journey time validation, with mitigation measures to account for queue lengths not included in routes. Supplementary data to support use of ANPR should be considered."

2.6.13 WSP has stated in Section 6.5.2 that "The ANPR journey times are based on a large sample rate of many vehicles and, as there are no locations within the cordon where vehicles would seek to stop, will be more reliable record of the average journey times across the peak hour than the small sample of observations that would be possible to record using moving observers. It is also noted that the ANPR journey times will take account of vehicles that are stopped by a red traffic signal and vehicles that pass straight through on green, which will be similar to the journey times reported by the model. Moving observer journey times occasionally present the risk of only including one of the two traffic signal behaviours."

2.6.14 AECOM agrees to the above response and ANPR data is considered robust as it includes more journey time samples as compared to the moving observer method. However, the use of ANPR survey at the cordon zones does not provide the journey time in the intermediate sections.

2.6.15 TfL Modelling guidelines v3.0 which are considered to provide comprehensive microsimulation guidance state that "Modelled journey times should be averaged over multiple seeds…and be within 15% of surveyed on-street journey times according to MAP v2.2. Journey time output should be presented as the cumulative journey time obtained by all vehicles that follow individual journey time segments as well as complete journey times for vehicles that follow the entire journey time surveyed route." Also, Section 4.3.4 of TAG unit M3.1 Highway Assignment Modelling states that "It is standard practice to use journey time validation at the route level. However, increasingly there is a need to take a more detailed approach and check journey time validation at the link level or for segments of the route as well." It is therefore considered best practice in microsimulation models to compare modelled and observed journey times for smaller segments, as this would help determine whether the queueing and delays are represented in correct locations in the network. This is particularly important given the issues that WSP outline with collecting reliable queue data and comparison with microsimulation models.

2.6.16 As stated earlier, AECOM also has concerns that the ANPR survey may not have captured the full extent of the queues, due to cameras being situated on congested links. Therefore, some of the congestion may not be fully represented in the model.

2.6.17 It is therefore recommended that the obtained ANPR journey time data must be verified against a secondary source data (e.g. TrafficMaster data) which would also provide details of delay on intermediate sections along the journey time routes in the model. This issue is therefore considered to be unresolved and is **SIGNIFICANT**.

Issue 15: Turning count data is unreliable since it is collected from ANPR

2.6.18 In the previous review AECOM requested the following:

"Turning counts from ANPR are unlikely to be reliable, supplementary data, using video MCC's may be required."

2.6.19 In response to this issue, WSP has stated the following in Section 6.6:

"There is no suitable historic count data available, and it is considered that the observations from the ANPR are more likely to be reliable than a new traffic count. It is noted that the model is showing an excellent level of calibration against the observed turning count data from the ANPR data. Furthermore, there is no opportunity to undertake supplementary traffic surveys at this time. The combination of further road works, plus Covid-19 pandemic conditions would result in surveys which are not reflective of network conditions. As such, the capture rate outlined in the ANPR analysis provides evidence that the surveys captured are appropriate."

2.6.20 AECOM understands there is limited available data for flow calibration. It is assumed that the observed flows used for the traffic flow calibration are based upon the uplifted ANPR captured flows and not based upon only the captured number of trips. However, AECOM is unable to establish this based on some spot-checks. AECOM has concerns that the raw ANPR data based only on the captured number plates has been used for calibration. These are lower than manual traffic counts provided with the ANPR data, especially at some locations where the capture rate is low (see Figure 1 in Section 2.3) potentially resulting in unrealistically low flows being used in the flow comparisons. It is therefore recommended that more clarity is provided, with details of calculations, to confirm how the observed flows in the model calibration results were calculated, particularly with regard to M1 Junction 14.

2.6.21 In addition to the above and as stated earlier, WSP should also demonstrate that the ANPR cameras are not underrepresenting certain turning movements, given that both the matrix development and turning count calibration rely on these proportions. This issue is therefore considered unresolved and is **SIGNIFICANT**.

3 Conclusions and Recommendations

3.1.1 AECOM previously reviewed the LMVR produced by WSP for Milton Keynes East Paramics modelling. The findings of this review conducted by AECOM are documented in Technical Note 05. The review indicated that there were a significant number of issues to which AECOM had requested further clarification and justification.

3.1.2 In order to provide response to the findings of AECOM's previous review, WSP has produced a document (Ref: "Response to MKE Paramics LMVR Comments", dated September 2020) which is reviewed and discussed in this technical note.

3.1.3 The review indicates that some issues identified by AECOM are resolved based on the comments provided by WSP. However, there are a few unresolved issues for which AECOM have provided further recommendations.

3.1.4 Table 3 below shows a summary of the present status of the issues identified in the previous audit.

Table 3: Audit Summary Table

ID	Issue Description	Previous Level of Issue	Current Level of Issue	Comments/ Recommendations
Model Specification				
1	Unclear how peak hour was determined	MEDIUM	MEDIUM	More information requested to determine how modelled peak hour traffic flows relate to peak hours calculated from ANPR data requested.
Data Collection Review				
2	ANPR data collection, reliability and verification process unclear	SIGNIFICANT	SIGNIFICANT	Slight concerns with the sample size of link count data compared to determine the representative day. However, this is resolved as no more data is available. Furthermore, there are concerns with the low ANPR capture rate at some few sites which may impact the turning proportions, which is **SIGNIFICANT** issue.
3	Ongoing roadworks during data collection	SIGNIFICANT	MEDIUM	Concerns with the forecast year demand development considering the roadworks impact. Requested details of methodology.
4	Journey times are based on ANPR data, number of journey time samples and assessment of reliability not provided.	MEDIUM	MEDIUM	Concerns regarding the full extent of the delay/ congestion not captured in journey time data recorded using ANPR surveys. Use of TrafficMaster data (or similar) for additional validation is recommended.

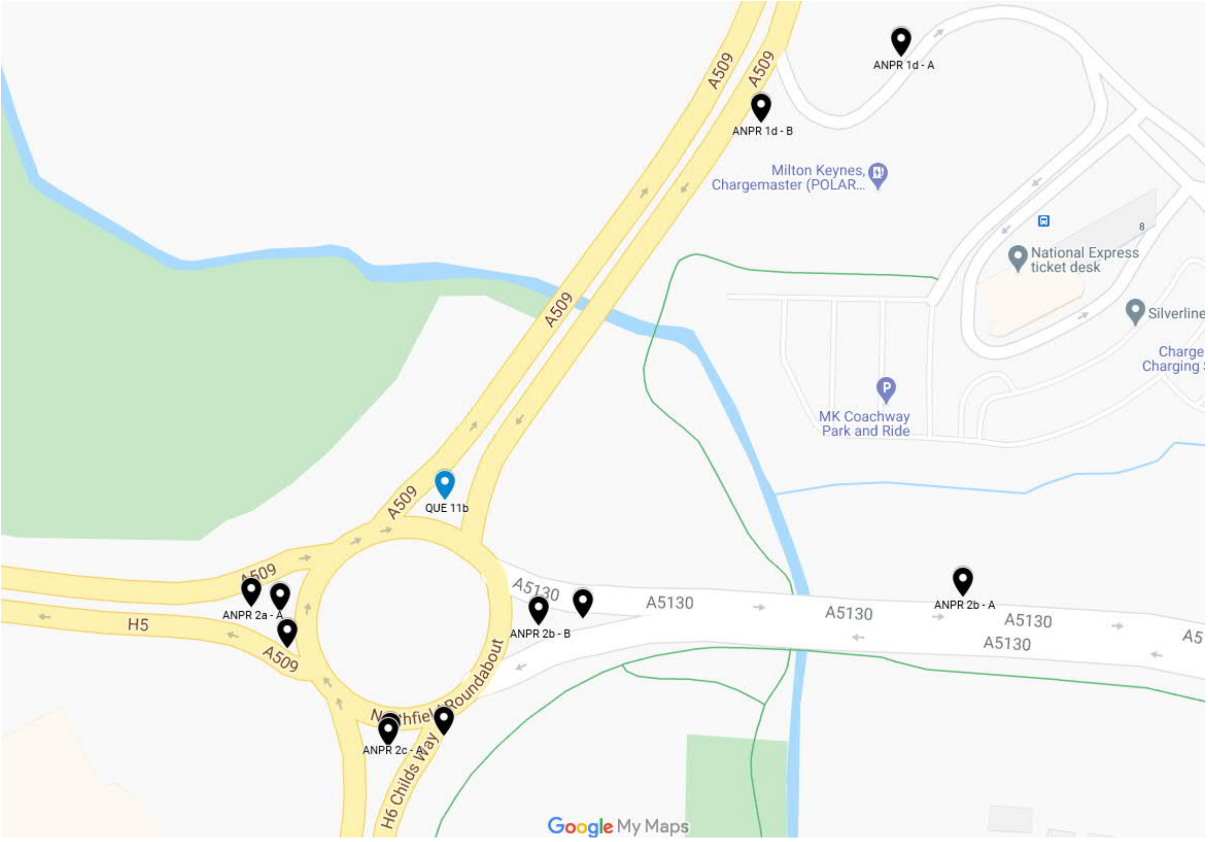
ID	Issue Description	Previous Level of Issue	Current Level of Issue	Comments/ Recommendations
5	Methodology for queue length measurement unclear	MEDIUM	MINOR	WSP do not state which cameras were used/ where these are on the network. It is recommended that more detail is provided.
Base Model Development				
6	Evidence to support network is suitable with appropriate kerbs, junctions and links not provided	MINOR	**RESOLVED**	-
7	Unclear how maximum traffic signal timings were determined for use in the model at vehicle actuated signals.	MINOR	**RESOLVED**	-
8	Changes to headway settings at junctions are not supported, these have been changed from the 2 second gap recommended.	MINOR	MEDIUM	Saturation Flow reporting is recommended.
9	Unjustified changes to generalised cost parameters and degrees of familiarity	MEDIUM	MINOR	Recommendation to illustrate that the future year proposals which will be tested in the models do not introduce any route choice
Model Demand and Matrix Development				
10	Demand methodology provided is not detailed enough to assess whether it is suitable	SIGNIFICANT	**RESOLVED**	-
Model Calibration and Validation				
11	It is unclear how many runs are used to validate and calibrate this model.	MEDIUM	MINOR	Recommendation to provide more information on the level of confidence in average results as a few routes fail variability check, which requires explanation.
12	Latent demand unreleased as a result of congestion has not been mentioned.	MINOR	MEDIUM	Latent demand values are requested – so level of latent demand is understood. However, it is recommended that the links with latent demand are extended to capture the queues and avoid issue in forecasting.
13	Queue length graphs presented in Appendix C show	SIGNIFICANT	MEDIUM	Recommendations to compare the queue lengths in models to images from

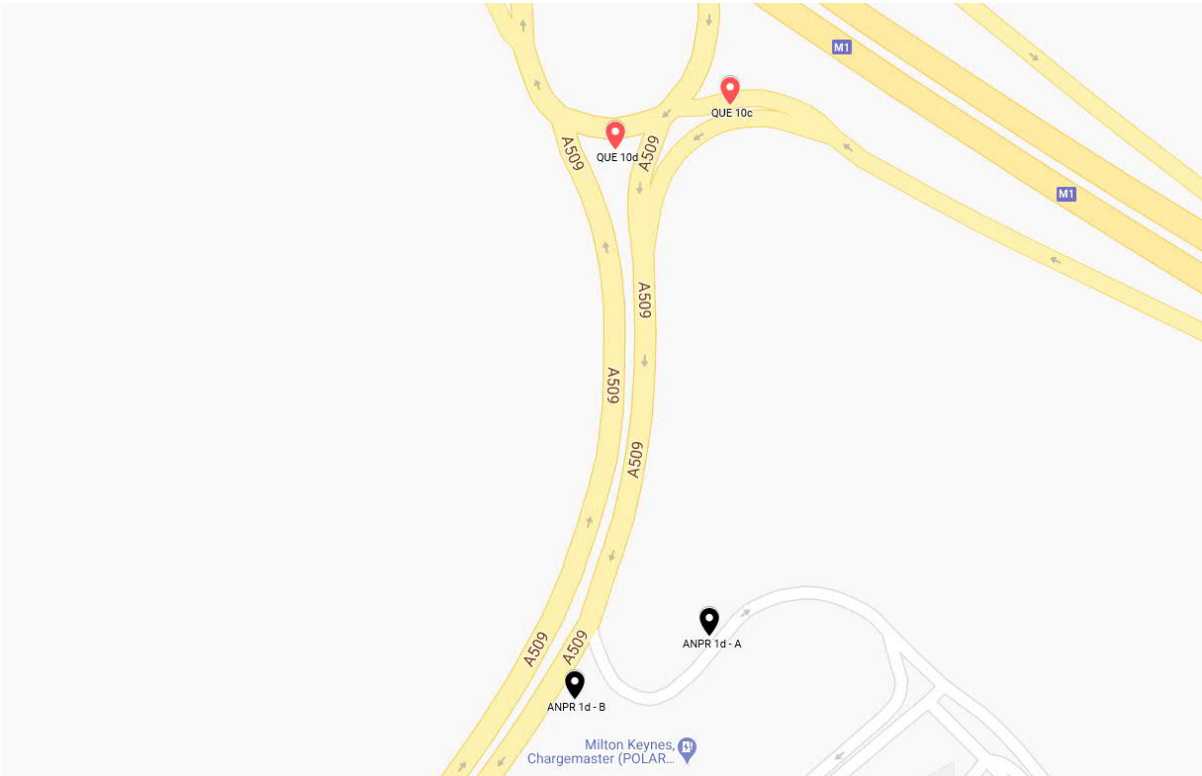
ID	Issue Description	Previous Level of Issue	Current Level of Issue	Comments/ Recommendations
	significant over and under estimation. Model instability clear on some routes.			video cameras/Google Traffic Maps and document this.
14	Journey time data is unreliable since it is collected from ANPR and the journey time route excludes a significant portion of queueing on approach to some junctions. Therefore, there may be some delays that are not represented well in the model.	**SIGNIFICANT**	**SIGNIFICANT**	It is recommended to use Trafficmaster or similar compare the journey time routes in small segments rather than whole route – so the delay on particular sections can be verified (especially since queue data collection was difficult as reported by WSP). Reiterate issue with ANPR sites not capturing full extent of delay, due to being located where the full extent of congestion was not captured. Again, recommend use of Trafficmaster data to overcome this issue.
15	Turning count data is unreliable since it is collected from ANPR	**SIGNIFICANT**	**SIGNIFICANT**	There are concerns that the observed flows using for calibration are based on raw ANPR data (captured plates only). It is recommended that better clarity is provided with required calculations to confirm the source of the observed flows in the model calibration results. Also, there are concerns that low capture rate may be impacting the turning proportions. WSP should provide evidence that turning proportions are not impacted by low capture rates.

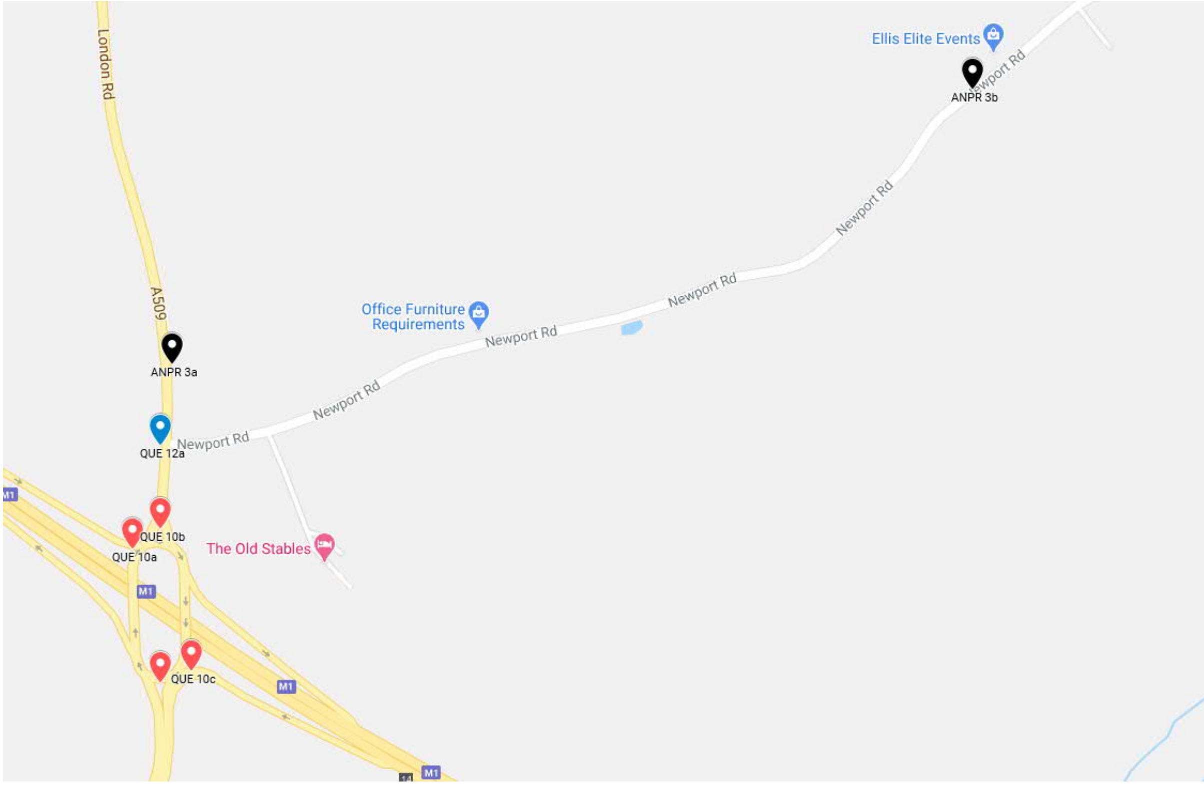
3.1.5 Based on the responses provided by WSP on the issues identified earlier, AECOM cannot determine whether the base Paramics model developed by WSP is representative of the current conditions in the area and provides a reliable basis for forecasting. It is noted that many of the issues are now resolved. However, some outstanding issues remain and AECOM has made some recommendations/ suggestions for providing the further information required to assess the base model quality. It is recommended that the issues identified, and concerns highlighted in this technical note are resolved by WSP. Furthermore, it must be noted that AECOM cannot fully verify the model without reviewing the Paramics model itself.

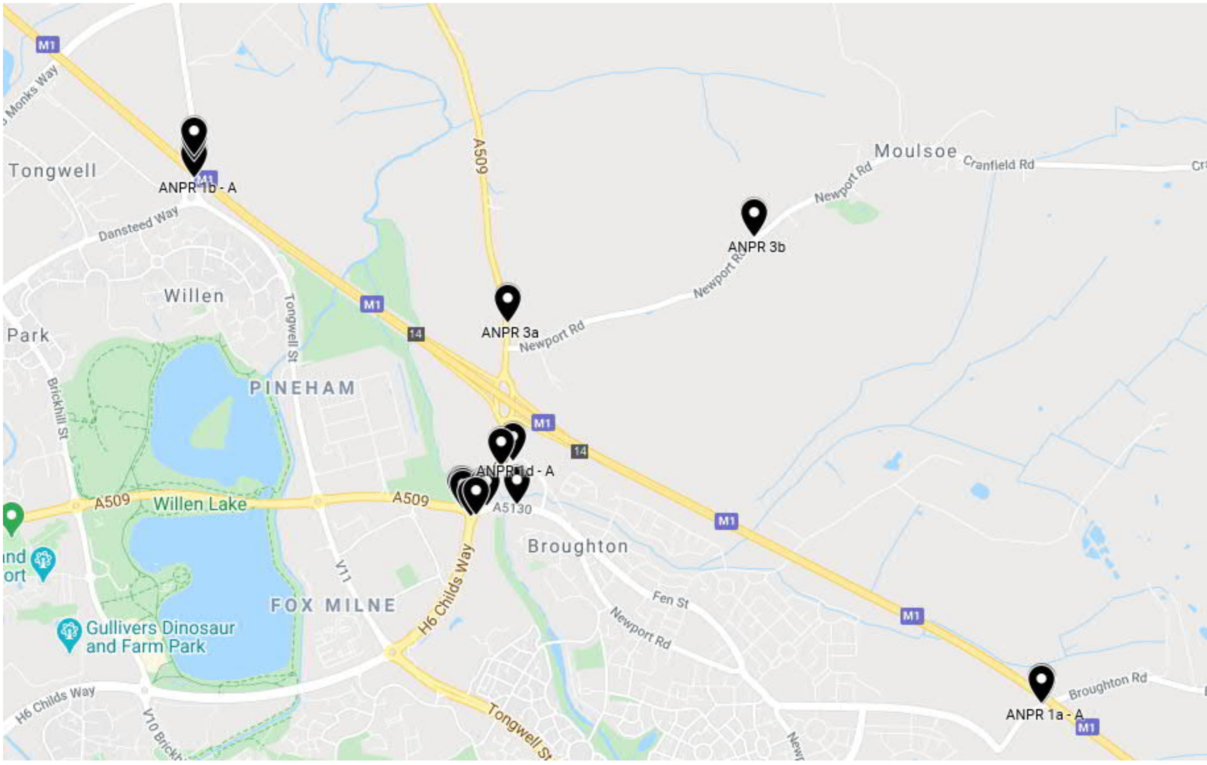
Appendix B

ANPR CAMERA VIEWS


ANPR 1d - A
ANPR 1d - B
A509
Milton Keynes, Chargemaster (POLAR...
National Express ticket desk
Silverline
MK Coachway Park and Ride
QUE 11b
A5130
ANPR 2b - A
ANPR 2b - B
ANPR 2a - A
H5
Northfield Roundabout
ANPR 2c - A
H6 Childs Way
Google My Maps

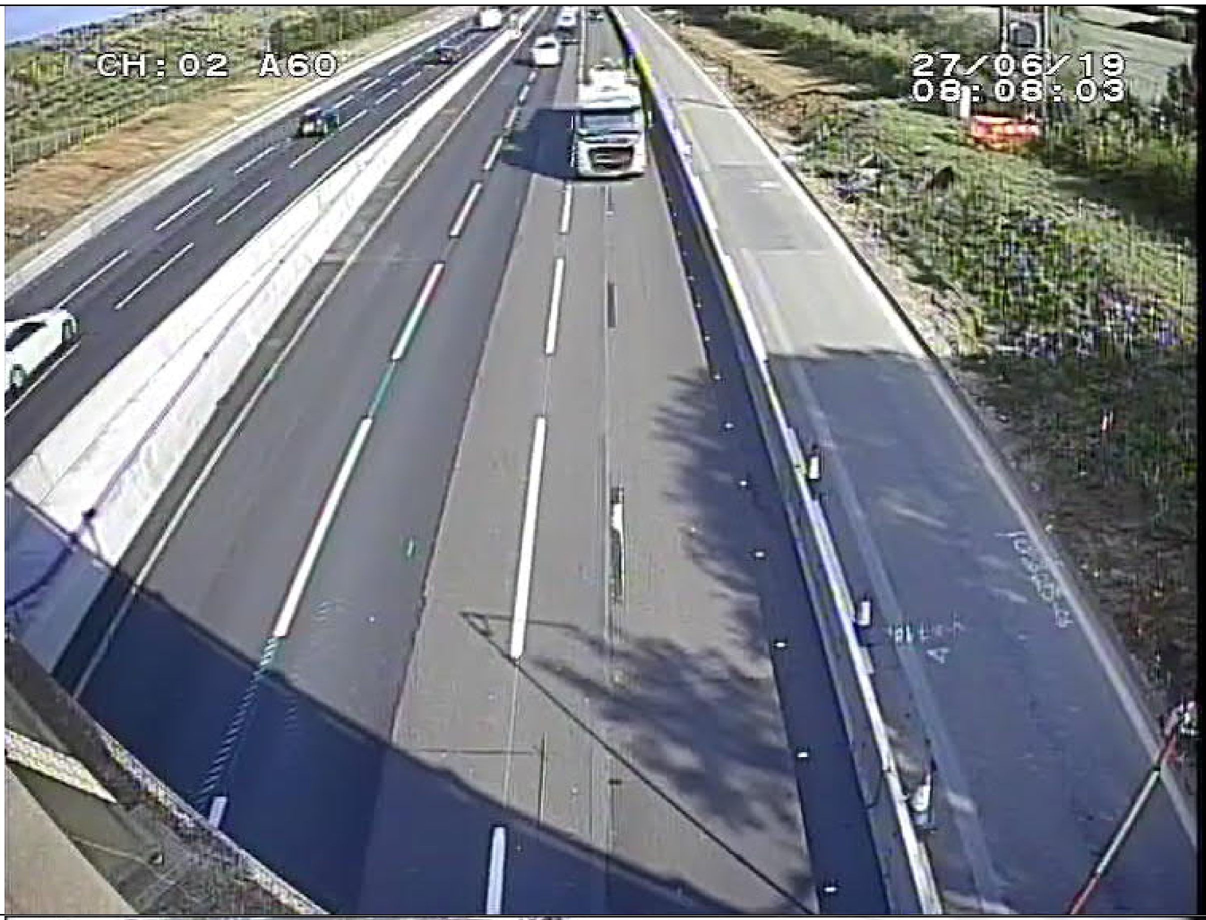

M1
QUE 10c
QUE 10d
A509
ANPR 1d - A
ANPR 1d - B
Milton Keynes, Chargemaster (POLAR...

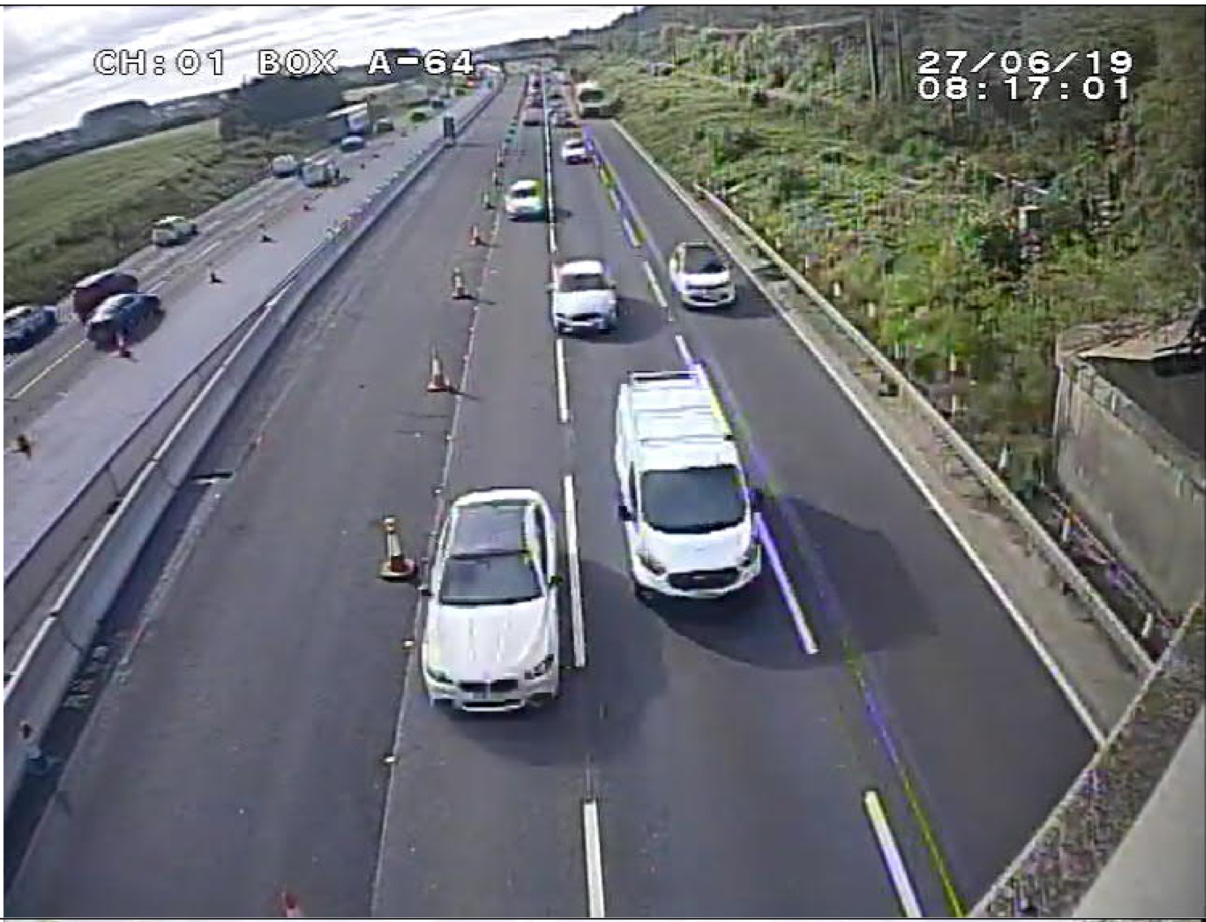

London Rd
A509
ANPR 3a
QUE 12a
Newport Rd
QUE 10b
QUE 10a
QUE 10c
The Old Stables
Office Furniture Requirements
Ellis Elite Events
ANPR 3b
M1


M1
Tongwell
ANPR 1b - A
Dansteed Way
Willen
Park
PINEHAM
Tongwell St
A509
ANPR 3a
Newport Rd
ANPR 3b
Moulsoe
Cranfield Rd
Willen Lake
Brickhill St
FOX MILNE
V11
H6 Childs Way
A5130
Broughton
Fen St
Gullivers Dinosaur and Farm Park
Broughton Rd
ANPR 1a - A
14

CAMERA	SNAPSHOT
ANPR 1a-a	

ANPR 1a-b		
ANPR 1a-c		

ANPR 1a-d		
ANPR 1b-a		

ANPR 1b-b		
ANPR 1b-c		

ANPR 1b-d		
ANPR 1d-a		

ANPR 1d-b (3 channels)	 	

		
ANPR 2a-a		

ANPR 2a-b (2 channels)	 

ANPR 2a-c (2 channels)		

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<tr><td>ANPR 2b-b
(2 channels)</td><td></td><td></td><td></td></tr>
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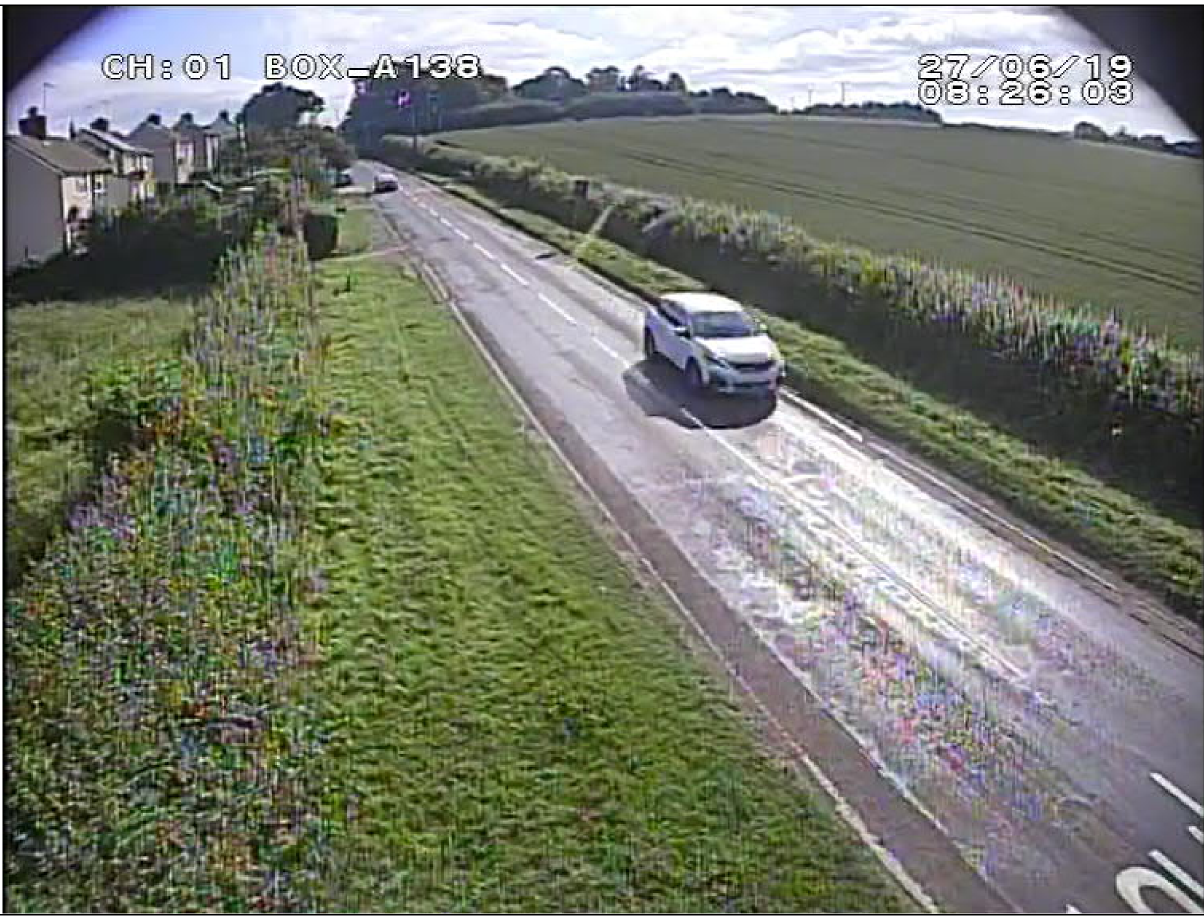
ANPR 2b-c (2 channels)		

	 CH:02 A20 27/06/19 08:12:02	
ANPR 2c-a	 CH:01 BOX_A107 27/06/19 08:29:01	

ANPR 2c-b (2 channels)

ANPR 2c-c		
ANPR 3a		

ANPR 3b	

Appendix C

QUEUE LENGTH DATA

Vehicle Flow Information
Calibration Statistics
All Vehicles
AM Peak

Index	Junction	Name	Origin	Destination	Reference	Observed Flow	Modelled Flow	Difference	% Difference	G.E.H. Value (using hourly flows)	Flow Test (using hourly flows)
1	1	M1 Junction 14	A509 N	A509 N	J1) M1 J14 A-A	7	12	5	77.6%	1.7	Pass Low
2	1	M1 Junction 14	A509 N	M1 E	J1) M1 J14 A-B	284	316	32	11.1%	1.8	Pass Low
3	1	M1 Junction 14	A509 N	A509 S	J1) M1 J14 A-C	556	663	107	19.2%	4.3	Fail Low
4	1	M1 Junction 14	A509 N	M1 W	J1) M1 J14 A-D	90	102	13	14.0%	1.3	Pass Low
5	1	M1 Junction 14	M1 E	A509 N	J1) M1 J14 B-A	187	208	21	11.1%	1.5	Pass Low
7	1	M1 Junction 14	M1 E	A509 S	J1) M1 J14 B-C	1254	1404	150	11.9%	4.1	Pass Mid
8	1	M1 Junction 14	M1 E	M1 W	J1) M1 J14 B-D	2467	2789	322	13.0%	6.3	Pass Mid
9	1	M1 Junction 14	A509 S	A509 N	J1) M1 J14 C-A	258	327	69	26.7%	4.0	Pass Low
10	1	M1 Junction 14	A509 S	M1 E	J1) M1 J14 C-B	396	548	152	38.3%	7.0	Fail Low
11	1	M1 Junction 14	A509 S	A509 S	J1) M1 J14 C-C	1	2	1	48.0%	0.4	Pass Low
12	1	M1 Junction 14	A509 S	M1 W	J1) M1 J14 C-D	451	565	113	25.1%	5.0	Fail Low
13	1	M1 Junction 14	M1 W	A509 N	J1) M1 J14 D-A	142	150	8	5.9%	0.7	Pass Low
14	1	M1 Junction 14	M1 W	M1 E	J1) M1 J14 D-B	2302	2435	133	5.8%	2.7	Pass Mid
15	1	M1 Junction 14	M1 W	A509 S	J1) M1 J14 D-C	970	1048	79	8.1%	2.5	Pass Mid
17	2	A509 / P&R	A509 N	P&R	28::103::105	22	27	5	23.9%	1.1	Pass Low
18	2	A509 / P&R	A509 N	A509 S	28::103::26	2758	3079	321	11.6%	5.9	Pass High
19	2	A509 / P&R	P&R	A509 S	128::26::24	0	0	0		0.0	Pass Low
20	2	A509 / P&R	A509 S	A509 N	101::25::27	1107	1441	334	30.2%	9.4	Fail Mid
21	3	A509 / A5130 / A4146	A509 N	A509 N	J3) A509/A5130 A-A	0	0	0		0.0	Pass Low
22	3	A509 / A5130 / A4146	A509 N	A5130	J3) A509/A5130 A-B	123	187	63	51.3%	5.1	Pass Low
23	3	A509 / A5130 / A4146	A509 N	A4146	J3) A509/A5130 A-C	1328	1504	176	13.2%	4.7	Pass Mid
24	3	A509 / A5130 / A4146	A509 N	A509 W	J3) A509/A5130 A-D	1307	1374	67	5.1%	1.8	Pass Mid
25	3	A509 / A5130 / A4146	A5130	A509 N	J3) A509/A5130 B-A	218	201	-18	-8.0%	1.2	Pass Low
27	3	A509 / A5130 / A4146	A5130	A4146	J3) A509/A5130 B-C	135	147	12	8.5%	1.0	Pass Low
28	3	A509 / A5130 / A4146	A5130	A509 W	J3) A509/A5130 B-D	375	416	41	11.0%	2.1	Pass Low
29	3	A509 / A5130 / A4146	A4146	A509 N	J3) A509/A5130 C-A	515	702	187	36.4%	7.6	Fail Low
30	3	A509 / A5130 / A4146	A4146	A5130	J3) A509/A5130 C-B	47	61	14	29.1%	1.9	Pass Low
32	3	A509 / A5130 / A4146	A4146	A509 W	J3) A509/A5130 C-D	1	4	3	249.8%	1.7	Pass Low
33	3	A509 / A5130 / A4146	A509 W	A509 N	J3) A509/A5130 D-A	373	531	157	42.1%	7.4	Fail Low
34	3	A509 / A5130 / A4146	A509 W	A5130	J3) A509/A5130 D-B	165	217	52	31.4%	3.8	Pass Low
35	3	A509 / A5130 / A4146	A509 W	A4146	J3) A509/A5130 D-C	13	20	6	45.2%	1.5	Pass Low
37	4	Newport Road / A509	A509 N	A509 S	40::39::105x	690	826	136	19.7%	4.9	Fail Low
38	4	Newport Road / A509	A509 N	Newport Road	40::39::149	24	35	11	45.8%	2.0	Pass Low
39	4	Newport Road / A509	Newport Road	A509 S	150::149::105x	247	262	15	6.1%	0.9	Pass Low
40	4	Newport Road / A509	A509 S	A509 N	38::105x::39	416	476	60	14.3%	2.8	Pass Low
41	4	Newport Road / A509	A509 S	Newport Road	38::105x::149	178	219	41	23.2%	2.9	Pass Low

	Sum Obs.	Sum Mod.	Diff	% Diff	Ave. GEH
Overall Stats	19410	22295	2886	14.9%	3.1

wsp

Vehicle Flow Information
Calibration Statistics
All Vehicles
PM Peak

Index	Junction	Name	Origin	Destination	Reference	Observed Flow	Modelled Flow	Difference	% Difference	G.E.H. Value (using hourly flows)	Flow Test (using hourly flows)
1	1	M1 Junction 14	A509 N	A509 N	J1) M1 J14 A-A	29	20	-9	-30.1%	1.8	Pass Low
2	1	M1 Junction 14	A509 N	M1 E	J1) M1 J14 A-B	333	344	11	3.2%	0.6	Pass Low
3	1	M1 Junction 14	A509 N	A509 S	J1) M1 J14 A-C	549	562	13	2.4%	0.6	Pass Low
4	1	M1 Junction 14	A509 N	M1 W	J1) M1 J14 A-D	197	202	5	2.6%	0.4	Pass Low
5	1	M1 Junction 14	M1 E	A509 N	J1) M1 J14 B-A	273	275	3	1.0%	0.2	Pass Low
7	1	M1 Junction 14	M1 E	A509 S	J1) M1 J14 B-C	522	568	46	8.7%	2.0	Pass Low
8	1	M1 Junction 14	M1 E	M1 W	J1) M1 J14 B-D	2740	2930	190	6.9%	3.6	Pass High
9	1	M1 Junction 14	A509 S	A509 N	J1) M1 J14 C-A	472	609	137	28.9%	5.9	Fail Low
10	1	M1 Junction 14	A509 S	M1 E	J1) M1 J14 C-B	718	626	-92	-12.8%	3.5	Pass Mid
11	1	M1 Junction 14	A509 S	A509 S	J1) M1 J14 C-C	1	0	-1	-56.4%	0.7	Pass Low
12	1	M1 Junction 14	A509 S	M1 W	J1) M1 J14 C-D	649	499	-150	-23.2%	6.3	Fail Low
13	1	M1 Junction 14	M1 W	A509 N	J1) M1 J14 D-A	117	121	4	3.7%	0.4	Pass Low
14	1	M1 Junction 14	M1 W	M1 E	J1) M1 J14 D-B	2562	2678	116	4.5%	2.3	Pass Mid
15	1	M1 Junction 14	M1 W	A509 S	J1) M1 J14 D-C	519	537	18	3.5%	0.8	Pass Low
17	2	A509 / P&R	A509 N	P&R	28::103::105	25	18	-7	-27.4%	1.5	Pass Low
18	2	A509 / P&R	A509 N	A509 S	28::103::26	1566	1650	84	5.3%	2.1	Pass Mid
19	2	A509 / P&R	P&R	A509 S	128::26::24	0	0	0		0.0	Pass Low
20	2	A509 / P&R	A509 S	A509 N	101::25::27	1842	1734	-107	-5.8%	2.5	Pass Mid
21	3	A509 / A5130 / A4146	A509 N	A509 N	J3) A509/A5130 A-A	0	12	12		4.8	Pass Low
22	3	A509 / A5130 / A4146	A509 N	A5130	J3) A509/A5130 A-B	204	209	6	2.8%	0.4	Pass Low
23	3	A509 / A5130 / A4146	A509 N	A4146	J3) A509/A5130 A-C	860	918	57	6.7%	1.9	Pass Mid
24	3	A509 / A5130 / A4146	A509 N	A509 W	J3) A509/A5130 A-D	503	512	9	1.7%	0.4	Pass Low
25	3	A509 / A5130 / A4146	A5130	A509 N	J3) A509/A5130 B-A	399	334	-66	-16.5%	3.4	Pass Low
27	3	A509 / A5130 / A4146	A5130	A4146	J3) A509/A5130 B-C	116	130	14	12.3%	1.3	Pass Low
28	3	A509 / A5130 / A4146	A5130	A509 W	J3) A509/A5130 B-D	161	178	17	10.7%	1.3	Pass Low
29	3	A509 / A5130 / A4146	A4146	A509 N	J3) A509/A5130 C-A	800	789	-12	-1.5%	0.4	Pass Mid
30	3	A509 / A5130 / A4146	A4146	A5130	J3) A509/A5130 C-B	49	72	23	46.6%	3.0	Pass Low
32	3	A509 / A5130 / A4146	A4146	A509 W	J3) A509/A5130 C-D	3	3	-1	-21.2%	0.4	Pass Low
33	3	A509 / A5130 / A4146	A509 W	A509 N	J3) A509/A5130 D-A	642	595	-47	-7.3%	1.9	Pass Low
34	3	A509 / A5130 / A4146	A509 W	A5130	J3) A509/A5130 D-B	239	329	89	37.3%	5.3	Pass Low
35	3	A509 / A5130 / A4146	A509 W	A4146	J3) A509/A5130 D-C	7	11	4	48.3%	1.2	Pass Low
37	4	Newport Road / A509	A509 N	A509 S	40::39::105x	728	810	83	11.4%	3.0	Pass Mid
38	4	Newport Road / A509	A509 N	Newport Road	40::39::149	45	40	-6	-12.2%	0.8	Pass Low
39	4	Newport Road / A509	Newport Road	A509 S	150::149::105x	378	316	-62	-16.3%	3.3	Pass Low
40	4	Newport Road / A509	A509 S	A509 N	38::105x::39	787	893	106	13.5%	3.7	Pass Mid
41	4	Newport Road / A509	A509 S	Newport Road	38::105x::149	102	122	20	19.3%	1.9	Pass Low

	Sum Obs.	Sum Mod.	Diff	% Diff	Ave. GEH
Overall Stats	19138	19645	507	2.7%	2.0

Appendix D

FLOW CALIBRATION

Vehicle Flow Information
Calibration Statistics
All Vehicles
AM Peak

Index	Junction	Name	Origin	Destination	Reference	Observed Flow	Modelled Flow	Difference	% Difference	G.E.H. Value (using hourly flows)	Flow Test (using hourly flows)
1	1	M1 Junction 14	A509 N	A509 N	J1) M1 J14 A-A	7	12	5	77.6%	1.7	Pass Low
2	1	M1 Junction 14	A509 N	M1 E	J1) M1 J14 A-B	284	316	32	11.1%	1.8	Pass Low
3	1	M1 Junction 14	A509 N	A509 S	J1) M1 J14 A-C	556	663	107	19.2%	4.3	Fail Low
4	1	M1 Junction 14	A509 N	M1 W	J1) M1 J14 A-D	90	102	13	14.0%	1.3	Pass Low
5	1	M1 Junction 14	M1 E	A509 N	J1) M1 J14 B-A	187	208	21	11.1%	1.5	Pass Low
7	1	M1 Junction 14	M1 E	A509 S	J1) M1 J14 B-C	1254	1404	150	11.9%	4.1	Pass Mid
8	1	M1 Junction 14	M1 E	M1 W	J1) M1 J14 B-D	2467	2789	322	13.0%	6.3	Pass Mid
9	1	M1 Junction 14	A509 S	A509 N	J1) M1 J14 C-A	258	327	69	26.7%	4.0	Pass Low
10	1	M1 Junction 14	A509 S	M1 E	J1) M1 J14 C-B	396	548	152	38.3%	7.0	Fail Low
11	1	M1 Junction 14	A509 S	A509 S	J1) M1 J14 C-C	1	2	1	48.0%	0.4	Pass Low
12	1	M1 Junction 14	A509 S	M1 W	J1) M1 J14 C-D	451	565	113	25.1%	5.0	Fail Low
13	1	M1 Junction 14	M1 W	A509 N	J1) M1 J14 D-A	142	150	8	5.9%	0.7	Pass Low
14	1	M1 Junction 14	M1 W	M1 E	J1) M1 J14 D-B	2302	2435	133	5.8%	2.7	Pass Mid
15	1	M1 Junction 14	M1 W	A509 S	J1) M1 J14 D-C	970	1048	79	8.1%	2.5	Pass Mid
17	2	A509 / P&R	A509 N	P&R	28::103::105	22	27	5	23.9%	1.1	Pass Low
18	2	A509 / P&R	A509 N	A509 S	28::103::26	2758	3079	321	11.6%	5.9	Pass High
19	2	A509 / P&R	P&R	A509 S	128::26::24	0	0	0		0.0	Pass Low
20	2	A509 / P&R	A509 S	A509 N	101::25::27	1107	1441	334	30.2%	9.4	Fail Mid
21	3	A509 / A5130 / A4146	A509 N	A509 N	J3) A509/A5130 A-A	0	0	0		0.0	Pass Low
22	3	A509 / A5130 / A4146	A509 N	A5130	J3) A509/A5130 A-B	123	187	63	51.3%	5.1	Pass Low
23	3	A509 / A5130 / A4146	A509 N	A4146	J3) A509/A5130 A-C	1328	1504	176	13.2%	4.7	Pass Mid
24	3	A509 / A5130 / A4146	A509 N	A509 W	J3) A509/A5130 A-D	1307	1374	67	5.1%	1.8	Pass Mid
25	3	A509 / A5130 / A4146	A5130	A509 N	J3) A509/A5130 B-A	218	201	-18	-8.0%	1.2	Pass Low
27	3	A509 / A5130 / A4146	A5130	A4146	J3) A509/A5130 B-C	135	147	12	8.5%	1.0	Pass Low
28	3	A509 / A5130 / A4146	A5130	A509 W	J3) A509/A5130 B-D	375	416	41	11.0%	2.1	Pass Low
29	3	A509 / A5130 / A4146	A4146	A509 N	J3) A509/A5130 C-A	515	702	187	36.4%	7.6	Fail Low
30	3	A509 / A5130 / A4146	A4146	A5130	J3) A509/A5130 C-B	47	61	14	29.1%	1.9	Pass Low
32	3	A509 / A5130 / A4146	A4146	A509 W	J3) A509/A5130 C-D	1	4	3	249.8%	1.7	Pass Low
33	3	A509 / A5130 / A4146	A509 W	A509 N	J3) A509/A5130 D-A	373	531	157	42.1%	7.4	Fail Low
34	3	A509 / A5130 / A4146	A509 W	A5130	J3) A509/A5130 D-B	165	217	52	31.4%	3.8	Pass Low
35	3	A509 / A5130 / A4146	A509 W	A4146	J3) A509/A5130 D-C	13	20	6	45.2%	1.5	Pass Low
37	4	Newport Road / A509	A509 N	A509 S	40::39::105x	690	826	136	19.7%	4.9	Fail Low
38	4	Newport Road / A509	A509 N	Newport Road	40::39::149	24	35	11	45.8%	2.0	Pass Low
39	4	Newport Road / A509	Newport Road	A509 S	150::149::105x	247	262	15	6.1%	0.9	Pass Low
40	4	Newport Road / A509	A509 S	A509 N	38::105x::39	416	476	60	14.3%	2.8	Pass Low
41	4	Newport Road / A509	A509 S	Newport Road	38::105x::149	178	219	41	23.2%	2.9	Pass Low

	Sum Obs.	Sum Mod.	Diff	% Diff	Ave. GEH
Overall Stats	19410	22295	2886	14.9%	3.1

Vehicle Flow Information
Calibration Statistics
All Vehicles
PM Peak

Index	Junction	Name	Origin	Destination	Reference	Observed Flow	Modelled Flow	Difference	% Difference	G.E.H. Value (using hourly flows)	Flow Test (using hourly flows)
1	1	M1 Junction 14	A509 N	A509 N	J1) M1 J14 A-A	29	20	-9	-30.1%	1.8	Pass Low
2	1	M1 Junction 14	A509 N	M1 E	J1) M1 J14 A-B	333	344	11	3.2%	0.6	Pass Low
3	1	M1 Junction 14	A509 N	A509 S	J1) M1 J14 A-C	549	562	13	2.4%	0.6	Pass Low
4	1	M1 Junction 14	A509 N	M1 W	J1) M1 J14 A-D	197	202	5	2.6%	0.4	Pass Low
5	1	M1 Junction 14	M1 E	A509 N	J1) M1 J14 B-A	273	275	3	1.0%	0.2	Pass Low
7	1	M1 Junction 14	M1 E	A509 S	J1) M1 J14 B-C	522	568	46	8.7%	2.0	Pass Low
8	1	M1 Junction 14	M1 E	M1 W	J1) M1 J14 B-D	2740	2930	190	6.9%	3.6	Pass High
9	1	M1 Junction 14	A509 S	A509 N	J1) M1 J14 C-A	472	609	137	28.9%	5.9	Fail Low
10	1	M1 Junction 14	A509 S	M1 E	J1) M1 J14 C-B	718	626	-92	-12.8%	3.5	Pass Mid
11	1	M1 Junction 14	A509 S	A509 S	J1) M1 J14 C-C	1	0	-1	-56.4%	0.7	Pass Low
12	1	M1 Junction 14	A509 S	M1 W	J1) M1 J14 C-D	649	499	-150	-23.2%	6.3	Fail Low
13	1	M1 Junction 14	M1 W	A509 N	J1) M1 J14 D-A	117	121	4	3.7%	0.4	Pass Low
14	1	M1 Junction 14	M1 W	M1 E	J1) M1 J14 D-B	2562	2678	116	4.5%	2.3	Pass Mid
15	1	M1 Junction 14	M1 W	A509 S	J1) M1 J14 D-C	519	537	18	3.5%	0.8	Pass Low
17	2	A509 / P&R	A509 N	P&R	28::103::105	25	18	-7	-27.4%	1.5	Pass Low
18	2	A509 / P&R	A509 N	A509 S	28::103::26	1566	1650	84	5.3%	2.1	Pass Mid
19	2	A509 / P&R	P&R	A509 S	128::26::24	0	0	0		0.0	Pass Low
20	2	A509 / P&R	A509 S	A509 N	101::25::27	1842	1734	-107	-5.8%	2.5	Pass Mid
21	3	A509 / A5130 / A4146	A509 N	A509 N	J3) A509/A5130 A-A	0	12	12		4.8	Pass Low
22	3	A509 / A5130 / A4146	A509 N	A5130	J3) A509/A5130 A-B	204	209	6	2.8%	0.4	Pass Low
23	3	A509 / A5130 / A4146	A509 N	A4146	J3) A509/A5130 A-C	860	918	57	6.7%	1.9	Pass Mid
24	3	A509 / A5130 / A4146	A509 N	A509 W	J3) A509/A5130 A-D	503	512	9	1.7%	0.4	Pass Low
25	3	A509 / A5130 / A4146	A5130	A509 N	J3) A509/A5130 B-A	399	334	-66	-16.5%	3.4	Pass Low
27	3	A509 / A5130 / A4146	A5130	A4146	J3) A509/A5130 B-C	116	130	14	12.3%	1.3	Pass Low
28	3	A509 / A5130 / A4146	A5130	A509 W	J3) A509/A5130 B-D	161	178	17	10.7%	1.3	Pass Low
29	3	A509 / A5130 / A4146	A4146	A509 N	J3) A509/A5130 C-A	800	789	-12	-1.5%	0.4	Pass Mid
30	3	A509 / A5130 / A4146	A4146	A5130	J3) A509/A5130 C-B	49	72	23	46.6%	3.0	Pass Low
32	3	A509 / A5130 / A4146	A4146	A509 W	J3) A509/A5130 C-D	3	3	-1	-21.2%	0.4	Pass Low
33	3	A509 / A5130 / A4146	A509 W	A509 N	J3) A509/A5130 D-A	642	595	-47	-7.3%	1.9	Pass Low
34	3	A509 / A5130 / A4146	A509 W	A5130	J3) A509/A5130 D-B	239	329	89	37.3%	5.3	Pass Low
35	3	A509 / A5130 / A4146	A509 W	A4146	J3) A509/A5130 D-C	7	11	4	48.3%	1.2	Pass Low
37	4	Newport Road / A509	A509 N	A509 S	40::39::105x	728	810	83	11.4%	3.0	Pass Mid
38	4	Newport Road / A509	A509 N	Newport Road	40::39::149	45	40	-6	-12.2%	0.8	Pass Low
39	4	Newport Road / A509	Newport Road	A509 S	150::149::105x	378	316	-62	-16.3%	3.3	Pass Low
40	4	Newport Road / A509	A509 S	A509 N	38::105x::39	787	893	106	13.5%	3.7	Pass Mid
41	4	Newport Road / A509	A509 S	Newport Road	38::105x::149	102	122	20	19.3%	1.9	Pass Low

	Sum Obs.	Sum Mod.	Diff	% Diff	Ave. GEH
Overall Stats	19138	19645	507	2.7%	2.0

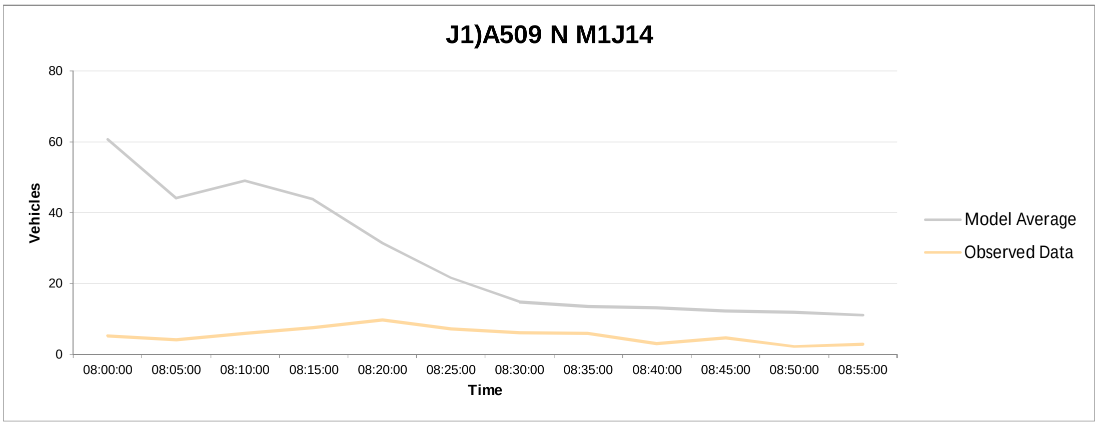
Appendix E

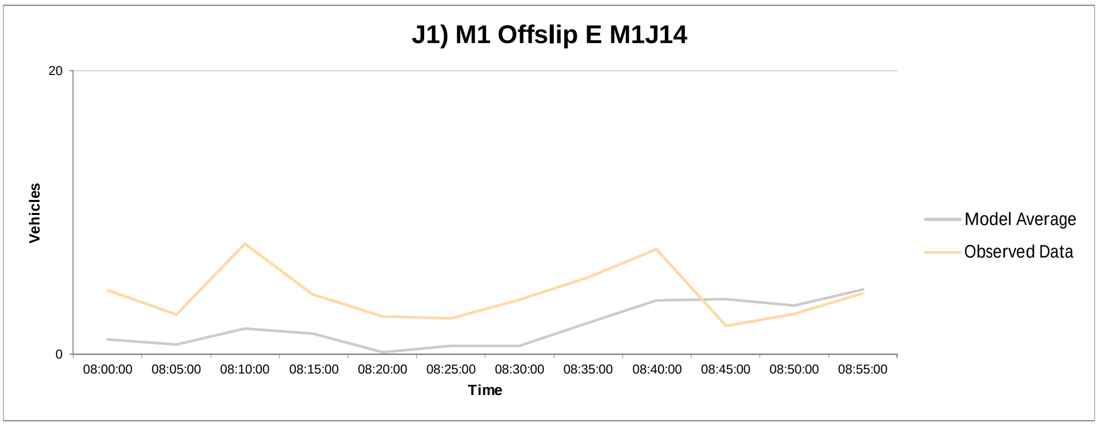
MODEL QUEUE GRAPHS (AM)

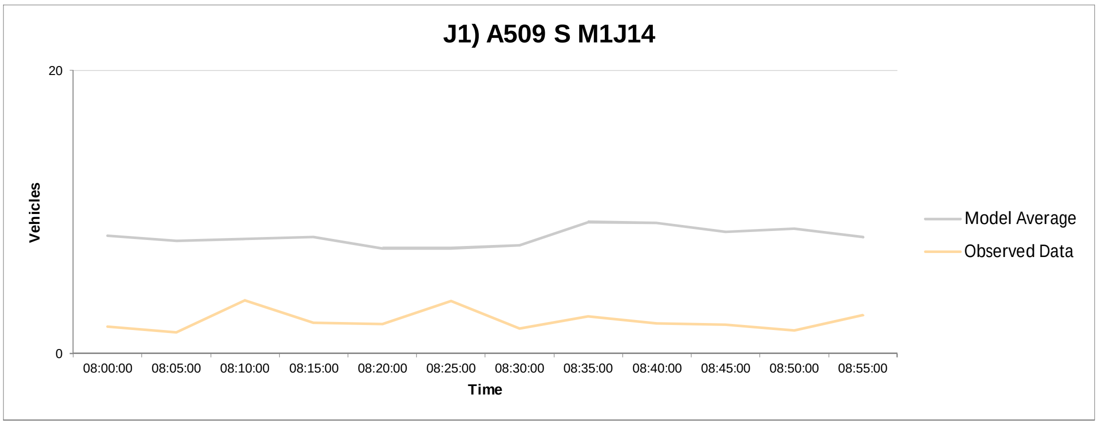
Public

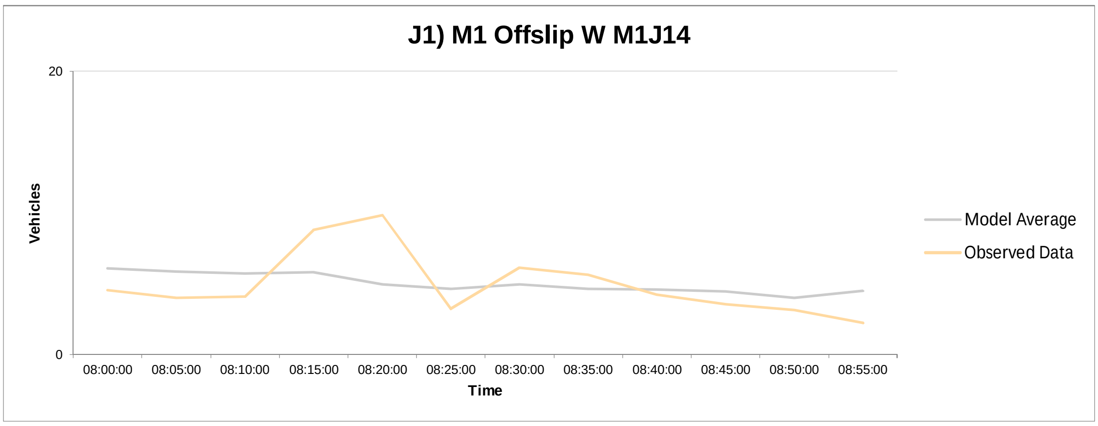
Queue Graphs

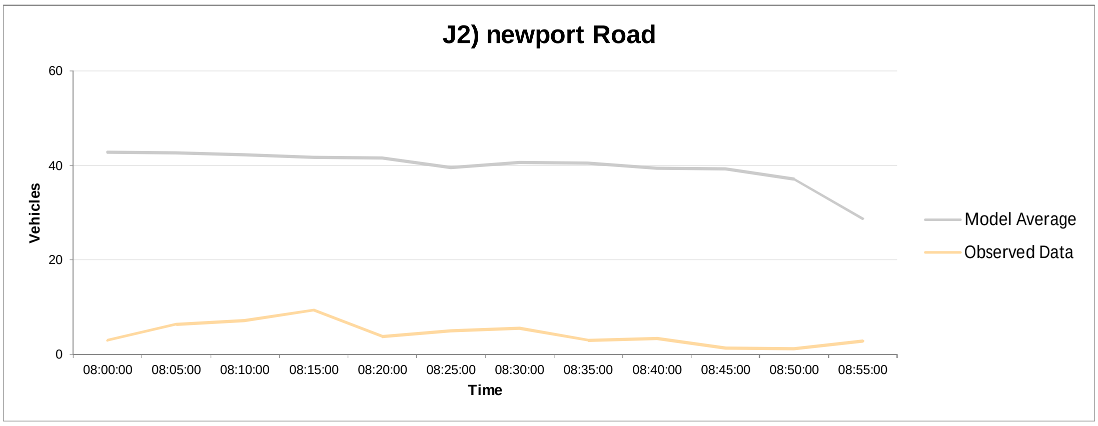
Junction Number 1
AM Peak



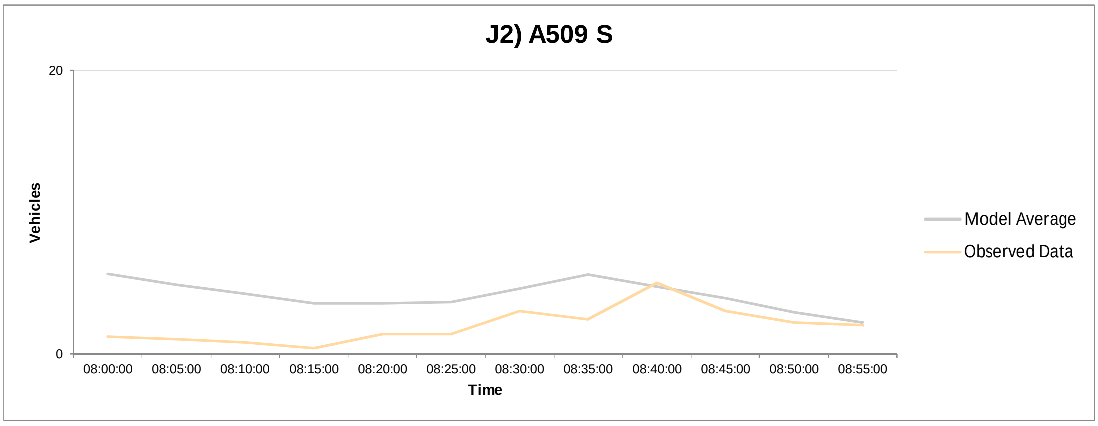








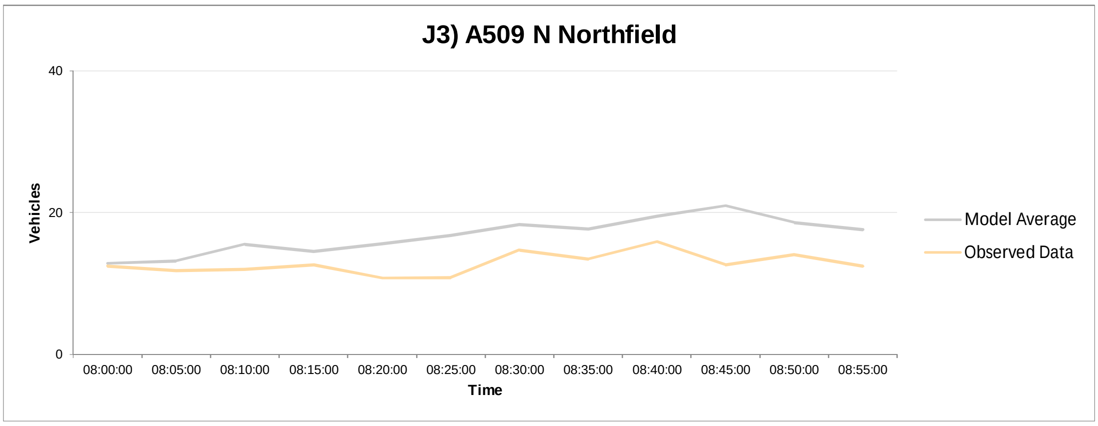
J2) newport Road
Vehicles
60
40
20
0
08:00:00
08:05:00
08:10:00
08:15:00
08:20:00
08:25:00
08:30:00
08:35:00
08:40:00
08:45:00
08:50:00
08:55:00
Time
Model Average
Observed Data

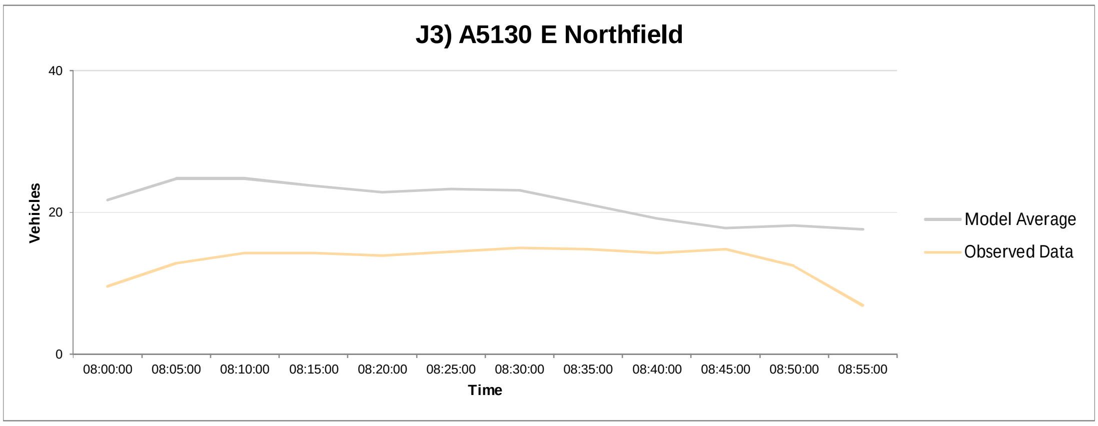


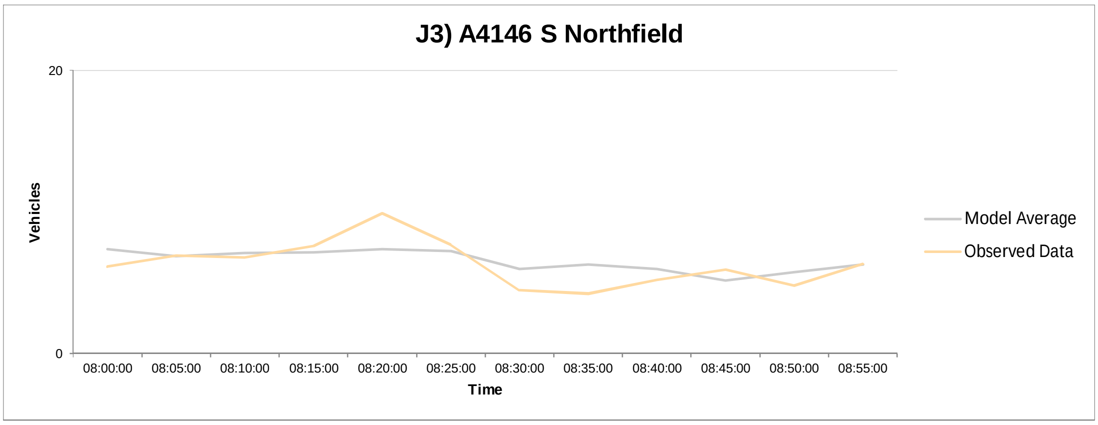
J2) A509 S
Vehicles
20
0
08:00:00
08:05:00
08:10:00
08:15:00
08:20:00
08:25:00
08:30:00
08:35:00
08:40:00
08:45:00
08:50:00
08:55:00
Time
Model Average
Observed Data

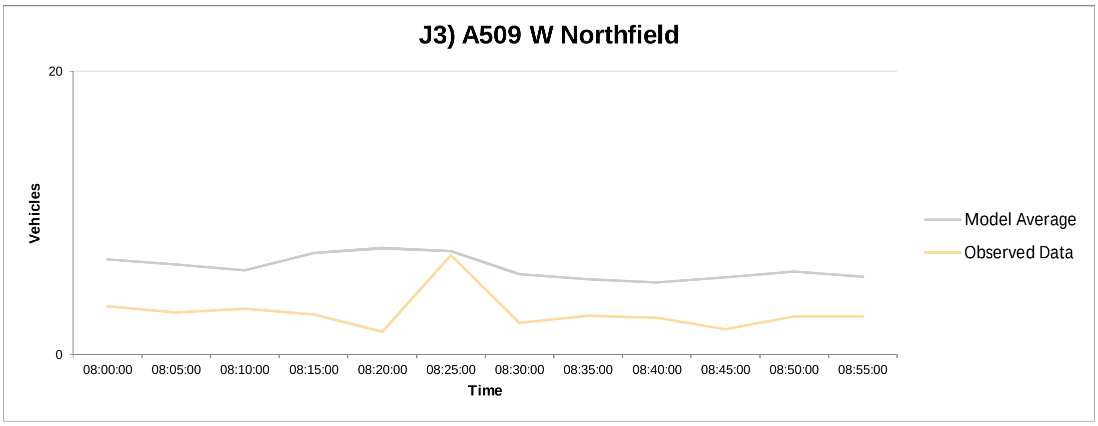
Queue Graphs

Junction Number 3
AM Peak







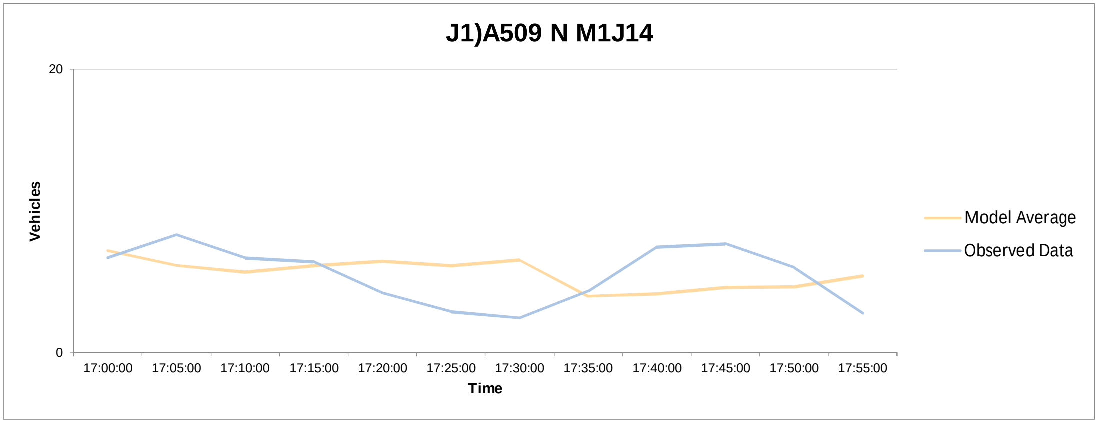


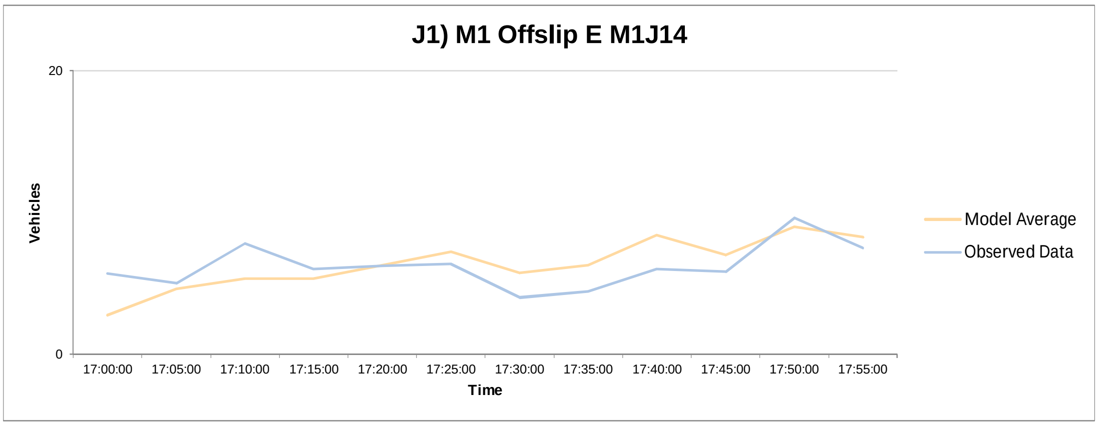
Appendix F

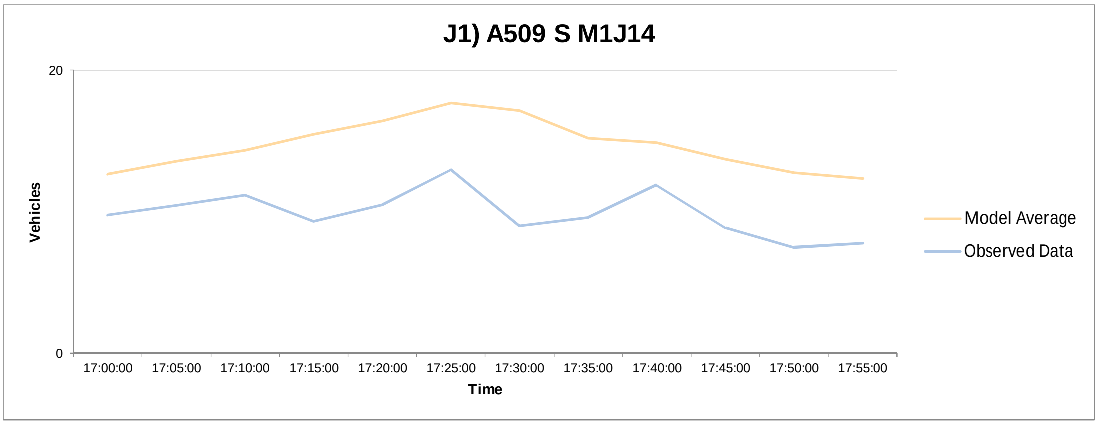
MODEL QUEUE GRAPHS (PM)

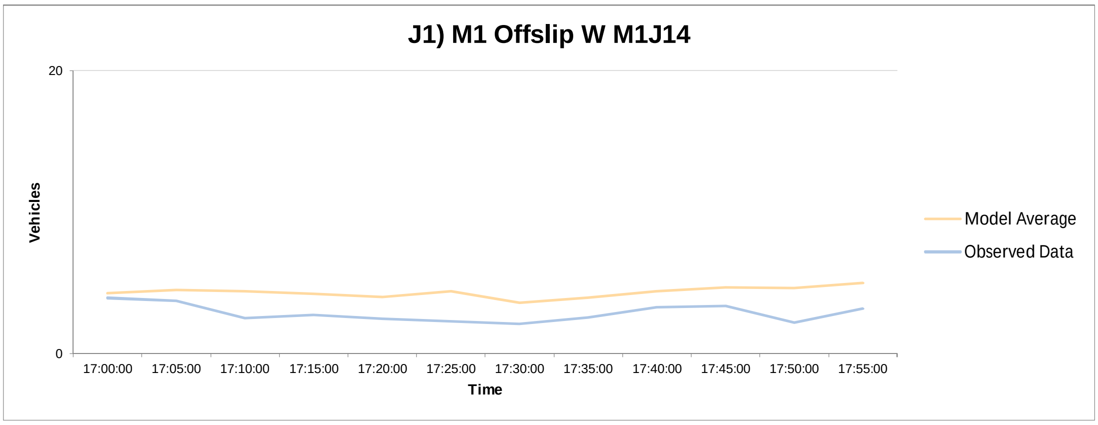
Queue Graphs

Junction Number 1
PM Peak



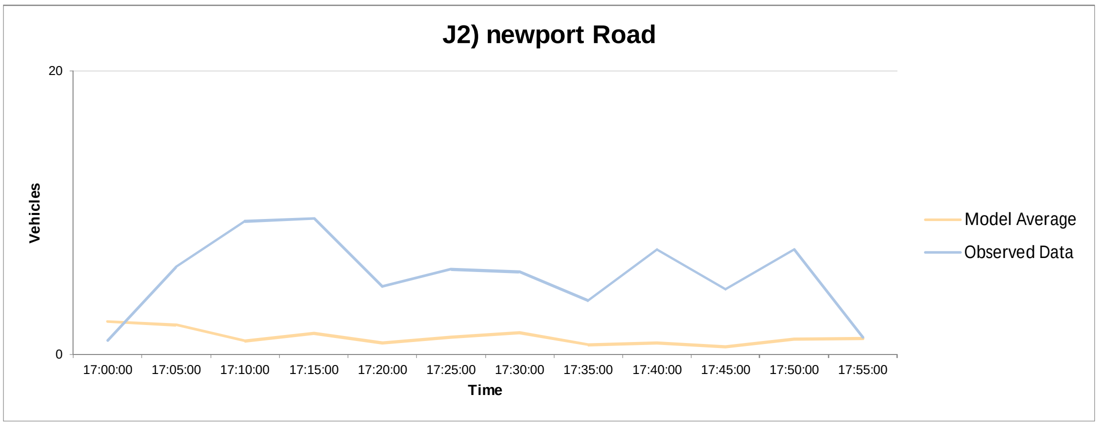


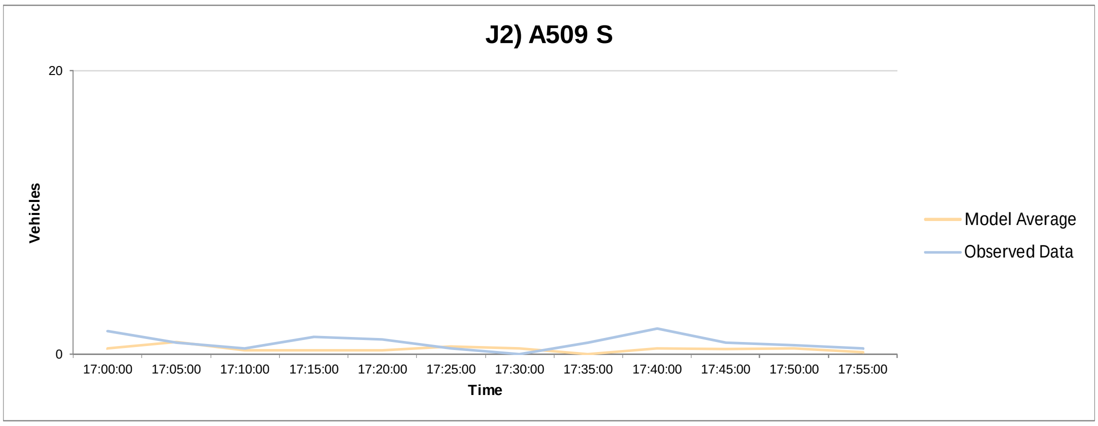




Queue Graphs

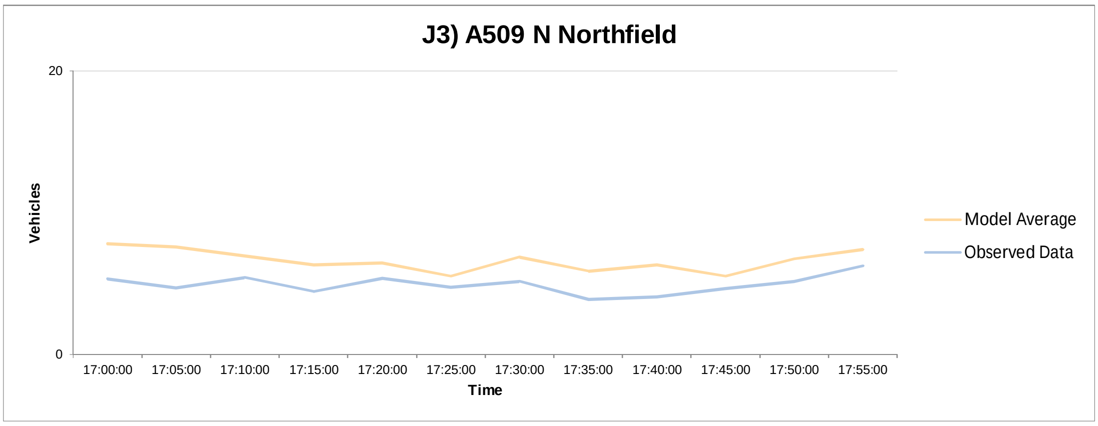
Junction Number 2
PM Peak

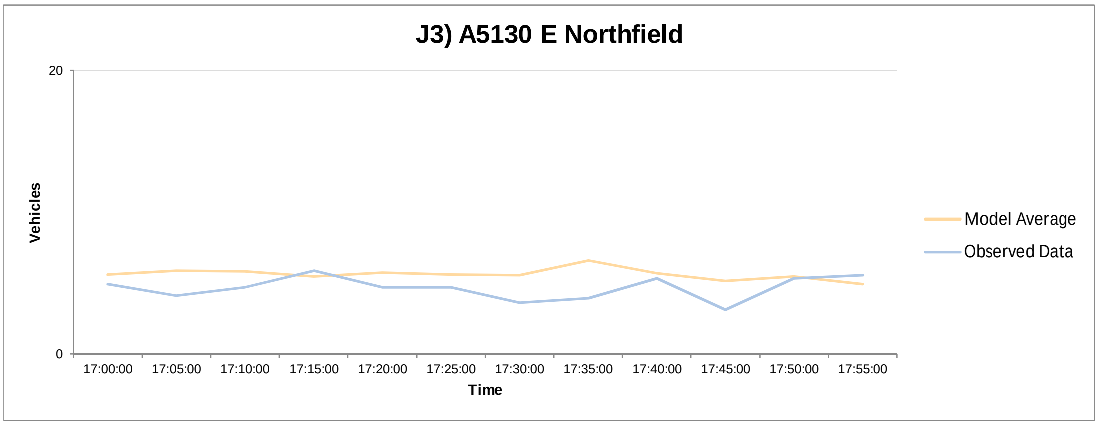


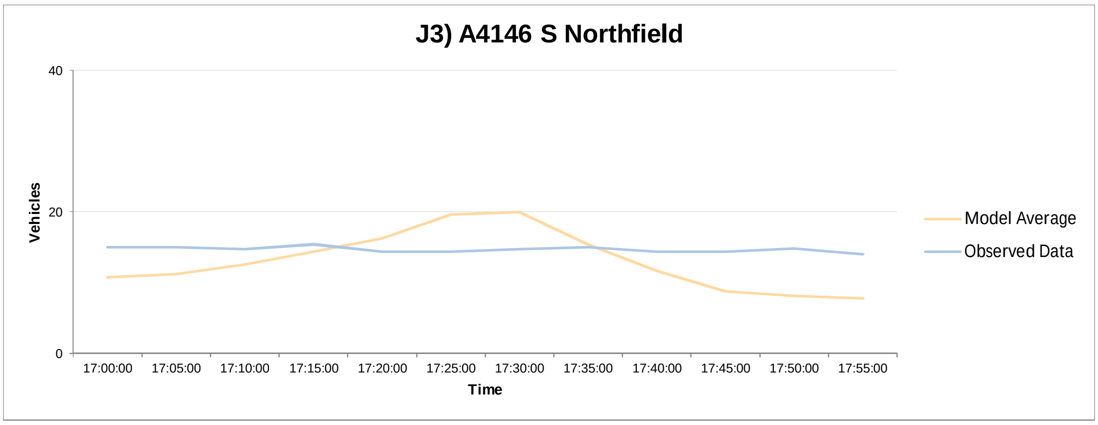


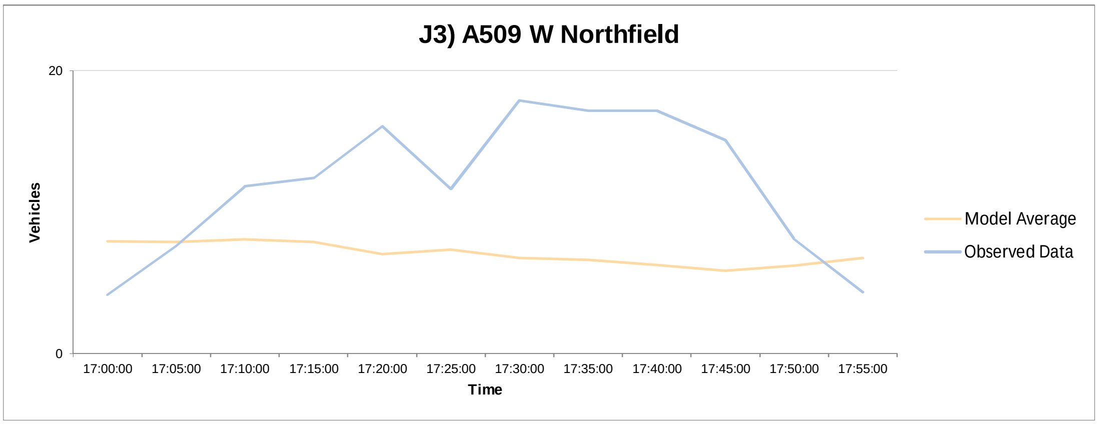
Queue Graphs

Junction Number 3
PM Peak



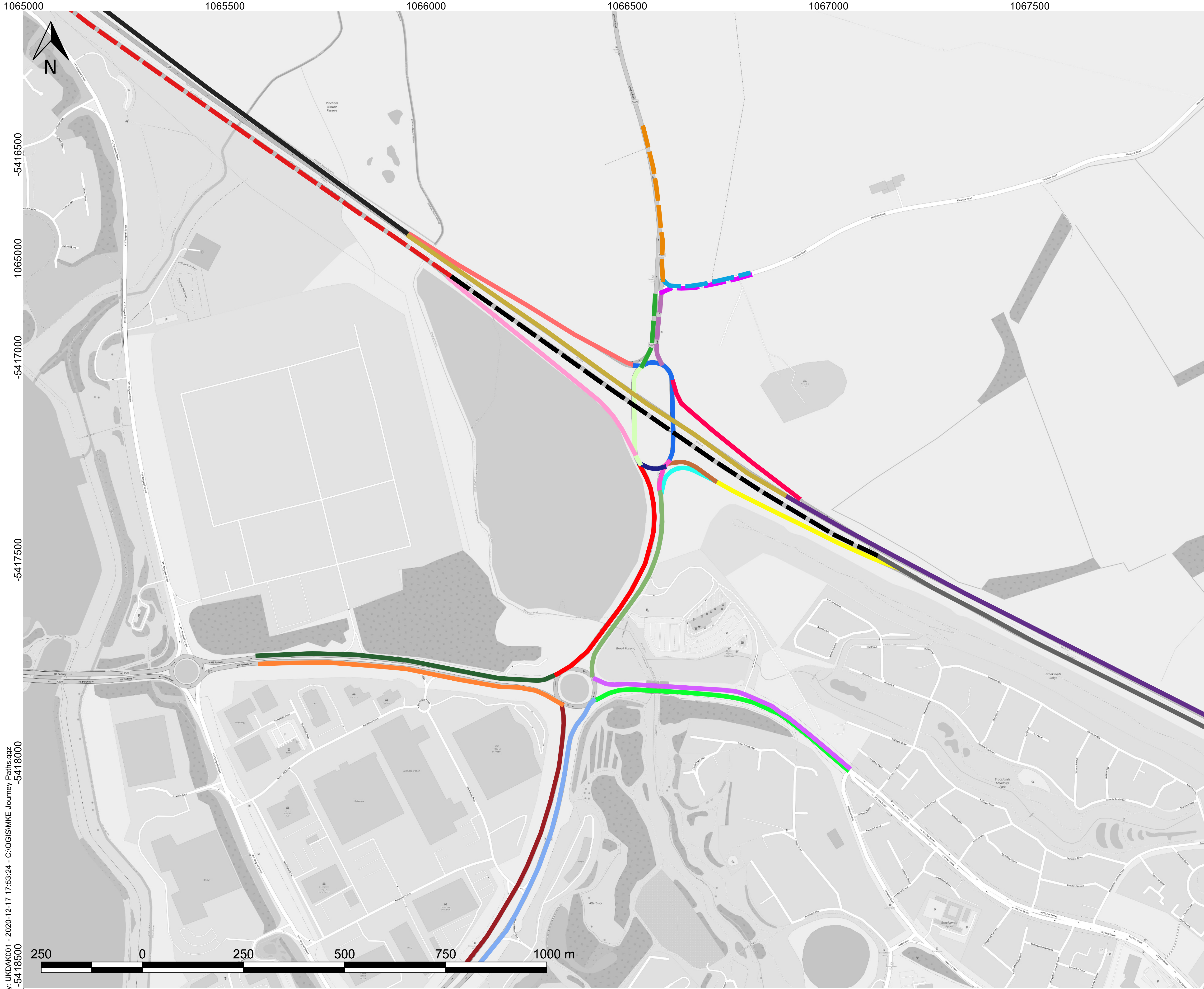






Appendix G

MODEL JOURNEY TIMES



TM Route 30
TM Route 29
TM Route 28
TM Route 27
TM Route 26
TM Route 25
TM Route 24
TM Route 23
TM Route 22
TM Route 21
TM Route 20
TM Route 19
TM Route 18
TM Route 17
TM Route 16
TM Route 15
TM Route 14
TM Route 13
TM Route 12
TM Route 11
TM Route 10
TM Route 9
TM Route 8
TM Route 7
TM Route 6
TM Route 5
TM Route 3
TM Route 2
TM Route 1
OSM Standard

Unit 9, The Chase, John Tate Road, Foxholes Business Park, Hertford, SG13 7NN

TITLE: Trafficmaster Journey Time Routes

DRAWN:	CHECKED:	APPROVED:
QGIS FILE: MKE Journey Paths.qgz	SCALE @A3: 1:8870	DATE: 17/12/20
PROJECT No: 70057521	DRAWING No:	REV:

Created by: UKDAK001 - 2020-12-17 17:53:24 - C:\QGIS\MKE Journey Paths.qgz

Journey Times
Validation Statistics

AM Peak

Route:	Segment	Graph Group	Observed Average	Observed 95% Conf	Modelled Average	Modelled 95% Conf	Var Chk	% Diff	Diff	Conf?	15%	60s	WebTAG	Distance (m)
Route 1: M1 WB	Full	1	215	7	199	1	TRUE	-7.3%	-16	FALSE	TRUE	TRUE	TRUE	4500
Route 2: M1 EB	Full	2	208	3	193	0	TRUE	-7.1%	-15	FALSE	TRUE	TRUE	TRUE	4498
Route 3: M1 E to A509 N	Full	3	271	18	257	6	TRUE	-5.2%	-14	TRUE	TRUE	TRUE	TRUE	3109
Route 4: M1 E to A509 W	Full	4	245	21	256	10	TRUE	4.4%	11	TRUE	TRUE	TRUE	TRUE	3269
Route 5: M1 W to A4146	Full	5	237	28	199	4	TRUE	-16.2%	-38	FALSE	FALSE	TRUE	TRUE	2382
Route 6: M1 W to A509 (N)	Full	6	128	14	116	3	TRUE	-9.0%	-12	TRUE	TRUE	TRUE	TRUE	1792
Route 7: A509(N) to M1 E	Full	7	197	41	157	1	TRUE	-20.5%	-41	TRUE	FALSE	TRUE	TRUE	2978
Route 8: A509(N) to M1 W	Full	8	221	27	175	2	TRUE	-20.7%	-46	FALSE	FALSE	TRUE	TRUE	2365
Route 9: A509(N) to A4146	Full	9	202	48	173	3	TRUE	-14.5%	-29	TRUE	TRUE	TRUE	TRUE	822
Route 10: A4146 to M1 E	Full	10	241	15	239	2	TRUE	-0.8%	-2	TRUE	TRUE	TRUE	TRUE	3595
Route 11: A4146 to M1 W	Full	11	168	9	149	1	TRUE	-11.1%	-19	FALSE	TRUE	TRUE	TRUE	2534
Route 12: A4146 to A509 N	Full	12	130	17	131	9	FALSE	1.0%	1	TRUE	TRUE	TRUE	TRUE	860
TM Route 1	Full	13	72		96	0	TRUE	33.6%	24	FALSE	FALSE	TRUE	TRUE	2106
TM Route 2	Full	14	68		40	0	TRUE	-41.0%	-28	FALSE	FALSE	TRUE	TRUE	500
TM Route 3	Full	15	44		28	1	TRUE	-36.8%	-16	FALSE	FALSE	TRUE	TRUE	216
TM Route 5	Full	16	22		12	2	FALSE	-44.6%	-10	FALSE	FALSE	TRUE	TRUE	272
TM Route 6	Full	17	12		11	2	FALSE	-8.9%	-1	FALSE	TRUE	TRUE	TRUE	153
TM Route 7	Full	18	19		28	1	TRUE	46.9%	9	FALSE	FALSE	TRUE	TRUE	118
TM Route 8	Full	19	6		4	0	TRUE	-32.0%	-2	FALSE	FALSE	TRUE	TRUE	78
TM Route 9	Full	20	65		36	4	FALSE	-44.8%	-29	FALSE	FALSE	TRUE	TRUE	358
TM Route 10	Full	21	183		202	60	FALSE	10.1%	19	FALSE	TRUE	TRUE	TRUE	729
TM Route 11	Full	22	22		32	0	TRUE	45.4%	10	FALSE	FALSE	TRUE	TRUE	735
TM Route 12	Full	23	107		63	1	TRUE	-41.0%	-44	FALSE	FALSE	TRUE	TRUE	783
TM Route 13	Full	24	79		114	7	TRUE	44.0%	35	FALSE	FALSE	TRUE	TRUE	807
TM Route 14	Full	25	57		41	0	TRUE	-28.2%	-16	FALSE	FALSE	TRUE	TRUE	713
TM Route 15	Full	26	59		26	0	TRUE	-56.3%	-33	FALSE	FALSE	TRUE	TRUE	713
TM Route 16	Full	27	34		33	2	TRUE	-4.0%	-1	FALSE	TRUE	TRUE	TRUE	433
TM Route 17	Full	28	17		7	1	FALSE	-58.9%	-10	FALSE	FALSE	TRUE	TRUE	54
TM Route 18	Full	29	15		30	2	FALSE	102.8%	15	FALSE	FALSE	TRUE	TRUE	178
TM Route 19	Full	30	24		17	0	TRUE	-31.0%	-8	FALSE	FALSE	TRUE	TRUE	380
TM Route 20	Full	31	44		29	0	TRUE	-33.7%	-15	FALSE	FALSE	TRUE	TRUE	764
TM Route 21	Full	32	50		106	0	TRUE	113.5%	56	FALSE	FALSE	TRUE	TRUE	2504
TM Route 22	Full	33	71		120	1	TRUE	69.9%	50	FALSE	FALSE	TRUE	TRUE	2409
TM Route 23	Full	34	36		39	0	TRUE	8.6%	3	FALSE	TRUE	TRUE	TRUE	1004
TM Route 24	Full	35	58		83	0	TRUE	44.5%	26	FALSE	FALSE	TRUE	TRUE	2095
TM Route 25	Full	36	24		16	0	TRUE	-31.5%	-8	FALSE	FALSE	TRUE	TRUE	366
TM Route 26	Full	37	7		15	1	FALSE	106.0%	8	FALSE	FALSE	TRUE	TRUE	143
TM Route 27	Full	38	33		76	1	TRUE	128.7%	43	FALSE	FALSE	TRUE	TRUE	137
TM Route 28	Full	39	101		1293	95	FALSE	1179.3%	1192	FALSE	FALSE	FALSE	FALSE	286
TM Route 29	Full	40	15		14	0	TRUE	-6.6%	-1	FALSE	TRUE	TRUE	TRUE	288
TM Route 30	Full	41	201		157	13	FALSE	-21.9%	-44	FALSE	FALSE	TRUE	TRUE	507

Journey Times
Validation Statistics

PM Peak

Route:	Segment	Graph Group	Observed Average	Observed 95% Conf	Modelled Average	Modelled 95% Conf	Var Chk	% Diff	Diff	Conf?	15%	60s	WebTAG	Distance (m)
Route 1: M1 WB	Full	1	206	1	192	0	TRUE	-6.7%	-14	FALSE	TRUE	TRUE	TRUE	4500
Route 2: M1 EB	Full	2	206	1	193	0	TRUE	-6.6%	-14	FALSE	TRUE	TRUE	TRUE	4498
Route 3: M1 E to A509 N	Full	3	257	5	254	8	TRUE	-1.0%	-3	TRUE	TRUE	TRUE	TRUE	3109
Route 4: M1 E to A509 W	Full	4	193	2	187	2	TRUE	-3.2%	-6	FALSE	TRUE	TRUE	TRUE	3269
Route 5: M1 W to A4146	Full	5	190	2	166	1	TRUE	-13.0%	-25	FALSE	TRUE	TRUE	TRUE	2382
Route 6: M1 W to A509 (N)	Full	6	117	2	108	1	TRUE	-7.6%	-9	FALSE	TRUE	TRUE	TRUE	1792
Route 7: A509(N) to M1 E	Full	7	174	8	152	1	TRUE	-12.7%	-22	FALSE	TRUE	TRUE	TRUE	2978
Route 8: A509(N) to M1 W	Full	8	197	17	141	1	TRUE	-28.4%	-56	FALSE	FALSE	TRUE	TRUE	2365
Route 9: A509(N) to A4146	Full	9	148	17	81	1	TRUE	-45.2%	-67	FALSE	FALSE	FALSE	FALSE	822
Route 10: A4146 to M1 E	Full	10	272	8	258	2	TRUE	-5.2%	-14	FALSE	TRUE	TRUE	TRUE	3595
Route 11: A4146 to M1 W	Full	11	212	12	170	1	TRUE	-19.9%	-42	FALSE	FALSE	TRUE	TRUE	2534
Route 12: A4146 to A509 N	Full	12	173	14	149	2	TRUE	-14.1%	-24	FALSE	TRUE	TRUE	TRUE	860
TM Route 1	Full	13	63		90	0	TRUE	41.9%	27	FALSE	FALSE	TRUE	TRUE	2106
TM Route 2	Full	14	56		43	1	TRUE	-22.6%	-13	FALSE	FALSE	TRUE	TRUE	500
TM Route 3	Full	15	39		23	0	TRUE	-41.8%	-16	FALSE	FALSE	TRUE	TRUE	216
TM Route 5	Full	16	33		11	0	TRUE	-66.2%	-22	FALSE	FALSE	TRUE	TRUE	272
TM Route 6	Full	17	8		11			32.6%	3	FALSE	FALSE	TRUE	TRUE	153
TM Route 7	Full	18	34		47	7	FALSE	37.6%	13	FALSE	FALSE	TRUE	TRUE	118
TM Route 8	Full	19	4		4			-2.7%	0	FALSE	TRUE	TRUE	TRUE	78
TM Route 9	Full	20	43		21	0	TRUE	-50.6%	-22	FALSE	FALSE	TRUE	TRUE	358
TM Route 10	Full	21	64		67	0	TRUE	5.3%	3	FALSE	TRUE	TRUE	TRUE	729
TM Route 11	Full	22	22		32	0	TRUE	43.1%	10	FALSE	FALSE	TRUE	TRUE	735
TM Route 12	Full	23	360		98	13	FALSE	-72.9%	-263	FALSE	FALSE	FALSE	FALSE	783
TM Route 13	Full	24	61		41	0	TRUE	-32.3%	-20	FALSE	FALSE	TRUE	TRUE	807
TM Route 14	Full	25	282		45	1	TRUE	-84.1%	-237	FALSE	FALSE	FALSE	FALSE	713
TM Route 15	Full	26	40		24			-39.7%	-16	FALSE	FALSE	TRUE	TRUE	713
TM Route 16	Full	27	83		48	1	TRUE	-41.8%	-35	FALSE	FALSE	TRUE	TRUE	433
TM Route 17	Full	28	20		9	0	TRUE	-53.9%	-11	FALSE	FALSE	TRUE	TRUE	54
TM Route 18	Full	29	22		27	1	TRUE	24.0%	5	FALSE	FALSE	TRUE	TRUE	178
TM Route 19	Full	30	32		17	0	TRUE	-48.4%	-16	FALSE	FALSE	TRUE	TRUE	380
TM Route 20	Full	31	46		29	0	TRUE	-36.7%	-17	FALSE	FALSE	TRUE	TRUE	764
TM Route 21	Full	32	61		108	0	TRUE	77.5%	47	FALSE	FALSE	TRUE	TRUE	2504
TM Route 22	Full	33	66		105	0	TRUE	58.8%	39	FALSE	FALSE	TRUE	TRUE	2409
TM Route 23	Full	34	48		39	0	TRUE	-18.8%	-9	FALSE	FALSE	TRUE	TRUE	1004
TM Route 24	Full	35	81		83	0	TRUE	2.7%	2	FALSE	TRUE	TRUE	TRUE	2095
TM Route 25	Full	36	28		17	0	TRUE	-41.4%	-12	FALSE	FALSE	TRUE	TRUE	366
TM Route 26	Full	37	7		8			21.1%	1	FALSE	FALSE	TRUE	TRUE	143
TM Route 27	Full	38	15		20	1	TRUE	34.2%	5	FALSE	FALSE	TRUE	TRUE	137
TM Route 28	Full	39	63		22	0	TRUE	-65.1%	-41	FALSE	FALSE	TRUE	TRUE	286
TM Route 29	Full	40	12		14	0	TRUE	17.6%	2	FALSE	FALSE	TRUE	TRUE	288
TM Route 30	Full	41	50		19	0	TRUE	-61.2%	-30	FALSE	FALSE	TRUE	TRUE	507

Unit 9, The Chase
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Hertford
SG13 7NN

wsp.com

PUBLIC

Appendix L.3

LMVR ADDENDUM2

Public

TECHNICAL NOTE

DATE:	15 March 2021	**CONFIDENTIALITY:**	Public
SUBJECT:	M1 Junction 14 Paramics Model – Addendum (2) to Local Model Validation Report		
PROJECT:	70075721	**AUTHOR:**	D Gooding
CHECKED:	S Biggs	**APPROVED:**	S Biggs

1.1 Introduction

1.1.1 This Technical Note forms an addendum to the Local Model Validation Report (LMVR) for the M1 Junction 14 and Northfield Roundabout Paramics model. This technical note should be read alongside the original LMVR and the first addendum, but supersedes any model statistics that are presented in those documents.

1.1.2 The LMVR focuses on the following outstanding matters:

i The use of the ANPR data
ii Comments relating to flow volumes in the models
iii Queue values and labelling
iv Revalidation of the updated model against observed journey time data

1.2 Use of the ANPR Data

1.2.1 The previous review by AECOM has still highlighted concerns regarding the use of the ANPR data for both turning count and journey time validation due to some arms showing small sample sizes and the lack of a corroborating junction turning counts to check the OD matrix against. However, it was agreed at a meeting with AECOM and Highways England on 2 March 2021 that as there is currently no alternative data which either already exists or can be collected, the ANPR data can be used for calibration and validation of the journey times, OD movements and travel times for this model. It was agreed with AECOM that their concerns with regards to the ANPR data would be recorded as a residual risk within the modelling and that any future reviews of the model forecasting would need to consider the context of that residual risk when drawing conclusions.

1.2.2 WSP also accepts AECOM's comments relating to the factoring of the ANPR traffic flows, and for consistency will use the values suggested in the AECOM technical note.

1.3 Model Changes

1.3.1 In light of the AECOM comments regarding the factoring of traffic flows from the ANPR data, WSP has revisited both the AM and PM matrices and traffic profiles. The AM and PM traffic flow profiles have been amended in the model to better reflect the observed MCC traffic profiles, meaning that they are now calculated by entry rather than by turning movement to ensure that any residual concerns relating to the sample sizes and factoring of OD movements into the traffic matrix were not taken into the traffic profiles as well. This change was applied to both AM and PM models for consistency.

1.3.2 In addition to this change, the signal scripts were revisited to ensure that the model operated as realistically as possible with the amended traffic flow profiles. These changes were minor but resulted in the signals extending more realistically in response to traffic demand and cutting surplus green time where necessary to reduce the loss of saturated conditions. Minor tweaks were also made to some link headways/ priorities to reflect the impacts of the changed traffic profiles.

1.4 Flow Validation

1.4.1 WSP has revisited to the traffic flow validation and taken on board the comments relating the PM peak. For simplicity, WSP has adopted the AM and PM peak observed flows identified in AECOM's report.

1.4.2 Additionally, to ensure that traffic flows in the model represent the profile of the MCC data counts (rather than the smaller samples of the matched data), the PM peak traffic profiles have been recalculated from the inbound MCC flows on each zone entry to the model.

1.4.3 Table 1 summarises the traffic count calibration against the following criteria from TAG:

- GEH < 5 — 85% pass rate required
- Flow Tests — 85% overall pass rate required

1.4.4 It is noted that the GEH and Flow Tests are either/ or tests, although in this case the model passes both within the TAG requirements. Table 1 summarises the traffic count calibration results.

Table 1 – Traffic Count Calibration

	% GEH<5	% Passing Flow Tests	% Meeting TAG
AM Peak	100%	100%	100%
PM Peak	100%	100%	100%

1.4.5 It is considered that the model is showing an excellent level of performance against the traffic flow calibration tests with all turning counts passing both the GEH and flow volume tests from TAG. Appendices A and B contain the detailed traffic count calibration statistics for the AM and PM Peaks respectively.

1.5 Queues

1.5.1 The queue routes in Paramics Discovery collect queue data about the length of queue in all lanes spanned by the queue route (on most approaches, this means that the queue route is reporting the average or maximum queue across several lanes). This does not necessarily mean that all lanes see the maximum queue length, instead it means that the maximum queue on the approach is as reported by the queue route.

1.5.2 Furthermore, it is noted that the queue lengths are a summary of the result of 15 independent seeded runs, meaning that the graphs and data typically show an average maximum queue.

1.5.3 Appendices C and D contain queue graphs for AM and PM peaks respectively for the following junctions. The queue graphs are grouped by junction as follows, and generally proceed clockwise round the junction from the north:

– Junction 1: M1 Junction 14
– Junction 2: A509/ Newport Road
– Junction 3: Northfield Roundabout
– Junction 4: Park and Ride access

1.5.4 The queue graphs show a good level of match between the observed and the modelled queue lengths, with modelled queues generally showing a similar profile and order of magnitude to the observed.

1.6 Journey Times

1.6.1 The journey time data is presented for two sources, data from the ANPR survey and data from the TrafficMaster flows. The tests set out by TAG is for the model to meet the greater of the following two tests:

i Modelled journey time within 15% of the observed journey time
ii Modelled journey time within 60 seconds of the observed journey time

1.6.2 To identify the number of modelled journey times close to the observed the percentage of modelled journey times within 30 seconds of the observed has also been recorded.

1.6.3 Detailed tables summarising the journey times for each individual journey time route are contained in Appendix E and F for the AM and PM peaks respectively, while cumulative journey time graphs calculated from the Trafficmaster data are contained in Appendices G and H.

1.6.4 During initial validation, the ANPR journey times were the preferred source of data, however the latest validation has also given some consideration to performance of the model against the Trafficmaster data.

ALL JOURNEY TIMES

1.6.5 Firstly, the LMVR summarises the performance of the model against all of the journey time routes tested, as summarised in Table 2,.

Table 2 – Performance of All Individual Journey Time Routes against TAG Criteria

	Within 15%	Within 60s	Within 30s	TAG Pass
AM peak	31.7%	90.2%	70.7%	90.2%
PM Peak	36.6%	87.8%	75.6%	87.8%

1.6.6 The model shows a good performance against the TAG criteria, passing in both peaks, with many routes that pass on the 60s criteria meeting the tighter 30 second criteria as well.

1.6.7 WSP notes that there have been several journey times where it has proven almost impossible to provide a close match to the observed journey time, these are described in more detail below.

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ANPR JOURNEY TIMES

1.6.8 As described above, several different journey time sources have been used within the model validation. The first is the ANPR journey time data which is contemporary with the OD count data used for the model validation. The performance of the ANPR journey times against the TAG criteria is set out in Table 3 below.

Table 3 – ANPR validation

	Within 15%	Within 60s	Within 30s	TAG Pass
AM peak	58.3%	91.7%	66.7%	91.7%
PM Peak	75.0%	83.3%	75.0%	83.3%

1.6.9 The model is generally showing a good performance against the TAG criteria – while the PM Peak does not quite meet 85%, the only movements that do not pass (two from the A4146 entry) show a modelled journey time only falls slightly outside the criteria (by about 3 seconds) and as the third journey time from this entry is showing a good level of performance it is considered that the model is suitable.

INDIVIDUAL TRAFFIC MASTER JOURNEY TIMES

1.6.10 The individual TrafficMaster journey times show a good level of match between the observed and modelled journey times, with nearly 90% of routes meeting the TAG criteria. As a further test, the proportion of journey times within 30 seconds has also been reviewed. This data is summarised in Table 4 below.

Table 4 – Trafficmaster (Individual) validation

	Within 15%	**Within 60s**	**Within 30s**
AM peak	20.6%	89.7%	75.9%
PM Peak	20.6%	89.7%	75.9%

1.6.11 As with the overall journey times, the individual Trafficmaster journey times are also showing a good level of match between the observed and modelled journey times, nearly 90% meeting the TAG criteria and over three quarters meeting the lower "within 30 seconds" criteria.

GROUPED TRAFFICMASTER JOURNEY TIMES

1.6.12 The final journey time test that has been completed is to group the traffic master journey times into journey paths through the model to review the total travel time of vehicles on longer routes. The model has not explicitly been validated against these cumulative routes, w

1.6.13 Table 5 summarises the performance of the cumulative journey times against the TAG criteria, while Appendices F and G contain graphs and tables showing the performance and content of each of the journey time routes.

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Table 5 – Trafficmaster Cumulative Route Journey Times

	Within 15%	Within 60s	Within 30s
AM peak	23.5%	70.6%	52.9%
PM Peak	23.5%	76.5%	41.2%

1.6.14 It is considered that the model is showing a good level of performance against this completely independent data, as shown by the individual route section performance. Many of the graphs contained in the appendices show that parts of most routes show modelled journey times that are near-parallel to the observed journey time along that same section of road.

COMMENTS ON INDIVIDUAL JOURNEY TIME ROUTES

1.6.15 While the journey time validation shows generally good performance in the model, there are a couple of routes where journey times were either much shorter or longer than was possible to achieve in the model.

1.6.16 For example, the A509 southbound in the PM peak shows a good level of validation for routes 7, 8 and 9 which all pass within ±10 seconds of the observed journey times, albeit with a knock-on effect on Newport Road, where the journey time is predicted to be significantly longer than expected. This is because even with a "priority changing" traffic signal to let traffic out from Newport Road, vehicles struggle to find suitable gaps in traffic. In the AM Peak, these journey times on the A509 southbound are generally slightly fast, but to make these any slower would have exacerbated queues and delay on Newport Road in the PM peak. It is therefore considered that the best balance has been achieved in this location.

1.6.17 The A4146 northbound approach to the Northfield Roundabout is also showing as too fast, particularly in the PM peak. There are limited options to change this journey time (either signal timings or reducing the saturation flow with a longer headway factor) and while various combinations were tested, most of these resulted in excessive delays to the A4146, causing a knock on effect on turning count performance and downstream journey times. It is considered that the current model offers the best balance between performance of the A4146 and the performance of the rest of the model.

1.7 Latent Demand

1.7.1 The model shows no unreleased vehicles on any entry in the AM peak. In the PM peak, the only location showing unreleased vehicles is Newport Road, where the latent demand peaks at a value generally between 30 and 40 vehicles at around 17:45, before dissipating. As Paramics records the delay and travel time a vehicle experiences from the moment a vehicle is released into the model (even if it is shown as an unreleased vehicle in the model), this means that the model results will include the travel times and delay associated with this latent demand for any trip that started during the validation peak that is completed before the end of the cool down period .

1.8 Conclusion

1.8.1 It is considered that the model validation statistics show an excellent journey time and queue length calibration and a very good journey time performance.

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APPENDIX A: AM PEAK TRAFFIC COUNT CALIBRATION

Vehicle Flow Information
Calibration Statistics
All Vehicles
AM Peak

Index	Junction	Name	Origin	Destination	Reference	Observed Flow	Modelled Flow	Difference	% Difference	G.E.H. Value (using hourly flows)	Flow Test (using hourly flows)
1	1	M1 Junction 14	A509 N	A509 N	J1) M1 J14 A-A	7	11	4	61.0%	1.4	Pass Low
2	1	M1 Junction 14	A509 N	M1 E	J1) M1 J14 A-B	292	311	19	6.5%	1.1	Pass Low
3	1	M1 Junction 14	A509 N	A509 S	J1) M1 J14 A-C	582	543	-39	-6.7%	1.6	Pass Low
4	1	M1 Junction 14	A509 N	M1 W	J1) M1 J14 A-D	87	99	12	13.9%	1.3	Pass Low
5	1	M1 Junction 14	M1 E	A509 N	J1) M1 J14 B-A	211	206	-5	-2.2%	0.3	Pass Low
7	1	M1 Junction 14	M1 E	A509 S	J1) M1 J14 B-C	1419	1328	-91	-6.4%	2.5	Pass Mid
8	1	M1 Junction 14	M1 E	M1 W	J1) M1 J14 B-D	2737	2801	64	2.4%	1.2	Pass High
9	1	M1 Junction 14	A509 S	A509 N	J1) M1 J14 C-A	326	328	2	0.6%	0.1	Pass Low
10	1	M1 Junction 14	A509 S	M1 E	J1) M1 J14 C-B	563	585	22	3.8%	0.9	Pass Low
11	1	M1 Junction 14	A509 S	A509 S	J1) M1 J14 C-C	0	1	1		1.6	Pass Low
12	1	M1 Junction 14	A509 S	M1 W	J1) M1 J14 C-D	562	586	24	4.2%	1.0	Pass Low
13	1	M1 Junction 14	M1 W	A509 N	J1) M1 J14 D-A	157	148	-9	-5.8%	0.7	Pass Low
14	1	M1 Junction 14	M1 W	M1 E	J1) M1 J14 D-B	2485	2587	102	4.1%	2.0	Pass Mid
15	1	M1 Junction 14	M1 W	A509 S	J1) M1 J14 D-C	1074	969	-105	-9.8%	3.3	Pass Mid
17	2	A509 / P&R	A509 N	P&R	28::103::105	31	23	-8	-26.0%	1.6	Pass Low
18	2	A509 / P&R	A509 N	A509 S	28::103::26	3046	2819	-227	-7.5%	4.2	Pass High
19	2	A509 / P&R	P&R	A509 S	128::26::24	0	0	0		0.0	Pass Low
20	2	A509 / P&R	A509 S	A509 N	101::25::27	1453	1500	47	3.2%	1.2	Pass Mid
21	3	A509 / A5130 / A4146	A509 N	A509 N	J3) A509/A5130 A-A	0	0	0		0.0	Pass Low
22	3	A509 / A5130 / A4146	A509 N	A5130	J3) A509/A5130 A-B	133	160	27	20.5%	2.2	Pass Low
23	3	A509 / A5130 / A4146	A509 N	A4146	J3) A509/A5130 A-C	1455	1377	-78	-5.3%	2.1	Pass Mid
24	3	A509 / A5130 / A4146	A509 N	A509 W	J3) A509/A5130 A-D	1459	1275	-184	-12.6%	5.0	Pass Mid
25	3	A509 / A5130 / A4146	A5130	A509 N	J3) A509/A5130 B-A	242	245	3	1.3%	0.2	Pass Low
27	3	A509 / A5130 / A4146	A5130	A4146	J3) A509/A5130 B-C	151	159	8	5.5%	0.7	Pass Low
28	3	A509 / A5130 / A4146	A5130	A509 W	J3) A509/A5130 B-D	418	393	-25	-5.9%	1.2	Pass Low
29	3	A509 / A5130 / A4146	A4146	A509 N	J3) A509/A5130 C-A	648	658	10	1.5%	0.4	Pass Low
30	3	A509 / A5130 / A4146	A4146	A5130	J3) A509/A5130 C-B	63	54	-9	-14.7%	1.2	Pass Low
32	3	A509 / A5130 / A4146	A4146	A509 W	J3) A509/A5130 C-D	1	4	3	253.3%	1.7	Pass Low
33	3	A509 / A5130 / A4146	A509 W	A509 N	J3) A509/A5130 D-A	562	585	23	4.0%	0.9	Pass Low
34	3	A509 / A5130 / A4146	A509 W	A5130	J3) A509/A5130 D-B	255	226	-29	-11.3%	1.9	Pass Low
35	3	A509 / A5130 / A4146	A509 W	A4146	J3) A509/A5130 D-C	20	21	1	4.0%	0.2	Pass Low
37	4	Newport Road / A509	A509 N	A509 S	40::39::105x	708	703	-5	-0.7%	0.2	Pass Mid
38	4	Newport Road / A509	A509 N	Newport Road	40::39::149	25	25	0	1.3%	0.1	Pass Low
39	4	Newport Road / A509	Newport Road	A509 S	150::149::105x	260	259	-1	-0.4%	0.1	Pass Low
40	4	Newport Road / A509	A509 S	A509 N	38::105x::39	469	478	9	2.0%	0.4	Pass Low
41	4	Newport Road / A509	A509 S	Newport Road	38::105x::149	225	217	-8	-3.7%	0.6	Pass Low

	Sum Obs.	Sum Mod.	Diff	% Diff	Ave. GEH
Overall Stats	22126	21683	-443	-2.0%	1.2

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APPENDIX B: PM PEAK TRAFFIC COUNT CALIBRATION

Vehicle Flow Information
Calibration Statistics
All Vehicles
PM Peak

Index	Junction	Name	Origin	Destination	Reference	Observed Flow	Modelled Flow	Difference	% Difference	G.E.H. Value (using hourly flows)	Flow Test (using hourly flows)
1	1	M1 Junction 14	A509 N	A509 N	J1) M1 J14 A-A	27	23	-4	-16.0%	0.9	Pass Low
2	1	M1 Junction 14	A509 N	M1 E	J1) M1 J14 A-B	351	355	4	1.1%	0.2	Pass Low
3	1	M1 Junction 14	A509 N	A509 S	J1) M1 J14 A-C	570	564	-6	-1.0%	0.2	Pass Low
4	1	M1 Junction 14	A509 N	M1 W	J1) M1 J14 A-D	201	177	-24	-11.9%	1.7	Pass Low
5	1	M1 Junction 14	M1 E	A509 N	J1) M1 J14 B-A	294	259	-35	-12.0%	2.1	Pass Low
7	1	M1 Junction 14	M1 E	A509 S	J1) M1 J14 B-C	567	490	-77	-13.6%	3.3	Pass Low
8	1	M1 Junction 14	M1 E	M1 W	J1) M1 J14 B-D	2934	2902	-32	-1.1%	0.6	Pass High
9	1	M1 Junction 14	A509 S	A509 N	J1) M1 J14 C-A	575	532	-43	-7.5%	1.8	Pass Low
10	1	M1 Junction 14	A509 S	M1 E	J1) M1 J14 C-B	1041	1007	-34	-3.2%	1.1	Pass Mid
11	1	M1 Junction 14	A509 S	A509 S	J1) M1 J14 C-C	0	1	1		1.0	Pass Low
12	1	M1 Junction 14	A509 S	M1 W	J1) M1 J14 C-D	810	825	15	1.8%	0.5	Pass Mid
13	1	M1 Junction 14	M1 W	A509 N	J1) M1 J14 D-A	131	121	-10	-7.9%	0.9	Pass Low
14	1	M1 Junction 14	M1 W	M1 E	J1) M1 J14 D-B	2848	2840	-8	-0.3%	0.1	Pass High
15	1	M1 Junction 14	M1 W	A509 S	J1) M1 J14 D-C	582	532	-50	-8.6%	2.1	Pass Low
17	2	A509 / P&R	A509 N	P&R	28::103::105	29	18	-11	-37.0%	2.2	Pass Low
18	2	A509 / P&R	A509 N	A509 S	28::103::26	1692	1569	-123	-7.3%	3.1	Pass Mid
19	2	A509 / P&R	P&R	A509 S	128::26::24	0	0	0		0.0	Pass Low
20	2	A509 / P&R	A509 S	A509 N	101::25::27	2428	2364	-64	-2.6%	1.3	Pass Mid
21	3	A509 / A5130 / A4146	A509 N	A509 N	J3) A509/A5130 A-A	0	0	0		0.0	Pass Low
22	3	A509 / A5130 / A4146	A509 N	A5130	J3) A509/A5130 A-B	220	198	-22	-9.9%	1.5	Pass Low
23	3	A509 / A5130 / A4146	A509 N	A4146	J3) A509/A5130 A-C	930	890	-40	-4.3%	1.3	Pass Mid
24	3	A509 / A5130 / A4146	A509 N	A509 W	J3) A509/A5130 A-D	543	480	-63	-11.6%	2.8	Pass Low
25	3	A509 / A5130 / A4146	A5130	A509 N	J3) A509/A5130 B-A	445	392	-53	-11.8%	2.6	Pass Low
27	3	A509 / A5130 / A4146	A5130	A4146	J3) A509/A5130 B-C	128	132	4	3.0%	0.3	Pass Low
28	3	A509 / A5130 / A4146	A5130	A509 W	J3) A509/A5130 B-D	177	231	54	30.4%	3.8	Pass Low
29	3	A509 / A5130 / A4146	A4146	A509 N	J3) A509/A5130 C-A	989	1088	99	10.0%	3.1	Pass Mid
30	3	A509 / A5130 / A4146	A4146	A5130	J3) A509/A5130 C-B	61	78	17	27.9%	2.0	Pass Low
32	3	A509 / A5130 / A4146	A4146	A509 W	J3) A509/A5130 C-D	4	3	-1	-33.3%	0.7	Pass Low
33	3	A509 / A5130 / A4146	A509 W	A509 N	J3) A509/A5130 D-A	994	882	-112	-11.2%	3.6	Pass Mid
34	3	A509 / A5130 / A4146	A509 W	A5130	J3) A509/A5130 D-B	375	319	-56	-14.9%	3.0	Pass Low
35	3	A509 / A5130 / A4146	A509 W	A4146	J3) A509/A5130 D-C	12	11	-1	-7.2%	0.3	Pass Low
37	4	Newport Road / A509	A509 N	A509 S	40::39::105x	766	788	22	2.8%	0.8	Pass Mid
38	4	Newport Road / A509	A509 N	Newport Road	40::39::149	48	39	-9	-17.9%	1.3	Pass Low
39	4	Newport Road / A509	Newport Road	A509 S	150::149::105x	384	332	-52	-13.6%	2.8	Pass Low
40	4	Newport Road / A509	A509 S	A509 N	38::105x::39	870	821	-49	-5.6%	1.7	Pass Mid
41	4	Newport Road / A509	A509 S	Newport Road	38::105x::149	130	112	-18	-14.0%	1.7	Pass Low

	Sum Obs.	Sum Mod.	Diff	% Diff	Ave. GEH
Overall Stats	22156	21375	-781	-3.5%	1.6

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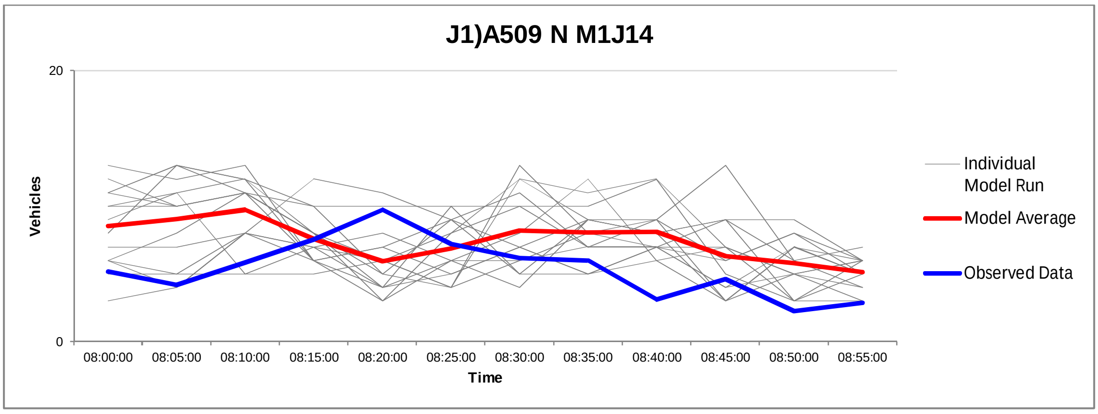
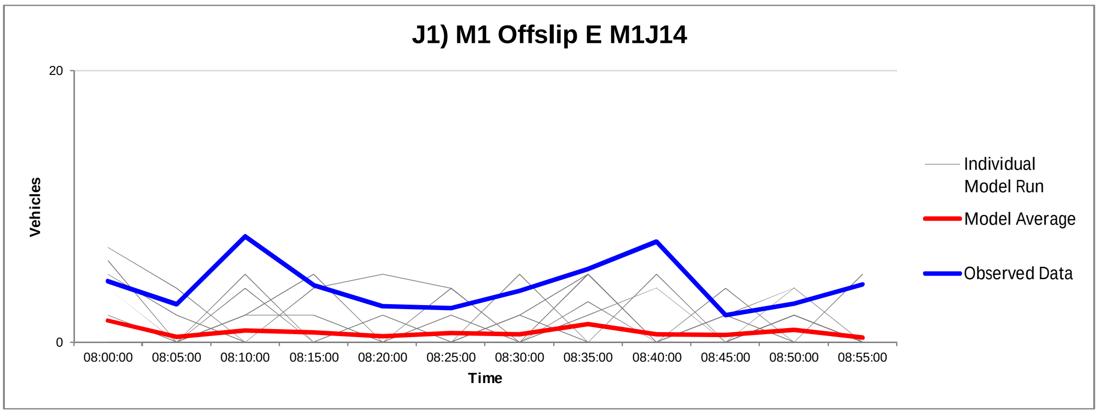
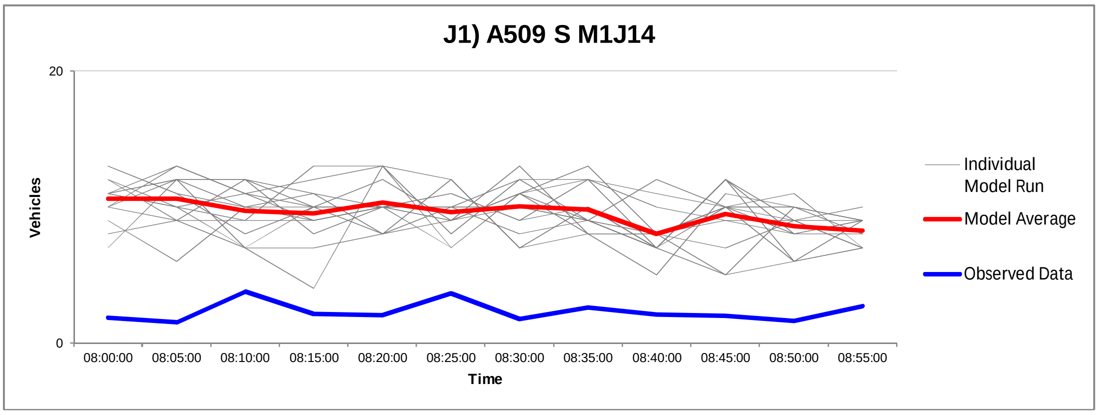
APPENDIX C: AM PEAK QUEUE GRAPHS

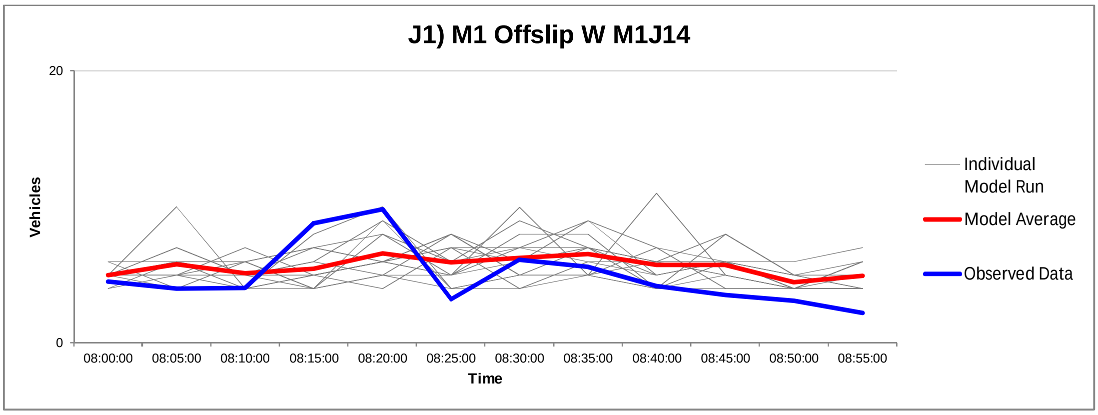
Queue Graphs

Junction Number 1
AM Peak



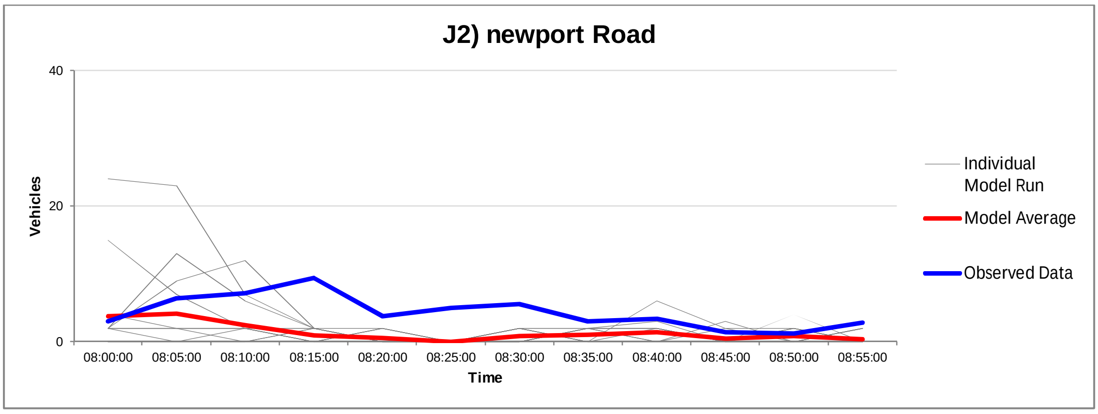


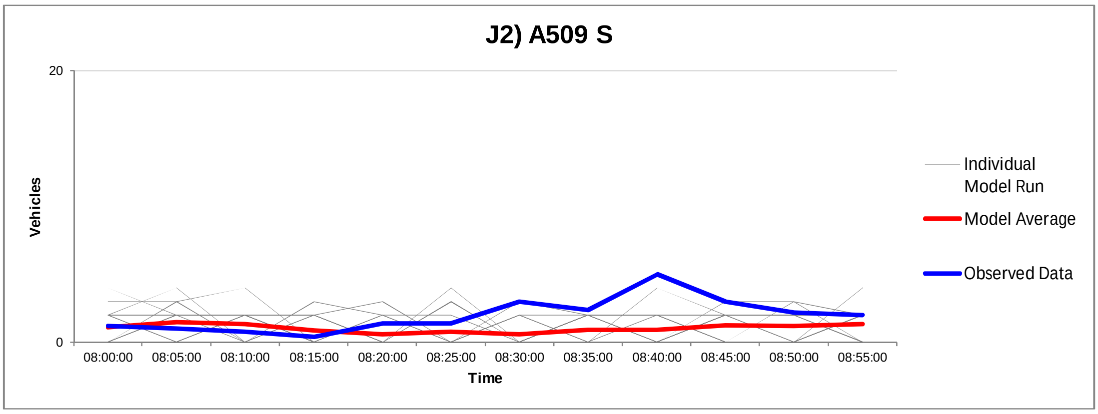




Queue Graphs

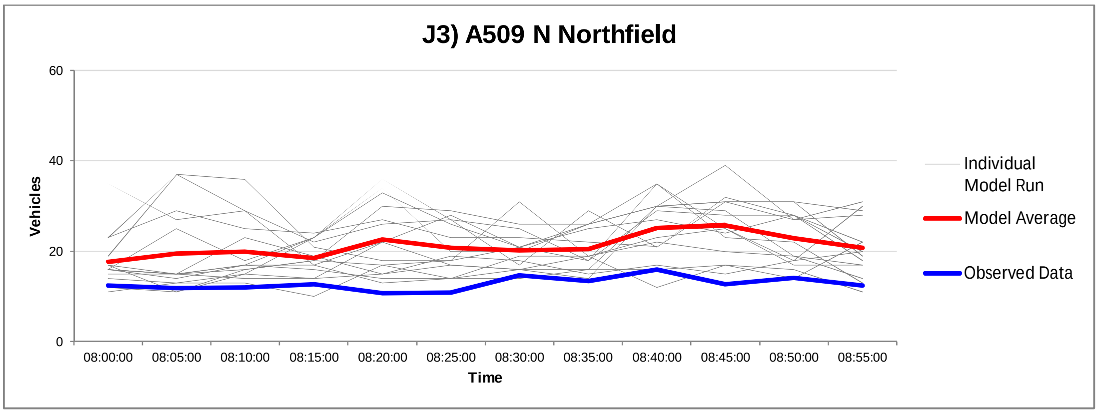
Junction Number 2
AM Peak

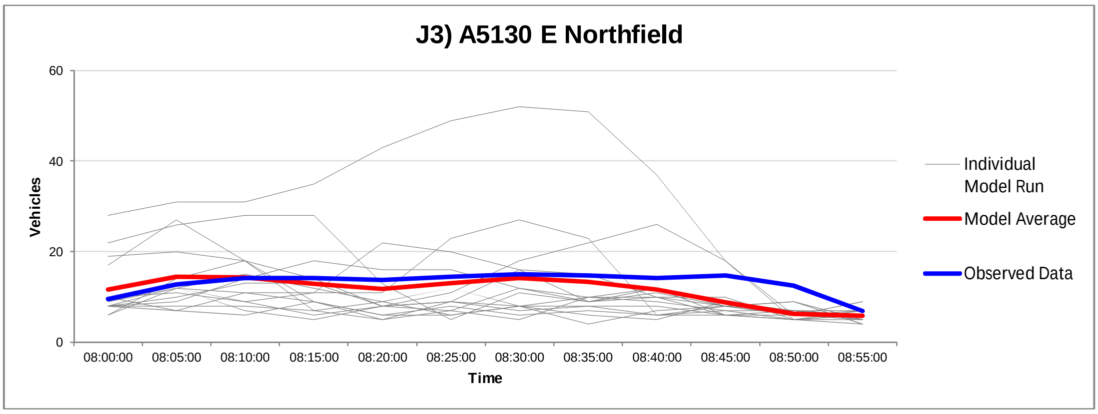


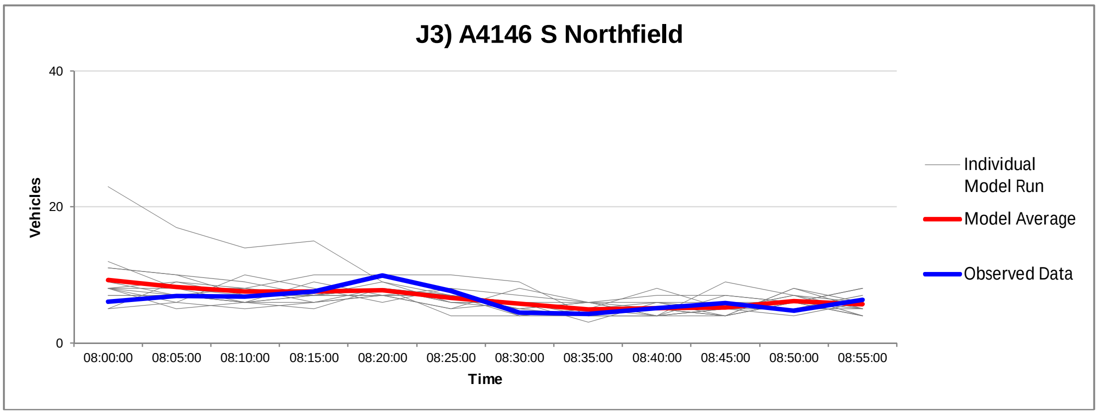


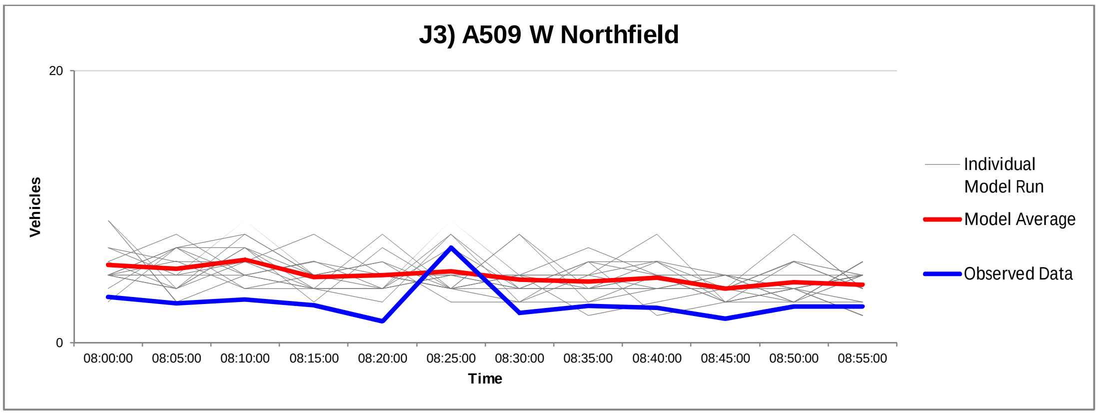
Queue Graphs

Junction Number 3
AM Peak









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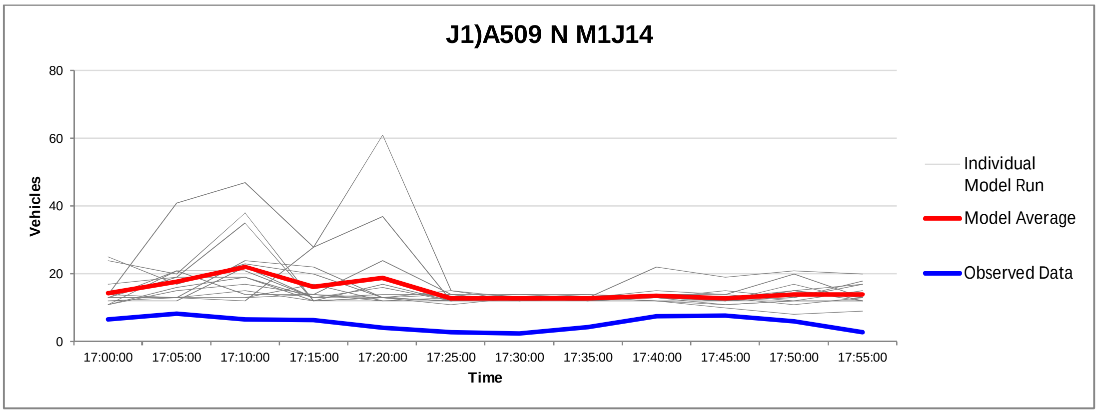
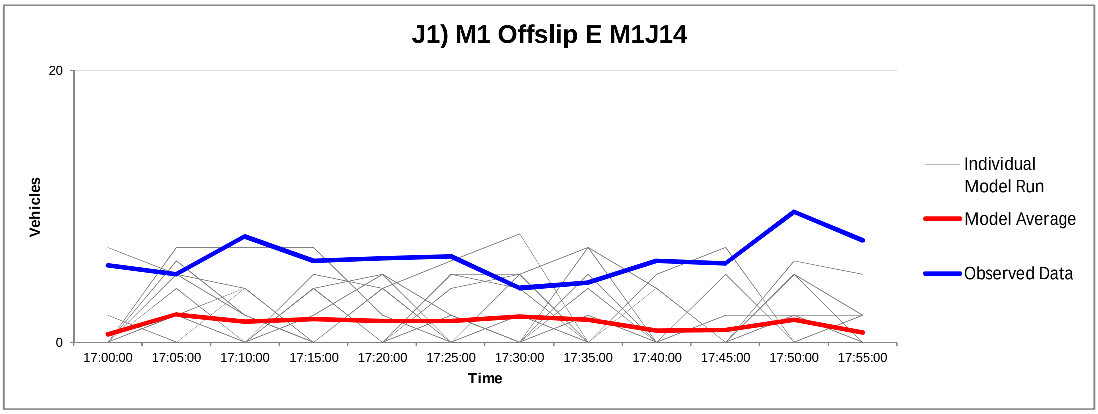
CHECKED:	S Biggs	**APPROVED:**	S Biggs

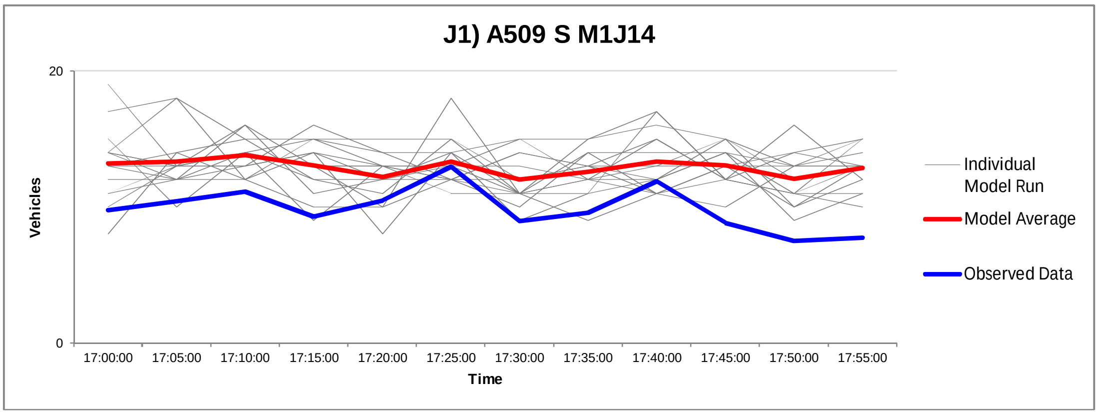
APPENDIX D: PM PEAK QUEUE GRAPHS

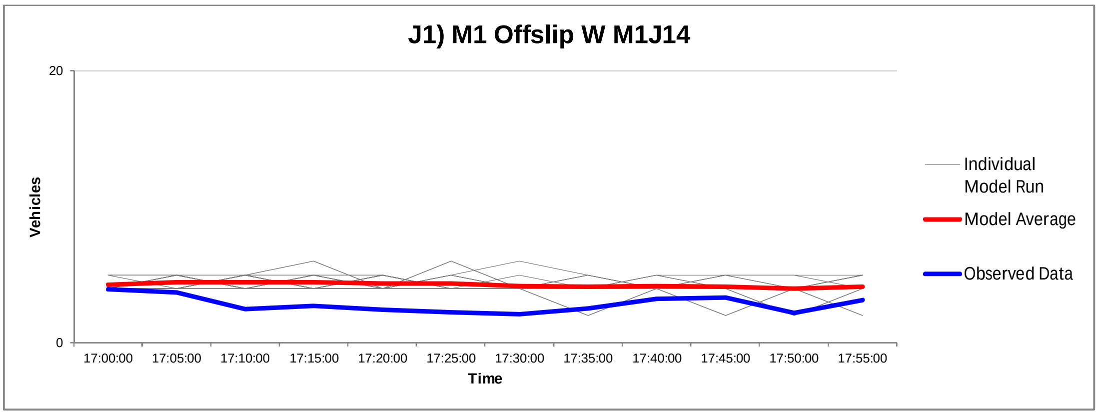
Queue Graphs

Junction Number 1
PM Peak



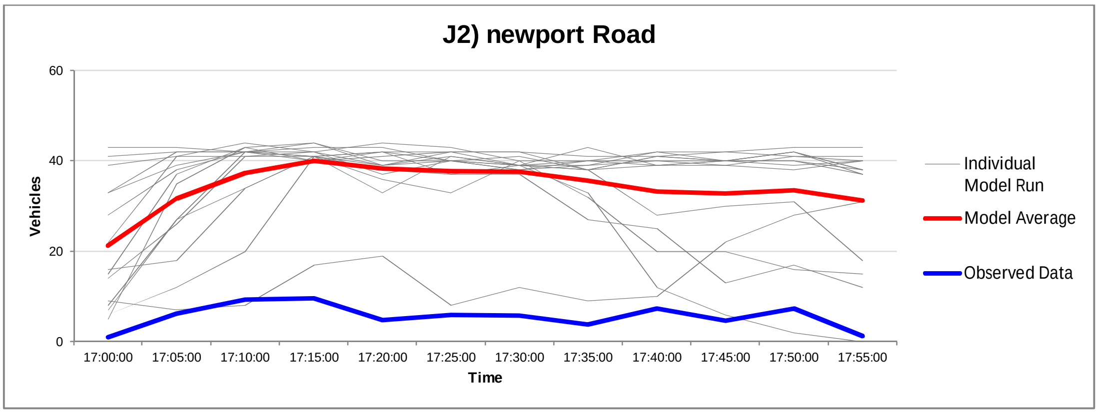


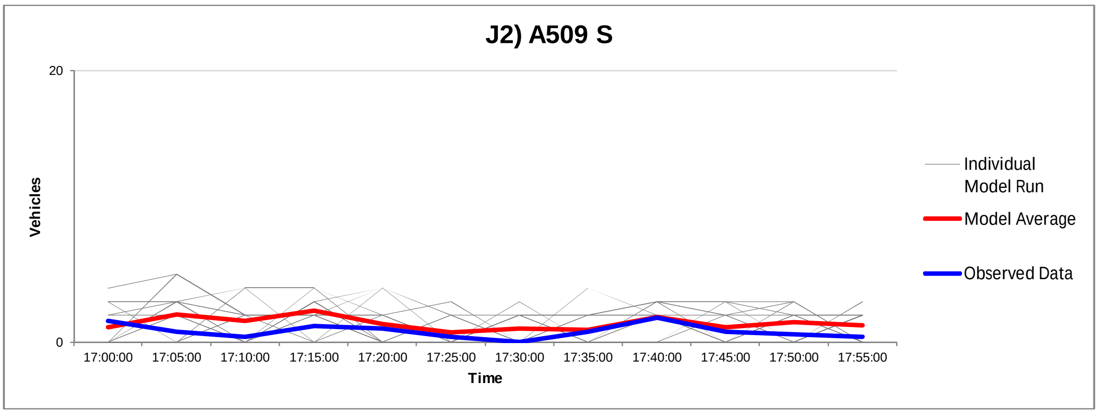




Queue Graphs

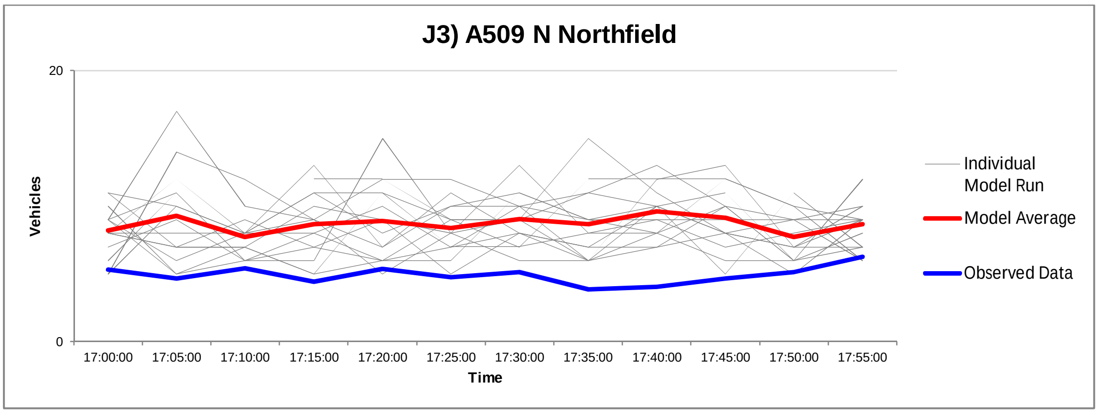
Junction Number 2
PM Peak

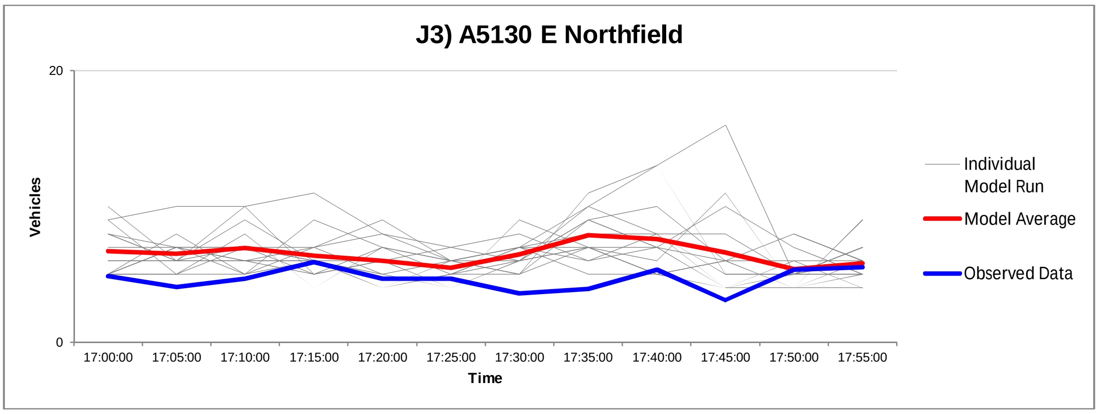


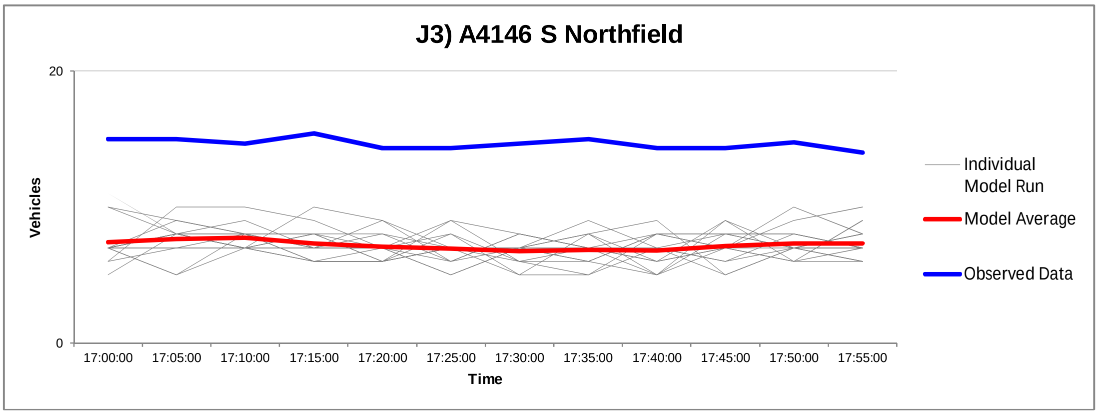


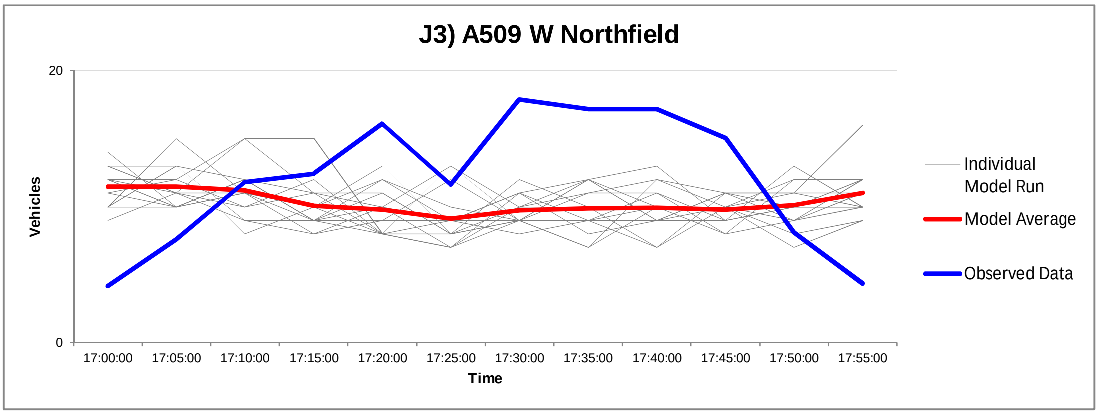
Queue Graphs

Junction Number 3
PM Peak









TECHNICAL NOTE

DATE:	15 March 2021	**CONFIDENTIALITY:**	Public
SUBJECT:	M1 Junction 14 Paramics Model – Addendum (2) to Local Model Validation Report		
PROJECT:	70075721	**AUTHOR:**	D Gooding
CHECKED:	S Biggs	**APPROVED:**	S Biggs

APPENDIX E: AM PEAK JOURNEY TIME VALIDATION

Journey Times
Validation Statistics

AM Peak

		Graph	Observed		Modelled									
Route:	**Segment**	**Group**	**Average**	**95% Conf**	**Average**	**95% Conf**	**Var Chk**	**% Diff**	**Diff**	**Conf?**	**15%**	**60s**	**WebTAG**	**Distance (m)**
Route 1: M1 WB	Full	1	215	7	199	1	TRUE	-7.5%	-16	FALSE	TRUE	TRUE	TRUE	4500
Route 2: M1 EB	Full	2	208	3	194	0	TRUE	-6.8%	-14	FALSE	TRUE	TRUE	TRUE	4498
Route 3: M1 E to A509 N	Full	3	271	18	240	12	TRUE	-11.4%	-31	FALSE	TRUE	TRUE	TRUE	3109
Route 4: M1 E to A509 W	Full	4	245	21	298	23	FALSE	21.3%	52	FALSE	FALSE	TRUE	TRUE	3269
Route 5: M1 W to A4146	Full	5	237	28	213	6	TRUE	-10.1%	-24	TRUE	TRUE	TRUE	TRUE	2382
Route 6: M1 W to A509 (N)	Full	6	128	14	111	1	TRUE	-12.8%	-16	FALSE	TRUE	TRUE	TRUE	1792
Route 7: A509(N) to M1 E	Full	7	197	41	154	1	TRUE	-22.3%	-44	FALSE	FALSE	TRUE	TRUE	2978
Route 8: A509(N) to M1 W	Full	8	221	27	172	2	TRUE	-22.0%	-49	FALSE	FALSE	TRUE	TRUE	2365
Route 9: A509(N) to A4146	Full	9	202	48	142	7	TRUE	-29.8%	-60	FALSE	FALSE	FALSE	FALSE	822
Route 10: A4146 to M1 E	Full	10	241	15	236	2	TRUE	-1.8%	-4	TRUE	TRUE	TRUE	TRUE	3595
Route 11: A4146 to M1 W	Full	11	168	9	155	2	TRUE	-8.0%	-14	FALSE	TRUE	TRUE	TRUE	2534
Route 12: A4146 to A509 N	Full	12	130	17	110	2	TRUE	-15.3%	-20	FALSE	FALSE	TRUE	TRUE	860
TM Route 1	Full	13	72		93	0	TRUE	29.3%	21	FALSE	FALSE	TRUE	TRUE	2106
TM Route 2	Full	14	68		44	1	TRUE	-35.4%	-24	FALSE	FALSE	TRUE	TRUE	500
TM Route 3	Full	15	44		21	1	TRUE	-51.5%	-22	FALSE	FALSE	TRUE	TRUE	216
TM Route 5	Full	16	22		20	6	FALSE	-8.7%	-2	FALSE	TRUE	TRUE	TRUE	272
TM Route 6	Full	17	12		17	4	FALSE	40.5%	5	FALSE	FALSE	TRUE	TRUE	153
TM Route 7	Full	18	19		28	1	TRUE	46.1%	9	FALSE	FALSE	TRUE	TRUE	118
TM Route 8	Full	19	6		5	0	FALSE	-22.7%	-1	FALSE	FALSE	TRUE	TRUE	78
TM Route 9	Full	20	65		56	7	FALSE	-14.6%	-10	FALSE	TRUE	TRUE	TRUE	358
TM Route 10	Full	21	183		108	21	FALSE	-41.0%	-75	FALSE	FALSE	FALSE	FALSE	729
TM Route 11	Full	22	22		32	0	TRUE	45.6%	10	FALSE	FALSE	TRUE	TRUE	735
TM Route 12	Full	23	107		74	4	FALSE	-30.7%	-33	FALSE	FALSE	TRUE	TRUE	783
TM Route 13	Full	24	79		65	5	FALSE	-17.5%	-14	FALSE	FALSE	TRUE	TRUE	807
TM Route 14	Full	25	57		36	0	TRUE	-37.4%	-21	FALSE	FALSE	TRUE	TRUE	713
TM Route 15	Full	26	59		26	0	TRUE	-55.8%	-33	FALSE	FALSE	TRUE	TRUE	713
TM Route 16	Full	27	34		32	0	TRUE	-7.4%	-3	FALSE	TRUE	TRUE	TRUE	433
TM Route 17	Full	28	17		13	0	TRUE	-22.8%	-4	FALSE	FALSE	TRUE	TRUE	54
TM Route 18	Full	29	15		23	1	TRUE	50.7%	8	FALSE	FALSE	TRUE	TRUE	178
TM Route 19	Full	30	24		17	0	TRUE	-32.4%	-8	FALSE	FALSE	TRUE	TRUE	380
TM Route 20	Full	31	44		29	0	TRUE	-33.9%	-15	FALSE	FALSE	TRUE	TRUE	764
TM Route 21	Full	32	50		107	0	TRUE	115.2%	57	FALSE	FALSE	TRUE	TRUE	2504
TM Route 22	Full	33	71		123	4	TRUE	74.4%	53	FALSE	FALSE	TRUE	TRUE	2409
TM Route 23	Full	34	36		39	0	TRUE	8.5%	3	FALSE	TRUE	TRUE	TRUE	1004
TM Route 24	Full	35	58		83	0	TRUE	44.7%	26	FALSE	FALSE	TRUE	TRUE	2095
TM Route 25	Full	36	24		17	0	TRUE	-31.1%	-7	FALSE	FALSE	TRUE	TRUE	366
TM Route 26	Full	37	7		9	0	TRUE	18.0%	1	FALSE	FALSE	TRUE	TRUE	143
TM Route 27	Full	38	33		36	2	FALSE	9.3%	3	FALSE	TRUE	TRUE	TRUE	137
TM Route 28	Full	39	101		31	3	FALSE	-69.6%	-70	FALSE	FALSE	FALSE	FALSE	286
TM Route 29	Full	40	15		14	0	TRUE	-6.3%	-1	FALSE	TRUE	TRUE	TRUE	288
TM Route 30	Full	41	201		20	0	TRUE	-90.0%	-180	FALSE	FALSE	FALSE	FALSE	507

TECHNICAL NOTE

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SUBJECT:	M1 Junction 14 Paramics Model – Addendum (2) to Local Model Validation Report		
PROJECT:	70075721	**AUTHOR:**	D Gooding
CHECKED:	S Biggs	**APPROVED:**	S Biggs

APPENDIX F: PM PEAK JOURNEY TIME VALIDATION

Journey Times
Validation Statistics

PM Peak

Route:	Segment	Graph Group	Observed Average	Observed 95% Conf	Modelled Average	Modelled 95% Conf	Var Chk	% Diff	Diff	Conf?	15%	60s	WebTAG	Distance (m)
Route 1: M1 WB	Full	1	206	1	192	0	TRUE	-7.2%	-15	FALSE	TRUE	TRUE	TRUE	4500
Route 2: M1 EB	Full	2	206	1	198	1	TRUE	-4.3%	-9	FALSE	TRUE	TRUE	TRUE	4498
Route 3: M1 E to A509 N	Full	3	257	5	212	4	TRUE	-17.5%	-45	FALSE	FALSE	TRUE	TRUE	3109
Route 4: M1 E to A509 W	Full	4	193	2	204	3	TRUE	5.6%	11	FALSE	TRUE	TRUE	TRUE	3269
Route 5: M1 W to A4146	Full	5	190	2	170	2	TRUE	-10.6%	-20	FALSE	TRUE	TRUE	TRUE	2382
Route 6: M1 W to A509 (N)	Full	6	117	2	112	1	TRUE	-4.1%	-5	FALSE	TRUE	TRUE	TRUE	1792
Route 7: A509(N) to M1 E	Full	7	174	8	183	3	TRUE	5.0%	9	FALSE	TRUE	TRUE	TRUE	2978
Route 8: A509(N) to M1 W	Full	8	197	17	203	3	TRUE	2.8%	6	TRUE	TRUE	TRUE	TRUE	2365
Route 9: A509(N) to A4146	Full	9	148	17	146	4	TRUE	-1.1%	-2	TRUE	TRUE	TRUE	TRUE	822
Route 10: A4146 to M1 E	Full	10	272	8	255	4	TRUE	-6.5%	-18	FALSE	TRUE	TRUE	TRUE	3595
Route 11: A4146 to M1 W	Full	11	212	12	149	1	TRUE	-29.9%	-64	FALSE	FALSE	FALSE	FALSE	2534
Route 12: A4146 to A509 N	Full	12	173	14	110	3	TRUE	-36.6%	-63	FALSE	FALSE	FALSE	FALSE	860
TM Route 1	Full	13	63		90	0	TRUE	42.8%	27	FALSE	FALSE	TRUE	TRUE	2106
TM Route 2	Full	14	56		45	1	TRUE	-18.6%	-10	FALSE	FALSE	TRUE	TRUE	500
TM Route 3	Full	15	39		21	1	TRUE	-46.1%	-18	FALSE	FALSE	TRUE	TRUE	216
TM Route 5	Full	16	33		11	0	TRUE	-66.9%	-22	FALSE	FALSE	TRUE	TRUE	272
TM Route 6	Full	17	8		11	0	TRUE	32.6%	3	FALSE	FALSE	TRUE	TRUE	153
TM Route 7	Full	18	34		30	1	TRUE	-12.4%	-4	FALSE	TRUE	TRUE	TRUE	118
TM Route 8	Full	19	4		4			-2.7%	0	FALSE	TRUE	TRUE	TRUE	78
TM Route 9	Full	20	43		24	0	TRUE	-43.4%	-19	FALSE	FALSE	TRUE	TRUE	358
TM Route 10	Full	21	64		68	1	TRUE	6.2%	4	FALSE	TRUE	TRUE	TRUE	729
TM Route 11	Full	22	22		32	0	TRUE	43.3%	10	FALSE	FALSE	TRUE	TRUE	735
TM Route 12	Full	23	360		51	0	TRUE	-85.8%	-309	FALSE	FALSE	FALSE	FALSE	783
TM Route 13	Full	24	61		41	0	TRUE	-32.7%	-20	FALSE	FALSE	TRUE	TRUE	807
TM Route 14	Full	25	282		48	0	TRUE	-83.1%	-235	FALSE	FALSE	FALSE	FALSE	713
TM Route 15	Full	26	40		24	0	TRUE	-38.9%	-15	FALSE	FALSE	TRUE	TRUE	713
TM Route 16	Full	27	83		43	1	TRUE	-48.1%	-40	FALSE	FALSE	TRUE	TRUE	433
TM Route 17	Full	28	20		15	0	TRUE	-27.8%	-6	FALSE	FALSE	TRUE	TRUE	54
TM Route 18	Full	29	22		27	2	FALSE	23.0%	5	FALSE	FALSE	TRUE	TRUE	178
TM Route 19	Full	30	32		17	0	TRUE	-47.0%	-15	FALSE	FALSE	TRUE	TRUE	380
TM Route 20	Full	31	46		30	0	TRUE	-35.4%	-16	FALSE	FALSE	TRUE	TRUE	764
TM Route 21	Full	32	61		112	0	TRUE	85.0%	52	FALSE	FALSE	TRUE	TRUE	2504
TM Route 22	Full	33	66		104	0	TRUE	56.5%	37	FALSE	FALSE	TRUE	TRUE	2409
TM Route 23	Full	34	48		39	0	TRUE	-18.6%	-9	FALSE	FALSE	TRUE	TRUE	1004
TM Route 24	Full	35	81		84	0	TRUE	3.1%	3	FALSE	TRUE	TRUE	TRUE	2095
TM Route 25	Full	36	28		27	2	FALSE	-5.0%	-1	FALSE	TRUE	TRUE	TRUE	366
TM Route 26	Full	37	7		9	0	TRUE	33.2%	2	FALSE	FALSE	TRUE	TRUE	143
TM Route 27	Full	38	15		66	2	TRUE	346.1%	51	FALSE	FALSE	TRUE	TRUE	137
TM Route 28	Full	39	63		372	53	FALSE	491.5%	309	FALSE	FALSE	FALSE	FALSE	286
TM Route 29	Full	40	12		14	0	TRUE	17.2%	2	FALSE	FALSE	TRUE	TRUE	288
TM Route 30	Full	41	50		46	4	FALSE	-6.6%	-3	FALSE	TRUE	TRUE	TRUE	507

TECHNICAL NOTE

DATE:	15 March 2021	**CONFIDENTIALITY:**	Public
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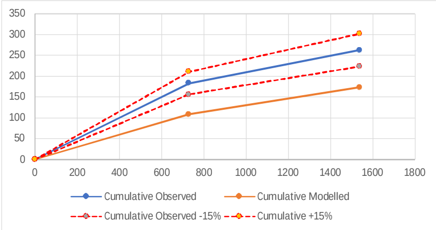
CHECKED:	S Biggs	**APPROVED:**	S Biggs

APPENDIX G: AM PEAK CUMULATIVE TRAFFICMASTER JOURNEY TIMES

MKE Cumulative JT Routes

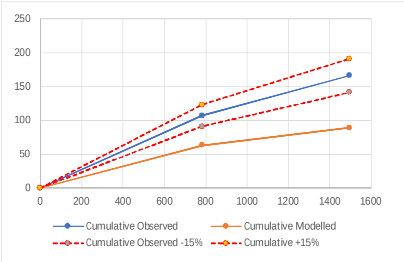
CJT 1

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM10	183	108	183	108	729	729	155.8491684	155.8491684	210.8547573	210.8547573
TM13	79	65	263	173	807	1537	67.32353685	223.1727053	91.08478515	301.9395424



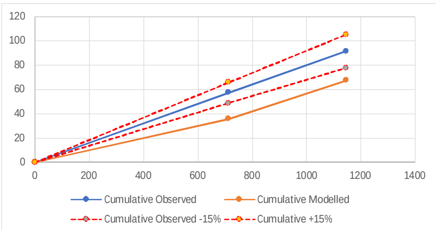
CJT 2

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM12	107	63	107	63	783	783	90.95	90.95	123.05	123.05
TM15	59	26	166	89	713	1496	50.15	141.1	67.85	190.9



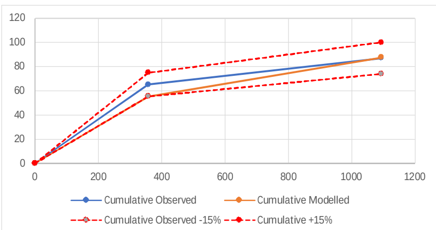
CJT 3

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM14	57	36	57	36	713	713	48.85726546	48.85726546	66.10100621	66.10100621
TM16	34	32	92	68	433	1147	28.96704781	77.82431327	39.19071175	105.291718



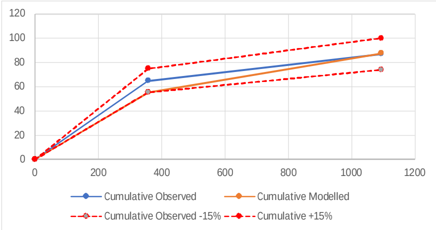
CJT 4

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM9	65	56	65	56	358	358	55.32004256	55.32004256	74.84476346	74.84476346
TM11	22	32	87	88	735	1094	18.7	74.02004256	25.3	100.1447635



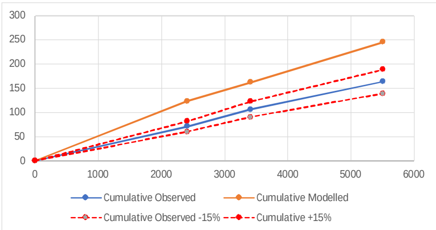
CJT 5

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM9	65	56	65	56	358	358	55.32004256	55.32004256	74.84476346	74.84476346
TM11	22	32	87	88	735	1094	18.7	74.02004256	25.3	100.1447635



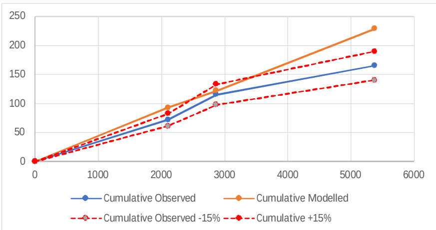
CJT 6

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM22	71	123	71	123	2409	2409	60.20241091	60.20241091	81.45032064	81.45032064
TM23	36	39	106	162	1004	3413	30.24123447	90.44364538	40.91461134	122.364932
TM 24	58	83	164	245	2095	5508	48.89562063	139.339266	66.1528985	188.5178305



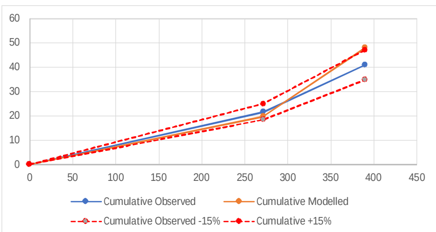
CJT 7

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM1	72	93	72	93	2106	2106	61.13789661	61.13789661	82.71597777	82.71597777
TM 20	44	29	116	122	764	2870	37.08702185	98.22491847	50.17655898	132.8925367
TM 21	50	107	165	229	2504	5374	42.17090554	140.395824	57.05475456	189.9472913



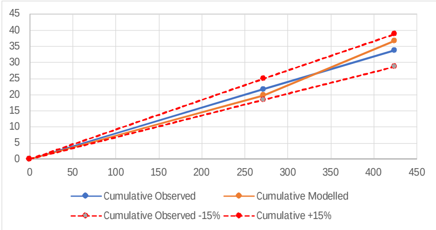
CJT 8

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 5	22	20	22	20	272	272	18.41248143	18.41248143	24.91100429	24.91100429
TM 7	19	28	41	48	118	390	16.41439578	34.82687721	22.20771194	47.11871623



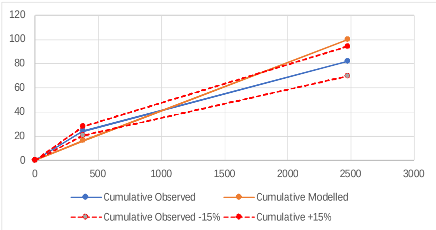
CJT 9

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 5	22	20	22	20	272	272	18.41248143	18.41248143	24.91100429	24.91100429
TM 6	12	17	34	37	153	425	10.26883573	28.68131716	13.8931307	38.80413498



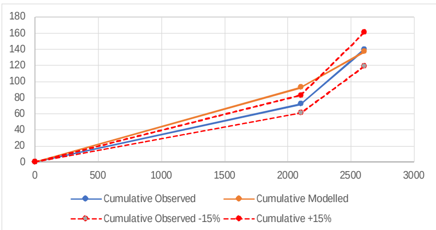
CJT 10

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 19	24	17	24	17	380	380	20.77247484	20.77247484	28.10393654	28.10393654
TM 24	58	83	82	100	2095	2474	48.89562063	69.66809547	66.1528985	94.25683505



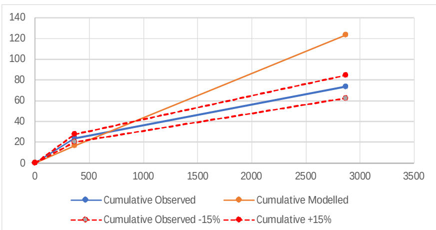
CJT 11

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 1	72	93	72	93	2106	2106	61.13789661	61.13789661	82.71597777	82.71597777
TM 2	68	44	140	137	500	2606	57.80638676	118.9442834	78.20864091	160.9246187



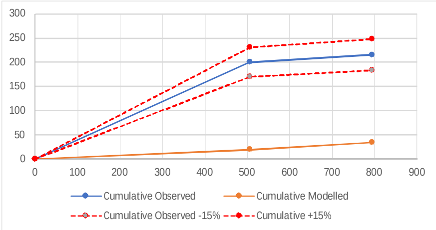
CJT 12

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 25	24	17	24	17	366	366	20.39958291	20.39958291	27.5994357	27.5994357
TM 21	50	107	74	123	2504	2869	42.17090554	62.57048845	57.05475456	84.65419026



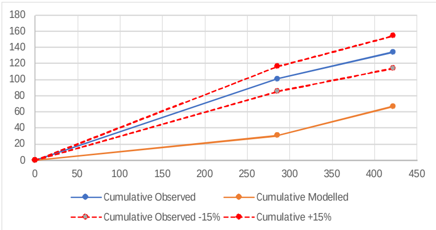
CJT 13

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 30	201	20	201	20	507	507	170.471878	170.471878	230.6384232	230.6384232
TM 29	15	14	216	34	288	795	12.95333386	183.4252119	17.52509875	248.163522



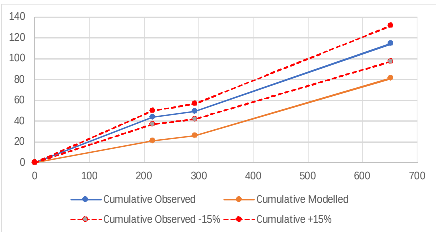
CJT 14

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 28	101	31	101	31	286	286	85.91263201	85.91263201	116.2347374	116.2347374
TM 27	33	36	134	67	137	423	28.23893887	114.1515709	38.20562318	154.4403606



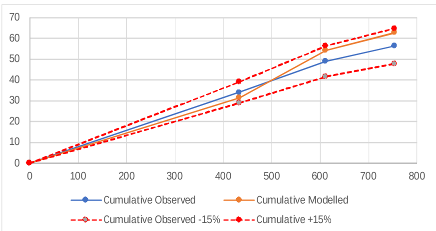
CJT 15

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 3	44	21	44	21	216	216	37.00550291	37.00550291	50.06626864	50.06626864
TM 8	6	5	49	26	78	293	4.998094825	42.00359773	6.762128292	56.82839693
TM 9	65	56	114	81	358	652	55.32004256	97.32364029	74.84476346	131.6731604



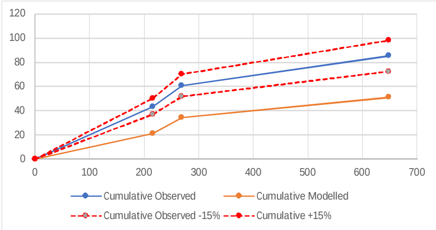
CJT 16

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 16	34	32	34	32	433	433	28.96704781	28.96704781	39.19071175	39.19071175
TM 18	15	23	49	54	178	612	12.75030845	41.71735627	17.25041732	56.44112907
TM 26	7	9	56	63	143	754	6.223348018	47.94070429	8.419823789	64.86095286



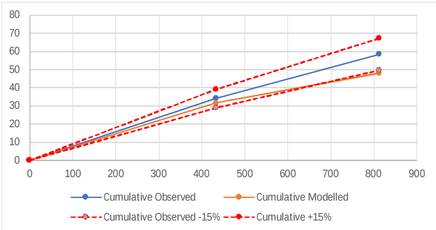
CJT 17

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 3	44	21	44	21	216	216	37.00550291	37.00550291	50.06626864	50.06626864
TM 17	17	13	61	35	54	269	14.80591374	51.81141665	20.03153035	70.09779899
TM 19	24	17	85	51	380	649	20.77247484	72.58389148	28.10393654	98.20173554



CJT 18

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 16	34	32	34	32	433	433	28.96704781	28.96704781	39.19071175	39.19071175
TM 19	24	17	59	48	380	813	20.77247484	49.73952265	28.10393654	67.29464829



TECHNICAL NOTE

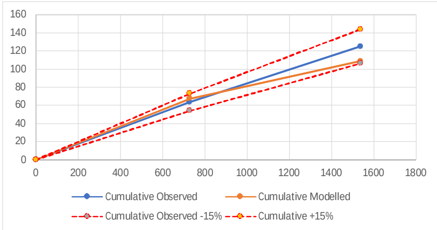
DATE:	15 March 2021	**CONFIDENTIALITY:**	Public
SUBJECT:	M1 Junction 14 Paramics Model – Addendum (2) to Local Model Validation Report		
PROJECT:	70075721	**AUTHOR:**	D Gooding
CHECKED:	S Biggs	**APPROVED:**	S Biggs

APPENDIX H: PM PEAK CUMULATIVE TRAFFIC MASTER JOURNEY TIMES

MKE Cumulative JT Routes

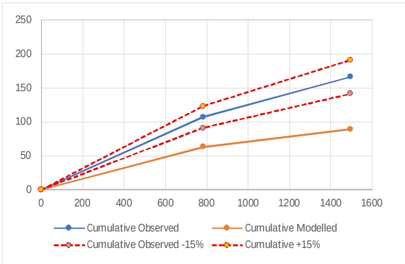
CJT 1

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM10	64	68	64	68	729	729	54.17438571	54.17438571	73.29475714	73.29475714
TM13	61	41	125	109	807	1537	52.07044182	106.2448275	70.44824481	143.743002



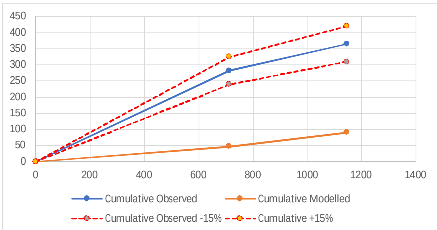
CJT 2

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM12	107	63	107	63	783	783	90.95	90.95	123.05	123.05
TM15	59	26	166	89	713	1496	50.15	141.1	67.85	190.9



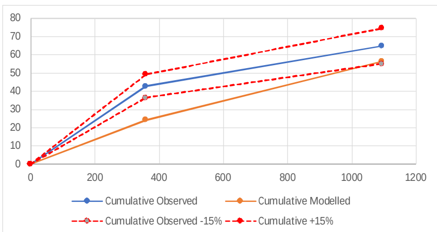
CJT 3

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM14	282	48	282	48	713	713	239.9900138	239.9900138	324.6923716	324.6923716
TM16	83	43	365	90	433	1147	70.18413881	310.1741526	94.95501133	419.6473829



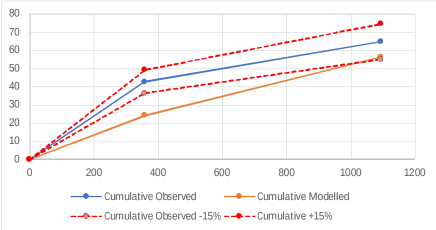
CJT 4

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM9	43	24	43	24	358	358	36.39210656	36.39210656	49.23637947	49.23637947
TM11	22	32	65	56	735	1094	18.7	55.09210656	25.3	74.53637947



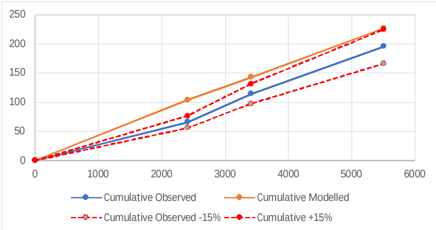
CJT 5

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM9	43	24	43	24	358	358	36.39210656	36.39210656	49.23637947	49.23637947
TM11	22	32	65	56	735	1094	18.7	55.09210656	25.3	74.53637947



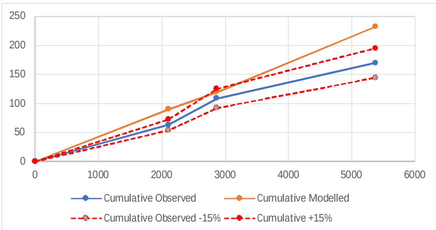
CJT 6

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM22	66	104	66	104	2409	2409	56.34882077	56.34882077	76.23663987	76.23663987
TM23	48	39	114	143	1004	3413	40.879795	97.22861578	55.30795795	131.5445978
TM 24	81	84	196	227	2095	5508	69.1106961	166.3393119	93.50270649	225.0473043



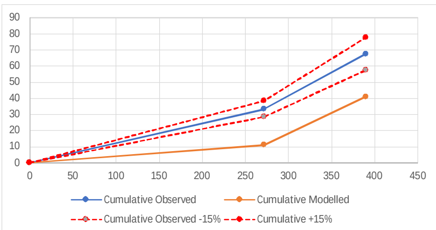
CJT 7

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM1	63	90	63	90	2106	2106	53.79590074	53.79590074	72.78268924	72.78268924
TM 20	46	30	109	120	764	2870	38.94987655	92.74577729	52.6968918	125.479581
TM 21	61	112	170	232	2504	5374	51.64466251	144.3904398	69.87219046	195.3517715



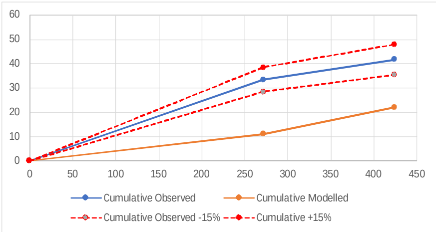
CJT 8

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 5	33	11	33	11	272	272	28.37437199	28.37437199	38.38885622	38.38885622
TM 7	34	30	68	41	118	390	29.0473649	57.42173689	39.29937604	77.68823226



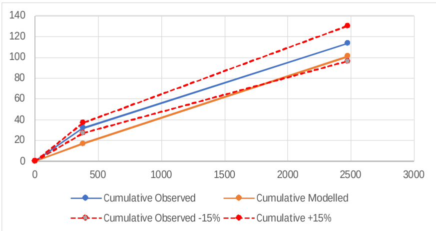
CJT 9

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 5	33	11	33	11	272	272	28.37437199	28.37437199	38.38885622	38.38885622
TM 6	8	11	42	22	153	425	7.049683128	35.42405511	9.537806584	47.9266628



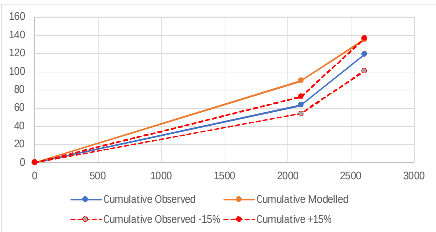
CJT 10

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 19	32	17	32	17	380	380	27.26241537	27.26241537	36.88444432	36.88444432
TM 24	81	84	113	101	2095	2474	69.1106961	96.37311147	93.50270649	130.3871508



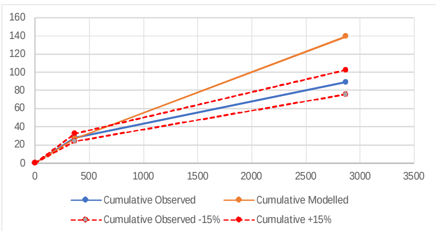
CJT 11

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 1	63	90	63	90	2106	2106	53.79590074	53.79590074	72.78268924	72.78268924
TM 2	56	45	119	136	500	2606	47.32005691	101.1159576	64.02125346	136.8039427



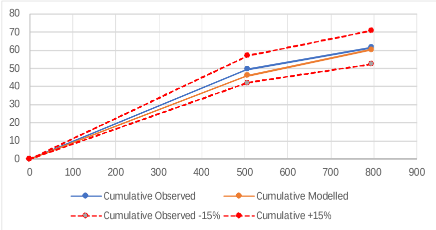
CJT 12

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 25	28	27	28	27	366	366	24.099143	24.099143	32.60472288	32.60472288
TM 21	61	112	89	139	2504	2869	51.64466251	75.74380551	69.87219046	102.4769133



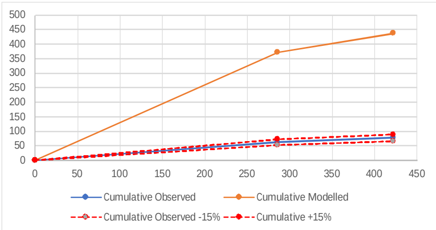
CJT 13

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 30	50	46	50	46	507	507	42.09536889	42.09536889	56.95255792	56.95255792
TM 29	12	14	62	60	288	795	10.26806778	52.36343668	13.89209171	70.84464962



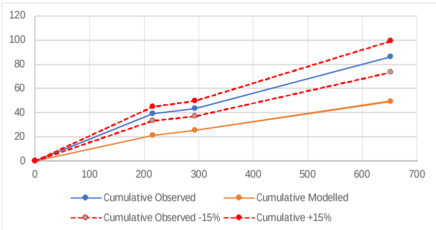
CJT 14

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 28	63	372	63	372	286	286	53.43045493	53.43045493	72.28826255	72.28826255
TM 27	15	66	78	437	137	423	12.50156455	65.93201948	16.91388146	89.20214401



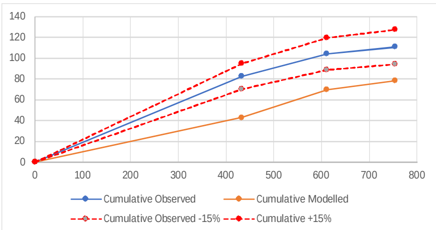
CJT 15

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 3	39	21	39	21	216	216	33.36695737	33.36695737	45.14353056	45.14353056
TM 8	4	4	43	25	78	293	3.494579247	36.86153662	4.727960158	49.87149072
TM 9	43	24	86	49	358	652	36.39210656	73.25364318	49.23637947	99.10787019



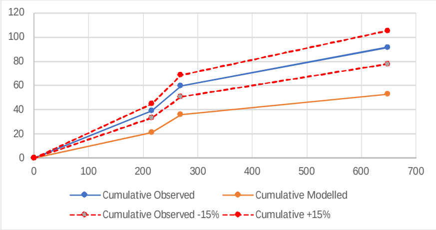
CJT 16

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 16	83	43	83	43	433	433	70.18413881	70.18413881	94.95501133	94.95501133
TM 18	22	27	104	69	178	612	18.38349893	88.56763774	24.87179267	119.826804
TM 26	7	9	111	78	143	754	5.616090818	94.18372856	7.598240519	127.4250445



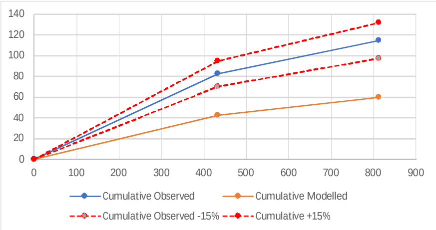
CJT 17

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 3	39	21	39	21	216	216	33.36695737	33.36695737	45.14353056	45.14353056
TM 17	20	15	60	36	54	269	17.2927064	50.65966377	23.39601453	68.5395451
TM 19	32	17	92	53	380	649	27.26241537	77.92207913	36.88444432	105.4239894



CJT 18

	Observed	Modelled	Cumulative Observed	Cumulative Modelled	Distance	Cumulative Distance	Observed -15%	Cumulative Observed -15%	Observed +15%	Cumulative +15%
Start	0	0	0	0	0	0	0	0	0	0
TM 16	83	43	83	43	433	433	70.18413881	70.18413881	94.95501133	94.95501133
TM 19	32	17	115	60	380	813	27.26241537	97.44655418	36.88444432	131.8394557



Appendix L.4

HIGHWAYS ENGLAND / AECOM - TECHNICAL NOTES & REVIEWS

Project:	**Milton Keynes East**	Job No:	**60600479** **DM016.002**
Subject:	**Review of Paramics LMVR Report**		
Prepared by:	**Tara Tanoz-Sargeant**	Date:	**26/06/2020**
Checked by:	**Phil Arnold**	Date:	**29/06/2020**
Verified by:	**Colin Hardie/Liz Judson**	Date:	**30/06/2020**
Approved by:	**John Alderman**	Date:	**06/07/2020**

1 Introduction

1.1.1 Highways England (HE) has requested that AECOM undertake a review of the Local Model Validation Report (LMVR) produced by WSP for Milton Keynes East modelling. The LMVR documents the development, calibration and validation of the Paramics Discovery model that will be used as a base to test the impact of a proposed development "Milton Keynes East".

2 Structure

2.1.1 The structure of this report follows the structure of the LMVR produced by WSP.

- Overview of model purpose and specification;
- Review of data collection;
- Model periods and demand;
- Review of base model development;
- Review of calibration and validation processes; and
- Conclusions and recommendations.

3 Overview of Model and Specification

3.1.1 The Milton Keynes East model has been developed to assess the impact of the proposed development and its associated infrastructure improvements.

3.1.2 WSP took a S-Paramics model previously built with a base year of 2011, and recalibrated and validated to a 2019 base while updating the software to Paramics Discovery.

The model covers Junction 14 of the M1 and key junctions in the vicinity as shown in

3.1.3 Figure 1 below.

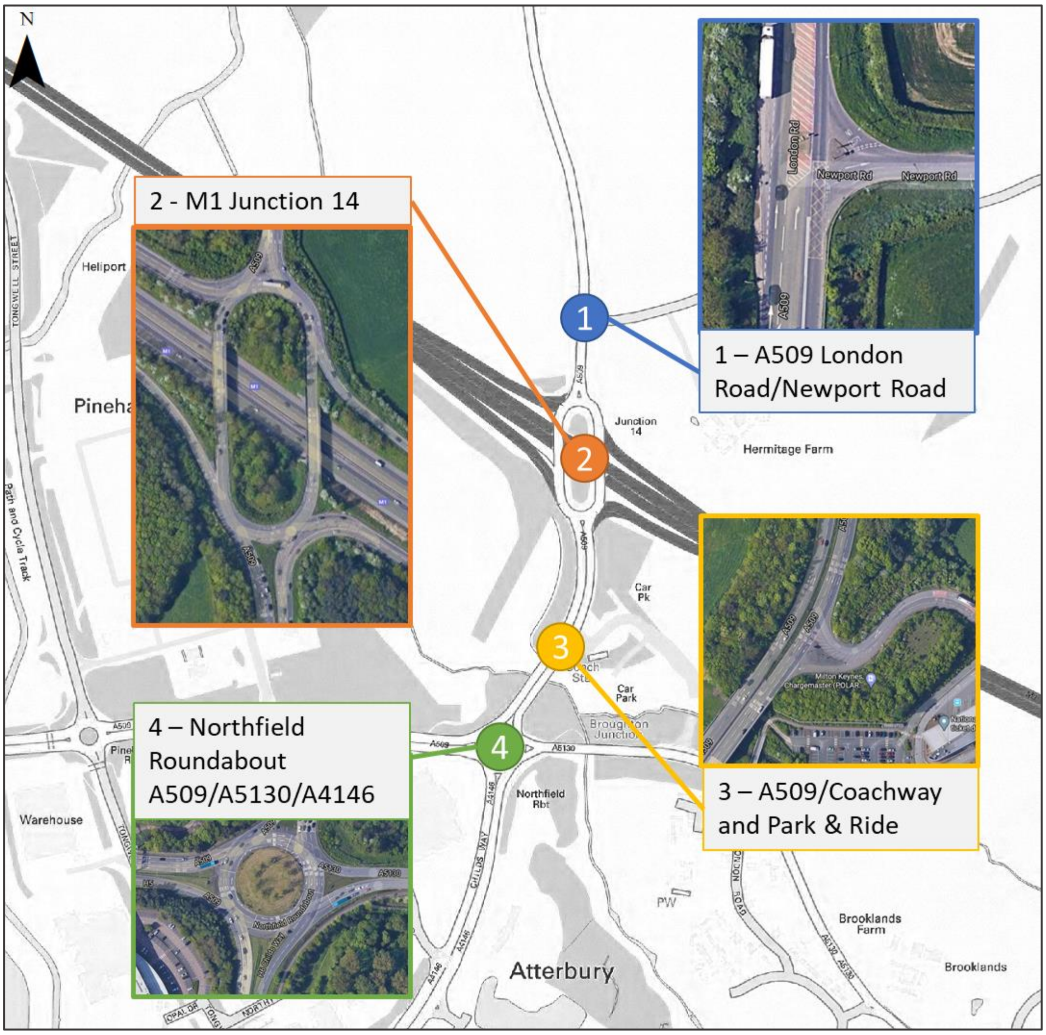


Figure 1 - Diagram showing the key junctions modelled

3.1.4 The two key junctions in this model are the grade separated M1 Junction 14 roundabout and the Northfield A509/A5130 roundabout, these are both signal controlled junctions.

3.1.5 Two peak hours have been assessed which are:

- Weekday AM Peak (08:00 – 09:00); and
- Weekday PM Peak (17:00 – 18:00).

4 Data Collection Review

4.1.1 The base year model was built using the following survey data:

- Automatic Number Plate Recognition (ANPR) from 27th June 2019;
- Queue Length counts from 27th June 2019; and
- Automatic Traffic Counts (ATCs) taken between 26 June 2019 – 8th July 2019.

4.1.2 ANPR data from only one day is used as a basis for journey time data. No analysis is provided to establish that the day in which the ANPR data was collected represents a typical weekday. This data is used for calibrating and validating journey times in the base year model.

4.1.3 The ANPR day should be highlighted within the ATC profile to provide evidence that the ANPR data is collected on a typical day.

4.1.4 Similarly, queue length counts are used for the same day as the ANPR counts. Without evidence that the 27th June 2019 is representative of an average weekday, the reliability of these queue counts for calibration cannot be assessed.

4.1.5 The ATC counts only provide 6 neutral days as defined by the DfT's TAG criteria. For any further applications of the model it is recommended that a larger sample period is used.

4.1.6 ATC data is sparse and only collected at three locations, which do not cover all cordon points. There is no reference made to what the ATC counts are used for in this model. No evidence is provided in any part of the report to show how ATC counts are used for the Milton Keynes East model.

4.1.7 The number of journey time samples used to validate the models are not presented.

4.1.8 Confidence intervals should be provided to demonstrate that the data is reliable and that outliers have been identified and removed if necessary.

4.1.9 The data used to build this base model may not be typical due to ongoing works with A421 widening and M1 J13 to J16 SMART motorway works. WSP should provide reassurances regarding the validity of the count data and how representative the junction operation will be once these roadworks are complete and traffic conditions return to typical conditions. WSP should outline how this would be considered in forecast scenarios.

5 Model Periods

5.1.1 Paramics models require a warm-up and cool down period to be included so that traffic conditions, and congestion build up is representative in the peak hour of the model. These have been run to cover the periods below:

- Weekday AM 07:00 – 10:00 (Peak: 08:00 – 09:00)
- Weekday PM 16:00 – 19:00 (Peak: 17:00 – 18:00)

5.1.2 Paragraph 3.2.3 of the LMVR states that 15 randomly seeded runs are used to assess calibration and validation of the model.

5.1.3 It is unclear how the peak hours were established. The method for identifying the peak hours should be detailed in the LMVR. It is recommended that journey times and queue lengths are also used to help inform the selection of the peak hour.

5.1.4 Each peak hour has a build-up period of 1 hour to populate the network prior to the assessment of the peak hour, followed by a 1 hour cool down period. This is acceptable, given the extents of the network.

6 Base Model Development

6.1.1 The Paramics Discovery model itself has not been audited as part of this report. The following subsections review the approach and methodology described in the LMVR.

6.2 Model Structure and Parameters

6.2.1 There is no discussion about the existing Paramics model used to develop the new base year, and no comparison of the network has been provided.

6.2.2 Paragraph 3.3.2 of the LMVR states that *“Nodes, kerbs and links have been adjusted where necessary so that vehicle behaviour is consistent with the observed vehicle behaviour on the ground”*. It is unclear how this was verified without video footage, or a site visit to help inform the modelling.

6.2.3 The generalised cost changes may be justified if it is to prevent vehicles rerouting through Junction 14 to avoid congestion on the M1. Since defined routes are used in the modelling, additional explanation should be provided to justify the changes to distance factors. Adding a distance multiplier to prevent vehicles routing via the off slip, to return onto the M1 due to minimal journey time changes may be an appropriate measure, however this should be explicitly stated.

6.2.4 Section 3.6 in the LMVR outlines changes made to the default familiarity parameters, these affect driver route choice in a model, no evidence or justification has been provided for these changes. While the base model has no route choice, these changes may affect the results if new route choice is introduced in forecast year models.

6.2.5 Section 3.8 of the LMVR discusses link cost factors and hazard override functionality. This functionality allows more realistic movements to be included in the model, especially in large junctions with complex behaviour or where lane allocations vary from defaults set in Paramics. In this case, these parameters are used for the M1 J14 Roundabout and Northfield Roundabout to ensure realistic lane use in the model. However, whether these measures are appropriate or effective cannot be determined without further information, or a review of the model.

6.2.6 Defined routes appear to be used appropriately to prevent traffic routing through J14 to avoid congestion on the M1.

6.3 Traffic Signals

6.3.1 Section 3.10 details signal methodology employed in the base year model. Signals at both the M1 Junction 14 and Northfield Roundabout are built into the Discovery model as detector loops to approximate vehicle actuation (MOVA) at these junctions.

6.3.2 Tables 3.1 and 3.2 provide maximum green times at each roundabout, these effectively cap the amount of time that a single stage could remain on green. These are used in lieu of average signal timings: however, how these maximums are determined is unclear and requires further comment within the LMVR.

6.3.3 Reference is made to calibration of journey times, a review of the methodology of this is outlined in Section 8 below.

6.4 Junction Specific Parameters

6.4.1 Junction specific parameters have been considered and applied where relevant. Based on the information provided in the LMVR these are appropriate.

6.4.2 The headway, which controls how close vehicles travel to the vehicle in front, has been left at the default value of 1 second. It should be noted that drivers are recommended to keep a 2 second safety gap from the vehicle in front. Given that no site observations were undertaken, the modeller should justify the use of the smaller time gap between vehicles.

6.5 Speed Limits

6.5.1 Changes to the speed limit on the M1 in the model are appropriate for the Smart Motorway upgrades taking place between January 2018 and March 2022.

6.5.2 There is no evidence of speed profiling for the M1, so the speed distribution of traffic may not be represented if a blanket speed reduction was applied. Profiling could be undertaken using ANPR data collected for this study.

7 Model Demand and Matrix Development

7.1.1 Paragraph 4.2.1 of the LMVR states that *"ANPR data has been used for the matrix building process"*. ANPR data is only collected for the 26th June 2019. It is not recommended that a single day's ANPR data is used to derive matrices.

7.1.2 It is expected that the ANPR data will not capture all vehicles on the network, and therefore it is difficult to understand how demand matrices have been established. Further information is required on capture rate and the development of the demand matrices. Generally, ANPR data is accompanied by Manual Classified Counts (using the camera footage) to ascertain the capture rate - however based on the information provided this does not seem to be the case. Given that ANPR data has been collected via video, vehicle count data could still be obtained to inform matrix development, and it is recommended that this is undertaken.

7.1.3 Section 4.4 of the LMVR describes the use of profiles; however, it does not explicitly state the type of traffic counts used to derive the profiles. There are several different methodologies that could be used to produce these profiles. It is difficult to comment on the profiles without supporting evidence to show that profiles from the ANPR data are representative and that the capture rate is sufficient.

7.1.4 This model is built and validated to atypical conditions, some reference to how these will be mitigated for forecasting should be provided. This is especially important given the model will be used to test the impact of new development in the area.

7.1.5 A clearer demand development methodology is needed to assess whether this model is suitable for the purpose of this modelling exercise.

8 Model Calibration and Validation

8.1 Turning Count Calibration

8.1.1 The data used for calibration of turning counts is not explicitly stated, however it is assumed that this is based on ANPR data, as apart from the ATC data, no other data was collected to enable this. As discussed above, the ANPR data will not represent the full volume of vehicles as it is likely that a proportion of vehicles are not captured.

8.1.2 The comparison of modelled and observed turning counts provided in Tables 5-2 and 5-3 show that 100% of counts meet the criteria; however, this is to be expected if the data used to develop the matrices are also used for calibration and there is no route choice in the network. No evidence has been provided to verify that 'observed turning counts' are accurate since no evidence has been provided, but these may have been based on ANPR data.

8.2 Queue Length Calibration

8.2.1 Paragraph 3.2.3 of the LMVR states that 15 randomly seeded runs are used to assess calibration and validation of the model. It is unclear whether this is per peak period, or in total. Graphs presented in Appendix C suggest that more than 15 runs were used for the calibration of queues. If runs were dismissed on incomplete model runs or other reasons, these should be clearly explained.

8.2.2 No comment has been provided within the LMVR regarding any latent demand that cannot be released from zones as a result of congestion.

8.2.3 Queue length graphs presented in Appendix C appear very different from observed queue lengths. Overestimation of the base year queues may result in unrealistically long queue lengths in the forecast years, and therefore suggest a greater impact from a development, while an underestimation of queues in the base year would result in potential queues as a result of a development to be underrepresented in the forecast year. Some examples are provided in figures 2 to 3 below.

8.2.4 Graph below shows some major differences, with the model showing longer queues than that of the surveyed queues by 100 vehicles (around 600m).

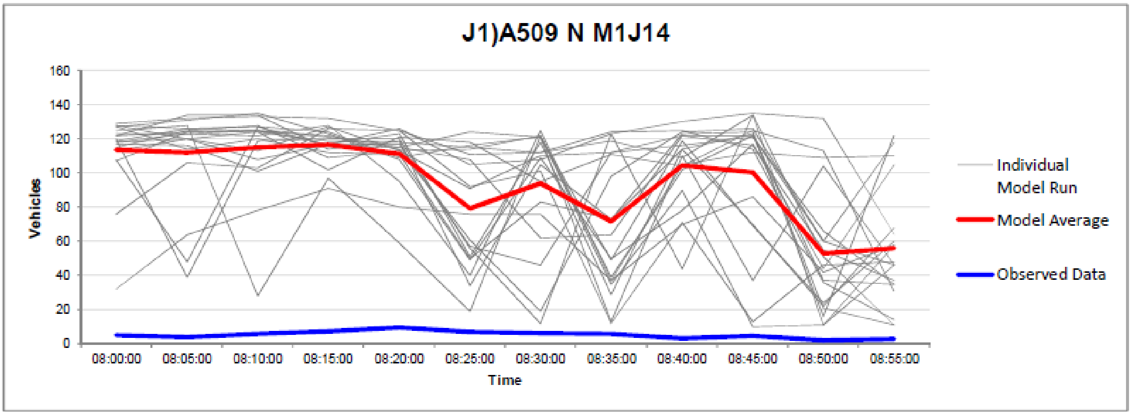


Figure 2 Graph taken from Appendix C showing major differences between the queue lengths observed and the queue lengths modelled.

8.2.5 Similarly, the graph below shows three model runs where queue lengths are substantially longer than others visible under the blue observed data line. If these model runs are producing unrealistic queues or journey times, then these should be excluded from all results.

8.2.6 For example, these three runs may skew results to present favourable calibration conditions in other queue length checks and journey time validation. Given this disparity between seed runs, it would be helpful to provide information on the confidence level and intervals of the base model results.

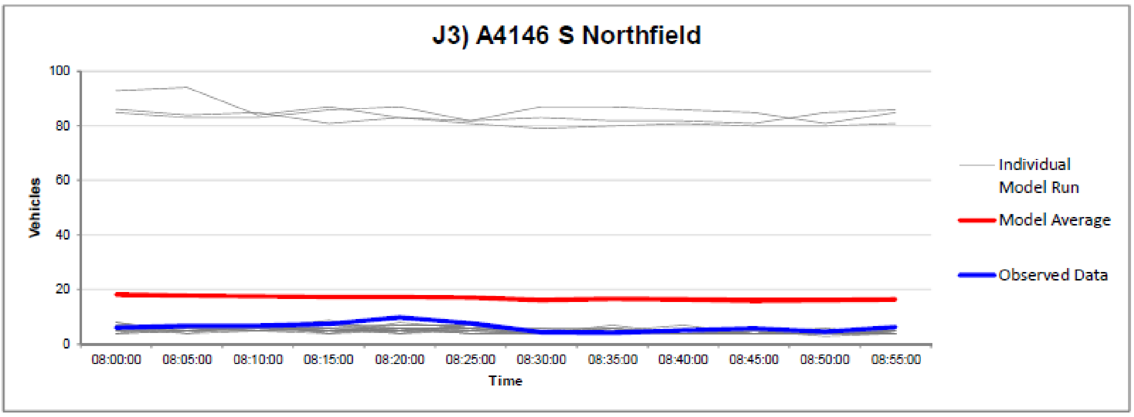


Figure 3 Graph taken from Appendix C showing three model runs with significantly different model results.

8.3 Journey Time Validation

8.3.1 The DfT TAG criteria are only appropriate for routes with distances between 3 and 15km. Many of the journey time routes presented are shorter than 3 km. It is recommended that only the 15% criteria are used since a 60 second variation is too long for a very short route. The model still appears to meet the 85% criteria using only the 15% criteria.

8.3.2 Journey times are validated using the ANPR data from 26th June 2019. This is acceptable given that the journey time data has not been used to develop the demand matrices.

8.3.3 Journey time profiles would be helpful to determine whether queueing and delays are in correct locations and the modelled peak hour is representative of the actual peak hour in this area. The modellers have not completed any journey time profiling.

8.3.4 It is unclear why the results for turning count and queue length calibration are based on different numbers of model runs compared to the journey time validation.

8.3.5 The table in Appendix D summarising results of the journey time validation does not present the confidence intervals for Routes 1-6, so it is difficult to determine where the model averages fall.

8.3.6 Queue lengths do not include full length of queues on approach to junctions, this is limited by ANPR site locations. The modellers should provide commentary or additional supporting information where queue data indicates queues extend past the ANPR, to provide greater confidence that the delay at each junction is captured.

9 Conclusions and Recommendations

9.1.1 To simplify the technical aspects of the audit each issue above has been aligned to the following rating, **MINOR**, **MEDIUM** and **MAJOR**.

9.1.2 A **MINOR** item is an advisory and can either be accommodated / changed or clarified with additional information, a **MEDIUM** item requires remediation or an additional explanation on why it has been done, which will then be re-considered, and **MAJOR** item requires correction before it can be reconsidered for review.

9.1.3 Issues or errors found during this LMVR audit are classified into three categories:

Table 1 below shows a summary of the status of the issues identified during the audit.

Table 1: Audit Summary Table

ID	Description	Classification	Required Evidence or Changes
Model Specification			
1	Unclear how peak hour was determined	**MEDIUM**	Additional information regarding how peak hour was chosen would be helpful in determining validity of approach.
Data Collection Review			
2	ANPR data collection, reliability and verification process unclear	**MAJOR**	Information to help determine that the data collected on 27th June 2019 is a representative day. Evidence of ATC data used to verify the profile should be provided to show representative day and verify ANPR data. Capture rate of ANPR data not provided to support use of this data.
3	Ongoing roadworks during data collection	**MAJOR**	Reassurances should be provided regarding use of data collected during ongoing works on the A421 and M1 Smart motorway schemes. Details of how any future changes in traffic flows arising from these roadworks coming to an end will be considered in forecast scenarios should be provided.
4	Journey times are based on ANPR data, number of journey time samples and assessment of reliability not provided.	**MEDIUM**	Journey time reliability reliant on quality of ANPR data. Is supplementary data required?
5	Methodology for queue length measurement unclear	**MEDIUM**	Methodology for queue length surveys should be clarified to show that the data is suitable for calibration of the model. Was this collected manually on site, using traffic cameras or an alternative method?
Base Model Development			

6	Evidence to support network is suitable with appropriate kerbs, junctions and links not provided	**MINOR**	Evidence to support how modellers know that the vehicle behaviour is consistent should be provided. For example, if a site visit was conducted or video footage was used to verify.
7	Unclear how maximum traffic signal timings were determined for use in the model at vehicle actuated signals.	**MINOR**	Some evidence could be provided to support this if site-based observations or video footage was used.
8	Changes to headway settings at junctions are not supported, these have been changed from the 2 second gap recommended.	**MINOR**	Modeller should justify use of smaller time gap between vehicles given no site visit was conducted.
9	Unjustified changes to generalised cost parameters and degrees of familiarity	**MEDIUM**	Modeller should provide justification for changing the generalised cost parameters. Evidence should be provided to justify changes to levels of familiarity by user class.
Model Demand and Matrix Development			
10	Demand methodology provided is not detailed enough to assess whether it is suitable	**MAJOR**	Greater transparency/ information required to determine demand methodology. This should include ANPR validity, ATC verification and capture rate for the data.
Model Calibration and Validation			
11	It is unclear how many runs are used to validate and calibrate this model.	**MEDIUM**	The final runs used for reporting should be consistent across all calibration and validation exercises. Any mode results considered outliers should be excluded and justified where necessary.
12	Latent demand unreleased as a result of congestion has not been mentioned.	**MINOR**	Latent demand should be discussed if vehicles are unreleased, especially if queues may affect the release onto the network.
13	Queue length graphs presented in Appendix C show significant over and under estimation. Model	**MAJOR**	Greater detail required on queue length data collection. Model runs should be excluded with justification if an unrealistic result is observed.

	instability clear on some routes.		
14	Journey time data is unreliable since it is collected from ANPR and the journey time route excludes a significant portion of queueing on approach to some junctions. Therefore, there may be some delays that are not represented well in the model.	**MAJOR**	Greater detail required for journey time validation, with mitigation measures to account for queue lengths not included in routes. Supplementary data to support use of ANPR should be considered.
15	Turning count data is unreliable since it is collected from ANPR	**MAJOR**	Turning counts from ANPR are unlikely to be reliable, supplementary data, using video MCC's may be required.

9.1.4 Modelling issues considered to be **MAJOR** are:

- Insufficient evidence of checks and verification of ANPR data collected and no detail of capture rate;
- Ongoing roadworks during data collection mean data may not be 'typical';
- There is insufficient supporting information provided on matrix development;
- Modelled queue lengths are not representative of the onsite observations;
- Journey time data is unreliable and excludes significant portions of queueing observed on some routes; and
- Turning count data is unreliable since it is collected from ANPR.

9.1.5 AECOM has reviewed the LMVR provided by WSP for the Paramics model of Milton Keynes J14 and the vicinity.

9.1.6 The evidence and detail provided on model development does not provide enough justification for model demand development. Therefore, based on issues highlighted in the table above, further information is required for AECOM to conclude whether this base model is representative of the current conditions in the area and provides a reliable basis to estimate any forecast year scenarios. However, AECOM cannot fully verify the model without reviewing the Paramics model itself.

Project:	**Milton Keynes East**	Job No:	**60600479** **DM016.007**
Subject:	**Review of WSP Response to MKE Paramics LMVR Comments**		
Prepared by:	**Jay Shah**	Date:	**02/11/2020**
Checked by:	**Phil Arnold**	Date:	**06/11/2020**
Verified by:	**Colin Hardie/Liz Judson**	Date:	**10/11/2020**
Approved by:	**John Alderman**	Date:	**10/11/2020**

1 Introduction

1.1.1 AECOM has previously been commissioned by Highways England (HE) to undertake a review of the Local Model Validation Report (LMVR) produced by WSP for Milton Keynes East (MKE) modelling. The LMVR documents the development, calibration and validation of the Paramics Discovery model that will be used as a base to test the impact of a proposed development "Milton Keynes East". The review did not include any audit of the Paramics model itself.

1.1.2 The findings of the review conducted by AECOM are documented in Technical Note 05 ("Review of Paramics LMVR Report"). The review indicated that there were a significant number of issues to which AECOM had requested further clarification and justification.

1.1.3 In order to respond to these findings from AECOM (TN 05), WSP have produced document (Ref: "Response to MKE Paramics LMVR Comments", dated September 2020). This document provides detailed clarification and additional information to provide better clarity on the issues identified by AECOM.

1.1.4 Highways England (HE) has requested that AECOM undertake a review of the document developed by WSP in response to AECOM's initial findings. This technical note (TN 08) documents the review of the response note from WSP and provides comments to conclude if the issues are resolved.

1.1.5 The purpose of this review is to verify if all the issues identified by AECOM in the previous review are resolved. Based on the documentation provided, the review will conclude whether the base model is likely to be representative of the current conditions in the area and provide a reliable basis for forecasting. It should again be noted that the models have not been audited by AECOM and therefore these cannot be fully verified.

2 Review of WSP Responses

2.1 Introduction

2.1.1 This section details the issue identified in the previous audit by AECOM and WSP's response to those issues. Based on the responses from WSP, AECOM has assessed whether the issue is resolved. AECOM has made further recommendations if the issues are unresolved.

2.1.2 Similar to the previous review, each issue is categorised into following categories:

MINOR – item is an advisory and can either be accommodated / changed or clarified with additional information;

MEDIUM – item requires remediation or an additional explanation on why it has been done, which will then be re-considered;

SIGNIFICANT – item requires correction before it can be reconsidered for review.

2.2 Model Specification Issues

Issue 1: Unclear how peak hour was determined

2.2.1 In the previous review AECOM requested the following:

"Additional information regarding how the peak hour was chosen would be helpful in determining validity of approach."

2.2.2 WSP in the response document has provided a table of hourly flows during AM and PM based on ANPR data. The ANPR data indicates that the peak hour in the AM starts at 07.45 and the peak hour in the PM starts at 16.30.

2.2.3 WSP stated that the purpose of the Paramics model is to assess the impact of the proposed MKE development on M1 Junction 14 and the Northfield roundabout. The peak trip generations based on the Transport Assessment for this proposed development are estimated to be between 08.00 – 09.00 in AM and between 17.00 – 18.00 in PM. The strategic model to be used to develop the forecast year models has the peak hours from 08.00 to 09.00 in AM and from 17.00 to 18.00 in PM. Thus, the peak hours selected for the base Paramics model are in accordance with the Transport Assessment and Strategic Model peak hours. It is noted that the AM calculated peak hour is similar to the peak hour selected, although the PM peak hour chosen is more distinct from the one calculated from ANPR data.

2.2.4 Based on the comments provided, AECOM understands that WSP has assumed the peak hours are consistent with those in the Transport Assessment. AECOM cannot verify the method in the Transport Assessment so cannot determine how peak hours were calculated. As WSP has shown, the Transport Assessment peak hours do not match with the peak hours calculated from the ANPR data. It is reasonable to consider the development trip generation, but ideally the combined profile of surveyed traffic and development trip generation would be assessed. The strategic model is based on data collected over a much wider network, so the choice of peak hour for that model is not relevant to the local microsimulation model. It is noted that the choice of peak hour may also be influenced by delay information, if there is significant congestion which causes a dip in the profiles of traffic counts, but that does not appear to be the case in the study area.

2.2.5 It is recommended that further information is provided, to show that traffic volumes in the peak hours calculated from the ANPR data are not significantly higher the surveyed traffic flows in the modelled peak hours. Although it is recognised that the peak development trip generation will be modelled, there is a risk that lower trip generation would have greater impact if base traffic conditions are more congested. This issue is therefore unresolved and is considered **MEDIUM**

2.2.6 It should be noted that the base model may not be suitable for other purposes, due to the peak hour being aligned to the peak development trip generation.

2.3 Data Collection Issues

Issue 2: ANPR data collection, reliability and verification process unclear

2.3.1 In the previous review AECOM requested the following:

"Information to help determine that the data collected on 27th June 2019 is a representative day.

Evidence of ATC data used to verify the profile should be provided to show representative day and verify ANPR data.

Capture rate of ANPR data not provided to support use of this data."

2.3.2 Section 3.2.3 of the WSP document states "AECOM on behalf of Highways England this was issued 21 June 2019, as confirmed by Highways England, "The review confirms that your approach to traffic survey is sensible"."

2.3.3 It should be noted that although AECOM considered that the approach of data collection was sensible, the LMVR developed by WSP did not fully demonstrate how this approach was implemented, so AECOM requested clarification during the previous review.

2.3.4 WSP stated that various discussions occurred between WSP and Highways England, Milton Keynes Council and Highways England SMART motorway team with regards to conducting the surveys. The following data was collected during the ANPR surveys:

- OD movement matrices for matched number plates;
- Link counts at the entries to the ANPR cordon;
- Details of the proportion of matched number plates;
- OD journey times; and
- Trip chains

2.3.5 The two-way link count data of two sites located on the edge of the model study area has been reviewed – Site 2 located at A5130, east of the Northfield Roundabout and Site 25 located at A509, north of Newport Road. Table 1 below shows the AM and PM peak hour data at these sites during the surveyed dates.

Table 1: Two-Way Link Counts Data

Count Date	Site 25 – A5130		Site 2 – A509	
	08:00-09:00	17:00-18:00	08:00-09:00	17:00-18:00
Thurs 27/6/19	1318	1837	1181	1284
Fri 28/6/19	1202	1837	1063	1176
Sat 29/6/19	981	1244	452	611
Sun 30/6/19	593	1277	224	659
Mon 1/7/19	1106	1830	1110	1244
Tue 2/7/19	1132	1880	1211	1258
Wed 3/7/19	1001	1888	1129	1240
Weekday Mean	1151.8	1854.4	1138.8	1240.4

Ref: WSP Document (Response to MKE Paramics LMVR Comments)

2.3.6 Based on the comparison it is seen that the modelled day (Thursday 27th June 2019) is reasonably close or higher than the average Weekday peak hour flows at these sites. It is also noted that the AM peak at Site 25 is considerably higher than the weekday average flows which must be considered in developing the forecast scenarios. However, AECOM notes that the sample size (one week) is not high, and it is best practice to consider at least two weeks of link count data for the comparison. However, as it is not possible to collect further data AECOM considers this issue to be resolved.

2.3.7 Furthermore, WSP has provided the capture rate information for the ANPR data based on MCC data comparison. Figure 1 shows the capture rate at all the sites where ANPR cameras were installed.

Site	Overall Sample Rates			Inbound Sample Rates			Outbound Sample Rates			Inbound Match Rates		
	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Matched Plates	Match Rate
01a	85251	76940	90%	43599	39487	91%	41652	37453	90%	43599	35928	82%
01b	81690	75082	92%	39020	36700	94%	42670	38382	90%	39020	34448	88%
01d	331	275	83%	-	-	-	331	275	83%	-	-	-
02a	19370	13724	71%	9633	5950	62%	9737	7774	80%	9633	5606	58%
02b	10221	9212	90%	6114	5316	87%	4107	3896	95%	6114	4343	71%
02c	22521	19125	85%	10280	8228	80%	12241	10897	89%	10280	7031	68%
03a	17358	13681	79%	8829	8519	96%	8529	5162	61%	8829	7924	90%
03b	3996	3843	96%	2118	2078	98%	1878	1765	94%	2118	1791	85%
Total	**240738**	**211882**	**88%**	**119593**	**106278**	**89%**	**121145**	**105604**	**87%**	**119593**	**97071**	**81%**

External Site
Internal Site

*Inbound match rates are only shown for the external sites that have traffic inbound to the study area
*For internal sites, the MCC and capture data will relate to EB and WB or NB and SB as opposed to Inbound and Outbound

Ref: WSP Document (Response to MKE Paramics LMVR Comments)

Figure 1 – ANPR Capture Rate

2.3.8 WSP in the response document has quoted in Section 3.2.11 “The data shows a reasonably good level of plate matching across all sites.”

2.3.9 As seen in the data, there are a few locations where the capture rate shows a significant number of plates are not captured. For example, Site “02a” has an inbound capture rate of 62%. Similarly, Site “03a” has the outbound sample rate of 61%.

2.3.10 It is standard practice to uplift the volume of trips captured by ANPR cameras, based on the capture rate provided (calculated from an MCC conducted using the video footage) to provide the actual volume of vehicles passing each ANPR site.

2.3.11 WSP has confirmed in Section 5.2.4 that "The matrices for these vehicle classes were expanded from the sample matrix to a full population matrix using the match rate data provided by the survey company and were then compared to the observed link counts at the ANPR cordon sites to ensure that the resultant flows at the zone entries/exits were appropriate. Following expansion of the matrices, the differences between the totals of the original sample matrices and the expanded full population matrices are as set out in Table 5-3 below." Table 2 below shows the difference between the Sample and Population matrices from ANPR data.

Table 2: Difference between Sample and Population matrices from ANPR

	AM Period	PM Period
ANPR Matrix (Sample)	26285	27601
Matrix (full population)	28065	29715
Difference	+1780	+2114
% Difference	6.8%	7.7%

Ref: WSP Document (Response to MKE Paramics LMVR Comments)

2.3.12 Based on this evidence provided by WSP, AECOM can confirm that the approach to uplift the flows based on the capture rate information is sensible and valid. However, AECOM has concerns that low capture rates at some of the sites (as listed above) may impact the turning proportions at the roundabouts. There is a concern that some traffic lanes may be obscured by queuing or other factors and are therefore under-represented. It is therefore recommended that WSP provides evidence that the ANPR cameras at these sites did not underrepresent certain lanes/ movements and the vehicle turning proportions are not impacted. This issue is therefore considered as unresolved and is **SIGNIFICANT**.

Issue 3: Ongoing roadworks during data collection

2.3.13 In the previous review AECOM requested the following:

"Reassurances should be provided regarding use of data collected during ongoing works on the A421 and M1 Smart motorway schemes. Details of how any future changes in traffic flows arising from these roadworks coming to an end will be considered in forecast scenarios should be provided."

2.3.14 WSP has stated that the roadworks (on the M1 to install smart motorway infrastructure and roadworks associated with widening the A421) are long term, spanning several years, meaning that it would be impossible to avoid collecting data whilst they are ongoing, without delaying planning applications across the entire sub-region that is affected by the works. WSP has stated that they confirmed that there were no road closures during the survey period. It is further confirmed by WSP in Section 3.3.8 that "WSP were also present on site on the day of the surveys to review conditions in the tail end of the PM peak. On site observations outlined that Junctions 13 and 14 were operating well with no issues that could be identified on site. It was noted that the mainline was also free-flowing. Whilst the SMART motorways works were visible and in place, there were three lanes of clear moving traffic throughout site observations."

2.3.15 Section 3.3.10 of the WSP document states "The impact of the roadworks will, however, be addressed in the modelling. For example, in the validation model the speed limit on the M1 has been reduced to around 50mph to account for the reduced speed limit within the roadworks. Once the validation model is acceptable, a "base" model will be created that reinstates the proper motorway speed limit and includes the impact of the smart motorway on the number of lanes available on the M1 and on the slip roads to Junction 14."

2.3.16 WSP has further stated in Section 3.3.13 "A review of WebTRIS data on the A421 (northbound and southbound on link A421 between M1 and A428) indicates that using data from w/c 15 October 2018 and w/c 14 October 2019 that 2019 flows are broadly higher than 2018. This is consistent for both directions and indicates that the variability between the two years is not large. This would demonstrate that the long-term road works do not appear to have materially altered the traffic flows on the A421. Arguably, it is therefore likely that the M1 does not suffer from large variance in traffic flows due to the road works."

2.3.17 Based on the provided information, AECOM understands that it was not possible for WSP to avoid the roadworks during the planned surveys as these are long-term. WSP has also sought to establish, as far as possible, that traffic conditions were not impacted significantly. Further, the approach to update the validated base model with the actual speed limits is deemed reasonable as that would mean there is a fair comparison with the forecast scenarios.

2.3.18 Further, WSP have stated that the forecast year traffic flows for the Paramics model will be derived from the Strategic model of the area as this will include all demands for trips in the local area. The impacts from road works in 2019 flows will not materially affect the future year demand matrices.

2.3.19 AECOM understands that taking an absolute growth from strategic models and applying to the base Paramics model flows (the base Paramics model flows could be lower than the actual flows due to roadworks) could result in lower forecast year flows. It is recommended that the forecast year demand methodology be documented to provide AECOM better clarity. This issue is considered as **MEDIUM**.

Issue 4: Journey times are based on ANPR data, number of journey time samples and assessment of reliability not provided.

2.3.20 In the previous review AECOM requested the following:

"Journey time reliability reliant on quality of ANPR data. Is supplementary data required?"

2.3.21 In the present response document, WSP has mentioned that when processing the raw ANPR data for use in the model, filtering was applied to:

- Remove all routes where only small samples of observations were recorded (generally <10 observations, with a few exceptions); and
- Remove any abnormally long journey times that could include vehicles that have either stopped in the middle of the study area or have left the study area and returned within a short space of time.

2.3.22 Figure 2 shows the location of the ANPR camera location sites.

Ref: WSP Document (Response to MKE Paramics LMVR Comments)

Figure 2 – ANPR Camera Location Sites

2.3.23 AECOM understands the approach adopted by WSP to calculate journey times from the raw ANPR data and this is acceptable. However, in the review document, AECOM did not question the reliability of using the ANPR data for journey time calculation, but whether the positions of the ANPR cameras would capture the full extent of network delay. There are concerns as some of these camera sites (Site 2a, 2c, 2b at the Northfield Roundabout, Site 3a on A509 London Road approach) are positioned in the middle of congested links and did not capture the full delay on approaches to the modelled junctions. Therefore, it is recommended that the journey time data should be validated/ cross checked with a secondary source of journey time data (e.g. TrafficMaster data). This issue is therefore unresolved and is considered **MEDIUM**.

Issue 5: Methodology for queue length measurement unclear

2.3.24 In the previous review AECOM requested the following:

"Methodology for queue length surveys should be clarified to show that the data is suitable for calibration of the model. Was this collected manually on site, using traffic cameras or an alternative method?"

2.3.25 WSP has clarified that the queue length surveys used for this study were collected using video cameras. The queue length calculations in Paramics model is further defined as follows:

- If the vehicle speed drops below a defined speed (normally 5mph); and
- The gap to the vehicle in front drops below a defined distance (normally 20m).

2.3.26 AECOM understands that the queue lengths measured on site using video cameras cannot be directly compared to those measured in the model (due to potential different definitions of what constitutes a queue). It is also agreed, as WSP state, that use of this data should consider the limitations in data collection. It is very difficult to reliably measure the back of queues - using a limited number of cameras it is unlikely there will be adequate views of queues which cannot be anticipated in advance of camera positioning. WSP do not state which cameras were used (the ANPR cameras do not appear to be sufficient)/ where these are on the network or give further details regarding when queue measurements were taken. AECOM cannot therefore verify the queue information is reliable. This issue therefore remains **MEDIUM**.

2.4 Base Model Development Issues

Issue 6: Evidence to support network is suitable with appropriate kerbs, junctions and links not provided

2.4.1 In the previous review AECOM requested the following:

"Evidence to support how modellers know that the vehicle behaviour is consistent should be provided. For example, if a site visit was conducted or video footage was used to verify."

2.4.2 In the response document, WSP stated that this Paramics model is based on an S-Paramics model that was originally calibrated and validated in 2012. The model was subsequently used several times (sometimes with further revalidation) to assess the impacts of several schemes on M1 Junction 14 and the Northfield roundabout.

2.4.3 WSP has stated in Section 4.2.2 – "The long life and use of the model means that the reasoning behind some of the coding decisions is unknown, however it is understood that the lane widths/ alignments etc. were based on OS CAD mapping of the study area. The current Paramics Discovery model was converted from the original S-Paramics model by Systra, however the differences between modelling approaches in Paramics Discovery and S-Paramics meant that some small changes were required to the network coding to respond to those differences and to improve some vehicle behaviours (such as vehicles randomly weaving at nodes). Many of these decisions to make changes to the model were made based on the modeller's professional judgement, which was based on their experience of building Paramics models and information taken from the survey videos, as the location and type of roads in the study area made it difficult to safely undertake a site visit."

2.4.4 Based on this response, AECOM understands that WSP has reviewed the survey videos and has implemented changes to the coding based on the professional judgement. It is understood that there are no significant adjustments made to the earlier validated model. WSP has considered video footage and adjusted the model where necessary: this is considered to be an acceptable approach and the issue is considered resolved.

Issue 7: Unclear how maximum traffic signal timings were determined for use in the model at vehicle actuated signals.

2.4.5 In the previous review AECOM requested the following:

"Some evidence could be provided to support this if site-based observations or video footage was used."

2.4.6 WSP has stated that the traffic signal timings are based upon the stage maximums identified in the traffic signal plans that were provided for the junctions by MKC.

2.4.7 The junction operates under MOVA control. AECOM understands that as the Paramics Discovery model cannot be linked to PC-MOVA, WSP attempted to replicate the signals behaviour as far as possible in the model and that the stage maximum times were derived from the S-Paramics model, the video surveys and traffic signal plans from Highways England and MKC.

2.4.8 AECOM can confirm that, in the absence of using PC-MOVA, using scripts to model the variable operation, based on available information such as signal plans and video footage is an acceptable approach. AECOM therefore consider the issue to be resolved – although it should be noted that the modelling itself cannot be verified since AECOM has not audited the model.

Issue 8: Changes to headway settings at junctions are not supported, these have been changed from the 2 second gap recommended.

2.4.9 In the previous review AECOM requested the following:

"Modeller should justify use of smaller time gap between vehicles given no site visit was conducted."

2.4.10 WSP has stated that the headways on approach to the traffic signals have been amended to increase/decrease the saturation flow to allow sufficient vehicles to pass through the traffic signals every cycle. WSP states in Section 4.4.2 – "It is noted that the 2007 Highways Agency Guidelines for the Use of Microsimulation Software identifies at Table 2 that the guidance for time headway between vehicles is based on a headway of one second. It is therefore considered that the headway parameters used in the model are suitable."

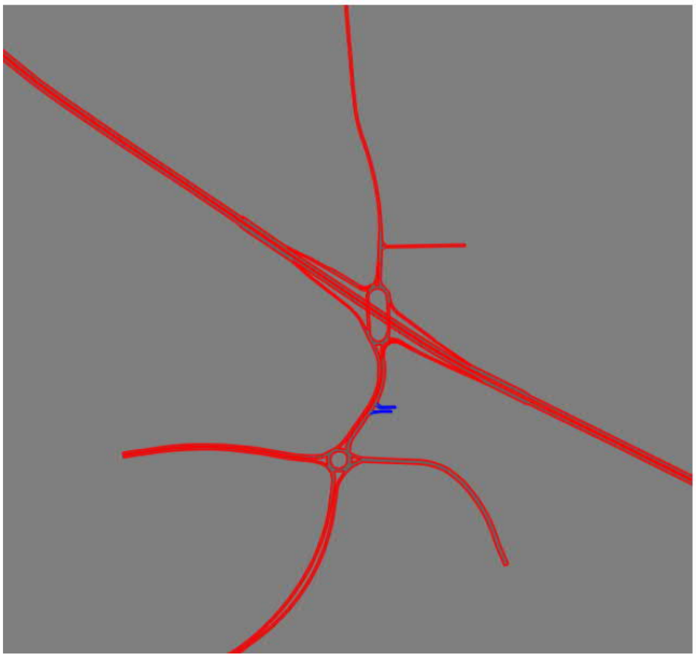
2.4.11 AECOM understands the that smaller time gaps between vehicles have been used to calibrate stop line capacity, to model observed throughput. However, it is possible that there is insufficient green time or other constraints to throughput, which are being masked by a higher saturation flow. It is therefore considered best practice to calibrate the saturation flows based on the survey data or RR67 calculated values, if the former is unavailable, to verify that modelled saturation flows are reasonable. It is therefore recommended that saturation flow calibration is provided to provide more confidence. This issue is therefore considered **MEDIUM**.

Issue 9: Unjustified changes to generalised cost parameters and degrees of familiarity

2.4.12 In the previous review AECOM requested the following:

"Modeller should provide justification for changing the generalised cost parameters. Evidence should be provided to justify changes to levels of familiarity by user class."

2.4.13 The generalised cost formula in Paramics is used by the model to select the routes of vehicles in the model but requires route choice in the model for changes in the cost values to have any significant impact on the routing of traffic. WSP has provided the Paramics model extent as shown in Figure 3.



Ref: WSP Document (Response to MKE Paramics LMVR Comments)

Figure 3 – MKE Paramics Model Extent

2.4.14 As seen in Figure 3, the model contains very limited route choices (1. using the M1 mainline or using the junction in east-west direction and 2. Using the bypass lane or the roundabout to travel towards A509 North). WSP has stated that the model is coded with defined routes to force vehicles to use the free-flow option (the mainline or a bypass lane).

2.4.15 AECOM understands that the generalised cost formula will not have any impact on routeing in the model.

2.4.16 WSP has provided the familiarity percentages coded in the model. The familiarity parameter in Paramics is used to define the proportion of vehicles that perceive minor links to be more expensive than major links and choose their route accordingly. WSP has confirmed that there are only two minor links in the model (shown in blue colour in Figure 3).

2.4.17 AECOM understands that these minor links will not impact any route choice in the models. Furthermore, WSP have confirmed that no development measures are anticipated to be coded into in that location which could have any impact on major/minor route choice.

2.4.18 Based on the justification and additional information provided by WSP, AECOM can consider the defined familiarly levels and generalised cost formula to be resolved, since they have no effect. However, WSP should illustrate that the proposals which will be tested in the models do not introduce any route choice, which would mean these parameters have an impact – this issue is considered **MINOR.**

2.5 Model Demand and Matrix Development Issues

Issue 10: Demand methodology provided is not detailed enough to assess whether it is suitable

2.5.1 In the previous review AECOM requested the following:

"Greater transparency/ information required to determine demand methodology. This should include ANPR validity, ATC verification and capture rate for the data."

2.5.2 In response to this, WSP has provided details regarding the demand development. The demand matrices used in the Paramics models are entirely based on the observed ANPR data.

2.5.3 Based on the details provided, AECOM understands the demand development methodology was as below:

- Step 1: ANPR data collected at all the eight cordon zones in Paramics model based on the matches for all vehicle classes (Cars, LGVs, OGV1 and OGV2).
- Step 2: Expansion of matrices for each vehicle classes from the sample matrix based upon the match rate data provided by the survey company.
- Step 3: Comparison of each zone's entries/exits from the matrices to the observed link counts at the ANPR cordon sites.
- Step 4: Expansion of the matrices based on the differences calculated in Step 3.
- Step 5: Summation of OGV1 and OGV2 matrices to develop HGV matrices.
- Step 6: Profiling of matrices in 15-minutes intervals based on traffic counts for the entry zones.

2.5.4 It must be noted that AECOM has not reviewed any demand spreadsheets as part of this review. However, based on the information provided AECOM can conclude that the approach to develop the base year model demand in Paramics models is appropriate. This issue is therefore considered to be resolved.

AECOM

2.6 Model Calibration and Validation Issues

Issue 11: It is unclear how many runs are used to validate and calibrate this model.

2.6.1 In the previous review AECOM requested the following:

"The final runs used for reporting should be consistent across all calibration and validation exercises. Any mode results considered outliers should be excluded and justified where necessary."

2.6.2 WSP stated that the model was run 15 times to obtain an average result from multiple seeded runs, which is considered to be sufficient for a model of this size.

2.6.3 WSP has provided variability check information in the journey time validation tables in LMVR Appendix D, based on 95% confidence intervals. However, there are a few routes which do not pass the variability check. It is therefore recommended that WSP provides information which indicates what level of confidence they have in the average results presented – and details of when a route is considered to pass or fail the variability check. This issue is therefore considered to be unresolved and is **MINOR**.

Issue 12: Latent demand unreleased as a result of congestion has not been mentioned.

2.6.4 In the previous review AECOM requested the following:

"Latent demand should be discussed if vehicles are unreleased, especially if queues may affect the release onto the network."

2.6.5 In response to this issue, WSP stated in Section 6.3.1 that "There is very limited numbers of unreleased vehicles in the model, with the main sources being the A509 southbound towards M1 Junction 14 and Childs Way towards the Northfield Roundabout. In most runs, while there are unreleased vehicles at the end of the validation hour, the number of unreleased vehicles dissipates in the cool down period to a point where there are no unreleased vehicles when the model ends."

2.6.6 Based on the above information, AECOM cannot verify the number of remaining vehicles in the network at the end of the peak hour. It is therefore recommended that the total latent demand is reported.

2.6.7 The model extent covers the locations where the survey data was collected in the network. The input traffic data is based on this survey data and therefore the presence of latent demand in the base model indicates that congestion in the network may not be accurately represented. It is therefore recommended that the level of congestion along the links where the demand remains unreleased is reviewed and that the latent demand in the AM and PM is reported to provide a better understanding to the reviewers. It is recommended that these links are extended to capture the queues and include the latent demand, especially as it is suspected that the forecast models (with higher demand than base) may result in longer queues on these links. However, if the level of latent demand is low in the base models, then the links can be extended in future year models, to make sure the full impact of the development is captured. This issue is therefore considered **MEDIUM**.

Issue 13: Queue length graphs presented in Appendix C show significant over and under estimation. Model instability clear on some routes.

2.6.8 In the previous review AECOM requested the following:

"Greater detail required on queue length data collection. Model runs should be excluded with justification if an unrealistic result is observed."

2.6.9 In the response document, WSP state that the modelled queue lengths are based on the average queue length observed by the model in each five-minute period during the assessment hours. As discussed in the section of Issue 5, WSP has confirmed that the queue length survey was carried out using the video cameras.

2.6.10 WSP states that it is evident that the queue length observations on the A509 southbound approach to the north of M1 Junction 14 must have not recorded the full extent of queueing as the journey time validation is only possible with longer queues. Section 6.4.4 further states that "While the Typical Traffic conditions shown in Google Maps does not provide the full extent of queuing in the model area, it does provide information about where traffic is moving more slowly than normal, which could be either as a queue or just slowly moving traffic. This information shows significantly longer A509 approach from the north".

2.6.11 AECOM understands that the method to calculate the queue length based on video camera by the enumerators may not be aligned to the method to calculate the queue length in the Paramics models. As stated above, queue length information is useful additional validation of the model, but the focus should be robust journey time validation, including the full extent of congested areas. However, it is recommended that the modelled queue lengths must be compared and should approximately correlate to the queuing conditions in the images from the video cameras or Google Traffic Maps – this should be documented. This issue is therefore unresolved and is considered **MEDIUM**.

Issue 14: Journey time data is unreliable since it is collected from ANPR and the journey time route excludes a significant portion of queueing on approach to some junctions. Therefore, there may be some delays that are not represented well in the model.

2.6.12 In the previous review AECOM requested the following:

"Greater detail required for journey time validation, with mitigation measures to account for queue lengths not included in routes. Supplementary data to support use of ANPR should be considered."

2.6.13 WSP has stated in Section 6.5.2 that "The ANPR journey times are based on a large sample rate of many vehicles and, as there are no locations within the cordon where vehicles would seek to stop, will be more reliable record of the average journey times across the peak hour than the small sample of observations that would be possible to record using moving observers. It is also noted that the ANPR journey times will take account of vehicles that are stopped by a red traffic signal and vehicles that pass straight through on green, which will be similar to the journey times reported by the model. Moving observer journey times occasionally present the risk of only including one of the two traffic signal behaviours."

2.6.14 AECOM agrees to the above response and ANPR data is considered robust as it includes more journey time samples as compared to the moving observer method. However, the use of ANPR survey at the cordon zones does not provide the journey time in the intermediate sections.

2.6.15 TfL Modelling guidelines v3.0 which are considered to provide comprehensive microsimulation guidance state that "Modelled journey times should be averaged over multiple seeds…and be within 15% of surveyed on-street journey times according to MAP v2.2. Journey time output should be presented as the cumulative journey time obtained by all vehicles that follow individual journey time segments as well as complete journey times for vehicles that follow the entire journey time surveyed route." Also, Section 4.3.4 of TAG unit M3.1 Highway Assignment Modelling states that "It is standard practice to use journey time validation at the route level. However, increasingly there is a need to take a more detailed approach and check journey time validation at the link level or for segments of the route as well." It is therefore considered best practice in microsimulation models to compare modelled and observed journey times for smaller segments, as this would help determine whether the queueing and delays are represented in correct locations in the network. This is particularly important given the issues that WSP outline with collecting reliable queue data and comparison with microsimulation models.

2.6.16 As stated earlier, AECOM also has concerns that the ANPR survey may not have captured the full extent of the queues, due to cameras being situated on congested links. Therefore, some of the congestion may not be fully represented in the model.

2.6.17 It is therefore recommended that the obtained ANPR journey time data must be verified against a secondary source data (e.g. TrafficMaster data) which would also provide details of delay on intermediate sections along the journey time routes in the model. This issue is therefore considered to be unresolved and is **SIGNIFICANT**.

Issue 15: Turning count data is unreliable since it is collected from ANPR

2.6.18 In the previous review AECOM requested the following:

"Turning counts from ANPR are unlikely to be reliable, supplementary data, using video MCC's may be required."

2.6.19 In response to this issue, WSP has stated the following in Section 6.6:

"There is no suitable historic count data available, and it is considered that the observations from the ANPR are more likely to be reliable than a new traffic count. It is noted that the model is showing an excellent level of calibration against the observed turning count data from the ANPR data. Furthermore, there is no opportunity to undertake supplementary traffic surveys at this time. The combination of further road works, plus Covid-19 pandemic conditions would result in surveys which are not reflective of network conditions. As such, the capture rate outlined in the ANPR analysis provides evidence that the surveys captured are appropriate."

2.6.20 AECOM understands there is limited available data for flow calibration. It is assumed that the observed flows used for the traffic flow calibration are based upon the uplifted ANPR captured flows and not based upon only the captured number of trips. However, AECOM is unable to establish this based on some spot-checks. AECOM has concerns that the raw ANPR data based only on the captured number plates has been used for calibration. These are lower than manual traffic counts provided with the ANPR data, especially at some locations where the capture rate is low (see Figure 1 in Section 2.3) potentially resulting in unrealistically low flows being used in the flow comparisons. It is therefore recommended that more clarity is provided, with details of calculations, to confirm how the observed flows in the model calibration results were calculated, particularly with regard to M1 Junction 14.

2.6.21 In addition to the above and as stated earlier, WSP should also demonstrate that the ANPR cameras are not underrepresenting certain turning movements, given that both the matrix development and turning count calibration rely on these proportions. This issue is therefore considered unresolved and is **SIGNIFICANT**.

3 Conclusions and Recommendations

3.1.1 AECOM previously reviewed the LMVR produced by WSP for Milton Keynes East Paramics modelling. The findings of this review conducted by AECOM are documented in Technical Note 05. The review indicated that there were a significant number of issues to which AECOM had requested further clarification and justification.

3.1.2 In order to provide response to the findings of AECOM's previous review, WSP has produced a document (Ref: "Response to MKE Paramics LMVR Comments", dated September 2020) which is reviewed and discussed in this technical note.

3.1.3 The review indicates that some issues identified by AECOM are resolved based on the comments provided by WSP. However, there are a few unresolved issues for which AECOM have provided further recommendations.

3.1.4 Table 3 below shows a summary of the present status of the issues identified in the previous audit.

Table 3: Audit Summary Table

ID	Issue Description	Previous Level of Issue	Current Level of Issue	Comments/ Recommendations
Model Specification				
1	Unclear how peak hour was determined	MEDIUM	MEDIUM	More information requested to determine how modelled peak hour traffic flows relate to peak hours calculated from ANPR data requested.
Data Collection Review				
2	ANPR data collection, reliability and verification process unclear	SIGNIFICANT	SIGNIFICANT	Slight concerns with the sample size of link count data compared to determine the representative day. However, this is resolved as no more data is available. Furthermore, there are concerns with the low ANPR capture rate at some few sites which may impact the turning proportions, which is **SIGNIFICANT** issue.
3	Ongoing roadworks during data collection	SIGNIFICANT	MEDIUM	Concerns with the forecast year demand development considering the roadworks impact. Requested details of methodology.
4	Journey times are based on ANPR data, number of journey time samples and assessment of reliability not provided.	MEDIUM	MEDIUM	Concerns regarding the full extent of the delay/ congestion not captured in journey time data recorded using ANPR surveys. Use of TrafficMaster data (or similar) for additional validation is recommended.

ID	Issue Description	Previous Level of Issue	Current Level of Issue	Comments/ Recommendations
5	Methodology for queue length measurement unclear	MEDIUM	MINOR	WSP do not state which cameras were used/ where these are on the network. It is recommended that more detail is provided.
Base Model Development				
6	Evidence to support network is suitable with appropriate kerbs, junctions and links not provided	MINOR	RESOLVED	-
7	Unclear how maximum traffic signal timings were determined for use in the model at vehicle actuated signals.	MINOR	RESOLVED	-
8	Changes to headway settings at junctions are not supported, these have been changed from the 2 second gap recommended.	MINOR	MEDIUM	Saturation Flow reporting is recommended.
9	Unjustified changes to generalised cost parameters and degrees of familiarity	MEDIUM	MINOR	Recommendation to illustrate that the future year proposals which will be tested in the models do not introduce any route choice
Model Demand and Matrix Development				
10	Demand methodology provided is not detailed enough to assess whether it is suitable	SIGNIFICANT	RESOLVED	-
Model Calibration and Validation				
11	It is unclear how many runs are used to validate and calibrate this model.	MEDIUM	MINOR	Recommendation to provide more information on the level of confidence in average results as a few routes fail variability check, which requires explanation.
12	Latent demand unreleased as a result of congestion has not been mentioned.	MINOR	MEDIUM	Latent demand values are requested – so level of latent demand is understood. However, it is recommended that the links with latent demand are extended to capture the queues and avoid issue in forecasting.
13	Queue length graphs presented in Appendix C show	SIGNIFICANT	MEDIUM	Recommendations to compare the queue lengths in models to images from

ID	Issue Description	Previous Level of Issue	Current Level of Issue	Comments/ Recommendations
	significant over and under estimation. Model instability clear on some routes.			video cameras/Google Traffic Maps and document this.
14	Journey time data is unreliable since it is collected from ANPR and the journey time route excludes a significant portion of queueing on approach to some junctions. Therefore, there may be some delays that are not represented well in the model.	SIGNIFICANT	SIGNIFICANT	It is recommended to use Trafficmaster or similar compare the journey time routes in small segments rather than whole route – so the delay on particular sections can be verified (especially since queue data collection was difficult as reported by WSP). Reiterate issue with ANPR sites not capturing full extent of delay, due to being located where the full extent of congestion was not captured. Again, recommend use of Trafficmaster data to overcome this issue.
15	Turning count data is unreliable since it is collected from ANPR	SIGNIFICANT	SIGNIFICANT	There are concerns that the observed flows using for calibration are based on raw ANPR data (captured plates only). It is recommended that better clarity is provided with required calculations to confirm the source of the observed flows in the model calibration results. Also, there are concerns that low capture rate may be impacting the turning proportions. WSP should provide evidence that turning proportions are not impacted by low capture rates.

3.1.5 Based on the responses provided by WSP on the issues identified earlier, AECOM cannot determine whether the base Paramics model developed by WSP is representative of the current conditions in the area and provides a reliable basis for forecasting. It is noted that many of the issues are now resolved. However, some outstanding issues remain and AECOM has made some recommendations/ suggestions for providing the further information required to assess the base model quality. It is recommended that the issues identified, and concerns highlighted in this technical note are resolved by WSP. Furthermore, it must be noted that AECOM cannot fully verify the model without reviewing the Paramics model itself.

Project:	**Milton Keynes East**	Job No:	**60600479** **DM016.009**
Subject:	**Review of WSP Response to MKE Paramics LMVR Comments**		
Prepared by:	**Jay Shah**	Date:	**11/02/2021**
Checked by:	**Phil Arnold**	Date:	**15/02/2021**
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Approved by:	**John Alderman**	Date:	**18/02/2021**

1 Introduction

1.1.1 AECOM had previously been commissioned by Highways England (HE) to undertake a review of the Local Model Validation Report (LMVR) produced by WSP for Milton Keynes East (MKE) modelling. The LMVR documents the development, calibration and validation of the Paramics Discovery model that will be used as a base to test the impact of a proposed development "Milton Keynes East". The review did not include any audit of the Paramics model itself.

1.1.2 The findings of the review conducted by AECOM are documented in Technical Note 05 ("Review of Paramics LMVR Report"). The review indicated that there were a significant number of issues to which AECOM had requested further clarification and justification.

1.1.3 In order to respond to these findings from AECOM (TN 05), WSP had produced document (Ref: "Response to MKE Paramics LMVR Comments", dated September 2020). This document provided detailed clarification and additional information to provide better clarity on the issues identified by AECOM. This document was subsequently reviewed by AECOM and the findings were documented by AECOM in Technical Note 08 (TN08). The review suggested that there were a few significant issues which required further clarifications.

1.1.4 In order to address the issues in TN 08 and to provide further clarity and related information to address those issues, WSP has produced a document (Ref: "Paramics Model Addendum to LMVR and Responses to AECOM Queries" dated January 2021). In addition to this document developed by WSP, AECOM has also reviewed the raw data spreadsheets (Ref: "ID04688 Milton Keynes East - ANPR OD Report - 27_06_2019" and "ID04688 Milton Keynes East - ANPR Sample Rate Report - 27_06_2019") which were subsequently requested.

1.1.5 Highways England (HE) has requested that AECOM undertake a review of the document developed by WSP in response to AECOM's findings. This technical note (TN 09) documents the review of the response note from WSP and provides comments to conclude if the issues are resolved.

1.1.6 The purpose of this review is to verify if all the issues identified by AECOM in the previous review are resolved. Based on the documentation provided, the review will conclude whether the base model is likely to be representative of the current conditions in the area and provide a reliable basis for forecasting. It should again be noted that the models have not been audited by AECOM and therefore these cannot be fully verified.

2 Review of WSP Responses

2.1 Introduction

2.1.1 This section details the issue identified in the previous audit (TN 08) by AECOM and WSP's response to those issues. Based on the responses from WSP, AECOM has assessed whether the issue is resolved. AECOM has made further recommendations if the issues are unresolved.

2.1.2 Similar to the previous review, each issue is categorised into following categories:

MINOR – item is an advisory and can either be accommodated / changed or clarified with additional information;

MEDIUM – item requires remediation or an additional explanation on why it has been done, which will then be re-considered;

SIGNIFICANT – item requires correction before it can be reconsidered for review.

2.2 Model Specification Issues

Issue 1: Unclear how peak hour was determined

2.2.1 In the previous review AECOM requested the following:

"More information requested to determine how modelled peak hour traffic flows relate to peak hours calculated from ANPR data requested."

2.2.2 The Paramics base model has been developed for the following AM and PM peak hours:

- AM Peak: 08:00 to 09:00
- PM Peak: 17:00 to 18:00

2.2.3 Section 2.1.4 of the WSP document states following reasons for the selection of the peak hours:

- The purpose of the model is to assess the impacts of the proposed Milton Keynes development for which the above times are predicted to be the peak hours for the Transport Assessment;
- The forecasting (years 2031, 2048) will be undertaken based on data extracted from the SATURN strategic model which has the same peak hours as those validated for the Paramics model; and
- The traffic forecasting for the proposed development is an hourly forecast and ties in with the peaks above.

2.2.4 In the previous review AECOM requested that WSP show that traffic volumes in the peak hours calculated from the ANPR data are not significantly higher than the surveyed traffic flows in the modelled peak hours.

2.2.5 In the response document, WSP has provided the flow difference comparison between the network peak and the modelled peak as shown in Table 1.

Table 1: Network Peaks and Flow Difference to Validation Peak

	Time	Flow Difference to Validated Peak
AM Peak	07:45 – 08:45	+1
PM Peak	16:30 – 17:30	+294

Ref: WSP Document (Response to MKE Paramics LMVR Comments)

2.2.6 Based on the comparison, it is clear that choosing 08:00 to 09:00 as the AM peak hour will have a negligible impact on the model. It is also noted that there is a three-quarter hour overlap between the model and network peaks.

2.2.7 However, as seen in the comparison there is a larger flow difference in the PM peak hour with the modelled peak having 294 vehicles less than the total network peak hour vehicles. Section 2.1.3 of the WSP document notes that 'The model also has warm-up and cool-down periods of 60 minutes, which means that the model also includes the shoulder peaks surrounding the main validation peak as well.' AECOM understands that having a 60-minute warm-up period will mean that the higher flows during the network peak hour will be modelled and the congested conditions will not be compromised.

2.2.8 Based on the comments and the comparison provided by WSP, AECOM considers that the selection of the peak hours is acceptable. The issue is therefore considered to be resolved.

2.3 Data Collection Issues

Issue 2: ANPR data collection concerns

2.3.1 In the previous review AECOM commented the following:

"AECOM has concerns with the low ANPR capture rate at some sites which may impact the turning proportions, which is **SIGNIFICANT** issue."

2.3.2 Figure 1 shows the location of the ANPR camera location sites where WSP had collected the data.

Ref: WSP Document (Response to MKE Paramics LMVR Comments)

Figure 1 – ANPR Camera Location Sites

2.3.3 In the previous review (TN 08), AECOM had concerns that low capture rates at some of the sites (Site 02a, Site 03a) may impact the turning proportions at the roundabouts. There was a concern that some traffic lanes may be obscured by queuing or other factors and are therefore under-represented. Therefore, AECOM recommended that WSP provides evidence that the ANPR cameras at these sites did not underrepresent certain lanes/ movements and the vehicle turning proportions are not impacted.

2.3.4 In order to respond to this, the response document from WSP includes Appendix B which contains the images of the views from the ANPR cameras providing more detail of these camera views.

2.3.5 AECOM has reviewed the images presented by WSP in Appendix B and it is not possible to determine whether the turning proportions are impacted by low capture rates; the cause of the low capture rate was not apparent, as more information regarding queuing on each lane would be needed to determine whether vehicles were obscured. ANPR sites (Site 02a, 02b, 02c, 03a) have a low match rate of vehicles compared to the manual count data. If the turning proportions are impacted at these sites at Northfield roundabout, the vehicles turning towards M1 Junction 14 (key junction for the study) from these sites could be inaccurate. There remains a risk from the use of ANPR data with a low capture rate to derived turning flows at junctions, so it is possible that the turning flows may not be accurate in some cases. However, this issue cannot be resolved due to the limitations of the collected data - the issue remains unresolved and **SIGNIFICANT**, but the risk should be documented going forwards. It is recommended that additional data (MCTC at the junctions where these sites are located) should be captured whenever the opportunity arises (post-Covid) in the future and the turning flows should be reviewed.

Issue 3: Ongoing roadworks during data collection

2.3.6 In the previous review AECOM stated:

"AECOM has concerns with the forecast year demand development methodology and if it considered the roadworks impact during the data collection period. AECOM requested further details of the forecasting methodology to clarify how the modelling will take account of the development trips and the impact of the roadworks in the Paramics model."

2.3.7 Section 2.3 of the WSP document details the approach WSP are adopting to develop the forecast year demand. WSP states 'With regards to the roadworks, the model will be amended to reflect the smart motorway that is currently under construction, including any associated speed limits (but not the automatic speed limit changes). It seems likely that the peak speed limit within the proposed smart motorway would be less than 70mph, but as a start the motorway will be recoded with a 70mph speed limit. The forecast traffic inputs to the Paramics model will be identified by calculating the difference in flow between the base year Saturn model flows and the forecast year Saturn model flows for each scenario and then by adding the "difference matrix" to the base year Paramics model. In the "with development" scenarios this difference matrix will not only include traffic redistribution in the local area but also the development traffic. It is understood that the Saturn model already addresses the "roadworks" issue and that the flows from that model will be representative when added to the Paramics matrix'.

2.3.8 The approach to develop the demand for the forecast year models is considered reasonable. In the previous review (TN 08), WSP provided assurance that the base year Paramics model flows are not largely impacted due to the roadworks. Furthermore, changing the actual speeds along the motorway for the forecast scenario models is a reasonable approach. Based on the details provided by WSP the issue is considered to be resolved.

Issue 4: ANPR based journey time data used for validation.

2.3.9 In the previous review AECOM had commented the following:

"Concerns regarding the full extent of the delay/congestion not captured in journey time data recorded using ANPR surveys. Use of Trafficmaster data (or similar) for additional validation is recommended."

2.3.10 Based on the recommendation from AECOM, WSP has obtained 2019 Trafficmaster journey time data for the area covered by Milton Keynes district. WSP has explained the approach to process the raw Trafficmaster data for the neutral days during the modelled AM and PM peak hours. The approach to process the journey time data is considered appropriate.

2.3.11 Section 2.4.4 of the WSP document states that 'The Trafficmaster data has then been processed to match 30 new journey paths in the Paramics model. This will provide more detailed information about the potential breakdown of journey times in the model. It should be noted that the ANPR data will be regarded as the main data source, while the Trafficmaster data will be treated as a secondary, supplementary data source.'

2.3.12 The use of Trafficmaster data in addition to the ANPR survey data to compare the modelled journey time values will help in determining the accuracy of the base models as the Trafficmaster data includes a large number of samples and allows journey times on different sections to be understood. This issue is therefore considered to be resolved.

Issue 5: Methodology for queue length measurement unclear

2.3.13 In the previous review AECOM commented the following:

"WSP do not state which cameras were used/where these are on the network. It is recommended that more detail is provided."

2.3.14 In the present response document, WSP has clarified in Section 2.5.1 that the queue length data was collected using cameras that had been installed at sites on the approaches to the junctions in the Paramics model study area. The queue length data was reported in two forms:

- Queues at the signal junctions shown as the maximum queue at green in each cycle; and
- Queues at the priority junctions shown as the maximum queue observed every minute through the peaks.

2.3.15 Furthermore, Section 2.5.2 of WSP document states that 'It is evident from the survey data outputs contained in Appendix B that there were instances when the on-street queue length exceeded the length that could be observed by the cameras – in this case highlighted using a coloured fill in the table cell. Reviewing these instances of excess queueing that could not be recorded by the cameras indicates that, in general, the queues only exceed the distance viewable from the survey cameras for a short time (normally up to six minutes/cycles), suggesting that the queue is unlikely to be significantly longer than has been reported.'

2.3.16 The data shared by WSP in Appendix B was reviewed by AECOM. The data suggests that there are a few lanes (lane A2, lane D1) during the AM peak and lane C3 during the PM peak at M1 Junction 14 which extend back beyond the view of the cameras. The data does not label the link names associated with these lanes and should be provided by WSP for further clarity as AECOM cannot determine which lanes are referred to in the data. This issue is therefore considered **MINOR**.

2.4 Base Model Development Issues

Issue 8: Changes to headway settings at junctions

2.4.1 In the previous review AECOM commented the following:

"Saturation Flow Calibration is recommended"

2.4.2 The response document from WSP states that the surveys were not designed to collect saturation flows, many of the camera angles do not provide sufficient view to calculate observed saturation flows. WSP also believes that the MOVA operation of the junctions would increase the saturation flow above that predicted by RR67 meaning that using these estimates would be unreliable.

2.4.3 AECOM further understands that Paramics Discovery does not automatically collect any files that allow saturation flows on individual links to be measured, meaning that they would have to be recorded from observations of the model visualisation, which can be subjective and potentially unreliable.

2.4.4 Sections 2.6.3 and 2.6.4 of the WSP document state that 'WSP believes that there is insufficient data to provide a Saturation Flow calibration for the model. As there is no further evidence relating to the headway adjustments, the adjustments to headway have been made in an informed manner during model calibration to ensure that there is sufficient throughput of traffic at the signal junctions. This is a normal part of calibration in Paramics Discovery and it is considered that the headway factors used are within the normal range for calibration adjustments. It is therefore considered that these adjustments are appropriate.'

2.4.5 WSP has confirmed that the headway adjustments have been made in an informed manner during model calibration. AECOM has not reviewed the Paramics model developed by WSP. However, since the headway parameters are not changed significantly from default values, and due to the limitations of the Paramics Discovery software to extract modelled saturation flow data, the issue is considered as resolved.

Issue 9: Unjustified changes to generalised cost parameters and degrees of familiarity

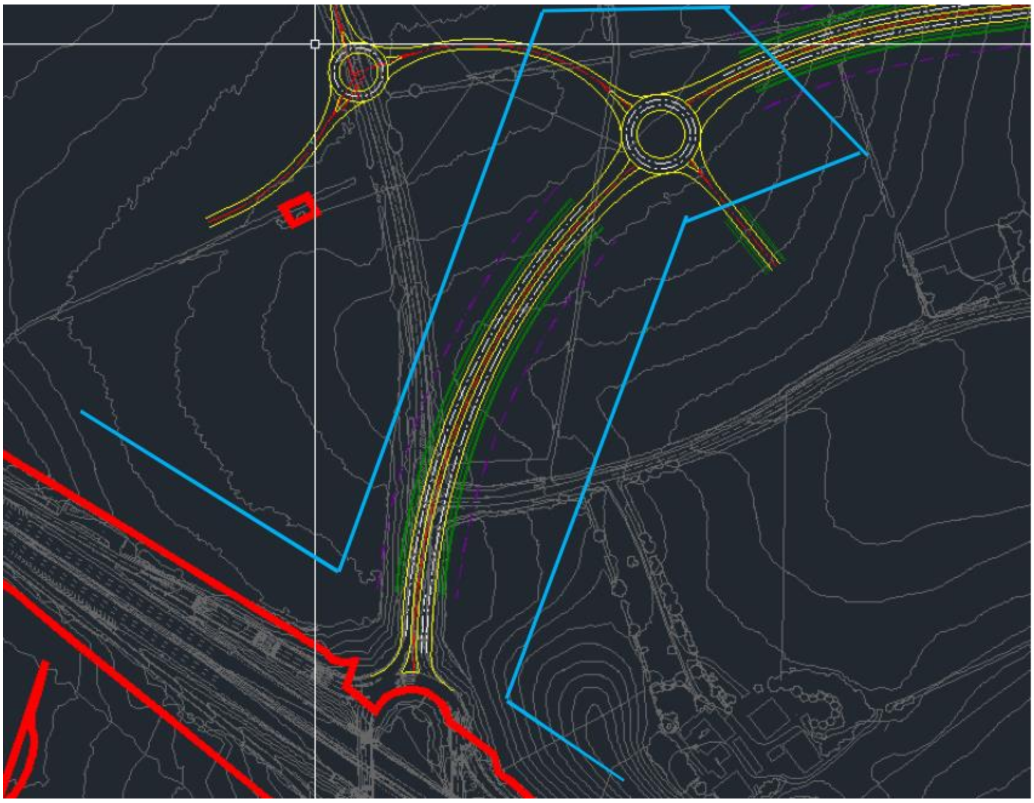
2.4.6 In the previous review AECOM requested the following:

"Recommendation to illustrate that the future year proposals which will be tested in the models do not introduce any route choice"

2.4.7 In the previous review (TN 08), AECOM acknowledged that the cost factors used in the model do not have any impact on the base models as there is no route choice.

2.4.8 WSP in Section 2.7.1 acknowledges AECOM's comment that the cost factors should be considered in the forecast models if there are any route choices implemented.

2.4.9 Section 2.7.2 and Section 2.7.3 in the WSP document provide information of the future year proposals. The proposals to be added into the model are the rerouting of the A509 to a new alignment, including closure of the existing A509/Newport Road junction and the first new roundabout to the north of the M1 only. An indicative arrangement (which may be subject to change) is shown by WSP in the document as shown in Figure 2. The model will also include the smart motorway scheme on the M1, including the new slip road arrangements – these will also be present in the reference case models.



Ref: WSP Document (Response to MKE Paramics LMVR Comments)

Figure 2 – MKE Paramics Model Extent

2.4.10 Based on the information provided by WSP, AECOM understands that the future year proposals to be added to the Paramics model will not introduce any additional route choice and therefore the cost factors currently in the model will not have any impact. The issue is considered to be resolved.

2.5 Model Demand and Matrix Development Issues

Issue 10: Model Demand Development methodology

2.5.1 In the previous review, AECOM had reviewed and accepted the approach adopted by WSP to develop the demand for the base year Paramics models. It should be noted that AECOM had not been supplied with and reviewed the spreadsheets associated with the demand calculations. However, in the previous review, AECOM identified some concerns associated with the flow calibration of the base models (TN 08 – Issue 15 – Section 2.6.23).

2.5.2 Section 2.8.1 of the document from WSP states that 'Changes have been made to the demand methodology after it was identified that the matrix had not been uplifted to match the full traffic sample, from the sample rate. The matrix has now been uplifted to match the full traffic sample; the remaining matrix build process remains as set out in the original response.' Furthermore Section 3.3 of the WSP document, which is an addendum to the LMVR, states that 'While reviewing AECOM's comments it became apparent that the ANPR matrix had been partly uplifted from the number of matches to the sample, but that it had not been uplifted to reflect the total vehicle count.'

2.5.3 Similar to the last review, AECOM has not been supplied with and reviewed spreadsheets associated with the demand calculation in the present review. AECOM understands that this change is mainly to address the errors in previous calculations, and it is therefore considered appropriate.

2.6 Model Calibration and Validation Issues

<u>Issue 11: Model Results Variability Concerns.</u>

2.6.1 In the previous review AECOM commented the following:

"Recommendation to provide more information on the level of confidence in average results as a few routes failed variability check, which required explanation."

2.6.2 AECOM raised minor concerns as the journey time validation tables by WSP showed that many journey time route results failed the variability check undertaken by WSP. AECOM requested further clarity on the approach taken with the variability check.

2.6.3 In order to respond to these minor concerns, WSP has included a section (Section 3.7) in the addendum document to the LMVR. This section states that 'In terms of model variability, the main variance will be as result of traffic flow variation between runs, because the model has no route choice and cannot significantly vary between runs. This means that the main sources of variability are likely to be the traffic signals, which are responding to the traffic demand using scripts. The journey time variability check in the model reports checks if the 95% confidence interval of the modelled journey time is within 5% of the modelled mean. This test is quite strict and does not always mean that the individual journey time suffers large swings of variability – very often it can be only a few seconds outside the window. In the AM peak 75.6% of journey times pass variability checks, but there is no evidence on the queue graphs of any significant outlier groups of runs, just a wider range of different journey times due to the interaction of the signal operation and release profile of traffic. In the PM peak 95% of journey times pass the variability check, showing that the PM peak model is less variable than the AM.'

2.6.4 WSP has further confirmed that the confidence interval of the average time per vehicle across the whole network is 6 seconds in the AM peak and 1 second in the PM peak.

2.6.5 Based on the above information provided by WSP, it is understood that the model results are not significantly variable and therefore AECOM's concerns are resolved.

<u>Issue 12: Latent demand unreleased as a result of congestion</u>

2.6.6 In the previous review AECOM commented the following:

"Latent demand values are requested – so level of latent demand is understood. However, it is recommended that the links with latent demand are extended to capture the queues and avoid issue in forecasting."

2.6.7 In response to this issue, WSP stated in Section 3.8 (Addendum to the LMVR) that 'The model is generally showing queues within its boundaries and no queueing into zones, with the exception of some occasional latent demand on the M1 westbound entry (due to a rolling queue that typically dissipates before the end of the peak hour) and on Newport Road, during the AM peak – this queue normally dissipates within the validation peak, with a few exceptions where latent demand of around 50 vehicles can be seen at the end of the peak, however these trips can complete during the model cool down and their travel times are accounted for in the model results. It is evident that the latent demand on Newport Road could be being caused by the traffic passing the end of the road being slightly too high in the AM peak, reducing the number of gaps available to traffic from Newport Road.'

2.6.8 It is likely that the 50 remaining vehicles which cannot enter the network at the end of the peak hour from Newport Road suggests there are coding issues at the A509/Newport Road junction. However, as there is no significant latent demand reported by WSP on the approach arms of the M1 Junction 14 which is the key junction in the network, this issue at the Newport Road junction is not expected to have critical impacts to the results. This issue is unresolved but is **MINOR**.

Issue 13: Queue Length Validation – Additional comparison

2.6.9 In the previous review AECOM commented the following:

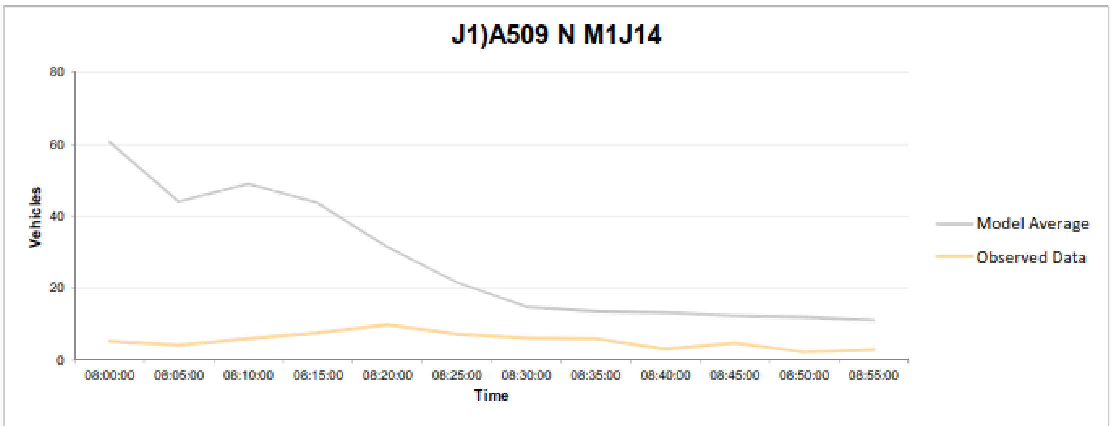
"Recommendations to compare the modelled queue lengths to the images from video cameras/Google Traffic Maps and document this"

2.6.10 In the previous review, WSP presented a queue length comparison on all the approach arms of the junctions modelled. The modelled queues were compared against surveyed data, and it should be noted that the surveys did not capture the queue lengths when the queues extend beyond the view of the cameras. Furthermore, AECOM and WSP have both acknowledged the limitations queue length comparisons in microsimulation models, as the method for measuring queue lengths by the enumerators may not be aligned to the method to calculate the queue length in Paramics model.

2.6.11 AECOM therefore recommended WSP compare and present the queue lengths from the model to the images from video cameras or Google Traffic maps which may show an approximate match of the queue lengths. WSP has stated in Section 2.5.3 that 'As suggested by AECOM, WSP has also reviewed the Google Traffic data for the local area for typical traffic conditions, but unfortunately the data is now showing "during-COVID" traffic conditions rather than the pre-COVID conditions, meaning that this data is not reliable.'

2.6.12 In the present WSP response document, WSP has provided the queue length data which indicates that there are only a few lanes in the study area where the queues extend beyond the view of the cameras. Also, as these instances are not consistent in the peak hour, WSP states in Section 2.5.4 that 'WSP believes that the queue length data obtained during the traffic surveys is reliable and is the best source of data available for model calibration.' WSP has therefore compared the modelled and observed queue lengths and presented this in Section 3 of the Addendum to the LMVR – the graphs for each approach are provided in an Appendix E and F respectively for AM and PM peak.

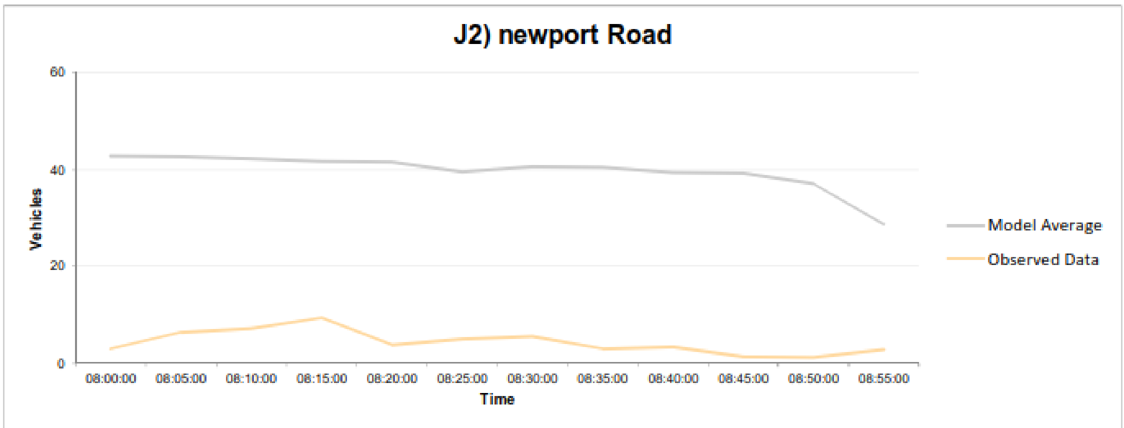
2.6.13 AECOM has reviewed the information provided in the Addendum and the queue graphs for the AM and PM peaks in Appendices. The graphs show a reasonable level of correlation between observed/ modelled queues at all the approach arms of M1 Junction 14 in both AM and PM peaks. However, during the AM peak, at the A509 north approach arm of M1 Junction 14, there is a larger inconsistency during the start of the peak hour, but this closely matches towards the end of the peak hour. Figure 3 shows the location queue validation results on this arm. Section 3.5.2 of the WSP document states that 'It is noted that the AM Peak A509 queue southbound towards Junction 14 is longer than observed because queue lengths were only collected to the Newport Road junction. It is noted that the sum of the two modelled journey times on this approach to the roundabout are very close to the sum of the two observed journey times, and this provides confidence that the level of delay being shown on the A509 southbound is appropriate.' AECOM has reviewed the journey time validation along A509 southbound approach to M1 Junction 14. The AM peak journey time along Trafficmaster sections 27 and 30 (shown in Appendix A) is 233 seconds in the model compared to 234 seconds observed journey time. This suggests that the model represents observed delay on this approach.



Ref: Appendix E – WSP Document (Response to MKE Paramics LMVR Comments)

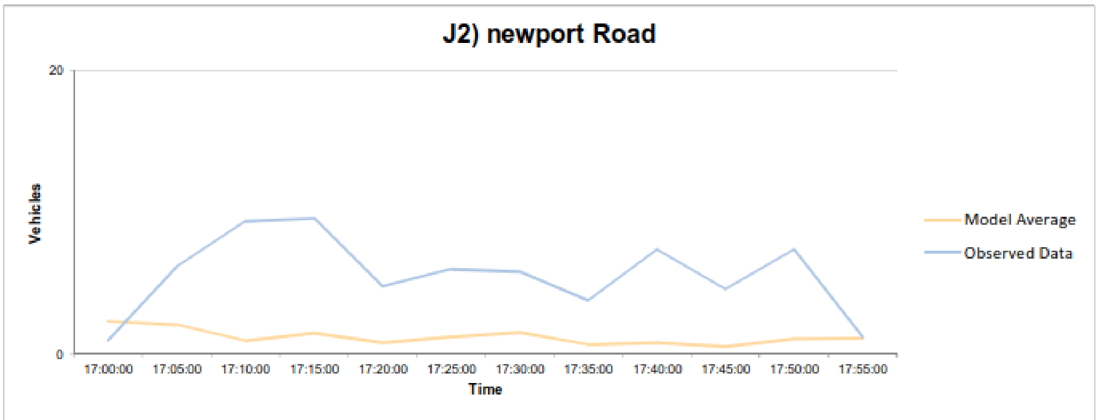
Figure 3 – AM peak queue validation graph at A509 North – M1 Junction 14

2.6.14 In the AM peak, the modelled queues at the Newport Road arm of the A509/Newport Road junction are consistently higher compared to the observed data. However, during the PM peak, the modelled queues match well with the observed data. Figure 4 and Figure 5 show the AM and PM peak queue results at this approach respectively.



Ref: Appendix E – WSP Document (Response to MKE Paramics LMVR Comments)

Figure 4 – AM peak queue validation graph at Newport Road



Ref: Appendix F – WSP Document (Response to MKE Paramics LMVR Comments)

Figure 5 – PM peak queue validation graph at Newport Road

2.6.15 WSP has not provided any modelled queue results as values but only in the form of the graphical comparison with the observed data. Table 2 presents the summary results compiled by AECOM based on the queue comparison graphs provided by WSP.

Table 2: Summary of Queue Results at key locations in AM Peak

Junction	Junction Approach Arm	Average Observed Range (vehicles)	Average Modelled Range (vehicles)	Comments
M1 J14	A509 N	5 to 10	10 to 60	Not representative
M1 J14	M1 off-slip E	~ 10	~ 10	Representative
M1 J14	A509 S	~ 5	~ 10	Minor Variations
M1 J14	M1 off-slip W	5 to 10	~ 8	Representative
Northfield Roundabout SB	A509 N	~ 15	15 to 20	Representative

Table 3: Summary of Queue Results at key locations in PM Peak

Junction	Junction Approach Arm	Average Observed Range (vehicles)	Average Modelled Range (vehicles)	Comments
M1 J14	A509 N	5 to 10	8 to 10	Representative
M1 J14	M1 off-slip E	~ 8	~ 8	Representative
M1 J14	A509 S	10 to 12	15 to 18	Minor Variations
M1 J14	M1 off-slip W	~ 5	~ 5	Representative
Northfield Roundabout SB	A509 N	~ 7	~ 8	Representative

2.6.16 Based on the review of the queue validation graphs provided by WSP, AECOM understands that the queues at all the approaches match well with the observed data except at the Newport Road approach arm during the AM peak. However, WSP has noted that queues on Newport Road were not fully recorded and the journey times from Newport Road match observed ANPR journey times.

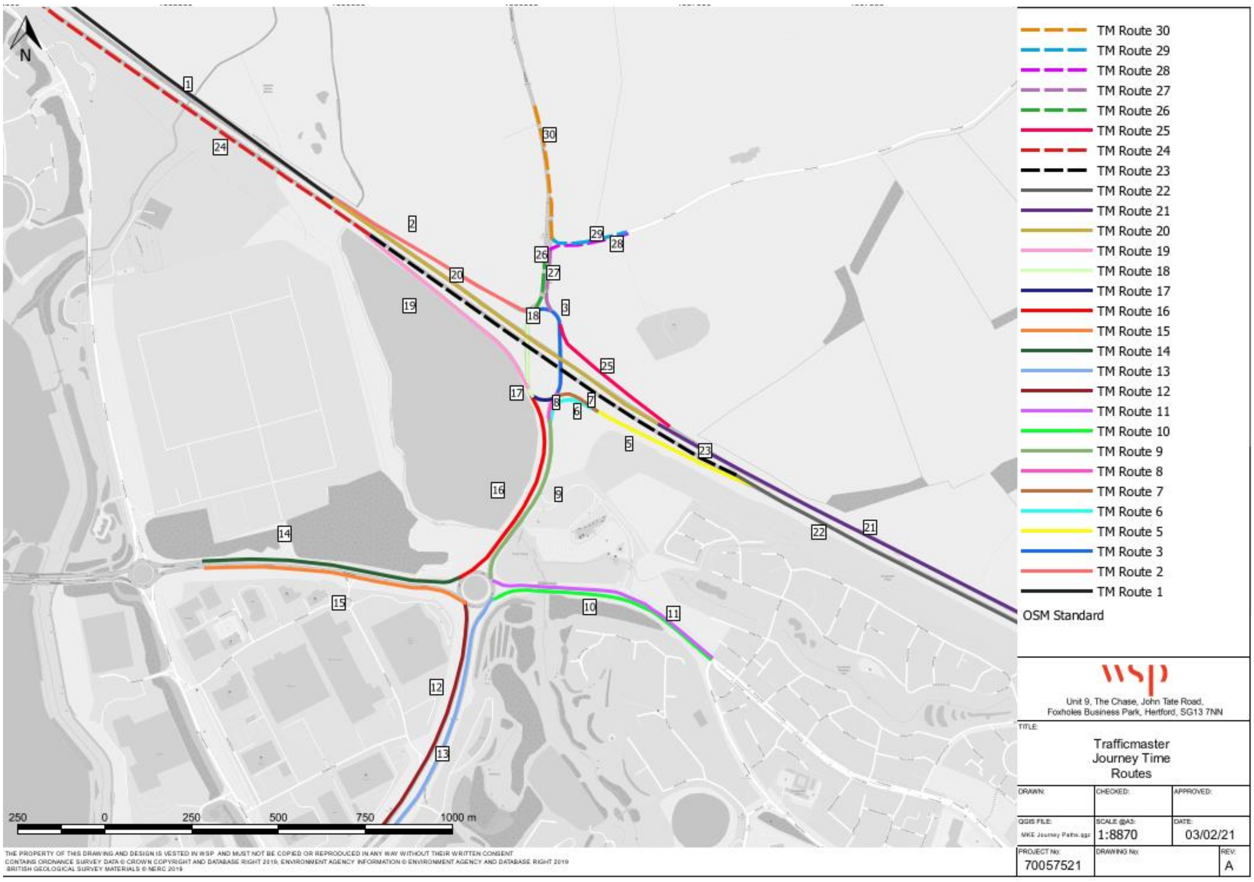
2.6.17 The limitations of queue length comparisons in microsimulation models should again be acknowledged, as the method for measuring queue lengths by the enumerators may not be aligned to the method to calculate the queue length in Paramics model. In addition, some queues are noted to extend beyond the view of the cameras. Based on the review, AECOM has concluded that the issue is resolved.

Issue 14: Journey time data Validation Issues

2.6.18 In the previous review AECOM commented the following:

"It is recommended to use Trafficmaster journey time data to compare the modelled journey time along all the routes in small segments rather than whole route – so the delay on particular sections can be verified."

2.6.19 Based on the recommendation from AECOM, WSP has obtained 2019 Trafficmaster data and analysed it to compare with the modelled journey times during the AM and PM peak hours. The journey time route sections in the study area based on the Trafficmaster data are shown in Figure 6 below. The enlarged image is also presented in Appendix A of this document.



Ref: WSP Document (Response to MKE Paramics LMVR Comments)

Figure 6 – Journey Time Sections based on Trafficmaster data

2.6.20 WSP has provided the journey time validation results in Appendix G of the response document showing the observed and the modelled values for each of the sections defined in Figure 6 above.

2.6.21 Based on the information provided, AECOM has compiled the information for the key routes (routes through M1 Junction 14) in the study area. The AM and PM peak results for the key routes are presented in Table 4 and Table 5 respectively.

Table 4: AM Peak Journey Time Validation Results on key routes (Trafficmaster Data)

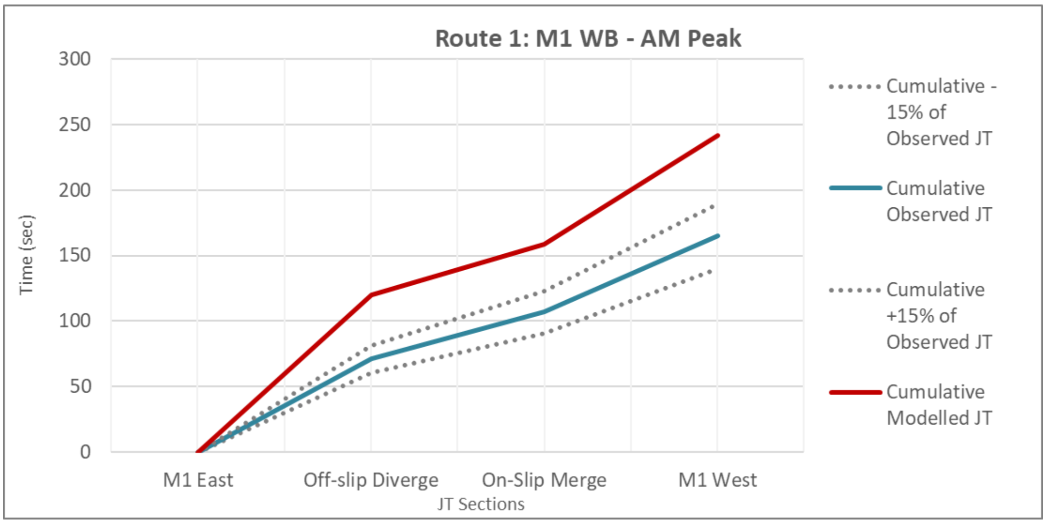
Route No.	Route Name	TM Sections	Observed JT (s)	Model JT (s)	Dist (m)	% Diff	< 15% (Y/N)	Abs. Diff (s)	< 60 s (Y/N)
1	M1 East – West	22, 23, 24	165	242	5508	47%	No	77	No
2	M1 West – East	1, 20, 21	166	231	5374	39%	No	65	No
3	M1 East to A509 North – Newport Junction	22, 5, 7, 17, 18, 26	151	212	3174	40%	No	61	No
4	M1 East to A509 South (Northfield Roundabout)	22, 5, 6, 9	170	179	3192	5%	Yes	9	Yes
5	M1 West to A509 South (Northfield Roundabout)	1, 2, 3, 8, 9	255	204	3258	20%	No	51	Yes
6	M1 West to A509 North – Newport Junction	1, 2, 26	147	151	2749	3%	Yes	4	Yes
12	A4146 South to A509 North (Newport Junction)	12, 16, 17, 26	165	118	1413	28%	No	47	Yes

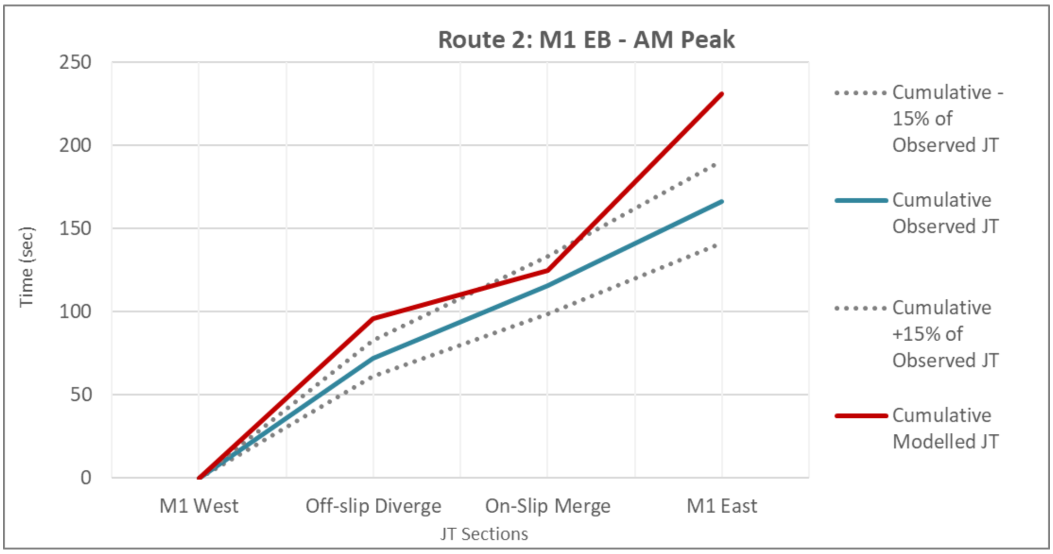
Table 5: PM Peak Journey Time Validation Results on key routes (Trafficmaster Data)

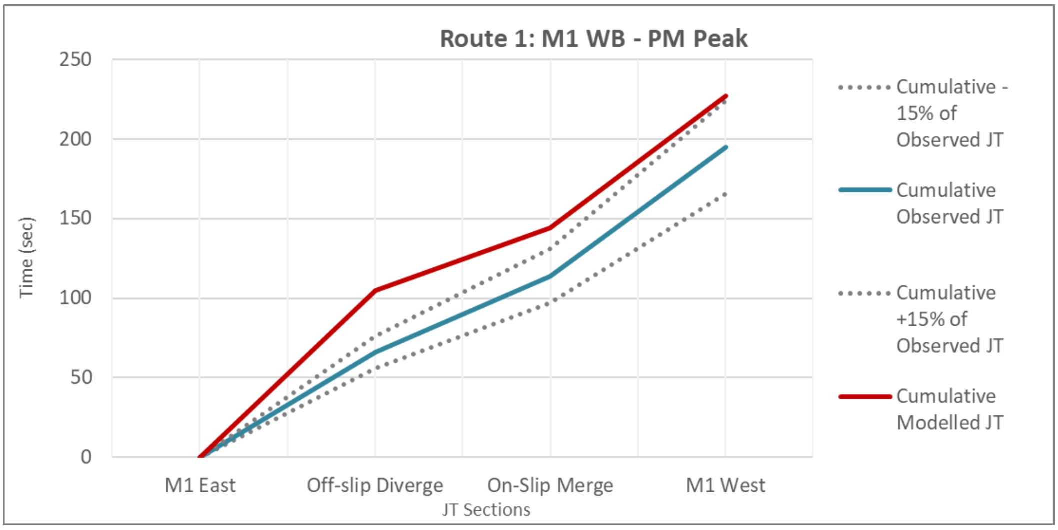
Route No.	Route Name	TM Sections	Observed JT (s)	Model JT (s)	Dist (m)	% Diff	< 15% (Y/N)	Abs. Diff (s)	< 60 s (Y/N)
1	M1 East – West	22, 23, 24	195	227	5508	16%	No	32	Yes
2	M1 West – East	1, 20, 21	170	227	5374	34%	No	57	Yes
3	M1 East to A509 North – Newport Junction	22, 5, 7, 17, 18, 26	182	207	3174	14%	Yes	25	Yes
4	M1 East to A509 South (Northfield Roundabout)	22, 5, 6, 9	150	148	3192	1%	Yes	2	Yes
5	M1 West to A509 South (Northfield Roundabout)	1, 2, 3, 8, 9	205	181	3258	12%	Yes	24	Yes
6	M1 West to A509 North – Newport Junction	1, 2, 26	126	141	2749	12%	Yes	15	Yes
12	A4146 South to A509 North (Newport Junction)	12, 16, 17, 26	470	163	1413	65%	No	307	No

2.6.22 As seen in the results, the journey time routes in the AM peak do not match well with the Trafficmaster data as five key routes out of seven are not within 15% of observed journey times. Although a few of these routes are within 60 seconds, the 15% criteria is more appropriate for short routes. The PM peak results show that most of the key routes passing through the junction meet the 15% TAG criteria. However, Route 12 from A4146 South to A509 North is significantly faster (307 seconds) than the observed data.

2.6.23 The results suggest that the journey time routes along the M1 in both directions are longer in the model compared to the Trafficmaster data in both the peak hours. Figure 7 shows the AM and PM peak journey time validation graphs along M1. Since these are free-flowing sections, AECOM has concerns that the speed limits coded in the model are not representative of the 2019 Trafficmaster data speeds, or the correspondence between the Trafficmaster sections and the Paramics model sections is not accurate. It is therefore recommended that WSP reviews the consistency of the sections coded in the model or the speed limit definitions. This issue is considered as **MEDIUM**.







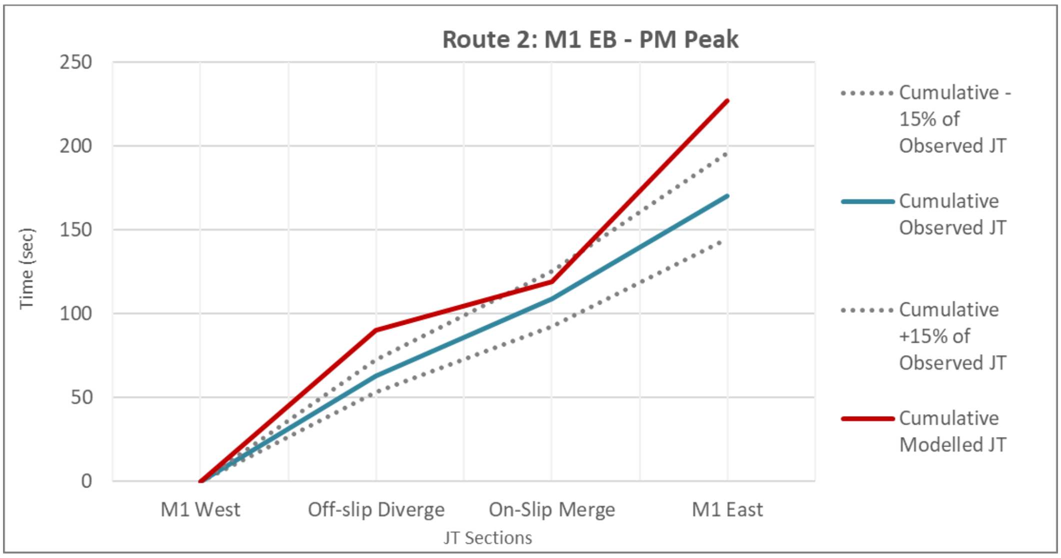


Figure 7 – Journey Time Validation along M1 – AM and PM Peak

2.6.24 AECOM has further compared the speed along the M1 in both directions based on the Trafficmaster data and compared it with the modelled data presented in Table 6 below. Based on the comparison, the free-flow speed in the model is not aligned with the Trafficmaster data. As during the surveys, there were roadworks along the M1, the speeds coded in the model seem to be appropriate. It is therefore recommended that the months included in the Trafficmaster data are reviewed and the correspondence between Trafficmaster data and the journey time sections in the model are reviewed. A free-flow speed of approximately 70mph along M1 during the roadworks does not appear correct – this is further supported by the fact that ANPR journey times along the M1 are slower and the model validates against these. This issue is considered as MEDIUM.

Table 6: Speed comparison along M1 as per Trafficmaster data

Route Name	Speed (TM Data) – AM Peak (mph)	Speed (Model) – AM Peak (mph)	Speed (TM Data) – PM Peak (mph)	Speed (Model) – PM Peak (mph)
M1 East – West	75	51	63	54

Route Name	Speed (TM Data) – AM Peak (mph)	Speed (Model) – AM Peak (mph)	Speed (TM Data) – PM Peak (mph)	Speed (Model) – PM Peak (mph)
M1 West – East	72	52	71	53

2.6.25 As it is evident that there are differences in the speed limits along M1 between Trafficmaster and Paramics models. AECOM has therefore compared the journey time profile of the remaining five key routes by excluding the journey time sections along the M1, so the modelled delay along the rest of the routes passing through M1 Junction 14 can be compared to the Trafficmaster data. These routes are shown in Figure 8. The journey time graphs along these routes for AM and PM peak models are shown in Figure 9 and Figure 10 respectively.

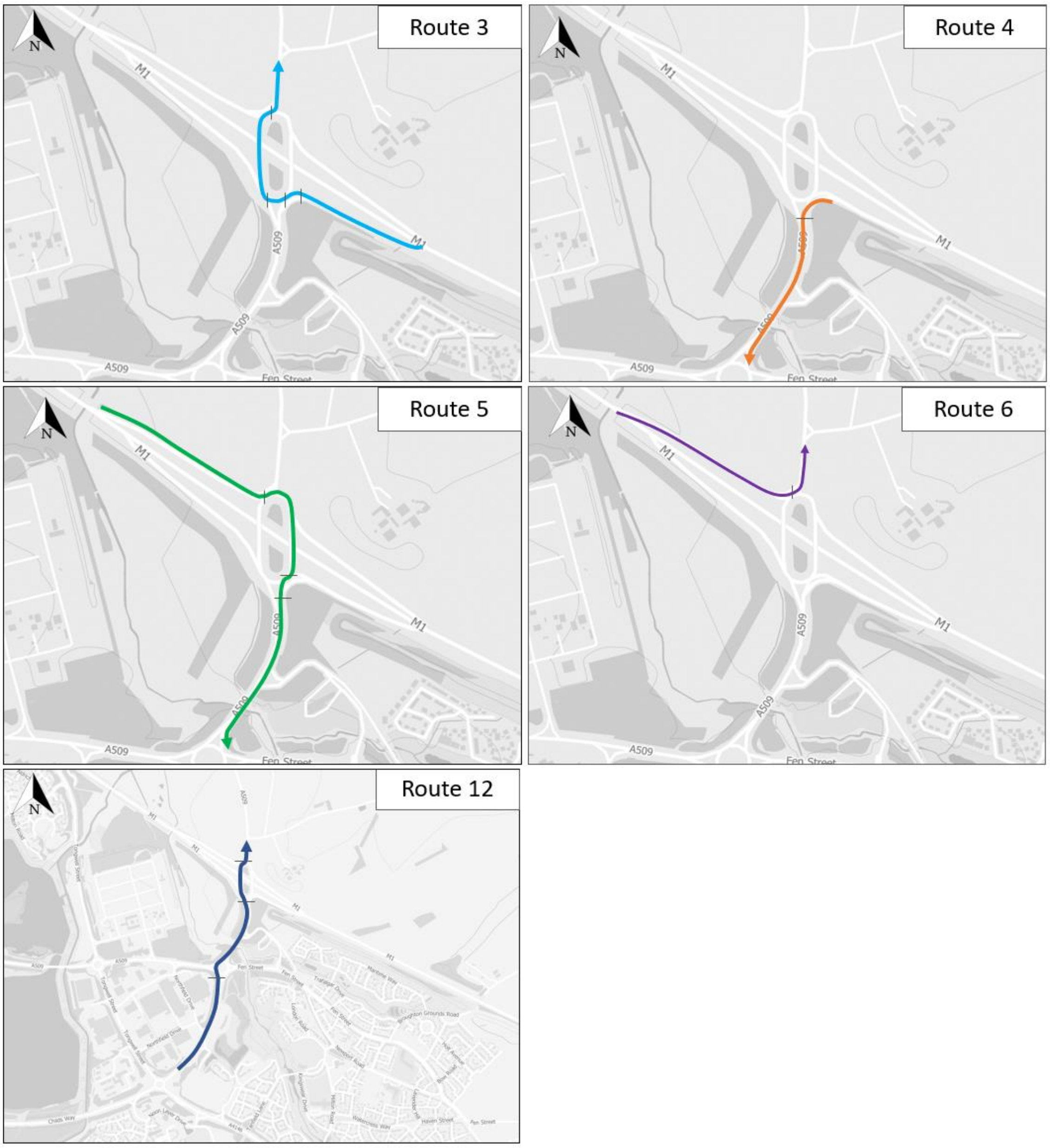
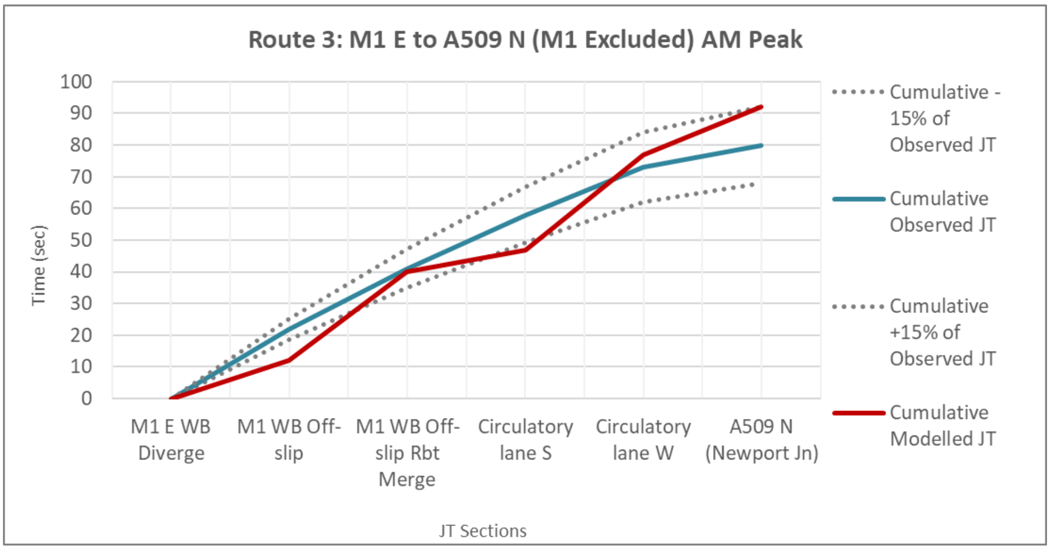
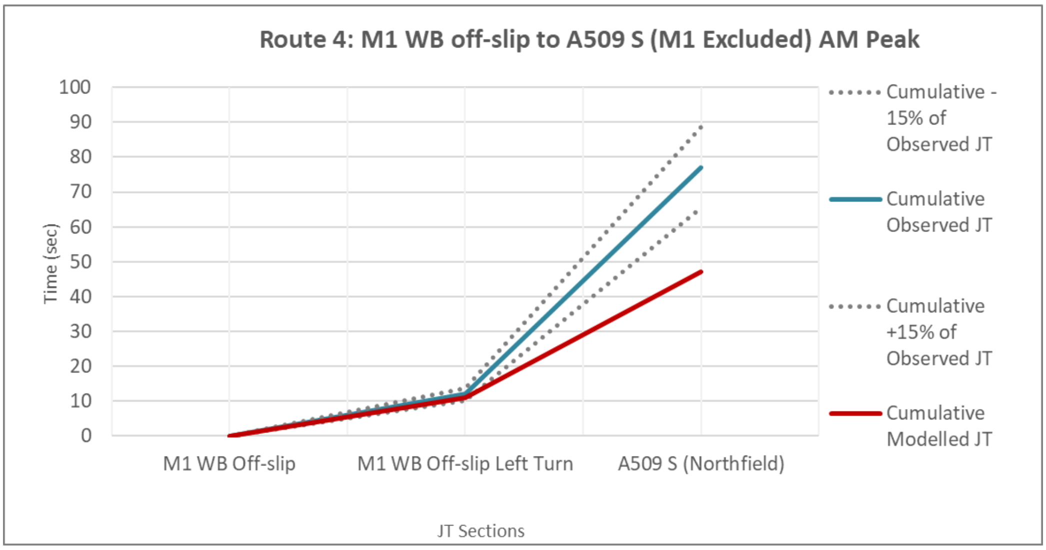
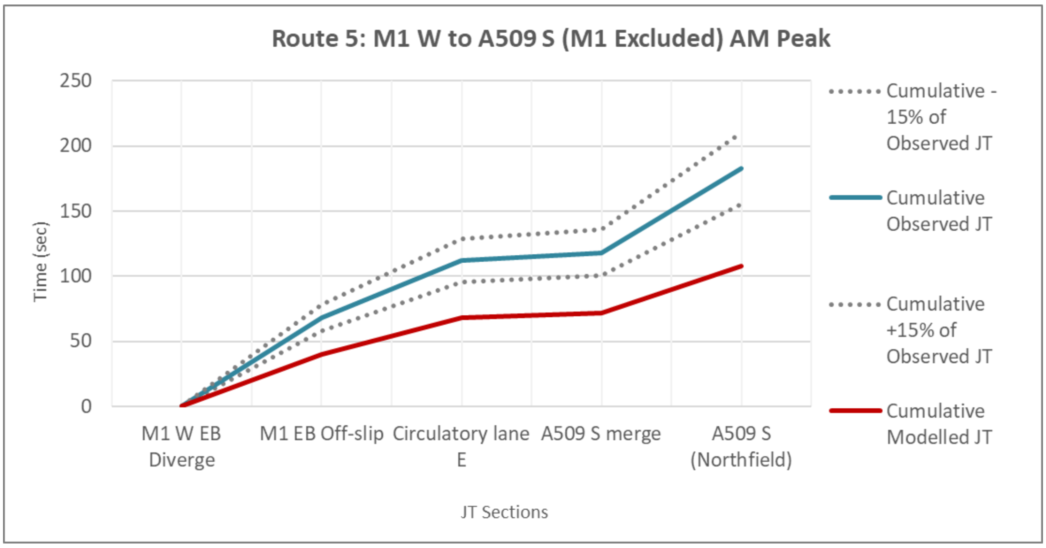
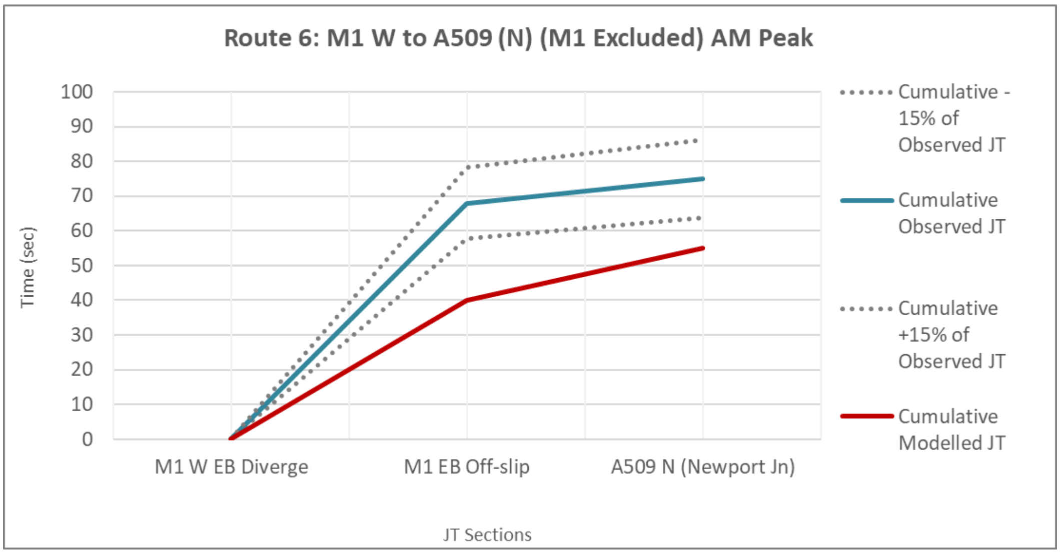


Figure 8 – Journey Time Route Definitions (Key Routes)


Route 3: M1 E to A509 N (M1 Excluded) AM Peak
Time (sec)
0
10
20
30
40
50
60
70
80
90
100
M1 E WB Diverge
M1 WB Off-slip
M1 WB Off-slip Rbt Merge
Circulatory lane S
Circulatory lane W
A509 N (Newport Jn)
JT Sections
Cumulative -15% of Observed JT
Cumulative Observed JT
Cumulative +15% of Observed JT
Cumulative Modelled JT


Route 4: M1 WB off-slip to A509 S (M1 Excluded) AM Peak
Time (sec)
0
10
20
30
40
50
60
70
80
90
100
M1 WB Off-slip
M1 WB Off-slip Left Turn
A509 S (Northfield)
JT Sections
Cumulative -15% of Observed JT
Cumulative Observed JT
Cumulative +15% of Observed JT
Cumulative Modelled JT


Route 5: M1 W to A509 S (M1 Excluded) AM Peak
Time (sec)
0
50
100
150
200
250
M1 W EB Diverge
M1 EB Off-slip
Circulatory lane E
A509 S merge
A509 S (Northfield)
JT Sections
Cumulative -15% of Observed JT
Cumulative Observed JT
Cumulative +15% of Observed JT
Cumulative Modelled JT



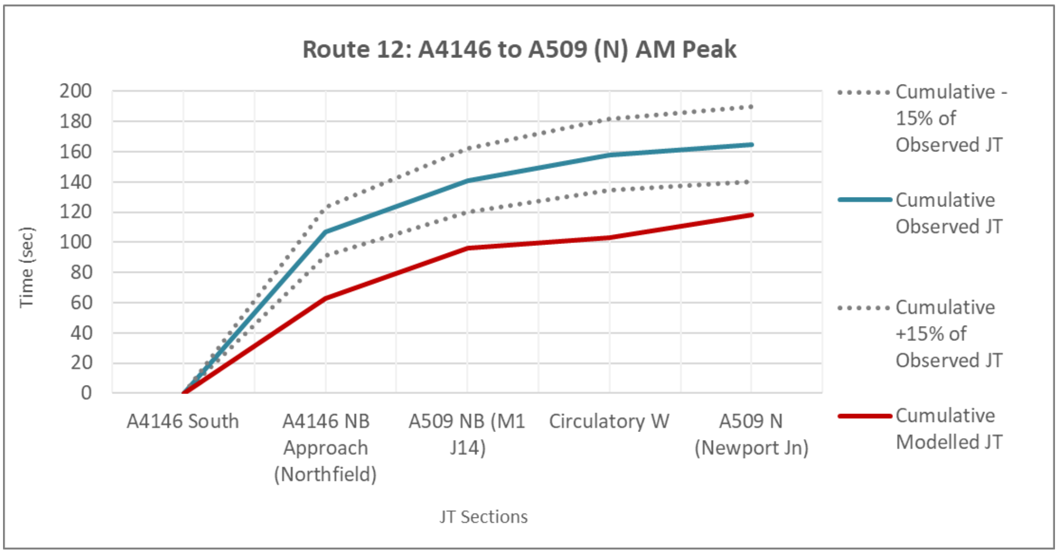
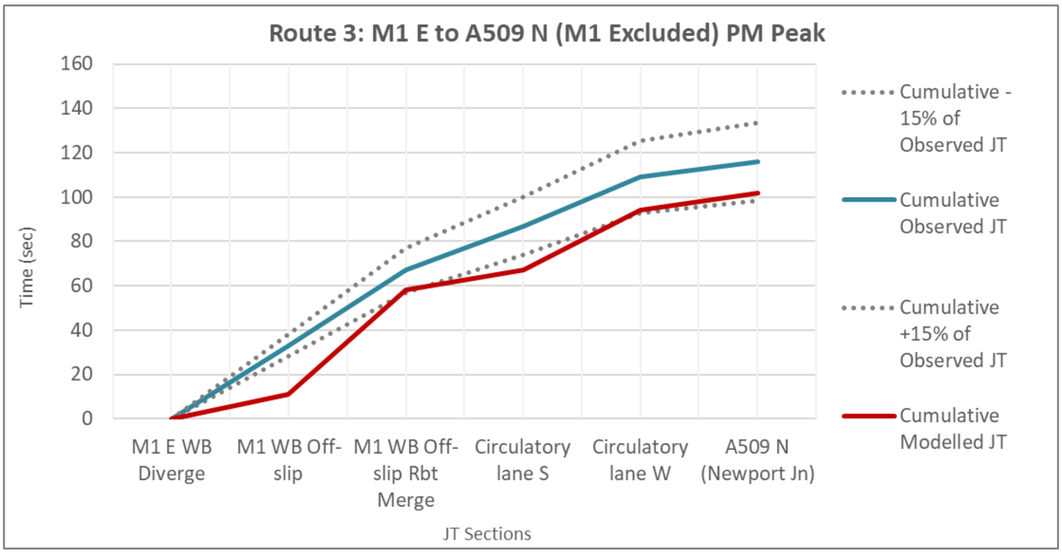
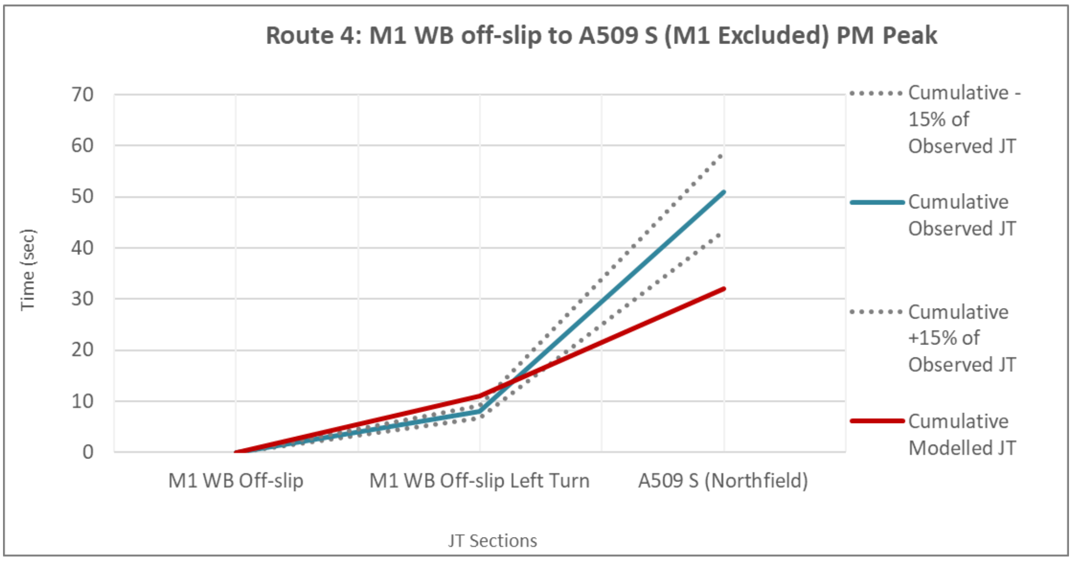
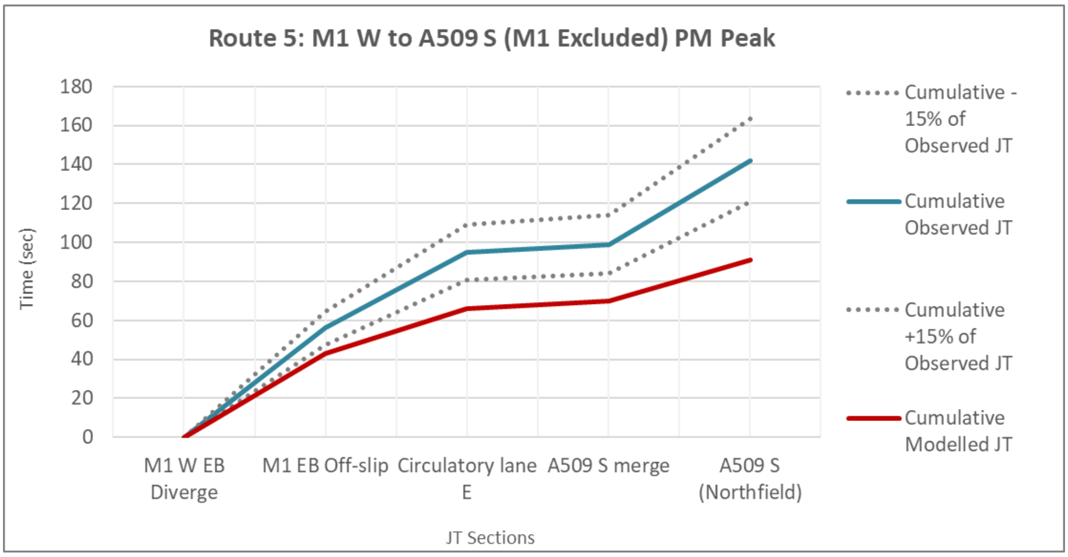
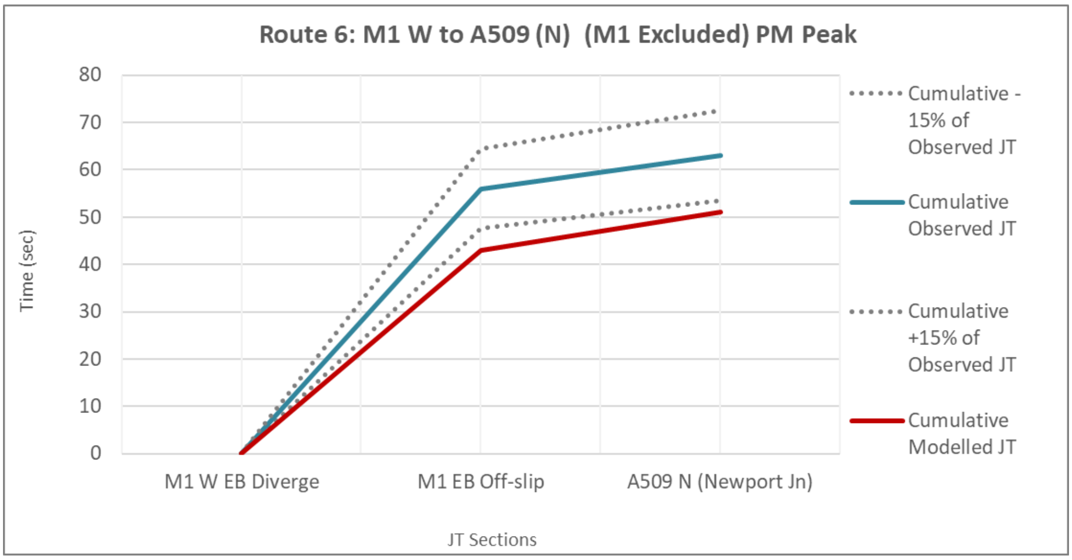


Figure 9 – Journey Time Validation along Key Routes – AM Peak




Route 4: M1 WB off-slip to A509 S (M1 Excluded) PM Peak
Time (sec)
70
60
50
40
30
20
10
0
M1 WB Off-slip
M1 WB Off-slip Left Turn
A509 S (Northfield)
JT Sections
Cumulative - 15% of Observed JT
Cumulative Observed JT
Cumulative +15% of Observed JT
Cumulative Modelled JT


Route 5: M1 W to A509 S (M1 Excluded) PM Peak
Time (sec)
180
160
140
120
100
80
60
40
20
0
M1 W EB Diverge
M1 EB Off-slip
Circulatory lane E
A509 S merge
A509 S (Northfield)
JT Sections
Cumulative - 15% of Observed JT
Cumulative Observed JT
Cumulative +15% of Observed JT
Cumulative Modelled JT


Route 6: M1 W to A509 (N) (M1 Excluded) PM Peak
Time (sec)
80
70
60
50
40
30
20
10
0
M1 W EB Diverge
M1 EB Off-slip
A509 N (Newport Jn)
JT Sections
Cumulative - 15% of Observed JT
Cumulative Observed JT
Cumulative +15% of Observed JT
Cumulative Modelled JT

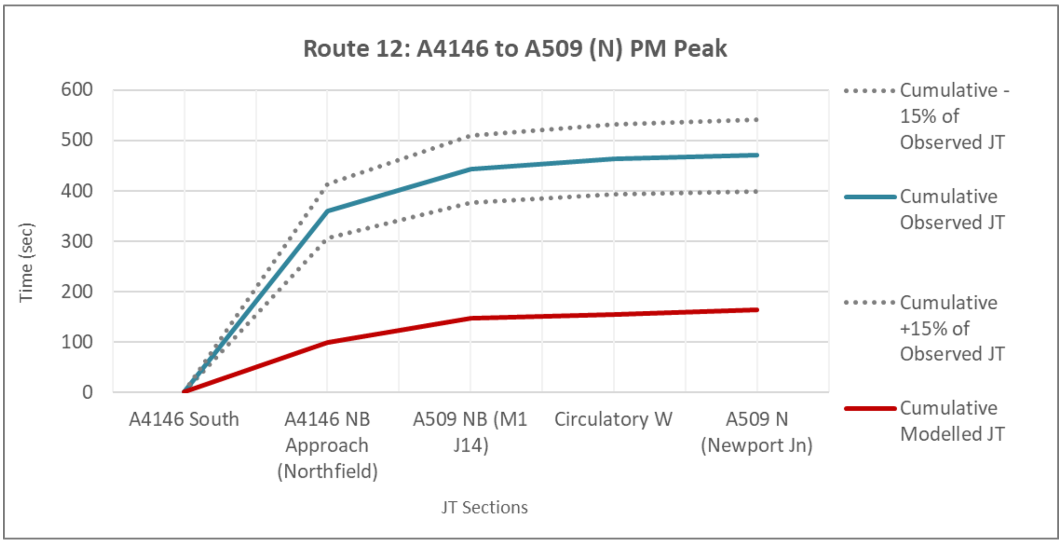


Figure 10 – Journey Time Validation along Key Routes – PM Peak

2.6.26 The summary of these five routes is shown in Table 7 and Table 8 for the AM and PM peak respectively.

Table 7: AM Peak Journey Time Validation Results on key routes (Trafficmaster Data)

Route No.	Route Name	TM Sections	Observed JT (s)	Model JT (s)	Dist (m)	% Diff	< 15% (Y/N)
3	M1 WB off-slip to A509 North – Newport Junction	5, 7, 17, 18, 26	80	92	765	15%	Yes
4	M1 WB off-slip to A509 South (Northfield Roundabout)	6, 9	77	47	511	39%	No
5	M1 EB off-slip to A509 South (Northfield Roundabout)	2, 3, 8, 9	183	108	1152	41%	No
6	M1 EB off-slip to A509 North – Newport Junction	2, 26	75	55	643	27%	No
12	A4146 South to A509 North (Newport Junction)	12, 16, 17, 26	165	118	1413	28%	No

Table 8: PM Peak Journey Time Validation Results on key routes (Trafficmaster Data)

Route No.	Route Name	TM Sections	Observed JT (s)	Model JT (s)	Dist (m)	% Diff	< 15% (Y/N)
3	M1 WB off-slip to A509 North – Newport Junction	5, 7, 17, 18, 26	116	102	765	12%	Yes
4	M1 WB off-slip to A509 South (Northfield Roundabout)	6, 9	51	32	511	37%	No

Route No.	Route Name	TM Sections	Observed JT (s)	Model JT (s)	Dist (m)	% Diff	< 15% (Y/N)
5	M1 EB off-slip to A509 South (Northfield Roundabout)	2, 3, 8, 9	142	91	1152	36%	No
6	M1 EB off-slip to A509 North – Newport Junction	2, 26	63	51	643	19%	No
12	A4146 South to A509 North (Newport Junction)	12, 16, 17, 26	470	163	1413	65%	No

2.6.27 As seen in the graphs and the tables above, both the AM and PM peak modelled journey times are faster than the Trafficmaster journey time data. The results suggest that the delay on the off-slips approaching M1 Junction 14 and on the circulatory links is not fully represented in the models as the journey time routes are faster than the observed data on the off-slips.

2.6.28 The modelled journey time on the eastbound off-slip is faster by 28 seconds, compared to the observed data in the AM peak; the same section is 13 seconds faster in the PM peak. The westbound off-slip in AM peak matches well with the observed data and is reasonably close in the PM peak, as the section is 9 seconds faster in the model. The southbound approach to the A509/ A5130 roundabout is faster in the model in both the AM and PM peak hours, compared to the Trafficmaster journey times. It should be noted that Route 12 in the PM peak model has significant inconsistency with the Trafficmaster data, which is likely to be due to the PM peak modelled flows being significantly low, compared to those surveyed at the ANPR sites, as discussed in the next section of this Technical Note.

2.6.29 Based on the above analysis, the key areas of concern are the M1 eastbound off-slip and southbound approach to the A509/ A5130 – these two sections account for most of the discrepancy between the observed and modelled journey times and it is likely that queuing which occurred during the surveys is not represented in the models.

2.6.30 Further to the above, WSP has provided the updated journey time validation results based on the ANPR surveyed journey times and updated model results. These are presented below in Table 9 and Table 10 for the AM and PM peak respectively.

Table 9: AM Peak Journey Time Validation Results (ANPR Data)

Route:	Segment	Graph Group	Observed Average	Observed 95% Conf	Modelled Average	Modelled 95% Conf	Var Chk	% Diff	Diff	Conf?	15%	60s	WebTAG	Distance (m)
Route 1: M1 WB	Full	1	215	7	199	1	TRUE	-7.3%	-16	FALSE	TRUE	TRUE	TRUE	4500
Route 2: M1 EB	Full	2	208	3	193	0	TRUE	-7.1%	-15	FALSE	TRUE	TRUE	TRUE	4498
Route 3: M1 E to A509 N	Full	3	271	18	257	6	TRUE	-5.2%	-14	TRUE	TRUE	TRUE	TRUE	3109
Route 4: M1 E to A509 W	Full	4	245	21	256	10	TRUE	4.4%	11	TRUE	TRUE	TRUE	TRUE	3269
Route 5: M1 W to A4146	Full	5	237	28	199	4	TRUE	-16.2%	-38	FALSE	FALSE	TRUE	TRUE	2382
Route 6: M1 W to A509 (N)	Full	6	128	14	116	3	TRUE	-9.0%	-12	TRUE	TRUE	TRUE	TRUE	1792
Route 7: A509(N) to M1 E	Full	7	197	41	157	1	TRUE	-20.5%	-41	TRUE	FALSE	TRUE	TRUE	2978
Route 8: A509(N) to M1 W	Full	8	221	27	175	2	TRUE	-20.7%	-46	FALSE	FALSE	TRUE	TRUE	2365
Route 9: A509(N) to A4146	Full	9	202	48	173	3	TRUE	-14.5%	-29	TRUE	TRUE	TRUE	TRUE	822
Route 10: A4146 to M1 E	Full	10	241	15	239	2	TRUE	-0.8%	-2	TRUE	TRUE	TRUE	TRUE	3595
Route 11: A4146 to M1 W	Full	11	168	9	149	1	TRUE	-11.1%	-19	FALSE	TRUE	TRUE	TRUE	2534
Route 12: A4146 to A509 N	Full	12	130	17	131	9	FALSE	1.0%	1	TRUE	TRUE	TRUE	TRUE	860

Ref: WSP Document (Response to MKE Paramics LMVR Comments)

Table 10: PM Peak Journey Time Validation Results (ANPR Data)

Route:	Segment	Graph Group	Observed Average	Observed 95% Conf	Modelled Average	Modelled 95% Conf	Var Chk	% Diff	Diff	Conf?	15%	60s	WebTAG	Distance (m)
Route 1: M1 WB	Full	1	206	1	192	0	TRUE	-6.7%	-14	FALSE	TRUE	TRUE	TRUE	4500
Route 2: M1 EB	Full	2	206	1	193	0	TRUE	-6.6%	-14	FALSE	TRUE	TRUE	TRUE	4498
Route 3: M1 E to A509 N	Full	3	257	5	254	8	TRUE	-1.0%	-3	TRUE	TRUE	TRUE	TRUE	3109
Route 4: M1 E to A509 W	Full	4	193	2	187	2	TRUE	-3.2%	-6	FALSE	TRUE	TRUE	TRUE	3269
Route 5: M1 W to A4146	Full	5	190	2	166	1	TRUE	-13.0%	-25	FALSE	TRUE	TRUE	TRUE	2382
Route 6: M1 W to A509 (N)	Full	6	117	2	108	1	TRUE	-7.6%	-9	FALSE	TRUE	TRUE	TRUE	1792
Route 7: A509(N) to M1 E	Full	7	174	8	152	1	TRUE	-12.7%	-22	FALSE	TRUE	TRUE	TRUE	2978
Route 8: A509(N) to M1 W	Full	8	197	17	141	1	TRUE	-28.4%	-56	FALSE	FALSE	TRUE	TRUE	2365
Route 9: A509(N) to A4146	Full	9	148	17	81	1	TRUE	-45.2%	-67	FALSE	FALSE	FALSE	FALSE	822
Route 10: A4146 to M1 E	Full	10	272	8	258	2	TRUE	-5.2%	-14	FALSE	TRUE	TRUE	TRUE	3595
Route 11: A4146 to M1 W	Full	11	212	12	170	1	TRUE	-19.9%	-42	FALSE	FALSE	TRUE	TRUE	2534
Route 12: A4146 to A509 N	Full	12	173	14	149	2	TRUE	-14.1%	-24	FALSE	TRUE	TRUE	TRUE	860

Ref: WSP Document (Response to MKE Paramics LMVR Comments)

2.6.31 It should be noted that the route sections of the Trafficmaster data and the ANPR data are not consistent and therefore the modelled values differ along the key routes. As seen in the ANPR based journey time validation results presented in Section 3.6 of WSP document, 75% of the routes meet the 15% validation criteria in both AM and PM peaks. The TAG criteria suggest that 85% of the routes must meet the 15% validation criteria. However, AECOM has reviewed the journey time validation along the key routes as defined in the above section which pass through the M1 Junction 14. The results suggest that five out of the six key routes (Route 1 to 6) meet the 15% criteria in the AM peak with one route failing marginally. In the PM peak, all the six key routes meet the 15% validation criteria.

2.6.32 The modelled journey times match reasonably well with the observed ANPR data. However, the AM and PM peak models have significantly faster journey times compared to the observed Trafficmaster data on key links through M1 Junction 14. Further, as detailed in Section 2.6.22 and 2.6.23, it is recommended that the Trafficmaster data needs to be reviewed as there seems to be an inconsistency between the ANPR based data and the Trafficmaster data. As the key sections through M1 Junction 14 do not match well with the Trafficmaster data, AECOM has concerns that the model is not accurately representing typical delay/ queuing conditions at the junction.

2.6.33 The difference in observed and modelled journey times does not indicate extensive queuing is missing from the models at M1 Junction 14. However, the queues on the eastbound off-slip to the M1 Junction 14 may be underrepresented in the model, with risk that the model does not highlight potential impact on the M1 eastbound; southbound queues at the A509/ A5130 roundabout also appear to be underrepresented, so there is a risk the model will not highlight potential blocking back which might impact M1 Junction 14.

2.6.34 There is a risk that the forecast models would overestimate the capacity of the junction and might not predict accurate impacts of additional development trips/ growth. This issue is therefore considered **SIGNIFICANT**.

Issue 15: Flow Calibration Data Issues

2.6.35 In the previous review AECOM made the following comment:

"There are concerns that the observed flows using for calibration are based on raw ANPR data (captured plates only). It is recommended that better clarity is provided with required calculations to confirm the source of the observed flows in the model calibration results. Also, there are concerns that low capture rate may be impacting the turning proportions. WSP should provide evidence that turning proportions are not impacted by low capture rates."

2.6.36 As detailed in Section 2.3.5 (Issue 2 – ANPR data Section) of this Technical Note, AECOM cannot verify if the turning proportions are impacted by the low capture rates at the ANPR sites. The ANPR and MCC data was the only data available to develop the model.

2.6.37 As discussed in Section 2.5.2 of this Technical Note (Issue 10 – Model demand development Section), WSP has updated the demand inputs of the model from the previous submission. Section 2.8.1 of the document from WSP states that 'Changes have been made to the demand methodology after it was identified that the matrix had not been uplifted to match the full traffic sample, from the sample rate. The matrix has now been uplifted to match the full traffic sample; the remaining matrix build process remains as set out in the original response.’ Furthermore, Section 3.3 of the WSP document, which is an addendum to the LMVR, states that ‘While reviewing AECOM’s comments it became apparent that the ANPR matrix had been partly uplifted from the number of matches to the sample, but that it had not been uplifted to reflect the total vehicle count.’

2.6.38 In the LMVR addendum document, WSP has provided the model calibration results summary as shown in Table 11 below.

Table 11: Flow Calibration Results Summary (AM and PM Peak)

	AM Peak	PM Peak
GEH < 5	80.6%	91.7
Flow < 700	78.6%	92.6
Flow 700-2700	85.7%	100
Flow > 700	100.0%	100
Passing Either Test	86.1%	94.4

Ref: WSP Document (Response to MKE Paramics LMVR Comments)

2.6.39 Section 3.4.1 of the WSP response document states that ‘As in the LMVR, at least 85% of traffic counts must pass one of two tests, one based on GEH being <5, the other based on the flow magnitude. One outlier run (the 15th AM peak run) showing much longer queueing on the A509W than in other scenarios has been identified and has been removed from the model results).’.

2.6.40 The removal of outlier run results is a standard approach. However, as AECOM has not reviewed the results spreadsheets or the models, this cannot be verified.

2.6.41 Although the TAG guidance requires either of the criteria (GEH<5 and the requirement based on the flow magnitude) to be met, it is advisable that the GEH criteria is met for all the flows. WSP seems to be using the combination of both the criteria for individual turning flows. The AM model can therefore be seen to have a lower level of flow calibration than presented as the GEH conditions do not appear to be met for all the turning flows. This issue is therefore considered **MEDIUM**.

2.6.42 It should be noted that although WSP has supplied raw ANPR data, no demand development spreadsheets or details of the method used to produce turning counts from the ANPR data were provided. Therefore, the requested evidence of how the turning flows were derived was not provided.

2.6.43 AECOM therefore requested WSP provide the ANPR raw data spreadsheets, so AECOM can verify some of the turning flows. WSP provided these raw data spreadsheets (Ref: “ID04688 Milton Keynes East - ANPR OD Report - 27_06_2019” and “ID04688 Milton Keynes East - ANPR Sample Rate Report - 27_06_2019”) which have been reviewed by AECOM.

2.6.44 WSP has detailed the flow calibration results at each turning count for all the junctions modelled in Appendix D of the document. Based on the raw ANPR data spreadsheets provided by WSP, AECOM has calculated turning counts and compared with the observed values used by WSP in the flow calibration tables. These are detailed in Table 12 and Table 13 for AM and PM peak respectively.

Table 12: AM Peak Flow Calibration Results

WSP Calculations							
Junction	**Origin**	**Destination**	**Observed Flow**	**Modelled Flow**	**Difference (M-O)**	**% Difference**	**GEH**
M1 J14	A509 N	A509 N	7	12	5	71.4%	1.62
	A509 N	M1 E	284	316	32	11.3%	1.85
	A509 N	A509 S	556	663	107	19.2%	4.33
	A509 N	M1 W	90	102	12	13.3%	1.22
	M1 E	A509 N	187	208	21	11.2%	1.49
	M1 E	A509 S	1254	1404	150	12.0%	4.11
	M1 E	M1 W	2467	2789	322	13.1%	6.28
	A509 S	A509 N	258	327	69	26.7%	4.03
	A509 S	M1 E	396	548	152	38.4%	7.00
	A509 S	A509 S	1	2	1	100.0%	0.82
	A509 S	M1 W	451	565	114	25.3%	5.06
	M1 W	A509 N	142	150	8	5.6%	0.66
	M1 W	M1 E	2302	2435	133	5.8%	2.73
	M1 W	A509 S	970	1048	78	8.0%	2.46
P&R	A509 N	P&R	22	27	5	22.7%	1.01
	A509 N	A509 S	2758	3079	321	11.6%	5.94
	P&R	A509 S	0	0	0	0.0%	0.00
	A509 S	A509 N	1107	1441	334	30.2%	9.36
Northfield Roundabout	A509 N	A509 N	0	0	0	0.0%	0.00
	A509 N	A5130	123	187	64	52.0%	5.14
	A509 N	A4146	1328	1504	176	13.3%	4.68
	A509 N	A509 W	1307	1374	67	5.1%	1.83
	A5130	A509 N	218	201	-17	7.8%	1.17
	A5130	A4146	135	147	12	8.9%	1.01
	A5130	A509 W	375	416	41	10.9%	2.06
	A4146	A509 N	515	702	187	36.3%	7.58
	A4146	A5130	47	61	14	29.8%	1.91
	A4146	A509 W	1	4	3	300.0%	1.90
	A509 W	A509 N	373	531	158	42.4%	7.43
	A509 W	A5130	165	217	52	31.5%	3.76
	A509 W	A4146	13	20	7	53.8%	1.72
Newport Junction	A509 N	A509 S	690	826	136	19.7%	4.94
	A509 N	Newport Road	24	35	11	45.8%	2.03
	Newport Road	A509 S	247	262	15	6.1%	0.94
	A509 S	A509 N	416	476	60	14.4%	2.84
	A509 S	Newport Road	178	219	41	23.0%	2.91

AECOM Calculations								
Junction	**Origin**	**Destination**	**Raw ANPR Matched Flow Data**	**Uplifted ANPR data (Observed Flow)**	**Modelled Flow**	**Difference (M-O)**	**% Difference**	**GEH**
M1 J14	A509 N	A509 N	6	7	12	5	77.7%	1.71
	A509 N	M1 E	265	292	316	24	8.2%	1.37
	A509 N	A509 S	524	582	663	81	13.9%	3.24
	A509 N	M1 W	78	87	102	15	17.7%	1.58
	M1 E	A509 N	178	211	208	-3	1.6%	0.23
	M1 E	A509 S	1195	1419	1404	-15	1.1%	0.40
	M1 E	M1 W	2305	2737	2789	52	1.9%	0.99
	A509 S	A509 N	240	326	327	1	0.4%	0.07
	A509 S	M1 E	378	563	548	-15	2.7%	0.64
	A509 S	A509 S	0	0	2	2	0.0%	2.00
	A509 S	M1 W	411	562	565	3	0.5%	0.12
	M1 W	A509 N	137	157	150	-7	4.2%	0.53
	M1 W	M1 E	2174	2485	2435	-50	2.0%	1.00
	M1 W	A509 S	940	1074	1048	-26	2.5%	0.81
P&R	A509 N	P&R	27	31	27	-4	12.3%	0.70
	A509 N	A509 S	2633	3046	3079	33	1.1%	0.59
	P&R	A509 S	0	0	0	0	0.0%	0.00
	A509 S	A509 N	1030	1453	1441	-12	0.8%	0.30
Northfield Roundabout	A509 N	A509 N	0	0	0	0	0.0%	0.00
	A509 N	A5130	117	133	187	54	41.0%	4.30
	A509 N	A4146	1267	1455	1504	49	3.4%	1.29
	A509 N	A509 W	1249	1459	1374	-85	5.8%	2.26
	A5130	A509 N	201	242	201	-41	17.1%	2.78
	A5130	A4146	125	151	147	-4	2.5%	0.31
	A5130	A509 W	347	418	416	-2	0.6%	0.12
	A4146	A509 N	470	648	702	54	8.3%	2.07
	A4146	A5130	46	63	61	-2	3.8%	0.31
	A4146	A509 W	1	1	4	3	190.0%	1.60
	A509 W	A509 N	359	562	531	-31	5.5%	1.32
	A509 W	A5130	163	255	217	-38	14.9%	2.48
	A509 W	A4146	13	20	20	0	1.7%	0.08
Newport Junction	A509 N	A509 S	642	708	826	118	16.7%	4.27
	A509 N	Newport Road	23	25	35	10	38.1%	1.76
	Newport Road	A509 S	231	260	262	2	0.8%	0.12
	A509 S	A509 N	385	469	476	7	1.6%	0.34
	A509 S	Newport Road	170	225	219	-6	2.7%	0.41

Ref: WSP Calculations based on WSP Document (Response to MKE Paramics LMVR Comments)

Table 13: PM Peak Flow Calibration Results

WSP Calculations

Junction	Origin	Destination	Observed Flow	Modelled Flow	Difference	% Difference	GEH
M1 J14	A509 N	A509 N	29	20	-9	31.0%	1.82
	A509 N	M1 E	333	344	11	3.3%	0.60
	A509 N	A509 S	549	562	13	2.4%	0.55
	A509 N	M1 W	197	202	5	2.5%	0.35
	M1 E	A509 N	273	275	2	0.7%	0.12
	M1 E	A509 S	522	568	46	8.8%	1.97
	M1 E	M1 W	2740	2930	190	6.9%	3.57
	A509 S	A509 N	472	609	137	29.0%	5.89
	A509 S	M1 E	718	626	-92	12.8%	3.55
	A509 S	A509 S	1	0	-1	100.0%	1.41
	A509 S	M1 W	649	499	-150	23.1%	6.26
	M1 W	A509 N	117	121	4	3.4%	0.37
	M1 W	M1 E	2562	2678	116	4.5%	2.27
	M1 W	A509 S	519	537	18	3.5%	0.78
P&R	A509 N	P&R	25	18	-7	28.0%	1.51
	A509 N	A509 S	1566	1650	84	5.4%	2.09
	P&R	A509 S	0	0	0	0.0%	0.00
	A509 S	A509 N	1842	1734	-108	5.9%	2.55
Northfield Roundabout	A509 N	A509 N	0	12	12	0.0%	4.90
	A509 N	A5130	204	209	5	2.5%	0.35
	A509 N	A4146	860	918	58	6.7%	1.95
	A509 N	A509 W	503	512	9	1.8%	0.40
	A5130	A509 N	399	334	-65	16.3%	3.40
	A5130	A4146	116	130	14	12.1%	1.26
	A5130	A509 W	161	178	17	10.6%	1.31
	A4146	A509 N	800	789	-11	1.4%	0.39
	A4146	A5130	49	72	23	46.9%	2.96
	A4146	A509 W	3	3	0	0.0%	0.00
	A509 W	A509 N	642	595	-47	7.3%	1.89
	A509 W	A5130	239	329	90	37.7%	5.34
	A509 W	A4146	7	11	4	57.1%	1.33
Newport Junction	A509 N	A509 S	728	810	82	11.3%	2.96
	A509 N	Newport Road	45	40	-5	11.1%	0.77
	Newport Road	A509 S	378	316	-62	16.4%	3.33
	A509 S	A509 N	787	893	106	13.5%	3.66
	A509 S	Newport Road	102	122	20	19.6%	1.89

AECOM Calculations

Junction	Origin	Destination	ANPR Matched Flow Data	Uplifted ANPR data (Observed Flow)	Modelled Flow	Difference	% Difference	GEH
M1 J14	A509 N	A509 N	24	27	20	-7	25.1%	1.39
	A509 N	M1 E	305	351	344	-7	1.9%	0.35
	A509 N	A509 S	503	570	562	-8	1.4%	0.35
	A509 N	M1 W	178	201	202	1	0.5%	0.08
	M1 E	A509 N	255	294	275	-19	6.4%	1.11
	M1 E	A509 S	492	567	568	1	0.3%	0.06
	M1 E	M1 W	2548	2934	2930	-4	0.1%	0.08
	A509 S	A509 N	435	575	609	34	5.9%	1.40
	A509 S	M1 E	671	1041	626	-415	39.9%	14.37
	A509 S	A509 S	0	0	0	0	0.0%	0.00
	A509 S	M1 W	599	810	499	-311	38.4%	12.16
	M1 W	A509 N	109	131	121	-10	7.3%	0.85
	M1 W	M1 E	2379	2848	2678	-170	6.0%	3.24
	M1 W	A509 S	486	582	537	-45	7.7%	1.90
P&R	A509 N	P&R	25	29	18	-11	38.0%	2.28
	A509 N	A509 S	1458	1692	1650	-42	2.5%	1.03
	P&R	A509 S	0	0	0	0	0.0%	0.00
	A509 S	A509 N	1707	2428	1734	-694	28.6%	15.22
Northfield Roundabout	A509 N	A509 N	0	0	12	12	0.0%	4.90
	A509 N	A5130	189	220	209	-11	4.9%	0.74
	A509 N	A4146	798	930	918	-12	1.2%	0.38
	A509 N	A509 W	471	543	512	-31	5.7%	1.34
	A5130	A509 N	362	445	334	-111	24.9%	5.62
	A5130	A4146	104	128	130	2	1.7%	0.19
	A5130	A509 W	144	177	178	1	0.6%	0.08
	A4146	A509 N	743	989	789	-200	20.3%	6.72
	A4146	A5130	46	61	72	11	17.5%	1.32
	A4146	A509 W	3	4	3	-1	24.9%	0.53
	A509 W	A509 N	602	994	595	-399	40.1%	14.16
	A509 W	A5130	227	375	329	-46	12.2%	2.44
	A509 W	A4146	7	12	11	-1	4.8%	0.17
Newport Junction	A509 N	A509 S	666	766	810	44	5.8%	1.58
	A509 N	Newport Road	42	48	40	-8	17.1%	1.25
	Newport Road	A509 S	345	384	316	-68	17.7%	3.63
	A509 S	A509 N	704	870	893	23	2.7%	0.78
	A509 S	Newport Road	96	130	122	-8	6.5%	0.75

Ref: WSP Calculations based on WSP Document (Response to MKE Paramics LMVR Comments)

2.6.45 Table 12 and Table 13 show the WSP flow calibration results on the left and AECOM calculations on the right. The tables compare the modelled flows presented by WSP against the observed flows calculated by WSP and the observed flows calculated by AECOM. AECOM has not reviewed the demand development spreadsheets and so cannot verify the observed flow calculations calculated by WSP.

2.6.46 The column ‘ANPR matched flow data' in the AECOM calculations shows matched vehicle numbers between the ANPR sites, which is impacted by the capture rate at the ANPR sites at either end of the trips. These turning flow values are uplifted based on the MCC data (the actual flows) surveyed at these sites shown in column ‘Uplifted ANPR data’. The uplifted values should be considered as observed turning flows, as this is derived from observed flows at MCC sites. It must be noted that AECOM has not undertaken any furnessing or profiling which might account for some minor differences. AECOM has then compared the observed flows to the modelled values presented by WSP in Appendix D of the WSP document. The differences between the calculated observed flows and modelled flows have been calculated, with the GEH values presented.

2.6.47 It is evident from the results that the observed flows presented by WSP are not uplifted to the MCC data. These values are closer to the raw ANPR captured data. It is therefore recommended that WSP revises the observed flow calculations and uses a robust and accurate approach to compare the modelled flows. This issue is therefore considered as unresolved and is **MEDIUM**.

2.6.48 The results show that the AM peak model results which fail to meet the GEH criteria in WSP calculations match well with the observed flows calculated by AECOM. All the turning flows in the model match well with the uplifted ANPR based turning flows calculated by AECOM. The GEH values are below 5 for all the turning flows in AM peak. The AM peak modelled flows on the M1 off-slip in the eastbound and westbound directions also match reasonably well with the observed flow values. This suggests that the model demand inputs have been uplifted to MCC counts, but the observed flows WSP compared these against were not.

2.6.49 The PM peak results show that there are a significant number of vehicles missing in the model on some key movements, when compared to the observed flows calculated by AECOM.

2.6.50 The modelled flows on the M1 off-slip in the eastbound and westbound direction match reasonably well with the observed flow values, although the M1 westbound off-slip modelled vehicles is on the low side but are still within acceptable threshold.

2.6.51 The PM peak model demand is approximately 700 vehicles lower from the Northfield roundabout to the south of M1 Junction 14 travelling towards M1 east and M1 west. There are significant differences between the flows AECOM has derived from the ANPR data and the modelled and observed flow volumes presented by WSP. To understand the journey time validation along the A509 northbound approach to the M1 Junction 14 from Northfield roundabout, AECOM reviewed the Trafficmaster data provided by WSP. The modelled journey time along this section (Section TM Route 16 in Figure 6) is 48 seconds which is 35 seconds faster than the observed Trafficmaster data (83 seconds). Based on the inconsistency in the modelled flows compared to the observed flows and also with the inconsistency in the journey time along this section, it is clear that there are significant issues with the PM peak model. It is therefore recommended that WSP reviews the calculations of demand and observed turning flows. As the two key movements most affected pass through the M1 J14, then it is likely that flows on the northbound A509 approach and circulating the roundabout are significantly underrepresented. This issue is therefore considered **SIGNIFICANT**.

3 Conclusions and Recommendations

3.1.1 AECOM previously reviewed the LMVR produced by WSP for Milton Keynes East Paramics modelling. The findings of this review conducted by AECOM are documented in Technical Note 05. The review indicated that there were a significant number of issues to which AECOM had requested further clarification and justification.

3.1.2 In order to provide response to the findings of AECOM's previous review, WSP has produced a document (Ref: "Response to MKE Paramics LMVR Comments", dated September 2020). This document was subsequently reviewed by AECOM and the findings are documented in Technical Note 08. As part of this review, AECOM requested further information and provided recommendations to address a few of the issues.

3.1.3 To provide further information and to address the issues identified in TN 08, WSP has produced a document (Ref: "Paramics Model Addendum to LMVR and Responses to AECOM Queries", dated January 2021). This document is reviewed by AECOM and the findings are documented in this Technical Note.

3.1.4 The review indicates that some issues identified by AECOM are resolved based on the comments provided by WSP. However, there are some unresolved issues for which AECOM have provided further recommendations.

3.1.5 Table 14 below shows a summary of the present status of the issues identified in the previous audit.

Table 14: Audit Summary Table

ID	Issue Description	Previous Level of Issue	Current Level of Issue	Comments/ Recommendations
Model Specification				
1	Unclear how peak hour was determined	**MEDIUM**	**RESOLVED**	
Data Collection Review				
2	ANPR data collection, - turning flows could be impacted	**SIGNIFICANT**	**SIGNIFICANT**	The issue remains unresolved as no more data is available to verify if the turning proportions. The camera views cannot confirm this and it remains a risk.
3	Ongoing roadworks during data collection – concerns with forecast demand methodology	**MEDIUM**	**RESOLVED**	
4	Journey times are based on ANPR data, recommendations to use TrafficMaster data	**MEDIUM**	**RESOLVED**	

ID	Issue Description	Previous Level of Issue	Current Level of Issue	Comments/ Recommendations
5	Concerns with Queue Length measurement	MINOR	MINOR	The data does not label the link names associated with these lanes and should be provided by WSP for further clarity as AECOM cannot determine which lanes are referred to in the data.
Base Model Development				
8	Changes to headway settings at junctions are not supported, these have been changed from the 2 second gap recommended.	MEDIUM	**RESOLVED**	
9	Unjustified changes to generalised cost parameters and degrees of familiarity	MINOR	**RESOLVED**	
Model Calibration and Validation				
11	It is unclear how many runs are used to validate and calibrate this model.	MINOR	**RESOLVED**	
12	Latent demand unreleased as a result of congestion information	MEDIUM	MINOR	There is no significant latent demand reported by WSP on the approach arms of the M1 Junction 14 which is the key junction in the network. There is latent demand reported along Newport Road approach to the junction, but it is not expected to have critical impacts to the results.
13	Queue length graphs presented in Appendix C show significant over and under estimation. Model instability clear on some routes.	MEDIUM	MINOR	The queues on the approach arms of M1 Junction 14 match reasonably well with the observed queue data. The queues along Newport Road do not match with the observed data, however the journey times match reasonably well. This issue is not expected to have critical impacts on the overall results.
14	Journey time validation	SIGNIFICANT	SIGNIFICANT	There are concerns that the Trafficmaster journey time sections are not consistent with the sections coded in the model. It is recommended that WSP reviews the consistency of the sections coded in the model or the speed limit

ID	Issue Description	Previous Level of Issue	Current Level of Issue	Comments/ Recommendations
				definitions along the M1 mainline. This issue is considered as **MEDIUM**. AECOM has concerns that the Trafficmaster data is not aligned to the duration when the surveys in the study area were conducted. It is recommended that the months included in the Trafficmaster data are reviewed and the correspondence between Trafficmaster data and the journey time sections in the model are reviewed. This issue is considered as **MEDIUM**. The modelled journey time does not match well to the observed Trafficmaster journey time data along the key routes passing through M1 Junction 14 in the model. The M1 westbound off-slip modelled journey times are faster than Trafficmaster. This issue is considered as **SIGNIFICANT**.
15	Turning count data is unreliable since it is collected from ANPR	**SIGNIFICANT**	**SIGNIFICANT**	WSP seems to be using a combination of TAG criteria for the turning flows. It is recommended that either the TAG GEH criteria or the flow threshold criteria are used to calculate the calibration results. This issue is **MEDIUM**. AECOM has concerns that the observed flows considered by WSP for the flow calibration purposes are not accurate. This issue is **MEDIUM**. There are significant flow differences between the modelled and observed traffic flows reported by WSP and those calculated by AECOM passing north through M1 Junction 14 in the PM peak hour. This

ID	Issue Description	Previous Level of Issue	Current Level of Issue	Comments/ Recommendations
				issue is considered **SIGNIFICANT**.

3.1.6 In the PM peak hour, AECOM has significant concerns regarding the flows modelled, since the calculations undertaken by AECOM indicate these should be significantly higher, in the northbound direction and travelling around M1 Junction 14 to the M1 east.

3.1.7 The PM peak hour comparison between journey times in Trafficmaster and the Paramics model indicates that congestion is underrepresented in the PM peak hour on the northbound approach to M1 Junction 14. The ANPR journey time data did not measure this delay, as the cameras are positioned such that the delay suffered by queuing vehicles along the A509 and A4146 were not included in the data.

3.1.8 In the AM peak hour, two key areas of concern are the eastbound off-slip and southbound approach to the A509/ A5130 – these two sections account for most of the discrepancy between the Trafficmaster observed and modelled journey times and it is likely that queuing which occurred during the surveys is not represented in the models. If traffic flows on either the eastbound off-slip or southbound on the A509 increase significantly in forecast scenarios, then there is a risk that impacts to the M1 are not highlighted by the model.

3.1.9 It should be noted that AECOM cannot verify the model without reviewing the Paramics model itself and has relied on information provided by WSP in the report and supporting spreadsheets.

Appendix M

PARAMICS TECHNICAL NOTE (PTN1A) - FUTURE YEAR IMPACTS

PARAMICS TECHNICAL NOTE 1A – MKE Development Tests

DATE:	15 March 2021	**CONFIDENTIALITY:**	Public
SUBJECT:	Milton Keynes East – Paramics Tech Note 1A – Development Tests		
PROJECT:	Milton Keynes East	**AUTHOR:**	A Smith
CHECKED:	A Smith	**APPROVED:**	A Norcutt

EXECUTIVE SUMMARY

This technical note summarises the findings of the work which has been undertaken to assess the impacts associated with development at Milton Keynes East, alongside planned and potential future growth within Milton Keynes itself, on M1 J14.

In agreement with MKC and HE the two key tools which have been used in this assessment are MK's Multi Modal Model (MKMMM), based on the Saturn software, and a micro-simulation Paramics model of J14 and Northfields roundabout.

Outputs from the Saturn modelling have been used as inputs to the Paramics modelling. These Core scenarios provide the basis of the assessment of the development. Further sensitivity tests have also been undertaken using the outputs from the Paramics models to feed back into the Saturn model; however, this Executive Summary focusses on what has been defined as "The Core Tests"; i.e. taking the unadjusted outputs from the Saturn models and using these as inputs to the Paramics models.

These tests have been carried out for both the AM and PM Peak periods for an updated 2016 baseline scenario as well as future year scenarios of 2031 (Local Plan period) and 2048 (representing the potential full build-out year of MKE). Tests for 2048 have been undertaken to provide both HE and MKC with information to help identify how future growth beyond the current Local Plan period may impact the operation of the highway network.

The key planning test on the Strategic Road Network (i.e. that for which HE are responsible), in accordance with Circular 02/2013, is to assess the impact of committed development (the Reference Case) alongside the proposed development against a period 10-years after the date of the planning application or the end of the Local Plan period, whichever is the greater. For MKE these dates coincide as 2031.

Strictly speaking the circular test for the Reference Case should be based on development already permitted only. It has however been agreed with MKC and HE to undertake a test that compares a 2031 Do Minimum Reference Case (i.e. full Local Plan growth) with a 2031 Do Minimum plus development scenario (Do Something) including both the proposed MKE highway infrastructure plus the full proposed build-out at MKE.

It should also be noted that the circular states that where the overall forecast demand at the time of opening of the development (the date at which the development first becomes available for occupation) can be accommodated by the existing infrastructure, further capacity mitigation will not be sought. It should be noted that the opening date for the development is anticipated to be no later than 2025 (which is when the first house would be occupied); however, an opening year test has not been undertaken at this stage but the findings of the assessment for the 2031 period should consider the context of this.

With regard to impacts at M1 J14, Highways England are responsible for the mainline M1 and the slip roads up to the circulatory carriageway which, along with the A509 approaches, are the responsibility of MKC. MKC are also the highway authority for Northfields Roundabout.

Whilst this technical note discusses the findings from assessing the impacts of development across both the HE and MKC components of M1 J14 and Northfields, the focus of this Executive Summary is on the slip roads of M1 J14.

PARAMICS TECHNICAL NOTE 1A – MKE Development Tests

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It should be noted that version 1 of this note was presented initially to Milton Keynes Council and Highways England as a summary of the analysis at that point in time. Following further discussions with Highways England and their modelling consultants, AECOM, adjustments and updates to the baseline validation models, in both time periods, have been completed and this note updated accordingly.

This version, 1A, is therefore based on the updated baseline models, the changes of which have been included in all future year models and presents updated results accordingly. It should also be noted that further strategic modelling outputs have now been included within the results, which had not been finalised at the time of issue of version 1 of this note. This includes running the Key Planning Test (2031 future year plus full development) through the MKMMM, which now supersedes other manual tests.

It is considered that one of the key criteria for assessing the impacts from the modelling is an assessment of queue lengths on the slip roads of M1 J14. The Paramics outputs, in terms of metres are shown and WSP have calculated approximate vehicle numbers, using a 5.75m length. A summary of the key queues at M1 J14 in the 2031 Do Minimum and the 2031 Do Minimum + New Infrastructure + Full MKE Development (Key Planning Test) are therefore presented below:

Maximum and Average Queues at M1 J14 – AM Peak

	2031 DM		2031 KEY PLANNING TEST	
AM Period	**Max (m)**	**Avg (m)**	**Max (m)**	**Avg (m)**
A509(N)	126	75	486	293
M1 Northbound off-slip (E) – right turn towards MKE	22	8	44	19
A509(S)	127	101	132	117
M1 Southbound off-slip (W) – right turn towards Central MK	108	68	173	95
M1 Northbound off-slip (E) - left turn towards Central MK[1]	753	129	409	115
M1 Southbound off-slip (W) - left turn towards MKE	0	0	0	0

[1] Whilst this is a free-flow left-turn Paramics is registering that there are times when a queue forms from a point in line with the stop line of the right turn towards the MKE site due to its interaction with the A509

Maximum and Average Queues at M1 J14 – PM Peak

	2031 DM		2031 KEY PLANNING TEST	
PM Period	**Max (m)**	**Avg (m)**	**Max (m)**	**Avg (m)**
A509(N)	518	196	446	225
M1 Northbound off-slip (E) – right turn towards MKE	26	16	62	38
A509(S)	140	120	131	113
M1 Southbound off-slip (W) – right turn towards Central MK	89	70	91	71
M1 Northbound off-slip (E) - left turn towards Central MK[1]	22	2	153	20
M1 Southbound off-slip (W) - left turn towards MKE	0	0	0	0

PARAMICS TECHNICAL NOTE 1A – MKE Development Tests

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A review of the maximum queues on the northbound and southbound slip roads of M1 J14, displayed in the tables above, has been undertaken against the physical space available on those slip roads. The existing slips have been measured as having an approximate length of 375 – 400m from slip to mainline.

From the results, there is an increase in the right turn queue from the northbound off-slip towards MKE, resulting from traffic being attracted predominantly to the employment land uses on the site. However, even when considering the maximum queue of 44m in the AM Peak, which would extend to a length of eight vehicles from the stop line (based on 5.75m per PCU), it can be seen that this would not interfere with the left-turn towards Central MK or with the mainline M1 as shown in the below image.

It is acknowledged that the Northbound off slip left turn is shown as experiencing maximum queues beyond the limits of the slip road in the Do Minimum scenario assuming that queue is measured from a point in line with the right turning lane stop line. However, when reviewing the modelling visuals, this appears to be a rolling queue that has been picked up within the Paramics queue parameters. With the Key Planning Tests however, it is noted that the maximum queues on the left turn lane reduce significantly with the introduction of the development and that average queues are contained within the slip extent. The PM results show that both the Do Minimum and Key Planning Test maximum queues can be accommodated within the slip extents.

The maximum queue on the southbound off-slip is circa 30 PCUs (173m) and occurs during the AM Peak. This queue relates to the right turn into Central MK which as one would expect is not a movement contributed to by the MKE proposals. Again, this maximum queue can be accommodated within the length of the slip road without impacting on the main line and as shown in the tables above the introduction of the development and associated infrastructure has no material impact on this slip. The max queues are shown in the figure below.

Whilst it can be seen that in the KPT tests the maximum queues can be accommodated within the length of the slip roads it should also be recognised that for much of the peak hour the queues will be much shorter and consequently not extend back to the extents shown above. It should also be noted that these queues incorporate full Local Plan growth.

Furthermore, the change in queues resulting from the introduction of full build out will be attributable not only to traffic generated by the development itself but also as a result of background traffic redistributing as a result of the new infrastructure being introduced.

The Key Planning Test presented is based on the 2031 Do Something test (including Full Build Out) undertaken within the MKMMM, and as such any potential re-routeing of 2031 Do Minimum traffic resulting from the introduction of the new infrastructure is fully accounted for.

In conclusion it is therefore considered that the introduction of the new infrastructure and full build out of MKE has no material impact on the operation of M1 J14 when compared with how the junction will perform in the 2031 Do Minimum scenario.

PARAMICS TECHNICAL NOTE 1A – MKE Development Tests

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1 INTRODUCTION

1.1.1. WSP have been commissioned by Berkley St James to provide transportation and highways advice in respect of the proposed development of part of the land to the northeast of Milton Keynes ('Milton Keynes East' or MKE).

1.1.2. 'Milton Keynes East' (MKE) has been identified as an allocation for a strategic urban extension within Plan:MK. Milton Keynes Council's (MKC) aspirations for the allocation is set out within Policy SD12 of Plan:MK.

1.1.3. As part of the planning application, it was agreed with the Council and key stakeholder, Highways England that a package of transport modelling was required to assess the scheme. This comprised of both strategic level modelling, utilising MK's Multi Modal Model (MKMMM), based on the Saturn software. In addition, a Paramics model, providing a micro-simulation detailed review of J14 and Northfields roundabout has been constructed to assess the changes in traffic at that location. Please see TTN1 for further details on the modelling methodology set out for the MKE site.

1.1.4. Recent discussions and presentations with Highways England and Milton Keynes Councils (04 February 2021) – have set out the modelling work undertaken recently on the J14 and Northfields assessments.

1.1.5. These discussions summarised the key assessments and outputs used in determining the impact at the junction and how this can be managed in the future year scenarios. Further to using the standard strategic outputs, additional tests have been completed to ascertain whether increases in background traffic, re-routeing of vehicles or development specific traffic has the biggest influence at the junctions.

1.2 Further Meetings and updates

1.2.1. Following submission of the preliminary results and version 1 of this Paramics Technical Note (PTN1), a meeting was held with Milton Keynes, Highways England and AECOM (as Highways England's modelling consultants) on 02 March 2021 to run through the findings of the assessments and to discuss comments on the baseline model validation.

1.2.2. Following that meeting, further information has been provided on the baseline models, which is contained in a separate LMVR addendum Technical Note. The updated baseline models have been rectified in both the AM and PM peaks to present a consistent modelling approach which has then been carried forwards into the future year assessments presented herein.

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1.3 MKMMM Strategic Model

1.3.1. As set out above, the MKMMM model has been utilised to provide some flow outputs for the future year scenarios with and without the proposed Development.

1.3.2. The following Core scenarios have been run within the MKMMM;

- **Updated 2016 baseline** (revalidation and calibration following inclusion of 2019 surveys)
  - Agreement on modelling from both Milton Keynes and Highways England
- **2031 Reference Case (Do Minimum)**
  - End of local plan period
  - Includes known committed developments and committed infrastructure
  - MKC officers reviewed growth to ensure accuracy
- **2031 With Development (Do Something) – Partial Buildout**
  - Adding a part build of the scheme (residential and employment) onto the 2031 DM base
- **2048 Reference Case (Do Minimum)**
  - Adding further background growth outside of local plan
  - Using predominantly Tempro (plus info on a small number of specific sites)
  - Does not include MK2050 strategic growth
- **2048 With Development (Do Something) – Full Build**
  - Adding full build out of the site on top of 2048 DM

1.3.3. WSP TN4 sets out the growth assumptions applied in the 2031 and 2048 models. As set out in the bullet points above, the inclusion of allocated sites and committed developments (and associated infrastructure) has been utilised to create a future Do Minimum model for 2031 – representing the end of the Local Plan Period.

1.3.4. For 2048, growth has been added where known developments and still being built out to 2039 plus some additional TEMPRO/NTM growth between 2039 and 2048.

1.3.5. The 2048 future Do Minimum scenario therefore represents an informative test that can be used to set out the potential growth and impacts on the local network. The growth up to 2048 could change considerably, and as such the 2031 period is considered more accurate and indeed is the appropriate planning test.

1.3.6. The MKMMM outputs have been used to create cordons for the Paramics model.

1.3.7. Section 2 of this TN sets out the additional scenarios completed, including further sensitivity and Key Planning Tests.

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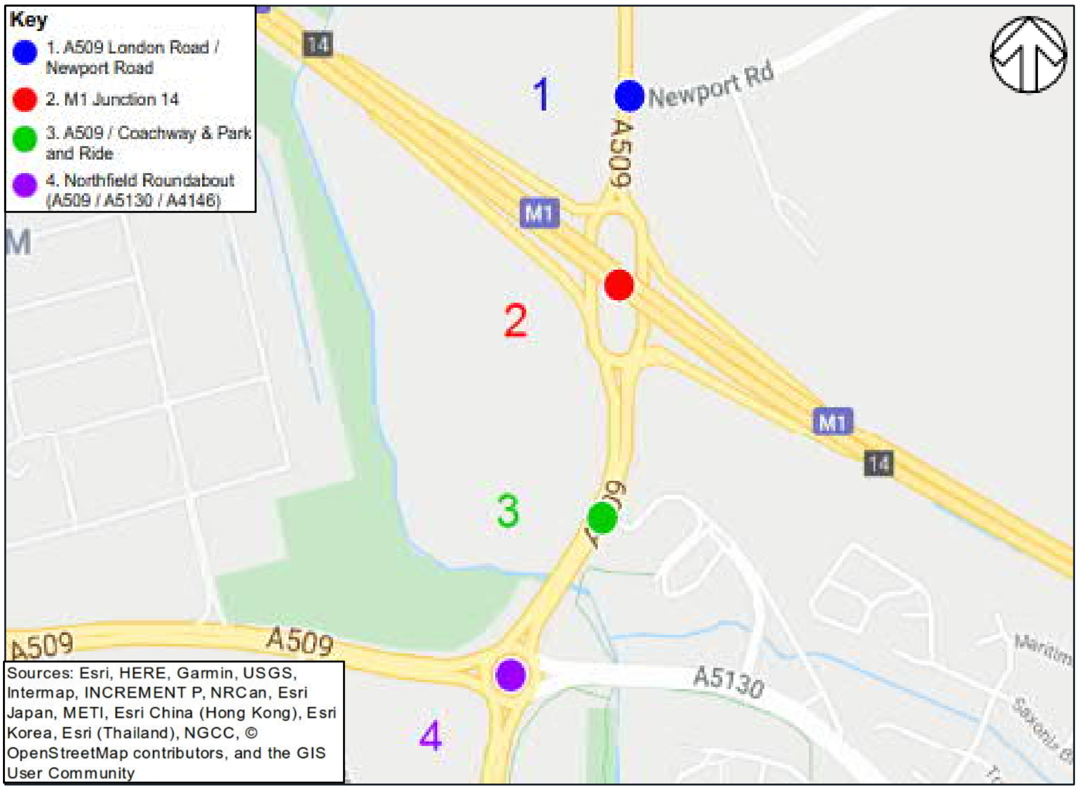
1.3.8. In addition, select link analysis (SLA) outputs have been completed that allow the review and consideration of the development flows only (e.g. without the background growth) – which have been used to test the impacts of the full development. This is discussed further in the summary of analysis in Section 5.

1.4 Paramics Model Purpose and Extent

1.4.1. As outlined in the introduction, the purpose of the Paramics model is to provide an accurate representation of typical traffic conditions in the vicinity of the M1, Junction 14 and Northfields Roundabout. The micro-simulation model is used to assess the impact of the proposed development, and any proposed infrastructure improvements that may be delivered as part of the development proposals. The model covers the area as shown in Figure 1-2 below, focusing in particular on the assessment of the following junctions:

1. A509 London Road / Newport Road priority junction;
2. M1 Junction 14 signalised roundabout junction (M1 / A509);
3. A509 / Coach way & Park and Ride; and
4. Northfield signalised roundabout junction (A509 Portway / A5130 / A4146 Childs Way).

Figure 1-1 – Study Area and Junctions



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1.4.2. The first stage of the modelling work has been to prepare a calibrated and validated base model, using criteria from the Department for Transport (DfT) Transport Appraisal Guidance (TAG).

1.4.3. This has been submitted to both MKC and Highways England. Following a number of meetings and requests for additional information, it is acknowledged that at the time of writing, the validated base model is still being discussed with MKC and Highways England.

1.4.4. However, for expediency and to understand the impacts of future year modelling, the second stage has been completed, including the preparation of forecast models, including background traffic growth along with the development related traffic and any highway improvement schemes.

1.4.5. The Paramics model extent covers both J14 and Northfields Roundabout. One of the key areas of focus is the interaction between the off-slips at J14 back onto the M1 Mainline. Figure 1-3 shows the current layout of J14.

Figure 1-2 – M1 J14 – Diverge lengths (current)

1.4.6. As shown above, the measurements of available slips in both directions (northbound diverge / off slip and southbound diverge / off-slip) is approximately 375 - 400m. Using a standard PCU length of 5.75m – this is the equivalent queuing space of approximately 65 vehicles.

1.4.7. It is acknowledged that the SMART motorway scheme is being developed, but the length of the merge / diverges / slips do not materially change under those proposals. It should also be noted that the SMART motorway scheme has been coded into the future year MKMMM and Paramics models.

1.5 MKE Development

1.5.1. TN1 and TN3 set out the MKE development and inputs included in the Strategic modelling. These notes should be read in conjunction with this TN.

1.5.2. It should be noted and highlighted that the modelling undertaken covers the whole allocation, with an uplift in terms of housing numbers and a worst case scenario in terms of employment uses on site. As such, the modelling outputs are considered to be extremely robust and likely to overestimate the levels of trip generation from the site. Whilst it is acknowledged that Highways England have queries regarding the trip generation, the fact that an uplifted number of residential units should be taken into consideration. Figure 1-4 below provides a summary of the proposed infrastructure being delivered as part of MKE.

Figure 1-3 – MKE Access and Infrastructure Plan (Extract of Indicative Parameter Plan)

1.5.3. As shown on the figure, the main infrastructure proposals consist of the following;

- A new bridge over the M1;
- A new link road around the eastern perimeter of the site connecting into M1 J14;
- A new north-south connection to the A422 into the MKE site, utilising the northern section of the existing A509;
- Down grading of the existing southern section of the A509 and realignment of the southbound approach;
- A new east-west connection through the site leading to the bridge crossing over the M1]; and
- Closure of the Newport Road junction with the A509 and reconfiguration of Newport Road to form a new junction with the eastern perimeter road and connection to the village of Moulsoe.

1.5.4. This infrastructure has been coded into the MKMMM Do Something models in full, and in part within the Paramics modelling (which as shown on Figure 1-2 focuses on J14 and Northfields Roundabout).

1.6 Technical Note Context

1.6.1. This Paramics Technical Note (PTN1) sets out a summary of the Paramics model assessments undertaken prior to submission of the planning application (and supporting modelling outputs) due for submission March 2021.

1.6.2. The note sets out the narrative and key planning tests in the assessment of J14 and outlines the conclusions of the assessments completed.

1.6.3. This informative Technical note therefore covers the following;

- **Section 2**: Sets out the modelling processes adopted;
- **Section 3**: Use of MKMMM Strategic outputs and future year assumptions to create Core outputs;
- **Section 4**: Iterative Paramics tests, including MKMMM sensitivity runs and additional informative Paramics tests / runs;
- **Section 5**: 2031 plus Full Development – the key planning test; and
- **Section 6**: Summary and Conclusion.

PARAMICS TECHNICAL NOTE 1A – MKE Development Tests

DATE:	15 March 2021	**CONFIDENTIALITY:**	Public
SUBJECT:	Milton Keynes East – Paramics Tech Note 1A – Development Tests		
PROJECT:	Milton Keynes East	**AUTHOR:**	A Smith
CHECKED:	A Smith	**APPROVED:**	A Norcutt

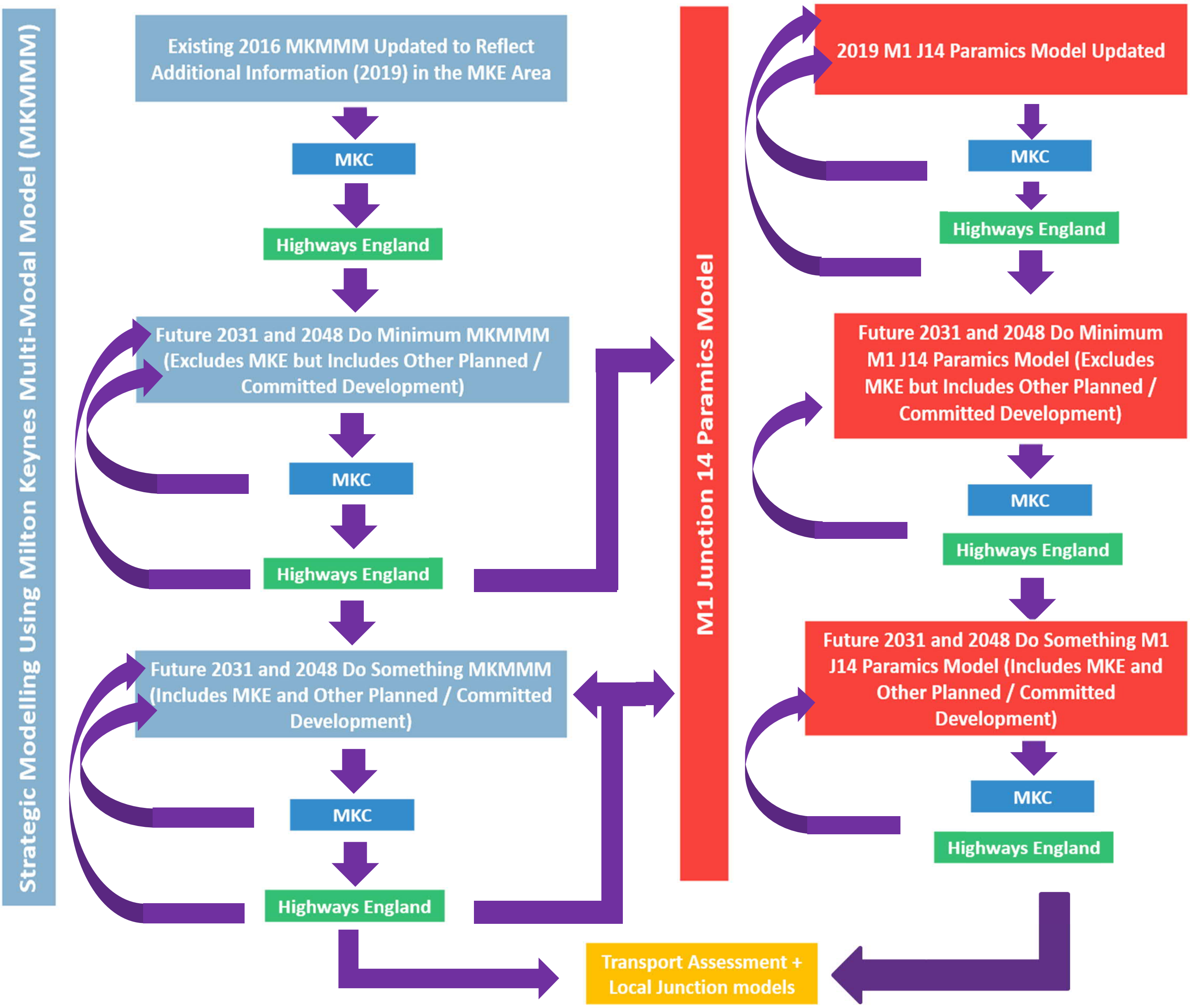
2 MODEL PROCESS

2.1.1. Figure 2.1 below sets out the modelling process adopted for the assessment of the MKE site. The diagram sets out how the strategic model progresses through various stages, with liaison and agreement with stakeholders before progressing. The strategic model then feeds into the detailed Paramics model. This was set out in WSP's Technical Note (TN1) – previously submitted in May 2019.

2.1.2. It should be noted that Stage 1 (base model revalidation) and Stage 2 (future year Do Minimum, 2031 and 2048) models have been agreed by both Highways England and Milton Keynes Council.

2.1.3. Whilst Stage 3 (with development, Do Something 2031 and 2048) has been agreed for use in the assessments by Milton Keynes Council, it is acknowledged that Highways England are still reviewing some of the development specific inputs, specifically around trip generation. This is subject to a separate technical discussion, which is ongoing – with more evidence to be submitted to Highways England in due course. However, it is considered that the impacts and modelling and associated routing would follow similar patterns as set out in the summary below – and as such, any changes in development inputs are not considered to be material at this stage.

Figure 2-1 - Modelling Process adopted for MKE – Strategic and Paramics



2.1.4. As outlined in the figure above, the strategic model feeds into the Paramics, but also in the case of MKE, the Paramics model has been used to inform a sensitivity test of the MKMMM. This is discussed further in Section 3. This is standard / normal modelling practice, and it is often seen with strategic models that cover a wider extent, including junctions / corridors that are also covered by more detailed modelling tools.

PARAMICS TECHNICAL NOTE 1A – MKE Development Tests

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STRATEGIC MODELLING - CORE ASSESSMENTS AND OTHER RUNS

2.1.5. As set out above, the 'Core' scenarios have been run using the strategic MKMMM model, with these being;

- 2031 Do Minimum,
- 2031 Do Something,
- 2048 Do Minimum,
- 2048 Do Something,

2.1.6. The core runs have been used within the TA and the Paramics modelling to get an understanding of the impacts relative to the wider MK area as a result of background traffic, route displacement, development proposals and infrastructure.

2.1.7. During the modelling exercises, it was evident further MKMMM and Paramics runs would be of benefit to assist in the assessment of the site, to enable a greater understanding of impacts and solutions.

2.1.8. The use of modelling iterations and sensitivity tests is a standard practice to inform decision makers on the outcomes of the impacts should certain key variables be altered.

2.1.9. Figure 2-2 sets out the modelling tests undertaken and the data used across the three key modelling tools (Strategic – MKMMM, Paramics and TA Local junction tests).

PARAMACS TECHNICAL NOTE 1A – MKE Development Tests

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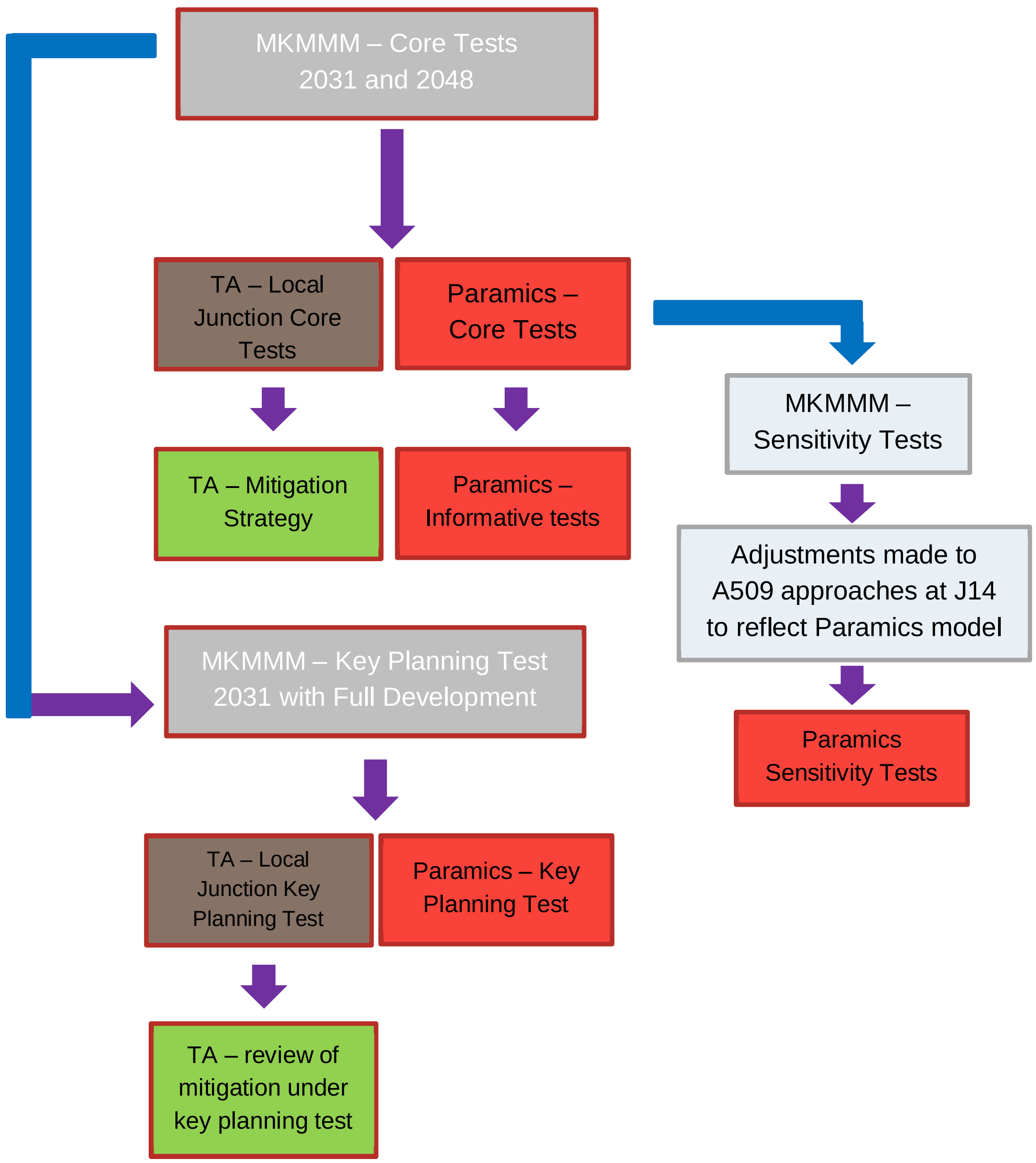
Figure 2-2 - Modelling Tests Undertaken in the MKMMM



2.1.11. As outlined in Figure 1-2, the MKMMM has been run for 3 main tests;

- **Core:** Core models represent the outputs from the Saturn MKMMM, without any adjustments
- **Sensitivity:** these outputs represent adjustments to the MKMMM at J14, reduced capacity
- **Key Planning Test:** these add the full development (assuming full build out) onto the 2031 DM flows. These have been run with and without the sensitivity tests. These are the outputs from the MKMMM and should be used.

2.1.12. As part of the previous Paramics tests a further scenario was also undertaken;

- **Full development manual tests:** These represent the tests whereby the development only trips were extracted from the SLA information and added manually onto the DM flows. These were not run through the strategic model and so don't include background re-routeing etc.

2.1.13. It should be noted that the manual full development tests have been superseded by the Key Planning Tests that have been run through the MKMMM model as this then incorporates wider traffic re-routing.

2.1.14. Table 2-1 below provides a summary of the modelling scenarios undertaken;

Table 2-1 – Modelling Scenarios and details

TYPE	YEAR / SCENARIO	DEVELOPMENT TEST
Core	*2031 Do Minimum*	*n/a*
	2031 Do Something	*Partial build out*
	2048 Do Minimum	*n/a*
	2048 Do Something	*Full build out*
Sensitivity	*2031 Do Minimum – Sensitivity*	*n/a*
	2031 Do Something – Sensitivity	*Partial build out*
	2048 Do Minimum – Sensitivity	*n/a*
	2048 Do Something – Sensitivity	*Full build out*
Key Planning Tests (KPT)	*2031 Key Planning Test (DM + Full development)*	*Equivalent to full build out – run through MKMMM*
	2031 Key Planning Test – Sensitivity (DM + Full Development)	*Equivalent to full build out – run through MKMMM*
KPT - Full development only manual tests	*2031 Do Minimum + Full Dev (from SLA)*	*Equivalent to full build out (development only) – added manually.*

PARAMICS TECHNICAL NOTE 1A – MKE Development Tests

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CORE TESTS

2.1.15. As described above, the core results provide a definitive test using the calibrated MKMMM model. These outputs have been used in the following sections of the TA to understand junction impacts both at a micro-simulation and local junction level. These outputs represent a key scenario to assess the impacts of the development against. The outputs of these tests are contained within **Appendix A.**

SENSITIVITY TESTS

2.1.16. A MKMMM sensitivity test has been run which applies specific alternative assumptions, focusing on the A509 approaches to J14. This was due to a review of the Paramics modelling (using the core results) against the MKMMM (Core) to understand whether the strategic model was reflecting the delays and queuing observed in the micro-simulation. This iterative approach is a common practice. The adjustments and results of these sensitivity tests are set out in Section 4. The outputs of these tests are contained within **Appendix B.**

KEY PLANNING TESTS

2.1.17. As outlined in Figure 2-2, the MKMMM has been run for two future years 2031 and 2048. The 2048 year includes significant growth beyond the Local Plan period and includes assumptions that may or may not occur. The 2031 year has a greater level of certainty and accuracy, as this represents the MK Local Plan period. The 2031 future growth has also been reviewed by WSP and MK planning officers in depth before being utilised in the recent MKMMM outputs.

2.1.18. It was discussed in the February 2021 meeting therefore that the 2031 future year would be considered the key planning test for the MKE impacts at J14. This was predominantly focused on the Paramics tests applied at this junction (discussed further below).

2.1.19. Whilst the 2048 future year presents a useful indication on the likely stresses across the network, it is considered likely that further Local Plans and infrastructure development programmes would be implemented between 2031 and 2048. Therefore, whilst used as an informative, the 2048 years can't be considered a fully accurate position of growth in the MK area. This is particularly true given that the 2048 DM scenarios do not account for the planned growth as part of the MK2050 strategy, the omission of which was agreed with MKC during the modelling process.

2.1.20. The key planning test on the Strategic Road Network (i.e. that for which HE are responsible), in accordance with Circular 02/2013, is to assess the impact of committed development (the Reference Case) alongside the proposed development against a period 10-years after the date of the planning application or the end of the Local Plan period, whichever is the greater. For MKE these dates coincide as 2031.

2.1.21. Strictly speaking the circular test for the Reference Case should be based on development already permitted development only. It has however been agreed with MKC and HE to undertake a test that compares a 2031 Do Minimum Reference Case (i.e. full Local Plan growth) with a 2031 Do Minimum plus development scenario (Do Something) including both the proposed MKE highway infrastructure plus the full proposed build-out at MKE.

2.1.22. Therefore, it is considered more appropriate and more accurate to assess the development against the 2031 future year. This is because this time period reflects the full Local Plan build out; would be 10-Years beyond planning submission; and would be 6+ Years beyond first occupation at the site. The outputs of these tests are contained within **Appendix C.**

KPT - MKMMM Run

2.1.23. For completeness the key planning test 2031 Do Something test (including Full Build Out) was undertaken within the MKMMM such that any potential re-routeing of 2031 Do Minimum traffic resulting from the introduction of the new infrastructure is fully accounted for.

2.1.24. The additional supplemental information is provided in **Appendix C**.

2.1.25. To ensure that the impacts at J14 and Northfields are adequately assessed, the demand from the full development (equivalent to the total development flows at 2048) were added onto the 2031 DM flows. As a result, two planning tests have been completed;

- 2031 Do Min and 2031 Key Planning Test (KPT) 2031 + Full MKE Development and Infrastructure Compared – Core Test
- 2031 Do Min and 2031 Key Planning Test (KPT) 2031 + Full MKE Development and Infrastructure Compared – Sensitivity Test (for information)

2.1.26. These outputs will be used primarily within the Paramics modelling platform, but will also be used to review certain key junctions across the MK network.

Extraction of full development Flows (without re-running through MKMMM)

2.1.27. To provide context of the development specific impacts, initial tests was undertaken extracting just the development only flows.

2.1.28. Under the Core assessments, the development is forecast to be partially built out by 2031. Therefore, to extract the full development flows, select link analysis was undertaken on the 2048 DS model to extract all of the DS model zones flows origins and destinations. The SLA outputs were used to create a development only turning matrix that mirror the Paramics cordon / extent.

2.1.29. The KTP run through the MKMMM discussed above is considered to be the most appropriate review tool and as such supersedes the manual tests previously applied.

PARAMICS TECHNICAL NOTE 1A – MKE Development Tests

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2.2 EXPLANATION OF DEMAND METHODOLOGY

2.2.1. TN1 originally set out the forecasting approach to be adopted for the Paramics modelling, which is replicated below;

- MKMMM forecast year adopted and used;
- As a sense check / alternative approach –use of the up to date 2019 traffic surveys has been made but then included the net trip change from the 2016 to 2031 and 2048 MKMMM flows (this would cater for forecast growth) to create the future years. A comparison exercise would then be undertaken.
- We would need to be mindful about proportional change – review turning flows that show a material absolute change versus percentage difference etc. This exercise would ensure that movements do not experience inappropriate growth assumptions if their relative flow is low.

2.2.2. Due to changes in zone and link structure in the DS network compared to the DM, where there is not an equivalent existing link, then outputs directly from the MKMMM cordon files have been used.

2.3 COMPARISON OF DEMAND

2.3.1. As set out above, the MKMMM outputs have been used to create Cordons of the DM and DS Paramics networks.

2.3.2. The Cordon outputs are provided in **Appendix D.** Please note that the cordon outputs are in PCUs, so where appropriate have been converted to vehicles using the following factors;

Table 2-2 – Modelling user class and PCU factors

USER CLASS	VEHICLE CLASS	PURPOSE	PCU
1	1	Car Commute	1
2	1	Car Employer's business	1
3	1	Car other	1
4	2	LGV	1
5	3	OGV	2.5

2.3.3. To assist with reviewing the zone structures for the Do Minimum and Do Something models are shown below in Figures 2-3 and 2-4.

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Figure 2-3 - DM Cordon & Zones

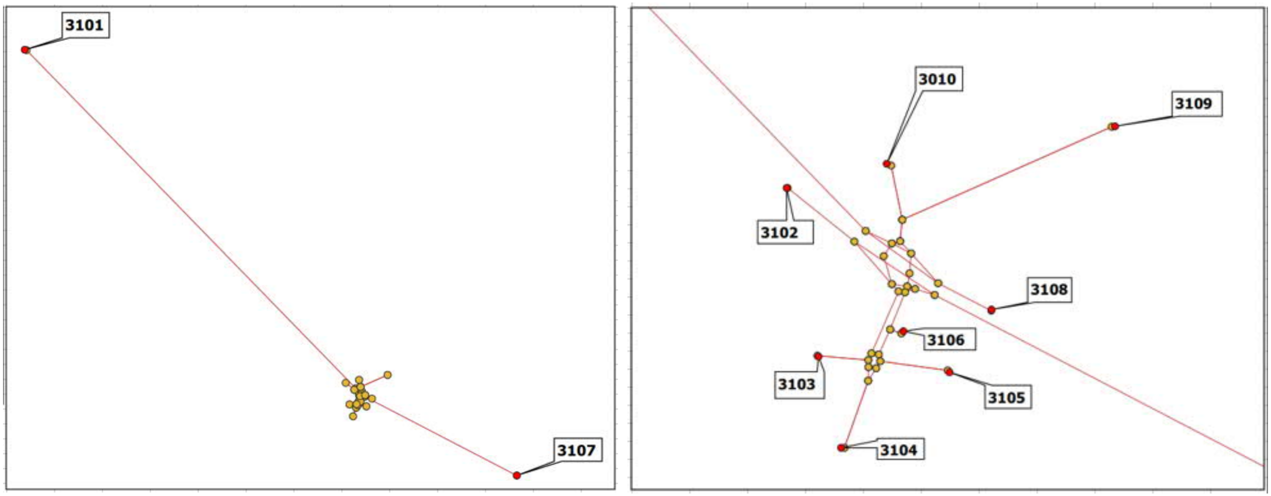
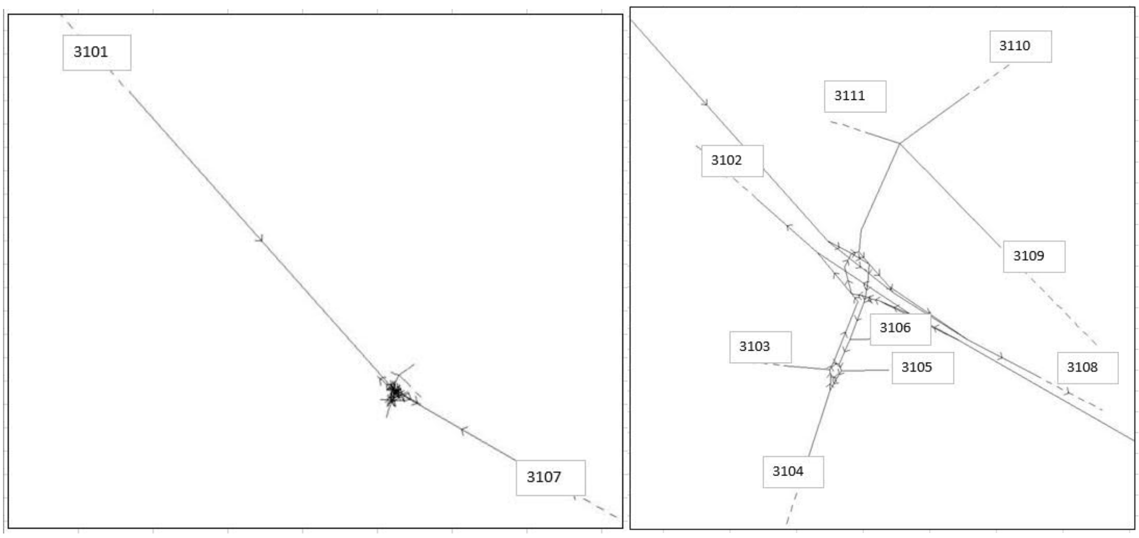


Figure 2-4 - DS Cordon & Zones



CORE RESULTS – TOTAL CORDON DEMAND CHANGES

2.3.4. To provide context on the vehicular demand changes within the model, the total cordon flows have been summarised by scenario and compared. Table 2-3 below provides the Core outputs for the Do Minimum and Do Something runs.

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Table 2-3 – Core Results – Total Cordon Demand

	SCENARIO	AM	PM
Core	2031 Do Minimum	15278	15634
	2031 Do Something	15776	15702
	Difference	497	68
	%	3.3%	0.4%
	2048 Do Minimum	17070	17465
	2048 Do Something	18334	17974
	Difference	1264	510
	%	7.4%	2.9%

2.3.5. In the Core 2031 future year, compared to the Do Minimum, the Do Something cordon results in a relatively small increase (c. 3%) in the AM peak and a negligible change in the PM peak (<1%). This would suggest that the new infrastructure associated with the site is fulfilling the objective by abstracting vehicular movements away from J14.

2.3.6. In 2048, with the full buildout, the development flows increase the percentage change to approximately 7% and 3% in the AM and PM peaks respectively. This is still considered to be relatively minor changes in terms of the total flows at the junction given the scale of growth in that period.

SENSITIVITY TESTS

2.3.7. A similar exercise has been undertaken for the Sensitivity tests. It should be noted however that as the focus of the sensitivity runs was on the key AM peak, PM results for the Do Something tests were not completed. Table 2-4 below shows the resulting changes in total cordon demand.

Table 2-4 – Sensitivity Results – Total Cordon Demand

	SCENARIO	AM	PM
Sensitivity	2031 Do Minimum	15385	15435
	2031 Do Something	15701	n/a
	Difference	316	-
	%	2.1%	-
	2048 Do Minimum	17117	n/a
	2048 Do Something	17756	n/a
	Difference	639	-
	%	3.7%	-

2.3.8. Under the sensitivity test, the Do Something impacts decrease compared to the Core results, to approximately 2% and 4% in the 2031 and 2048 AM periods respectively.

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KEY PLANNING TEST

2.3.9. Table 2.5 below shows the same comparison for the Key Planning Tests. Please note, that these runs were completed for the 2031 year only, as the Do Something is equivalent to full build out at the site.

Table 2-5 – Key Planning Tests Results – Total Cordon Demand

	SCENARIO	AM	PM
Key Planning Test	2031 Do Minimum (Core)	15278	15634
	2031 Do Something KPT (Core)	16547	16246
	Difference	1268	612
	%	8.3%	3.9%
	2031 Do Minimum (Sensitivity)	15385	15435
	2031 Do Something KPT (Sensitivity)	16220	15893
	Difference	835	458
	%	5.4%	3.0%

2.3.10. As would be expected, adding the total development onto a lower baseline (2031 vs 2048) results in a higher percentage impact compared to other scenarios. Under the core results, the development is shown to result in an 8% and 4% increase in total cordon demand in the AM and PM peaks respectively. Under the sensitivity runs the increase is approximately 5% and 3% in the AM and PM.

DEVELOPMENT ONLY FLOWS

2.3.11. Using the development only flows extracted from the SLA plots, it is useful to identify what proportion of the Key Planning Test the development represents. Table 2-6 shows that comparison.

Table 2-6 – Development Only (from SLA) – Total Cordon Demand

SCENARIO	AM	PM
Development only (from SLA) – full build	1582	1218
2031 Do Something – Key Planning Test	16547	16246
% of KPT	9.6%	7.5%

2.3.12. Using the MKMMM key planning test (Core), and comparing the Paramics model extents, the development is shown to represent approximately 10% and 8% of the AM and PM demand.

2.3.13. What is evident from the other comparisons in Tables 2-3, 2-4 and 2-5 therefore is that the new infrastructure associated with MKE, namely the M1 Bridge and connections to Tongwell Street is re-routeing traffic away from J14 and Northfields as intended. As such, the demand change as a result of the development is not as great, fulfilling one of the objectives of the HIF infrastructure.

3 PARAMICS MODEL - CORE RUNS

3.1 Core Assessments

3.1.1. As set out above, the Paramics model has been run for the same 'Core' scenarios as the Strategic MKMMM model.

3.1.2. **Appendix A** provides a series of outputs in excel format showing the summary of the Core assessments runs for the above scenarios.

3.1.3. For the purposes of this TN, the focus is on the general operation of the junctions, the queues, background growth, re-routeing and the development impact. The outputs in Appendix A contain queue comparisons, alongside other statistics.

3.2 Core Outputs -

2031 and 2048 DM – J14 General Commentary

3.2.1. A key focus in the AM is on the northbound off slip, which shows a heavy demand of vehicles utilising lane 1 on the slip – turning left onto the weaving section between J14 and Northfields. As a result, it is noted that the M1 mainline also shows slowing down of vehicles (not necessarily static queues).

3.2.2. It is evident that the mainline is influenced by vehicles wishing to use the northbound off-slip to turn left far more than those wishing to turn right at J14. Paramics and other micro-simulation software packages often struggle in interpreting weaving at approaches to off-slips and often stop vehicle movements as they wait to get into the appropriate lane. It is considered therefore that the slowing of vehicles is likely to be an over-estimation of delay.

3.2.3. In the PM period, the inverse of the AM is observed, e.g. the right turn into CMK from the southbound off slip sees the heaviest demand (compared to the northbound off slip in the AM) albeit the queues are contained within the slip infrastructure. The high right turn demand towards central MK utilises both lanes (the third lane is for left turn only onto the A509).

3.2.4. Similar to the AM, the M1 mainline experiences pockets of slowing and delay. These "shockwaves" occur from vehicles weaving to utilise the slip road, causing areas where vehicles try to change lanes, causing interaction and friction – in turn resulting in slowing of vehicles.

3.2.5. As 2048 DM includes significant additional growth beyond the local plan period of 2031 – the same areas of stress as noted in 2031 are shown to occur in 2048, albeit with increased queues and delays.

3.2.6. The northbound off slip exhibits queues on the slip itself, again as a result of the large left turn demand from vehicles heading toward CMK. Influence onto the mainline again is identified, but as noted above, this isn't always as a result of queues, but also vehicles weaving to change lanes into the appropriate lane in advance of the diverge.

3.2.7. As with 2031, the 2048 DM exhibits a high right turn demand towards central MK from the north west and as such, the southbound off slip experiences delays and queues back to the M1 mainline. As with 2031 results, these queues are largely rolling.

Core DM vs DS

3.2.8. The models have also been run using the Do Something (with development and infrastructure) outputs from the MKMMM strategic model. However, before discussing the Paramics DS outputs – it is important to outline how the MKMMM strategic model has changed traffic patterns in this key area.

3.2.9. It is evident that the new infrastructure added as part of the DS network has resulted in a significant re-routeing and changing in route choice for vehicles, especially those coming from the north east towards central Milton Keynes and J14. The new M1 bridge is shown to experience a considerable use of vehicles in both the AM and PM peaks and suggests that the new bridge over the M1 is fulfilling its brief and is being utilised by large volumes of traffic. In turn, this typically reduces pressure on the other crossing points of the M1.

3.2.10. The demand on the northern arm of J14 in the DS scenario increases in the southbound direction. This is not solely as a result of development traffic in isolation, but trips re-routeing from north of the site, away from the A509 and A422, instead utilising the development infrastructure before accessing the slips and strategic road network. It is important to note therefore that development trips in combination with background traffic and re-routeing traffic will then enter the junction.

3.2.11. With regards to the Paramics modelling, it is considered that the DS scenario indicates very little influence in the operation of the majority of the junctions. It is noted that the queues increase more noticeably on the A509 N – southbound approach, as a result of the changes in demand and development traffic as discussed above.

3.2.12. The AM period shows similar patterns to the DM, with demand on the northbound off slip causing queues to generate on the slip itself and then influence how vehicles approach the diverge on the mainline. As with the DM, this is largely due to the left turning vehicles, which are not related to development traffic.

3.2.13. To provide a more detailed comparison the maximum and average queues, as reported from Paramics have been recorded in the various DM and DS models. It should be noted that these are the Core scenarios, and so in 2031 Do Something runs, this represent a partial build out of the development and the 2048 Do Something runs represents a full build out.

3.2.14. These show the major approaches across the junctions in the model, with Table 3-1 below showing the AM period.

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Table 3-1 – 2031 and 2048 DM vs DS Max and Average Queues (metres) – AM Period

	2031DM		2048DM		2031DS		2048DS	
AM Period	**Max**	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**	**Avg**
J1) A509 N M1J14	126.3	75.1	145.7	121.5	411.5	199.2	485.7	450.6
J1) M1 Offslip E (right turn)	21.8	7.9	10.5	4.3	40.7	17.1	19.4	9.6
J1) A509 S M1J14	126.6	101.1	116.9	100.5	113.5	95.7	132.0	119.2
J1) M1 Offslip W (right turn)	108.1	68.2	277.0	190.6	110.3	72.9	280.8	250.0
J1) M1 Offslip E (left turn)	753.0	129.3	1608.1	984.2	606.3	124.6	2417.6	1389.3
J1) M1 Offslip W (left turn)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
J2) Newport Road	125.6	37.4	303.5	253.3	0.0	0.0	0.0	0.0
J2) A509 S	23.1	11.1	28.1	18.2	6.3	1.6	24.3	15.4
J2) A509 N	35.7	9.3	78.0	40.2	150.0	42.4	371.5	344.5
J2) Access Road_E	0.0	0.0	0.0	0.0	65.4	14.2	128.5	112.4
J2) Access Road_W	0.0	0.0	0.0	0.0	33.3	11.5	146.7	81.7
J3) A509 N Northfield	328.7	222.0	357.4	321.1	317.6	229.2	367.7	336.9
J3) A5130 E Northfield	148.3	91.1	254.4	141.4	132.8	84.6	175.3	99.5
J3) A4146 S Northfield	272.9	133.2	741.1	625.3	128.2	75.5	742.1	550.0
J3) A509 W Northfield	77.4	59.2	438.7	350.7	77.6	61.5	406.2	199.3
J4) P&R	0.0	0.0	2.8	0.1	0.0	0.0	2.6	0.1

3.2.15. It is important to note that the Paramics model will pick up queues based on a set of parameters, and if not met, then a queue isn't recorded. As evident in the results some of these queues represented slowing or are in a rolling queue at the approaches.

3.2.16. As noted above, the A509 N is observed to experience increases in queues under the DS scenario. The Eastern slip (the northbound off slip) right turn lane is shown to experience an increase, however it should be noted that in both the 2031 DS and 2048 DS the queues do not extend back to the main line.

3.2.17. The northbound off slip is shown to experience queues in the 2031 and 2048 Do Minimums that are beyond the slip infrastructure. This is where it is considered that the models are picking up slowing of vehicles on approach to the mainline, and as such the queue lengths are likely representative of a rolling queue.

3.2.18. Table 3-2 shows the same queue information but for the PM period.

Table 3-2 – 2031 and 2048 DM vs DS Max and Average Queues (metres) – PM Period

	2031DM		2048DM		2031DS		2048DS	
PM Period	**Max**	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**	**Avg**
J1) A509 N M1J14	518.3	196.0	1032.4	635.9	278.2	124.3	488.9	343.4
J1) M1 Offslip E (right turn)	26.2	15.8	43.0	20.5	50.5	23.8	50.1	24.6
J1) A509 S M1J14	140.1	119.6	164.7	124.9	124.0	106.5	117.6	102.8
J1) M1 Offslip W (right turn)	88.8	69.9	233.0	114.7	89.4	69.1	101.3	78.7
J1) M1 Offslip E (left turn)	21.6	1.7	1190.7	594.9	35.3	3.5	210.8	44.2
J1) M1 Offslip W (left turn)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
J2) Newport Road	297.3	179.4	305.2	263.9	0.0	0.0	0.0	0.0
J2) A509 S	10.0	3.1	31.5	19.1	13.1	5.6	18.3	8.0
J2) A509 N	363.5	118.4	514.7	390.1	8.2	2.4	237.6	73.7
J2) Access Road_E	0.0	0.0	0.0	0.0	17.9	4.1	122.8	69.7
J2) Access Road_W	0.0	0.0	0.0	0.0	42.8	22.8	136.9	50.7
J3) A509 N Northfield	159.3	122.1	342.6	284.6	182.6	128.7	265.1	177.7
J3) A5130 E Northfield	145.2	101.8	692.9	631.2	311.5	182.1	692.4	625.0
J3) A4146 S Northfield	99.1	80.7	83.4	65.7	89.2	71.0	70.5	56.0
J3) A509 W Northfield	126.8	106.1	134.1	113.9	120.9	102.0	156.8	115.9
J4) P&R	0.0	0.0	8.6	0.2	0.0	0.0	0.0	0.0

3.2.19. The PM period is shown to be less variable than the AM and the introduction of the DS scenario does not materially impact the majority of the queue profiles. The 2048 Do Something queues, do show improvement on the A509 into J14 compared to the Do Minimum, which is likely due to the positive influence of the new MKE infrastructure allowing traffic to route across the M1 via an alternative crossing point.

3.2.20. On balance, some improvements (reductions) in queueing is observed, which is balanced against the small negatives (increases) in queues at other locations.

3.3 Network and Delay Statistics

3.3.1. The Paramics model has provided outputs in terms of overall network statistics. This covers the whole model extent and provides an over-arching picture of network performance.

3.3.2. Table 3-3 provides the network outputs for the AM period.

Table 3-3 – 2031 and 2048 DM vs DS Core – Network Statistics – AM Period

	2031DM	2048DM	2031DS	2048DS
Total Time Taken (s)	9910892	28756678	8888433	36992585
Total Distance (m)	157279547	156249600	158031600	151502621
Total Vehicles	36411	37609	36936	37647
Average Time (s) / Vehicle	272	766	241	984
Average Time (s) / Mile	101	297	91	394
Average Distance (m) / Vehicle	4320	4154	4279	4024
Average Speed (mph)	36	12	41	9
Average Speed (kph)	58	20	65	15

3.3.3. Reviewing the Core results in the 2031 period, it is considered that the AM models generally perform better under the Do Something scenario, compared to the Do Minimum. The Do Something results have a higher average speed, even though more vehicles are loaded onto the network. The 2048 results indicate that the Do Something results have a small negative impact in terms of speed, but this is balanced out by the increase in total vehicles on the network.

3.3.4. Table 3-4 provides the same network outputs for the PM period.

Table 3-4 – 2031 and 2048 DM vs DS Core – Network Statistics – PM Period

	2031DM	2048DM	2031DS	2048DS
Total Time Taken (s)	8081851	18198961	7631088	13925193
Total Distance (m)	170386168	187893776	170499905	192344302
Total Vehicles	38675	42435	38868	44090
Average Time (s) / Vehicle	209	433	196	316
Average Time (s) / Mile	76	157	72	116
Average Distance (m) / Vehicle	4406	4427	4387	4363
Average Speed (mph)	47	24	50	31
Average Speed (kph)	76	38	80	50

3.3.5. The overall network statistics for the PM period indicate that the models in both the 2031 and 2048 future years result in higher average speeds, with increases in total vehicles. It is considered on balance that the PM period does not present a material change between the Do Minimum and Do Something scenarios.

LATENT DEMAND

3.3.6. Following a request by Highways England / AECOM in the March 2021 meeting, additional information on the latent demand being exhibited in the simulations has been presented.

3.3.7. It should be noted that to extract the information, the simulation was reviewed running to ascertain where periods of a demand were occurring. As such, the outputs represent a single model run (instead of an average of 15 seeds for the main results).

3.3.8. Additionally, Paramics records when vehicles cannot enter the network at a point in time. Should vehicles then be able to complete their journey within the simulation period, these are recorded within the main analysis / results. As such, these are more akin with supressed demand, as they can ultimately complete their origin / destination pairing. Latent demand exists where those vehicles cannot complete their journey at the end of the simulation period.

3.3.9. The demand results therefore outline the maximum reported number of vehicles (rounded to the nearest 10 vehicles) that were trying to load onto the network, and the number of vehicles at the end of the recorded time segment,.

3.3.10. Table 3-5 shows the outputs for the 2031 Do Minimum scenario.

Table 3-5 – 2031 DM Latent and Supressed Demand Summary

APPROACH / LINK	2031 DM - AM				2031 DM - PM			
	Time		Vehicles		Time		Vehicles	
	Start time	End time	Max reported in time period	Vehicles at End of time period	Start time	End time	Max reported in time period	Vehicles at End of time period
M1 Westbound	08:20	09:20	500	0	-	-	-	-
M1 Eastbound	-	-	-	-	-	-	-	-
A509 N	-	-	-	-	18:05	end	30	0
Newport Road	-	-	-	-	17:00	end	250	110
A5130	-	-	-	-	17:00	end	300	85
A4146	-	-	-	-	-	-	-	-
A509 W	-	-	-	-	-	-	-	-
East Access*	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
West Access*	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

**DS Only*

3.3.11. In the 2031 Do Minimum AM peak, the only reported suppressed demand was recorded on the M1 westbound link. The model was observed to create a flow breakdown event at the extent of the M1 mainline, not as a result of Junction 14, in turn suppressing the ability to load vehicles onto the network. As shown above, the vehicles ultimately did load into the simulation.

3.3.12. In the PM peak, small amounts of latent demand were recorded on Newport Road and the A5130.

3.3.13. For ease of comparison, Table 3-6 shows the outputs for the 2031 Do Something scenario.

Table 3-6 – 2031 DS Latent and Supressed Demand Summary

APPROACH / LINK	2031 DS - AM				2031 DS - PM			
	Time		Vehicles		Time		Vehicles	
	Start time	End time	Max reported in time period	Vehicles at End of time period	Start time	End time	Max reported in time period	Vehicles at End of time period
M1 Westbound	08:55	09:10	40	0	-	-	-	-
M1 Eastbound	-	-	-	-	-	-	-	-
A509 N	-	-	-	-	-	-	-	-
Newport Road	-	-	-	-	-	-	-	-
A5130	-	-	-	-	-	-	-	-
A4146	-	-	-	-	-	-	-	-
A509 W	-	-	-	-	-	-	-	-
East Access*	-	-	-	-	-	-	-	-
West Access*	-	-	-	-	-	-	-	-

3.3.14. The Do Something scenario in 2031 shows a small pocket of supressed demand on the M1 Westbound, which dissipates quickly at the tail end of the simulation peak hour. No other supressed or latent demand events were recorded in the AM or PM model periods.

3.3.15. The 2031 Do Something models are shown to include all traffic demand loaded, and does not have any latent demand on the approaches, unlike the equivalent Do Minimum scenarios.

3.3.16. A similar exercise was undertaken for the 2048 models, with Table 3-7 below showing the outputs for the 2048 Do Minimum scenario.

Table 3-7 – 2048 DM Latent and Supressed Demand Summary

APPROACH / LINK	2048 DM - AM				2048 DM - PM			
	Time		Vehicles		Time		Vehicles	
	Start time	End time	Max reported in time period	Vehicles at End of time period	Start time	End time	Max reported in time period	Vehicles at End of time period
M1 Westbound	08:00	end	3830	3648	17:25	end	1060	350
M1 Eastbound	-	-	-	-	-	-	-	-
A509 N	-	-	-	-	16:45	end	590	250
Newport Road	07:35	end	550	343	16:40	end	460	460
A5130	-	-	-	-	16:45	end	470	200
A4146	07:45	end	240	179	-	-	-	-
A509 W	07:50	10:00	260	0	-	-	-	-
East Access*	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
West Access*	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

**DS Only*

3.3.17. The additional background growth and demand in the 2048 Do Minimum AM peak, is shown to result in more approaches experiencing latent demand. The M1 westbound link is forecast to experience the highest number of vehicles trying to load onto the network. In the PM period, the demand is lower (compared to the AM) – but certain approaches, such as the A509 N, Newport Road, A5130 and M1 Westbound are still forecast to experience latent t demand at the end of the simulation period.

3.3.18. Table 3-8 shows the outputs for the 2048 Do Something scenario.

Table 3-8 – 2048 DS Latent and Supressed Demand Summary

APPROACH / LINK	2048 DS - AM				2048 DS - PM			
	Time		Vehicles		Time		Vehicles	
	Start time	End time	Max reported in time period	Vehicles at End of time period	Start time	End time	Max reported in time period	Vehicles at End of time period
M1 Westbound	07:50	end	3200	3100	-	-	-	-
M1 Eastbound	07:15	end	1020	1020	-	-	-	-
A509 N	07:25	end	1070	1070	-	-	-	-
Newport Road	-	-	-	-	-	-	-	-
A5130	-	-	-	-	16:40	end	500	240
A4146	08:00	08:40	90	0	-	-	-	-
A509 W	-	-	-	-	-	-	-	-
East Access*	07:35	end	100	100	-	-	-	-
West Access*	07:40	08:55	120	0	-	-	-	-

3.3.19. The 2048 Do Something scenario indicates that the M1 Westbound, M1 Eastbound and A509 N approaches experience latent demand. In the case of the M1 Westbound, this is not as high as recorded in the Do Minimum. In the PM peak, only the A5130 is forecast to have vehicles not able to load at the end of the simulation period.

Summary

3.3.20. In general, the 2031 models are shown to experience some supressed demand, which typically dissipates within the simulation period. The Do Something models in 2031 show less variation and lower levels of supressed / latent demand compared to the Do Minimum runs.

3.3.21. It is important to note that the 2048 outputs are provided for information and represent a high growth scenario. As such, the results indicate that certain links, namely the M1 Westbound, experiencing latent demand, meaning that vehicles cannot load onto the network at the end of the simulation period.

3.3.22. The models and scenarios have been compared to each other using the same parameters and thresholds and so remain a fair reflection of development impacts. Similar to the 2031 scenarios, the 2048 Do Something models are shown to experience less supressed or latent demand compared to their Do Minimum counterparts. This indicates that the Do Something scenarios can accommodate more traffic than the Do Minimum outputs.

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3.4 Key Journey Times

3.4.1. The main journey times included in the model have been presented below for comparison between the DM and DS results. Table 3-9 shows the outputs (in seconds) for the AM period.

Table 3-9 – 2031 and 2048 DM vs DS Core – Journey Times – AM Period

AM

Route Names	2031DM	2048DM	2031DS	2048DS
Route 1: M1 WB	256.0	456.0	211.0	454.0
Route 2: M1 EB	156.0	160.0	157.0	162.0
Route 3: M1 E to A509 N	299.0	652.0	269.0	707.0
Route 4: M1 E to A509 W	0.0	0.0	0.0	0.0
Route 5: M1 W to A4146	195.0	362.0	202.0	467.0
Route 6: M1 W to A509 (N)	95.0	182.0	113.0	277.0
Route 7: A509(N) to M1 E	119.0	126.0	186.0	296.0
Route 8: A509(N) to M1 W	162.0	197.0	299.0	389.0
Route 9: A509(N) to A4146	150.0	238.0	248.0	389.0
Route 10: A4146 to M1 E	0.0	0.0	197.0	215.0
Route 11: A4146 to M1 W	0.0	0.0	130.0	145.0
Route 12: A4146 to A509 N	111.0	120.0	116.0	140.0

3.4.2. Reviewing the 2031 results outlines that the Do Something journey times do not materially differ from the Do Minimum across the majority of the routes. An increase in journey times at Northfields Roundabout movements towards the M1 was identified, although little change was recorded on the M1 routes.

3.4.3. The 2048 results are similar to those recorded 2031 and are not considered to be materially different across the routes. The routes from the M1 W to the A4146, and some of the routes from Northfields show an increase under Do Something scenario.

3.4.4. Table 3-10 shows the results for the PM period.

Table 3-10 – 2031 and 2048 DM vs DS Core – Journey Times – PM Period

PM

Route Names	2031DM	2048DM	2031DS	2048DS
Route 1: M1 WB	149.0	237.0	149.0	156.0
Route 2: M1 EB	152.0	154.0	152.0	155.0
Route 3: M1 E to A509 N	177.0	316.0	195.0	210.0
Route 4: M1 E to A509 W	0.0	0.0	0.0	0.0
Route 5: M1 W to A4146	168.0	279.0	171.0	193.0
Route 6: M1 W to A509 (N)	95.0	126.0	110.0	113.0
Route 7: A509(N) to M1 E	127.0	131.0	190.0	319.0
Route 8: A509(N) to M1 W	215.0	245.0	306.0	537.0
Route 9: A509(N) to A4146	209.0	333.0	243.0	453.0
Route 10: A4146 to M1 E	0.0	0.0	195.0	195.0
Route 11: A4146 to M1 W	0.0	0.0	127.0	128.0
Route 12: A4146 to A509 N	105.0	116.0	112.0	112.0

3.4.5. The PM core outputs show little variability across the modelled journey time routes. The 2031 Do Something compared to the Do Minimum shows some small increases, however most routes are similar in terms overall time taken.

3.4.6. The 2048 results suggest that the Do Something scenario results in improved journey times compared to the majority of routes in the Do Minimum. Noticeable increases in journey times on Routes 8 and 9 are show. On balance however, the 2048 Do Something results show little change across the network.

3.5 Core Runs - Summary

3.5.1. **Appendix A** – provides the outputs in spreadsheet form, including the comparisons of the DM vs DS scenario for the two future years. The outputs present the queues, journey times and network statistics for the various model runs as summarised above.

3.5.2. The 2031 and 2048 DM scenarios both show queuing occurs at the junction, which in turns begins to influence how vehicles approach the slips. This is evident when watching the simulations run with shockwave and pulsing occurs as vehicles try to weave to the correct lane, in turn slow down and creating breaks in flow.

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3.5.3. It is important to note the Do Something scenarios not only include the development, but also include vehicle re-routeing, creating more demand onto J14 and Northfields Roundabout. As shown in both 2031 (partial build out) and 2048 (full build out) Do Something scenarios, it is evident that the new MKE infrastructure, including the new M1 bridge crossing experiences significant volumes of traffic utilising it. This has the benefit of providing alternative routes, balancing away from existing constraints, such as J14. Without this infrastructure, it is clear that the junctions, both J14 and Northfields Roundabout would operate under considerable pressure, with high delays and congestion.

3.5.4. Reviewing J14 itself, it is evident from the queue analysis however that maximum queues do not extend back onto the mainline in either direction (northbound off slip or southbound off slip) in either the AM or PM periods for those movements directly impacted by the development. The northbound off slip – left turn, exhibits rolling queues, however this is evident from the 2031 Do Minimum scenario and the Do Something scenario improves the performance of this movement in the AM peak.

3.5.5. It is noted that the modelling shows the influence of weaving as vehicles approach the diverge points at the junction. The weaving section between J14 and Northfields Roundabout is equally seen as a key area where a significant demand and level of interaction occurs.

3.5.6. The Core results, using the MKMMM outputs have been run and reviewed to give an understanding of impacts at the junction. In that review process, it became apparent that the strategic modelling flows at J14 were different to that achieved within the Paramics. As such, further tests to fully understand where the impacts are occurring at the junction, including the adoption of a sensitivity test is discussed in Section 4.

3.5.7. It should be noted that the 2048 flows are shown for information, and as set out in Section 1 are considered to present a useful interpretation of potential growth on the network. As discussed with MKC and Highways England, further key planning tests have also been completed, as set out in Section 5.

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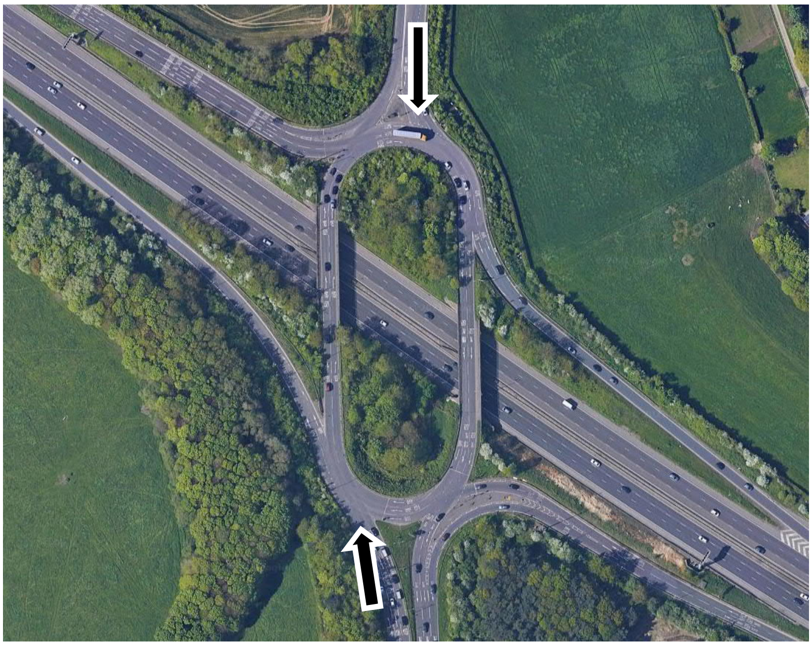
4 ITERATIVE / SENSITIVITY TESTS

4.1 Sensitivity Test

4.1.1. Upon review of the Core assessments within the Paramics model, compared against the MKMMM Saturn outputs, it was apparent that there was a difference in throughput and capacity, in particular at the A509 approaches to J14. Figure 4-1 below outlines the approaches reviewed further.

Figure 4-1 – A509 Sensitivity Review Locations



4.1.2. The Paramics model was suggested that the level of vehicles able to access J14 was less than what was currently coded into the Saturn model.

4.1.3. Differences in capacity thresholds are not unusual because the level of capacity is often overstated within Saturn due to the lower granularity afforded to network coding. Any such differences will be implicit within the future year modelling unless a manual adjustment is made to compensate for the differences. It should also be noted that in general Saturn modelling may reflect a 'generally good' label of calibration within the study area and there could still be differences of 10 or 20% on certain turning movements or approaches.

4.1.4. It should be noted that the MKMMM is a strategic model and as such has limitations in the level of detail that can be adopted when being used to assess such a wide area. Only through the iterative process, as described in Section 1, was it possible to review this further and then suggest amendments. This does not question the validity of the MKMMM model, but follows a standard iterative process when using more detailed analysis tools (in this case, Paramics micro-simulation) to then feed back into the strategic model.

4.1.5. If the level of capacity constraint within the MKMMM were coded such that more vehicles make certain movements more than observed in the Paramics, then this could mean the area is likely to attract more traffic in the future and any future forecasts may contain higher traffic flows as a result.

4.1.6. It is considered unlikely that vehicles would continue to utilise a route that experiences continued high delays and queues. In reality, it is likely that users will seek alternative routes. In the case of MKE, the infrastructure proposals include an alternative route via the new M1 Bridge, which would be attractive and result in a similar journey time with minimal adjustment to travellers route.

4.1.7. Table 4-1 shows the review of the saturation flows, demand flow and actual flows between the two model types, focusing in the 2048 future year, at just the A509 approaches.

Table 4-1 –2048 DM vs DS review of Saturn and Paramics capacity – A509 and J14

		2048 DO-MINIMUM			**2048 DO-SOMETHING**		
MKMMM outputs							
		SAT FLOW (PCUs)	DEMAND FLOW (PCUs)	ACTUAL FLOW (PCUs)	SAT FLOW (PCUs)	DEMAND FLOW (PCUs)	ACTUAL FLOW (PCUs)
2048 AM	A509 NB	3792	2163	1817	3792	2535	2040
	A509 SB	1252 (M1 SB On-slip), 2502 (Circulatory)	1397	1197	1252 (M1 SB On-slip), 2502 (Circulatory)	1857	1680
Paramics Outputs							
2048 AM	A509 NB	n/a	1650	1125	n/a	1734	1396
	A509 SB	n/a	1194	575	n/a	1544	542

4.1.8. The review indicates that the Paramics model represents approximately 50% of the vehicle throughput that the MKMMM suggests in the SB direction. In the NB direction the difference is greater percentage wise, however the flow profiles match more generally.

4.1.9. As such, it was agreed with MKC's modelling team to run a sensitivity test. This was completed using a fixed demand (no VDM) SATURN assignment of the 2031 and 2048 AM peak, DM and DS models, with the following adjustments made;

- A509 SB approach SAT FLOWS reduced by 50%
- A509 NB approach SAT FLOWS reduced by 25%

4.1.10. As outlined above, it should be noted that these Sensitivity results only make adjustments to two approaches. As such they are treated with caution and caveated as they have been completed to understand the potential re-routeing of traffic if one of the key approaches (the A509) were constrained to match the Paramics throughput.

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4.1.11. The same adjustments have been applied in both the DM and DS models for both 2031 and 2048 future years

4.1.12. Due to the nature of the adjustments applied in the sensitivity test, these do not replace the Core outputs, which remain the definitive tests. However, these sensitivity tests represent a useful indication of re-routeing. WSP considers that this could occur on a network that experiences queues and delay, and that the MKMMM represents the appropriate tool to test what would occur if vehicles were to seek alternative routes. As such the outputs are presented for information and consideration against the other scenarios presented above.

4.2 Sensitivity Test Outputs – MKMMM

4.2.1. The same modelling approach as set out for the Core tests have been applied for the sensitivity tests. The MKMMM has been used to generate strategic outputs and a cordon of the Paramics model extent created from those and fed into the Paramics future year models.

4.2.2. To provide context, it is useful to understand how the traffic patterns were altered with the sensitivity adjustments in place.

4.2.3. For ease of review – the 2048 DM and DS sensitivity outputs (in terms of throughput at the A509 approaches) are shown in Table 4-2 below.

Table 4-2 –2048 DM vs DS review of Saturn capacity following sensitivity adjustments

		2048 DO-MINIMUM (SENSITIVITY)			2048 DO-SOMETHING (SENSITIVITY)		
		SAT FLOW (PCUs)	DEMAND FLOW (PCUs)	ACTUAL FLOW (PCUs)	SAT FLOW (PCUs)	DEMAND FLOW (PCUs)	ACTUAL FLOW (PCUs)
2048 AM	A509 NB	2844	2272	1890	2844	2668	2122
	A509 SB	626 (M1 SB On-slip), 1251 (Circulatory)	919	775	626 (M1 SB On-slip), 1251 (Circulatory)	1044	976

4.2.4. As outlined above, with the adjustments in place there is clear reduction in the southbound movements under the sensitivity scenario. The sensitivity results indicate a reduction of 422 PCUS in the DM scenario and a reduction of 708 PCUs in the DS scenario compared to the Core results. The northbound flows show a negligible change compared to the Core results.

4.2.5. MKCs modelling team also provided some select link analysis (SLA) of the sensitivity tests.

4.2.6. Figures 4-2 and 4-3 below show the SLA by direction (northbound or southbound) of vehicles wishing to cross J14, identifying what links they have used in terms of origin.

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Figure 4-2 – A509 Sensitivity DS 2048 SB - SLA

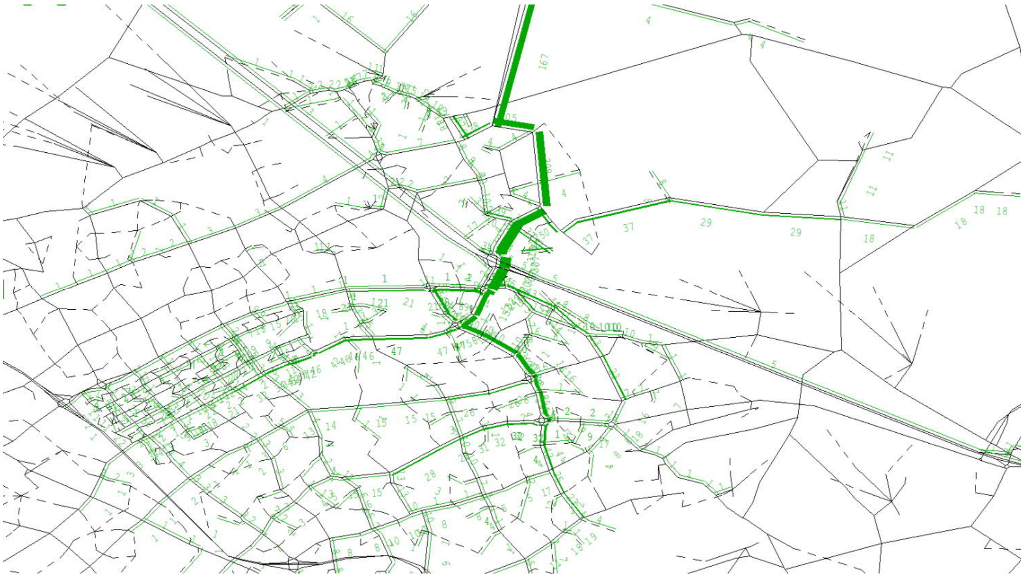
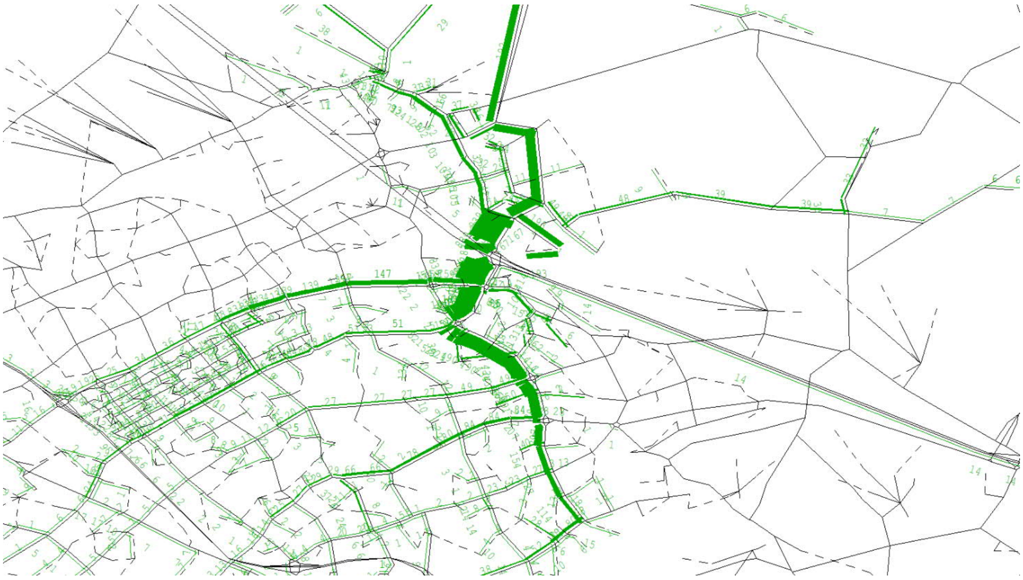


Figure 4-3 – A509 Sensitivity DS 2048 NB - SLA



4.2.7. The SLA's identify that under the sensitivity conditions, the new infrastructure, mainly the eastern link road is forecast to become a key corridor for access to and from the J14.

4.2.8. A small amount of traffic routes to and from the Moulsoe area, but it is clear that in the northbound direction, J14 still attracts vehicles from central Milton Keynes and that a lot of through movements occur.

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4.3 Sensitivity Test Outputs - Paramics

4.3.1. Using the MKMMM Sensitivity outputs, the strategic model information was fed into the Paramics model to create two distinct model scenarios;

- Do Minimum – Sensitivity
  - The same Do Minimum network and demand inputs, with adjustments to the A509 approaches at J14
- Do Something – Sensitivity
  - The same Do Something network and demand inputs, with adjustments to the A509 approaches at J14

4.3.2. The Core Do Something sensitivity tests were only run for the AM peak in the MKMMM. As shown in the Core results above in Section 2, the PM peak is not considered to be the key time period and the impacts are largely negligible in that time period. As such, the AM peak was focused on.

4.3.3. Summarised outputs, including spreadsheet outputs are contained within **Appendix B.** The primary focus is on the 2031 runs, as these are then used further in review of the Key Planning Tests discussed in Section 5 below, however, the 2048 Do Something sensitivity runs are also provided in the spreadsheet.

4.3.4. Under the sensitivity results, it is considered likely that the junction performs with fewer queues on the slips and surrounding approaches. The reduced demand from the north ultimately allows more diverging traffic to enter the junction as there are less conflicts with vehicles routeing through J14 from the north. The northbound off slip still demonstrates shockwaves and slowing of vehicles further upstream on the mainline. Northfields Roundabout still exhibits queues and slowing vehicles as seen in the Core results.

4.3.5. The DS models follow a similar pattern to the DM outputs, with reduced queues observed across the junction. The sensitivity test also indicates that queues and delays from the A509 N into J14, even with the development traffic do not reach similar levels compared to the core results.

4.3.6. Table 4-3 below provides a review of the DM and DS sensitivity models for the AM period, summarising the maximum and average queues.

Table 4-3 – 2031 DM vs DS (SENSITIVITY) Max and Average Queues (metres) – AM Period

SENSITIVITY	**2031DM SENS**		**2031DS SENS**	
AM Period	**Max**	**Avg**	**Max**	**Avg**
J1)A509 N M1J14	118.5	70.8	90.5	66.5
J1) M1 Offslip E (right turn)	13.8	5.4	29.5	13.7
J1) A509 S M1J14	113.3	100.5	122.3	98.4
J1) M1 Offslip W (right turn)	287.3	185.4	129.9	77.3
J1) M1 Offslip E (left turn)	1825.0	822.9	149.9	21.5
J1) M1 Offslip W (left turn)	0.0	0.0	0.0	0.0
J2) Newport Road	140.6	50.7		
J2) A509 S	13.2	6.2	8.6	2.7
J2) A509 N	37.3	10.3	19.1	12.8
J2) Access Road_E			0.0	0.0
J2) Access Road_W			27.9	8.3
J3) A509 N Northfield	358.9	306.2	286.2	169.3
J3) A5130 E Northfield	262.7	155.7	147.1	86.2
J3) A4146 S Northfield	741.0	632.9	168.5	86.9
J3) A509 W Northfield	435.8	370.6	86.0	65.4
J4) P&R	5.3	0.1	0.0	0.0

4.3.7. The queues indicate that under the sensitivity runs, the DS scenario does not have as big a change compared to the DM when reviewed against the Core runs.

4.3.8. It is noticeable that under the sensitivity test in the Do Something scenario, the left turn queues at the northbound off slip reduce significantly compared to the Do Minimum sensitivity results.

4.4 Network and Delay Statistics

4.4.1. Table 4-4 below provides the over-arching network statistics summary for the 2031 Do Minimum Sensitivity vs the 2031 Do Something sensitivity results.

Table 4-4 – 2031 DM vs DS (SENSITIVITY) – Network Statistics – AM Period

	2031DM SENS	2031DS SENS
Total Time Taken (s)	30274749	7315703
Total Distance (m)	158035033	158571749
Total Vehicles	37438	36729
Average Time (s) / Vehicle	809	199
Average Time (s) / Mile	309	74
Average Distance (m) / Vehicle	4221	4317
Average Speed (mph)	12	49
Average Speed (kph)	19	79

4.4.2. The network statistics suggest that the 2031 Do Minimum sensitivity results experience significant delay and as a result a reduced average speed. This is indicative of latent demand. The 2031 Do Something sensitivity results indicate higher average speeds, albeit with lower total vehicles on the network.

4.4.3. On balance the sensitivity results indicate that the 2031 Do Something may be more stable in modelling terms and as such closer to the Core results. It should be noted that latent demand statistics were not observed for the Sensitivity runs given the use of these scenarios as an informative data set.

4.5 Key Journey Times

4.5.1. The main journey times included in the model have been presented below in Table 4-5 for the 2031 Sensitivity tests.

4.5.2. When reviewing the journey times within the model, the scenarios present improved performance under the Do Something scenario. The journey times are indicative that the 2031 Do Minimum sensitivity tests are exhibiting higher delays and instability as a result. The 2031 Do Something sensitivity results are more aligned with other core results.

Table 4-5 – 2031 and 2048 DM vs DS – Journey Times – AM Period

AM

Route Names	**2031DM SENS**	**2031DS SENS**
Route 1: M1 WB	486	165
Route 2: M1 EB	162	157
Route 3: M1 E to A509 N	676	209
Route 4: M1 E to A509 W	0	0
Route 5: M1 W to A4146	345	182
Route 6: M1 W to A509 (N)	174	114
Route 7: A509(N) to M1 E	124	166
Route 8: A509(N) to M1 W	172	186
Route 9: A509(N) to A4146	213	134
Route 10: A4146 to M1 E	0	202
Route 11: A4146 to M1 W	0	134
Route 12: A4146 to A509 N	119	119

4.6 Sensitivity Test - Summary

4.6.1. The sensitivity tests were conducted to understand the level of re-routeing within the strategic model should reduced capacity be applied to the A509 approaches at J14. These reductions were calculated after reviewing the differences in throughput between the Paramics and MKMMM outputs under the Core scenarios.

4.6.2. As shown above, and as one would expect, the sensitivity tests reduce through traffic at J14. Some of the development traffic is still forecast to utilise J14, as it presents the most logical route choice for the southernmost areas of development within the masterplan, especially for the employment trips. However, when reviewing the DS vs the DM, the changes in queues, delays and overall operation would suggest that the DS scenario does not present a material or severe impact at the two junctions.

4.6.3. It is acknowledged that the sensitivity tests are a manual adjustment to alter route choice, which may not occur to the same degree in the day to day operation of the network. The adjustments are likely to slightly over-estimate the route transference away from J14, whereas the Core results are considered to over-estimate the attractiveness of J14. It is therefore considered that the results in any scenario would be somewhere between the Core and the Sensitivity.

PARAMICS TECHNICAL NOTE 1A – MKE Development Tests

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5 KEY PLANNING TEST

5.1.1. As outlined in Section 2, the MKMMM has been run for two future years 2031 and 2048. The 2048 year includes significant growth beyond the Local Plan period and includes assumptions that may or may not occur. The 2031 year has a greater level of certainty and accuracy, as this represents the MK Local Plan period. The 2031 future growth has also been reviewed by WSP and MK planning officers in depth before being utilised in the recent MKMMM outputs.

5.1.2. It was discussed in the February 2021 meeting therefore that the 2031 future year would be considered the key planning test for the MKE impacts at J14.

5.1.3. To ensure that the impacts at J14 and Northfields are adequately assessed, the demand from the full development (equivalent to the total development flows at 2048) were added onto the 2031 DM flows. As a result, two planning tests have been completed;

- 2031 Do Min and 2031 Key Planning Test (KPT) + Full MKE Development and Infrastructure Compared – Core Test
- 2031 Do Min and 2031 Key Planning Test (KPT) + Full MKE Development and Infrastructure Compared – Sensitivity Test (for information)

5.1.4. **Appendix C** provides summary outputs of the 2031 DM and 2031 Key Planning tests (KPT).

2031 DM AND KEY PLANNING TEST (2031 + FULL DEVELOPMENT) - CORE

Queues Results

5.1.5. The modelling shows that the introduction of the full development flows on top of the Do Minimum demand does not have a material impact on the operation of either J14 or Northfields Roundabout.

5.1.6. The queues increase on the northbound right turn off slip lane slightly, however, it is clear that the development does not always represent a significant proportion of traffic using this lane.

5.1.7. Table 5-1 provides a comparison of the queues under the 2031 DM vs the Key Planning Test (KPT) 2031 + Full development scenarios under the core scenarios.

Table 5-1 – 2031 DM vs KPT (Core) Max and Average Queues (metres) – AM Period

	2031DM		2031 KPT CORE	
AM Period	**Max**	**Avg**	**Max**	**Avg**
J1) A509 N M1J14	126.3	75.1	485.9	293.0
J1) M1 Offslip E (right turn)	21.8	7.9	43.9	19.2
J1) A509 S M1J14	126.6	101.1	132.3	116.7
J1) M1 Offslip W (right turn)	108.1	68.2	172.6	94.9
J1) M1 Offslip E (left turn)	753.0	129.3	409.1	114.7
J1) M1 Offslip W (left turn)	0.0	0.0	0.0	0.0
J2) Newport Road	125.6	37.4	0.0	0.0
J2) A509 S	23.1	11.1	24.2	12.6
J2) A509 N	35.7	9.3	334.4	151.5
J2) Access Road_E	0.0	0.0	125.1	51.7
J2) Access Road_W	0.0	0.0	112.6	36.2
J3) A509 N Northfield	328.7	222.0	332.8	243.6
J3) A5130 E Northfield	148.3	91.1	198.2	99.3
J3) A4146 S Northfield	272.9	133.2	701.7	342.3
J3) A509 W Northfield	77.4	59.2	90.0	66.9
J4) P&R	0.0	0.0	7.8	0.2

5.1.8. The queue outputs indicate that the maximum queue on the A509(N) southbound increases with the development, although this does not materially impact the operation of either J14 of the Northfields Roundabout.

5.1.9. The southbound off-slip queue results suggest that the KPT scenario does have a small impact on the queues, however they do not extend back to the mainline. The 2031 KPT results suggest a reduction in max and average queues at the northbound off slip for left turning vehicles.

5.1.10. As mentioned above, the development traffic typically utilises the right turning lane on this slip. The proportional impact of development traffic in this queue is considered to be low and not material.

5.1.11. At Northfields roundabout the majority of the arms do not experience a material change in queues, although under the KPT scenario, the southern arm, A4146 (Childs Way) does experience an increase in max and average queues.

5.1.12. Table 5-2 below provides a summary of the queue outputs (max and average) in the PM period.

5.1.13. The A509 approach in to J14 shows some decrease with the development in terms of maximum queues, but a slight increase in average queues, however this is not considered material given the increase in residential and employment trips likely to utilise this link.

5.1.14. Reviewing the queue outputs on the southbound off-slip the queue does not extend back to the mainline and the introduction of the development does not have an impact on the queue lengths.

5.1.15. On the eastern side of the junction, the KPT scenario does appear to increase queues on the northbound off-slip; however, this does not extend to the mainline and as such, the impact is not considered to be material or severe.

Table 5-2 – 2031 DM vs KPT (Core) Max and Average Queues (metres) – PM Period

	2031DM		2031 KPT CORE	
PM Period	**Max**	**Avg**	**Max**	**Avg**
J1) A509 N M1J14	518.3	196.0	445.9	225.5
J1) M1 Offslip E (right turn)	26.2	15.8	62.4	38.4
J1) A509 S M1J14	140.1	119.6	130.7	113.2
J1) M1 Offslip W (right turn)	88.8	69.9	91.1	71.4
J1) M1 Offslip E (left turn)	21.6	1.7	153.4	20.2
J1) M1 Offslip W (left turn)	0.0	0.0	0.0	0.0
J2) Newport Road	297.3	179.4	0.0	0.0
J2) A509 S	10.0	3.1	22.3	10.3
J2) A509 N	363.5	118.4	48.6	10.9
J2) Access Road_E	0.0	0.0	100.0	32.8
J2) Access Road_W	0.0	0.0	63.9	27.0
J3) A509 N Northfield	159.3	122.1	195.8	138.0
J3) A5130 E Northfield	145.2	101.8	425.5	260.7
J3) A4146 S Northfield	99.1	80.7	90.3	72.4
J3) A509 W Northfield	126.8	106.1	128.3	110.1
J4) P&R	0.0	0.0	0.0	0.0

5.1.16. Similar to the AM, the Northfields Roundabout is shown to experience similar queue profiles on three of its four approaches. It is acknowledged that the KPT scenario increases queuing on the eastern arm (A5130) when compared to the Do Minimum scenario.

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2031 DM AND 2031 KPT FULL DEVELOPMENT (SENSITIVITY)

5.1.17. For completeness the outputs of the assessments run under the sensitivity assumptions are also contained in **Appendix C**. Table 5-3 provides a summary of the queue results under the 2031 DM (Sensitivity) vs the 2031 KPT (Sensitivity) + Full Development results.

Table 5-3 – 2031 and 2031 KPT (Sensitivity) Max and Average Queues (metres) – AM Period

	2031DM (SENS)		2031 KPT (SENS)	
AM Period	**Max**	**Avg**	**Max**	**Avg**
J1) A509 N M1J14	118.5	70.8	106.3	72.1
J1) M1 Offslip E (right turn)	13.8	5.4	56.9	19.5
J1) A509 S M1J14	113.3	100.5	134.1	116.9
J1) M1 Offslip W (right turn)	287.3	185.4	175.2	94.4
J1) M1 Offslip E (left turn)	1825.0	822.9	678.2	109.1
J1) M1 Offslip W (left turn)	0.0	0.0	0.0	0.0
J2) Newport Road	140.6	50.7		
J2) A509 S	13.2	6.2	21.6	14.5
J2) A509 N	37.3	10.3	29.0	23.9
J2) Access Road_E			3.7	0.6
J2) Access Road_W			28.6	14.4
J3) A509 N Northfield	358.9	306.2	292.9	192.3
J3) A5130 E Northfield	262.7	155.7	127.4	83.6
J3) A4146 S Northfield	741.0	632.9	673.8	313.4
J3) A509 W Northfield	435.8	370.6	91.0	68.7
J4) P&R	5.3	0.1	2.8	0.1

5.1.18. Under the sensitivity scenario, the queues and operation of the junctions do not materially differ compared to the Core scenarios. As shown in Table 5-3, the queues are similar across both scenarios with some decreases observed, balanced by minor increases elsewhere.

5.1.19. With the introduction of the KPT scenario under sensitivity conditions, some queues do increase, but as outlined above, the queues which are more related to development traffic movements do not extend back to the mainline. It is noted that the northbound off slip left turn does show long rolling queues in the Do Minimum, however with the introduction of the development, this queue decreases.

5.1.20. The queues at Northfields Roundabout are shown to improve, with reductions in both maximum and average queues across all four approaches. Further analysis of Northfields is provided in the Transport Assessment.

5.1.21. Table 5-4 provides a summary of the queue results under the 2031 DM (Sensitivity) vs the 2031 KPT (Sensitivity) + Full Development results in the PM period.

Table 5-4 – 2031 and 2031 KPT (Sensitivity) Max and Average Queues (metres) – PM Period

	2031DM (SENS)		2031 KPT (SENS)	
AM Period	**Max**	**Avg**	**Max**	**Avg**
J1) A509 N M1J14	537.0	203.3	89.4	55.5
J1) M1 Offslip E (right turn)	27.7	14.8	45.9	28.9
J1) A509 S M1J14	134.5	119.5	121.3	106.3
J1) M1 Offslip W (right turn)	94.6	71.0	82.5	69.0
J1) M1 Offslip E (left turn)	0.0	0.0	0.0	0.0
J1) M1 Offslip W (left turn)	0.0	0.0	0.0	0.0
J2) Newport Road	304.2	179.9		
J2) A509 S	10.6	3.2	26.4	16.7
J2) A509 N	374.3	125.7	2.8	0.5
J2) Access Road_E			3.3	1.0
J2) Access Road_W			18.2	8.8
J3) A509 N Northfield	142.5	120.2	124.4	104.5
J3) A5130 E Northfield	133.8	93.5	227.2	130.4
J3) A4146 S Northfield	99.1	80.3	93.9	72.6
J3) A509 W Northfield	128.7	107.2	157.8	115.8
J4) P&R	0.0	0.0	0.0	0.0

5.1.22. Under the sensitivity scenario, and as shown in Table 5-4, the queues are similar across both scenarios with some notable decreases observed to the A509 approaches. This is balanced by minor increases elsewhere, including the eastern arm of Northfields Roundabout. However, on balance, it appears that the KPT under the sensitivity scenario does not materially affect the queues.

5.2 NETWORK AND DELAY STATISTICS

5.2.1. Table 5-5 and 5-6 below provide the network statistics / outputs for the Core and Sensitivity Key Planning Test scenarios in the AM and PM peaks respectively.

Table 5-5 – 2031 DM vs 2031 KPT DS Core and Sensitivity – Network Statistics – AM Period

	2031DM – Core	2031 KPT - Core	2031DM – Sens	2031 KPT - Sens
Total Time Taken (s)	9910892	10899025	30274749	9558492
Total Distance (m)	157279547	162139113	158035033	159981739
Total Vehicles	36411	38750	37438	37819
Average Time (s) / Vehicle	272	281	809	253
Average Time (s) / Mile	101	108	309	96
Average Distance (m) / Vehicle	4320	4184	4221	4230
Average Speed (mph)	36	34	12	39
Average Speed (kph)	58	55	19	63

5.2.2. Reviewing the network statistics in the AM peak indicates that the Key Planning Test in either the Core or Sensitivity runs. The 2031 Do Minimum sensitivity results appear to show higher delays compared to the others, which is not experienced under the standard core Do Minimum, as such, the Core results appear to be the truer comparison.

5.2.3. The AM period shows only a minor change in average speed across the network, despite a significant increase in total vehicles. As such, it is considered that the KPT test results in a minimal change in overall operation of the model.

Table 5-6 – 2031 DM vs 2031 KPT DS Core and Sensitivity – Network Statistics – PM Period

	2031DM – Core	2031 KPT - Core	2031DM – Sens	2031 KPT - Sens
Total Time Taken (s)	8081851	8554551	8069349	7290645
Total Distance (m)	170386168	173470661	170336835	170455653
Total Vehicles	38675	40108	38663	39359
Average Time (s) / Vehicle	209	213	209	185
Average Time (s) / Mile	76	79	76	69
Average Distance (m) / Vehicle	4406	4325	4406	4331
Average Speed (mph)	47	45	47	52
Average Speed (kph)	76	73	76	84

5.2.4. Similar to the AM, the PM peak shows very little difference between the Core and Sensitivity tests when comparing the KPT results versus the Do Minimum.

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LATENT DEMAND

5.2.5. Similar to the Core results, a review of the latent and suppressed demand under the Do Something Key planning Test has been completed. Table 5-7 shows the outputs for the 2031 Do Something (KPT) scenario. It should be noted that the sensitivity test was not reviewed.

Table 5-7 – 2031 KPT DS Latent and Supressed Demand Summary

APPROACH / LINK	2031 DS (KPT) - AM				2031 DS (KPT) - PM			
	Time		Vehicles		Time		Vehicles	
	Start time	End time	Max reported in time period	Vehicles at End of time period	Start time	End time	Max reported in time period	Vehicles at End of time period
M1 Westbound	-	-	-	-	-	-	-	-
M1 Eastbound	-	-	-	-	-	-	-	-
A509 N	08:00	09:00	20*	0	-	-	-	-
Newport Road	-	-	-	-	-	-	-	-
A5130	-	-	-	-	-	-	-	-
A4146	-	-	-	-	-	-	-	-
A509 W	-	-	-	-	-	-	-	-
East Access*	08:00	09:00	20*	0	17:25	18:25	150	0
West Access*	08:00	09:00	20*	0	17:30	17:45	10	0

**intermittent, small amounts of latent demand between 08:00 and 09:00 – mostly up to about 15-20 vehicles*

5.2.6. The 2031 Key Planning test shows very little supressed demand in both the AM and PM periods. In all recorded cases, vehicles ultimately completed their trips and were therefore included in the analysis. Compared against the 2031 Do Minimum results (shown in Table 3-5) the key planning test shows lower instances of supressed demand across the network in both time periods.

5.3 Key Journey Times

5.3.1. The key journey time outputs for the AM period have been summarised in Table 5-8 below.

Table 5-8 – 2031 DM vs 2031 KPT DS Core and Sensitivity – Journey Times – AM Period

AM

Route Names	2031DM – Core	2031 KPT - Core	2031DM – Sens	2031 KPT - Sens
Route 1: M1 WB	256	226	486	215
Route 2: M1 EB	156	157	162	157
Route 3: M1 E to A509 N	299	297	676	279
Route 4: M1 E to A509 W	0	0	0	0
Route 5: M1 W to A4146	195	216	345	200
Route 6: M1 W to A509 (N)	95	119	174	120
Route 7: A509(N) to M1 E	119	214	124	166
Route 8: A509(N) to M1 W	162	345	172	200
Route 9: A509(N) to A4146	150	282	213	149
Route 10: A4146 to M1 E	0	213	0	212
Route 11: A4146 to M1 W	0	145	0	144
Route 12: A4146 to A509 N	111	137	119	136

5.3.2. The Core results indicate very little variability between the KPT Core and the Do Minimum Core results. There are some increases in journey times from the Northfields Roundabout area towards the M1, however, the mainline and slip travel sections themselves do not show a material difference.

5.3.3. The KPT Sensitivity outputs are more aligned with what is observed under the core scenario, and suggest that the differences occurring overall under the sensitivity conditions are not significantly altering the outcomes of the analysis.

5.3.4. Table 5-9 presents the same information for the PM period.

Table 5-9 – 2031 DM vs 2031 KPT DS Core and Sensitivity – Journey Times – PM Period

AM

Route Names	2031DM – Core	2031 KPT - Core	2031DM – Sens	2031 KPT - Sens
Route 1: M1 WB	149	150	148	149
Route 2: M1 EB	152	152	152	152
Route 3: M1 E to A509 N	177	208	178	202
Route 4: M1 E to A509 W	0	0	0	0
Route 5: M1 W to A4146	168	177	167	161
Route 6: M1 W to A509 (N)	95	111	95	111
Route 7: A509(N) to M1 E	127	234	130	175
Route 8: A509(N) to M1 W	215	445	217	200
Route 9: A509(N) to A4146	209	368	211	134
Route 10: A4146 to M1 E	0	199	0	192
Route 11: A4146 to M1 W	0	129	0	127
Route 12: A4146 to A509 N	105	117	105	111

5.3.5. In general terms, the travel times in the core scenario comparison are broadly similar. Like the AM period, the travel segments between Northfields and the M1 are shown to experience some increases. The M1 mainline and slips show little relative change in performance.

5.3.6. The Sensitivity runs indicate a similar pattern to the Core results, albeit with less impact observed at Northfields Roundabout. This would be expected given the Sensitivity runs influencing traffic routes away from the A509 and such reducing demand, queues, delays and ultimately journey times at the roundabout. The differences between the two sensitivity scenarios would suggest that the full development is not having a material impact at either J14 or Northfields.

5.4 KEY PLANNING TEST – SUMMARY

5.4.1. Reviewing the Key Planning Test scenarios, J14 is shown to be able to accommodate the full development traffic and remain operating within safe and acceptable limits. In all scenarios the developments impacts on the southbound off slip (M1 off slip W) are negligible, or show a small reduction, indicating not material change.

5.4.2. The northbound off slip (M1 off slip E) right turn lane shows an increase in queues when comparing the KPT against the DM. When reviewing the footage, the development traffic makes up a small proportion of the queues on this lane of the slip. It is likely that the significant right turn demand from the southbound off slip, which the development does not add to, continues to dominate the green time available at the junction. Further improvements would likely be seen with the junctions MOVA controller in operation.

5.4.3. Considering the maximum queue, which should be noted does not occur at all times, the queues reach approximately 44 metres, well within the available slip extent.

5.4.4. The left turn lane at the northbound off slip is forecast to experience queues likely to extend beyond the slip extents in the Do Minimum. With the introduction of the KPT scenarios, these maximum queues reduce significantly and can largely be contained within the slip infrastructure. There is therefore a betterment over the Do Minimum with the development in place.

5.4.5. Figure 5-1 below shows the maximum queue lengths on the two diverges at J14 in the AM period.

5.4.6. The maximum queue on the southbound off-slip is circa 173m. This queue relates to the right turn into Central MK. Again, this maximum queue can be accommodated within the length of the slip road without impacting on the main line and as shown in the tables above the introduction of the development and associated infrastructure has no impact on this slip.

5.4.7. Whilst it can be seen that the maximum queues can be accommodated within the length of the slip roads it should also be recognised that for much of the peak hour the queues will be much shorter and consequently not extend back to the extents shown above. Furthermore, the change in queues resulting from the introduction of full build out are attributable not only to traffic generated by the development itself but also as a result of background traffic redistributing as a result of the new infrastructure being introduced.

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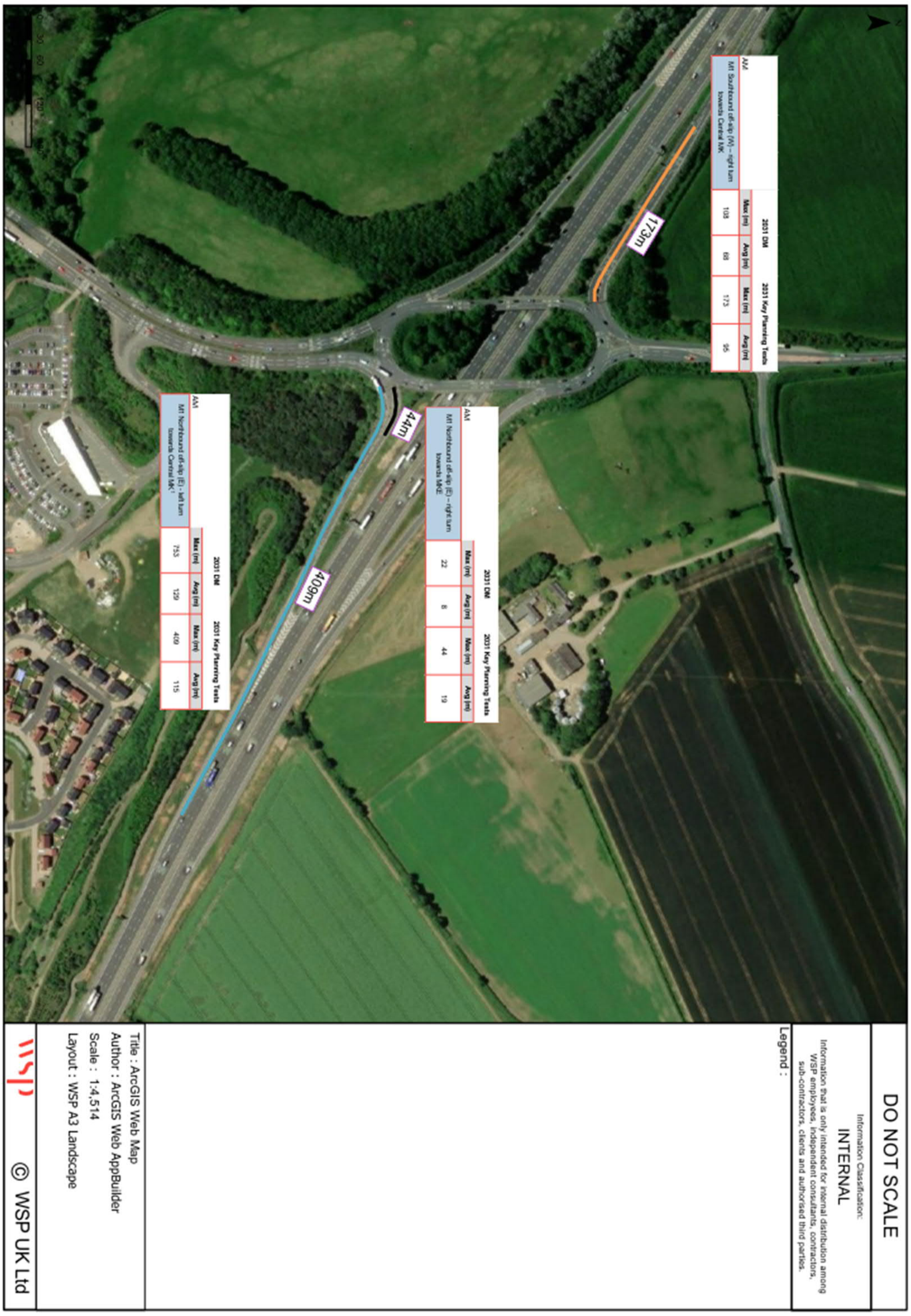
Figure 5-1 – Max Queue Lengths – Key Planning Test vs Do Minimum (AM Period)



PARAMICS TECHNICAL NOTE 1A – MKE Development Tests

DATE:	15 March 2021	**CONFIDENTIALITY:**	Public
SUBJECT:	Milton Keynes East – Paramics Tech Note 1A – Development Tests		
PROJECT:	Milton Keynes East	**AUTHOR:**	A Smith
CHECKED:	A Smith	**APPROVED:**	A Norcutt

6 CONCLUSIONS

6.1 Summary

6.1.1. A Paramics model of J14 and Northfields roundabout has been utilised to test a number of modelling scenarios to understand the impacts of background traffic growth, MKE development and its associated infrastructure on the junctions.

6.1.2. Due to the complexities of future year growth forecasts, there is a level of uncertainty on the demand at the junction, in particular during the 2048 scenario. As such, the end of local plan 2031 time period, has more accuracy in terms of committed growth and therefore can be relied on to give a more truer position of traffic demand at the junction.

6.1.3. The 2048 scenario provides a useful forecast into demand and strategic growth, and has been provided for information, however outlines that background increases in vehicular demand exceed the capacity of the junction, regardless of whether the development is introduced or not. It should be noted that the MK2050 strategy, adopted in January 2021 as an appendix to the Local Plan, is not accounted for in the growth forecasts for 2048 (which was agreed with MKC as part of the methodology). Therefore, the aspirational growth targets from MK2050 would be higher than what is included in the growth assumptions in the modelling as it stands.

6.1.4. It is important to consider that increased growth does not normally come in isolation, and it is very likely that future Local Plans will be developed that will include infrastructure delivery strategies to assist with local and strategic junctions on the MK network.

6.1.5. It is apparent from the tests completed that in isolation, the development has a small impact on the operation of the junction, and this is not considered to be material or severe. Queuing does not extend to the mainline on the J14 slips that are predominantly used by the development, even when accounting for the maximum queues in the peaks, and the queue profiles at Northfields Roundabout indicate little change when the development is added.

6.1.6. It is observed that the existing left turn demand from the east, utilising the northbound diverge before turning towards Northfields Roundabout results in the potential for a rolling queue along the slip lane. This rolling queue is likely to extend beyond the slip extents and start to influence mainline traffic, which is shown in the Do Minimum scenario. The addition of the full development and associated infrastructure in the Key Planning Tests identify that the maximum queues on this lane will reduce significantly, providing a betterment over the Do Minimum outputs. This may be due to the new infrastructure associated with the MKE site, enabling users an alternative crossing of the M1, without having to utilise J14.

6.1.7. The sensitivity test, which accounts for the queues and delays at A509 approaches indicates that vehicles would re-route away from J14 if consistent queuing and delays occurred.

6.1.8. As such, under the sensitivity tests, the queues largely decrease compared to the 'Core' scenarios, as the demand at the junction (in terms of through movements) reduces. As outlined above, it is considered that the junction would likely operate within a range of these scenarios.

6.1.9. The Key Planning Test, including the 2031 Do minimum growth, but adding the full MKE development (plus infrastructure) shows little change against the 2031 Do Minimum in isolation. Whilst some small increases in queues occur – this is not considered to represent a worsening of the junction, and it is considered that J14 can accommodate the development, alongside planned growth in the Local Plan.

6.1.10. Beyond 2031, background growth places pressures on J14, to a point where the junction and knock on impacts to Northfields Roundabout create instability, queueing and delay.

6.1.11. It is therefore considered that the MKE development is not the trigger for J14 likely to require improvements in the future as MKE forms part of the MK Local Plan, but it is background growth and consequently development associated with the next Local Plan period that will need a strategy to address impacts at J14 which could include delivering further infrastructure to relieve pressure at the junction, should car travel remain as prevalent.

6.1.12. MKE is forecast to be built out by 2048, however, this trajectory is very much worst case and could well be accelerated. As such, the inclusion of the full MKE site in the 2031 year, is an appropriate planning test and in accordance with the circular. This test demonstrates that the development impacts at J14 are not severe.

6.2 Conclusion

6.2.1. In reviewing the key planning scenario, the 2031 DM plus full development model, it is evident that the AM model indicates queuing on the eastern slip road (northbound off slip), primarily caused by a queue back from the southbound weaving section towards the Northfield Roundabout. While the right turn queue on northbound off slip shows some queueing extending along the slip road, it does not reach onto the M1 mainline.

6.2.2. It should be noted that the left turn queue from the east (northbound diverge) is observed to queue back, create rolling shockwaves and start to influence mainline traffic. The development does not add demand to this turn, and so any issues already observed are not solely attributable to the development. The MKE infrastructure, including the new M1 bridge and the eastern perimeter road enable development alongside background growth to utilise the local network and J14. This is shown to have a positive impact, reducing maximum queues, compared to the Do Minimum results – outlining that the development and associated infrastructure would be beneficial to that movement. Beyond 2031, the junction is observed to increase queues and delays in the AM predominantly as a result of background growth.

6.2.3. The PM model indicates some queuing on the western (southbound diverge), again caused by vehicles turning to the A509 south. These delays are shown in the DM scenarios, and whilst in the

DS models the development traffic is mixed among this queue, the development traffic does not make up a significant proportion of the queue.

6.2.4. Whilst it can be seen that the maximum queues can be accommodated within the length of the slip roads it should also be recognised that for much of the peak hour the queues will be much shorter and consequently not extend back to the extents shown above. It should also be noted that these queues incorporate full Local Plan growth and a period of 2031; i.e. at least six years into the build out of the development.

6.2.5. It is therefore considered that when reviewing the development impacts, combined with the Local Plan growth up to 2031, that J14 can accommodate the proposals without the need for alteration. Even when the maximum reported queues are plotted, these do not reach the M1 mainline. As MKE is part of the MK Local Plan, it is considered that the planning test is fulfilled.

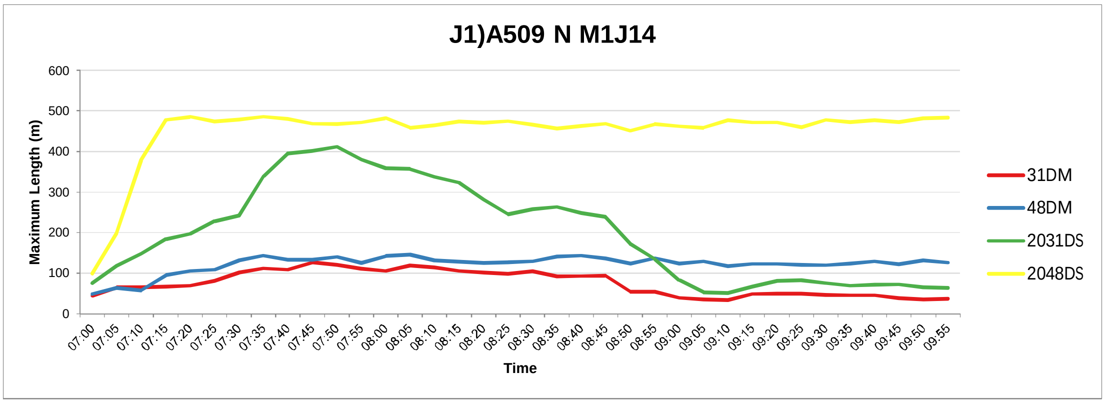
6.2.6. Acknowledging the 2048 data, it is evident that beyond 2031, the increase of background growth and re-routed traffic results in the junction experiencing queues and delays beyond satisfactory levels.

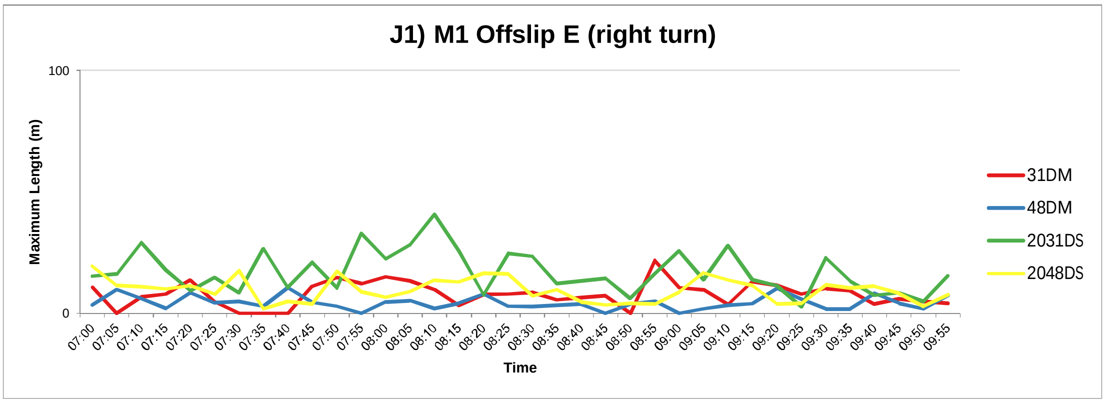
6.2.7. In conclusion it is therefore considered that the introduction of the new infrastructure and full build out of MKE has no material impact on the operation of M1 J14 when compared with how the junction will perform in the 2031 Do Minimum scenario.

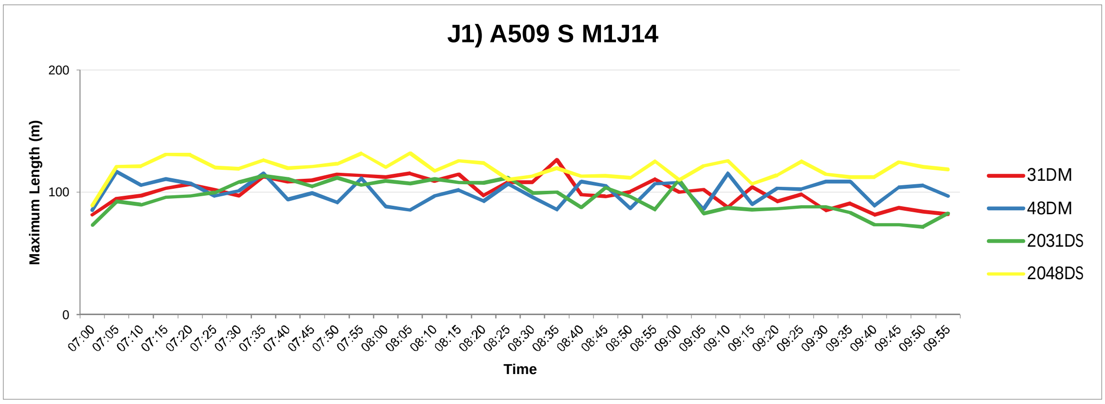
APPENDIX A

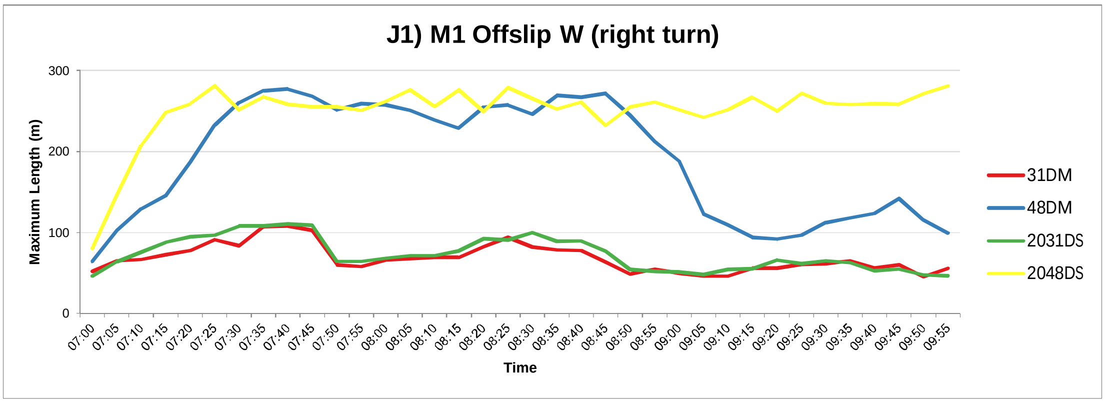
Comparison Graphs
AM

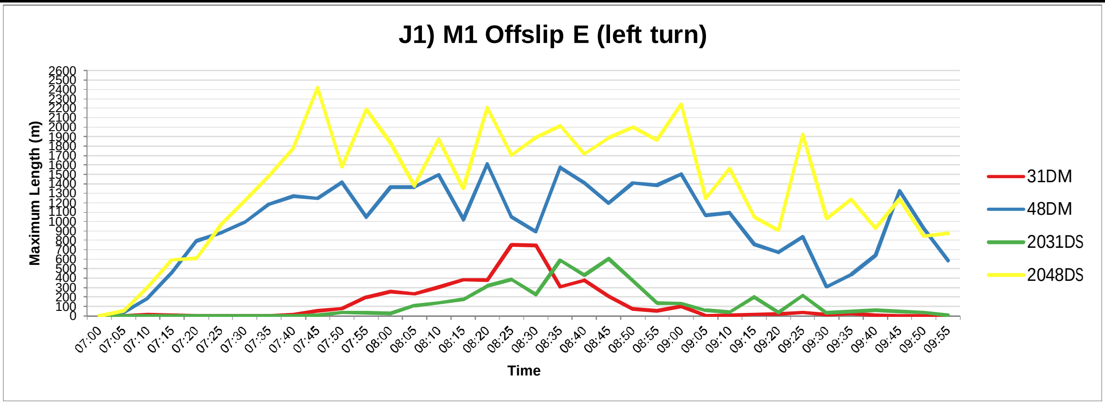
J1

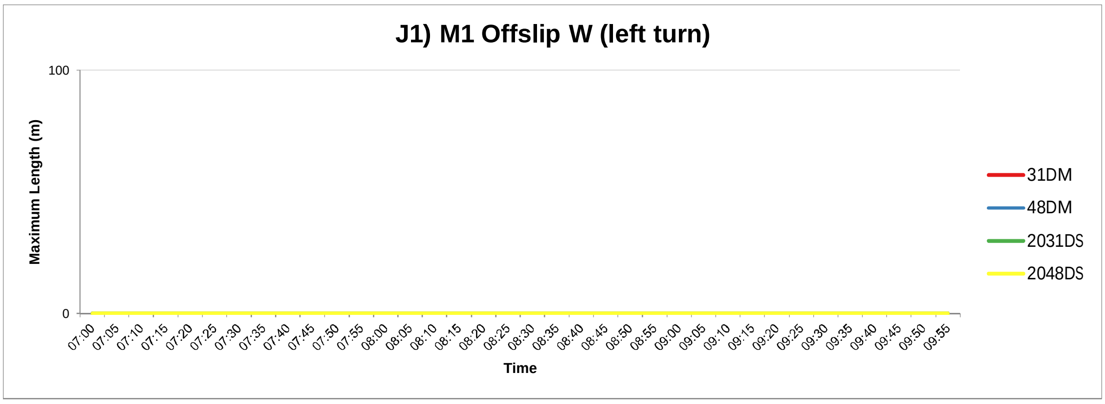




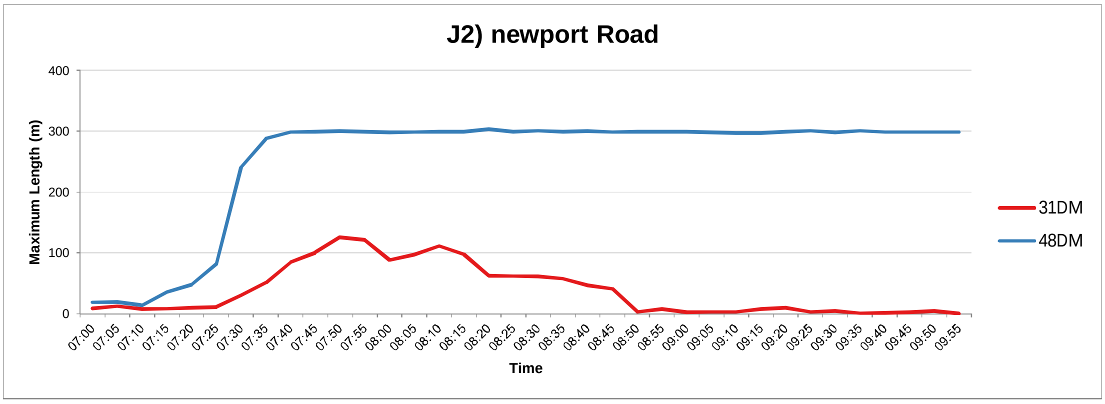


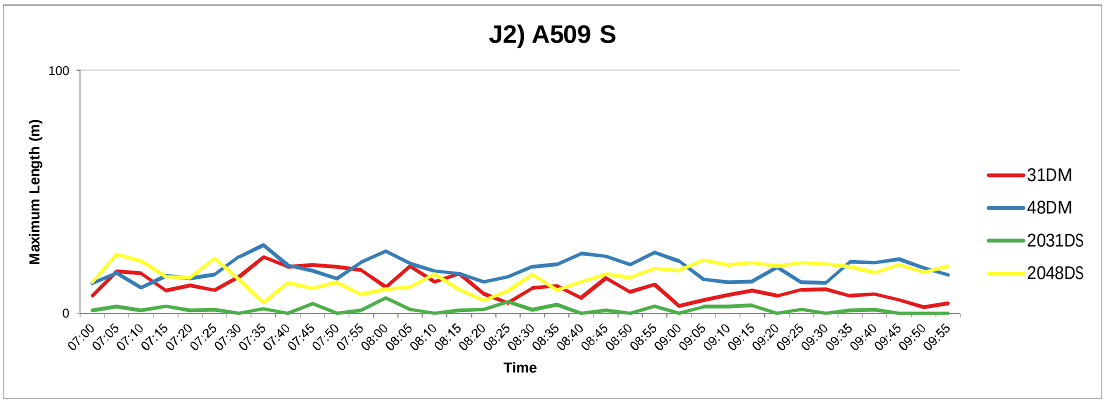


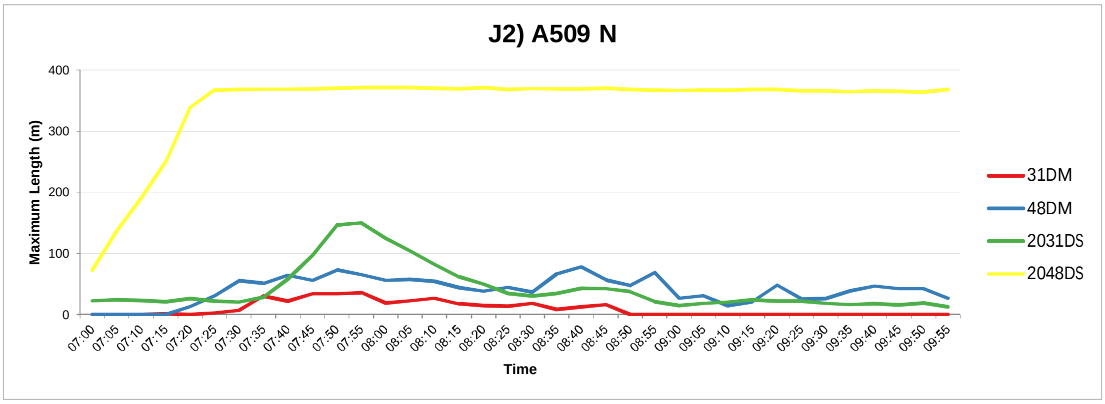

J1) M1 Offslip E (left turn)
Maximum Length (m)
Time
31DM
48DM
2031DS
2048DS

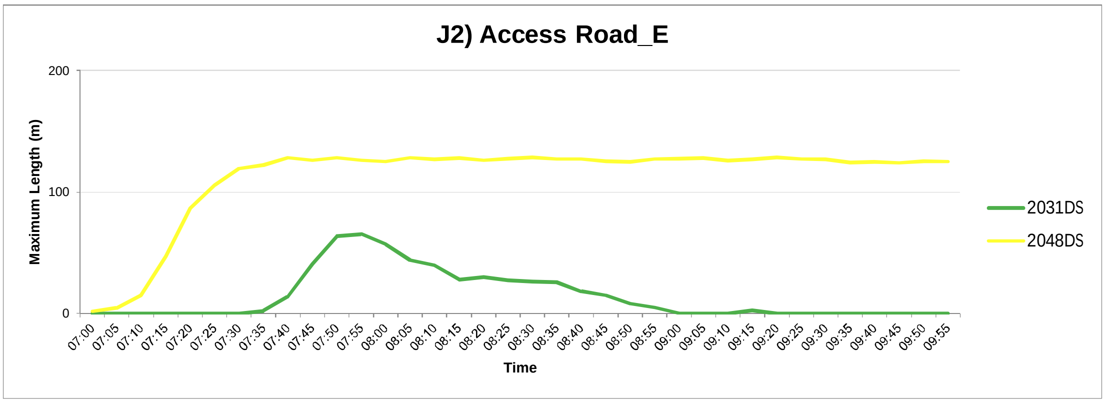

J1) M1 Offslip W (left turn)
Maximum Length (m)
Time
31DM
48DM
2031DS
2048DS

wsp	**Comparison Graphs** **AM** **J2**



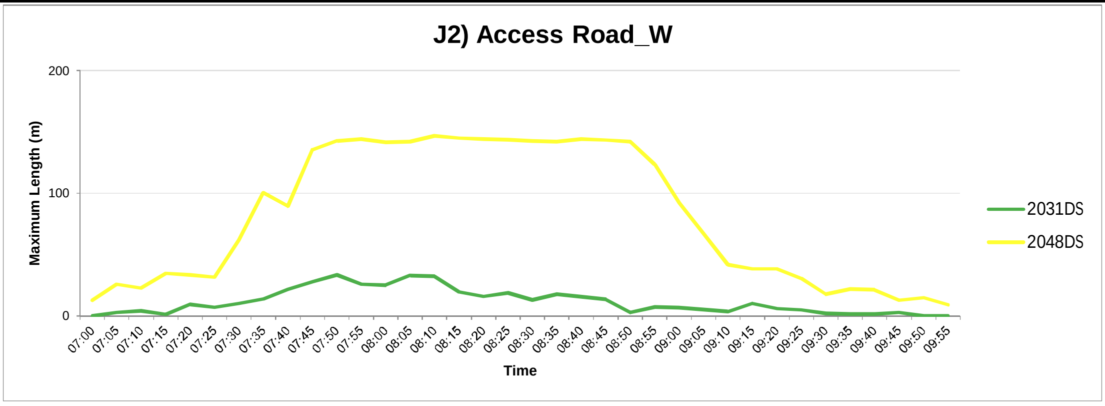






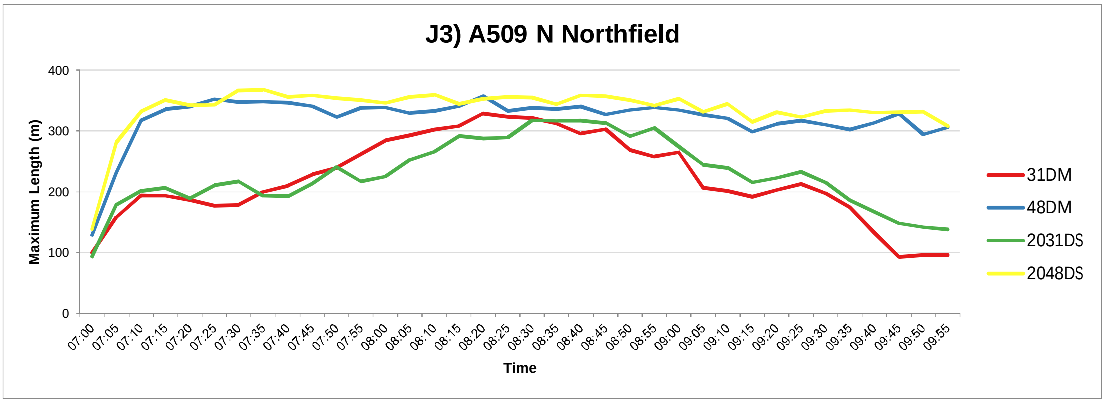
Comparison Graphs
AM

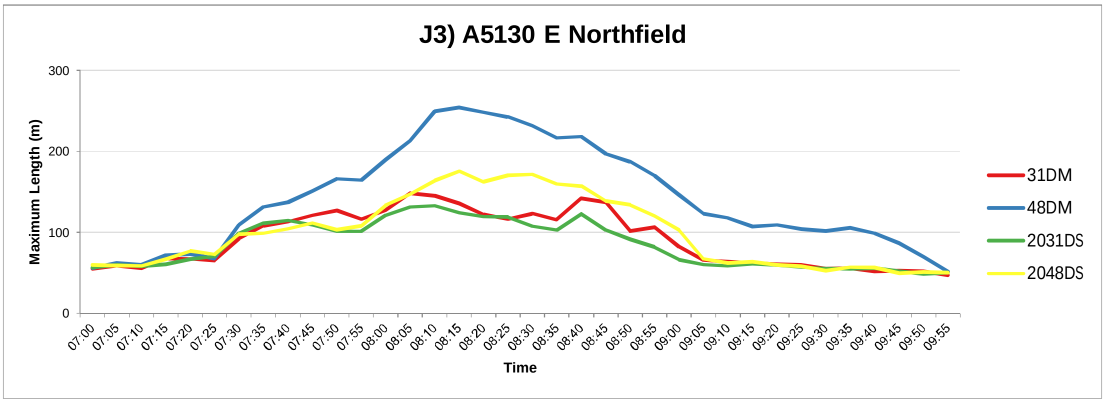
J2

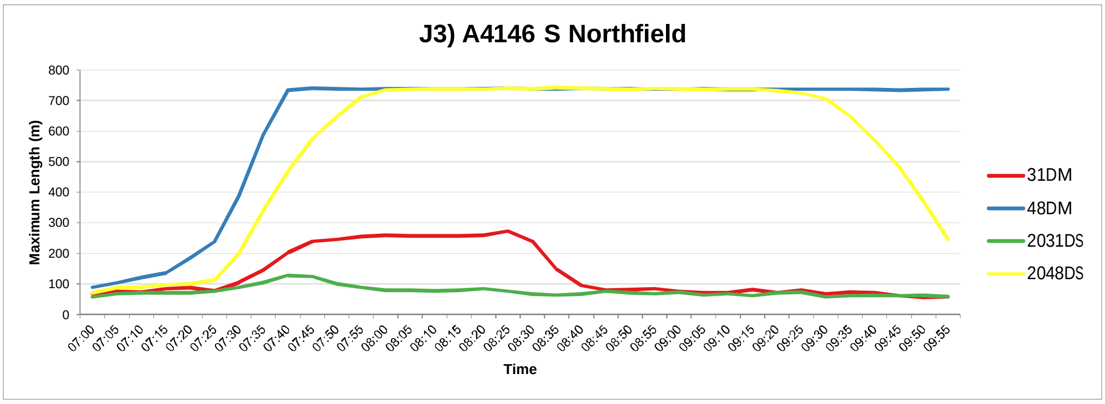


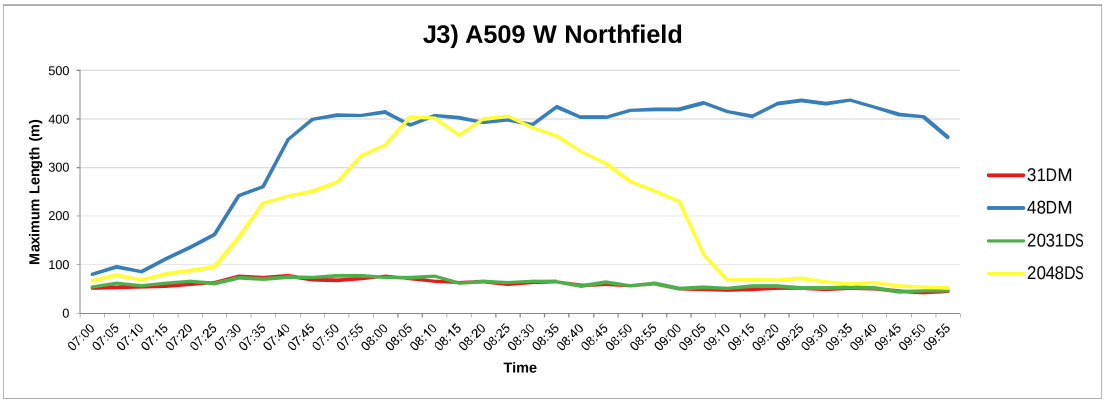
Comparison Graphs
AM

J3



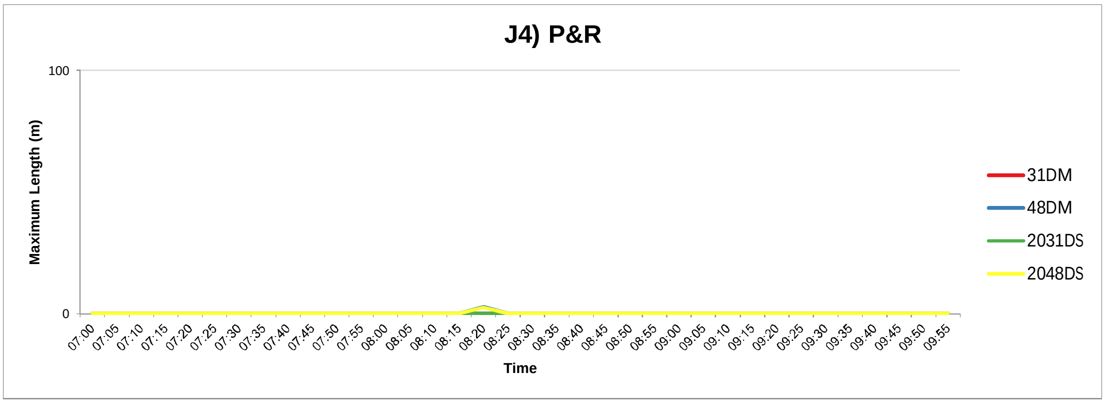






Comparison Graphs
AM

J4



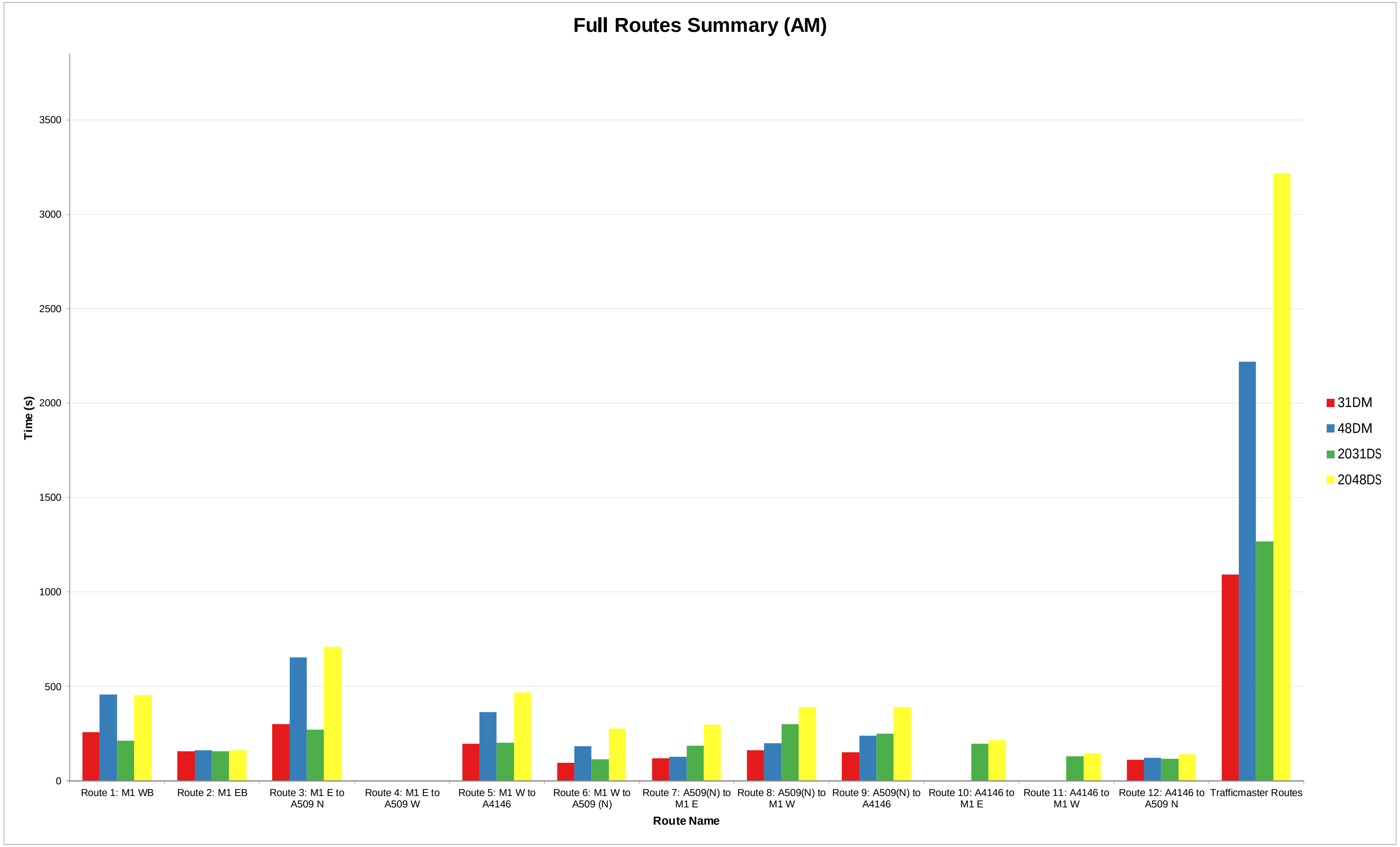
Queue Comparison
AM
Maximum Length Summary
Maximum Length (m)

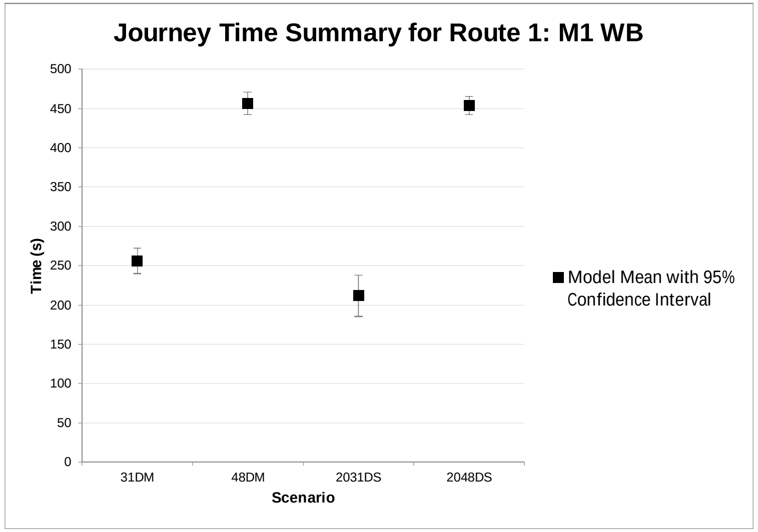
	31DM	48DM	2031DS	2048DS
J1)A509 N M1J14	126.3	145.7	411.5	485.7
J1) M1 Offslip E (right turn)	21.8	10.5	40.7	19.4
J1) A509 S M1J14	126.6	116.9	113.5	132.0
J1) M1 Offslip W (right turn)	108.1	277.0	110.3	280.8
J1) M1 Offslip E (left turn)	753.0	1608.1	606.3	2417.6
J1) M1 Offslip W (left turn)	0.0	0.0	0.0	0.0
J2) newport Road	125.6	303.5		
J2) A509 S	23.1	28.1	6.3	24.3
J2) A509 N	35.7	78.0	150.0	371.5
J2) Access Road_E			65.4	128.5
J2) Access Road_W			33.3	146.7
J3) A509 N Northfield	328.7	357.4	317.6	367.7
J3) A5130 E Northfield	148.3	254.4	132.8	175.3
J3) A4146 S Northfield	272.9	741.1	128.2	742.1
J3) A509 W Northfield	77.4	438.7	77.6	406.2
J4) P&R	0.0	2.8	0.0	2.6

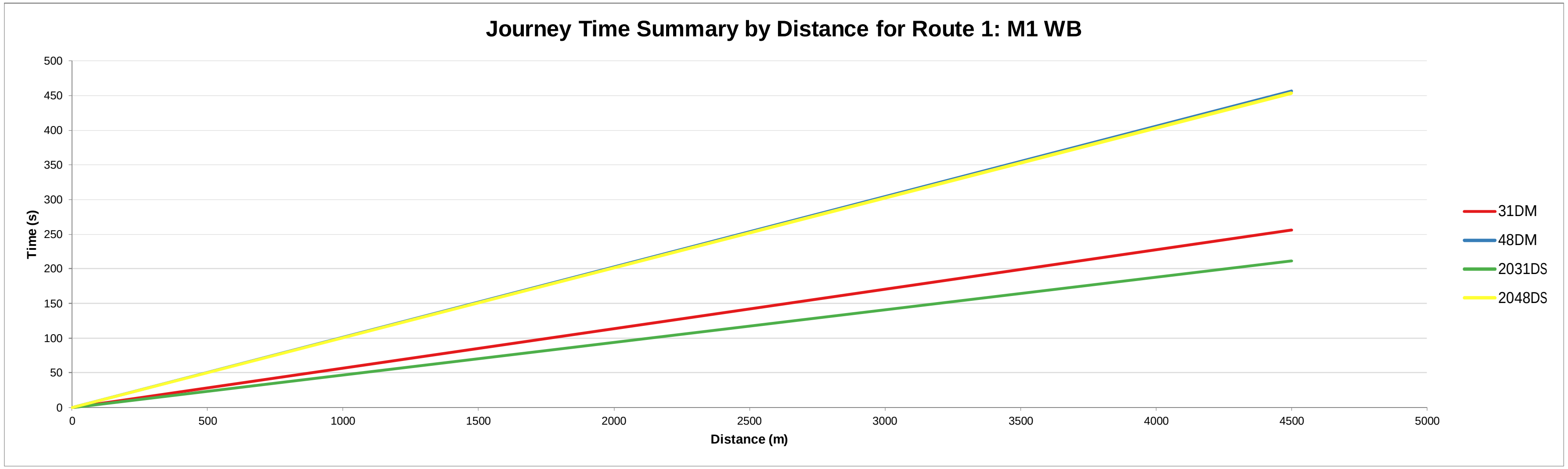
Queue Comparison
AM
Average Length Summary
Maximum Length (m)

	31DM	48DM	2031DS	2048DS
J1)A509 N M1J14	75.1	121.5	199.2	450.6
J1) M1 Offslip E (right turn)	7.9	4.3	17.1	9.6
J1) A509 S M1J14	101.1	100.5	95.7	119.2
J1) M1 Offslip W (right turn)	68.2	190.6	72.9	250.0
J1) M1 Offslip E (left turn)	129.3	984.2	124.6	1389.3
J1) M1 Offslip W (left turn)	0.0	0.0	0.0	0.0
J2) newport Road	37.4	253.3		
J2) A509 S	11.1	18.2	1.6	15.4
J2) A509 N	9.3	40.2	42.4	344.5
J2) Access Road_E			14.2	112.4
J2) Access Road_W			11.5	81.7
J3) A509 N Northfield	222.0	321.1	229.2	336.9
J3) A5130 E Northfield	91.1	141.4	84.6	99.5
J3) A4146 S Northfield	133.2	625.3	75.5	550.0
J3) A509 W Northfield	59.2	350.7	61.5	199.3
J4) P&R	0.0	0.1	0.0	0.1

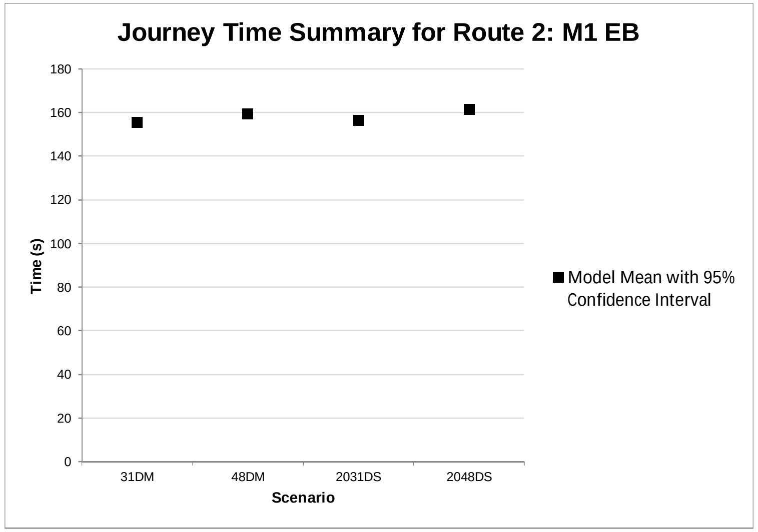
Journey Time Comparison Graphs
AM
07:00 - 10:00
Core

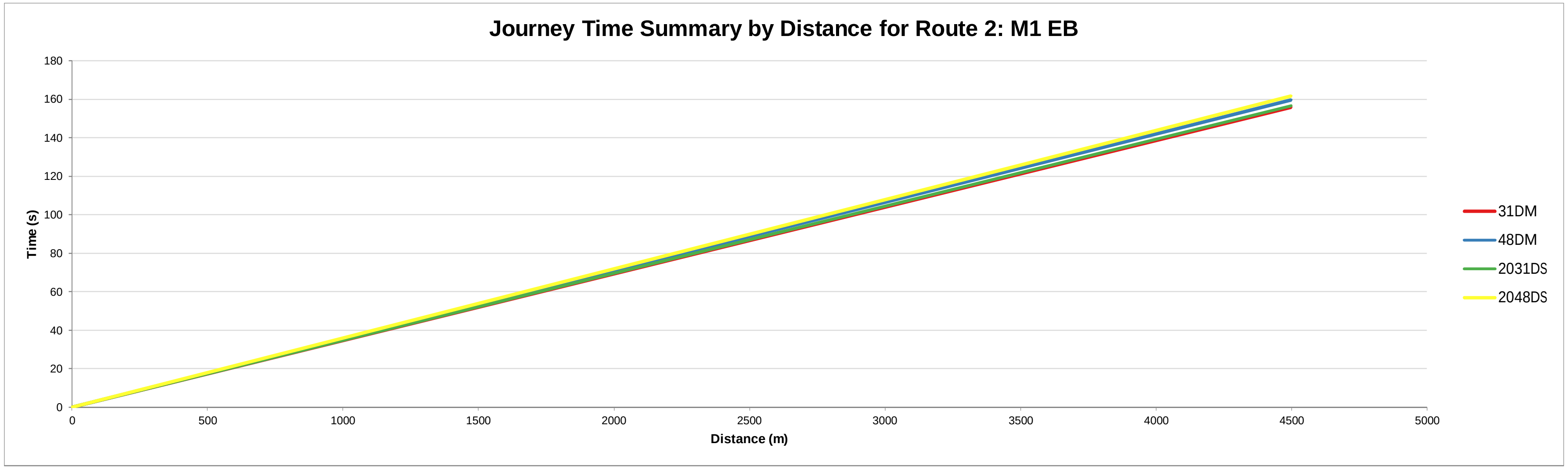


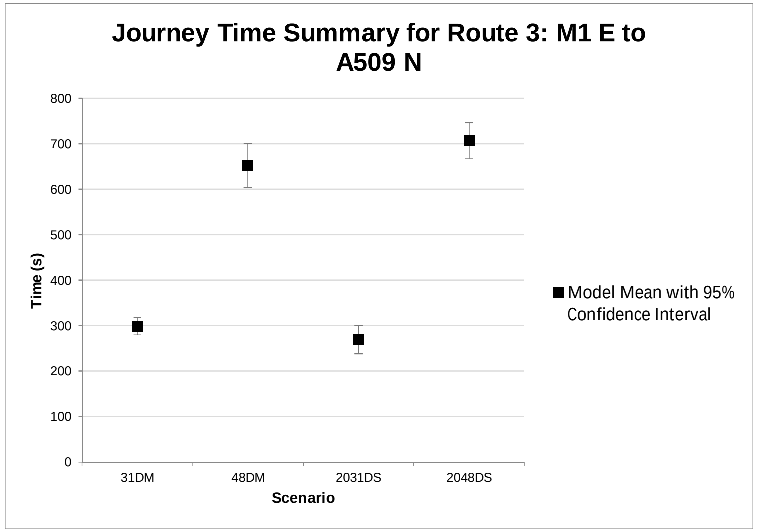

Journey Time Summary for Route 1: M1 WB
Time (s)
Scenario
31DM
48DM
2031DS
2048DS
Model Mean with 95% Confidence Interval

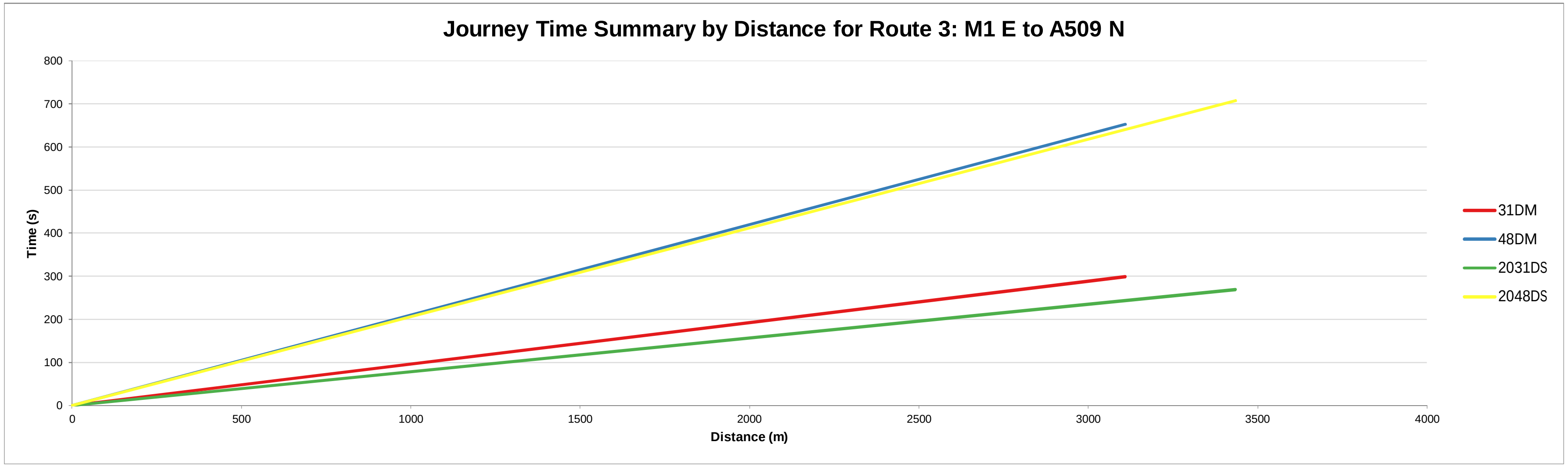

Journey Time Summary by Distance for Route 1: M1 WB
Time (s)
Distance (m)
31DM
48DM
2031DS
2048DS

Journey Time Comparison Graphs
AM
07:00 - 10:00
Core

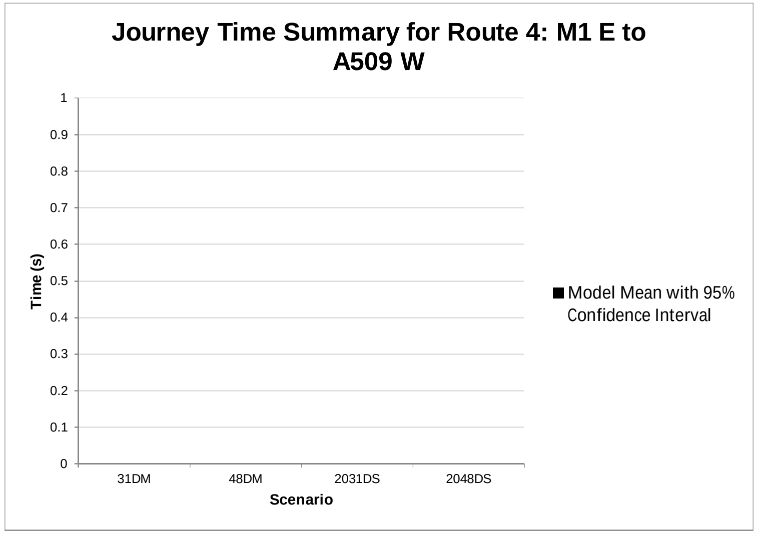


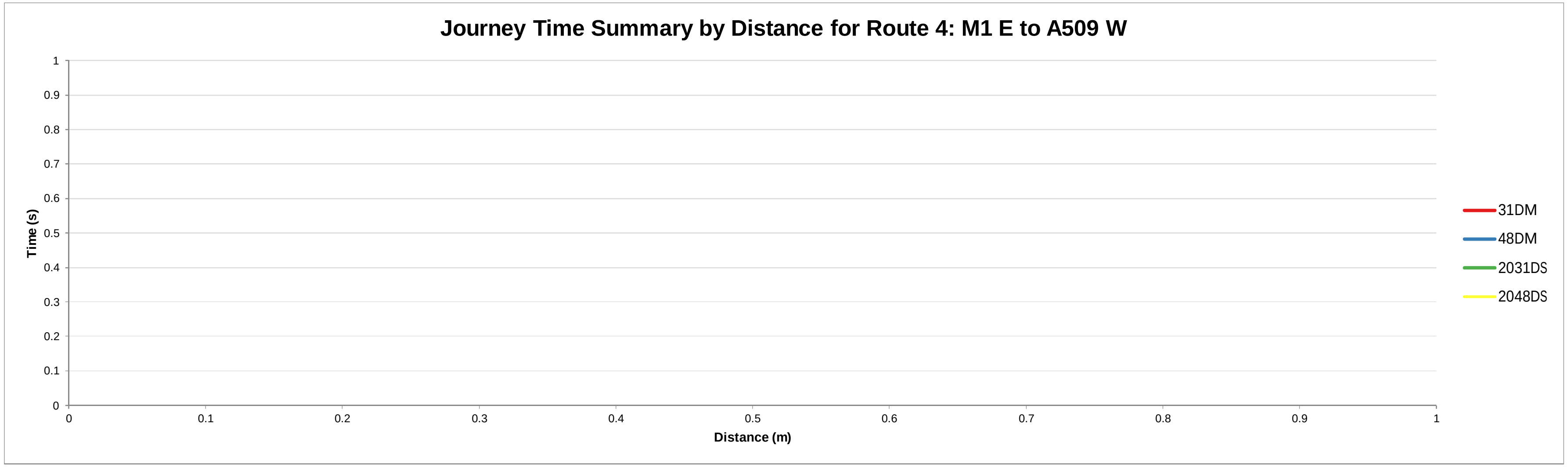



Journey Time Summary for Route 3: M1 E to A509 N
Time (s)
800
700
600
500
400
300
200
100
0
31DM
48DM
2031DS
2048DS
Scenario
Model Mean with 95% Confidence Interval

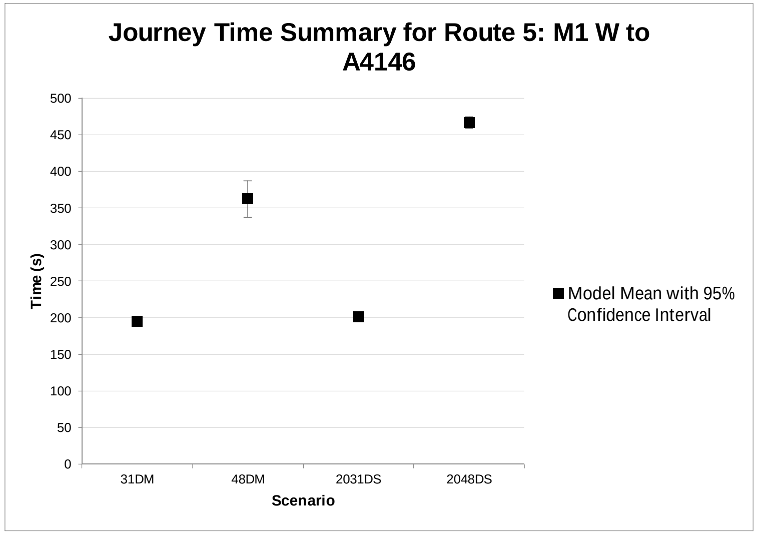

Journey Time Summary by Distance for Route 3: M1 E to A509 N
Time (s)
800
700
600
500
400
300
200
100
0
0
500
1000
1500
2000
2500
3000
3500
4000
Distance (m)
31DM
48DM
2031DS
2048DS

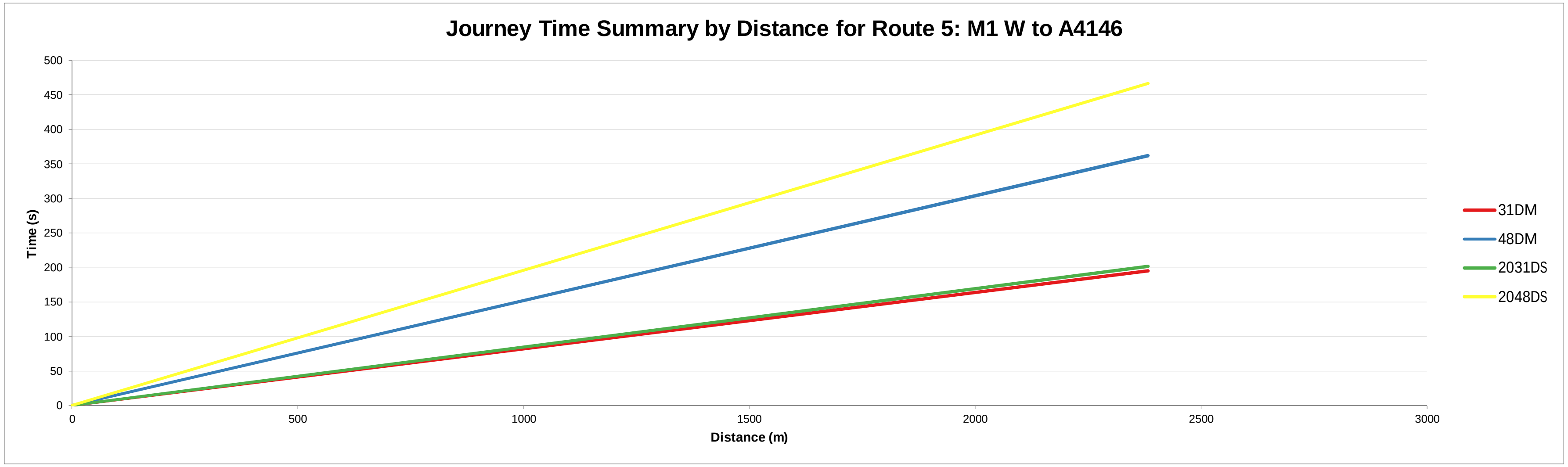
Journey Time Comparison Graphs
AM
07:00 - 10:00
Core

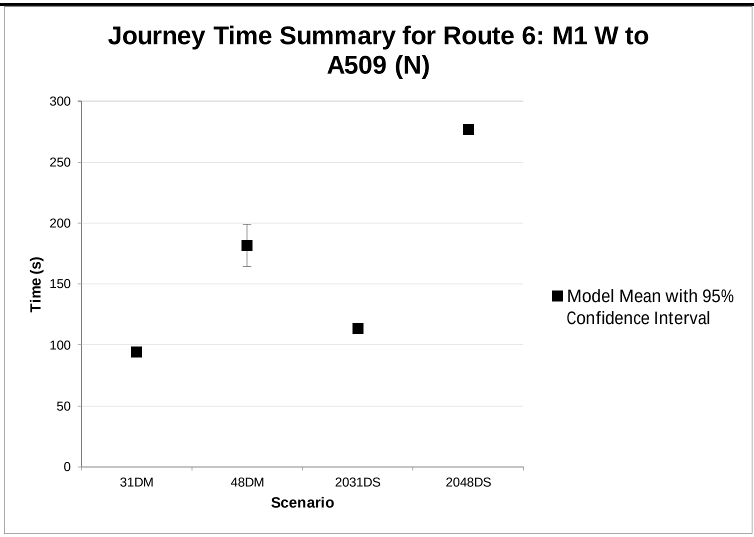


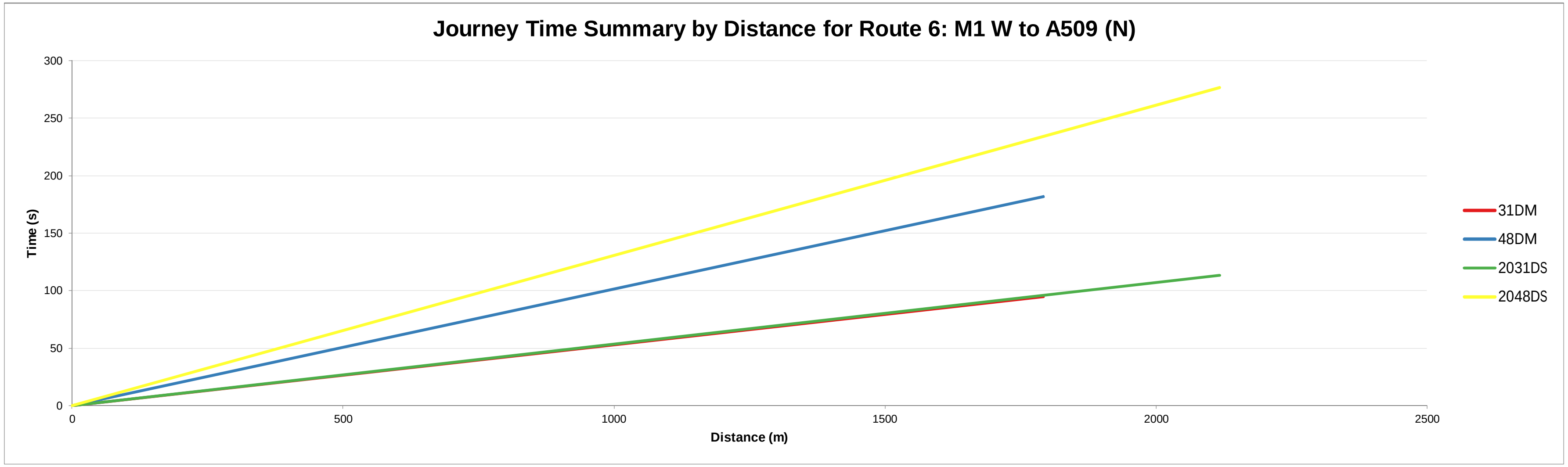


Journey Time Comparison Graphs
AM
07:00 - 10:00
Core

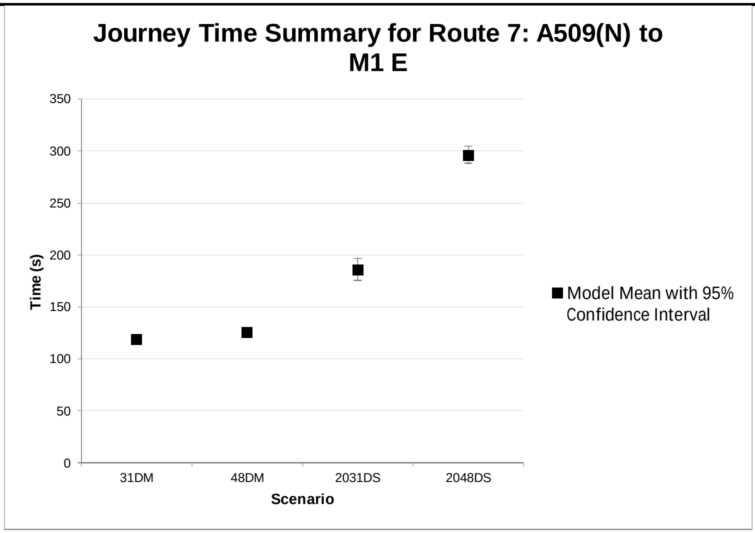


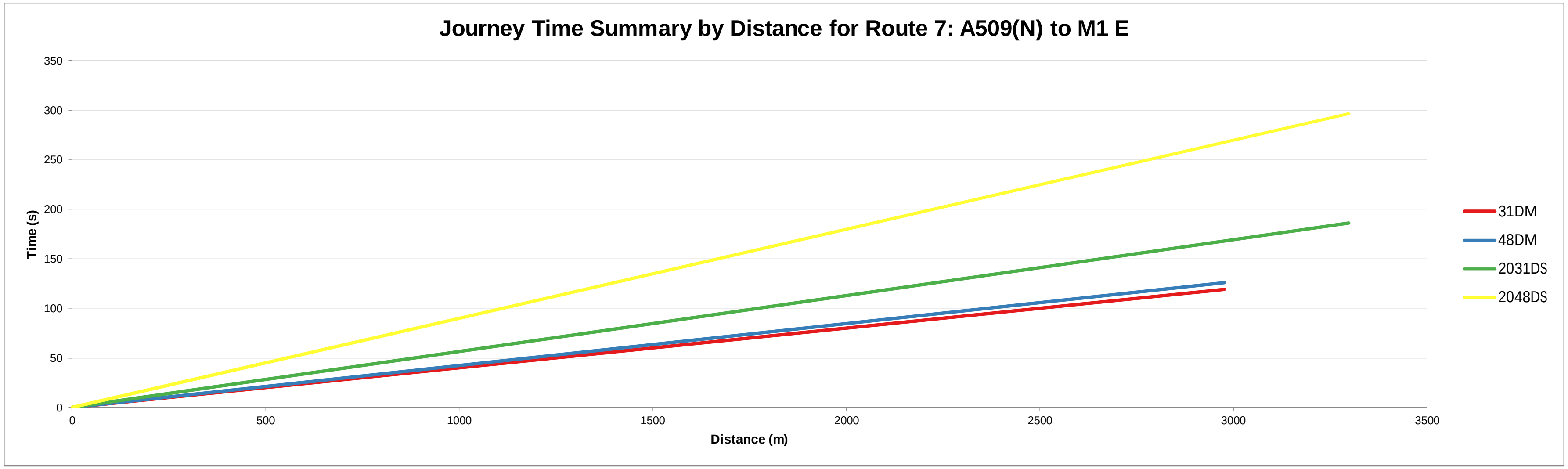



Journey Time Summary for Route 6: M1 W to A509 (N)
300
250
200
150
100
50
0
Time (s)
31DM
48DM
2031DS
2048DS
Scenario
Model Mean with 95% Confidence Interval

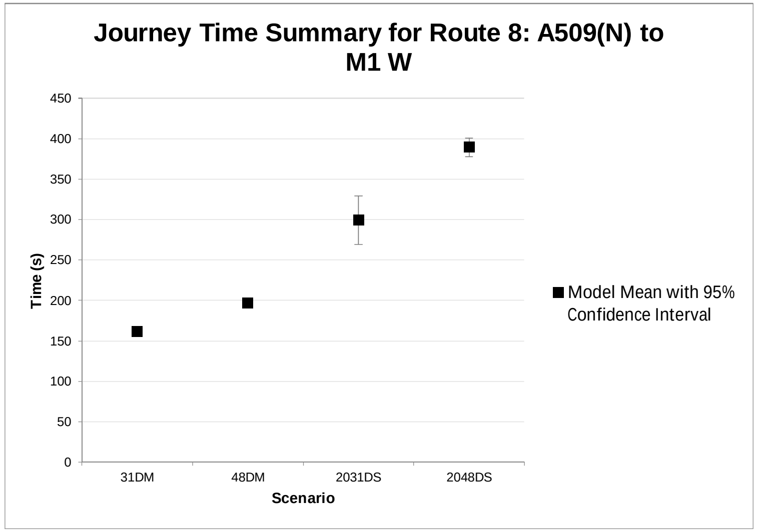

Journey Time Summary by Distance for Route 6: M1 W to A509 (N)
300
250
200
150
100
50
0
Time (s)
0
500
1000
1500
2000
2500
Distance (m)
31DM
48DM
2031DS
2048DS

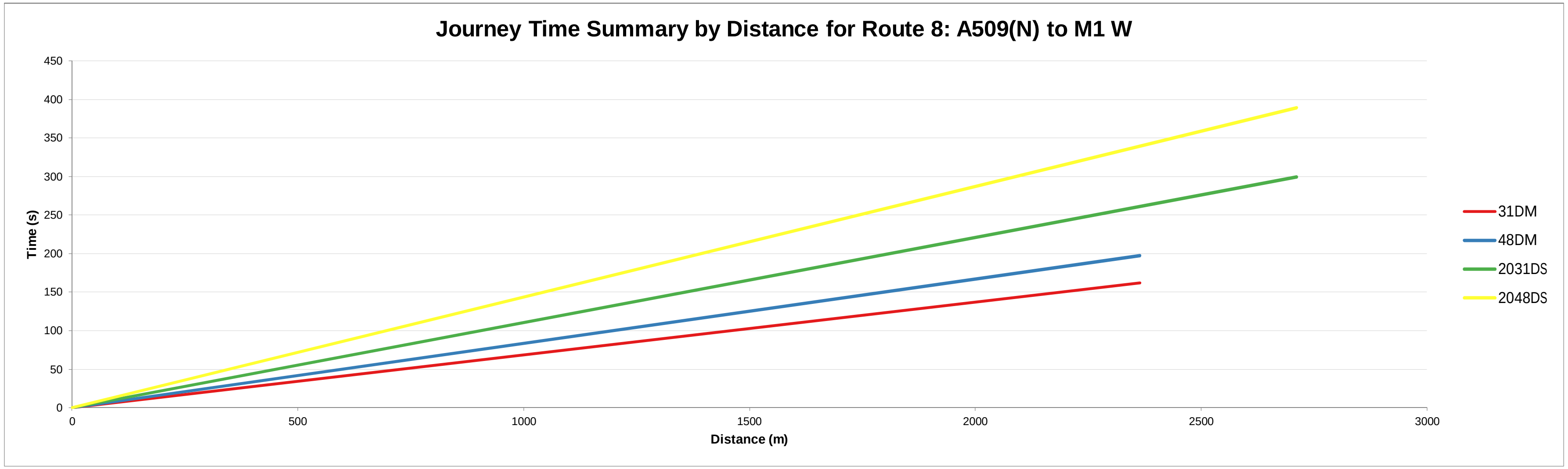
Journey Time Comparison Graphs
AM
07:00 - 10:00
Core



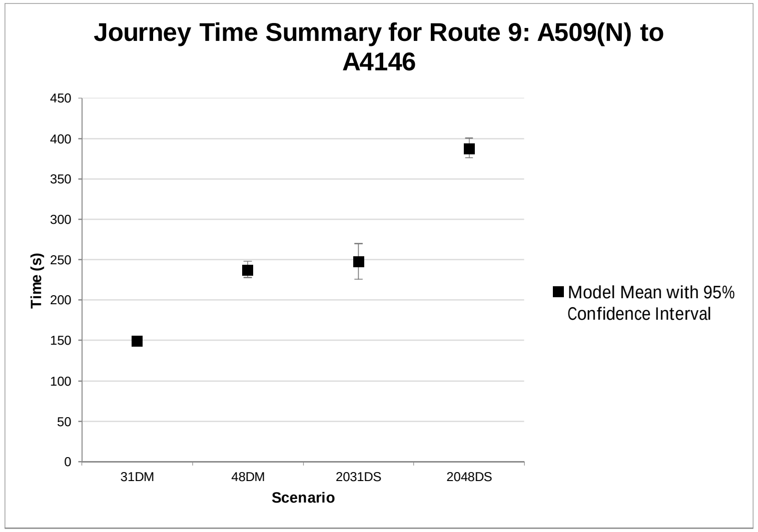


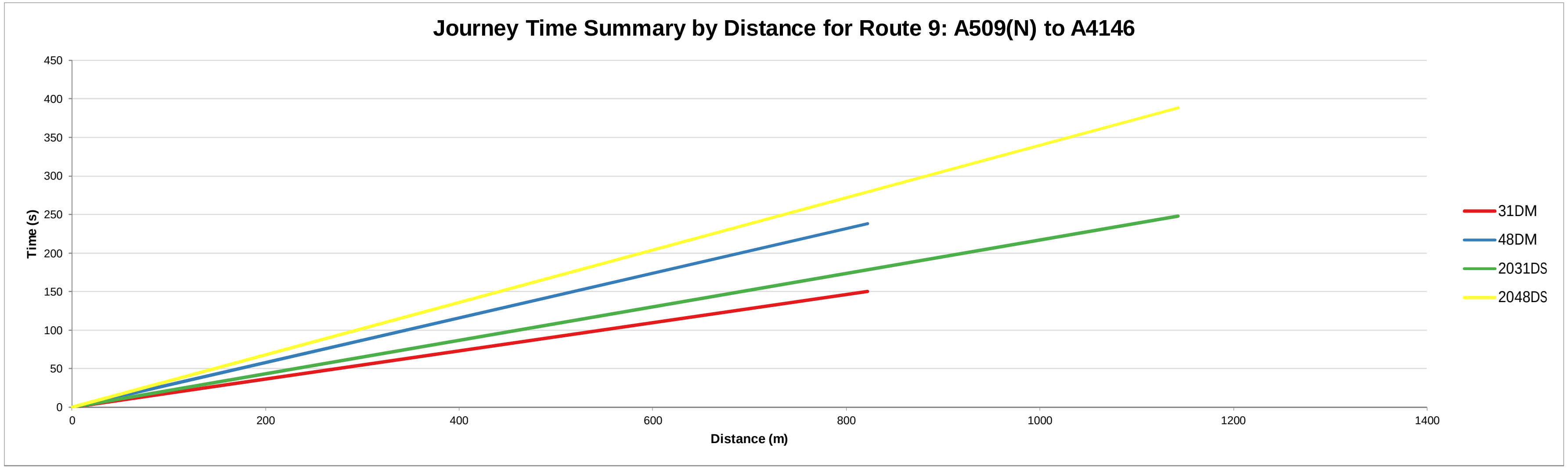
Journey Time Comparison Graphs
AM
07:00 - 10:00
Core



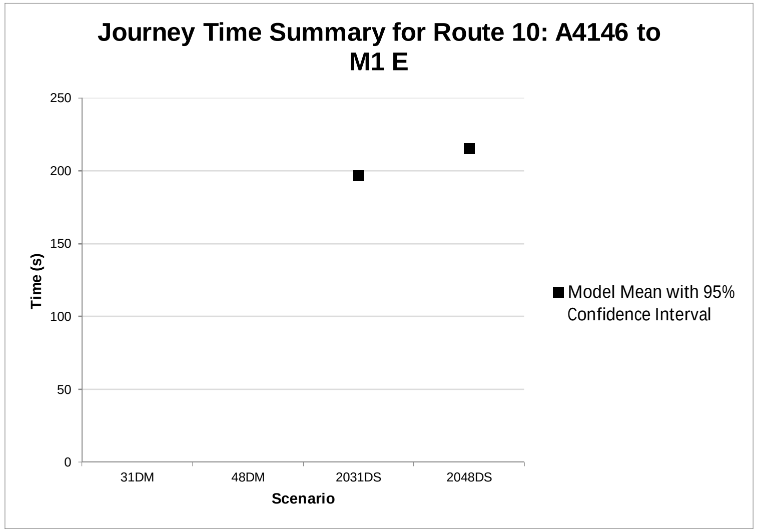


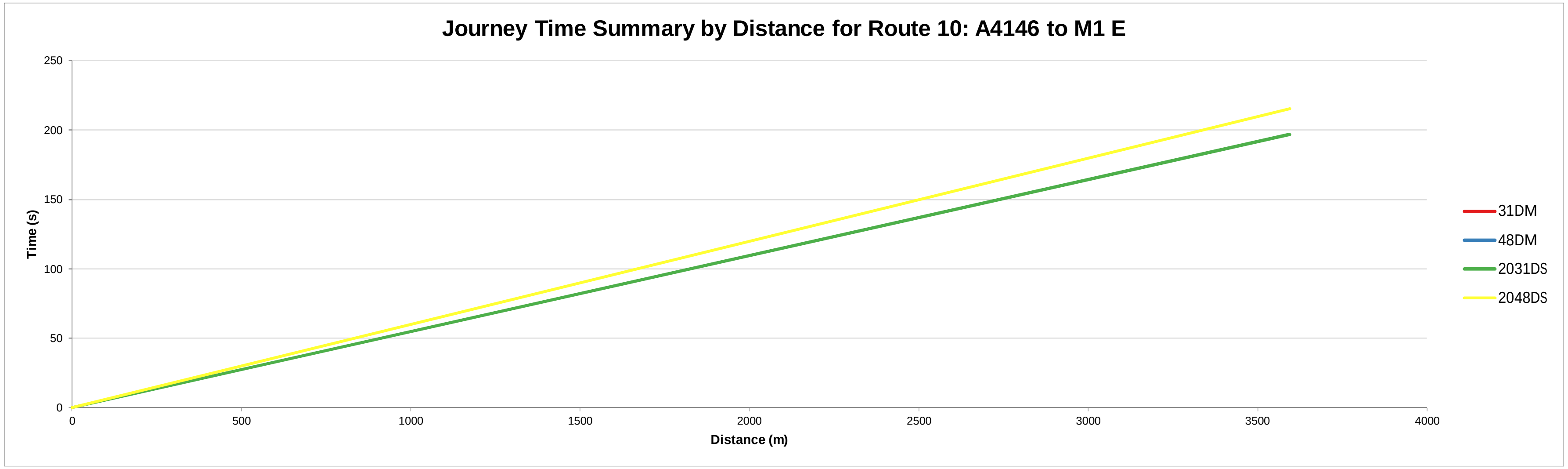
Journey Time Comparison Graphs
AM
07:00 - 10:00
Core



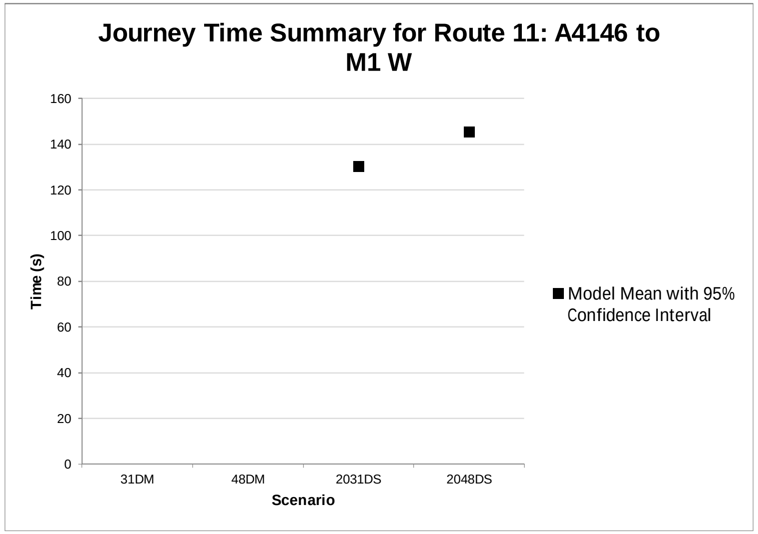


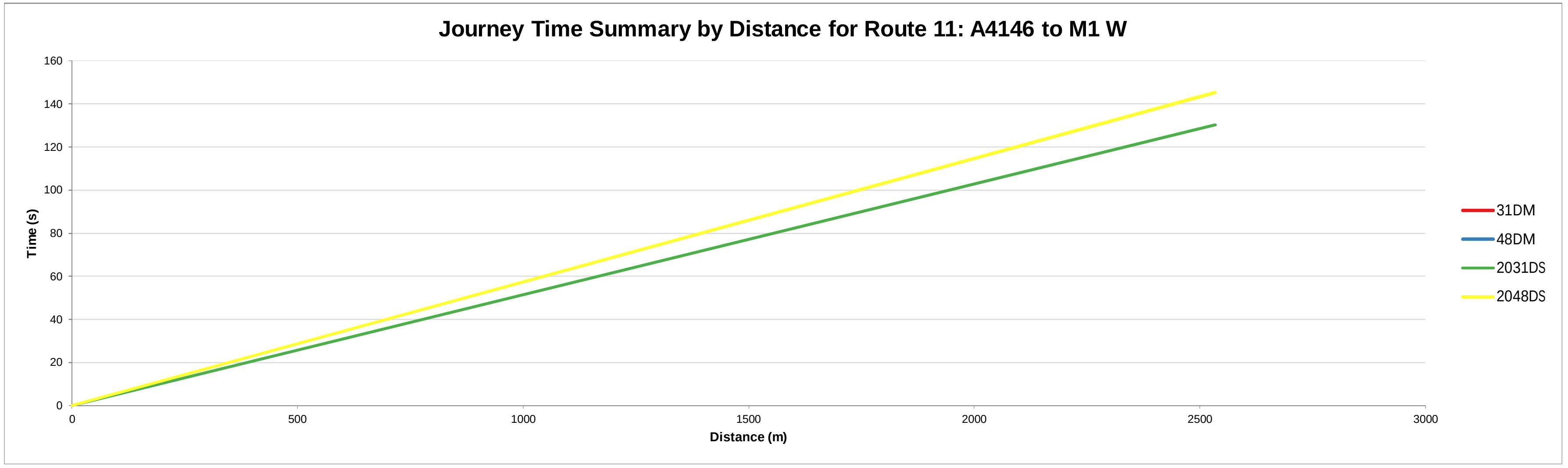
Journey Time Comparison Graphs
AM
07:00 - 10:00
Core

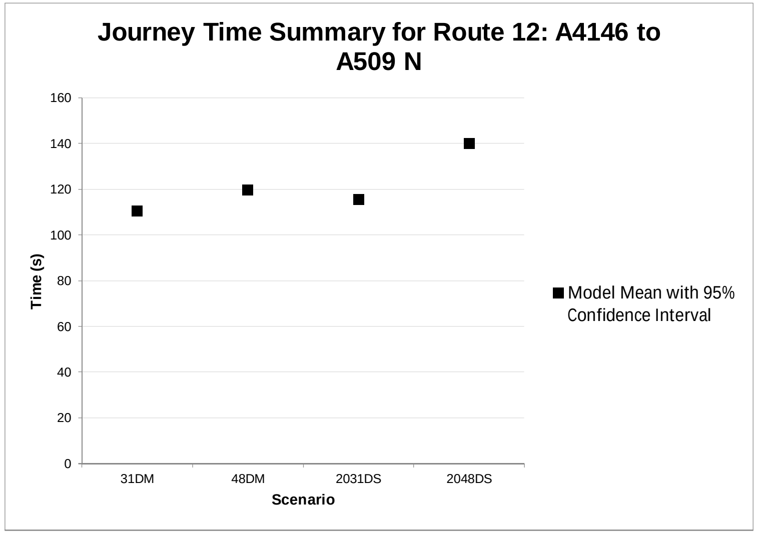




Journey Time Comparison Graphs
AM
07:00 - 10:00
Core



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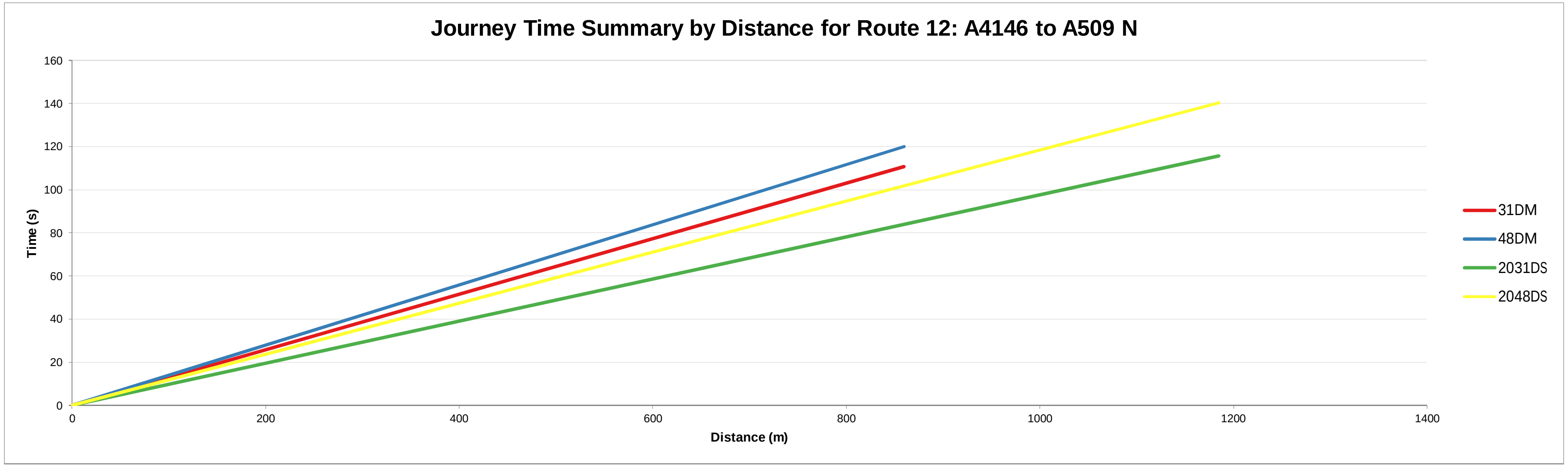
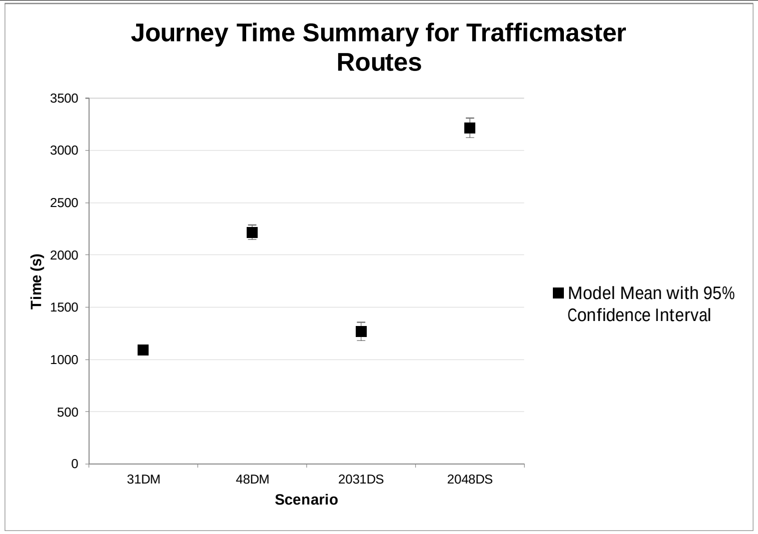
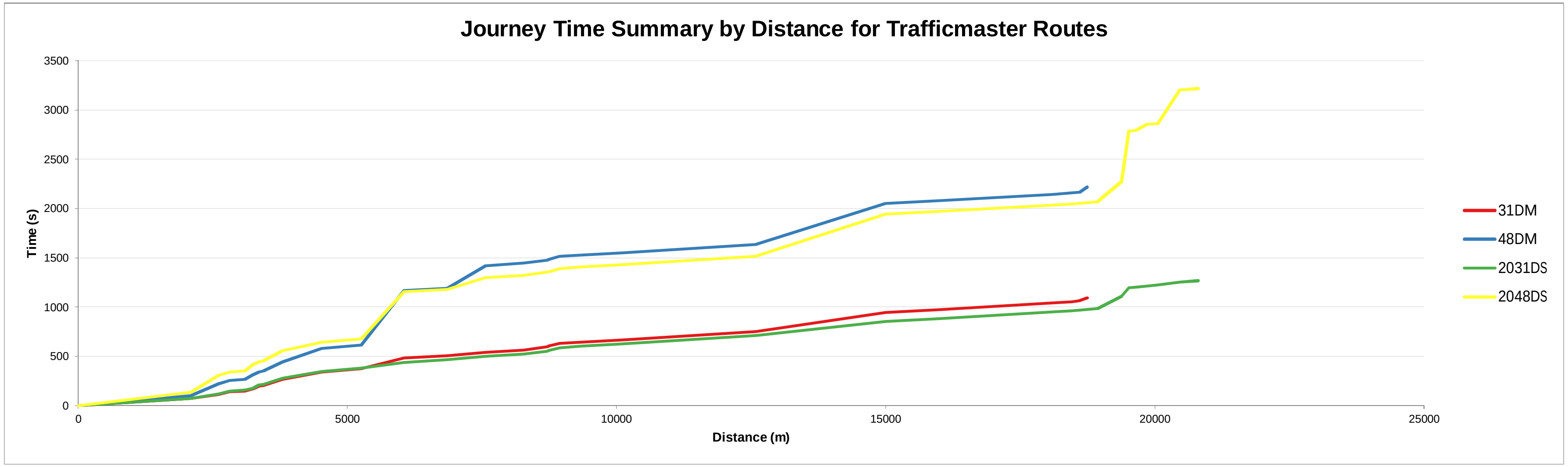
Time (s)
160
140
120
100
80
60
40
20
0
31DM
48DM
2031DS
2048DS
Scenario
Model Mean with 95% Confidence Interval

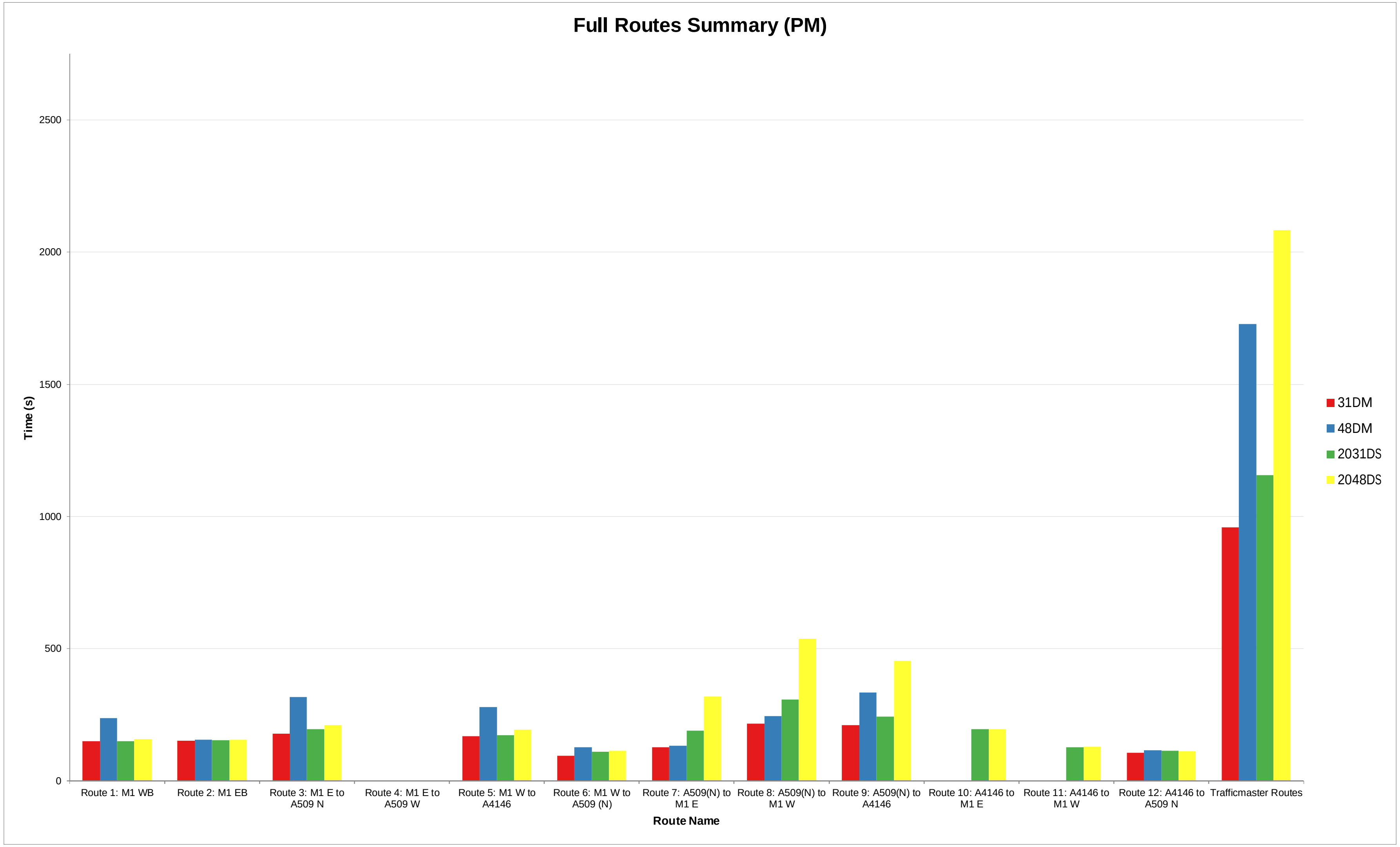

Journey Time Summary by Distance for Route 12: A4146 to A509 N
Time (s)
160
140
120
100
80
60
40
20
0
0
200
400
600
800
1000
1200
1400
Distance (m)
31DM
48DM
2031DS
2048DS

Journey Time Comparison Graphs
AM
07:00 - 10:00
Core

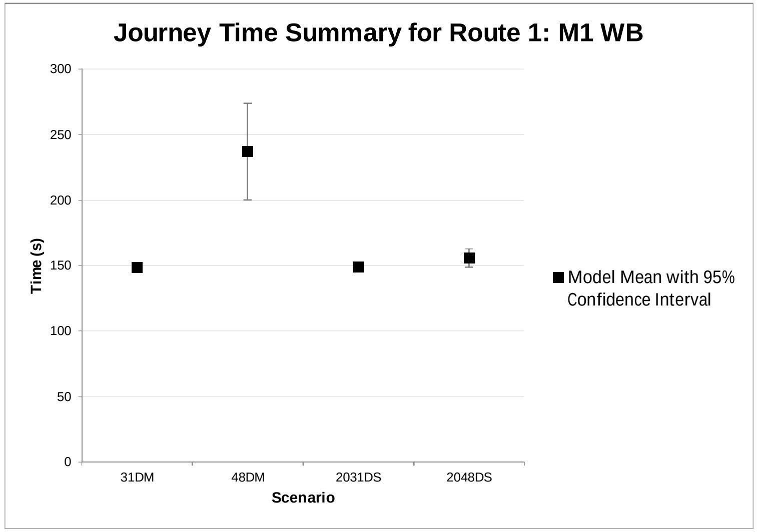


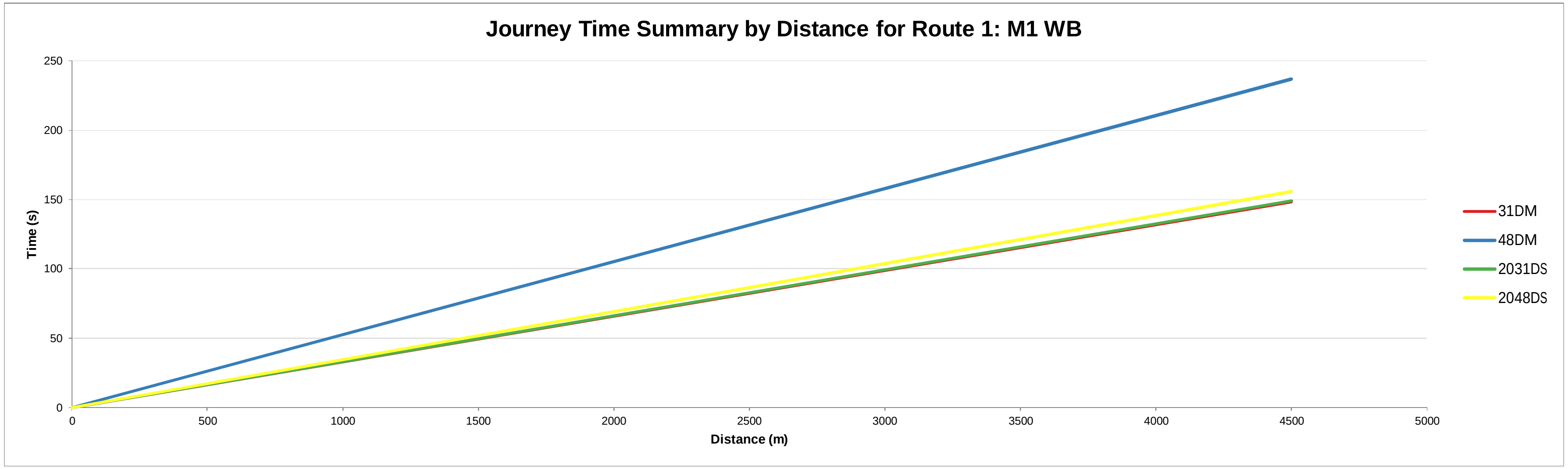


Journey Time Comparison Graphs
PM
16:00 - 19:00
Core

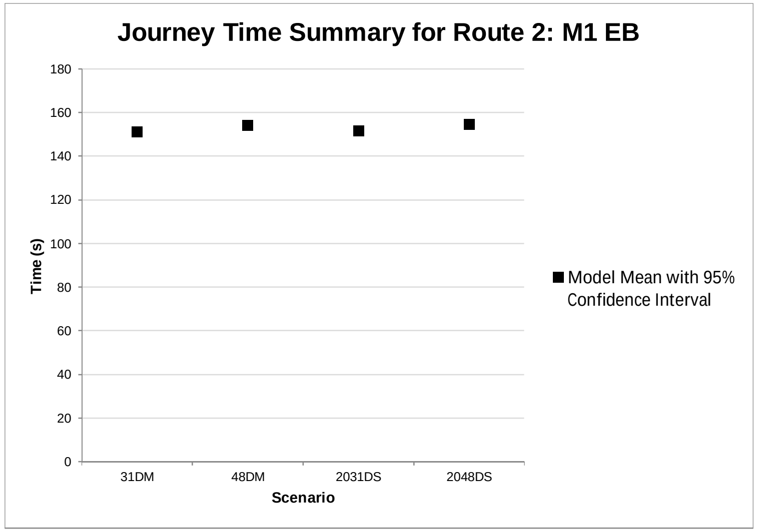


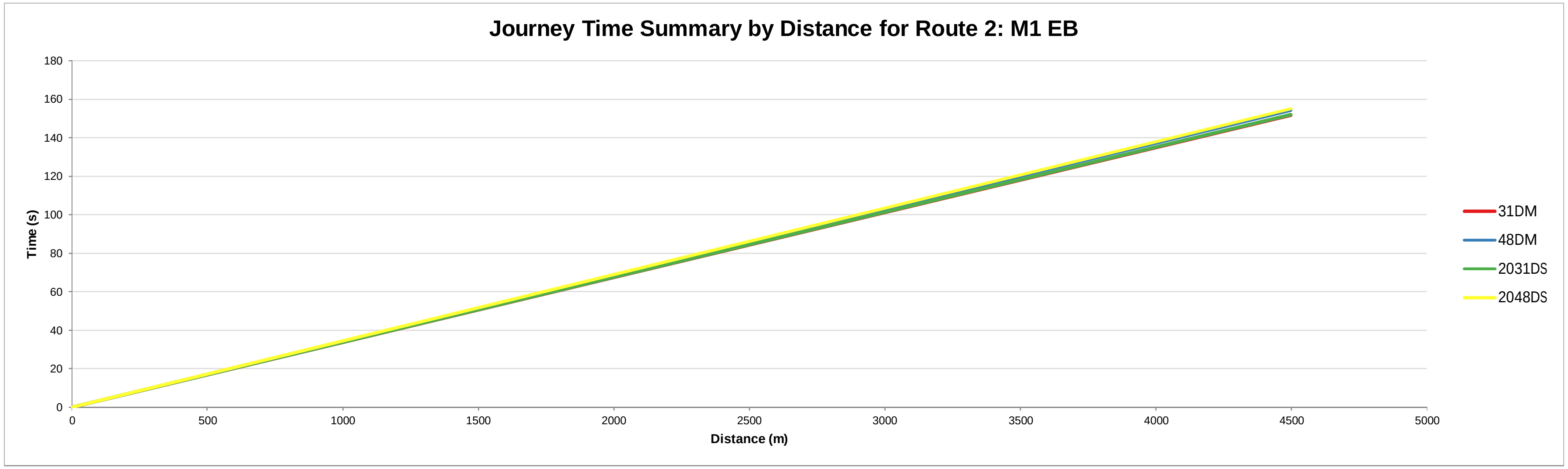
Journey Time Comparison Graphs
PM
16:00 - 19:00
Core



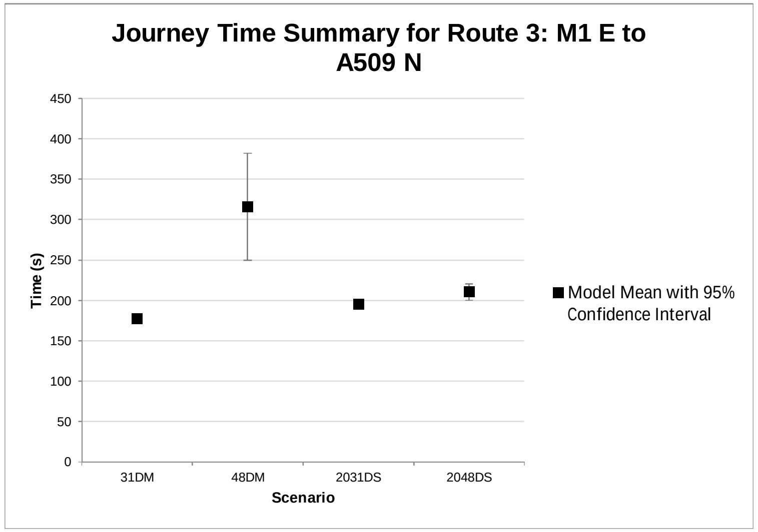


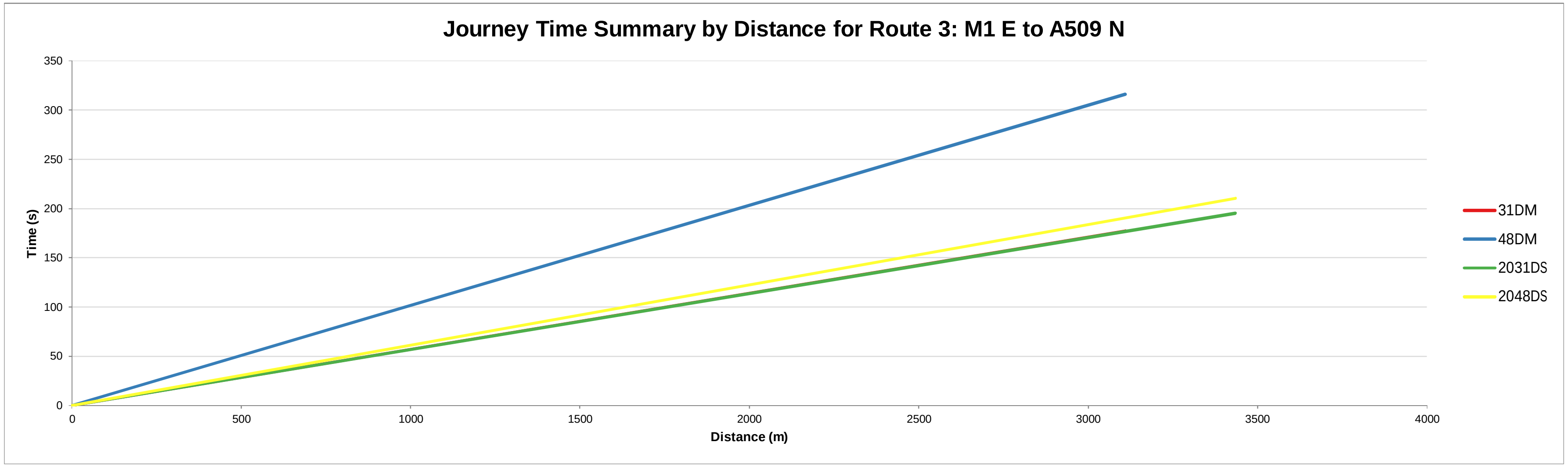
Journey Time Comparison Graphs
PM
16:00 - 19:00
Core



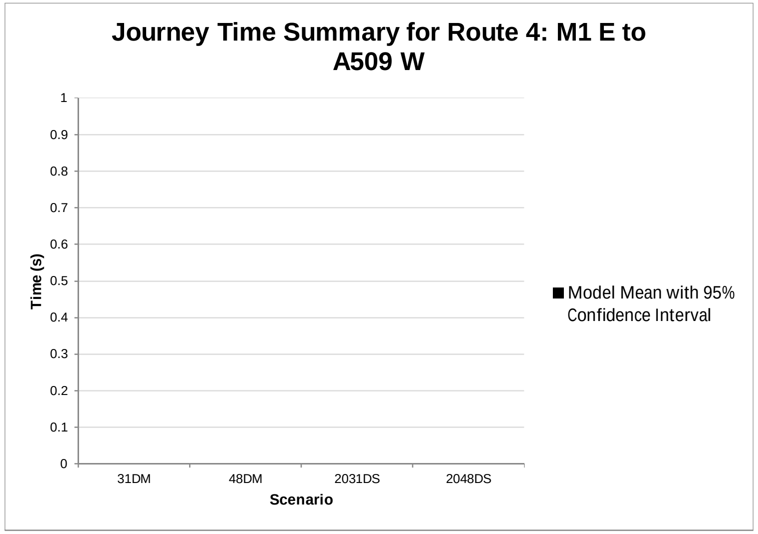


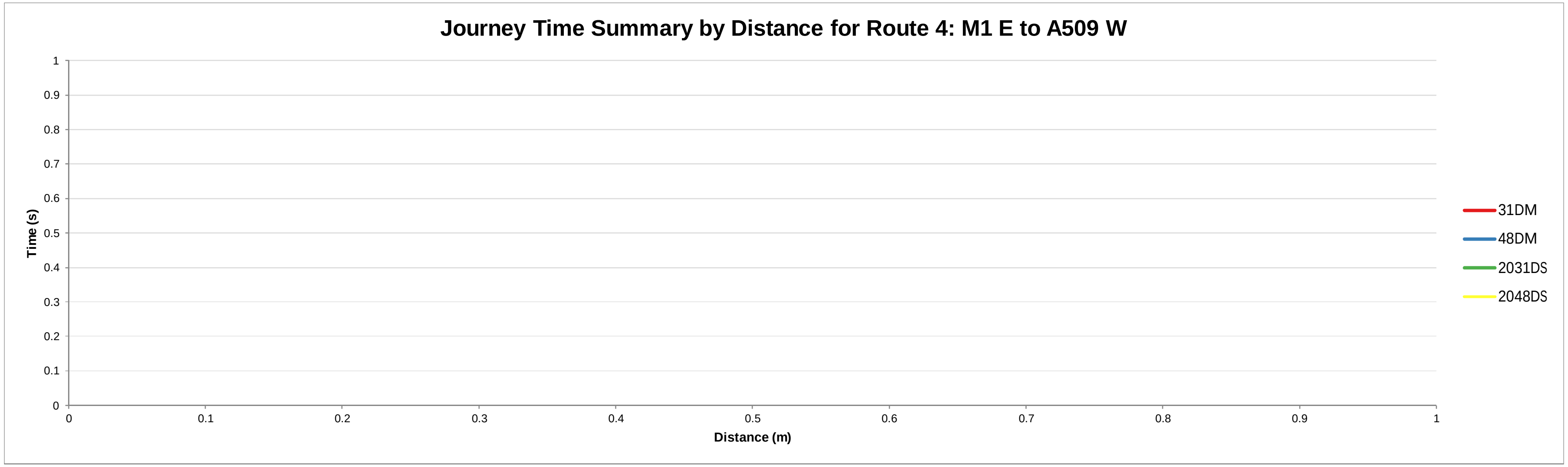
Journey Time Comparison Graphs
PM
16:00 - 19:00
Core



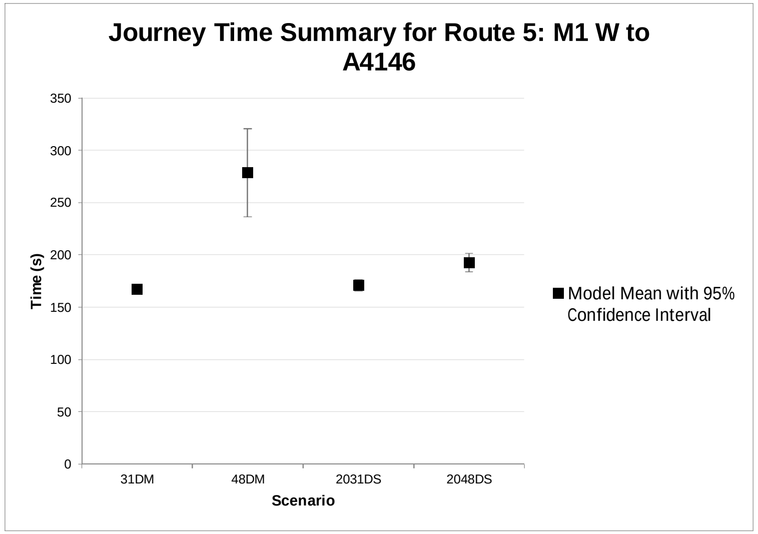


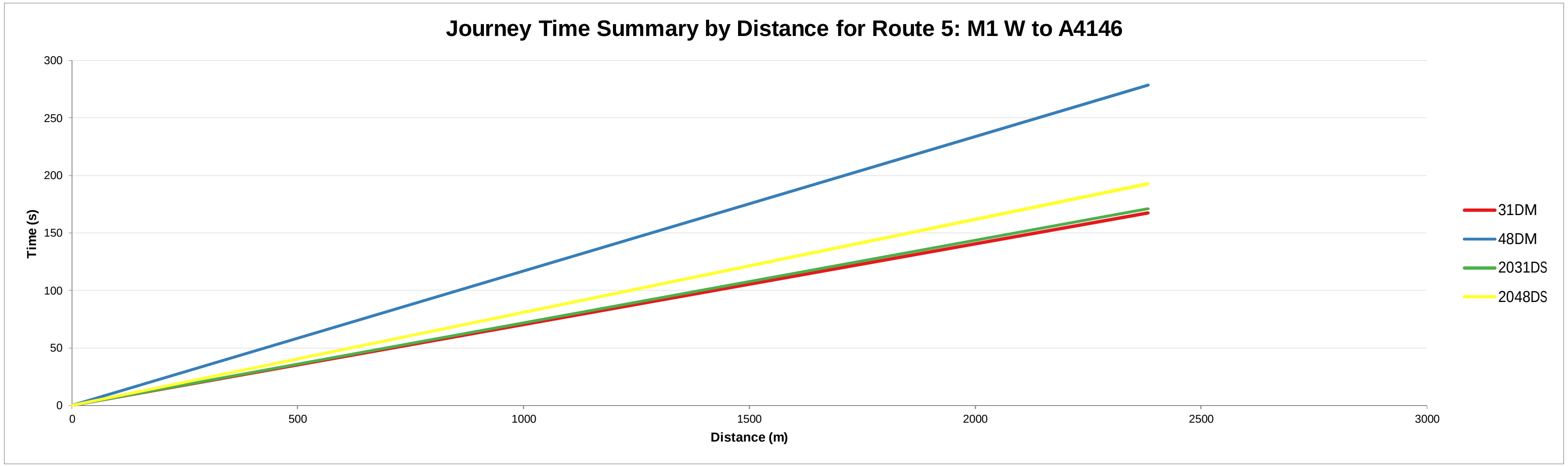
Journey Time Comparison Graphs
PM
16:00 - 19:00
Core



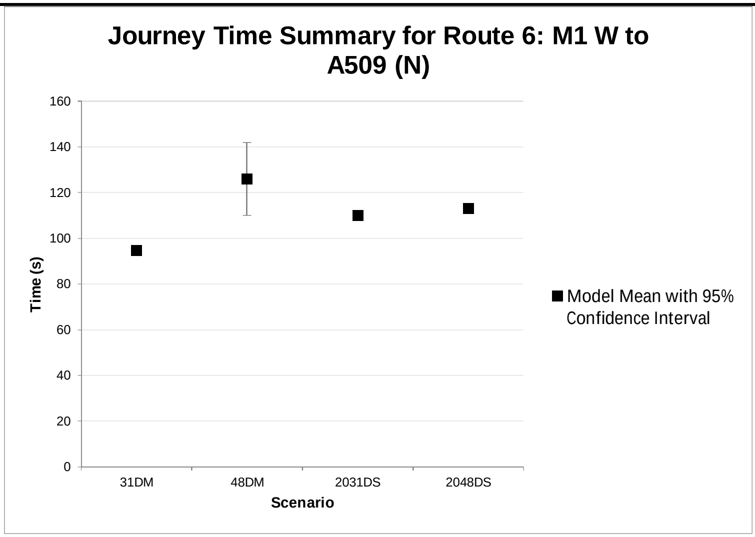


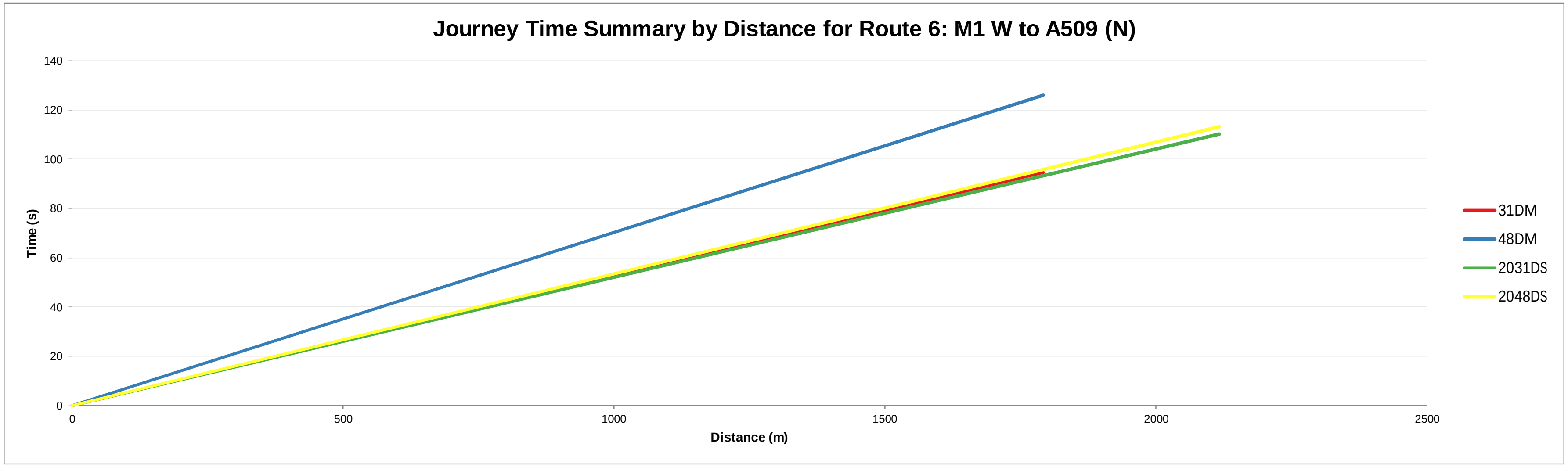
Journey Time Comparison Graphs
PM
16:00 - 19:00
Core



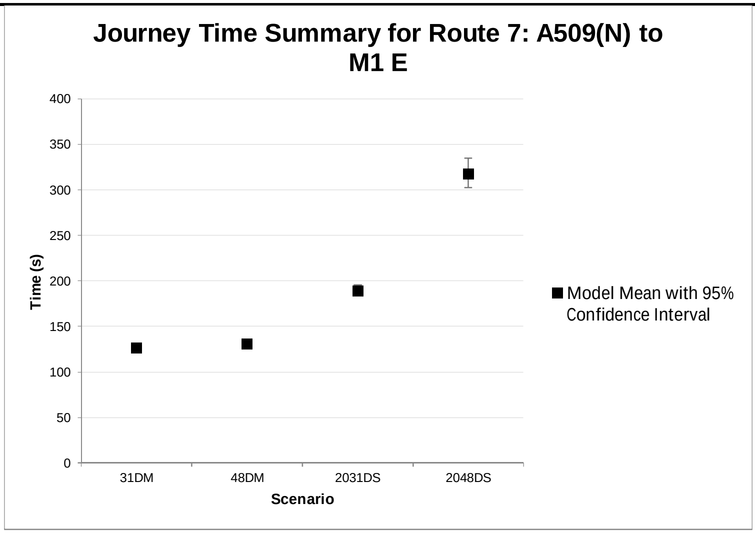


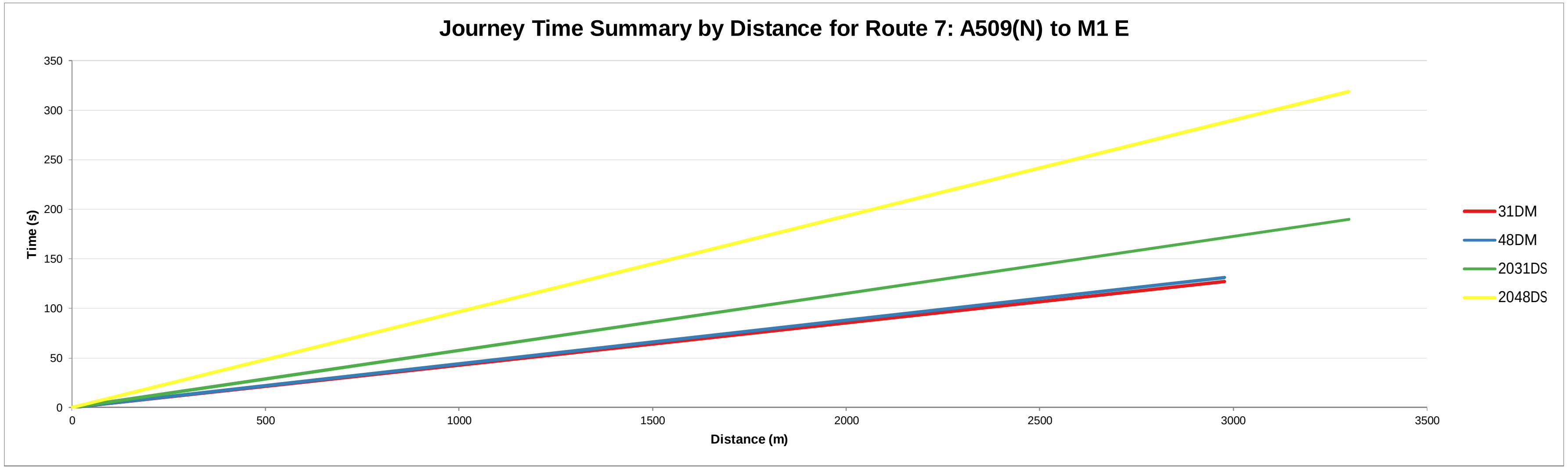
Journey Time Comparison Graphs
PM
16:00 - 19:00
Core



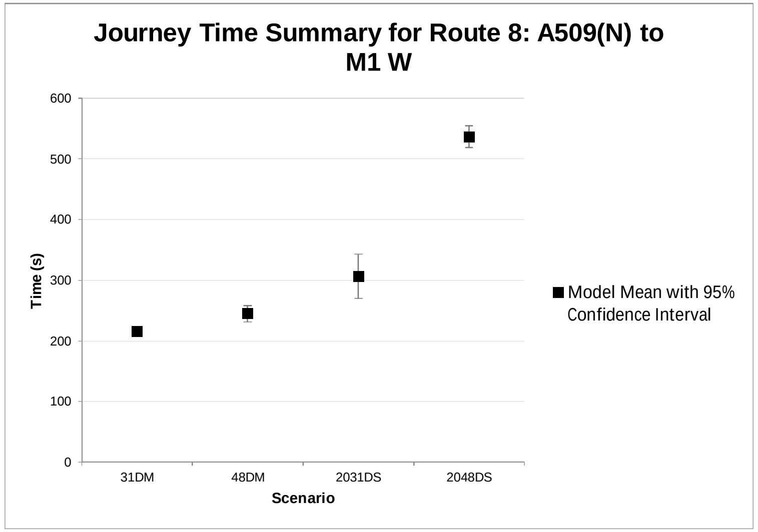


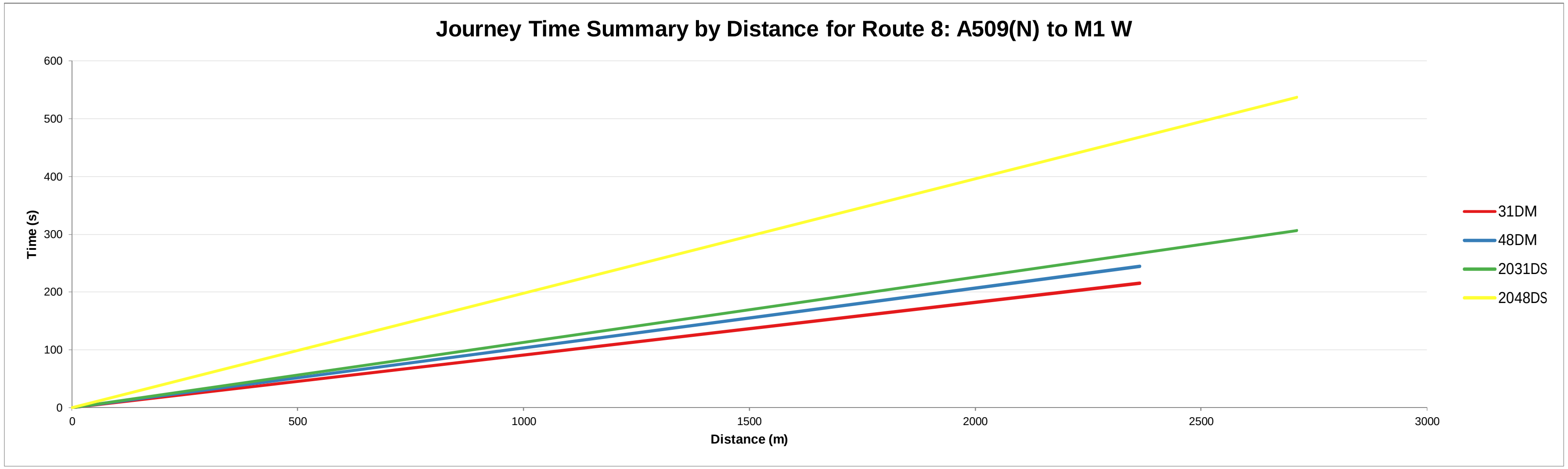
Journey Time Comparison Graphs
PM
16:00 - 19:00
Core



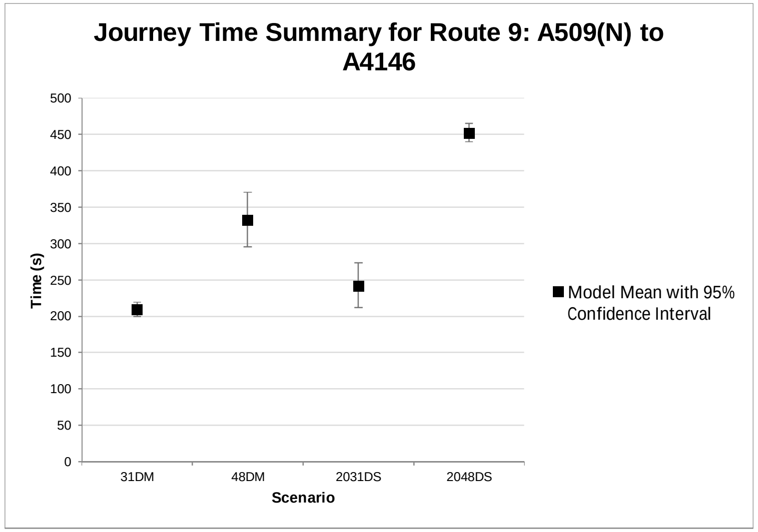


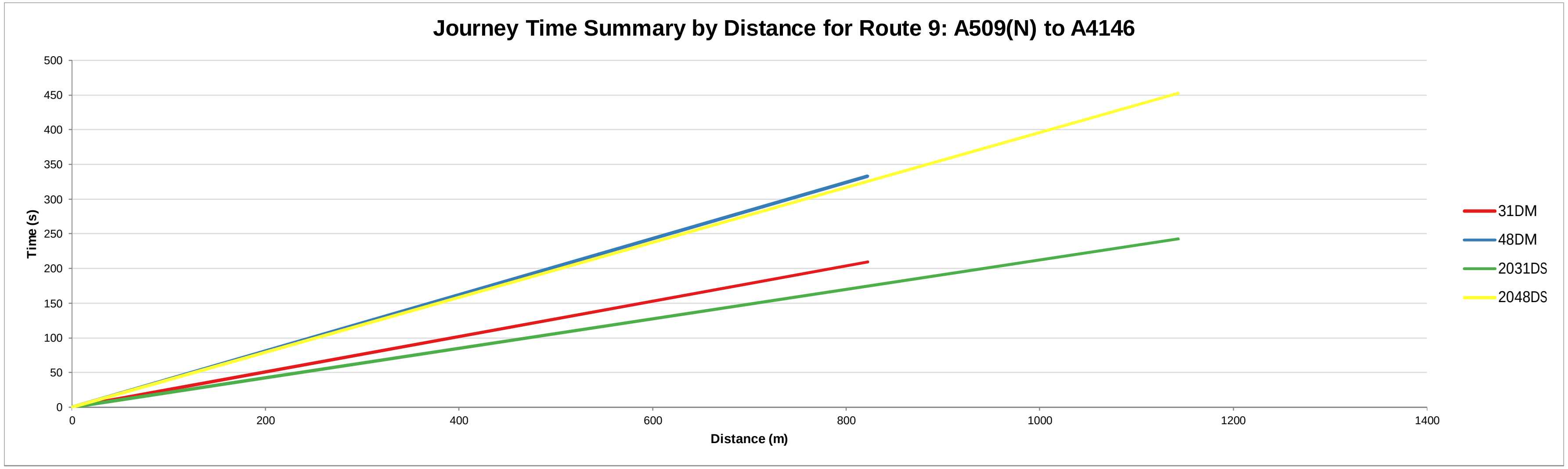
Journey Time Comparison Graphs
PM
16:00 - 19:00
Core



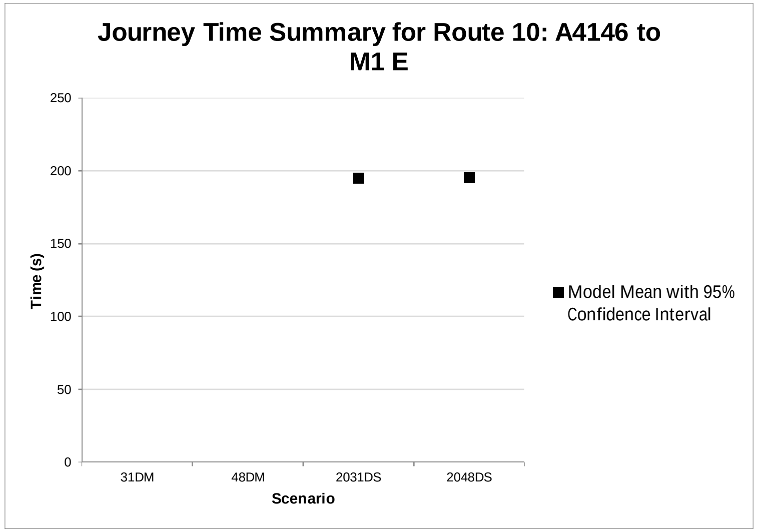


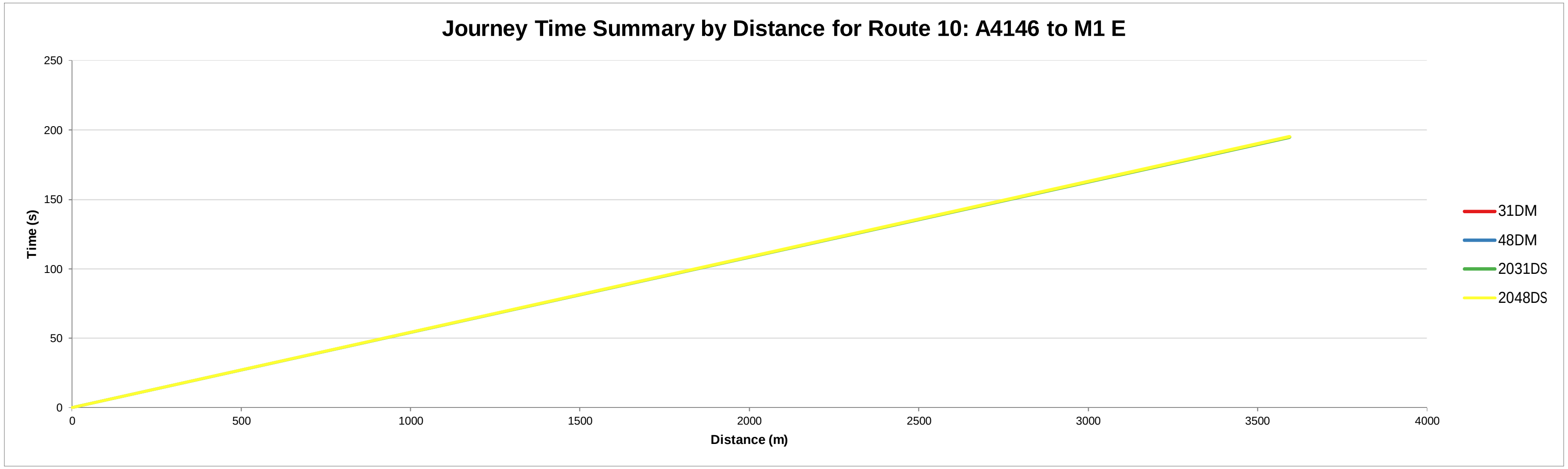
Journey Time Comparison Graphs
PM
16:00 - 19:00
Core



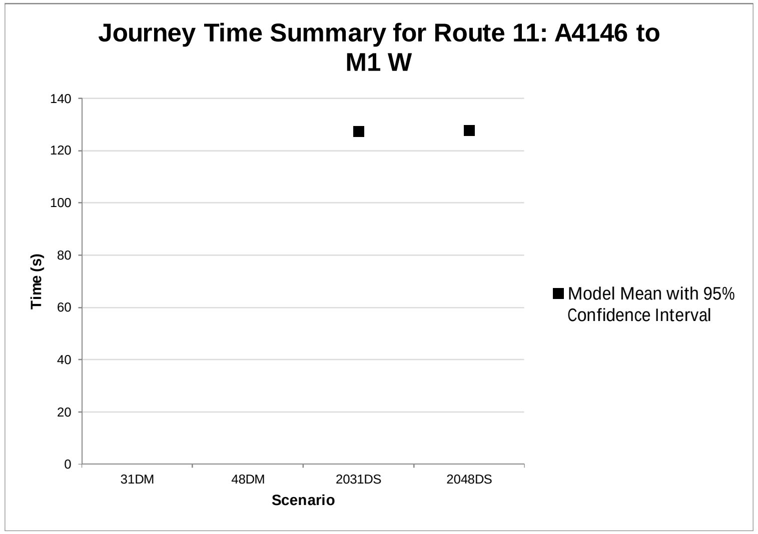


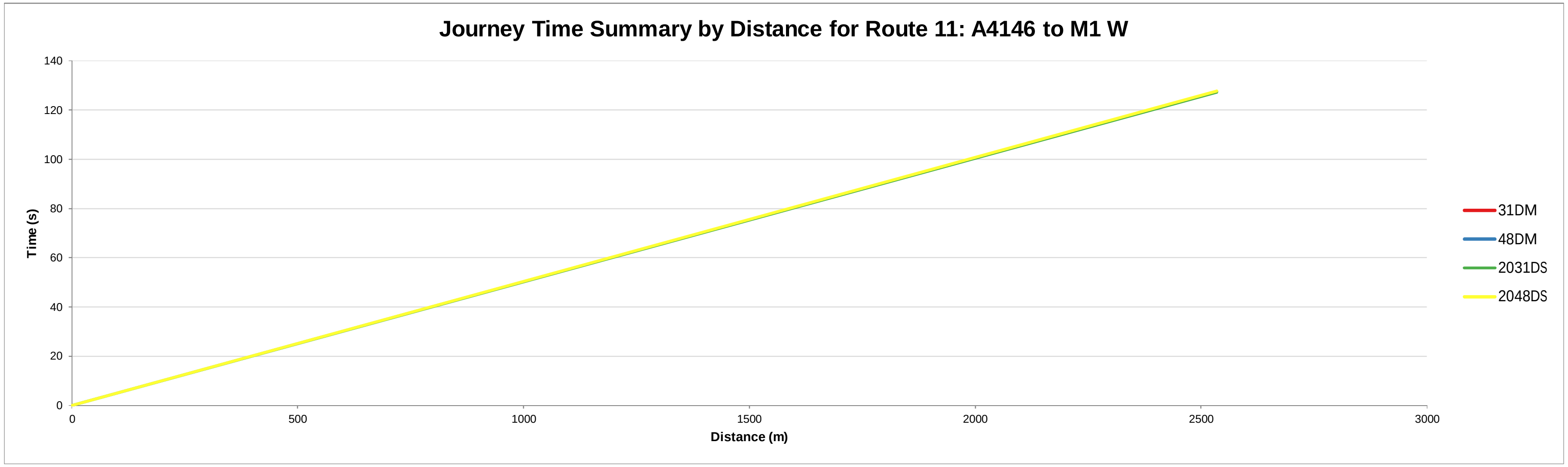
Journey Time Comparison Graphs
PM
16:00 - 19:00
Core

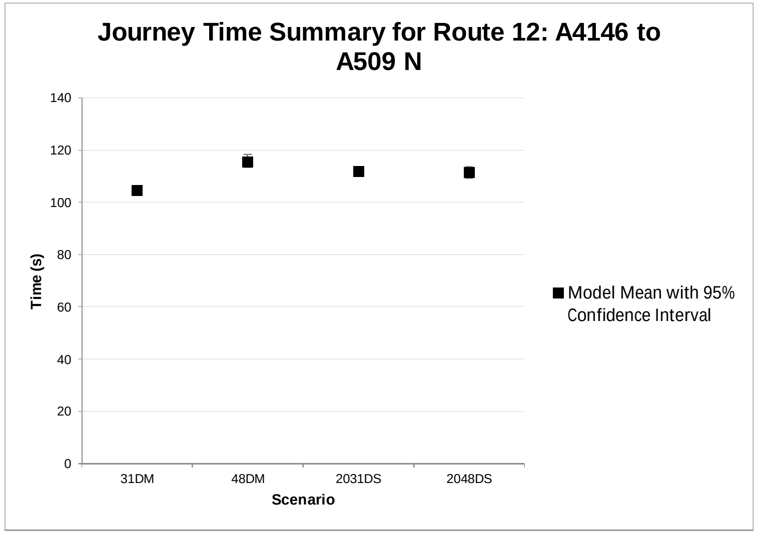


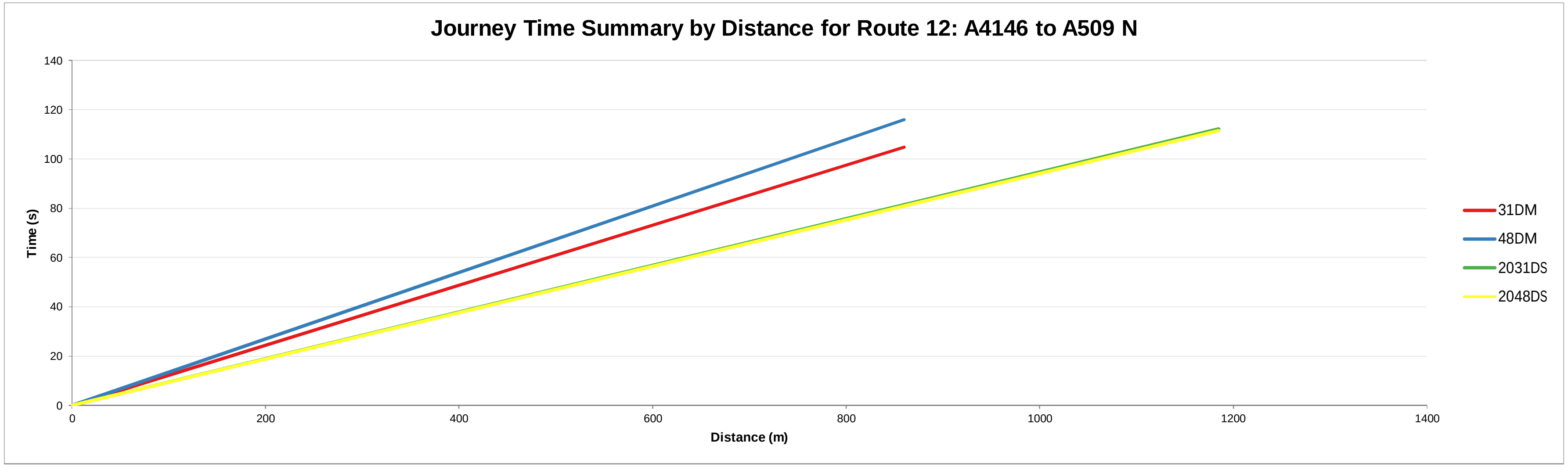


Journey Time Comparison Graphs
PM
16:00 - 19:00
Core

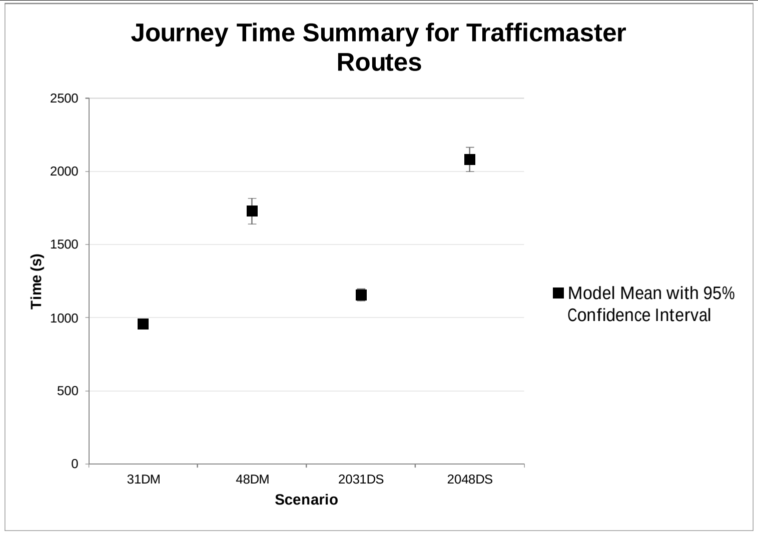


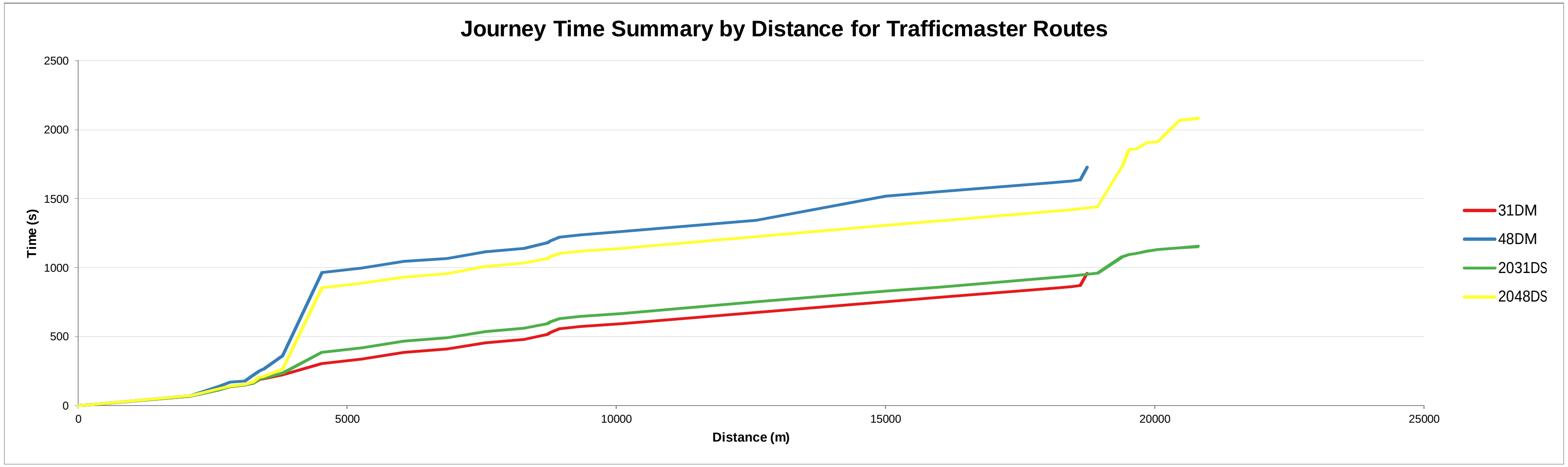



Journey Time Summary for Route 12: A4146 to A509 N
Time (s)
140
120
100
80
60
40
20
0
31DM
48DM
2031DS
2048DS
Scenario
Model Mean with 95% Confidence Interval


Journey Time Summary by Distance for Route 12: A4146 to A509 N
Time (s)
140
120
100
80
60
40
20
0
0
200
400
600
800
1000
1200
1400
Distance (m)
31DM
48DM
2031DS
2048DS

Journey Time Comparison Graphs
PM
16:00 - 19:00
Core

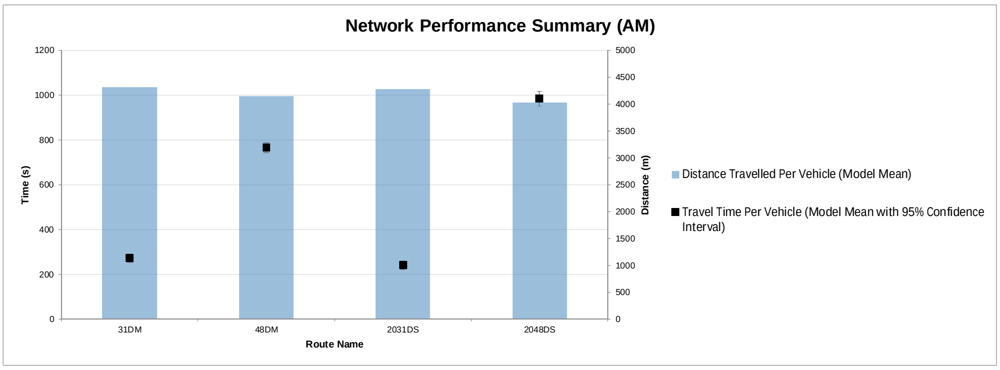


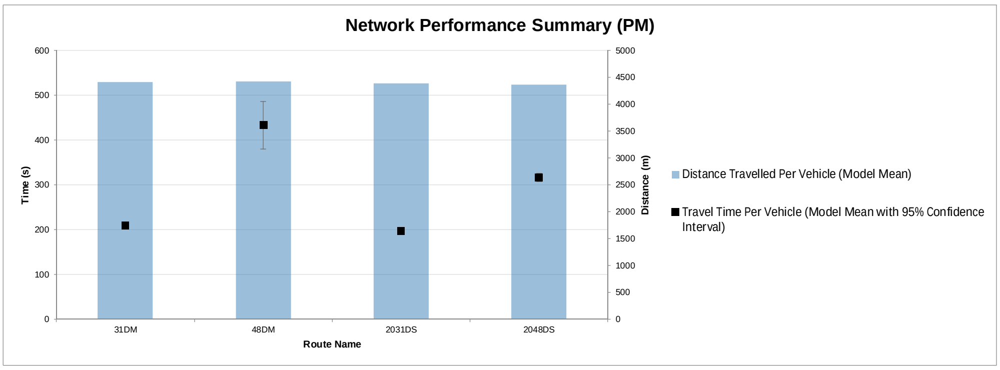


Journey Time Table
AM
Core

Route Names	31DM	48DM	2031DS	2048DS
Route 1: M1 WB	256	456	211	454
Route 2: M1 EB	156	160	157	162
Route 3: M1 E to A509 N	299	652	269	707
Route 4: M1 E to A509 W	0	0	0	0
Route 5: M1 W to A4146	195	362	202	467
Route 6: M1 W to A509 (N)	95	182	113	277
Route 7: A509(N) to M1 E	119	126	186	296
Route 8: A509(N) to M1 W	162	197	299	389
Route 9: A509(N) to A4146	150	238	248	389
Route 10: A4146 to M1 E	0	0	197	215
Route 11: A4146 to M1 W	0	0	130	145
Route 12: A4146 to A509 N	111	120	116	140
TM Route 1	72	100	76	136
TM Route 2	43	120	46	170
TM Route 3	24	33	23	36
TM Route 5	11	11	11	11
TM Route 6	21	51	22	60
TM Route 7	28	29	31	30
TM Route 8	5	11	5	14
TM Route 9	62	91	63	101
TM Route 10	77	135	73	86
TM Route 11	32	32	32	32
TM Route 12	105	552	58	480
TM Route 13	24	24	24	24
TM Route 14	35	230	35	117
TM Route 15	26	25	25	26
TM Route 16	30	29	30	31
TM Route 17	12	14	9	10
TM Route 18	23	24	23	28
TM Route 19	15	14	15	15
TM Route 20	23	23	23	24
TM Route 21	84	85	84	85
TM Route 22	193	419	146	426
TM Route 23	30	29	30	29
TM Route 24	65	62	65	62
TM Route 25	13	13	13	13
TM Route 26	9	10	22	23
TM Route 27	29	51	126	205
Acees Road_E Entry	0	0	83	513
Acees Road_E Exit	0	0	6	6
Acees Road_W Entry	0	0	16	60
Acees Road_W Exit	0	0	10	10
A509_N Entry	0	0	30	341
A509_N Exit	0	0	12	12
Trafficmaster Routes	1092	2218	1268	3216

	31DM (AM)	48DM (AM)	2031DS (AM)	2048DS (AM)	31DM (PM)	48DM (PM)	2031DS (PM)	2048DS (PM)			
Total Time Taken (s)	9910892	28756678	8888433	36992585	8081851	18198961	7631088	13925193			
Total Distance (m)	157279547	156249600	158031600	151502621	170386168	187893776	170499905	192344302			
Total Vehicles	36411	37609	36936	37647	38675	42435	38868	44090			
Total Delay (s)											
Average Time (s) / Vehicle	272	766	241	984	209	433	196	316			
Average Time (s) / Mile	101	297	91	394	76	157	72	116			
Average Distance (m) / Vehicle	4320	4154	4279	4024	4406	4427	4387	4363			
Average Speed (mph)	36	12	41	9	47	24	50	31			
Average Speed (kph)	58	20	65	15	76	38	80	50			
Average Delay / Vehicle											

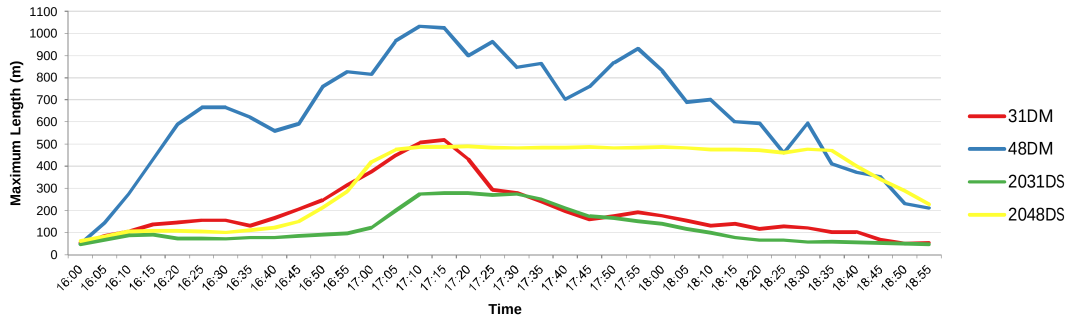




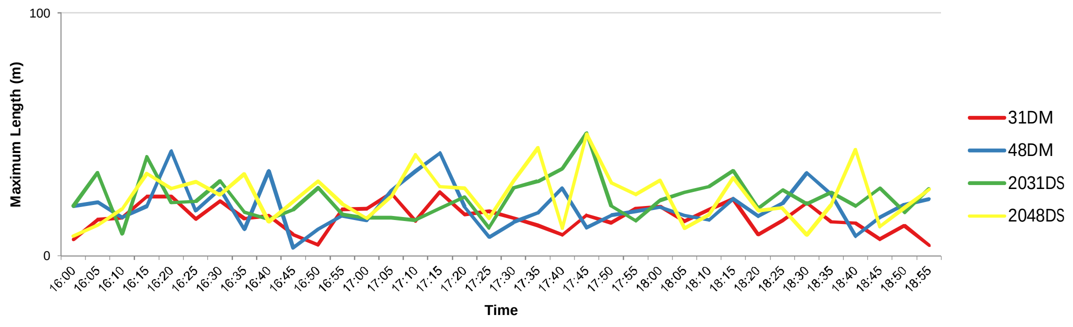
Comparison Graphs
PM

J1

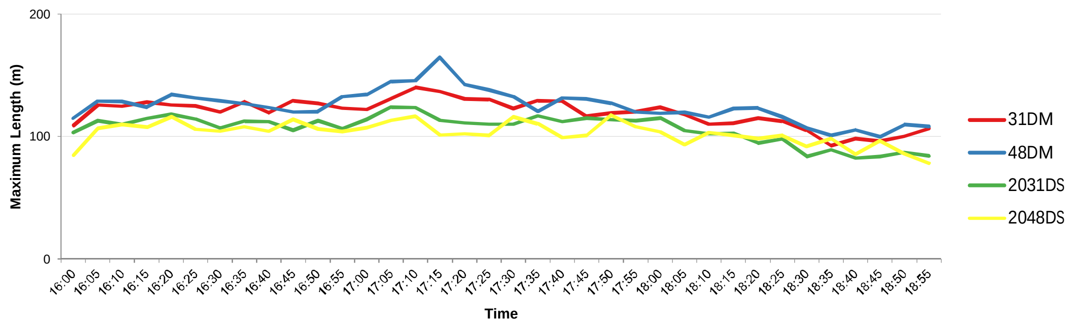
J1)A509 N M1J14



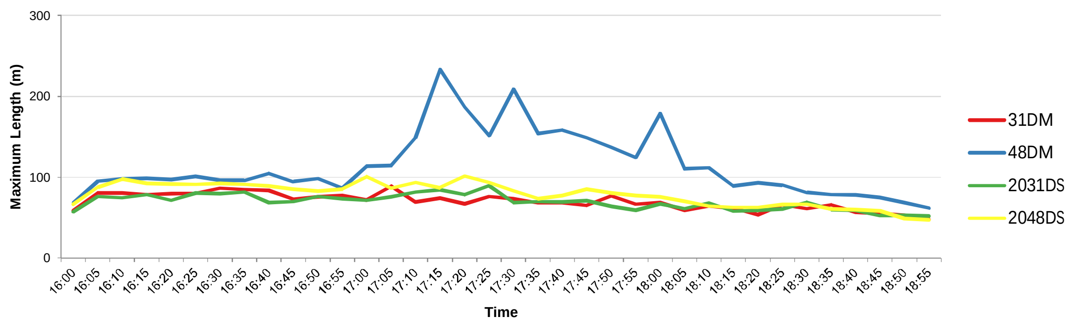
J1) M1 Offslip E (right turn)



J1) A509 S M1J14

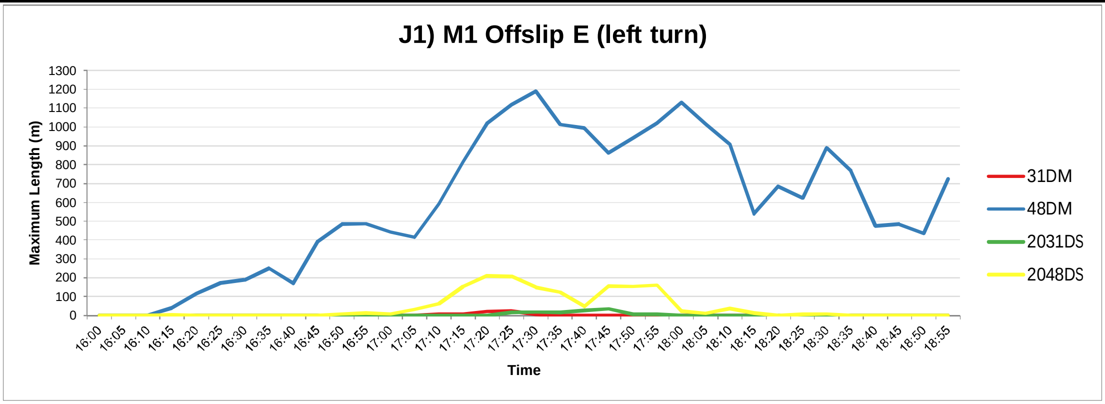


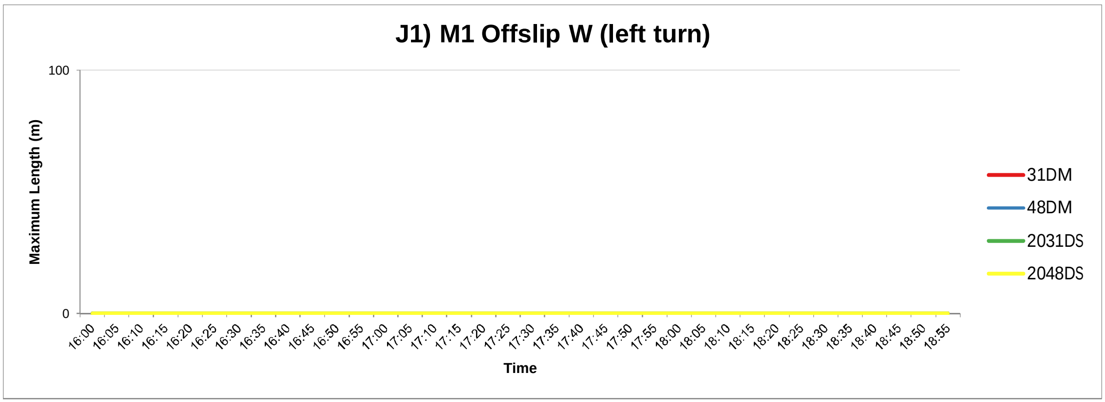
J1) M1 Offslip W (right turn)



Comparison Graphs
PM

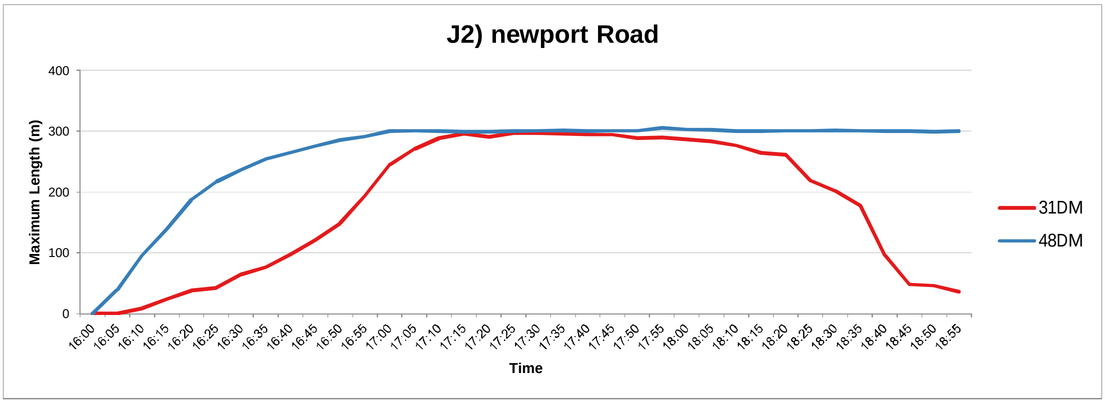
J1

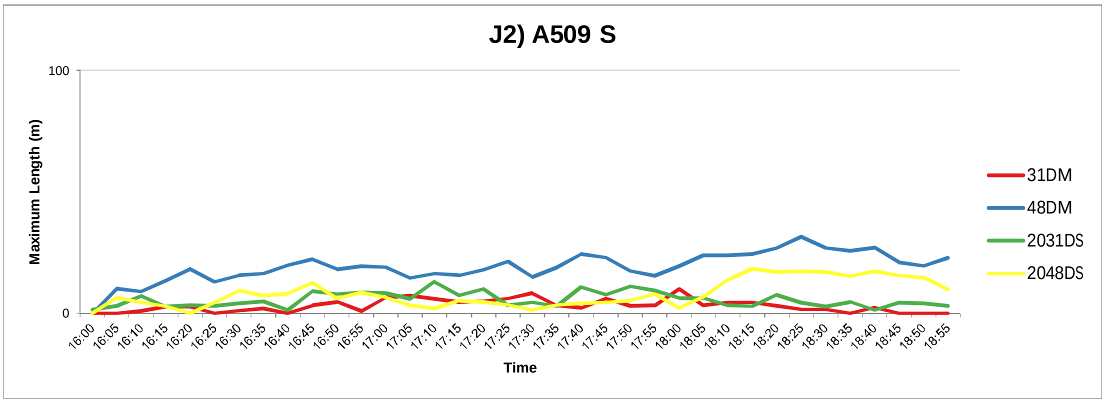


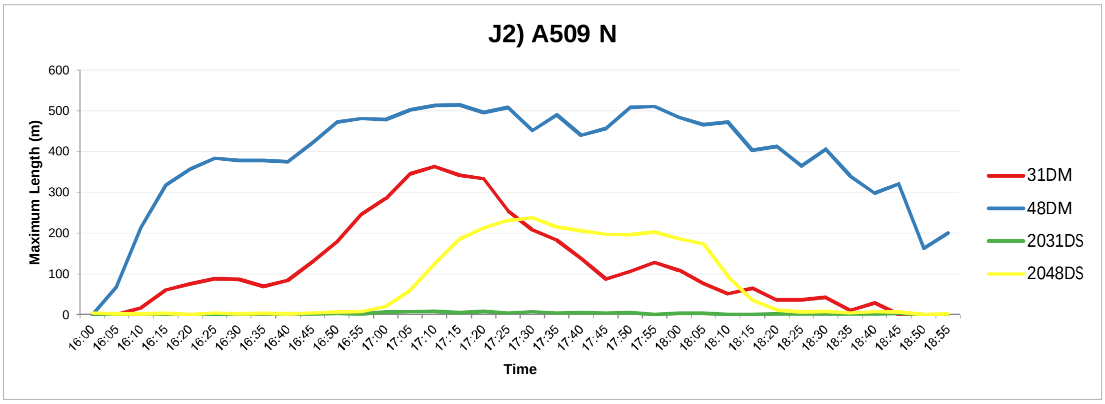


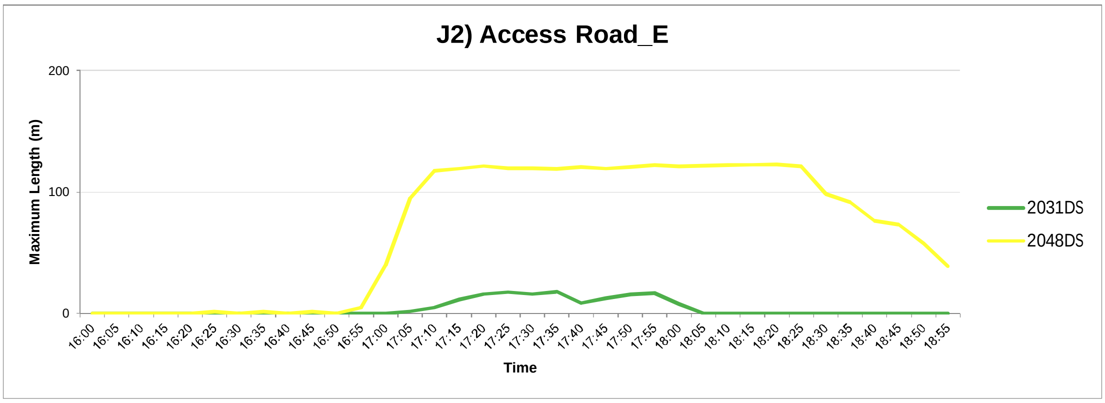
Comparison Graphs
PM

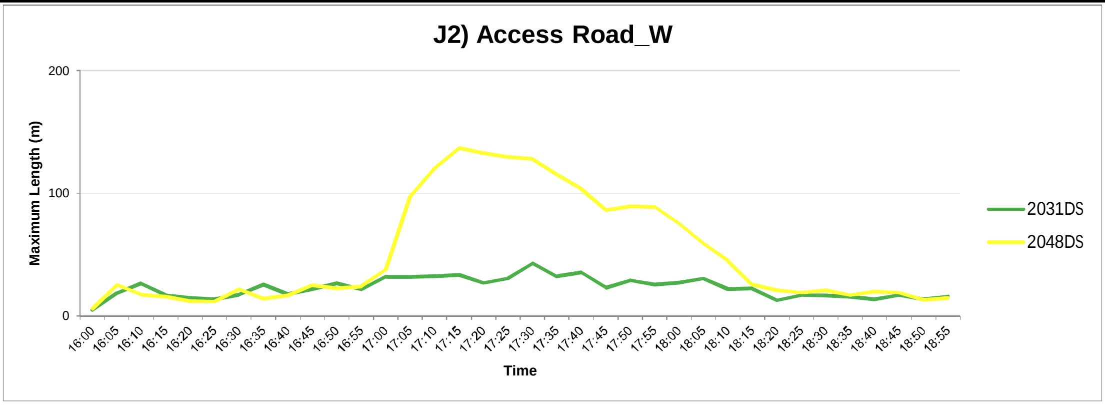
J2





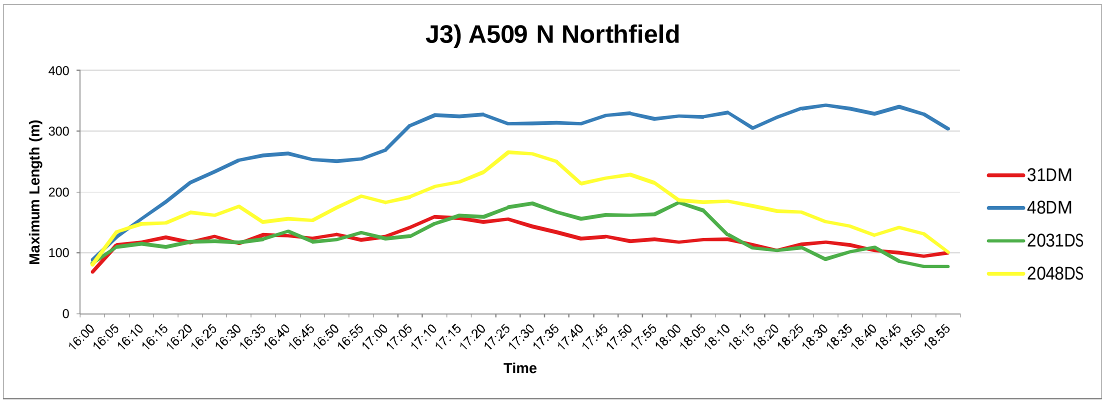


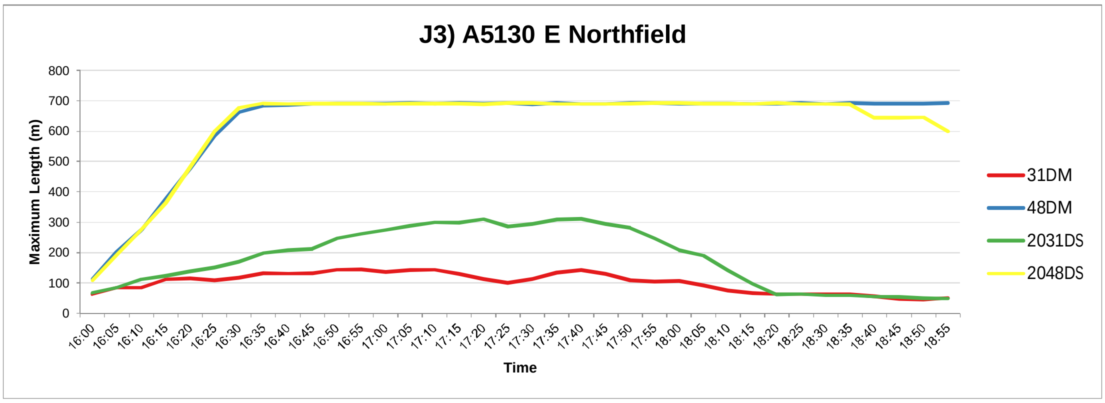


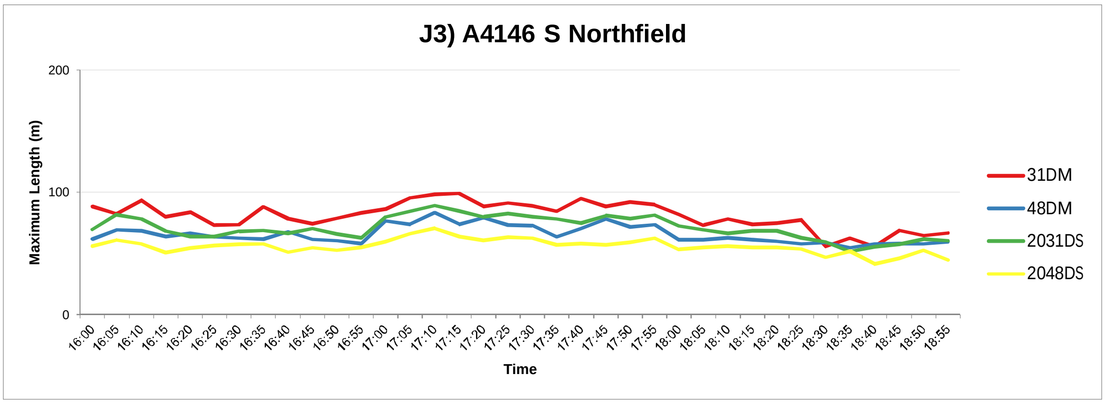

J2) Access Road_W
200
100
0
Maximum Length (m)
16:00
16:05
16:10
16:15
16:20
16:25
16:30
16:35
16:40
16:45
16:50
16:55
17:00
17:05
17:10
17:15
17:20
17:25
17:30
17:35
17:40
17:45
17:50
17:55
18:00
18:05
18:10
18:15
18:20
18:25
18:30
18:35
18:40
18:45
18:50
18:55
Time
2031DS
2048DS

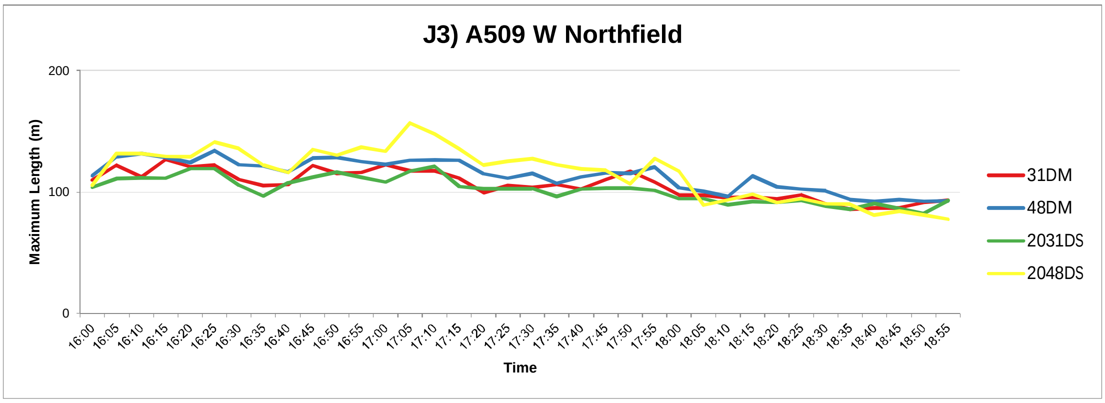
Comparison Graphs
PM

J3



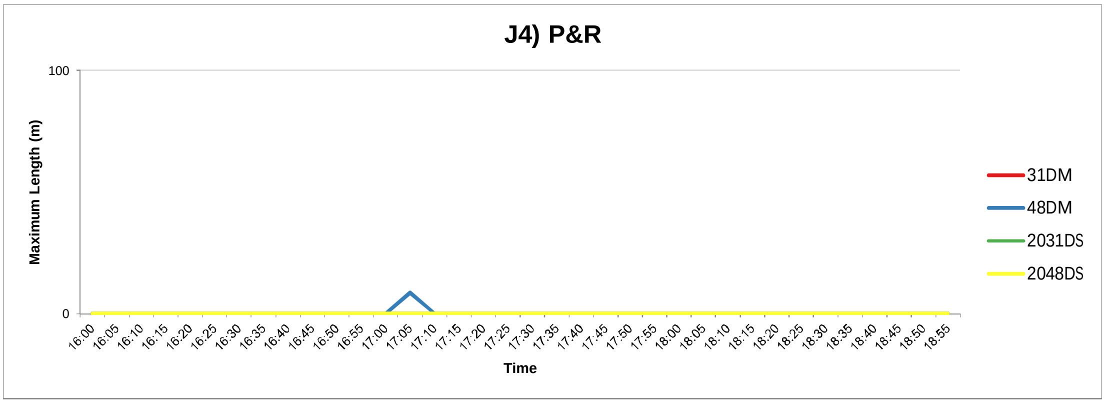






Comparison Graphs
PM

J4



Queue Comparison
PM
Maximum Length Summary
Maximum Length (m)

	31DM	48DM	2031DS	2048DS
J1)A509 N M1J14	518.3	1032.4	278.2	488.9
J1) M1 Offslip E (right turn)	26.2	43.0	50.5	50.1
J1) A509 S M1J14	140.1	164.7	124.0	117.6
J1) M1 Offslip W (right turn)	88.8	233.0	89.4	101.3
J1) M1 Offslip E (left turn)	21.6	1190.7	35.3	210.8
J1) M1 Offslip W (left turn)	0.0	0.0	0.0	0.0
J2) newport Road	297.3	305.2		
J2) A509 S	10.0	31.5	13.1	18.3
J2) A509 N	363.5	514.7	8.2	237.6
J2) Access Road_E			17.9	122.8
J2) Access Road_W			42.8	136.9
J3) A509 N Northfield	159.3	342.6	182.6	265.1
J3) A5130 E Northfield	145.2	692.9	311.5	692.4
J3) A4146 S Northfield	99.1	83.4	89.2	70.5
J3) A509 W Northfield	126.8	134.1	120.9	156.8
J4) P&R	0.0	8.6	0.0	0.0

Queue Comparison
PM
Average Length Summary
Maximum Length (m)

	31DM	48DM	2031DS	2048DS
J1)A509 N M1J14	196.0	635.9	124.3	343.4
J1) M1 Offslip E (right turn)	15.8	20.5	23.8	24.6
J1) A509 S M1J14	119.6	124.9	106.5	102.8
J1) M1 Offslip W (right turn)	69.9	114.7	69.1	78.7
J1) M1 Offslip E (left turn)	1.7	594.9	3.5	44.2
J1) M1 Offslip W (left turn)	0.0	0.0	0.0	0.0
J2) newport Road	179.4	263.9		
J2) A509 S	3.1	19.1	5.6	8.0
J2) A509 N	118.4	390.1	2.4	73.7
J2) Access Road_E			4.1	69.7
J2) Access Road_W			22.8	50.7
J3) A509 N Northfield	122.1	284.6	128.7	177.7
J3) A5130 E Northfield	101.8	631.2	182.1	625.0
J3) A4146 S Northfield	80.7	65.7	71.0	56.0
J3) A509 W Northfield	106.1	113.9	102.0	115.9
J4) P&R	0.0	0.2	0.0	0.0

Journey Time Table
PM
Core

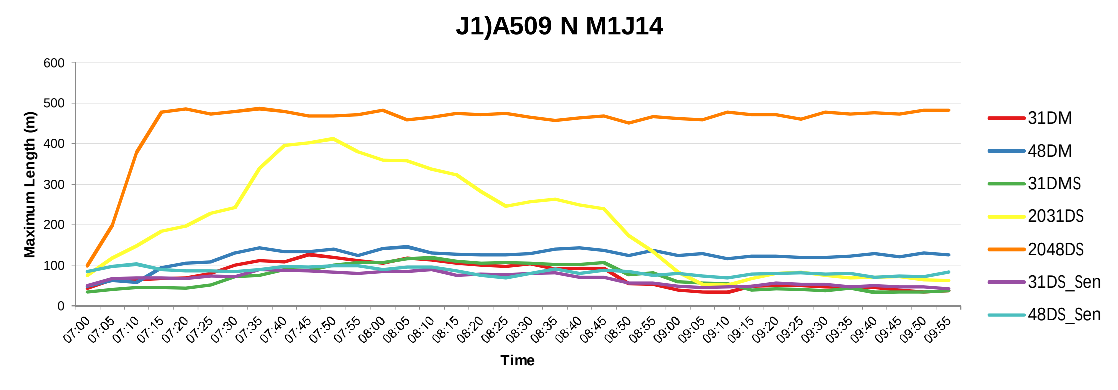
Route Names	31DM	48DM	2031DS	2048DS
Route 1: M1 WB	149	237	149	156
Route 2: M1 EB	152	154	152	155
Route 3: M1 E to A509 N	177	316	195	210
Route 4: M1 E to A509 W	0	0	0	0
Route 5: M1 W to A4146	168	279	171	193
Route 6: M1 W to A509 (N)	95	126	110	113
Route 7: A509(N) to M1 E	127	131	190	319
Route 8: A509(N) to M1 W	215	245	306	537
Route 9: A509(N) to A4146	209	333	243	453
Route 10: A4146 to M1 E	0	0	195	195
Route 11: A4146 to M1 W	0	0	127	128
Route 12: A4146 to A509 N	105	116	112	112
TM Route 1	68	72	70	73
TM Route 2	46	66	45	48
TM Route 3	24	31	22	22
TM Route 5	11	11	12	12
TM Route 6	11	40	12	15
TM Route 7	31	33	34	38
TM Route 8	4	11	4	5
TM Route 9	29	100	36	53
TM Route 10	80	602	152	591
TM Route 11	32	32	32	32
TM Route 12	48	46	47	45
TM Route 13	24	24	24	24
TM Route 14	46	48	45	51
TM Route 15	25	24	25	25
TM Route 16	37	38	34	32
TM Route 17	13	13	12	14
TM Route 18	27	31	25	24
TM Route 19	16	15	16	15
TM Route 20	22	23	22	23
TM Route 21	82	84	83	84
TM Route 22	77	174	77	82
TM Route 23	31	32	31	32
TM Route 24	66	65	66	67
TM Route 25	13	13	13	13
TM Route 26	8	10	22	22
TM Route 27	86	90	119	293
Acees Road_E Entry	0	0	17	119
Acees Road_E Exit	0	0	6	6
Acees Road_W Entry	0	0	17	43
Acees Road_W Exit	0	0	10	10
A509_N Entry	0	0	14	156
A509_N Exit	0	0	12	12
Trafficmaster Routes	958	1728	1155	2082

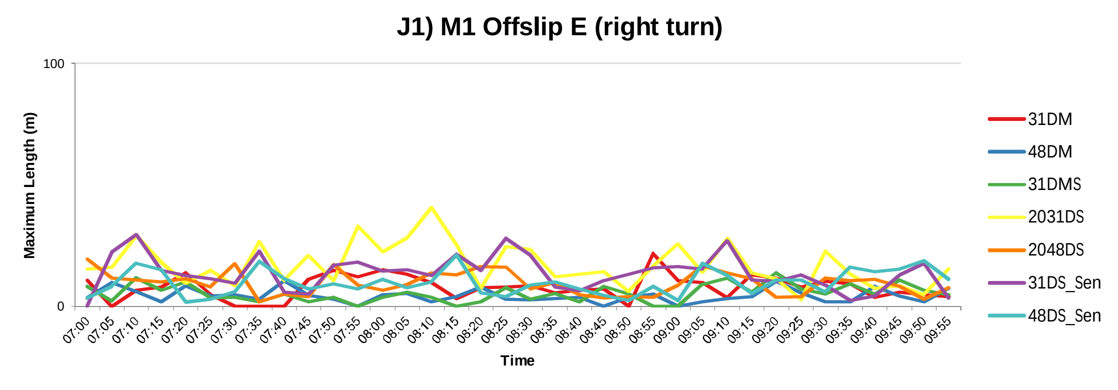
APPENDIX B

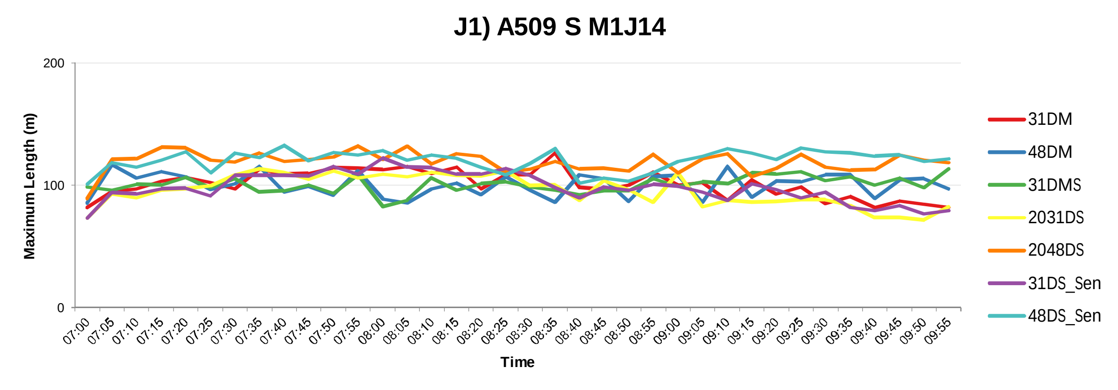
CG 9 QueueGraphs AM
CG 9 QueueTable Maximum AM
CG 9 QueueTable Average AM
CG 9 JtimeSmry
CG 9 JT Table AM
CG 9 NetPerf Summary

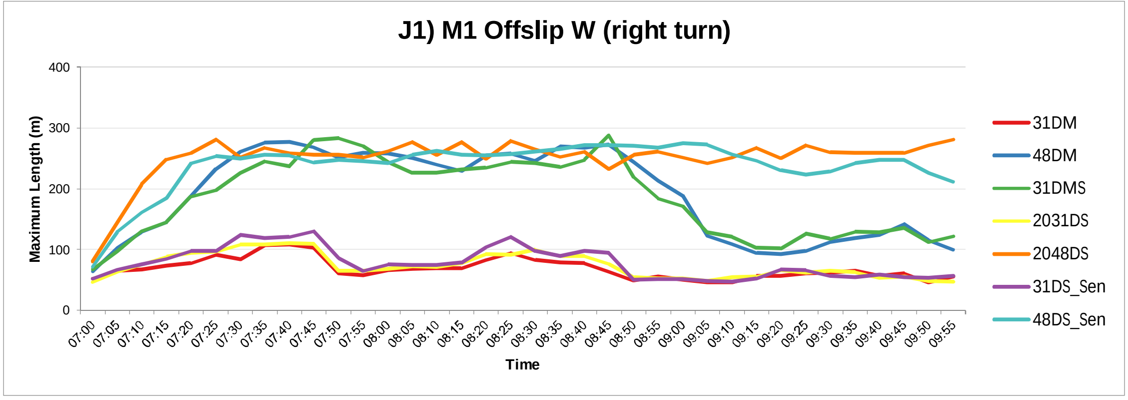
Comparison Graphs
AM

J1



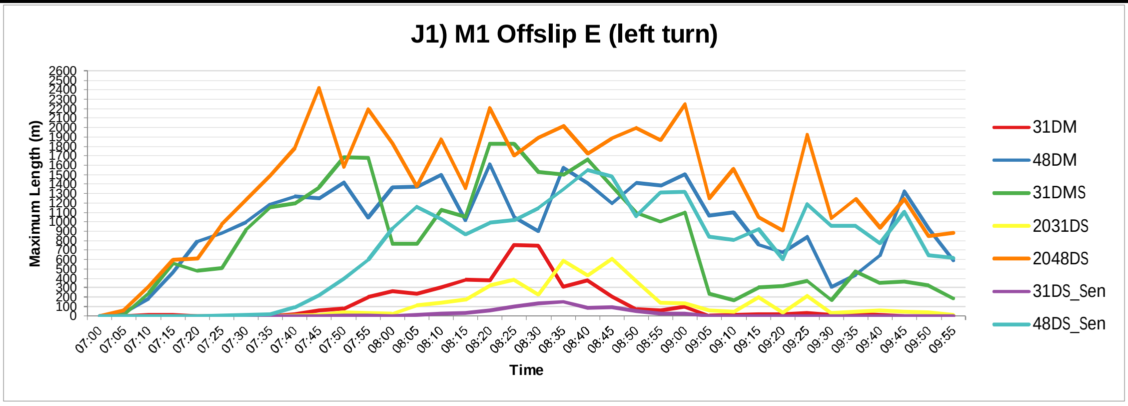


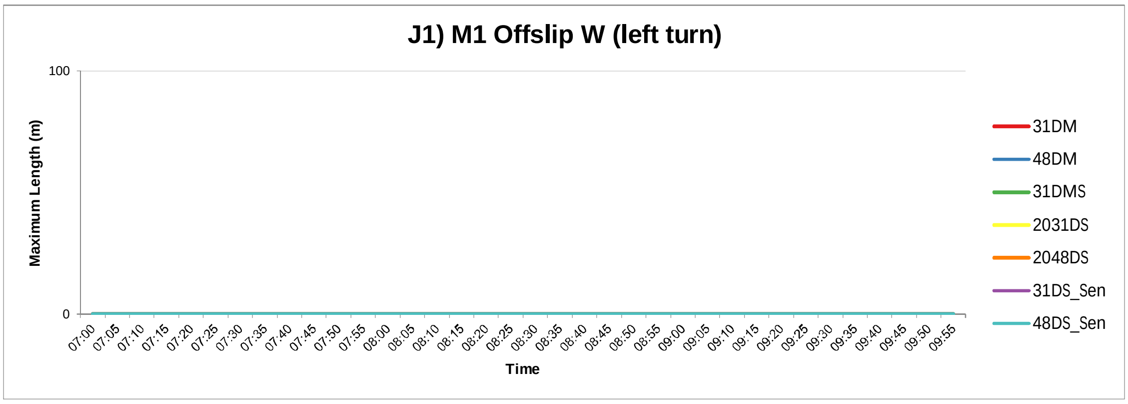




Comparison Graphs
AM

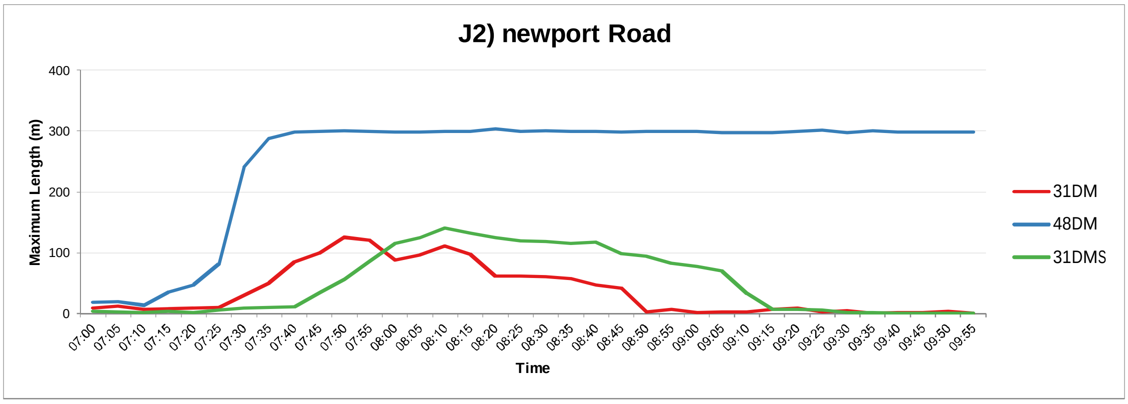
J1

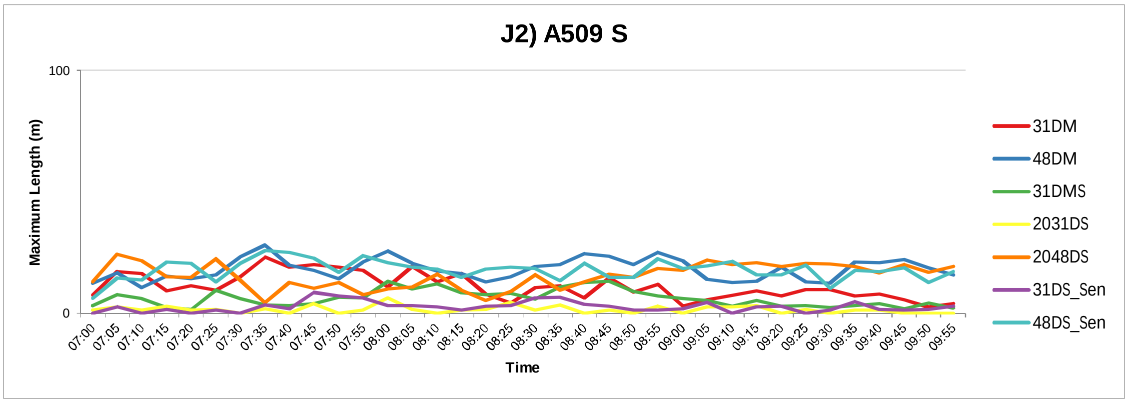


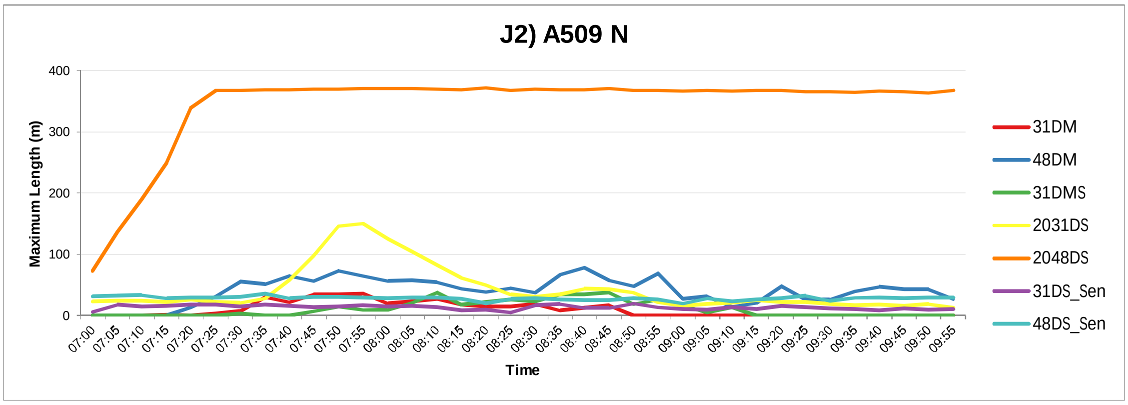


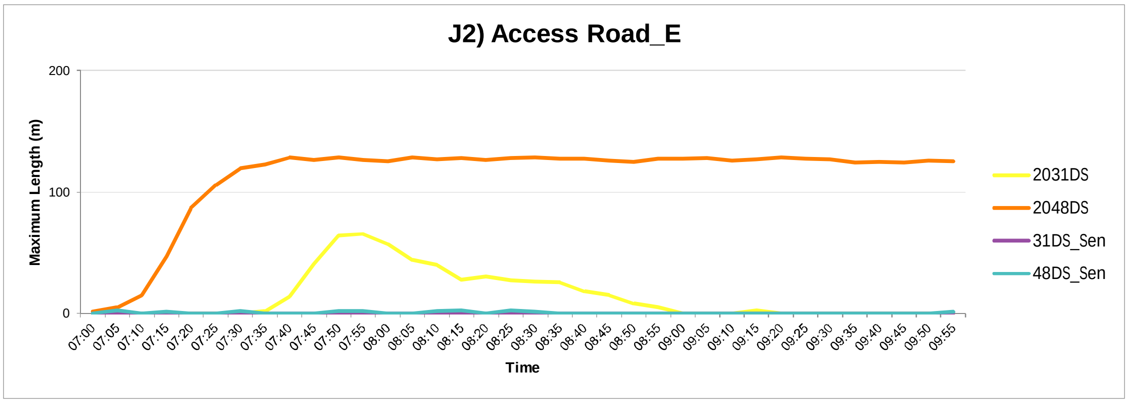
Comparison Graphs
AM

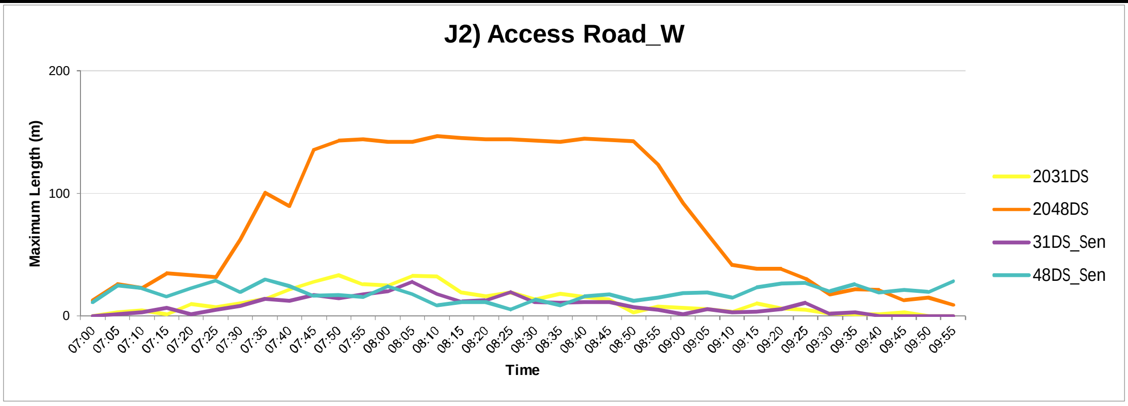
J2

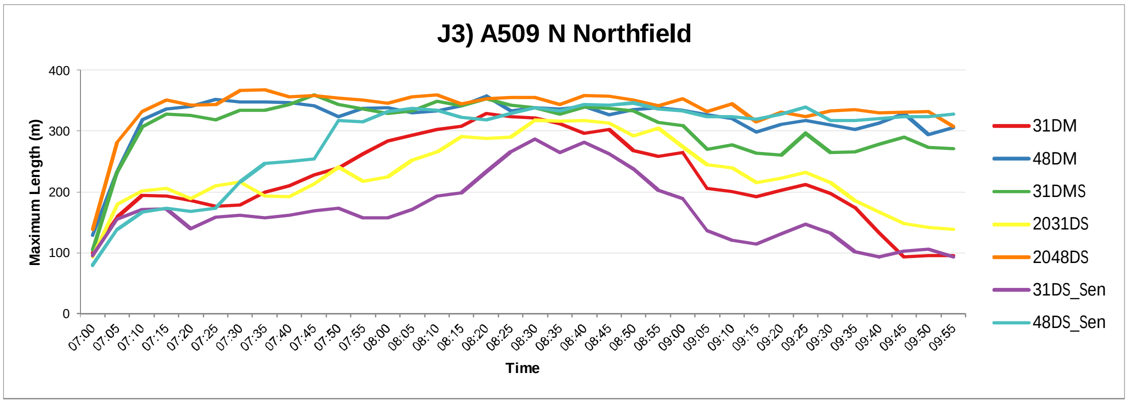


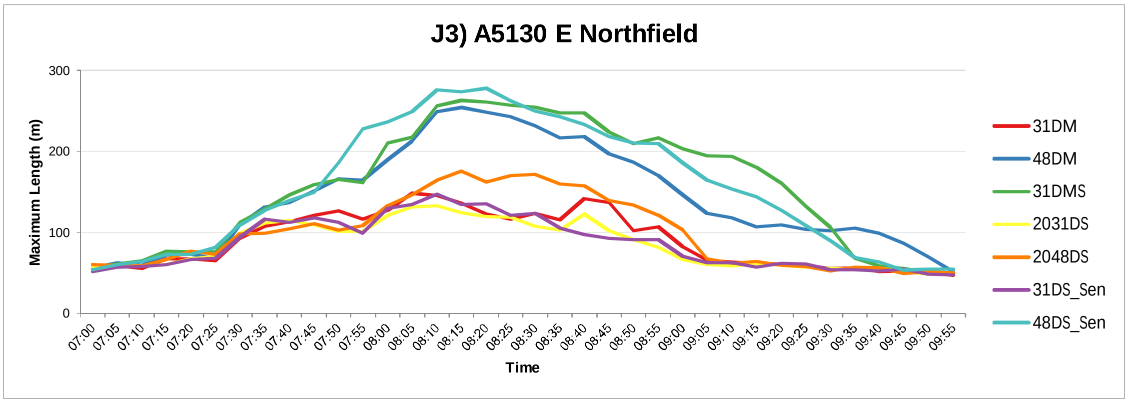


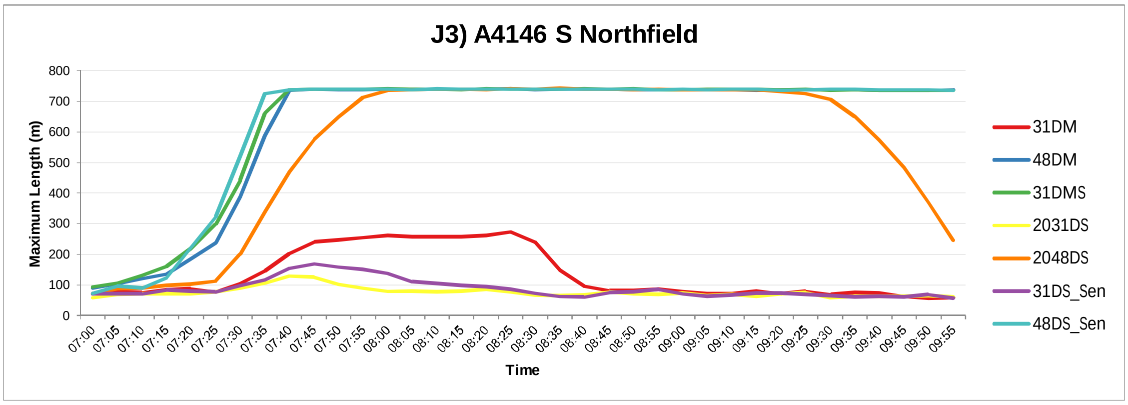


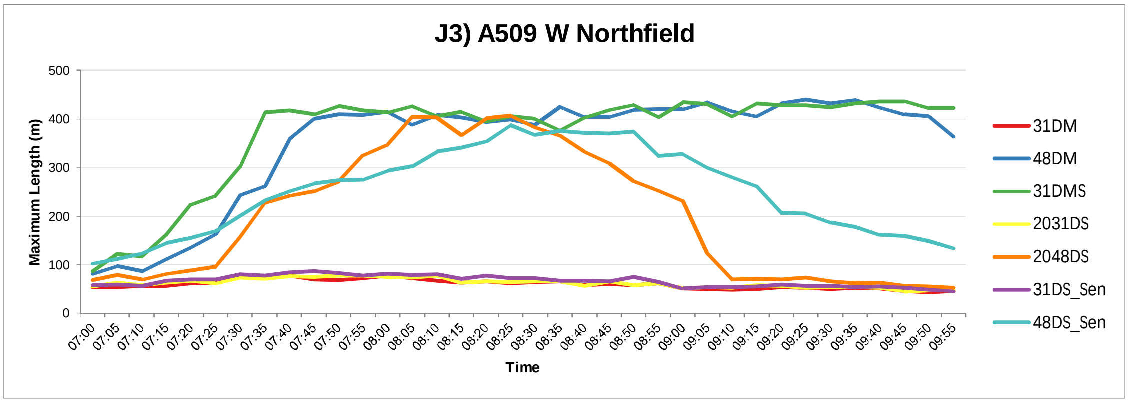


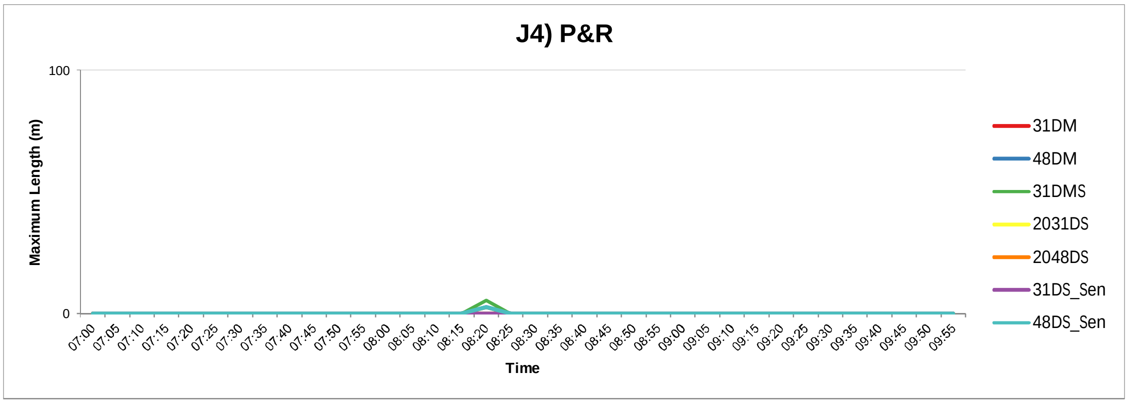

J2) Access Road_W
Maximum Length (m)
200
100
0
07:00
07:05
07:10
07:15
07:20
07:25
07:30
07:35
07:40
07:45
07:50
07:55
08:00
08:05
08:10
08:15
08:20
08:25
08:30
08:35
08:40
08:45
08:50
08:55
09:00
09:05
09:10
09:15
09:20
09:25
09:30
09:35
09:40
09:45
09:50
09:55
Time
2031DS
2048DS
31DS_Sen
48DS_Sen


J3) A509 N Northfield
Maximum Length (m)
Time
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen


J3) A5130 E Northfield
Maximum Length (m)
Time
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen


J3) A4146 S Northfield
Maximum Length (m)
Time
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen


J3) A509 W Northfield
Maximum Length (m)
Time
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen


J4) P&R
100
0
Maximum Length (m)
07:00
07:05
07:10
07:15
07:20
07:25
07:30
07:35
07:40
07:45
07:50
07:55
08:00
08:05
08:10
08:15
08:20
08:25
08:30
08:35
08:40
08:45
08:50
08:55
09:00
09:05
09:10
09:15
09:20
09:25
09:30
09:35
09:40
09:45
09:50
09:55
Time
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen

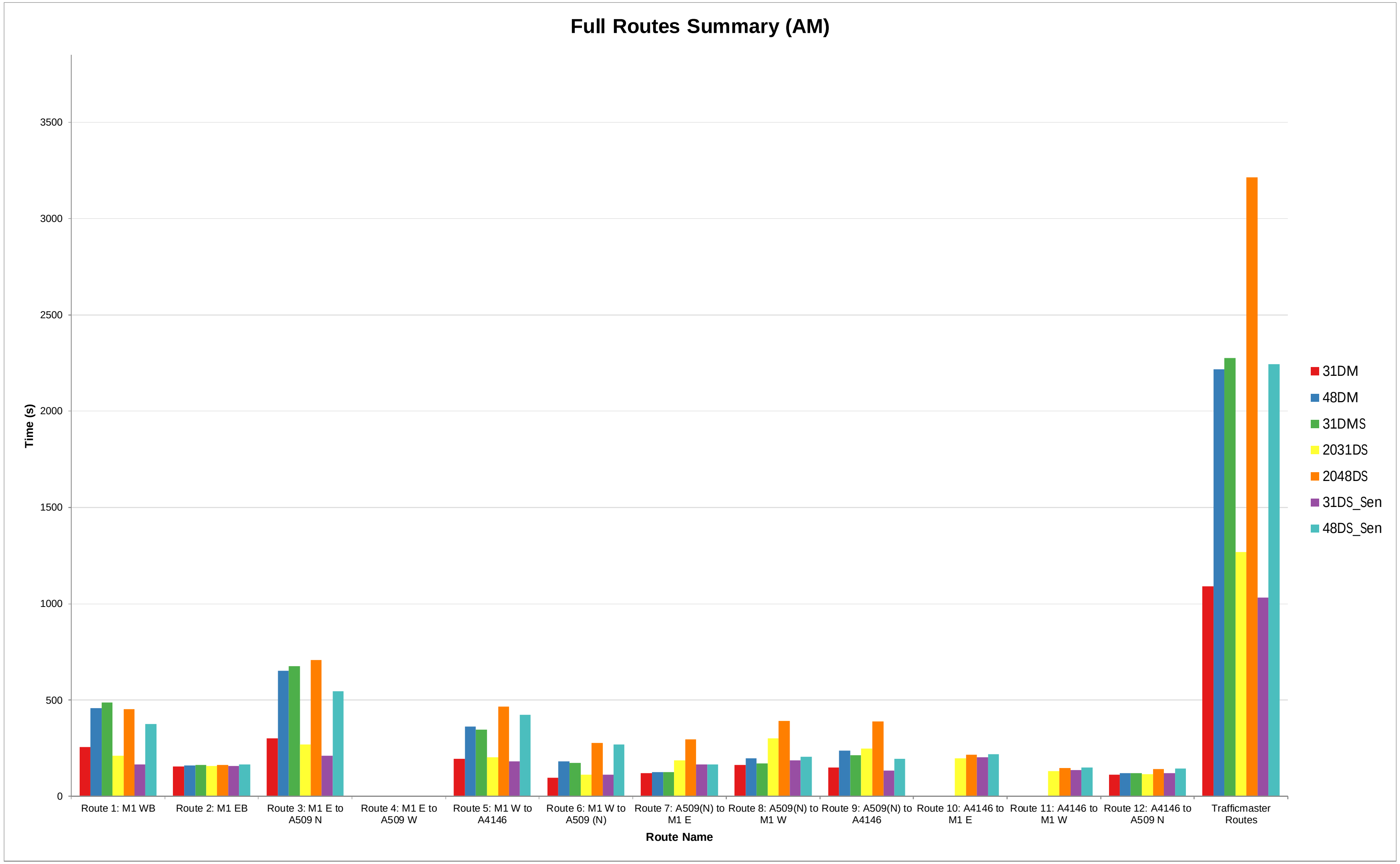
Queue Comparison
AM
Maximum Length Summary
Maximum Length (m)

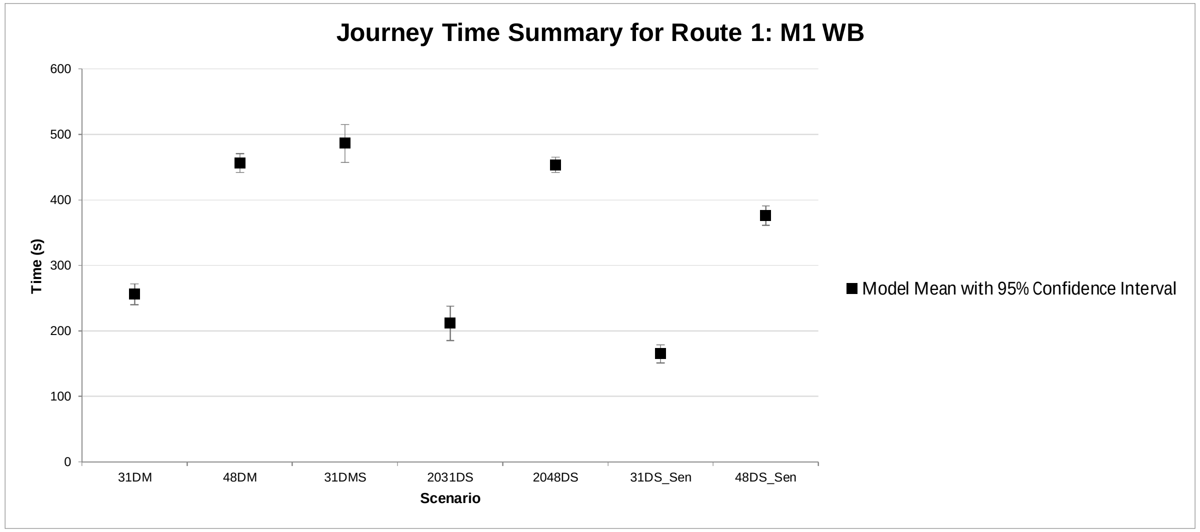
	31DM	48DM	31DMS	2031DS	2048DS	31DS_Sen	48DS_Sen
J1)A509 N M1J14	126.3	145.7	118.5	411.5	485.7	90.5	102.8
J1) M1 Offslip E (right turn)	21.8	10.5	13.8	40.7	19.4	29.5	21.0
J1) A509 S M1J14	126.6	116.9	113.3	113.5	132.0	122.3	132.6
J1) M1 Offslip W (right turn)	108.1	277.0	287.3	110.3	280.8	129.9	274.4
J1) M1 Offslip E (left turn)	753.0	1608.1	1825.0	606.3	2417.6	149.9	1548.1
J1) M1 Offslip W (left turn)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
J2) newport Road	125.6	303.5	140.6				
J2) A509 S	23.1	28.1	13.2	6.3	24.3	8.6	25.8
J2) A509 N	35.7	78.0	37.3	150.0	371.5	19.1	35.2
J2) Access Road_E				65.4	128.5	0.0	2.6
J2) Access Road_W				33.3	146.7	27.9	29.9
J3) A509 N Northfield	328.7	357.4	358.9	317.6	367.7	286.2	346.4
J3) A5130 E Northfield	148.3	254.4	262.7	132.8	175.3	147.1	277.9
J3) A4146 S Northfield	272.9	741.1	741.0	128.2	742.1	168.5	741.0
J3) A509 W Northfield	77.4	438.7	435.8	77.6	406.2	86.0	386.7
J4) P&R	0.0	2.8	5.3	0.0	2.6	0.0	2.7

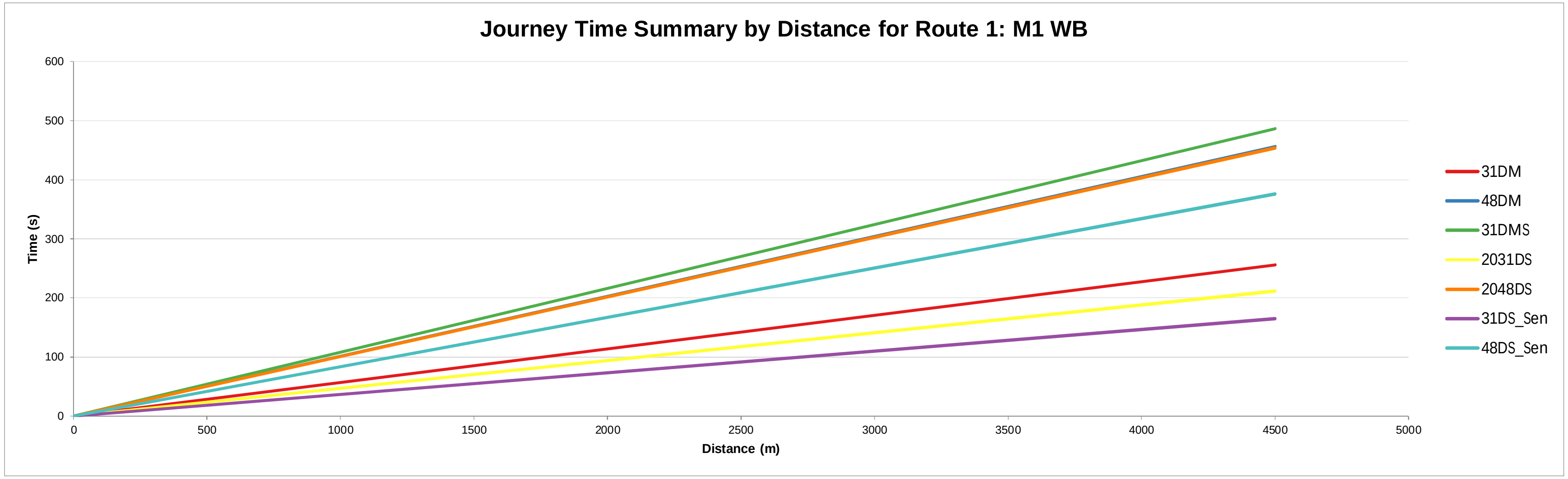
Queue Comparison
AM
Average Length Summary
Maximum Length (m)

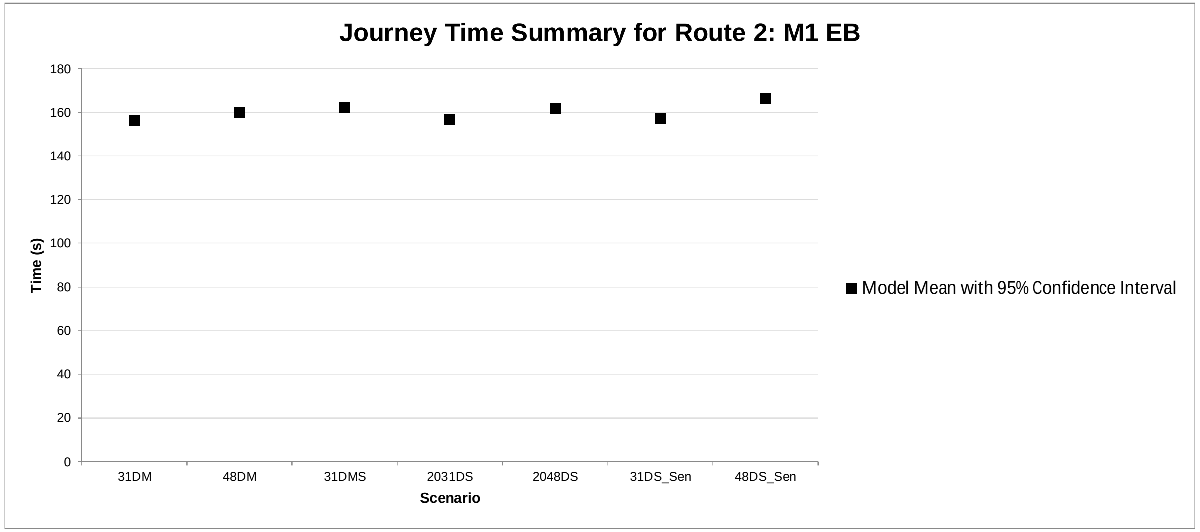
	31DM	48DM	31DMS	2031DS	2048DS	31DS_Sen	48DS_Sen
J1)A509 N M1J14	75.1	121.5	70.8	199.2	450.6	66.5	84.5
J1) M1 Offslip E (right turn)	7.9	4.3	5.4	17.1	9.6	13.7	9.8
J1) A509 S M1J14	101.1	100.5	100.5	95.7	119.2	98.4	120.3
J1) M1 Offslip W (right turn)	68.2	190.6	185.4	72.9	250.0	77.3	238.0
J1) M1 Offslip E (left turn)	129.3	984.2	822.9	124.6	1389.3	21.5	718.9
J1) M1 Offslip W (left turn)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
J2) newport Road	37.4	253.3	50.7				
J2) A509 S	11.1	18.2	6.2	1.6	15.4	2.7	17.9
J2) A509 N	9.3	40.2	10.3	42.4	344.5	12.8	27.8
J2) Access Road_E				14.2	112.4	0.0	0.5
J2) Access Road_W				11.5	81.7	8.3	18.7
J3) A509 N Northfield	222.0	321.1	306.2	229.2	336.9	169.3	289.2
J3) A5130 E Northfield	91.1	141.4	155.7	84.6	99.5	86.2	154.3
J3) A4146 S Northfield	133.2	625.3	632.9	75.5	550.0	86.9	634.7
J3) A509 W Northfield	59.2	350.7	370.6	61.5	199.3	65.4	250.8
J4) P&R	0.0	0.1	0.1	0.0	0.1	0.0	0.1

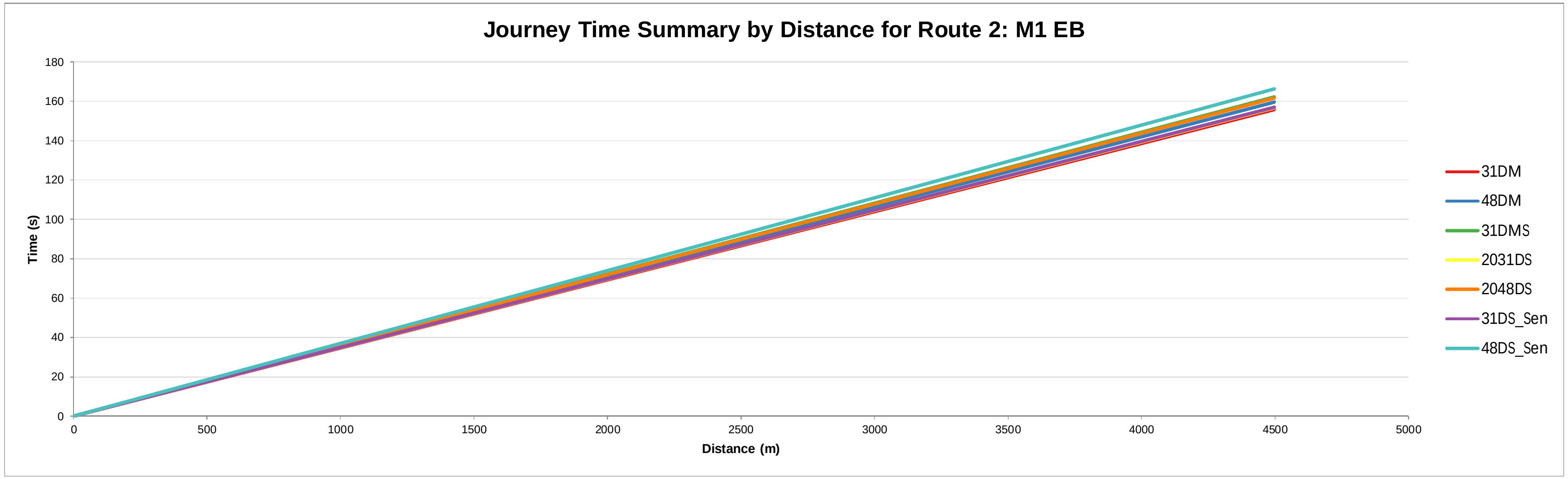
Journey Time Comparison Graphs
AM
07:00 - 10:00
Sensitivity



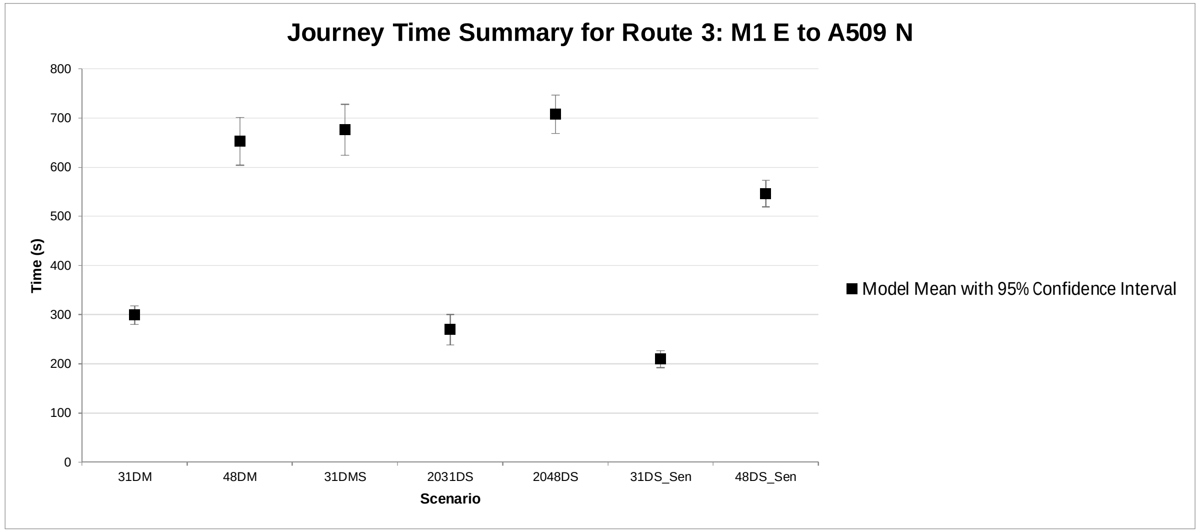

Journey Time Summary for Route 1: M1 WB
Time (s)
600
500
400
300
200
100
0
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen
Scenario
Model Mean with 95% Confidence Interval

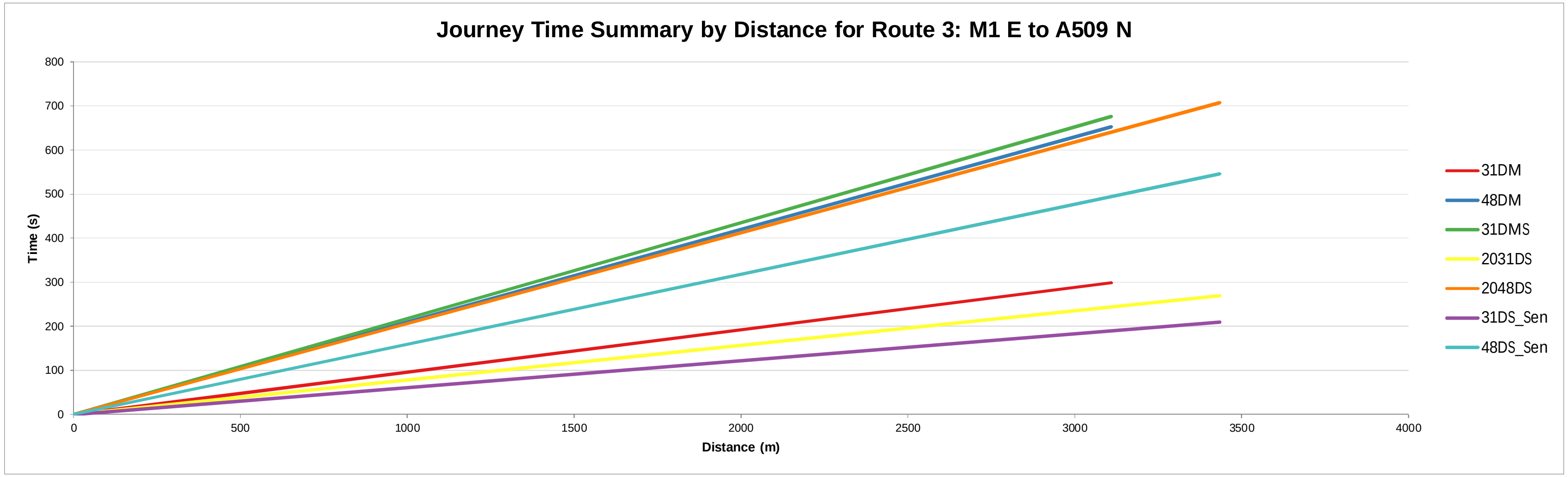

Journey Time Summary by Distance for Route 1: M1 WB
Time (s)
600
500
400
300
200
100
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Distance (m)
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen

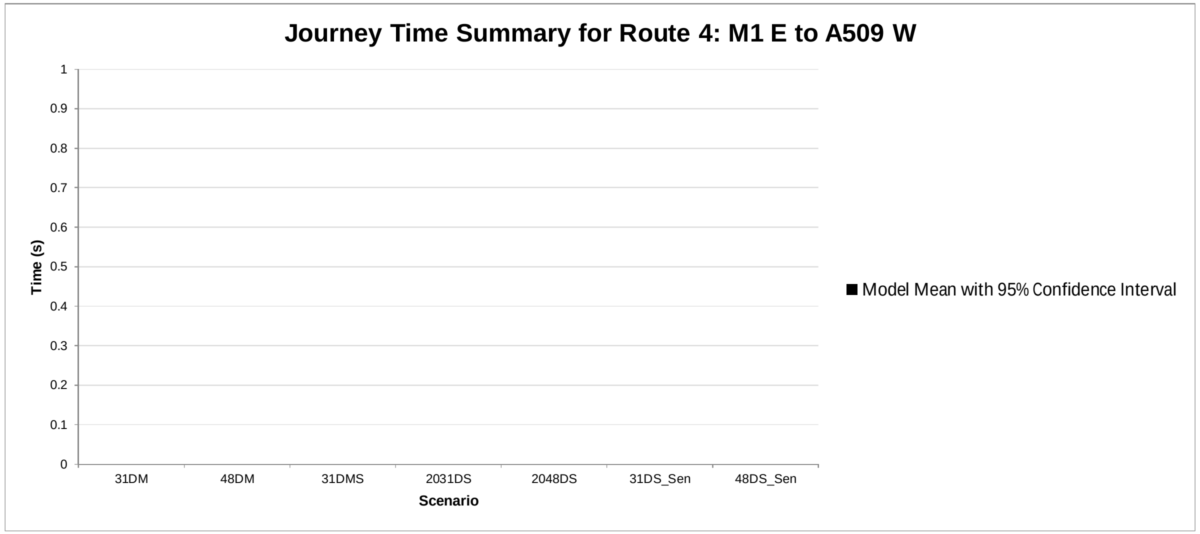

Journey Time Summary for Route 2: M1 EB
Time (s)
180
160
140
120
100
80
60
40
20
0
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen
Scenario
Model Mean with 95% Confidence Interval

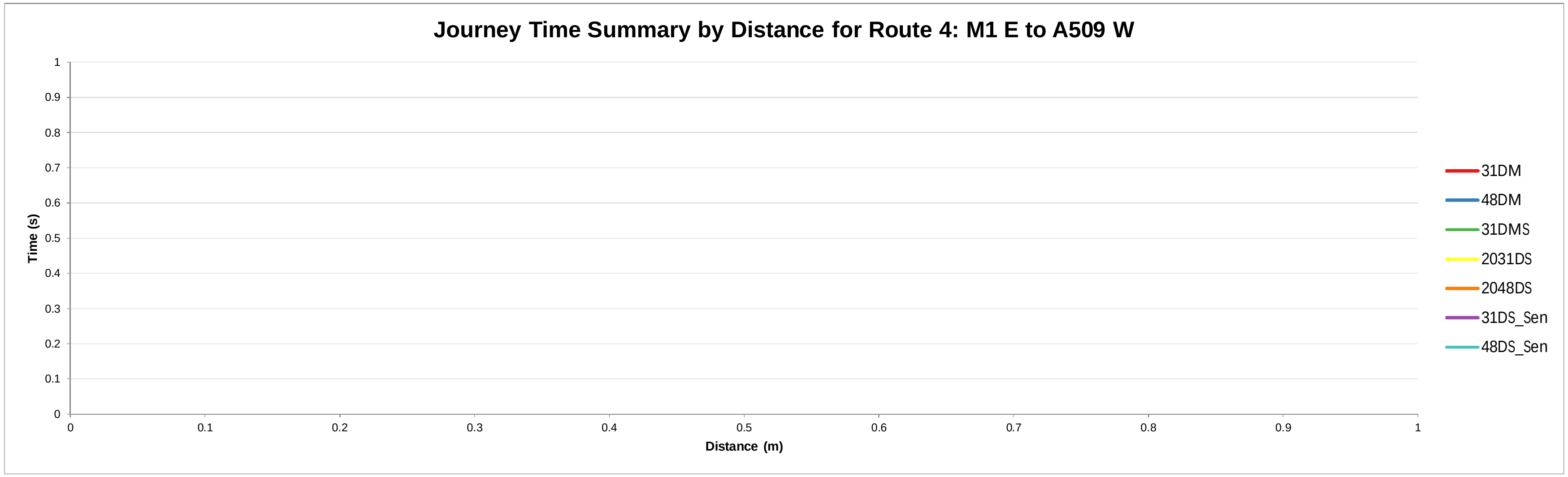

Journey Time Summary by Distance for Route 2: M1 EB
Time (s)
180
160
140
120
100
80
60
40
20
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Distance (m)
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen

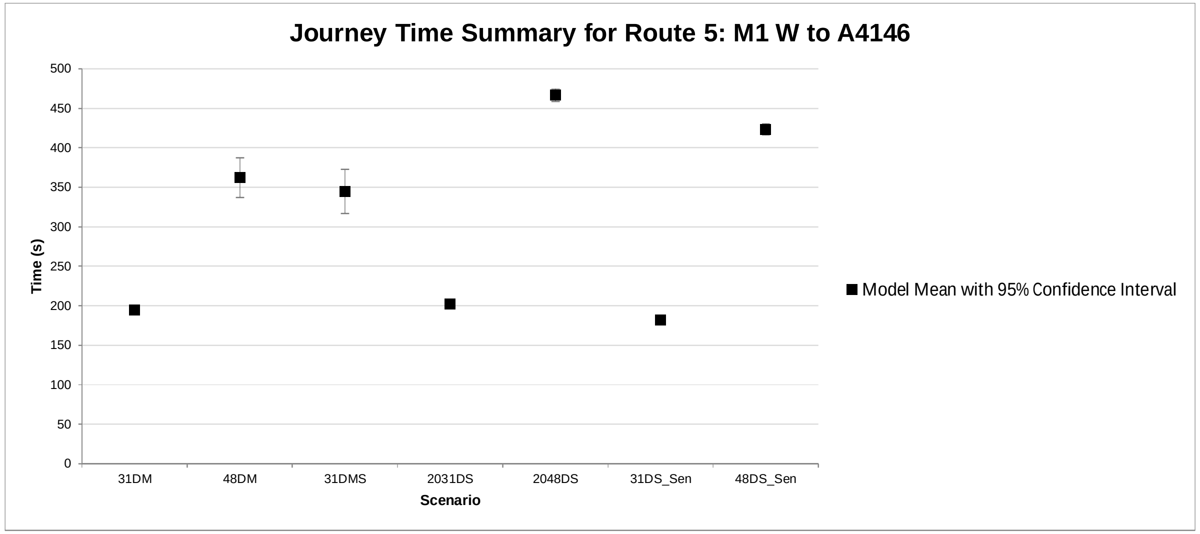
Journey Time Comparison Graphs
AM
07:00 - 10:00
Sensitivity

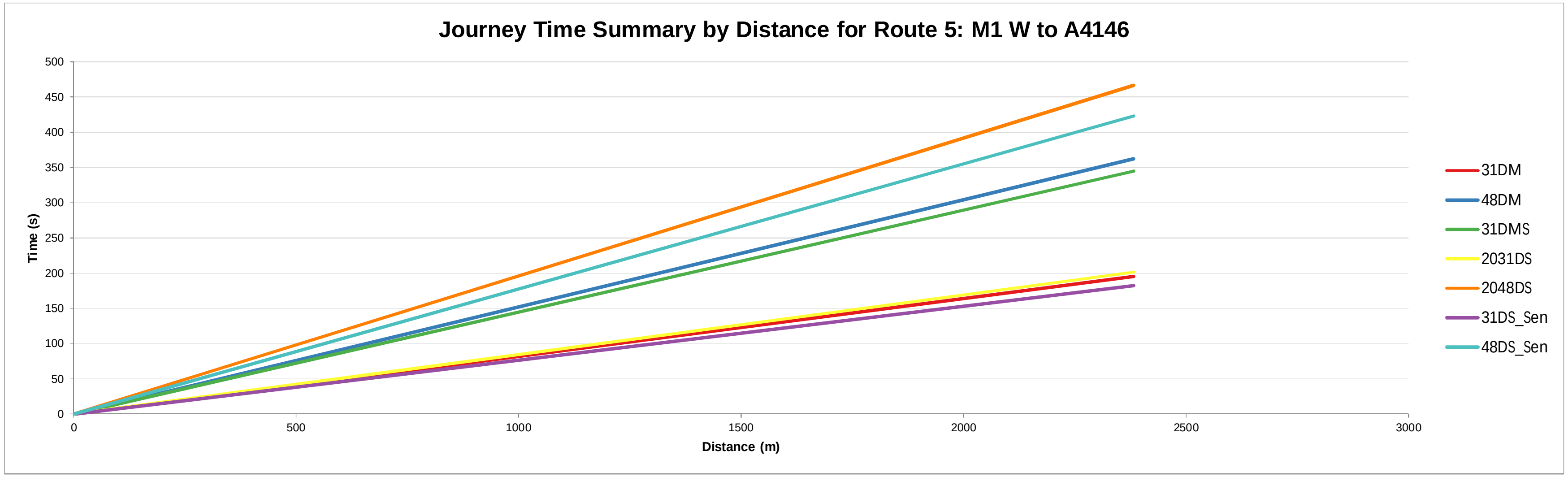


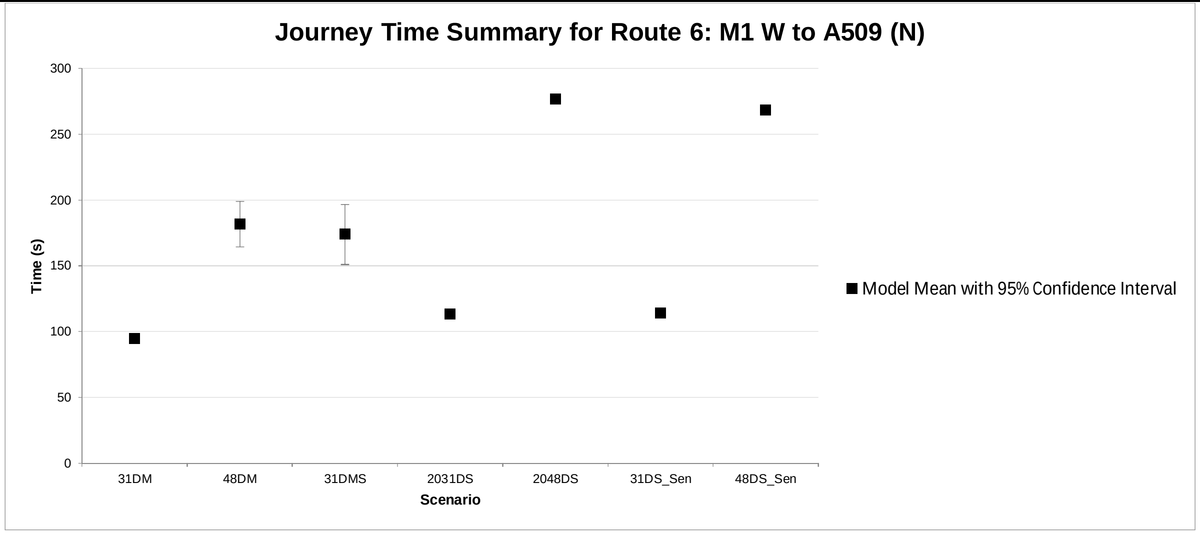


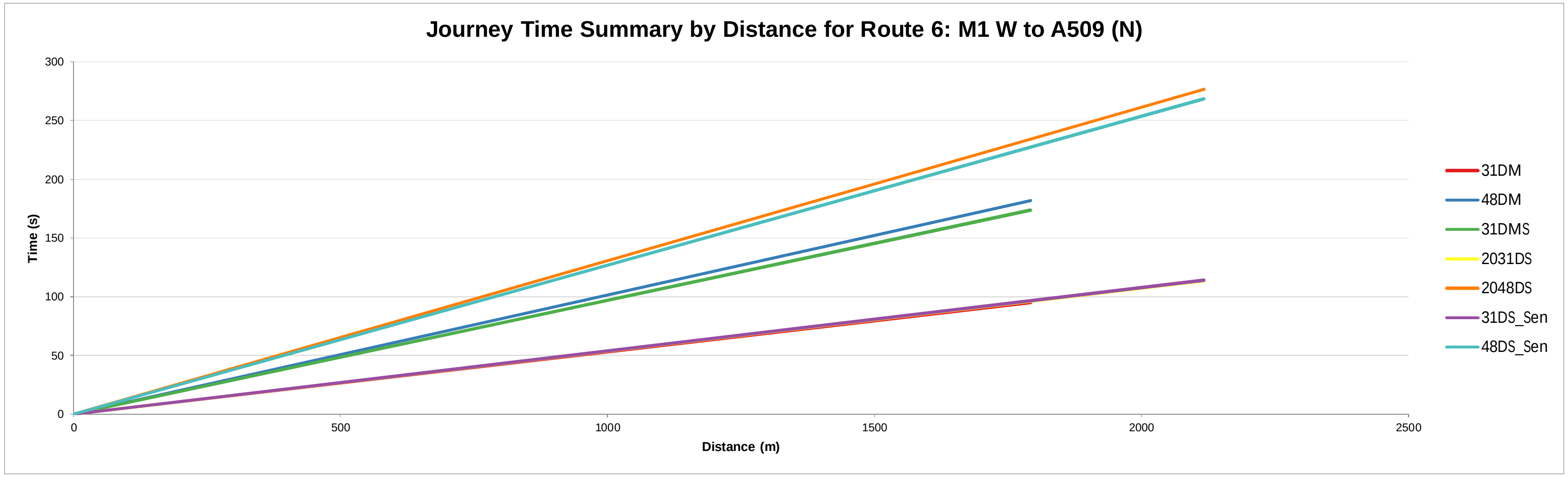

Journey Time Summary for Route 4: M1 E to A509 W
Time (s)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen
Scenario
Model Mean with 95% Confidence Interval

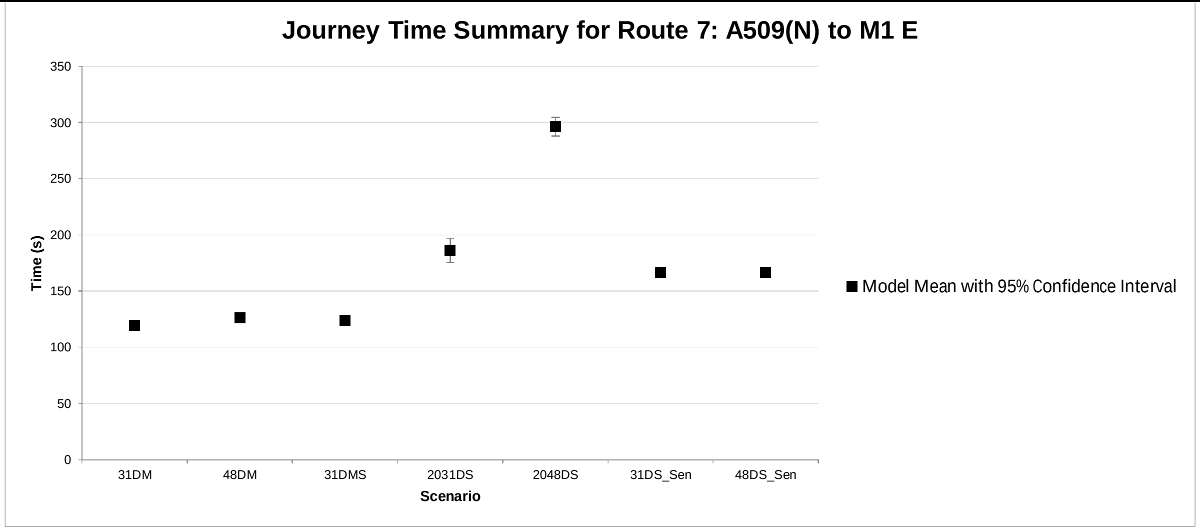

Journey Time Summary by Distance for Route 4: M1 E to A509 W
Time (s)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Distance (m)
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen

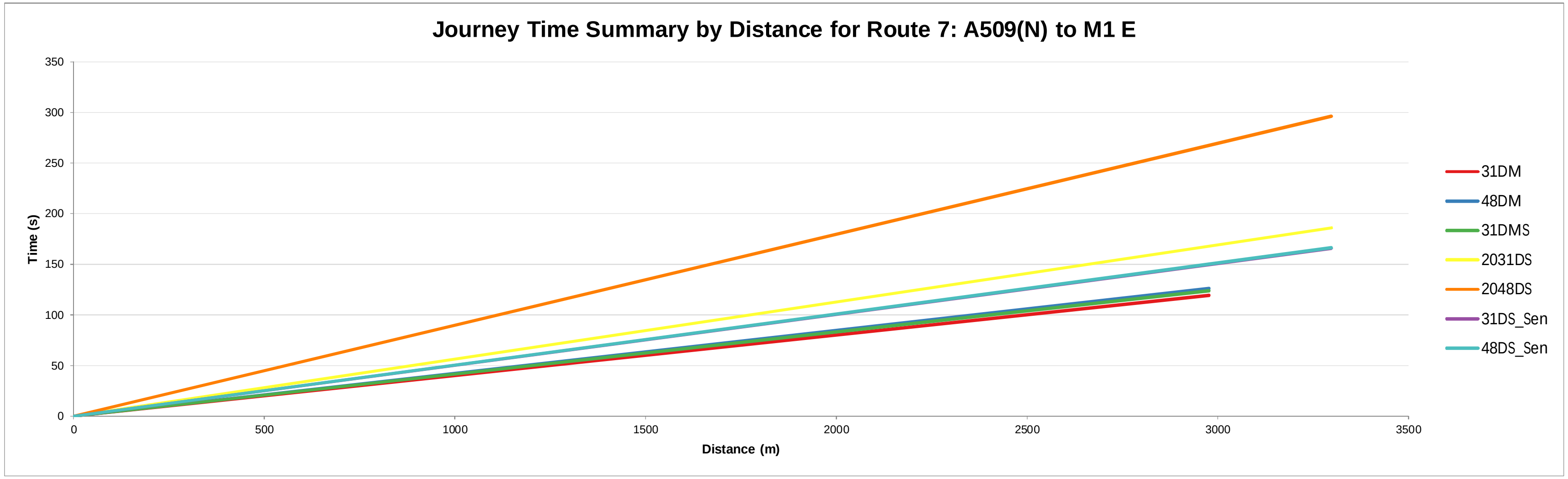

Journey Time Summary for Route 5: M1 W to A4146
Time (s)
500
450
400
350
300
250
200
150
100
50
0
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen
Scenario
Model Mean with 95% Confidence Interval


Journey Time Summary by Distance for Route 5: M1 W to A4146
Time (s)
500
450
400
350
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000
Distance (m)
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen

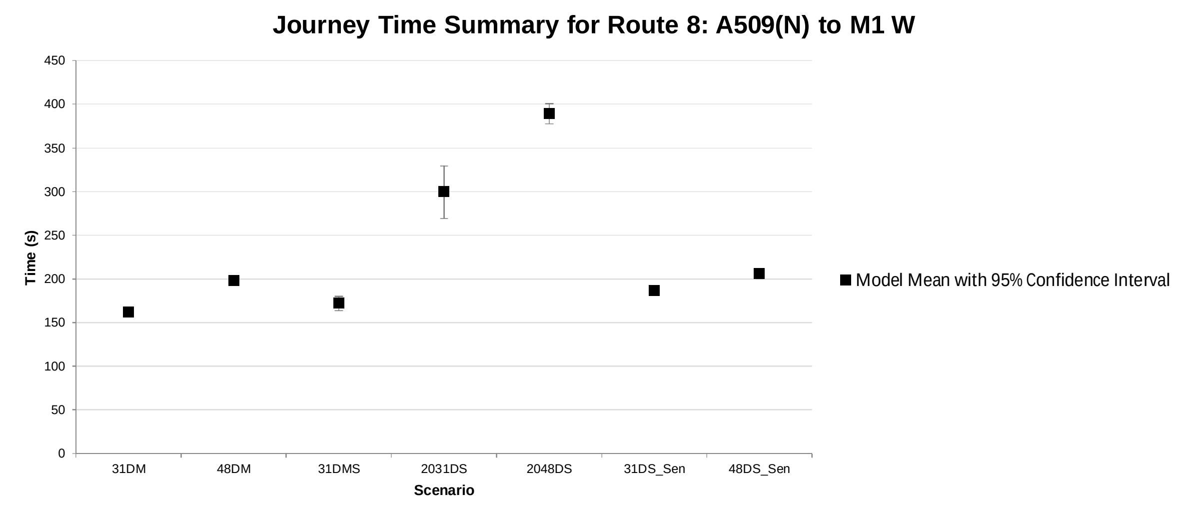

Journey Time Summary for Route 6: M1 W to A509 (N)
Time (s)
300
250
200
150
100
50
0
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen
Scenario
Model Mean with 95% Confidence Interval

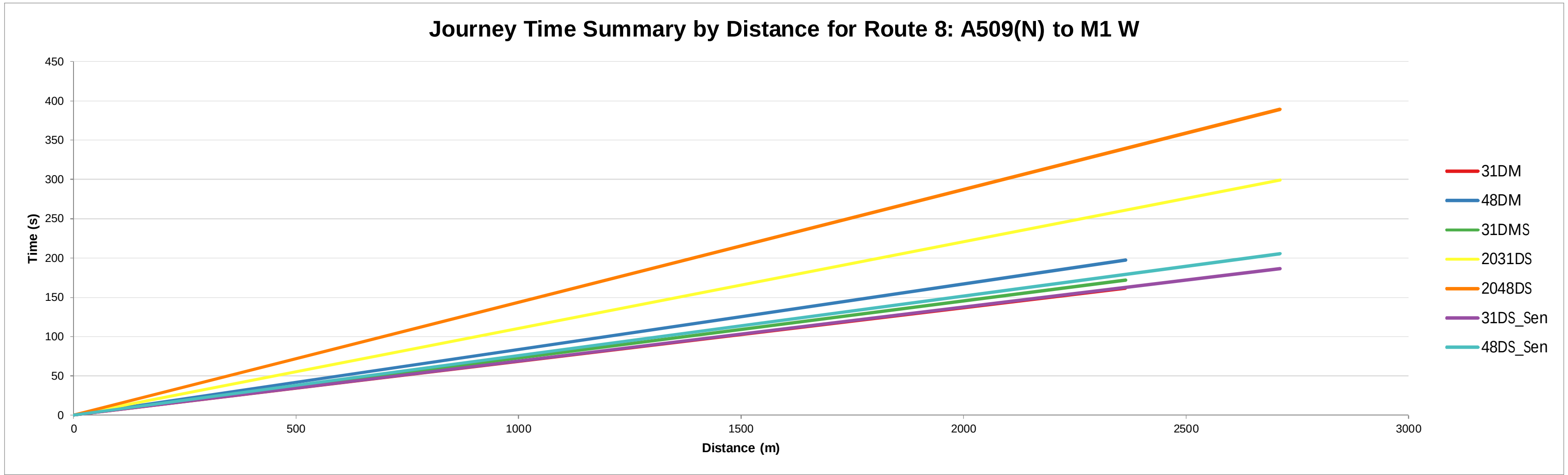

Journey Time Summary by Distance for Route 6: M1 W to A509 (N)
Time (s)
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
Distance (m)
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen

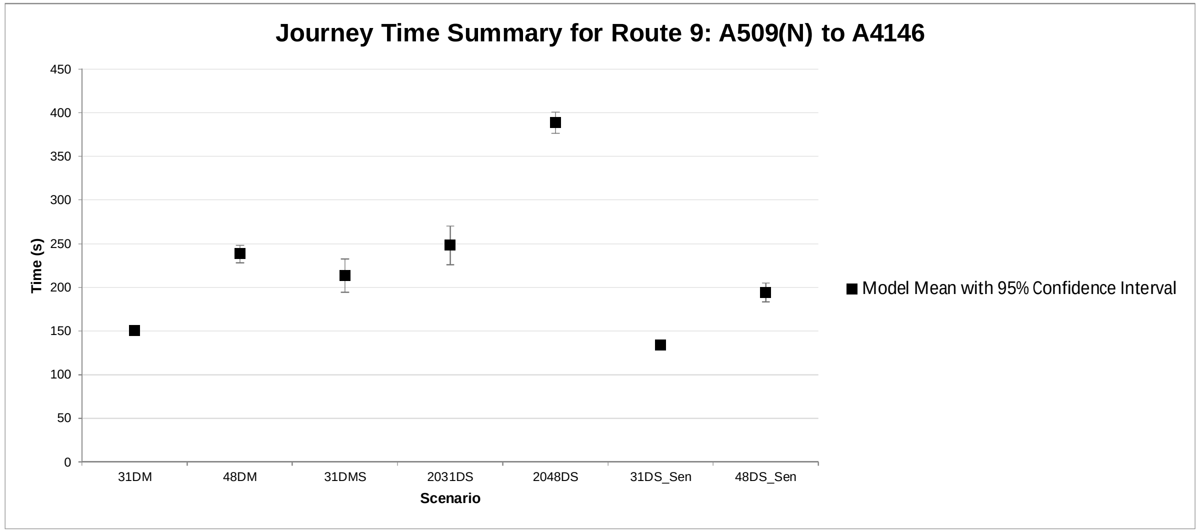

Journey Time Summary for Route 7: A509(N) to M1 E
Time (s)
350
300
250
200
150
100
50
0
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen
Scenario
Model Mean with 95% Confidence Interval

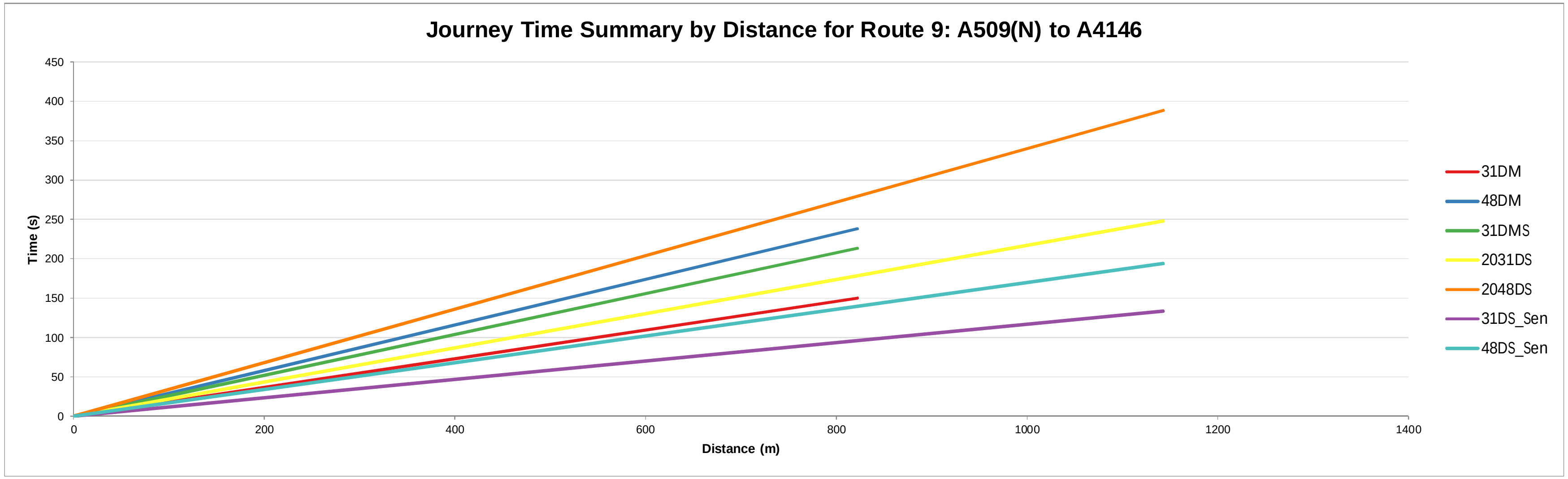

Journey Time Summary by Distance for Route 7: A509(N) to M1 E
Time (s)
350
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000
3500
Distance (m)
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen

Journey Time Comparison Graphs
AM
07:00 - 10:00
Sensitivity

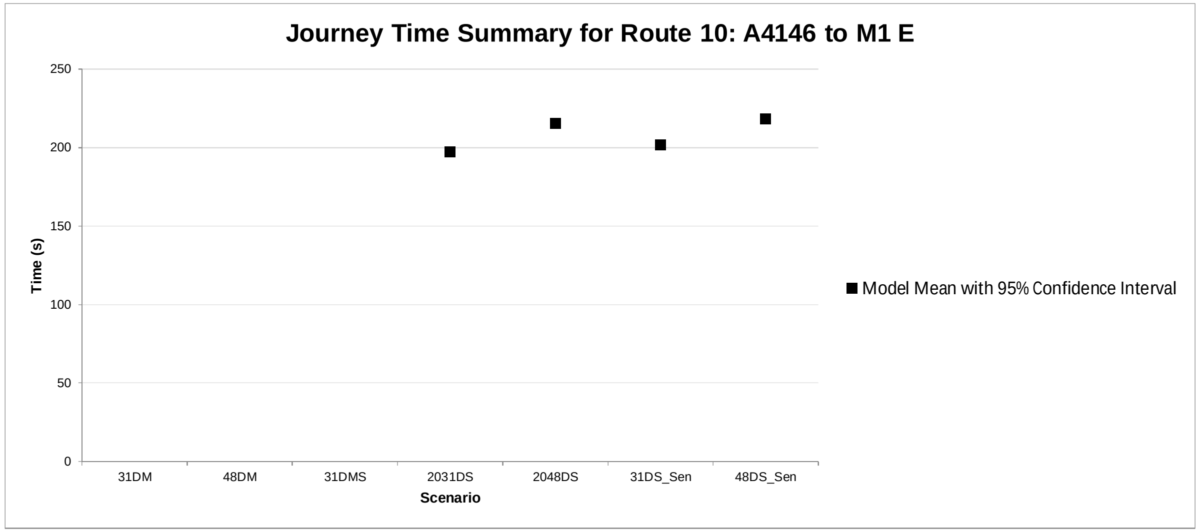


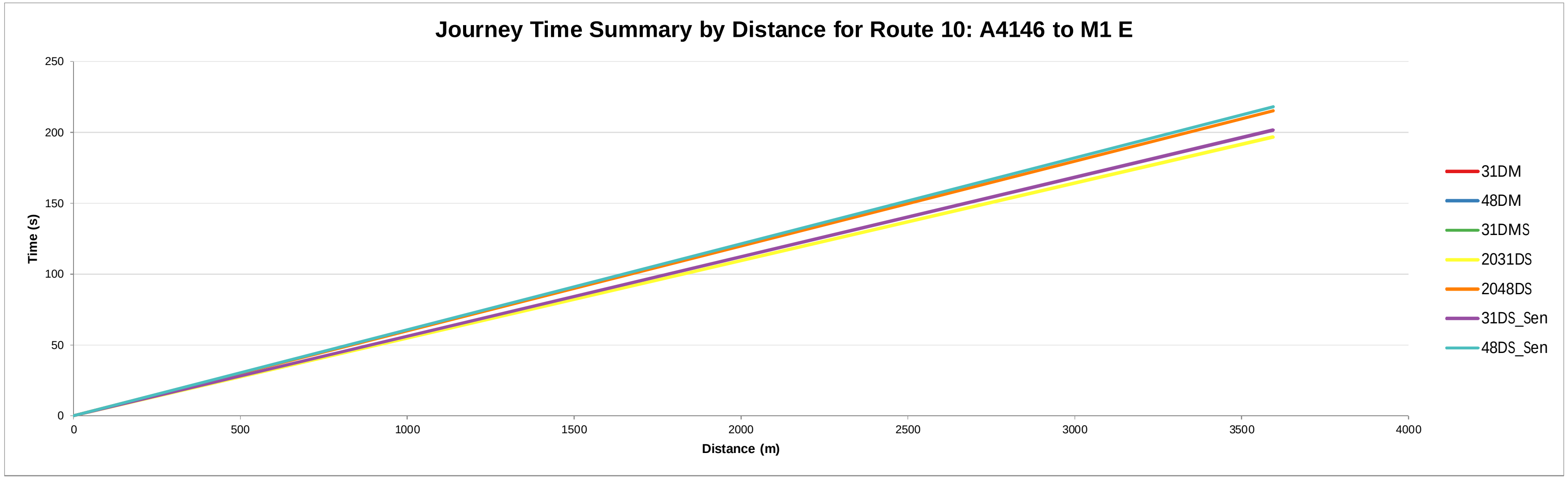


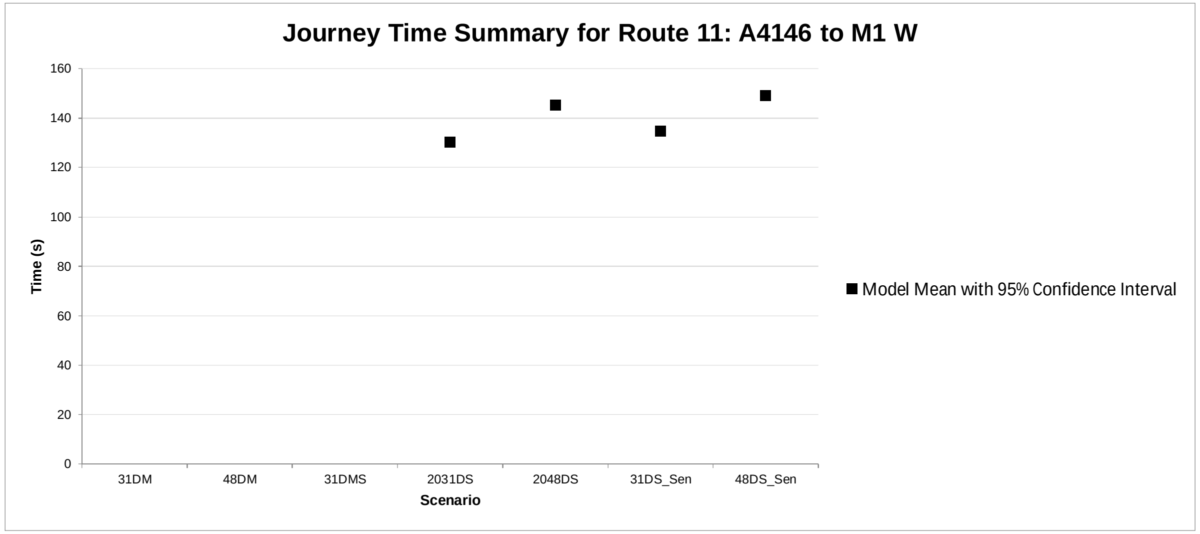

Journey Time Summary for Route 9: A509(N) to A4146
Time (s)
0
50
100
150
200
250
300
350
400
450
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen
Scenario
Model Mean with 95% Confidence Interval

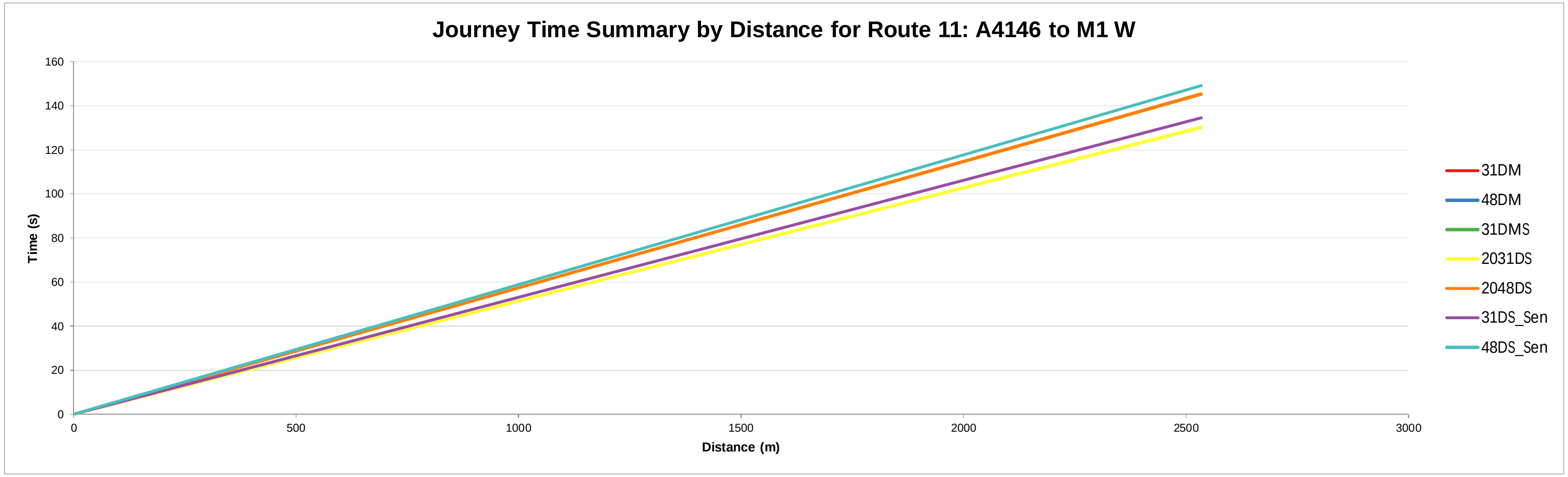

Journey Time Summary by Distance for Route 9: A509(N) to A4146
Time (s)
0
50
100
150
200
250
300
350
400
450
0
200
400
600
800
1000
1200
1400
Distance (m)
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen

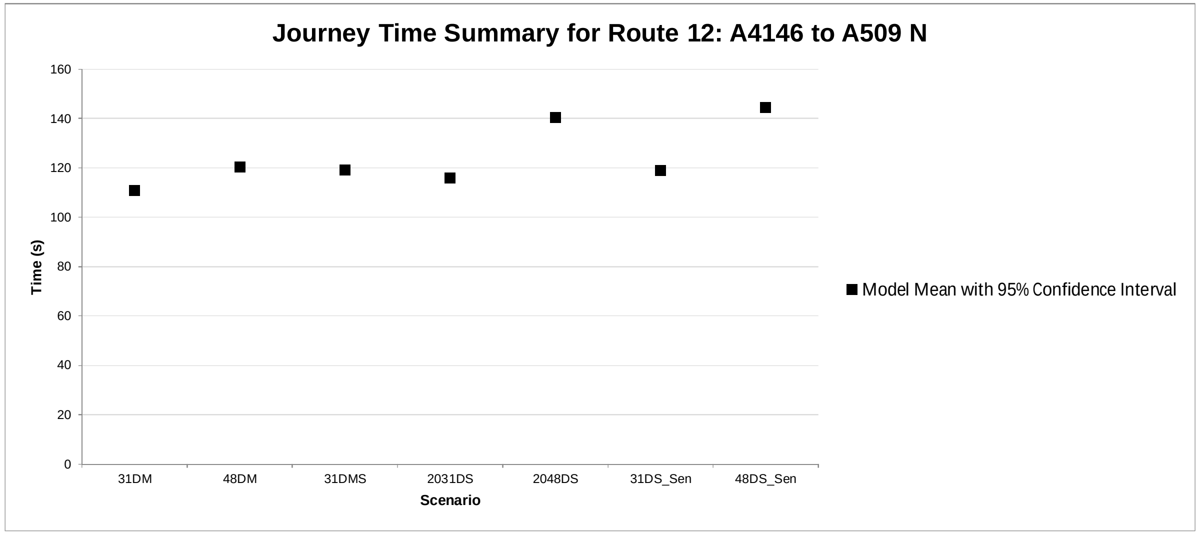
Journey Time Comparison Graphs
AM
07:00 - 10:00
Sensitivity

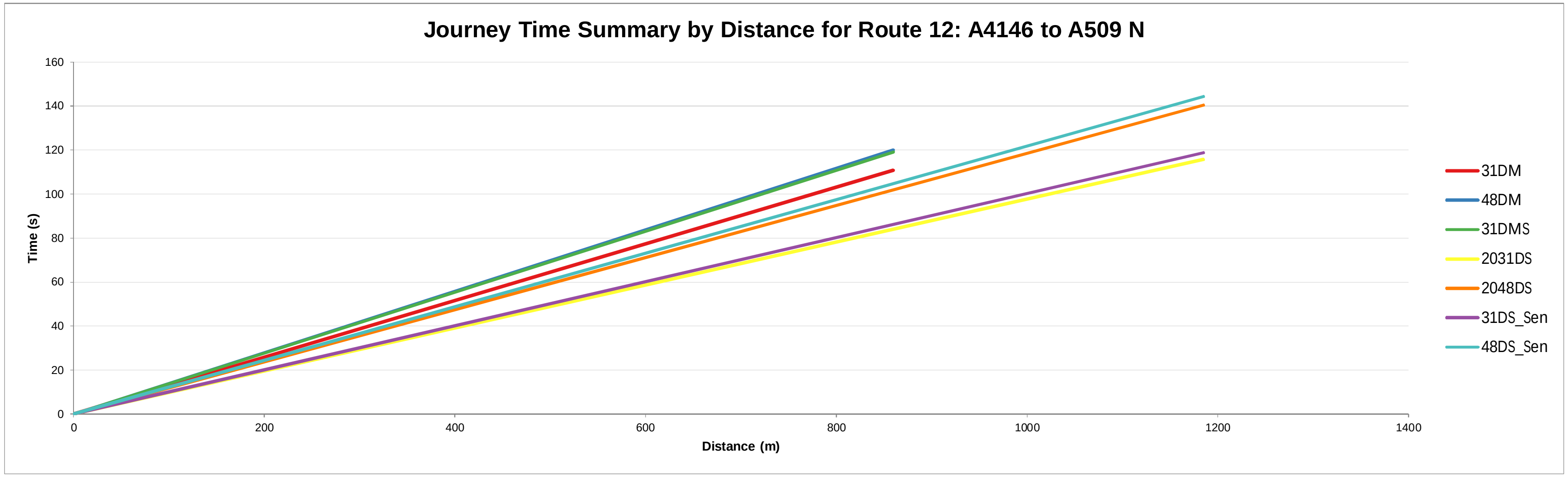


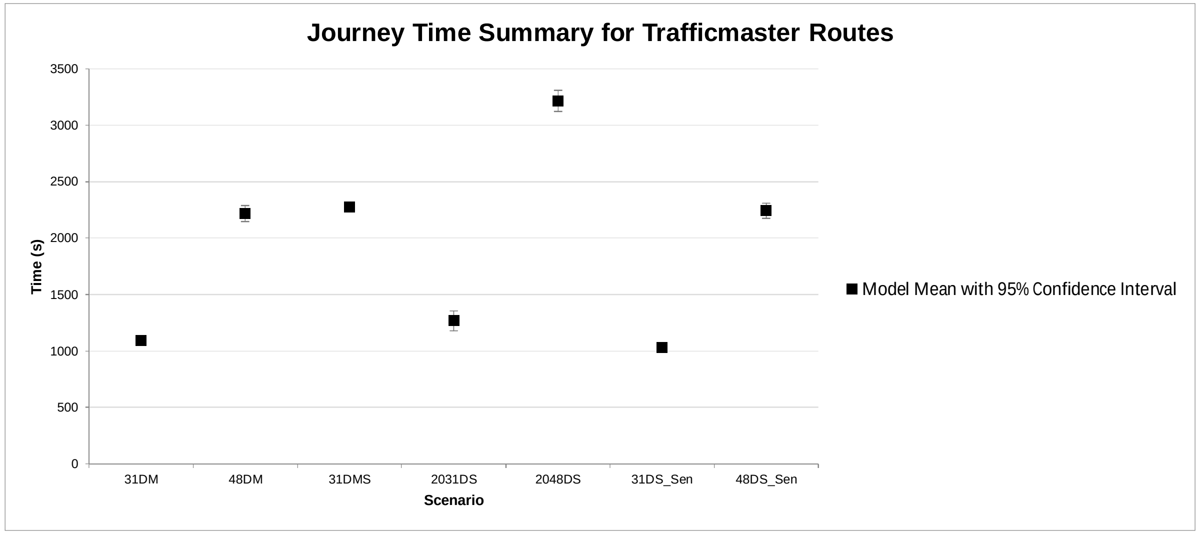


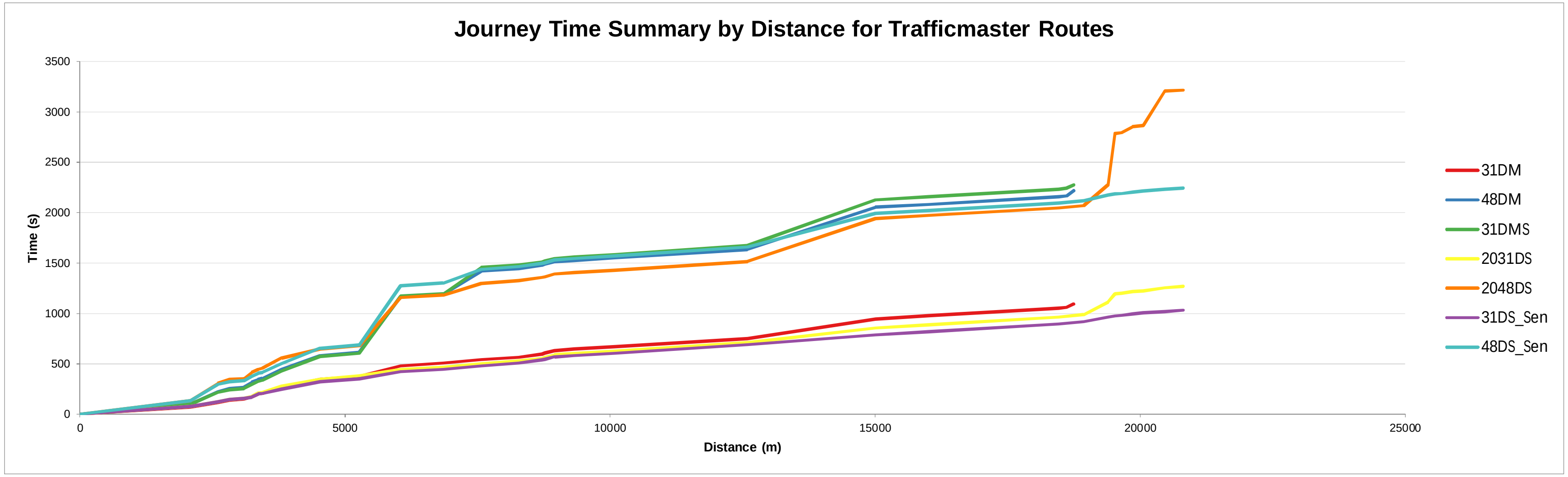

Journey Time Summary for Route 11: A4146 to M1 W
Time (s)
0
20
40
60
80
100
120
140
160
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen
Scenario
Model Mean with 95% Confidence Interval


Journey Time Summary by Distance for Route 11: A4146 to M1 W
Time (s)
0
20
40
60
80
100
120
140
160
0
500
1000
1500
2000
2500
3000
Distance (m)
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen


Journey Time Summary for Route 12: A4146 to A509 N
Time (s)
160
140
120
100
80
60
40
20
0
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen
Scenario
Model Mean with 95% Confidence Interval


Journey Time Summary by Distance for Route 12: A4146 to A509 N
Time (s)
160
140
120
100
80
60
40
20
0
0
200
400
600
800
1000
1200
1400
Distance (m)
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen

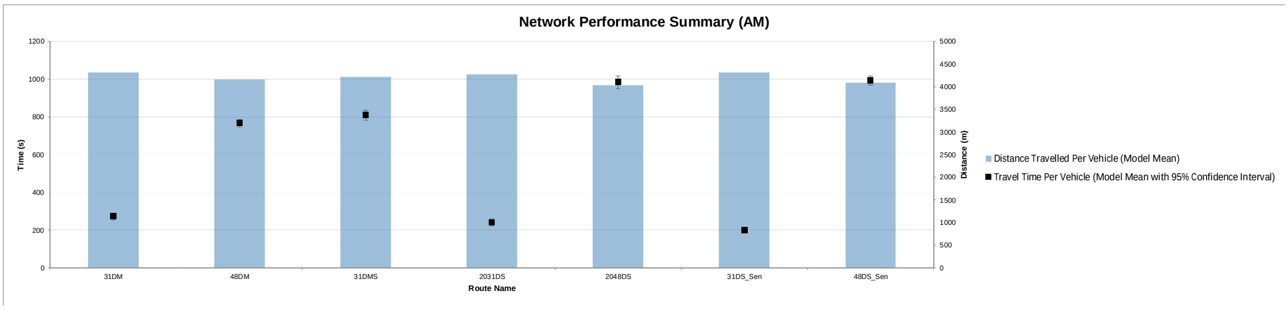

Journey Time Summary for Trafficmaster Routes
3500
3000
2500
2000
1500
1000
500
0
Time (s)
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen
Scenario
Model Mean with 95% Confidence Interval


Journey Time Summary by Distance for Trafficmaster Routes
3500
3000
2500
2000
1500
1000
500
0
Time (s)
0
5000
10000
15000
20000
25000
Distance (m)
31DM
48DM
31DMS
2031DS
2048DS
31DS_Sen
48DS_Sen

Journey Time Table
AM
Sensitivity

Route Names	31DM	48DM	31DMS	2031DS	2048DS	31DS_Sen	48DS_Sen
Route 1: M1 WB	256	456	486	211	454	165	376
Route 2: M1 EB	156	160	162	157	162	157	166
Route 3: M1 E to A509 N	299	652	676	269	707	209	546
Route 4: M1 E to A509 W	0	0	0	0	0	0	0
Route 5: M1 W to A4146	195	362	345	202	467	182	423
Route 6: M1 W to A509 (N)	95	182	174	113	277	114	269
Route 7: A509(N) to M1 E	119	126	124	186	296	166	166
Route 8: A509(N) to M1 W	162	197	172	299	389	186	206
Route 9: A509(N) to A4146	150	238	213	248	389	134	194
Route 10: A4146 to M1 E	0	0	0	197	215	202	218
Route 11: A4146 to M1 W	0	0	0	130	145	134	149
Route 12: A4146 to A509 N	111	120	119	116	140	119	144
TM Route 1	72	100	98	76	136	76	135
TM Route 2	43	120	116	46	170	48	163
TM Route 3	24	33	30	23	36	21	25
TM Route 5	11	11	11	11	11	11	11
TM Route 6	21	51	43	22	60	14	43
TM Route 7	28	29	28	31	30	29	29
TM Route 8	5	11	10	5	14	4	9
TM Route 9	62	91	87	63	101	44	88
TM Route 10	77	135	149	73	86	74	151
TM Route 11	32	32	32	32	32	32	32
TM Route 12	105	552	566	58	480	67	590
TM Route 13	24	24	24	24	24	24	24
TM Route 14	35	230	262	35	117	36	137
TM Route 15	26	25	25	25	26	25	26
TM Route 16	30	29	29	30	31	30	32
TM Route 17	12	14	13	9	10	8	9
TM Route 18	23	24	24	23	28	23	28
TM Route 19	15	14	14	15	15	15	14
TM Route 20	23	23	24	23	24	23	25
TM Route 21	84	85	86	84	85	85	88
TM Route 22	193	419	457	146	426	95	332
TM Route 23	30	29	29	30	29	31	30
TM Route 24	65	62	63	65	62	65	64
TM Route 25	13	13	13	13	13	13	13
TM Route 26	9	10	9	22	23	22	23
TM Route 27	29	51	33	126	205	49	54
Acees Road_E Entry	0	0	0	83	513	9	9
Acees Road_E Exit	0	0	0	6	6	6	6
Acees Road_W Entry	0	0	0	16	60	15	16
Acees Road_W Exit	0	0	0	10	10	10	10
A509_N Entry	0	0	0	30	341	14	16
A509_N Exit	0	0	0	12	12	12	12
Trafficmaster Routes	1092	2218	2275	1268	3216	1031	2243

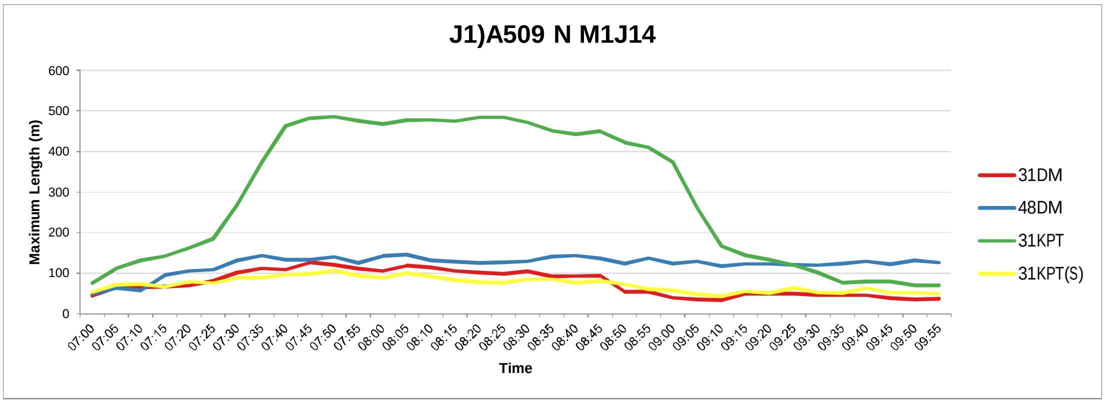
	31DM (AM)	48DM (AM)	31DMS (AM)	2031DS (AM)	2048DS (AM)	31DS_Sen (AM)	48DS_Sen (AM)	
Total Time Taken (s)	9910892	28756678	30274749	8888433	36992585	7315703	37100475	
Total Distance (m)	157279547	156249600	158035033	158031600	151502621	158571749	152996962	
Total Vehicles	36411	37609	37438	36936	37647	36729	37384	
Total Delay (s)								
Average Time (s) / Vehicle	272	766	809	241	984	199	993	
Average Time (s) / Mile	101	297	309	91	394	74	391	
Average Distance (m) / Vehicle	4320	4154	4221	4279	4024	4317	4092	
Average Speed (mph)	36	12	12	41	9	49	9	
Average Speed (kph)	58	20	19	65	15	79	15	
Average Delay / Vehicle								

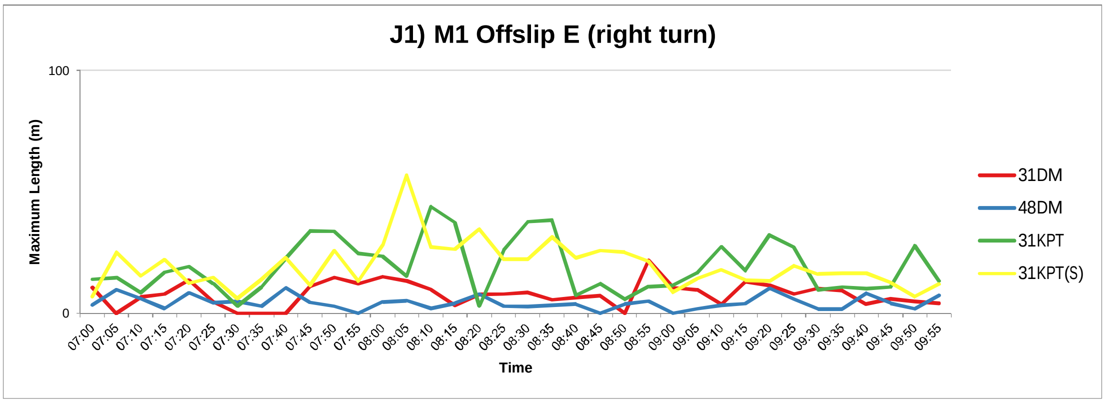


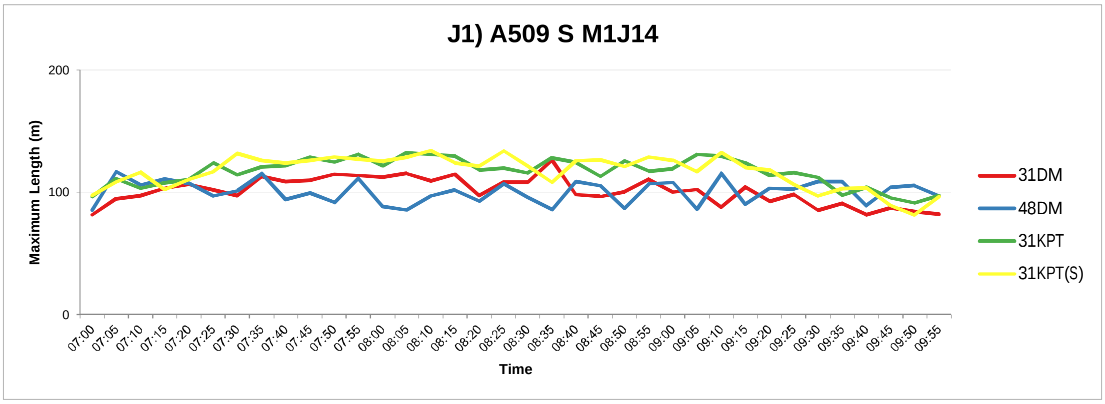
APPENDIX C

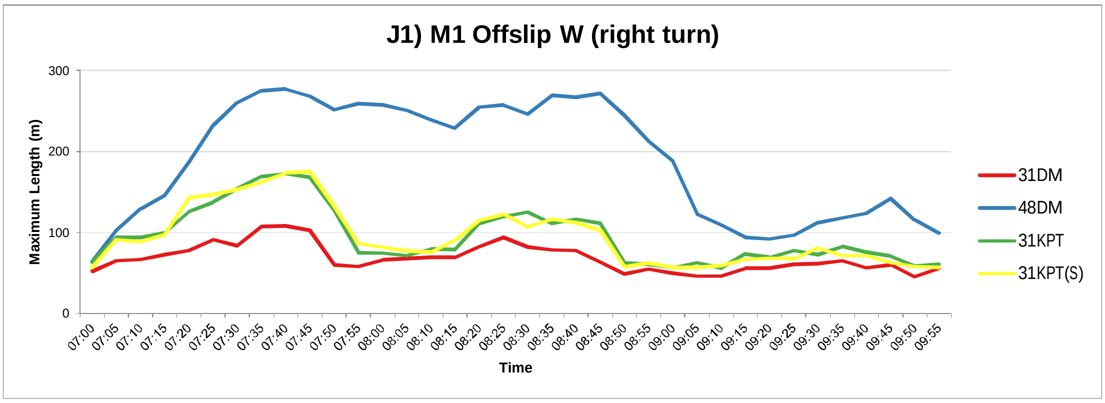
CG 8 QueueGraphs AM
CG 8 QueueTable Maximum AM
CG 8 QueueTable Average AM
CG 8 JtimeSmry
CG 8 JT Table AM
CG 8 NetPerf Summary
CG 8 QueueGraphs PM
CG 8 QueueTable Maximum PM
CG 8 QueueTable Average PM
CG 8 JT Table PM

wsp	**Comparison Graphs** **AM** **J1**



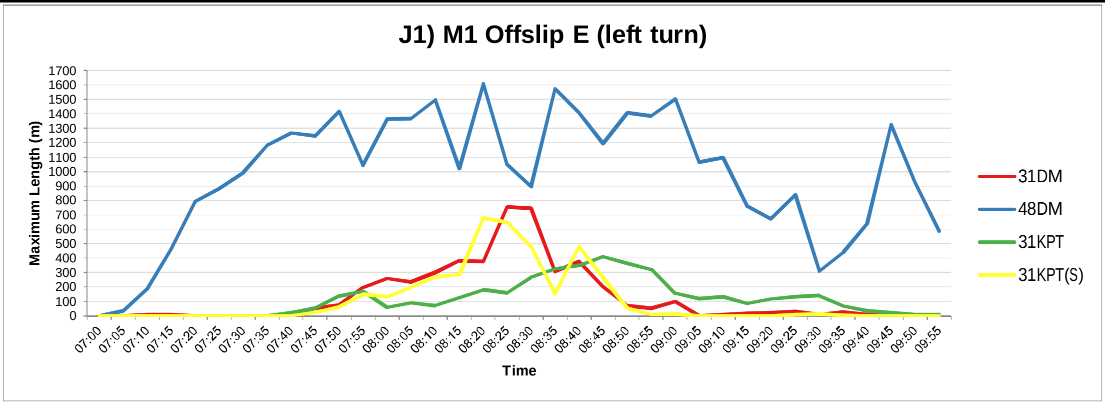


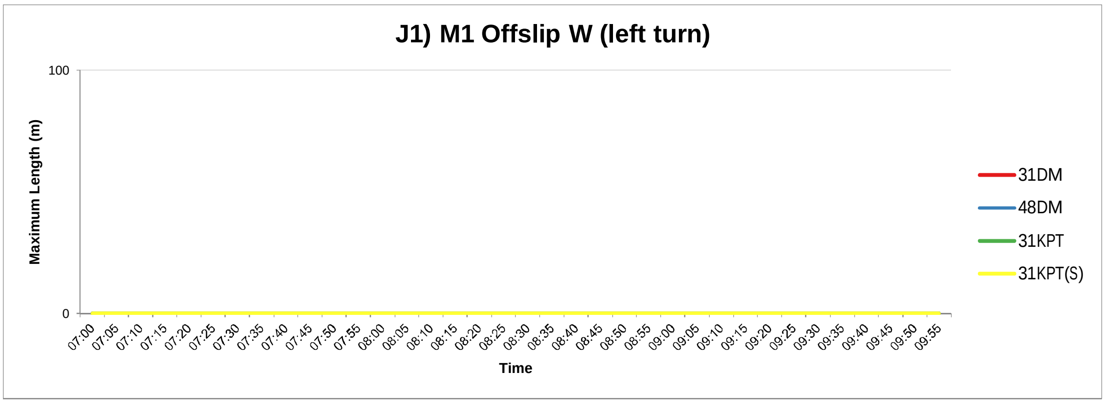


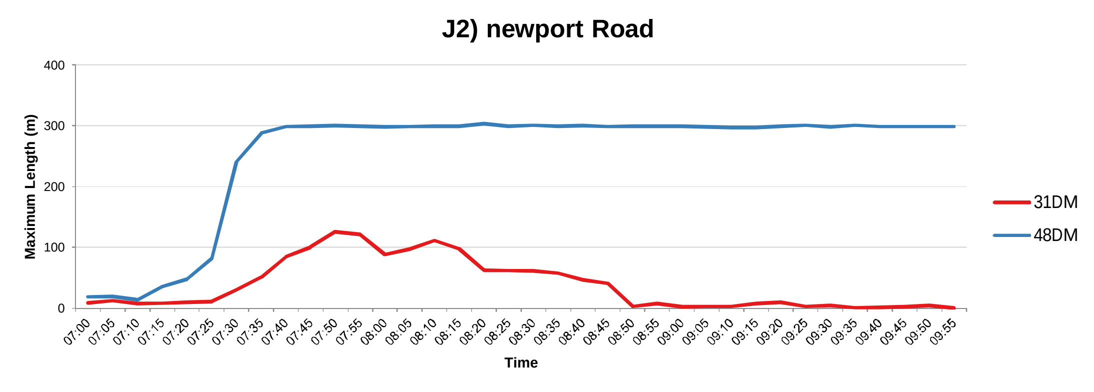


Comparison Graphs
AM

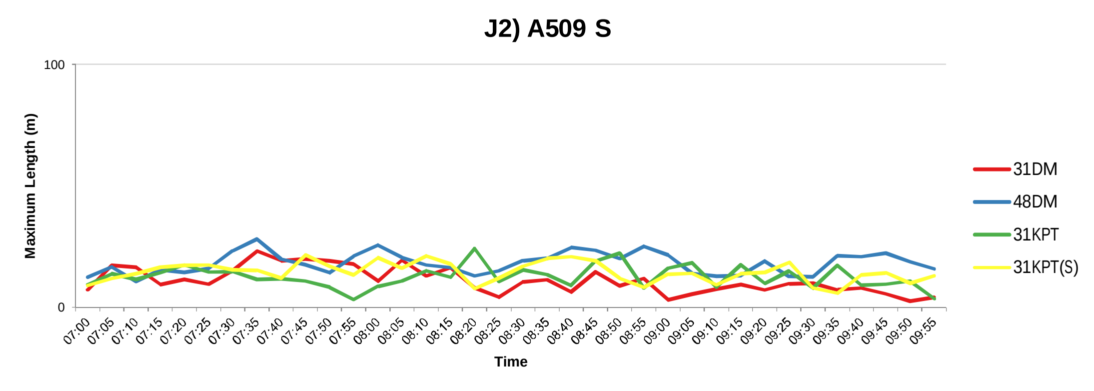
J1



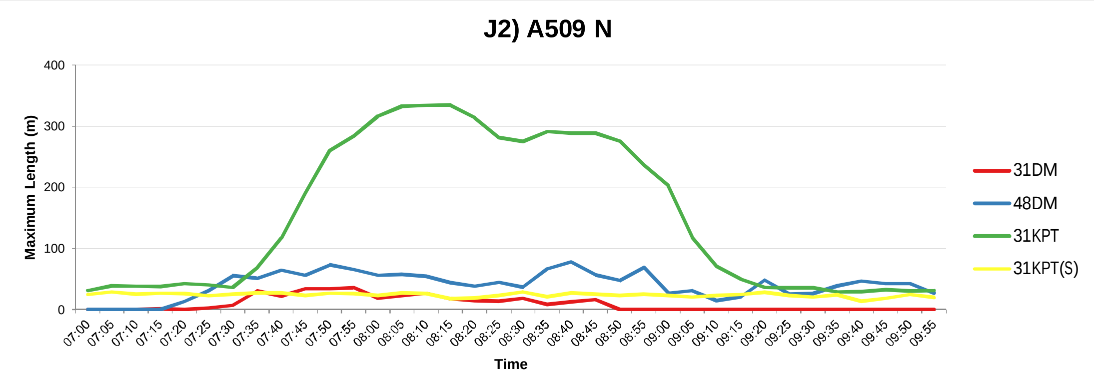




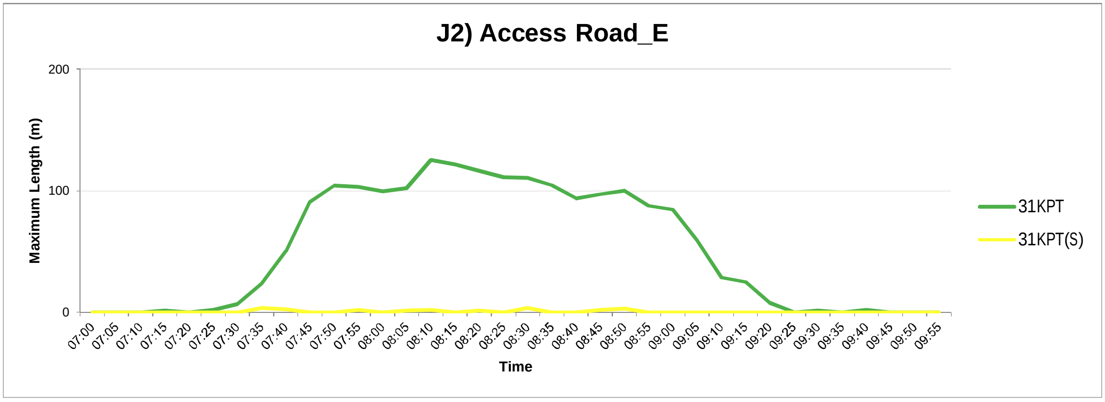
J2) newport Road
Maximum Length (m)
400
300
200
100
0
Time
31DM
48DM



J2) A509 S
Maximum Length (m)
100
0
Time
31DM
48DM
31KPT
31KPT(S)

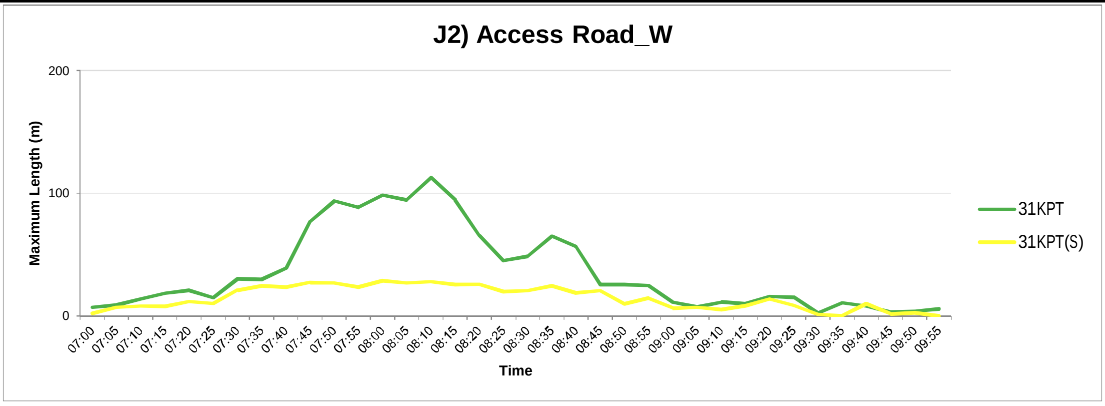


J2) A509 N
Maximum Length (m)
400
300
200
100
0
Time
31DM
48DM
31KPT
31KPT(S)



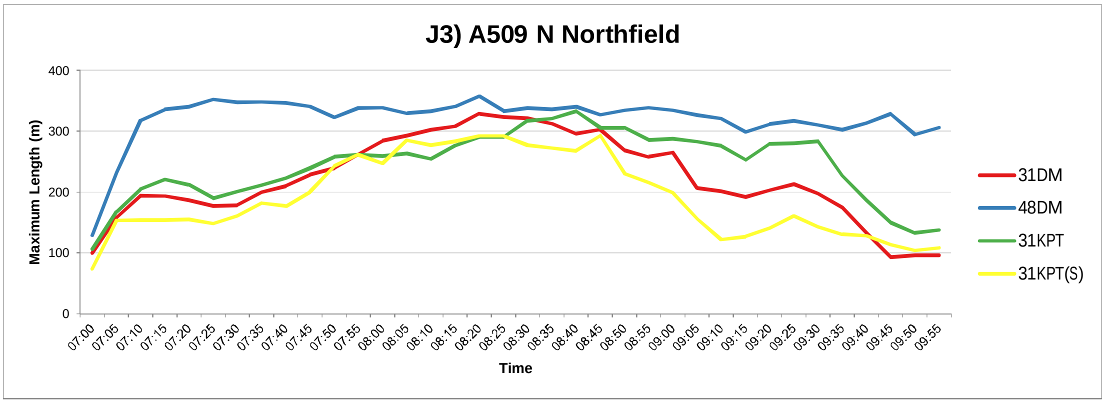
J2) Access Road_E
Maximum Length (m)
200
100
0
Time
31KPT
31KPT(S)

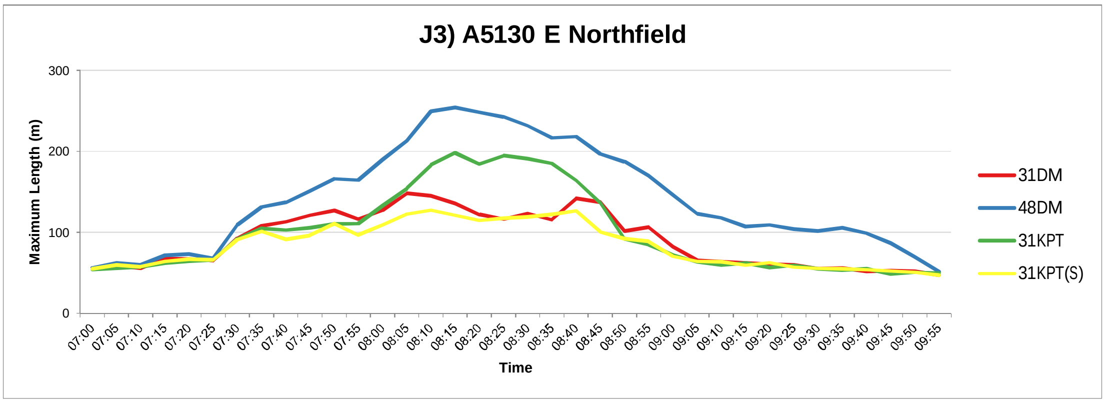
wsp	**Comparison Graphs** **AM** **J2**

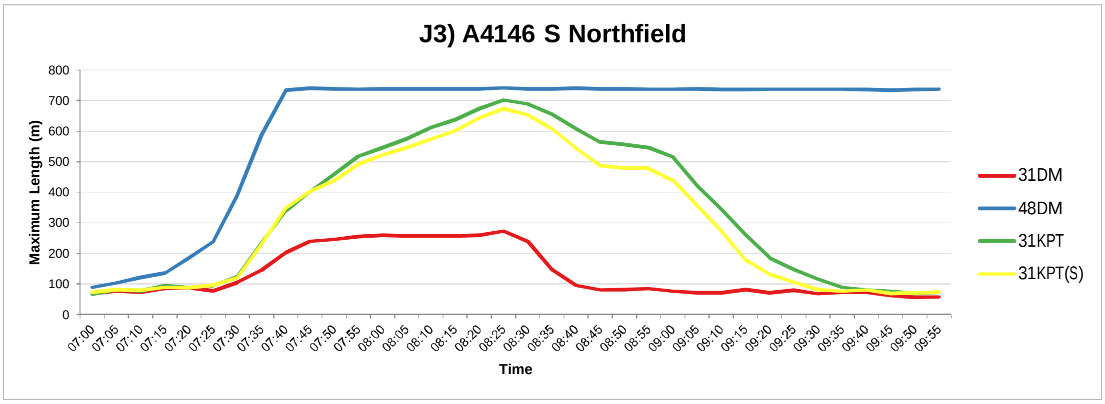


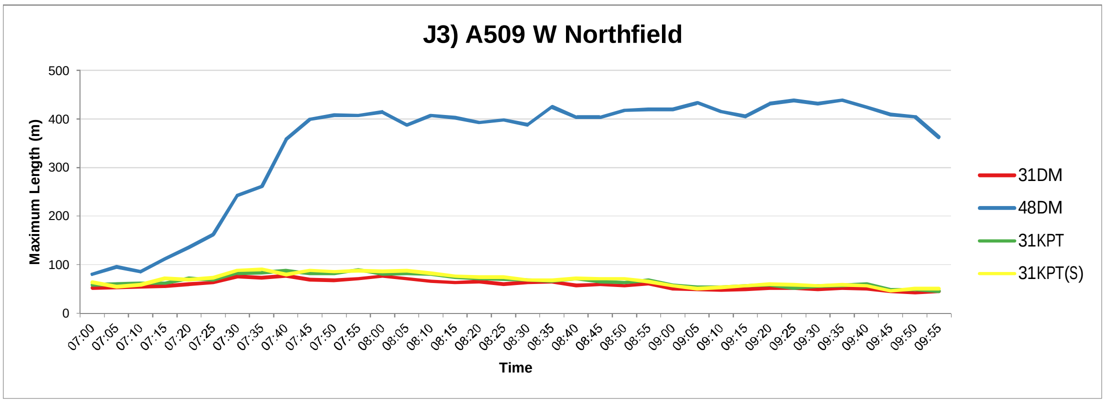
Comparison Graphs
AM

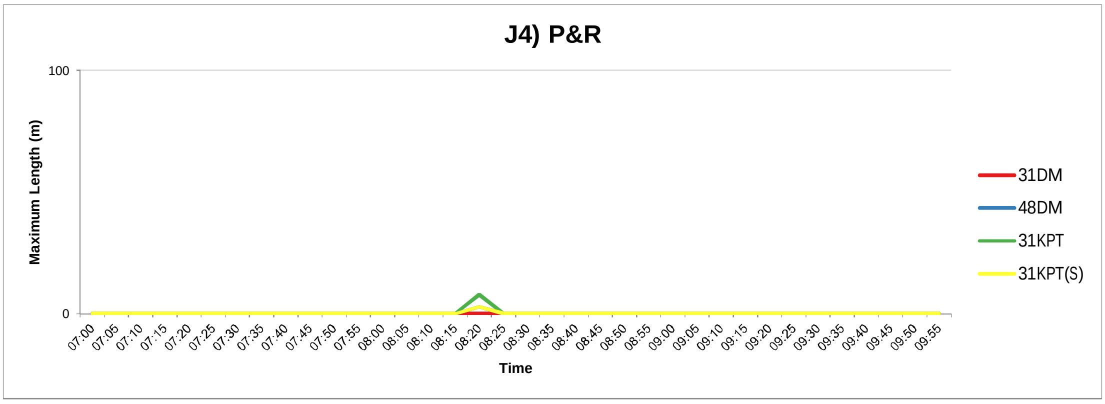
J3










J4) P&R
Maximum Length (m)
100
0
07:00
07:05
07:10
07:15
07:20
07:25
07:30
07:35
07:40
07:45
07:50
07:55
08:00
08:05
08:10
08:15
08:20
08:25
08:30
08:35
08:40
08:45
08:50
08:55
09:00
09:05
09:10
09:15
09:20
09:25
09:30
09:35
09:40
09:45
09:50
09:55
Time
31DM
48DM
31KPT
31KPT(S)

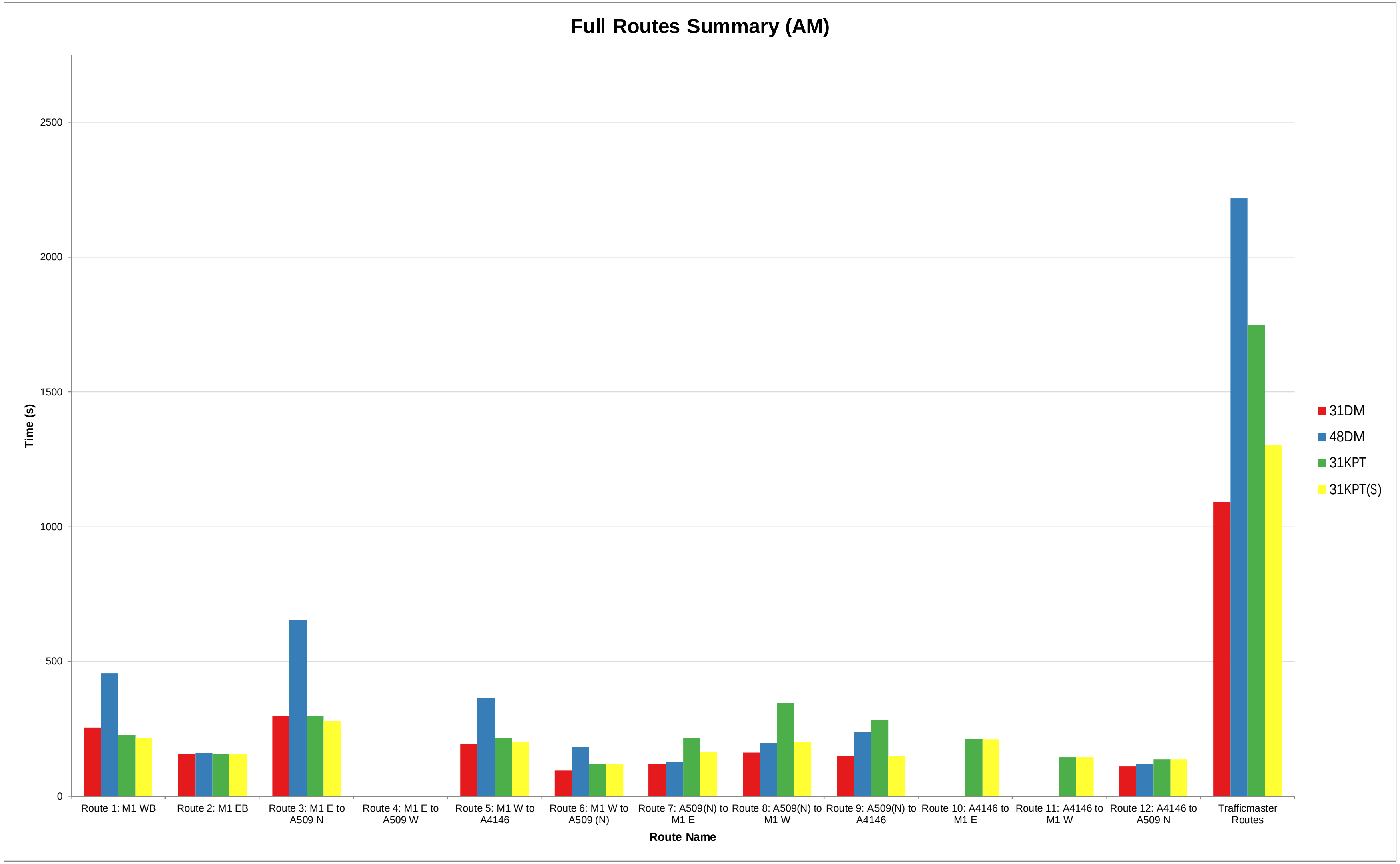
Queue Comparison
AM
Maximum Length Summary
Maximum Length (m)

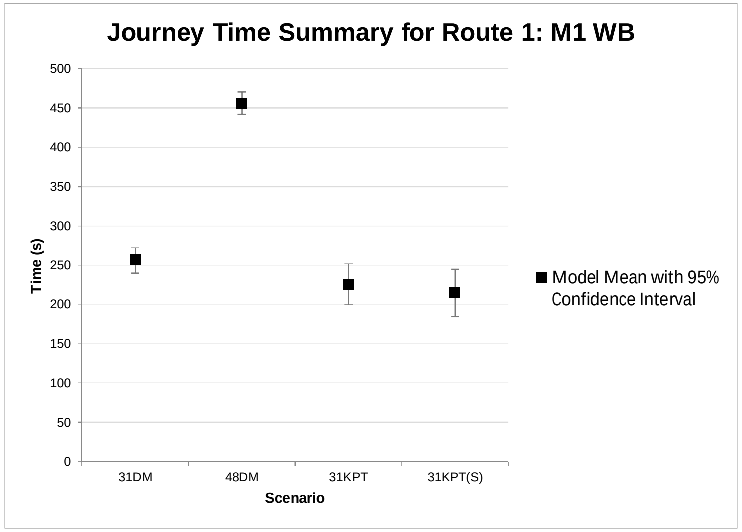
	31DM	48DM	31KPT	31KPT(S)
J1)A509 N M1J14	126.3	145.7	485.9	106.3
J1) M1 Offslip E (right turn)	21.8	10.5	43.9	56.9
J1) A509 S M1J14	126.6	116.9	132.3	134.1
J1) M1 Offslip W (right turn)	108.1	277.0	172.6	175.2
J1) M1 Offslip E (left turn)	753.0	1608.1	409.1	678.2
J1) M1 Offslip W (left turn)	0.0	0.0	0.0	0.0
J2) newport Road	125.6	303.5		
J2) A509 S	23.1	28.1	24.2	21.6
J2) A509 N	35.7	78.0	334.4	29.0
J2) Access Road_E			125.1	3.7
J2) Access Road_W			112.6	28.6
J3) A509 N Northfield	328.7	357.4	332.8	292.9
J3) A5130 E Northfield	148.3	254.4	198.2	127.4
J3) A4146 S Northfield	272.9	741.1	701.7	673.8
J3) A509 W Northfield	77.4	438.7	90.0	91.0
J4) P&R	0.0	2.8	7.8	2.8

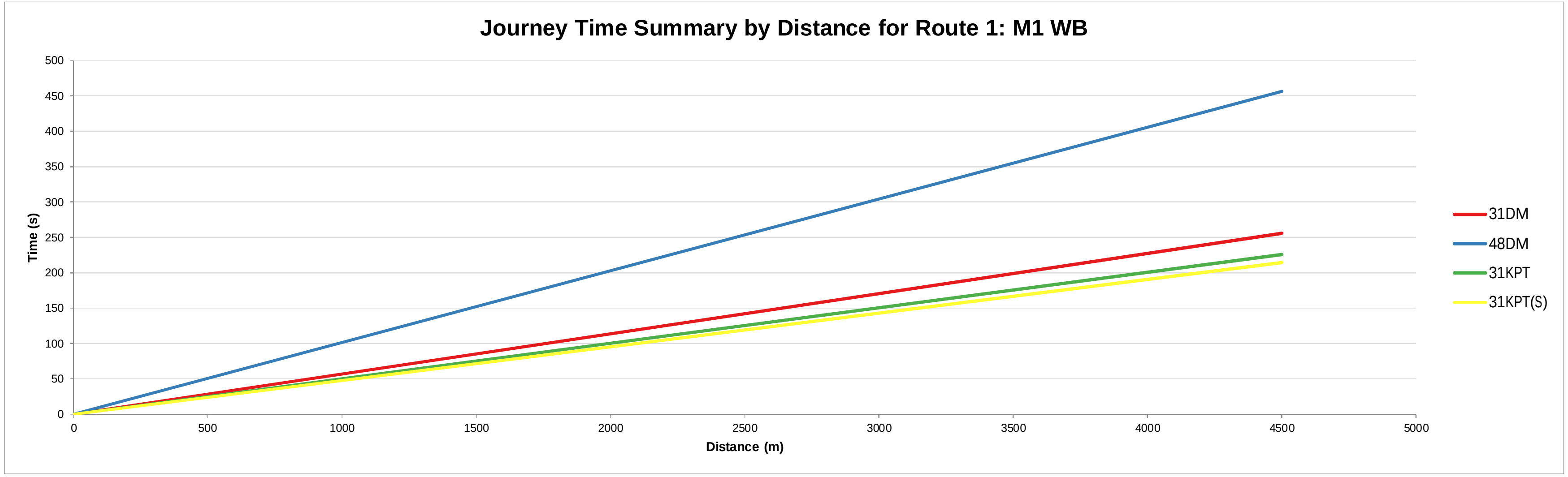
Queue Comparison
AM
Average Length Summary
Maximum Length (m)

	31DM	48DM	31KPT	31KPT(S)
J1)A509 N M1J14	75.1	121.5	293.0	72.1
J1) M1 Offslip E (right turn)	7.9	4.3	19.2	19.5
J1) A509 S M1J14	101.1	100.5	116.7	116.9
J1) M1 Offslip W (right turn)	68.2	190.6	94.9	94.4
J1) M1 Offslip E (left turn)	129.3	984.2	114.7	109.1
J1) M1 Offslip W (left turn)	0.0	0.0	0.0	0.0
J2) newport Road	37.4	253.3		
J2) A509 S	11.1	18.2	12.6	14.5
J2) A509 N	9.3	40.2	151.5	23.9
J2) Access Road_E			51.7	0.6
J2) Access Road_W			36.2	14.4
J3) A509 N Northfield	222.0	321.1	243.6	192.3
J3) A5130 E Northfield	91.1	141.4	99.3	83.6
J3) A4146 S Northfield	133.2	625.3	342.3	313.4
J3) A509 W Northfield	59.2	350.7	66.9	68.7
J4) P&R	0.0	0.1	0.2	0.1

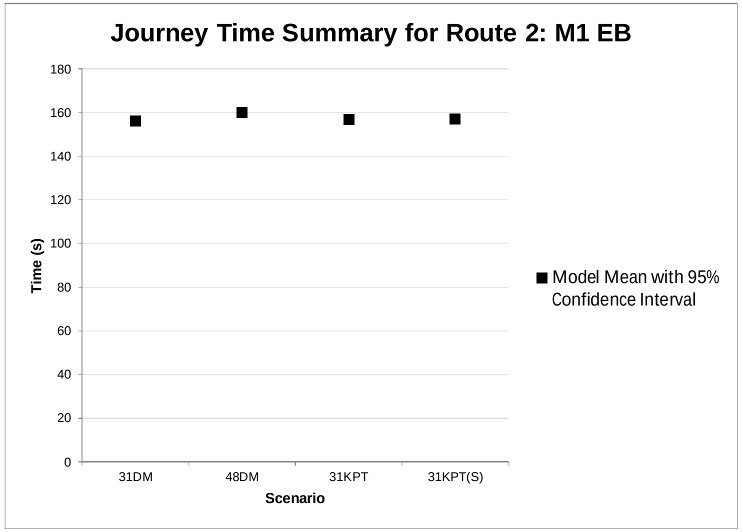
Journey Time Comparison Graphs
AM
07:00 - 10:00
Key Planning

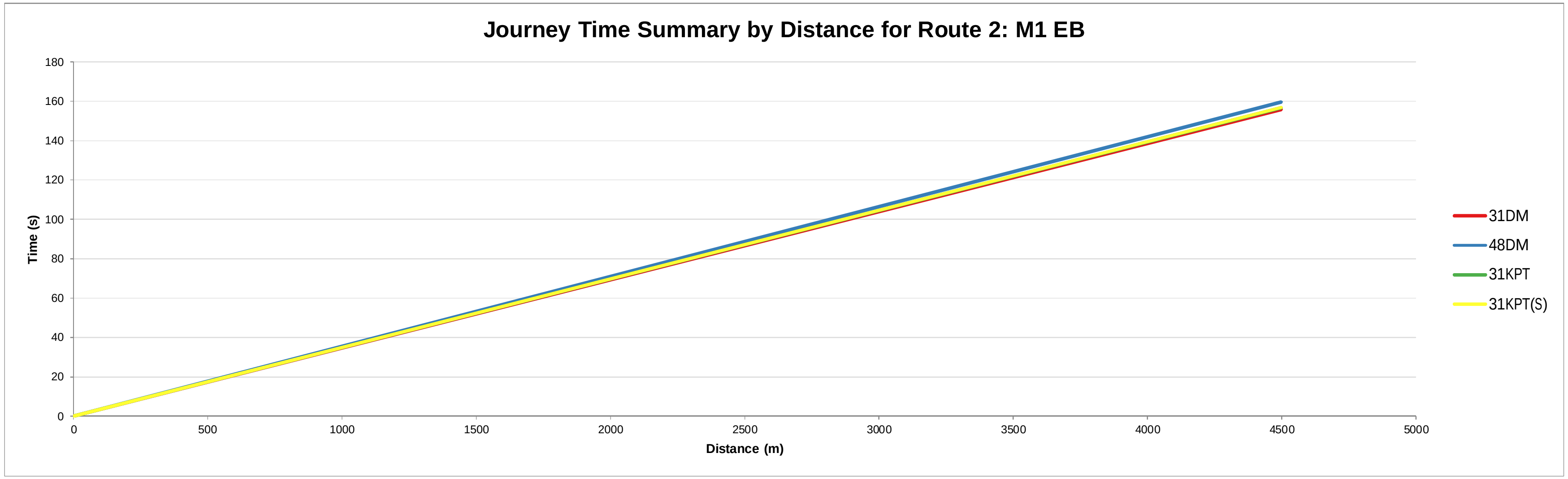


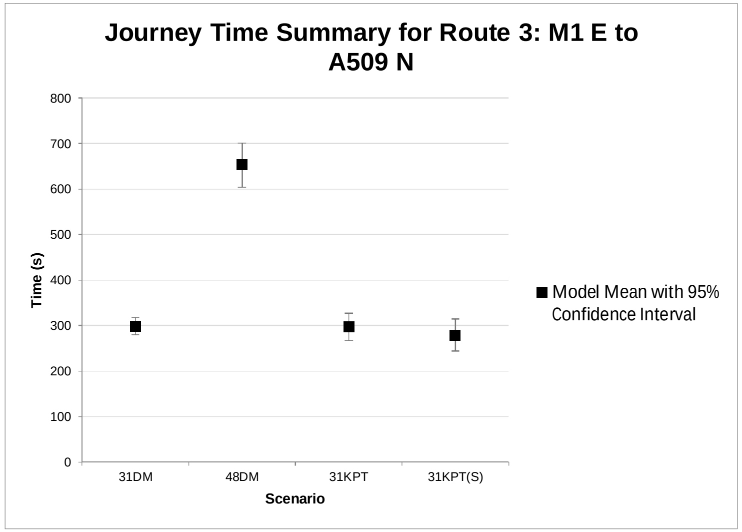

Journey Time Summary for Route 1: M1 WB
Time (s)
500
450
400
350
300
250
200
150
100
50
0
31DM
48DM
31KPT
31KPT(S)
Scenario
Model Mean with 95% Confidence Interval

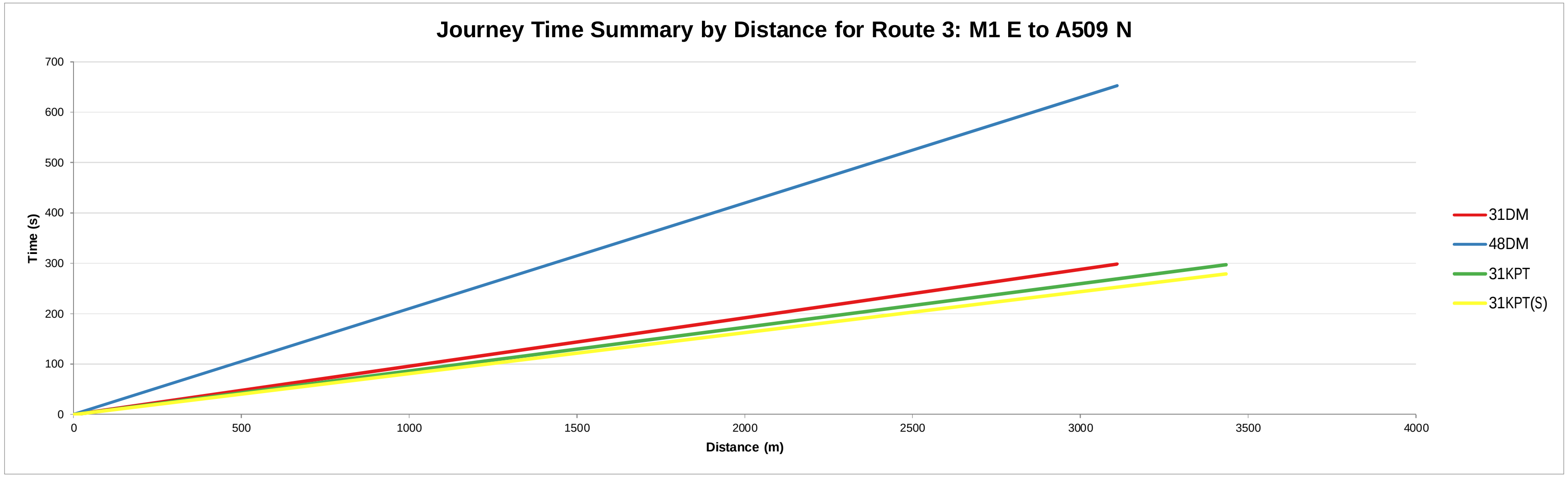

Journey Time Summary by Distance for Route 1: M1 WB
Time (s)
500
450
400
350
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Distance (m)
31DM
48DM
31KPT
31KPT(S)

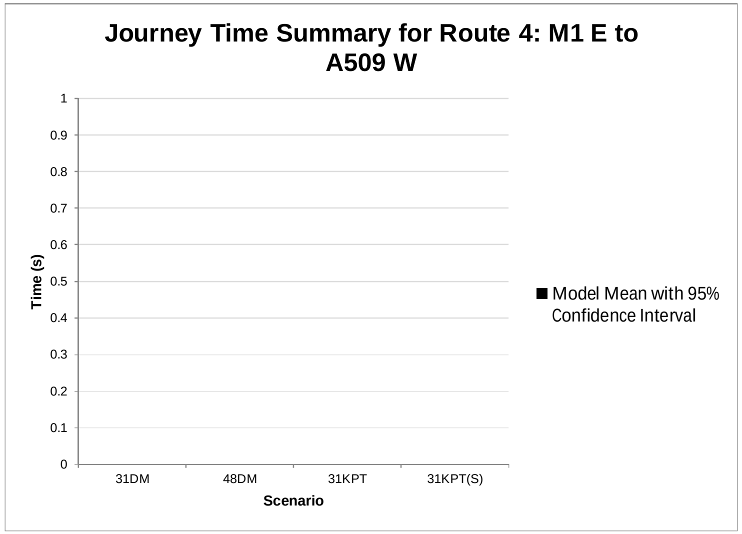
Journey Time Comparison Graphs
AM
07:00 - 10:00
Key Planning

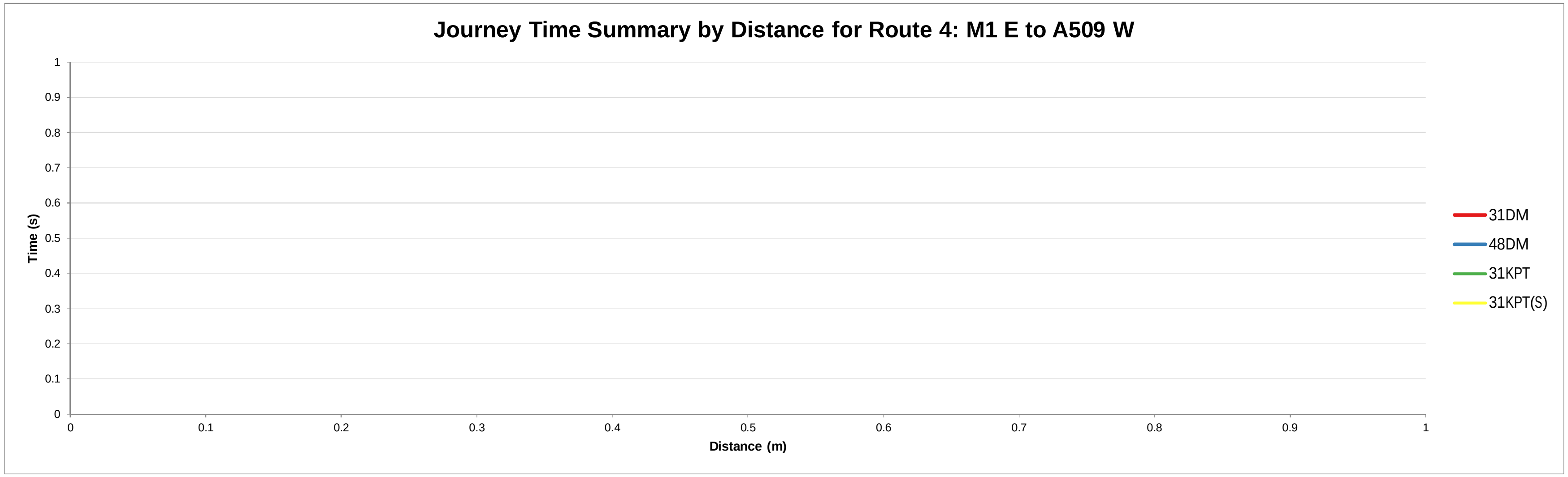


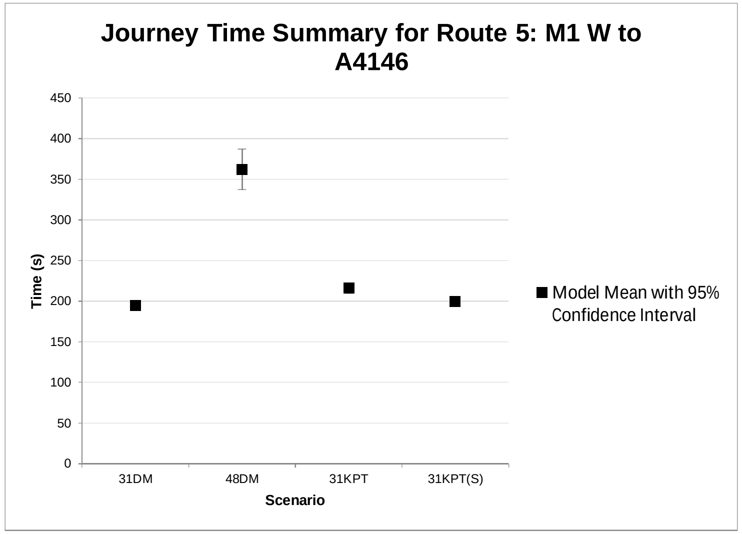


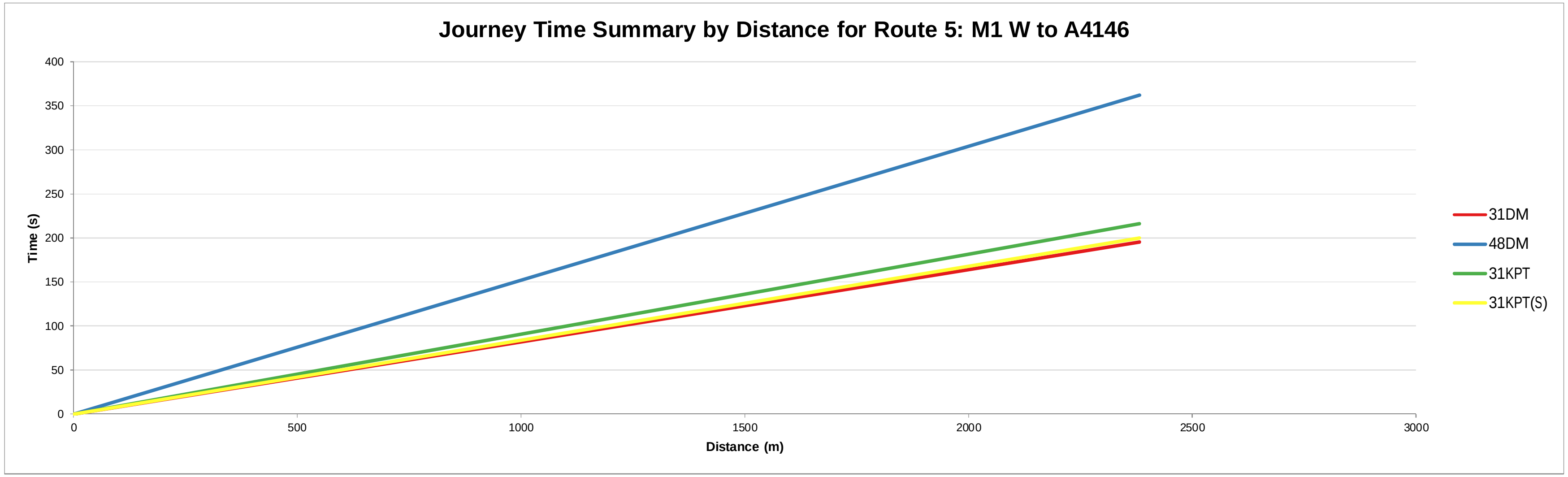

Journey Time Summary for Route 3: M1 E to A509 N
Time (s)
800
700
600
500
400
300
200
100
0
31DM
48DM
31KPT
31KPT(S)
Scenario
Model Mean with 95% Confidence Interval


Journey Time Summary by Distance for Route 3: M1 E to A509 N
Time (s)
700
600
500
400
300
200
100
0
0
500
1000
1500
2000
2500
3000
3500
4000
Distance (m)
31DM
48DM
31KPT
31KPT(S)

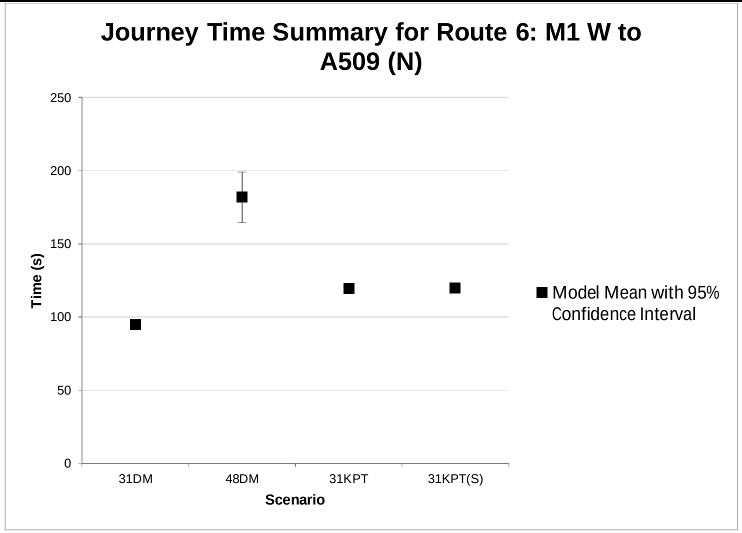

Journey Time Summary for Route 4: M1 E to A509 W
Time (s)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
31DM
48DM
31KPT
31KPT(S)
Scenario
Model Mean with 95% Confidence Interval

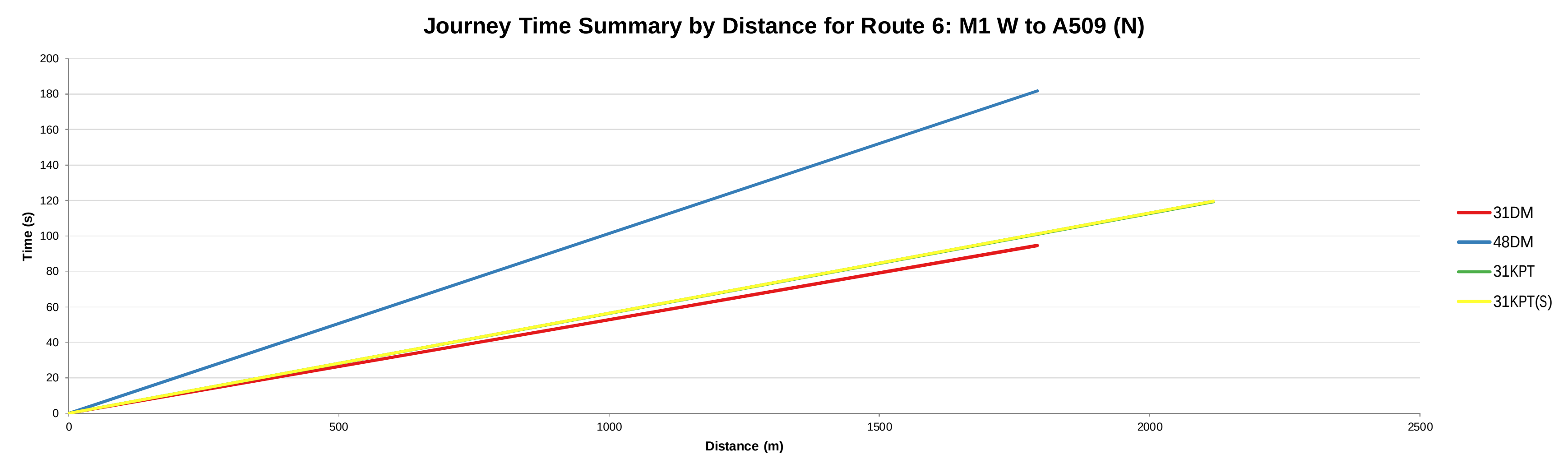

Journey Time Summary by Distance for Route 4: M1 E to A509 W
Time (s)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Distance (m)
31DM
48DM
31KPT
31KPT(S)

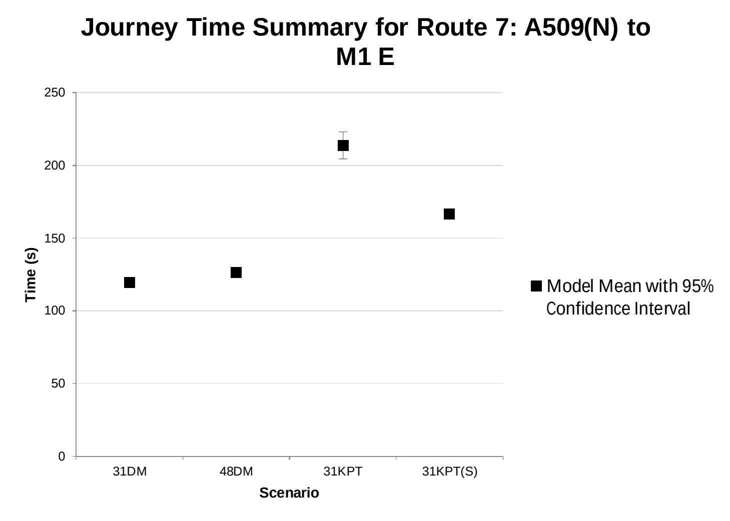

Journey Time Summary for Route 5: M1 W to A4146
Time (s)
450
400
350
300
250
200
150
100
50
0
31DM
48DM
31KPT
31KPT(S)
Scenario
Model Mean with 95% Confidence Interval

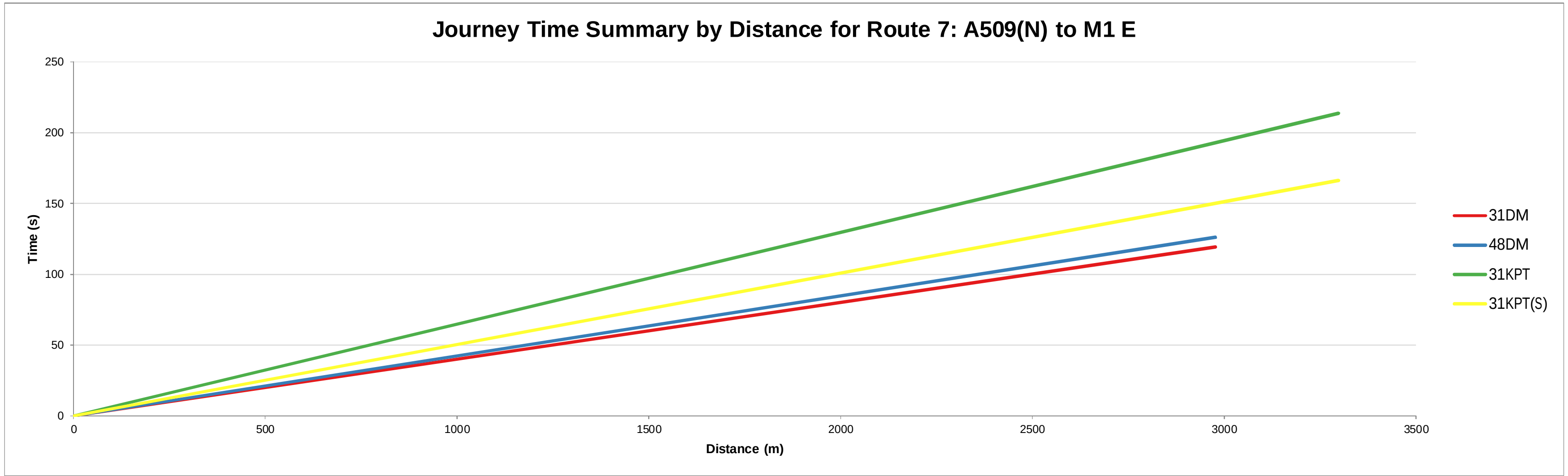

Journey Time Summary by Distance for Route 5: M1 W to A4146
Time (s)
400
350
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000
Distance (m)
31DM
48DM
31KPT
31KPT(S)

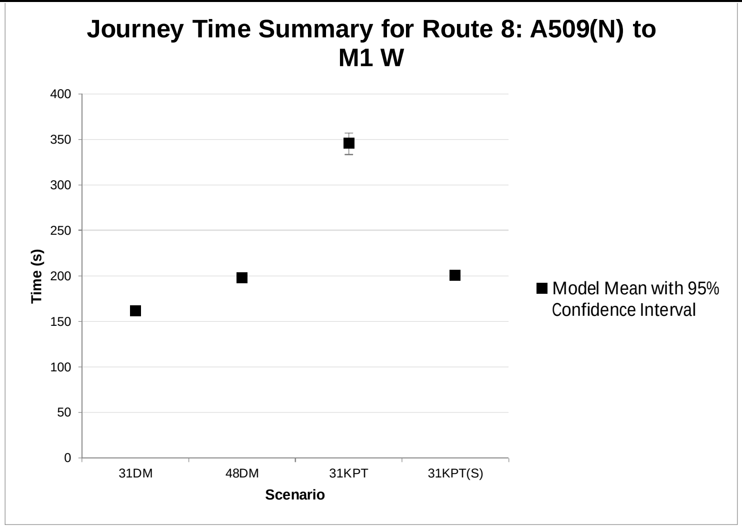
Journey Time Comparison Graphs
AM
07:00 - 10:00
Key Planning

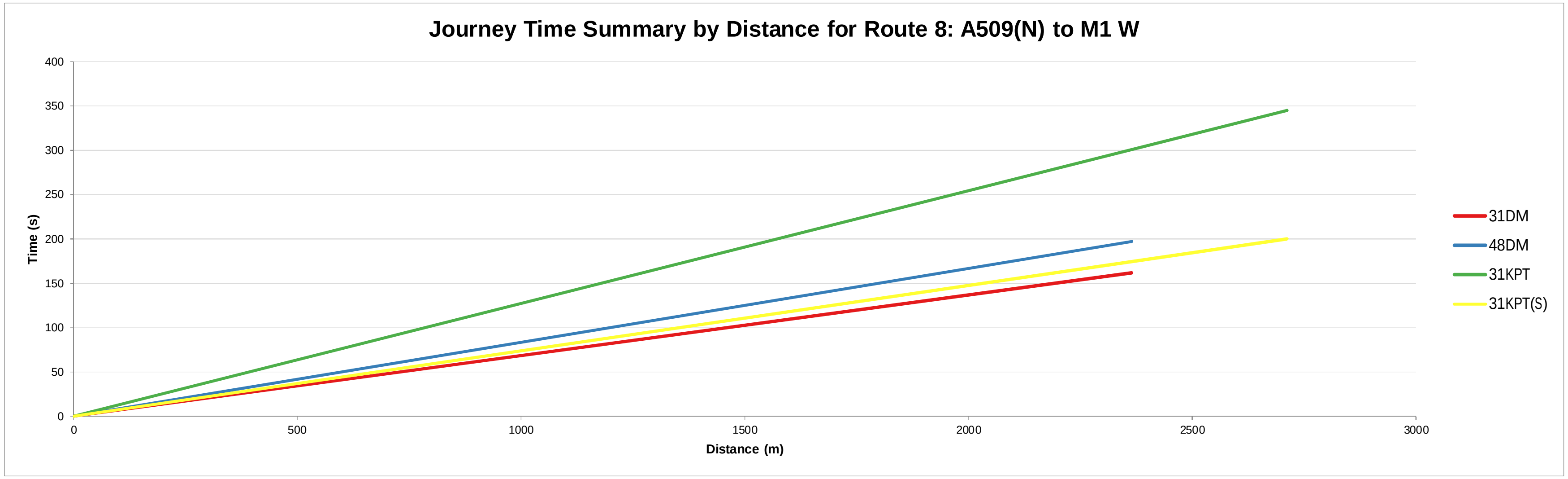




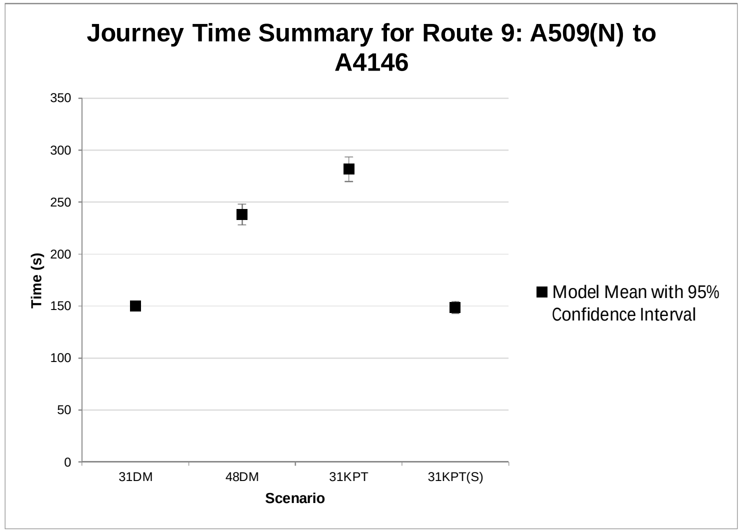

Journey Time Summary for Route 7: A509(N) to M1 E
250
200
150
100
50
0
Time (s)
31DM
48DM
31KPT
31KPT(S)
Scenario
Model Mean with 95% Confidence Interval

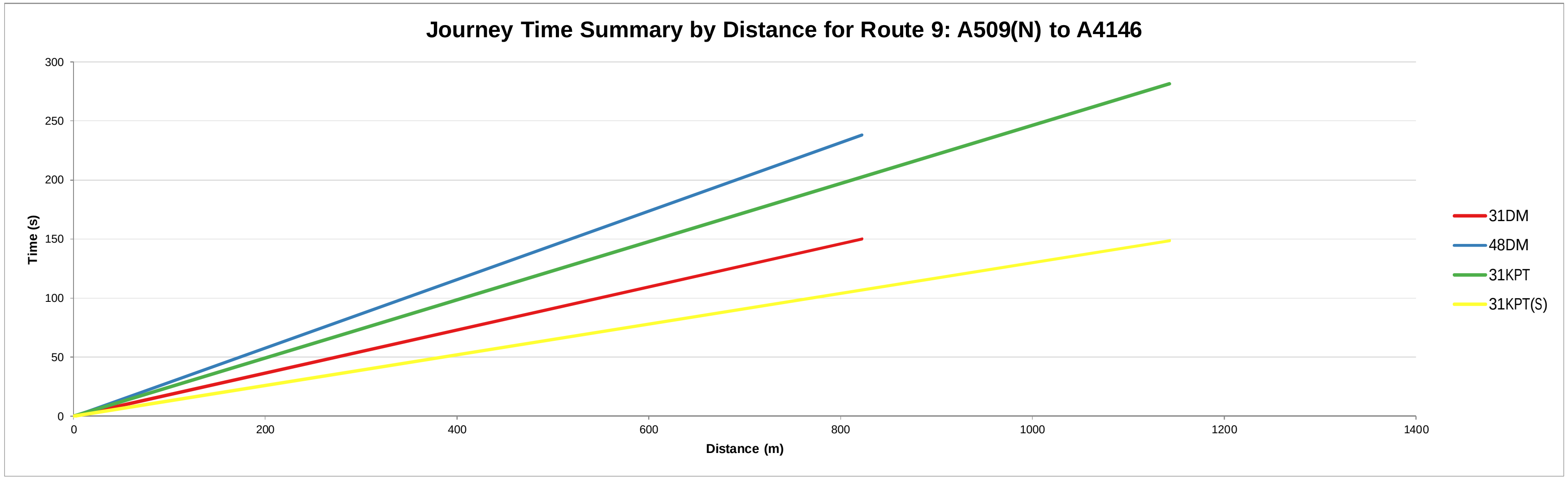

Journey Time Summary by Distance for Route 7: A509(N) to M1 E
250
200
150
100
50
0
Time (s)
0
500
1000
1500
2000
2500
3000
3500
Distance (m)
31DM
48DM
31KPT
31KPT(S)


Journey Time Summary for Route 8: A509(N) to M1 W
Time (s)
400
350
300
250
200
150
100
50
0
31DM
48DM
31KPT
31KPT(S)
Scenario
Model Mean with 95% Confidence Interval

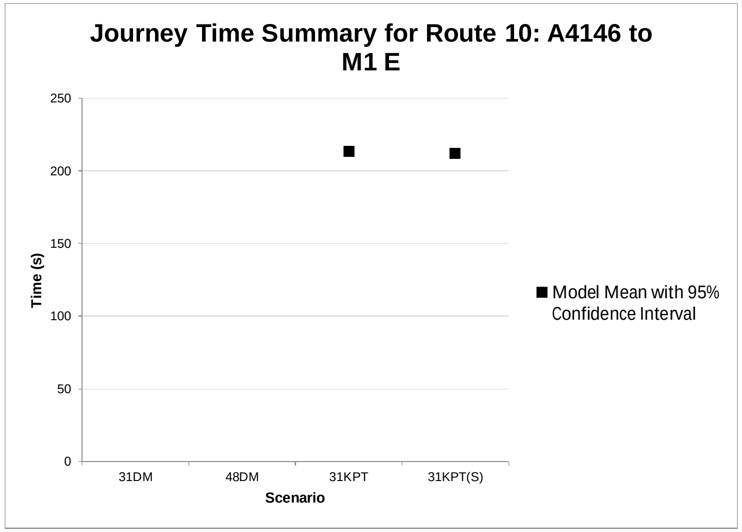

Journey Time Summary by Distance for Route 8: A509(N) to M1 W
Time (s)
400
350
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000
Distance (m)
31DM
48DM
31KPT
31KPT(S)

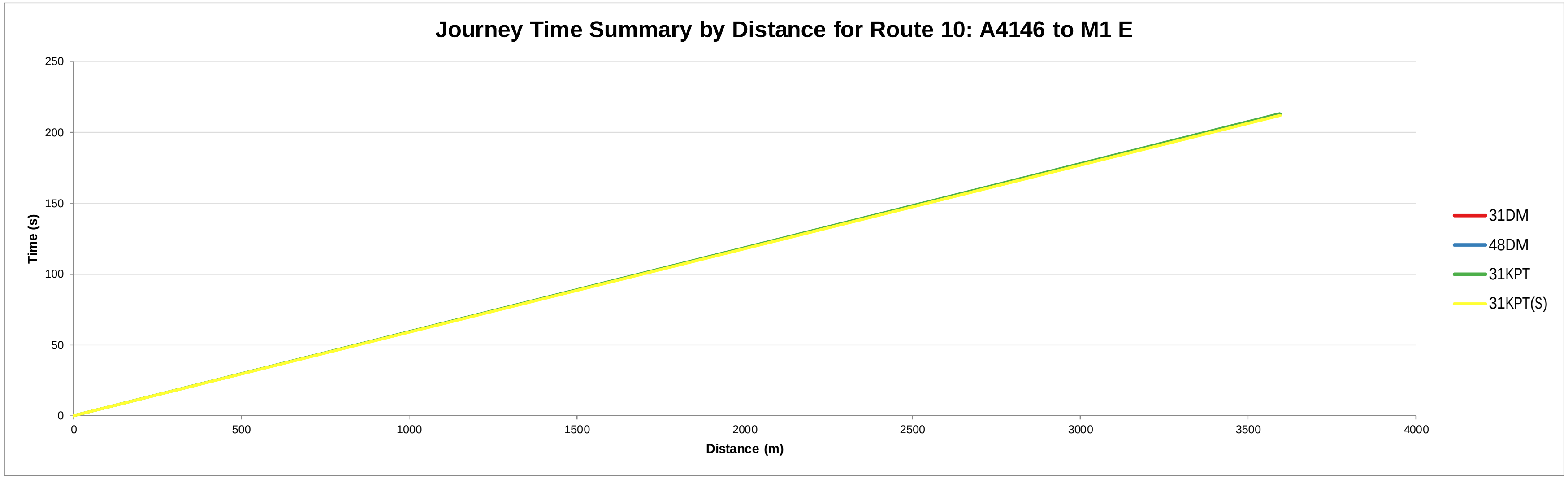
Journey Time Comparison Graphs
AM
07:00 - 10:00
Key Planning



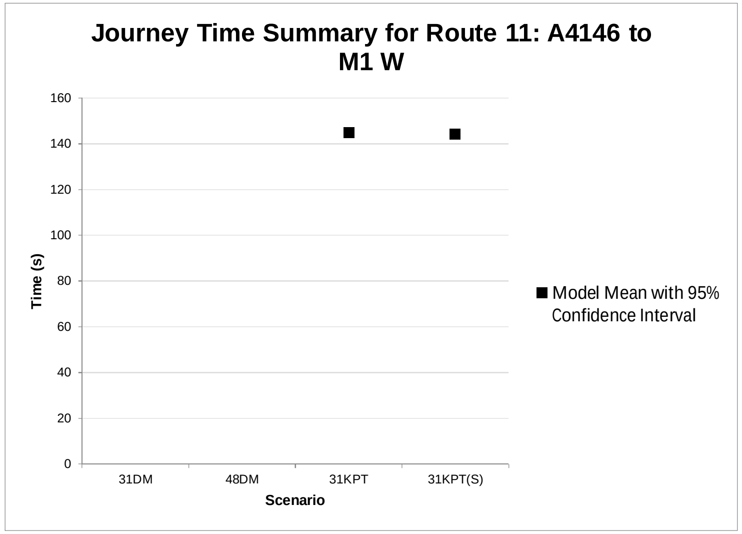


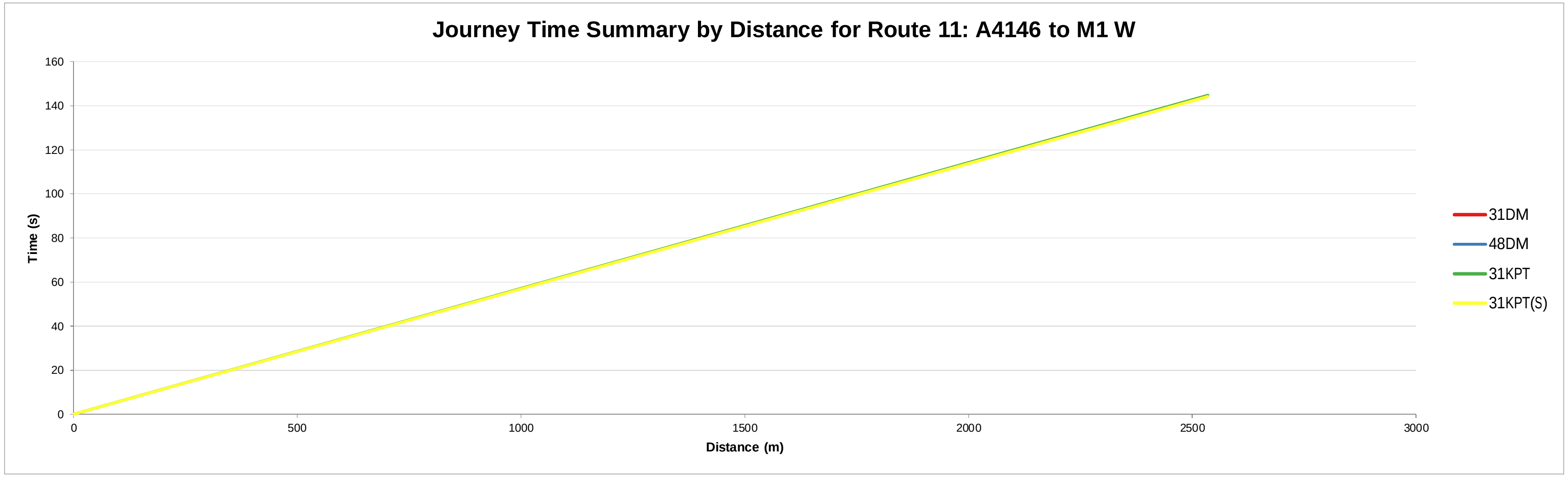
Journey Time Comparison Graphs
AM
07:00 - 10:00
Key Planning



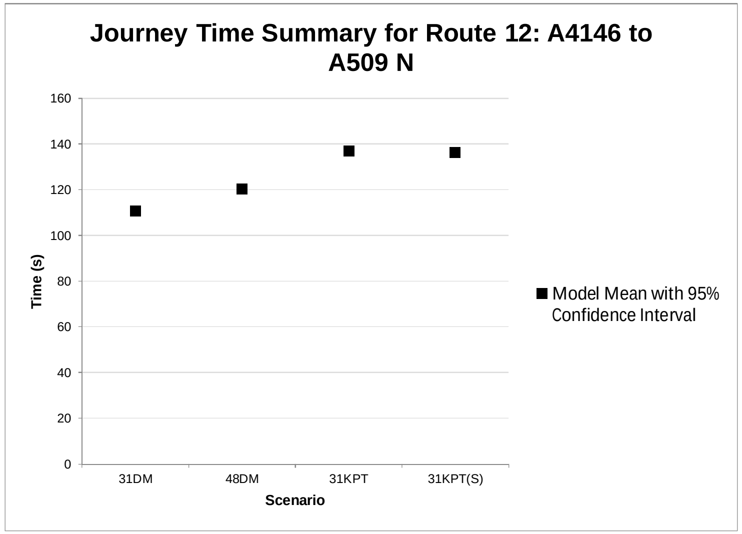


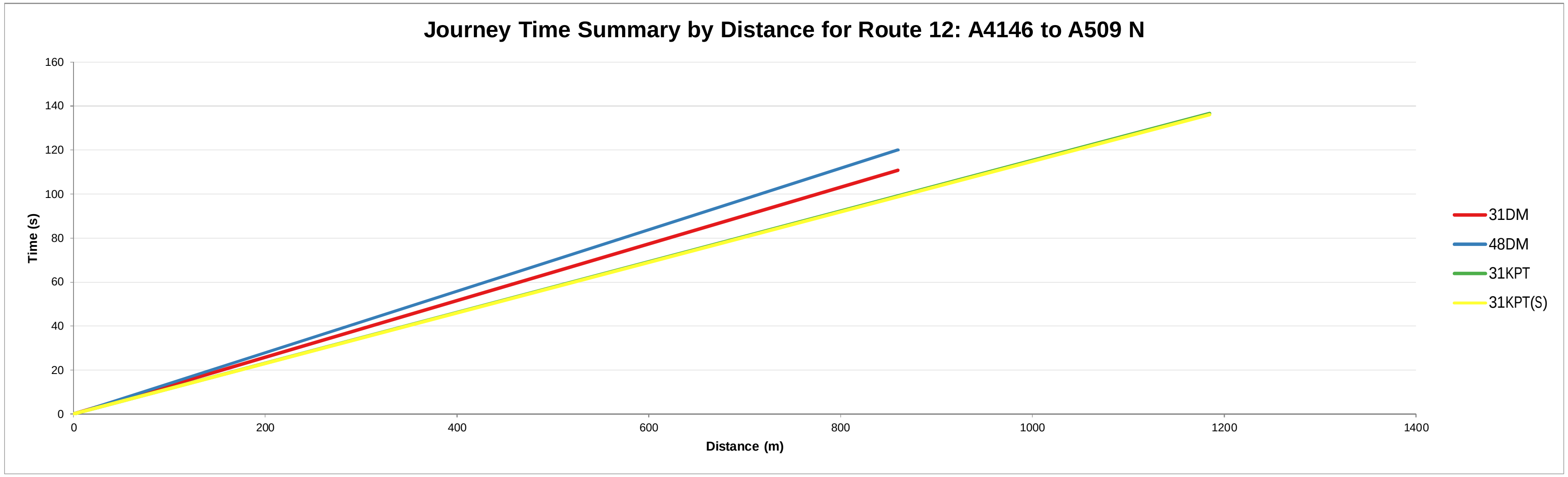
Journey Time Comparison Graphs
AM
07:00 - 10:00
Key Planning



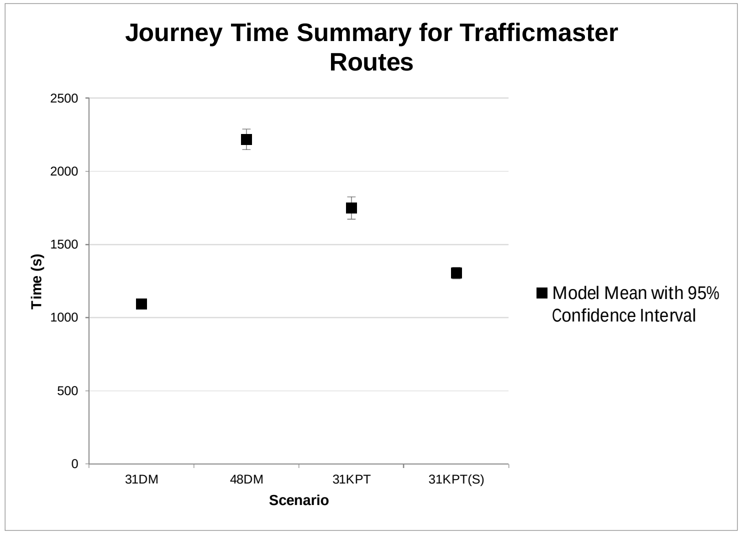


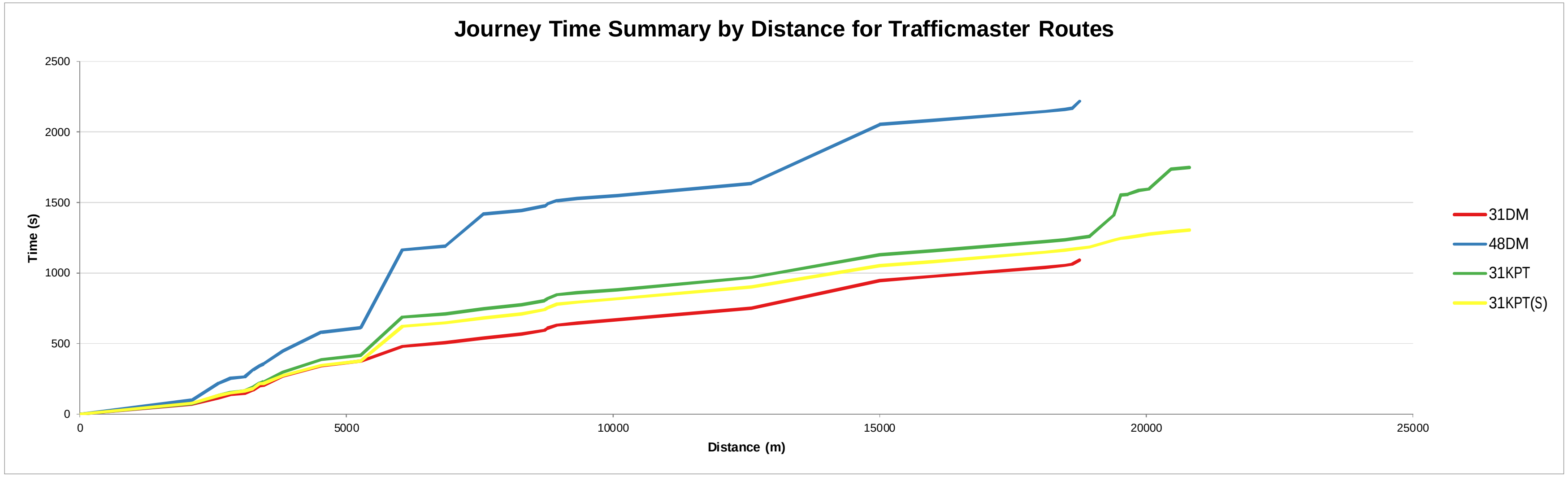
Journey Time Comparison Graphs
AM
07:00 - 10:00
Key Planning



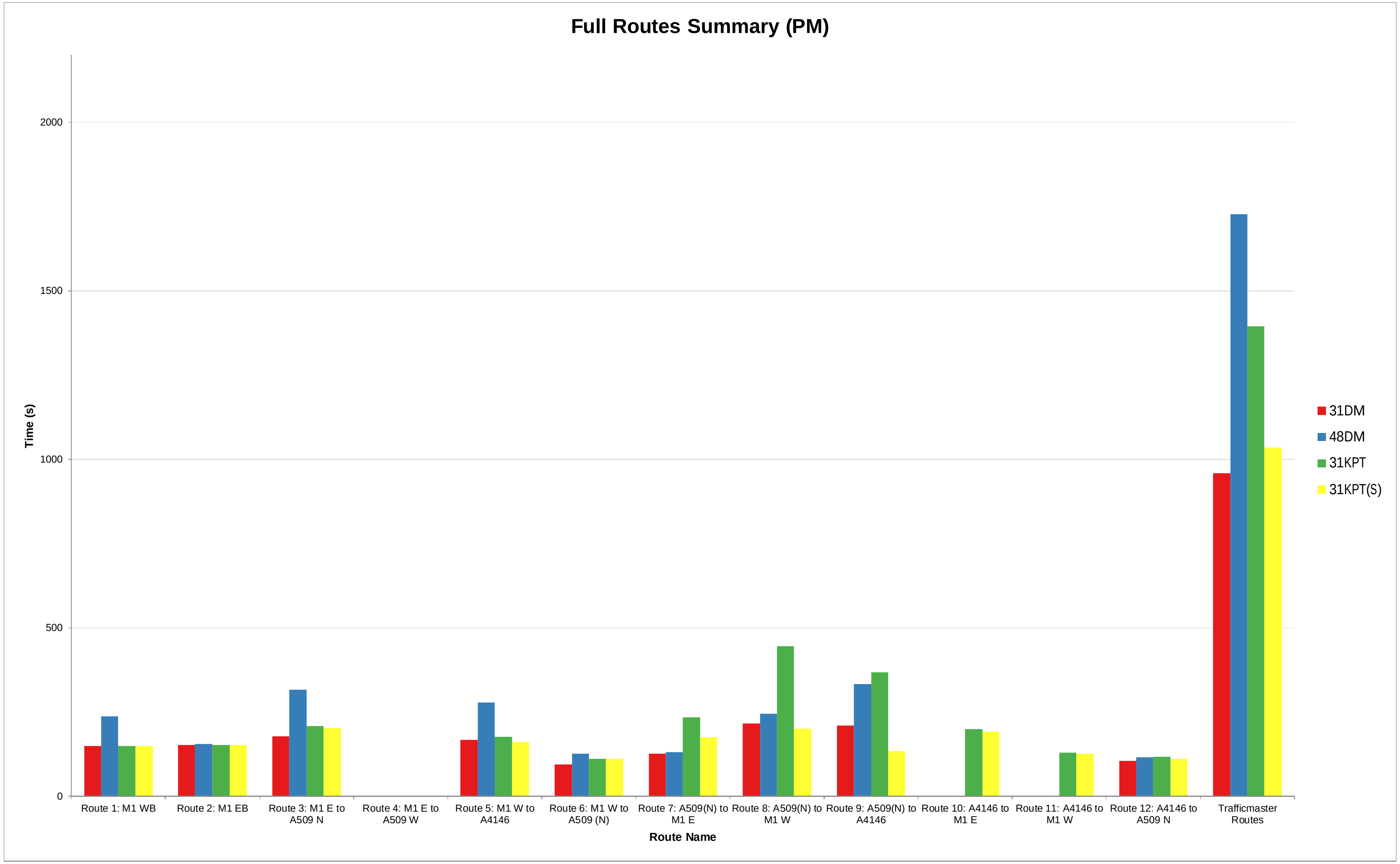


Journey Time Comparison Graphs
AM
07:00 - 10:00
Key Planning

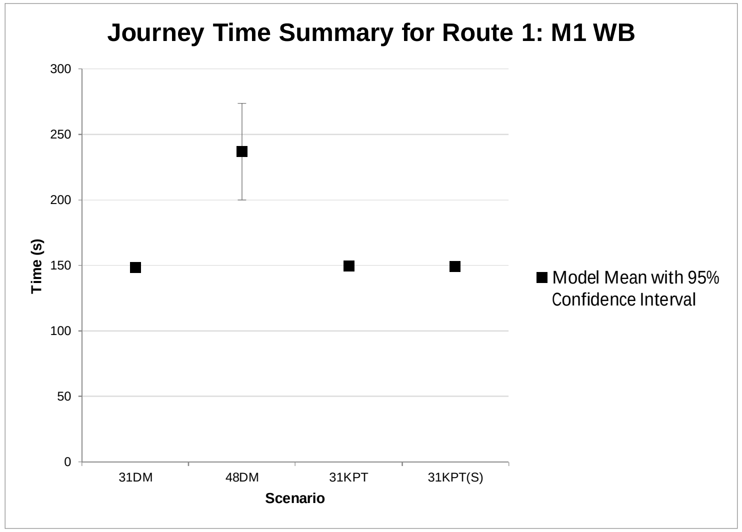


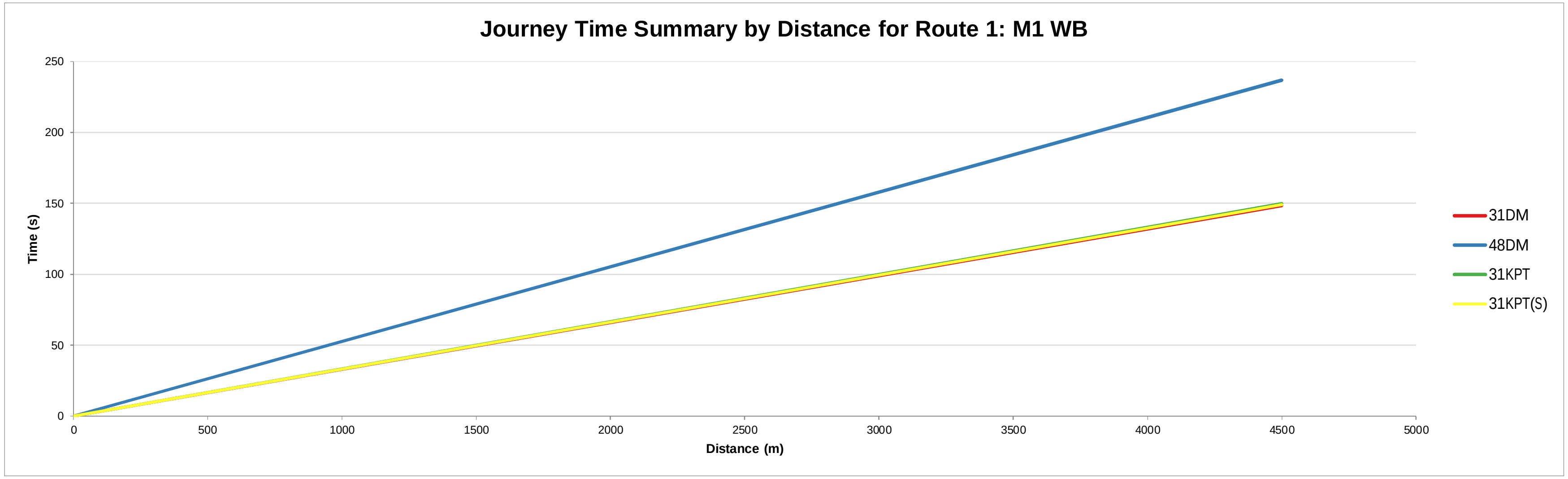


Journey Time Comparison Graphs
PM
16:00 - 19:00
Key Planning

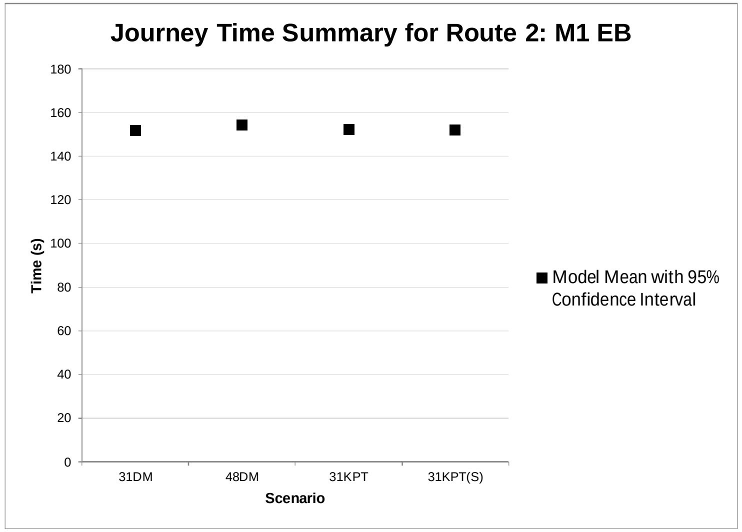


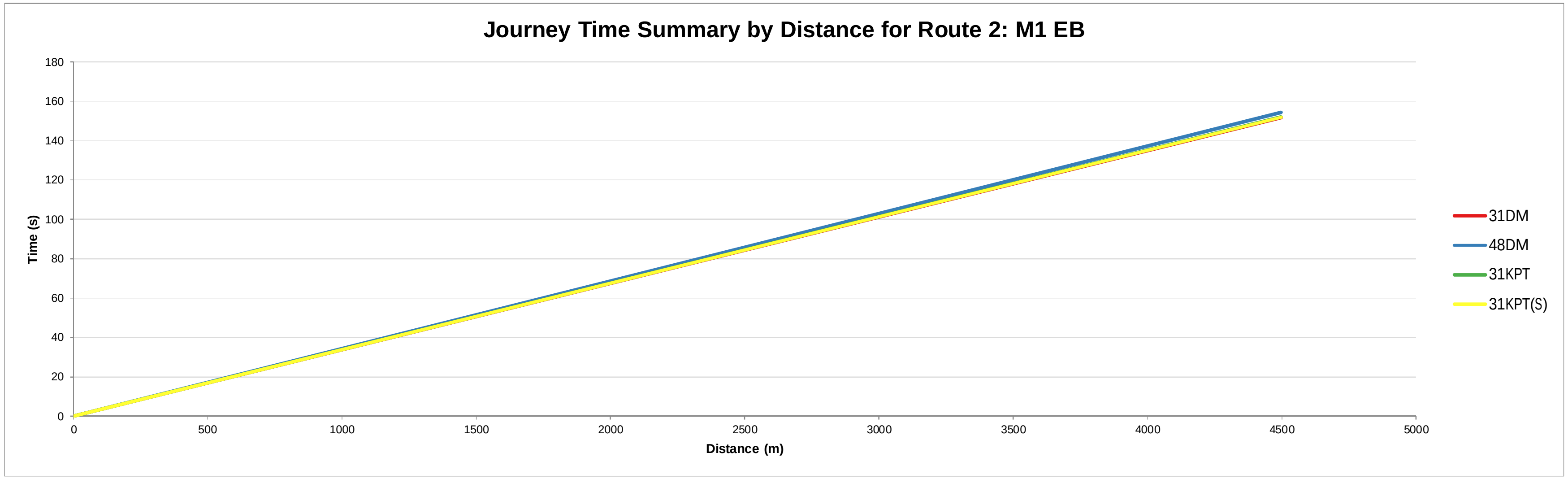
Journey Time Comparison Graphs
PM
16:00 - 19:00
Key Planning

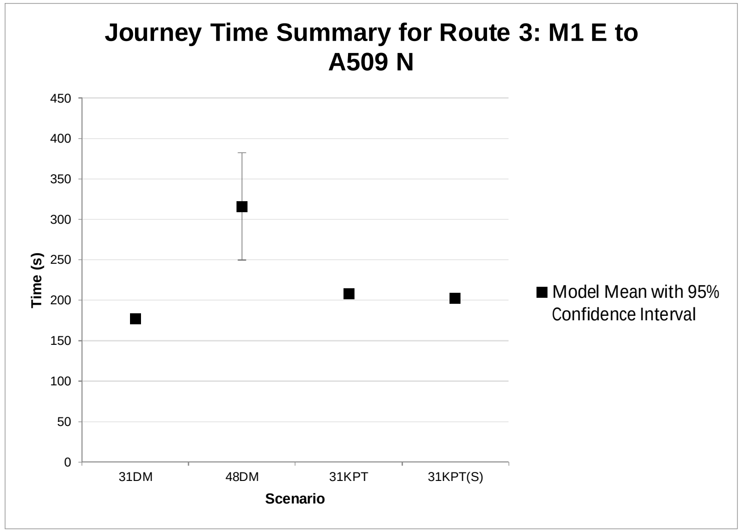


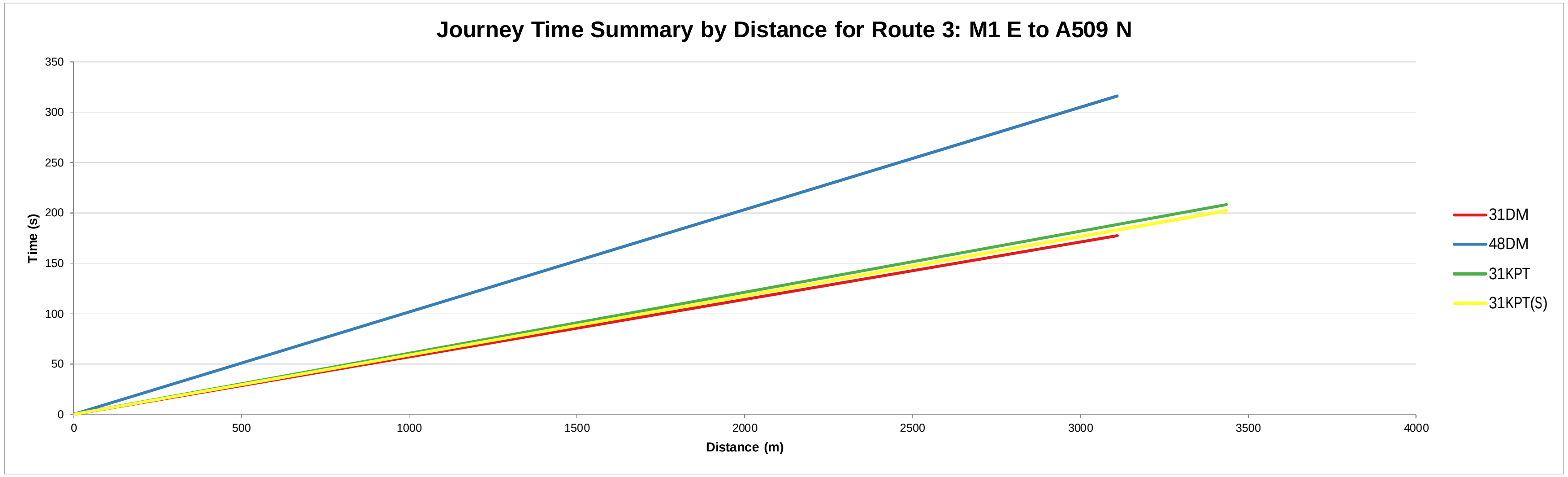


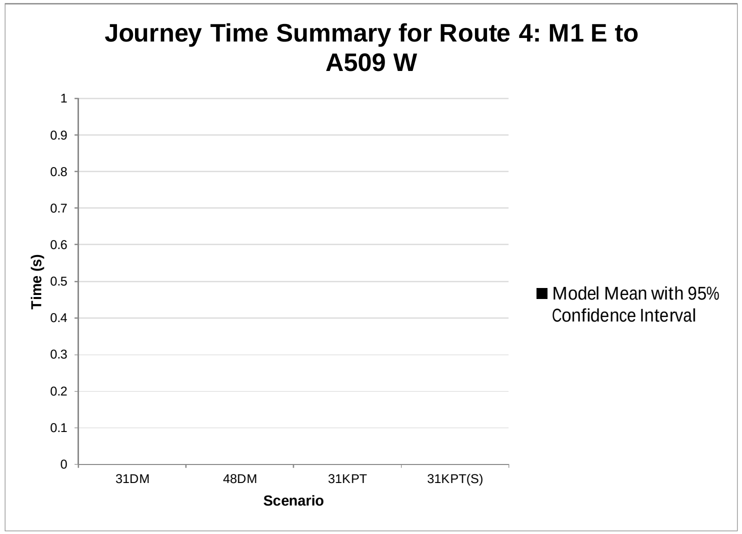
Journey Time Comparison Graphs
PM
16:00 - 19:00
Key Planning

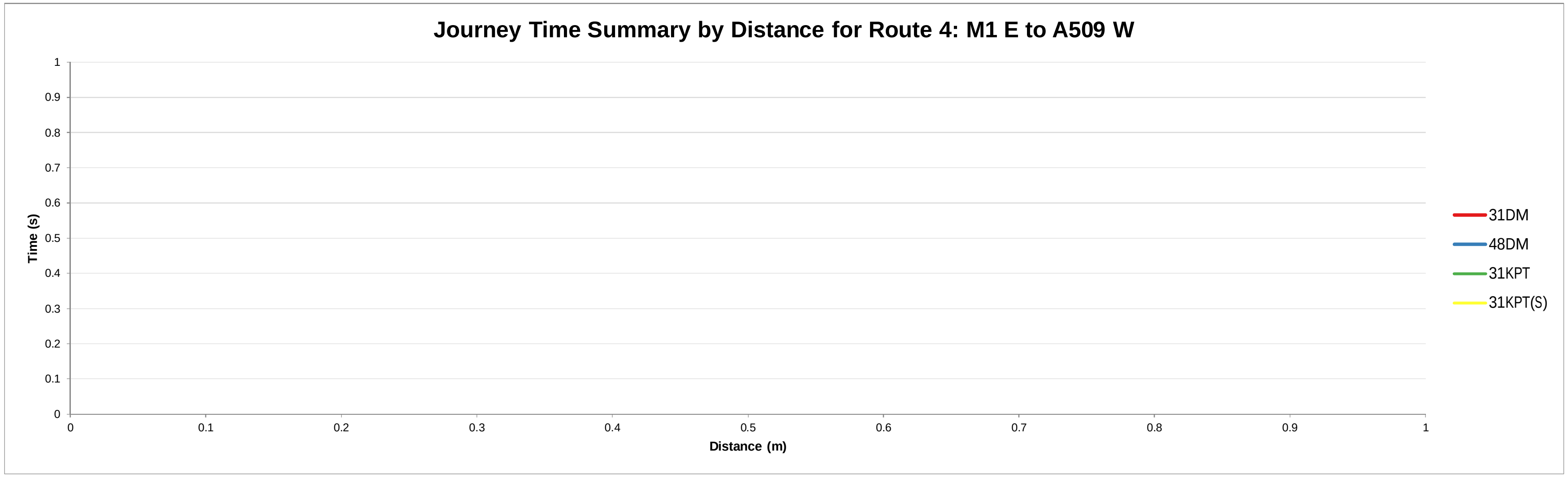




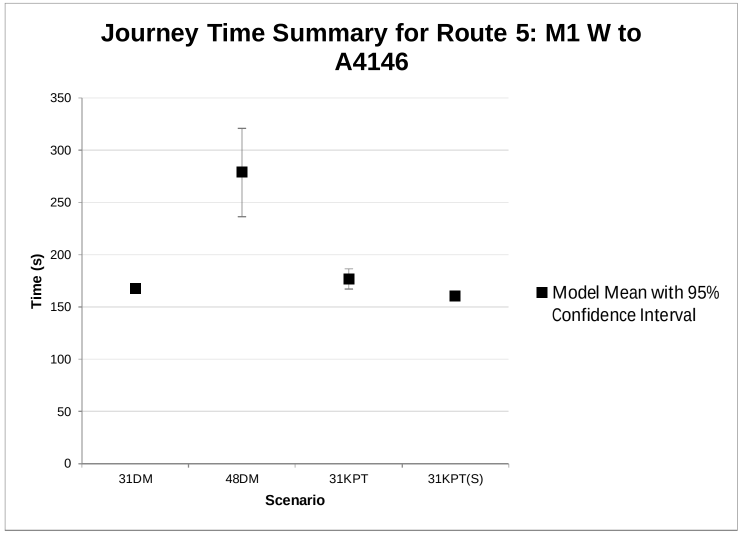

Journey Time Summary for Route 3: M1 E to A509 N
450
400
350
300
250
200
150
100
50
0
Time (s)
31DM
48DM
31KPT
31KPT(S)
Scenario
Model Mean with 95% Confidence Interval

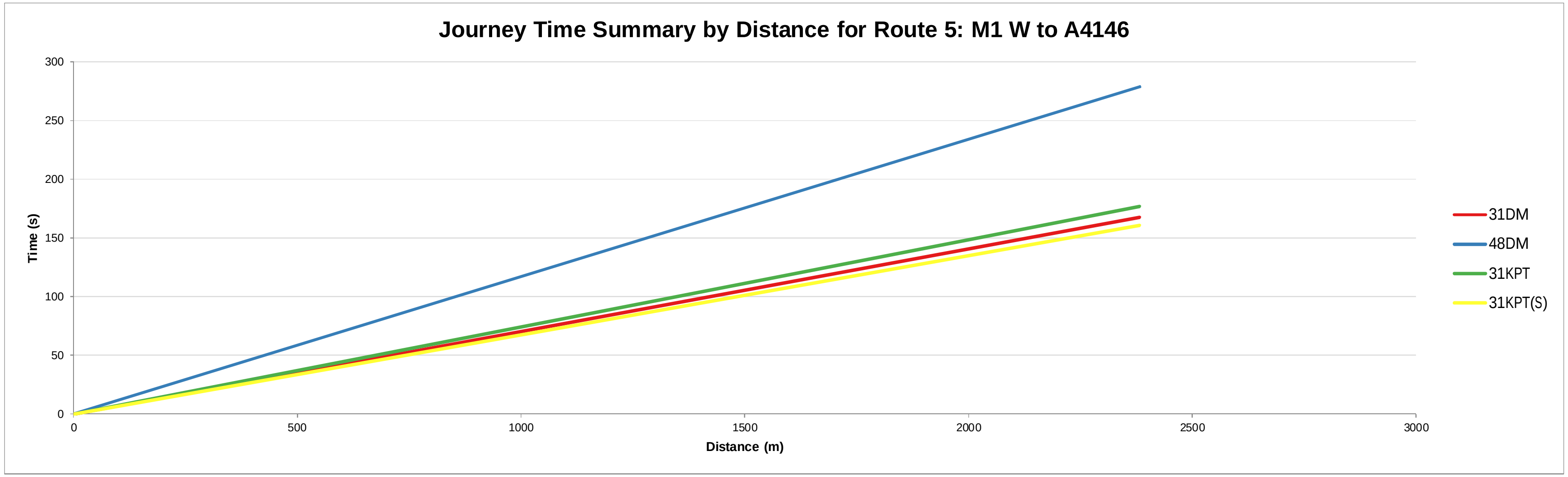

Journey Time Summary by Distance for Route 3: M1 E to A509 N
350
300
250
200
150
100
50
0
Time (s)
0
500
1000
1500
2000
2500
3000
3500
4000
Distance (m)
31DM
48DM
31KPT
31KPT(S)

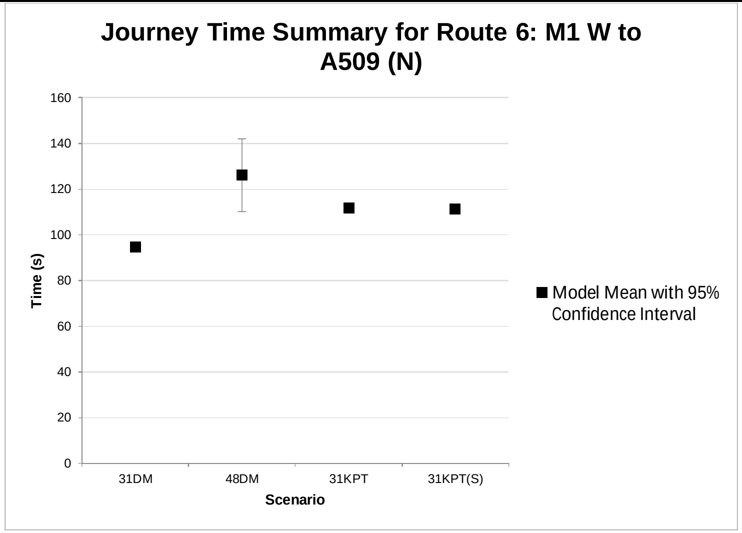

Journey Time Summary for Route 4: M1 E to A509 W
Time (s)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
31DM
48DM
31KPT
31KPT(S)
Scenario
Model Mean with 95% Confidence Interval

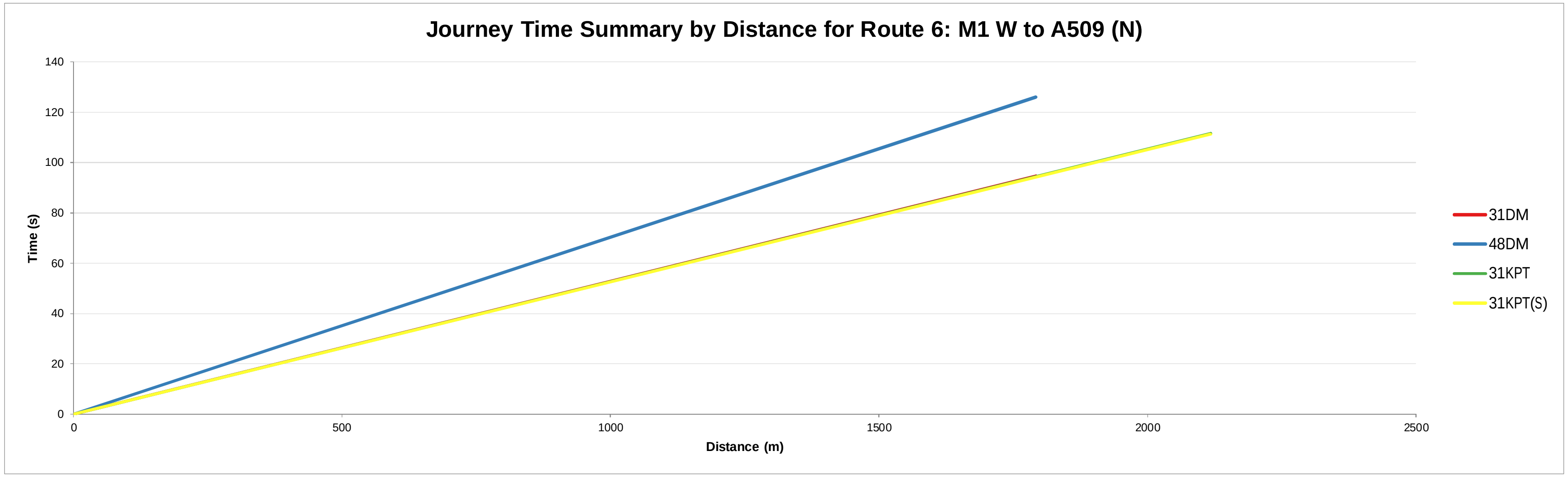

Journey Time Summary by Distance for Route 4: M1 E to A509 W
Time (s)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Distance (m)
31DM
48DM
31KPT
31KPT(S)

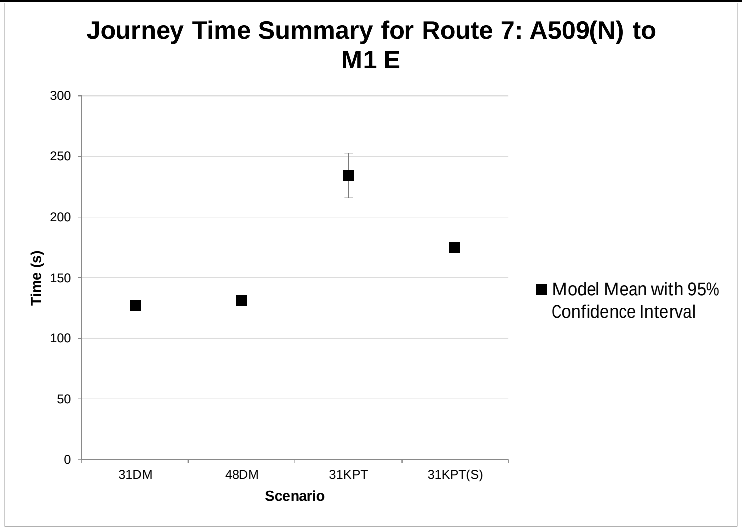
Journey Time Comparison Graphs
PM
16:00 - 19:00
Key Planning

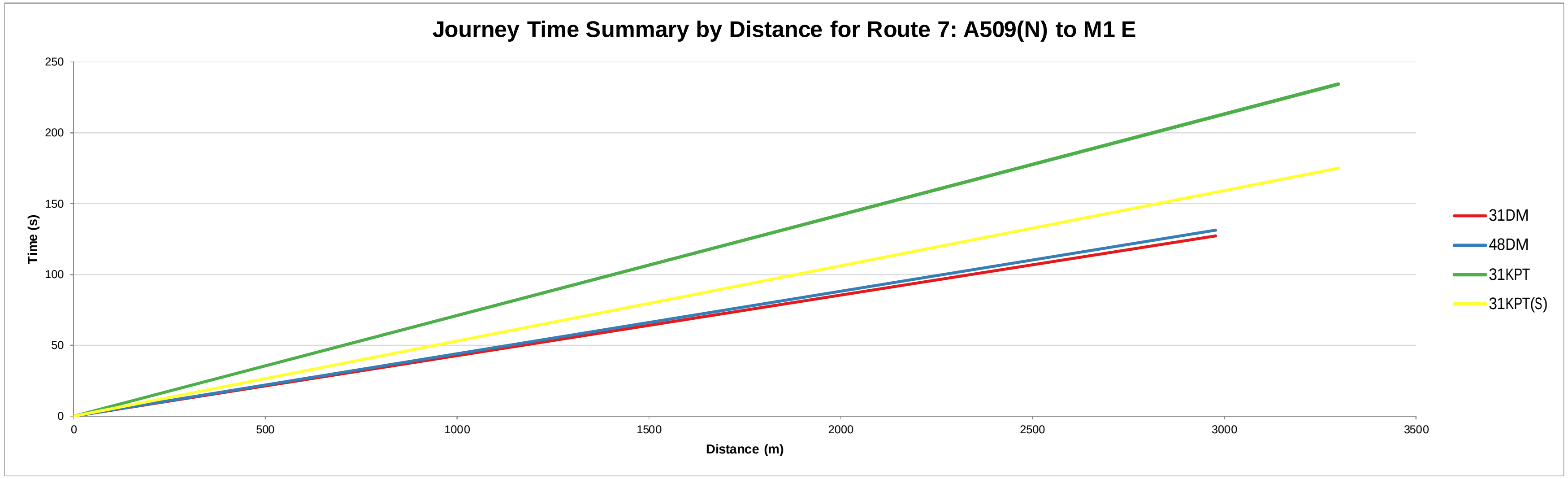


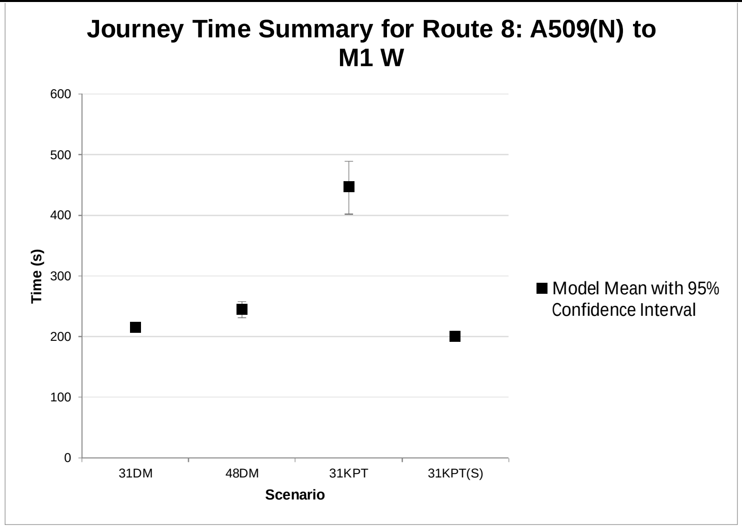


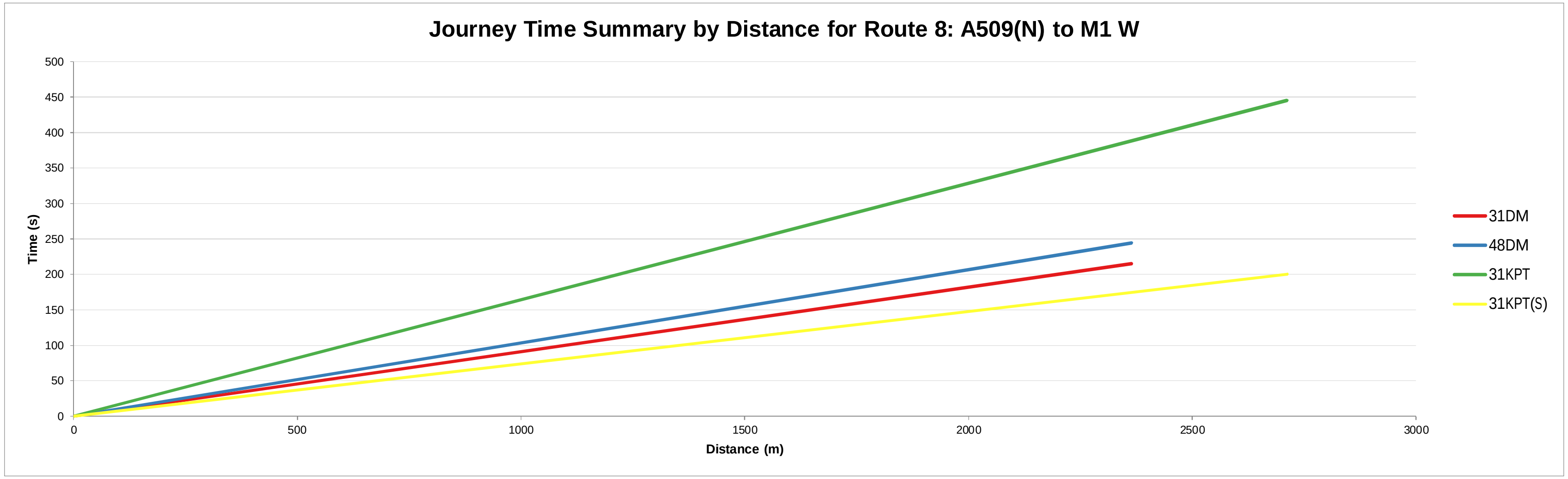

Journey Time Summary for Route 6: M1 W to A509 (N)
160
140
120
100
80
60
40
20
0
Time (s)
31DM
48DM
31KPT
31KPT(S)
Scenario
Model Mean with 95% Confidence Interval


Journey Time Summary by Distance for Route 6: M1 W to A509 (N)
140
120
100
80
60
40
20
0
Time (s)
0
500
1000
1500
2000
2500
Distance (m)
31DM
48DM
31KPT
31KPT(S)

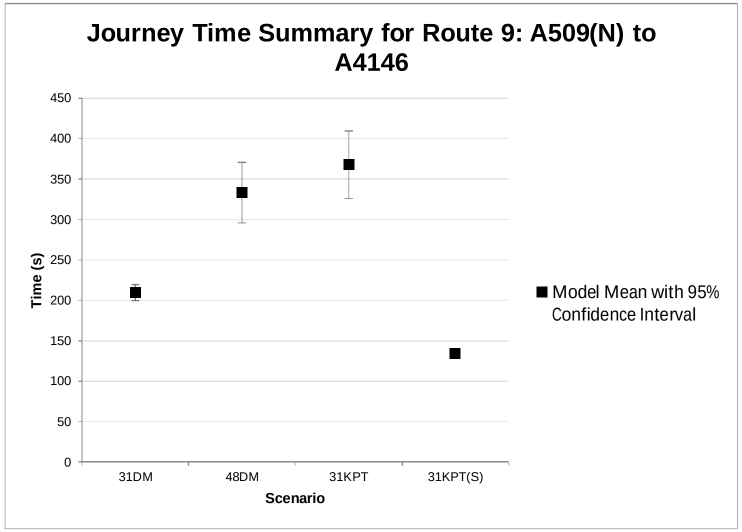

Journey Time Summary for Route 7: A509(N) to M1 E
Time (s)
300
250
200
150
100
50
0
31DM
48DM
31KPT
31KPT(S)
Scenario
Model Mean with 95% Confidence Interval

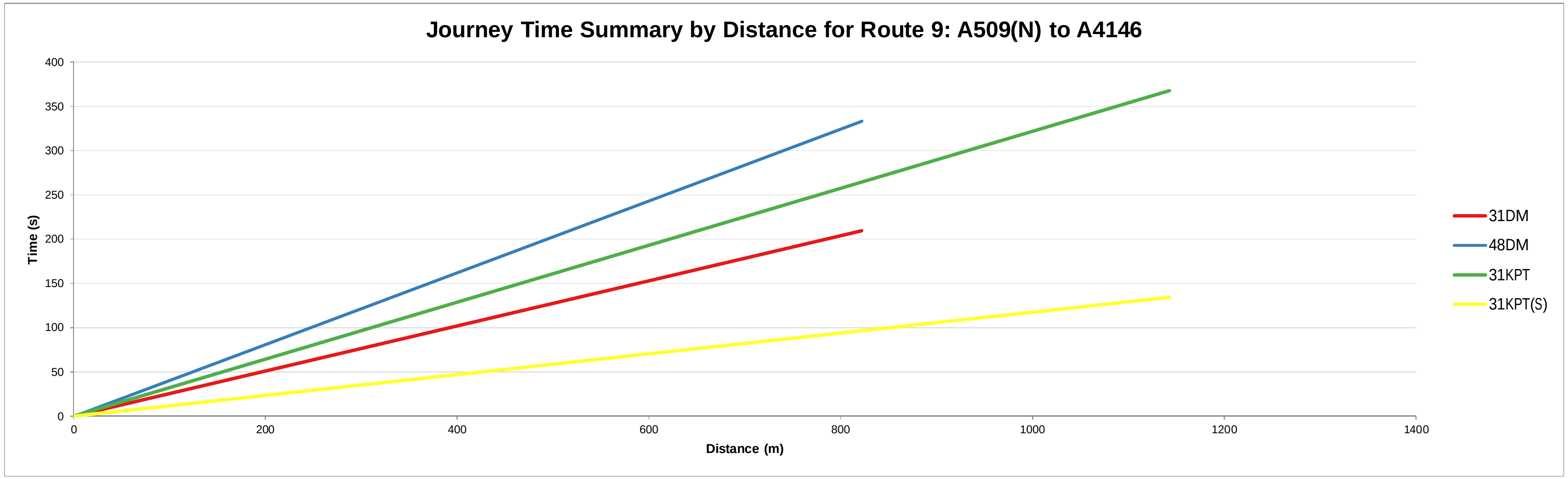

Journey Time Summary by Distance for Route 7: A509(N) to M1 E
Time (s)
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000
3500
Distance (m)
31DM
48DM
31KPT
31KPT(S)


Journey Time Summary for Route 8: A509(N) to M1 W
Time (s)
600
500
400
300
200
100
0
31DM
48DM
31KPT
31KPT(S)
Scenario
Model Mean with 95% Confidence Interval

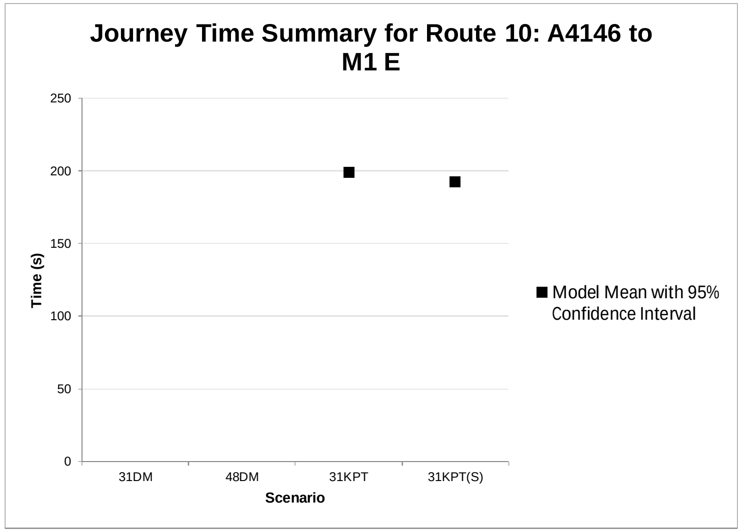

Journey Time Summary by Distance for Route 8: A509(N) to M1 W
Time (s)
500
450
400
350
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000
Distance (m)
31DM
48DM
31KPT
31KPT(S)

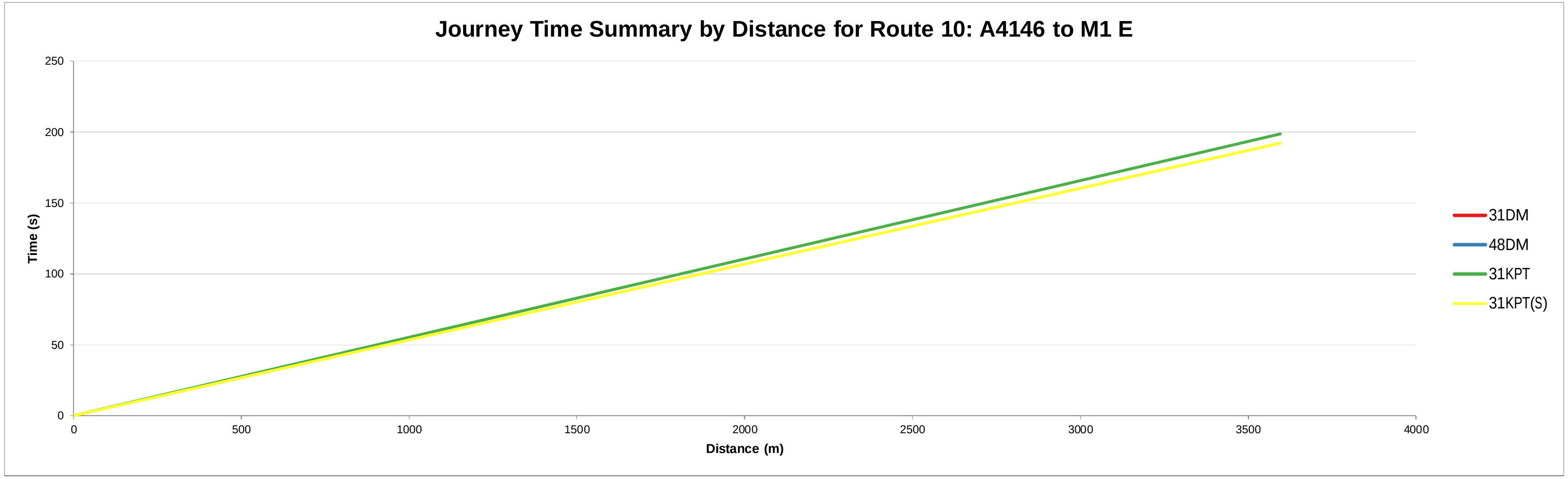
Journey Time Comparison Graphs
PM
16:00 - 19:00
Key Planning



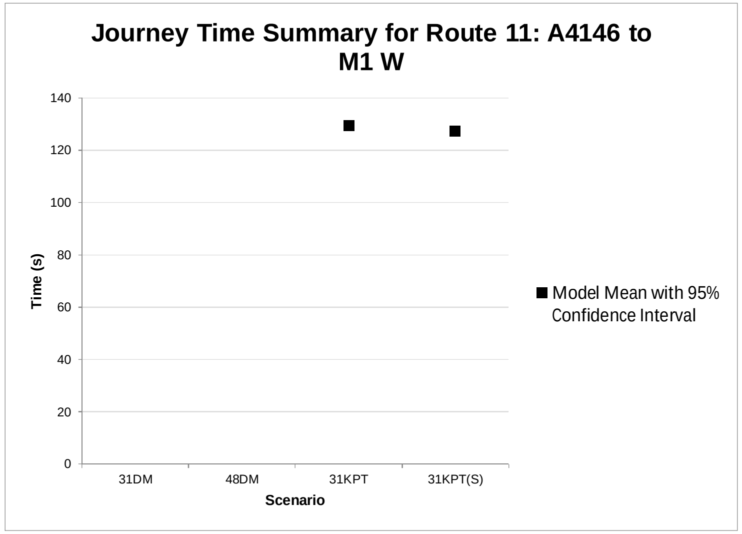


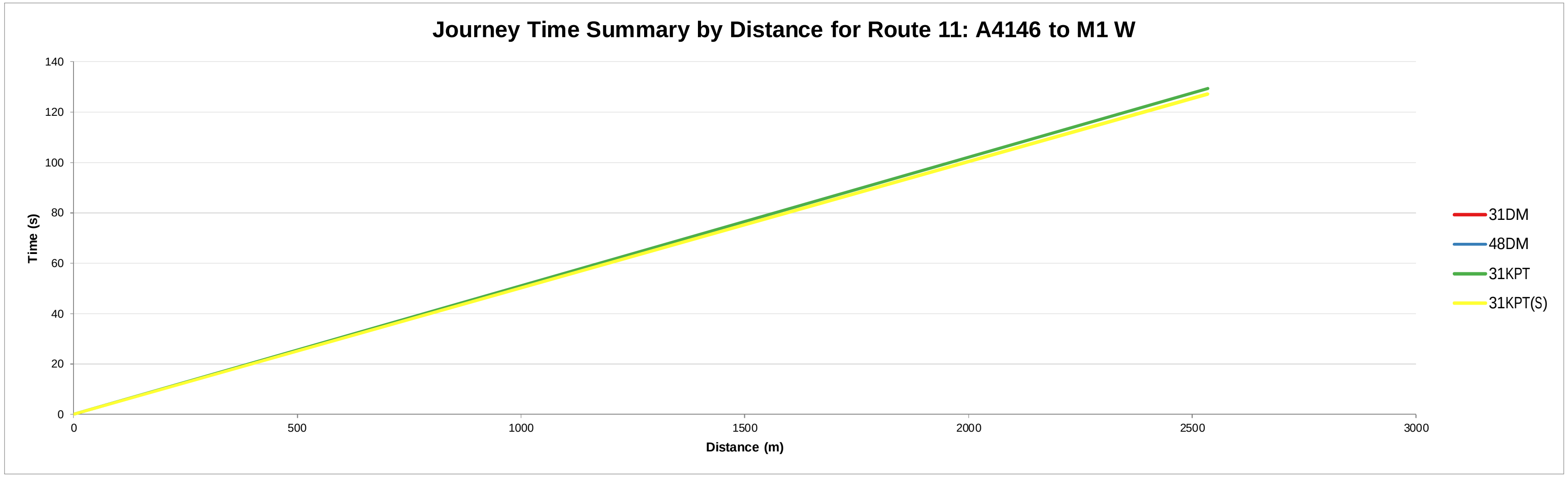
Journey Time Comparison Graphs
PM
16:00 - 19:00
Key Planning

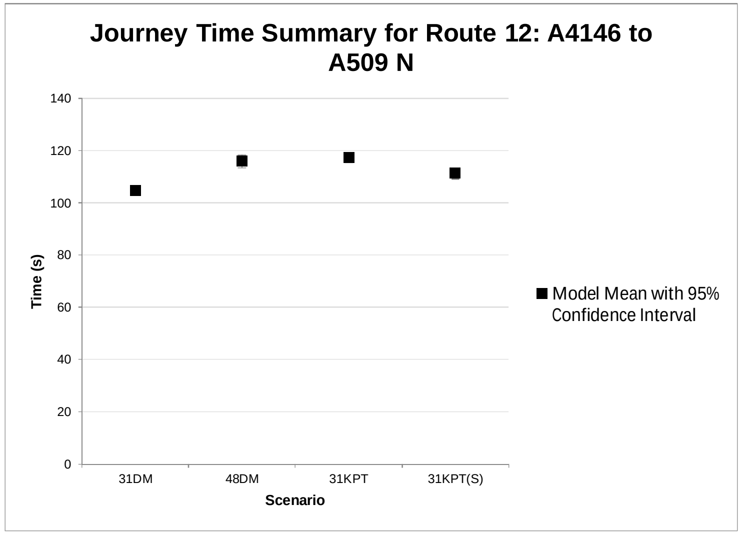


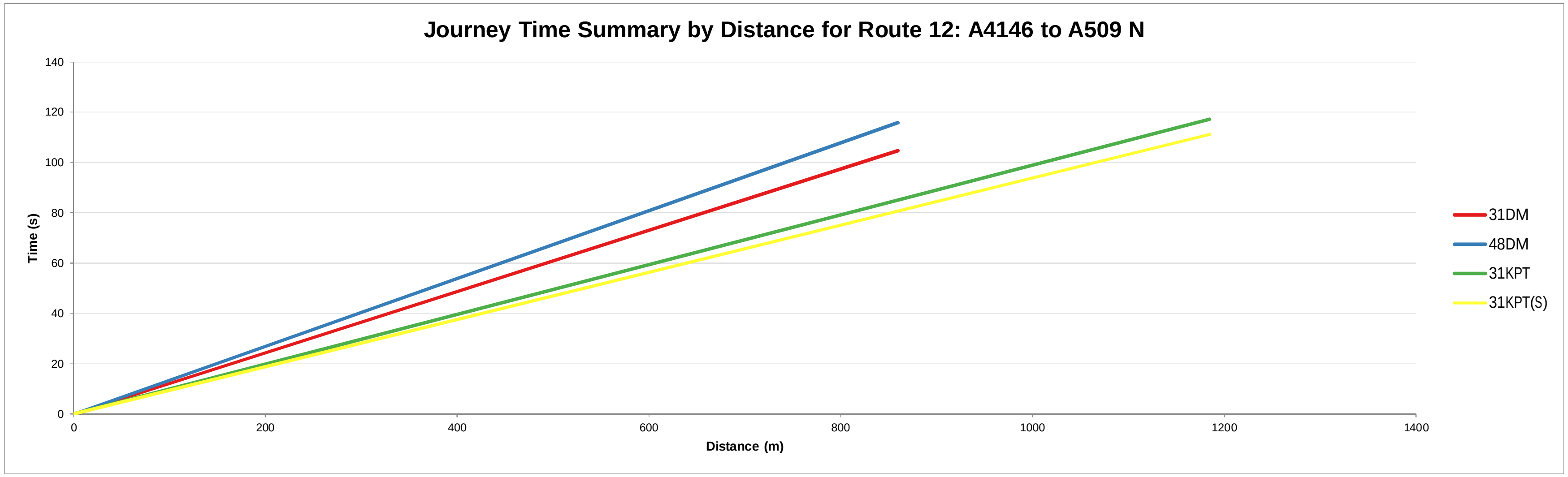


Journey Time Comparison Graphs
PM
16:00 - 19:00
Key Planning

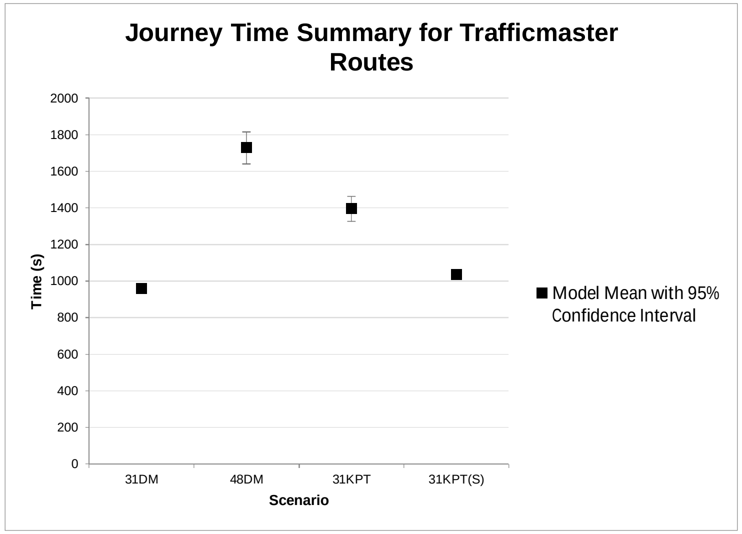


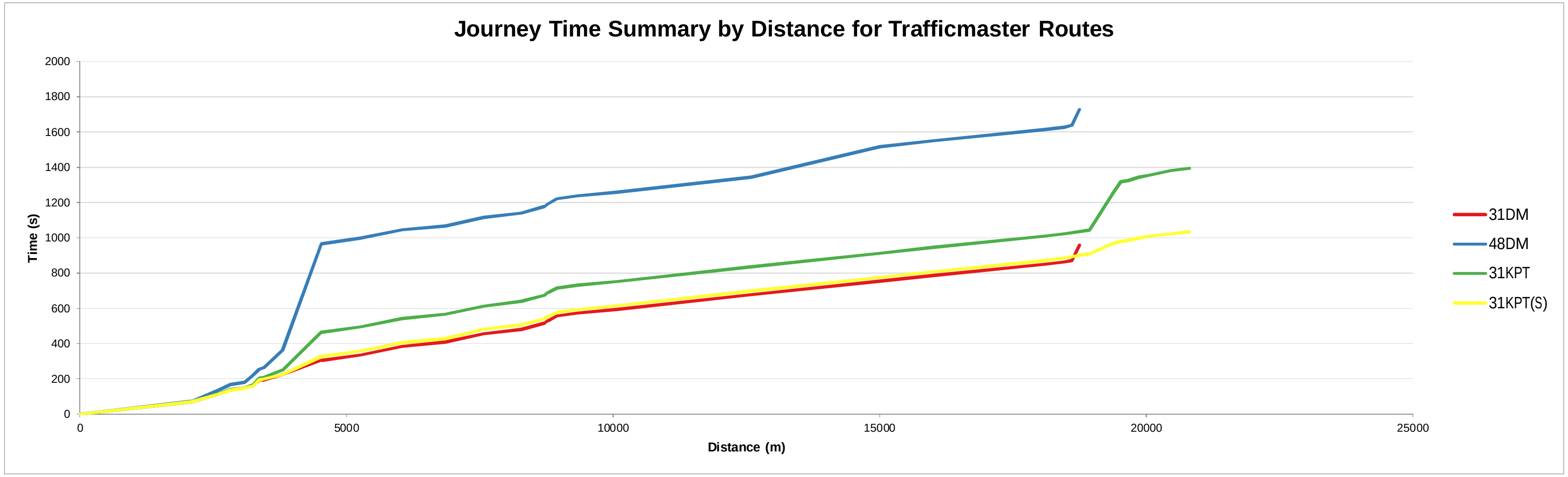



Journey Time Summary for Route 12: A4146 to A509 N
Time (s)
140
120
100
80
60
40
20
0
31DM
48DM
31KPT
31KPT(S)
Scenario
Model Mean with 95% Confidence Interval


Journey Time Summary by Distance for Route 12: A4146 to A509 N
Time (s)
140
120
100
80
60
40
20
0
0
200
400
600
800
1000
1200
1400
Distance (m)
31DM
48DM
31KPT
31KPT(S)

Journey Time Comparison Graphs
PM
16:00 - 19:00
Key Planning

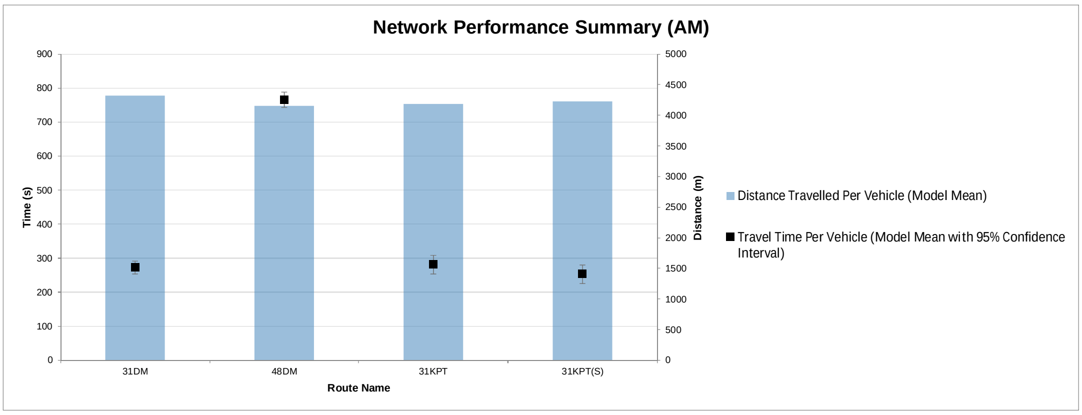


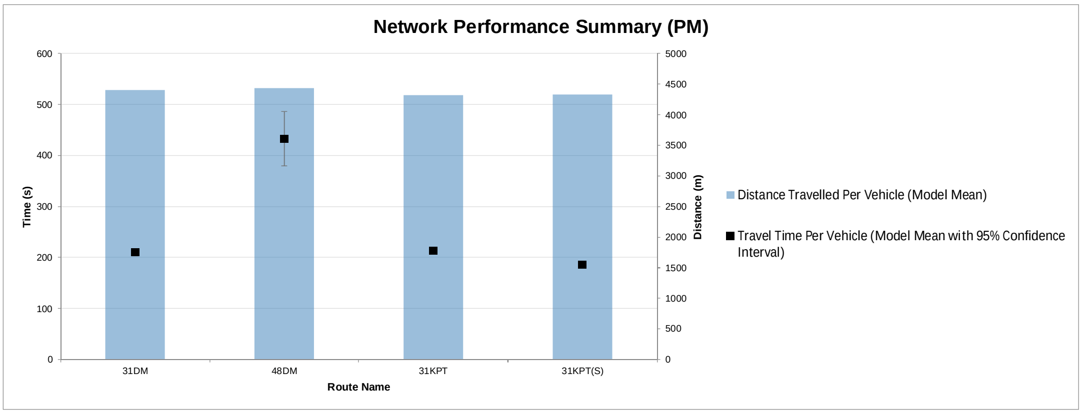


Journey Time Table
AM
Key Planning

Route Names	31DM	48DM	31KPT	31KPT(S)
Route 1: M1 WB	256	456	226	215
Route 2: M1 EB	156	160	157	157
Route 3: M1 E to A509 N	299	652	297	279
Route 4: M1 E to A509 W	0	0	0	0
Route 5: M1 W to A4146	195	362	216	200
Route 6: M1 W to A509 (N)	95	182	119	120
Route 7: A509(N) to M1 E	119	126	214	166
Route 8: A509(N) to M1 W	162	197	345	200
Route 9: A509(N) to A4146	150	238	282	149
Route 10: A4146 to M1 E	0	0	213	212
Route 11: A4146 to M1 W	0	0	145	144
Route 12: A4146 to A509 N	111	120	137	136
TM Route 1	72	100	75	75
TM Route 2	43	120	57	57
TM Route 3	24	33	21	20
TM Route 5	11	11	11	11
TM Route 6	21	51	25	18
TM Route 7	28	29	33	32
TM Route 8	5	11	6	5
TM Route 9	62	91	68	53
TM Route 10	77	135	90	72
TM Route 11	32	32	32	32
TM Route 12	105	552	270	247
TM Route 13	24	24	24	24
TM Route 14	35	230	36	37
TM Route 15	26	25	26	26
TM Route 16	30	29	32	33
TM Route 17	12	14	12	11
TM Route 18	23	24	27	27
TM Route 19	15	14	15	15
TM Route 20	23	23	23	23
TM Route 21	84	85	84	85
TM Route 22	193	419	161	149
TM Route 23	30	29	30	30
TM Route 24	65	62	65	65
TM Route 25	13	13	13	13
TM Route 26	9	10	22	22
TM Route 27	29	51	153	51
Acees Road_E Entry	0	0	140	9
Acees Road_E Exit	0	0	6	6
Acees Road_W Entry	0	0	28	16
Acees Road_W Exit	0	0	10	10
A509_N Entry	0	0	140	16
A509_N Exit	0	0	12	12
Trafficmaster Routes	1092	2218	1749	1304

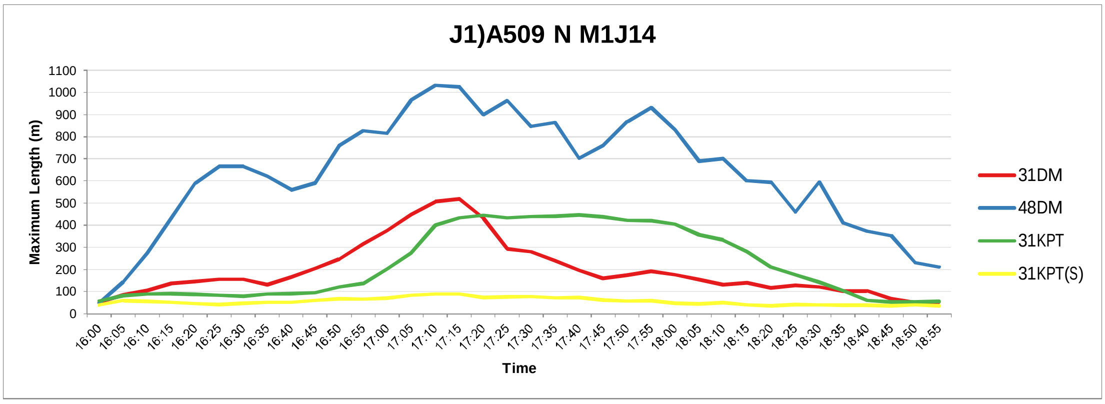
	31DM (AM)	48DM (AM)	31KPT (AM)	31KPT(S) (AM)	31DM (PM)	48DM (PM)	31KPT (PM)	31KPT(S) (PM)		
Total Time Taken (s)	9910892	28756678	10899025	9558492	8081851	18198961	8554551	7290645		
Total Distance (m)	157279547	156249600	162139113	159981739	170386168	187893776	173470661	170455653		
Total Vehicles	36411	37609	38750	37819	38675	42435	40108	39359		
Total Delay (s)										
Average Time (s) / Vehicle	272	766	281	253	209	433	213	185		
Average Time (s) / Mile	101	297	108	96	76	157	79	69		
Average Distance (m) / Vehicle	4320	4154	4184	4230	4406	4427	4325	4331		
Average Speed (mph)	36	12	34	39	47	24	45	52		
Average Speed (kph)	58	20	55	63	76	38	73	84		
Average Delay / Vehicle										

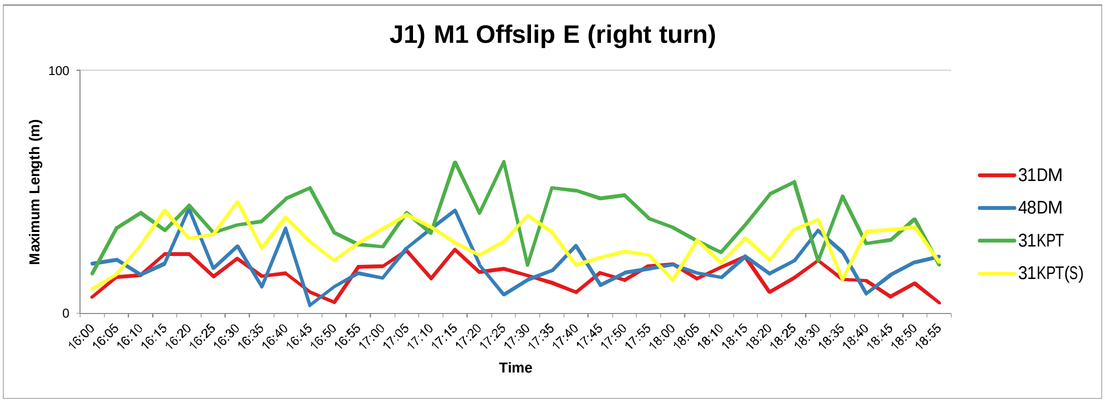


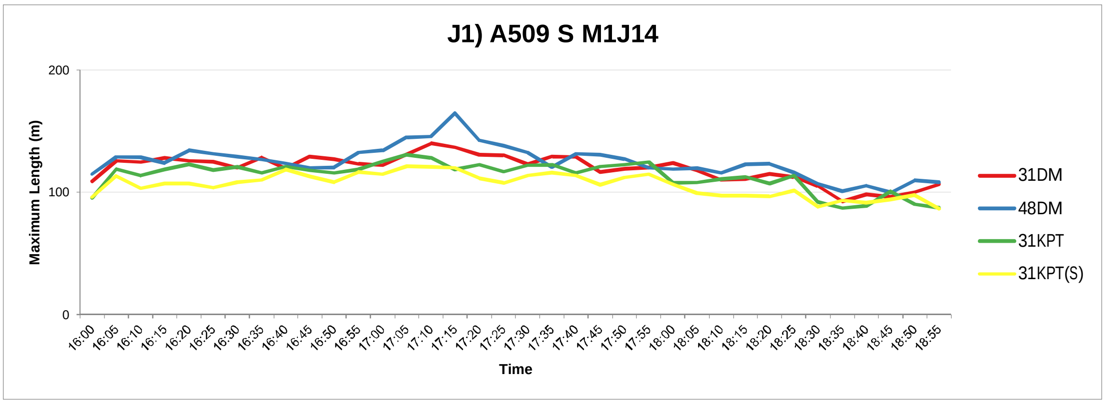


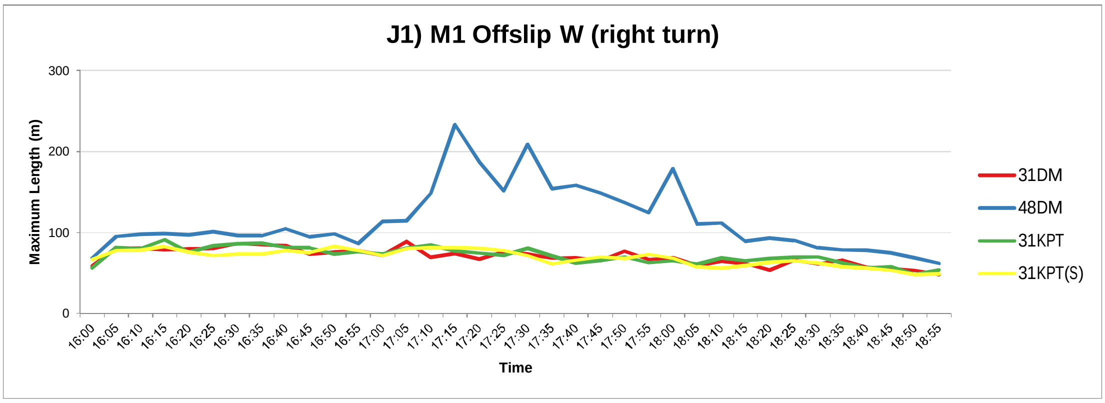
Comparison Graphs
PM

J1



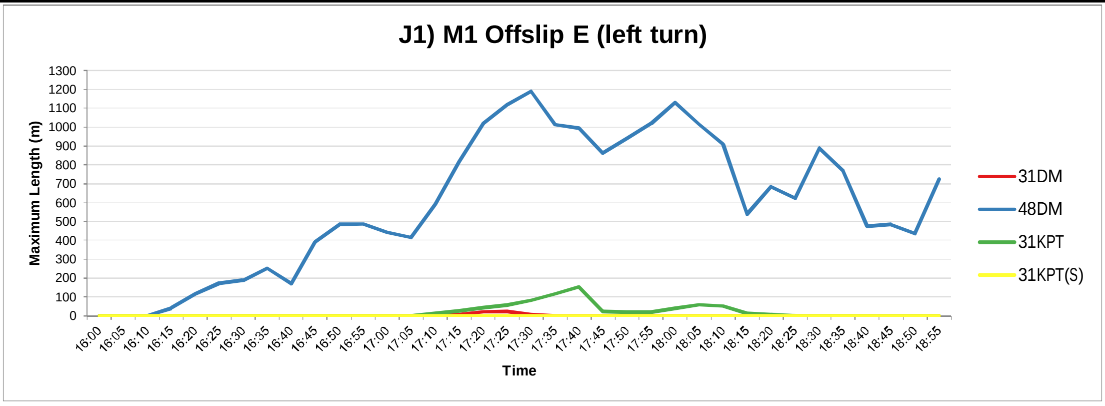


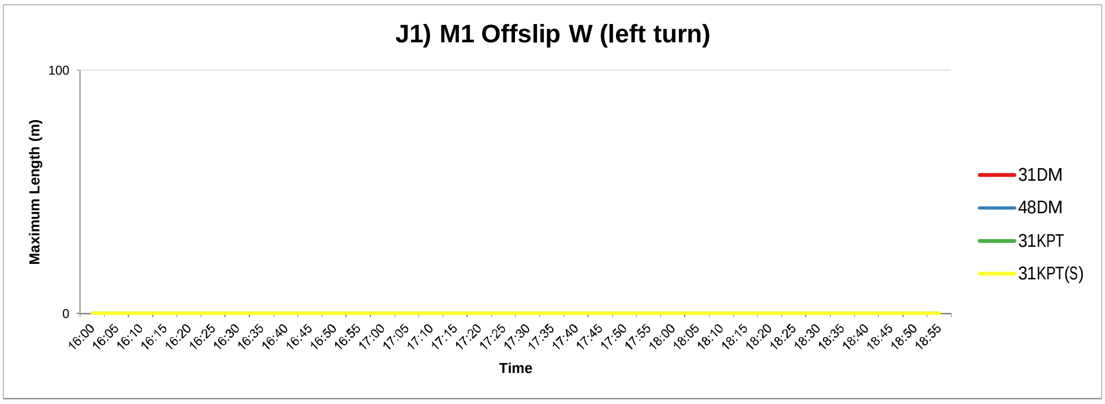


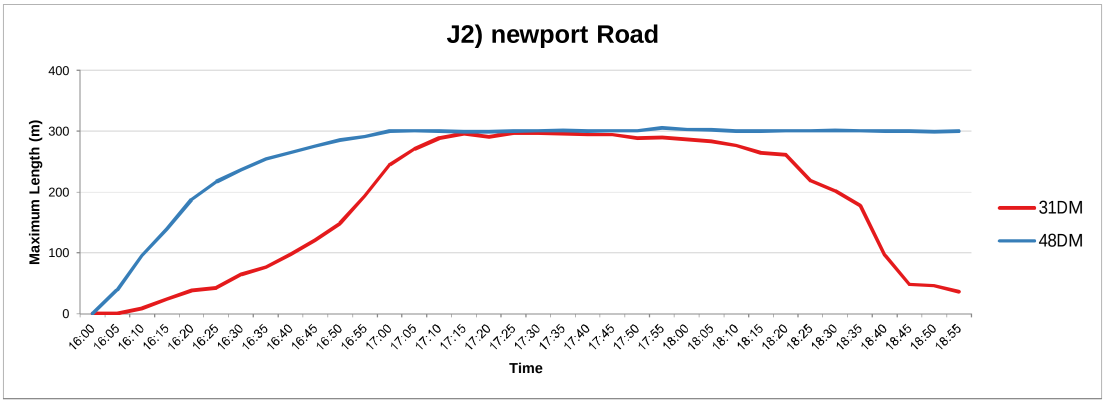


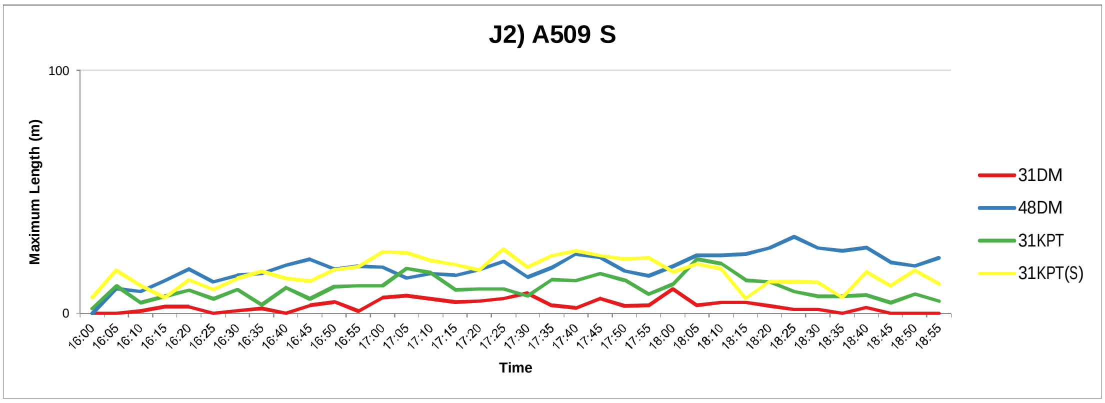
Comparison Graphs
PM

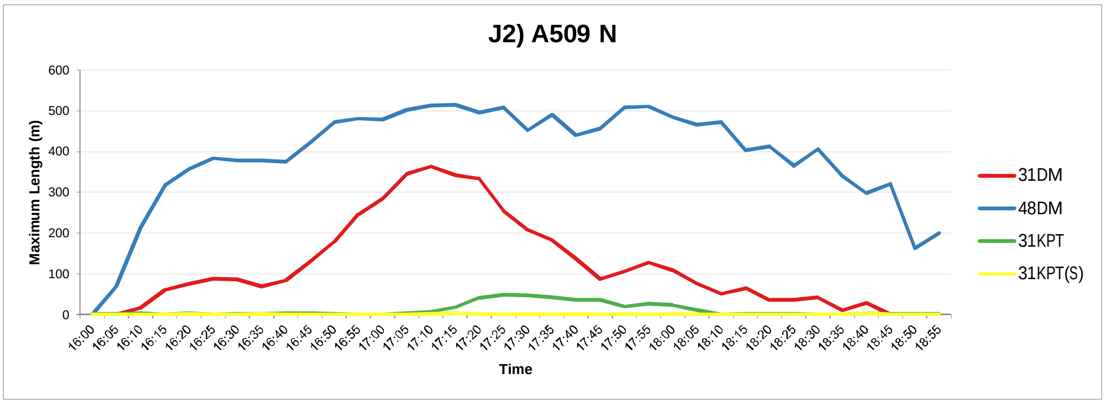
J1

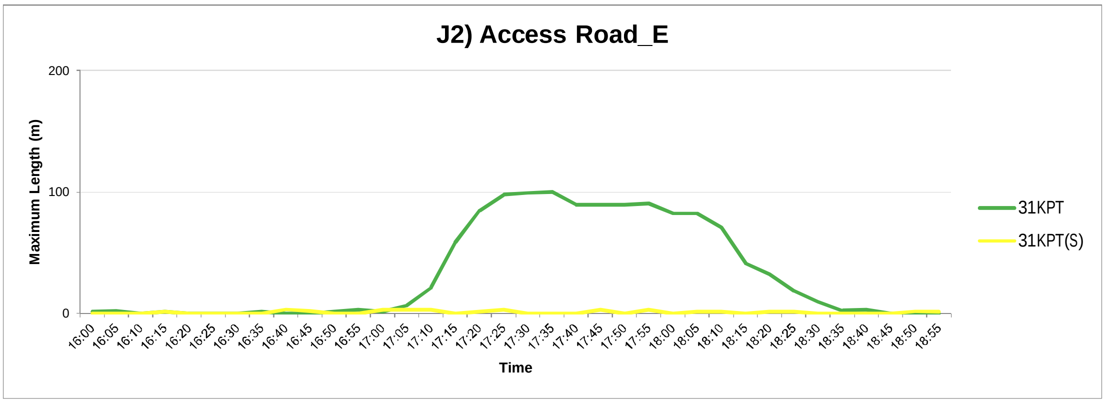


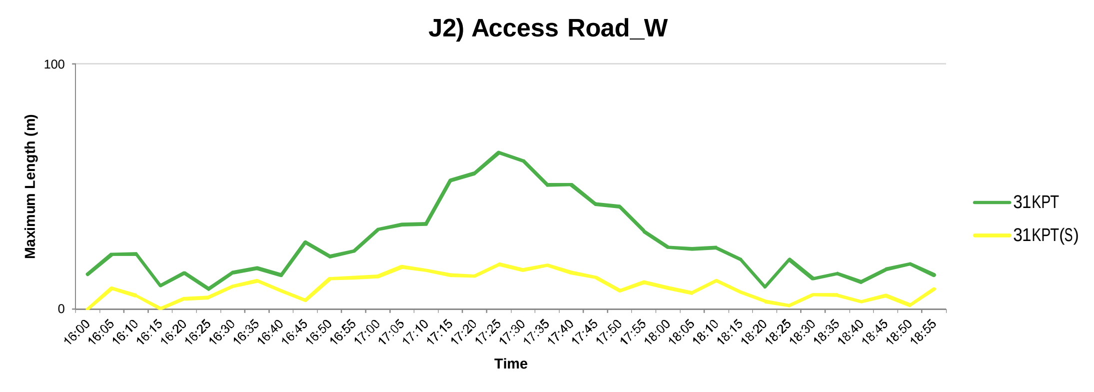



J2) newport Road
Maximum Length (m)
Time
31DM
48DM


J2) A509 S
Maximum Length (m)
Time
31DM
48DM
31KPT
31KPT(S)

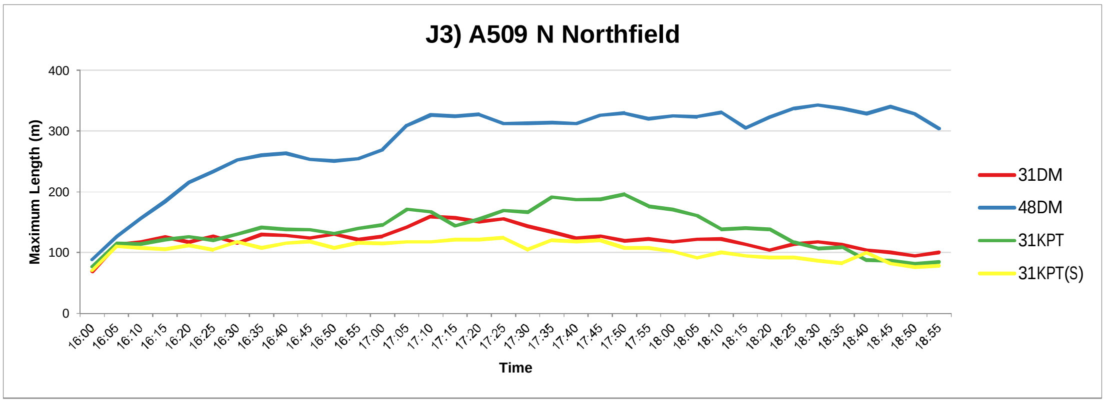

J2) A509 N
Maximum Length (m)
Time
31DM
48DM
31KPT
31KPT(S)

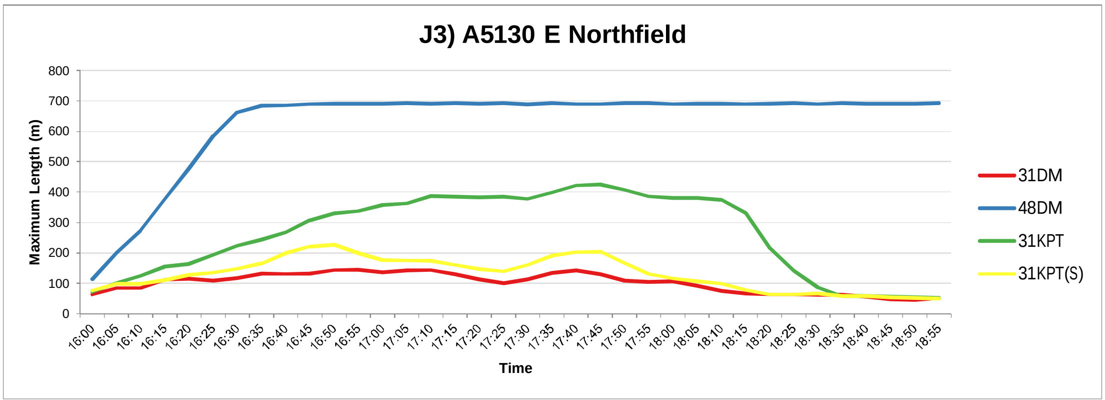

J2) Access Road_E
Maximum Length (m)
Time
31KPT
31KPT(S)

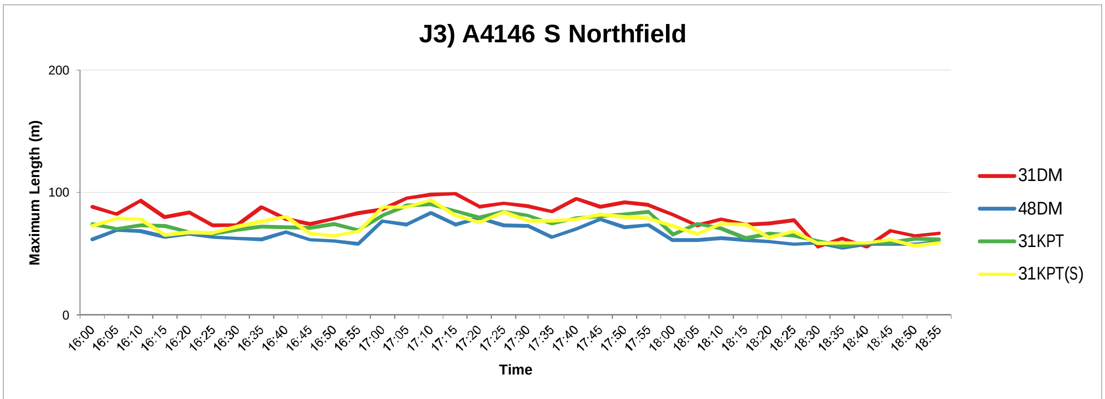

J2) Access Road_W
100
0
Maximum Length (m)
16:00
16:05
16:10
16:15
16:20
16:25
16:30
16:35
16:40
16:45
16:50
16:55
17:00
17:05
17:10
17:15
17:20
17:25
17:30
17:35
17:40
17:45
17:50
17:55
18:00
18:05
18:10
18:15
18:20
18:25
18:30
18:35
18:40
18:45
18:50
18:55
Time
31KPT
31KPT(S)

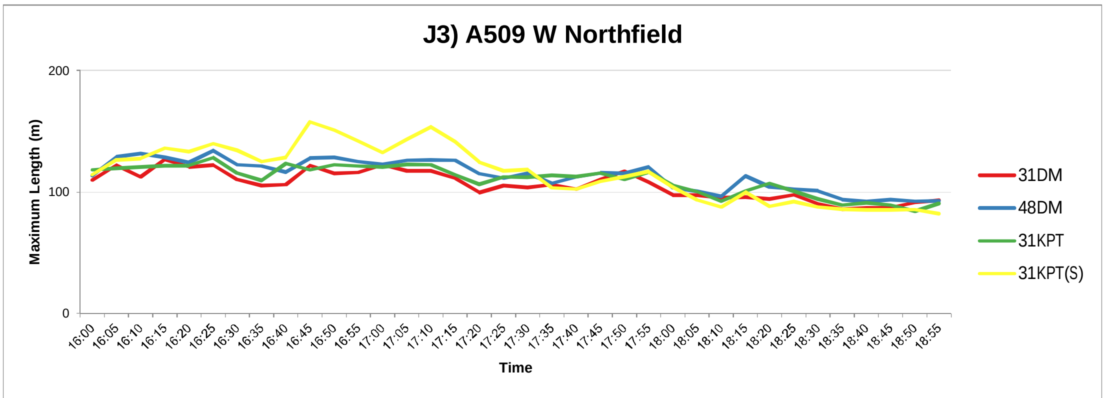
Comparison Graphs
PM

J3



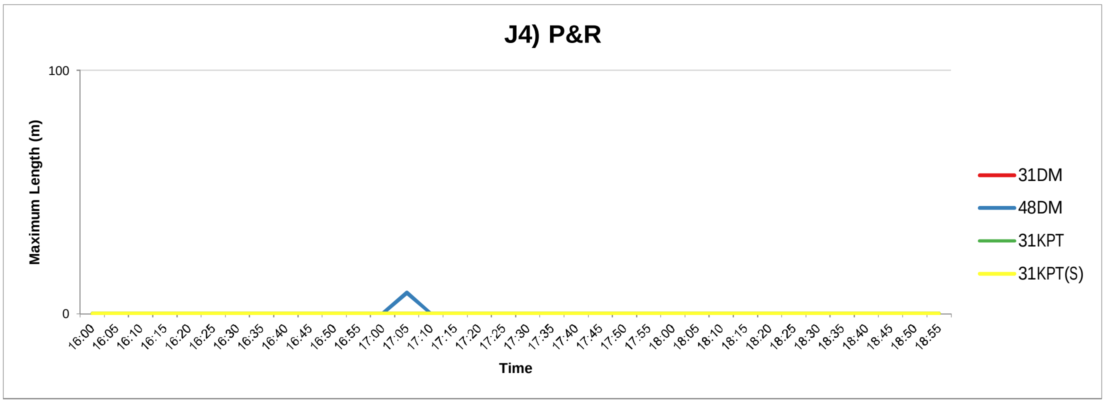






Comparison Graphs
PM

J4



Queue Comparison
PM
Maximum Length Summary
Maximum Length (m)

	31DM	48DM	31KPT	31KPT(S)
J1)A509 N M1J14	518.3	1032.4	445.9	89.4
J1) M1 Offslip E (right turn)	26.2	43.0	62.4	45.9
J1) A509 S M1J14	140.1	164.7	130.7	121.3
J1) M1 Offslip W (right turn)	88.8	233.0	91.1	82.5
J1) M1 Offslip E (left turn)	21.6	1190.7	153.4	0.0
J1) M1 Offslip W (left turn)	0.0	0.0	0.0	0.0
J2) newport Road	297.3	305.2		
J2) A509 S	10.0	31.5	22.3	26.4
J2) A509 N	363.5	514.7	48.6	2.8
J2) Access Road_E			100.0	3.3
J2) Access Road_W			63.9	18.2
J3) A509 N Northfield	159.3	342.6	195.8	124.4
J3) A5130 E Northfield	145.2	692.9	425.5	227.2
J3) A4146 S Northfield	99.1	83.4	90.3	93.9
J3) A509 W Northfield	126.8	134.1	128.3	157.8
J4) P&R	0.0	8.6	0.0	0.0

Queue Comparison
PM
Average Length Summary
Maximum Length (m)

	31DM	48DM	31KPT	31KPT(S)
J1)A509 N M1J14	196.0	635.9	225.5	55.5
J1) M1 Offslip E (right turn)	15.8	20.5	38.4	28.9
J1) A509 S M1J14	119.6	124.9	113.2	106.3
J1) M1 Offslip W (right turn)	69.9	114.7	71.4	69.0
J1) M1 Offslip E (left turn)	1.7	594.9	20.2	0.0
J1) M1 Offslip W (left turn)	0.0	0.0	0.0	0.0
J2) newport Road	179.4	263.9		
J2) A509 S	3.1	19.1	10.3	16.7
J2) A509 N	118.4	390.1	10.9	0.5
J2) Access Road_E			32.8	1.0
J2) Access Road_W			27.0	8.8
J3) A509 N Northfield	122.1	284.6	138.0	104.5
J3) A5130 E Northfield	101.8	631.2	260.7	130.4
J3) A4146 S Northfield	80.7	65.7	72.4	72.6
J3) A509 W Northfield	106.1	113.9	110.1	115.8
J4) P&R	0.0	0.2	0.0	0.0

wsp

Journey Time Table
PM
Key Planning

Route Names	31DM	48DM	31KPT	31KPT(S)
Route 1: M1 WB	149	237	150	149
Route 2: M1 EB	152	154	152	152
Route 3: M1 E to A509 N	177	316	208	202
Route 4: M1 E to A509 W	0	0	0	0
Route 5: M1 W to A4146	168	279	177	161
Route 6: M1 W to A509 (N)	95	126	111	111
Route 7: A509(N) to M1 E	127	131	234	175
Route 8: A509(N) to M1 W	215	245	445	200
Route 9: A509(N) to A4146	209	333	368	134
Route 10: A4146 to M1 E	0	0	199	192
Route 11: A4146 to M1 W	0	0	129	127
Route 12: A4146 to A509 N	105	116	117	111
TM Route 1	68	72	70	70
TM Route 2	46	66	46	46
TM Route 3	24	31	22	20
TM Route 5	11	11	13	12
TM Route 6	11	40	14	11
TM Route 7	31	33	38	36
TM Route 8	4	11	5	4
TM Route 9	29	100	41	27
TM Route 10	80	602	215	101
TM Route 11	32	32	32	32
TM Route 12	48	46	47	47
TM Route 13	24	24	24	24
TM Route 14	46	48	47	52
TM Route 15	25	24	25	25
TM Route 16	37	38	35	34
TM Route 17	13	13	13	13
TM Route 18	27	31	27	25
TM Route 19	16	15	16	16
TM Route 20	22	23	22	22
TM Route 21	82	84	83	83
TM Route 22	77	174	77	77
TM Route 23	31	32	31	31
TM Route 24	66	65	66	66
TM Route 25	13	13	13	13
TM Route 26	8	10	22	23
TM Route 27	86	90	215	61
Acees Road_E Entry	0	0	57	9
Acees Road_E Exit	0	0	6	6
Acees Road_W Entry	0	0	21	15
Acees Road_W Exit	0	0	10	10
A509_N Entry	0	0	28	13
A509_N Exit	0	0	12	12
Trafficmaster Routes	958	1728	1395	1035

APPENDIX D

Summary Comparison

Total Cordon Demand (PCUs)

		AM	PM
Core	2031 Do Minimum	15278	15634
	2031 Do Something	15776	15702
	Difference	497	68
	%	3.3%	0.4%
	2048 Do Minimum	17070	17465
	2048 Do Something	18334	17974
	Difference	1264	510
	%	7.4%	2.9%

		AM	PM
Sensitivity	2031 Do Minimum	15385	15435
	2031 Do Something	15701	n/a
	Difference	316	-
	%	2.1%	-
	2048 Do Minimum	17117	n/a
	2048 Do Something	17756	n/a
	Difference	639	-
	%	3.7%	-

		AM	PM
Key Planning Test	2031 Do Minimum	15278	15634
	2031 Do Something	16547	16246
	Difference	1268	612
	%	8.3%	3.9%
	2031 Do Minimum (Sensitivity)	15385	15435
	2031 Do Something (Sensitivity)	16220	15893
	Difference	835	458
	%	5.4%	3.0%

	AM	PM
Dev only (from SLA)	1582	1218
2031 Do Something - Planning Test	16547	16246
%	9.6%	7.5%

Scenarios Provided

2031	Do Minimum	Core	AM
2031	Do Minimum	Core	PM
2031	Do Something	Core	AM
2031	Do Something	Core	PM
2048	Do Minimum	Core	AM
2048	Do Minimum	Core	PM
2048	Do Something	Core	AM
2048	Do Something	Core	PM
2031	Key Planning Test	Core	AM
2031	Key Planning Test	Core	PM
2031	Key Planning Test	Sensitivity	AM
2031	Key Planning Test	Sensitivity	PM
2031	Do Minimum	Sensitivity	AM
2031	Do Minimum	Sensitivity	PM
2048	Do Minimum	Sensitivity	AM
2031	Do Something	Sensitivity	AM
2048	Do Something	Sensitivity	AM

2031_DM_Core_AM

Car Commute

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110
3101	0	0	99.94647	620.7351	126.4357	0.01425	0	424.4989	14.80695	140.6247
3102	0	0	0	0	0	0	0	0	0	0
3103	0	61.0141	0.04054	3.55521	137.6793	0	0	222.9456	25.50123	0.00972
3104	0	172.2588	0.68965	0	0.30812	0	0	70.39223	17.01445	1.27726
3105	0	26.01771	122.1026	20.10612	0	0	0	0.62936	0.1371	3.44256
3106	0	0	0	0	0	0	0	0	0	0
3107	0	250.6387	776.9594	407.3311	0.17486	0.0152	0	0	0.01215	82.70124
3108	0	0	0	0	0	0	0	0	0	0
3109	0	4.68066	72.75034	45.21926	0.61354	0.00311	0	1.2131	0	0.14979
3110	0	2.1102	3.17277	82.31957	63.18531	0.00605	0	174.9935	21.33782	0

Car Business

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110
3101	0	0	17.9139	205.3716	23.14877	0.00546	0	724.7846	3.57596	17.76342
3102	0	0	0	0	0	0	0	0	0	0
3103	0	24.04994	0.00261	3.45366	30.56392	0	0	60.37175	1.06053	0.002
3104	0	132.8276	0.08714	0	0.00518	0	0	24.53981	1.47393	0.20528
3105	0	13.55527	16.62975	1.92413	0	0	0	0.06217	0.00284	0.58745
3106	0	0	0	0	0	0	0	0	0	0
3107	0	320.5738	111.3792	79.43653	0.00956	0.0059	0	0	0.00211	18.06322
3108	0	0	0	0	0	0	0	0	0	0
3109	0	2.09837	6.85462	4.40216	0.02246	0.00025	0	0.52018	0	0.0103
3110	0	2.67107	0.21378	8.04034	3.54422	0.0003	0	34.74437	1.2093	0

Car Other

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110
3101	0	0	48.07337	291.6727	38.4147	0.00169	0	1251.111	5.96152	50.03273
3102	0	0	0	0	0	0	0	0	0	0
3103	0	35.90023	0.03092	3.12881	94.46537	0	0	107.2809	28.06556	0.02382
3104	0	152.9425	0.60255	0	1.07684	0	0	48.86576	22.82552	1.50345
3105	0	15.21504	88.01521	14.75546	0	0	0	0.16327	0.23291	7.74946
3106	0	0	0	0	0	0	0	0	0	0
3107	0	1293.08	280.1847	148.8602	0.06068	0.00339	0	0	0.0098	83.18652
3108	0	0	0	0	0	0	0	0	0	0
3109	0	4.14099	79.65733	48.77668	1.15507	0.00107	0	2.74286	0	0.31696
3110	0	1.14561	1.69061	44.81101	38.15416	0.00258	0	105.5753	19.62477	0

LGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110
3101	0	0	34.1749	125.8683	21.12136	0.01409	0	528.5598	5.18658	26.29063
3102	0	0	0	0	0	0	0	0	0	0
3103	0	15.64182	0.01196	2.3153	15.78864	0	0	63.5295	4.36851	0.00268
3104	0	70.71923	0.08276	0	0.10322	0	0	18.07006	3.8632	0.26869
3105	0	12.15296	23.61345	1.34776	0	0	0	0.03391	0.06746	5.81964
3106	0	0	0	0	0	0	0	0	0	0
3107	0	283.9966	102.6423	36.53535	0.00528	0.0167	0	0	0.00123	33.25728
3108	0	0	0	0	0	0	0	0	0	0
3109	0	2.45691	27.04385	13.28234	0.05299	0.00321	0	0.29398	0	0.02596
3110	0	0.93918	1.36628	13.26654	9.50844	0.04776	0	52.76752	4.07291	0

HGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110
3101	0	0	63.88092	143.6764	0.21799	0.02883	0	1110.871	7.08898	36.38669
3102	0	0	0	0	0	0	0	0	0	0
3103	0	30.24829	0.00001	0.50865	0.08564	0	0	29.49591	0.59224	0.00011
3104	0	123.7783	0.018	0	0.03815	0	0	8.26511	0.70118	0.30119
3105	0	0.28915	0.07946	0.04208	0	0	0	0.01079	0.00003	0.01258
3106	0	0	0	0	0	0	0	0	0	0
3107	0	1168.416	151.8283	32.17191	0	0.04915	0	0	0.00009	59.60737
3108	0	0	0	0	0	0	0	0	0	0
3109	0	0.5572	16.28926	3.59359	0.00002	0.00295	0	0.07723	0	0.00325
3110	0	6.45984	1.08256	16.69969	0.04183	0.00396	0	42.67036	0.83985	0

Total

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	264	1387	209	0	0	4040	37	271	0	6208.26
3102	0	0	0	0	0	0	0	0	0	0	0	0
3103	0	167	0	13	279	0	0	484	60	0	0	1001.735
3104	0	653	1	0	2	0	0	170	46	4	0	875.1052
3105	0	67	250	38	0	0	0	1	0	18	0	374.7977
3106	0	0	0	0	0	0	0	0	0	0	0	0
3107	0	3317	1423	704	0	0	0	0	0	277	0	5721.215
3108	0	0	0	0	0	0	0	0	0	0	0	0
3109	0	14	203	115	2	0	0	5	0	1	0	339.0118
3110	0	13	8	165	114	0	0	411	47	0	0	758.3193
3111	0	0	0	0	0	0	0	0	0	0	0	0
	0	4230.576	2149.111	2423.207	605.9813	0.2259	0	5110.08	189.6367	569.6259	0	

2031_DM_Core_PM

Car Commute

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110
3101	0	0	56.52845	249.6696	135.1434	0.22358	0	464.409	11.6562	76.49548
3102	0	0	0	0	0	0	0	0	0	0
3103	0	436.1783	0.00696	0.08773	0.42339	0	0	375.1471	8.86161	2.0734
3104	0	195.3621	0	0	0.02168	0	0	73.5875	1.78988	12.58227
3105	0	288.447	28.48377	4.03383	0	0	0	15.09146	0.47001	52.79843
3106	0	0	0	0	0	0	0	0	0	0
3107	0	428.3194	236.9553	124.7617	26.17911	0.64961	0	0	0.00083	133.7345
3108	0	0	0	0	0	0	0	0	0	0
3109	0	15.46725	21.78347	10.82405	1.22742	0.00007	0	4.98753	0	0.26543
3110	0	7.71192	0.0055	0.27354	43.5787	0.00237	0	166.8892	19.86035	0

Car Business

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110
3101	0	0	34.81218	133.6165	65.75597	0.10029	0	348.0569	4.93782	40.99938
3102	0	0	0	0	0	0	0	0	0	0
3103	0	87.84172	0.00213	0.00787	0.04537	0	0	57.18772	0.83242	0.20232
3104	0	64.51964	0	0	0.00284	0	0	14.06421	0.33737	1.34385
3105	0	80.99345	6.45251	1.03347	0	0	0	1.59897	0.12853	5.07793
3106	0	0	0	0	0	0	0	0	0	0
3107	0	274.3145	44.23006	33.43996	3.00795	0.14282	0	0	0.00037	37.25292
3108	0	0	0	0	0	0	0	0	0	0
3109	0	4.1586	1.90674	1.52656	0.0071	0.00002	0	0.49413	0	0.00983
3110	0	6.42821	0.00074	0.03067	0.5779	0.00132	0	29.6299	0.78236	0

Car Other

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110
3101	0	0	104.1089	375.8384	182.9226	0.26487	0	1830.418	9.20737	75.79733
3102	0	0	0	0	0	0	0	0	0	0
3103	0	259.002	0.02846	0.14882	0.51634	0	0	393.7857	34.35826	2.48408
3104	0	150.6655	0	0	0.01684	0	0	97.04673	5.66106	17.3996
3105	0	168.2441	47.96247	11.85553	0	0	0	13.34921	1.56209	81.58855
3106	0	0	0	0	0	0	0	0	0	0
3107	0	1457.678	382.3526	274.8666	9.56491	1.045	0	0	0.00276	191.2829
3108	0	0	0	0	0	0	0	0	0	0
3109	0	9.72289	68.54282	65.23481	6.09436	0.00044	0	3.27836	0	0.40033
3110	0	20.43575	0.05151	0.45049	118.1413	0.00617	0	194.6293	47.70588	0

LGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110
3101	0	0	25.03461	60.87857	0.59192	27.27703	0	335.6091	5.80288	34.42989
3102	0	0	0	0	0	0	0	0	0	0
3103	0	64.5498	0.00253	0.00861	0.06185	0	0	39.87867	3.41857	0.34805
3104	0	33.87408	0	0	0.00063	0	0	7.24332	0.84619	2.69737
3105	0	32.76481	4.05143	0.41219	0	0	0	6.36533	0.1576	8.03426
3106	0	0	0	0	0	0	0	0	0	0
3107	0	407.9069	51.0146	20.88089	0.02227	1.28944	0	0	0.00024	37.97018
3108	0	0	0	0	0	0	0	0	0	0
3109	0	6.82991	2.121	2.97552	0.00213	0.0946	0	0.22542	0	0.02672
3110	0	5.83947	0.0025	0.04134	0.28453	7.31943	0	46.28372	3.57387	0

HGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110
3101	0	0	12.74174	79.92692	0.00167	0.12598	0	1116.701	3.89039	19.02199
3102	0	0	0	0	0	0	0	0	0	0
3103	0	38.91849	0.00022	0.00513	0.02032	0	0	36.33982	20.96189	0.1842
3104	0	76.57861	0	0	0.00266	0	0	3.21677	0.2507	2.50155
3105	0	0.41146	0.08944	0.08486	0	0	0	0.04526	0.03021	0.02944
3106	0	0	0	0	0	0	0	0	0	0
3107	0	979.0814	39.54041	11.41893	0	0.00721	0	0	0	12.23538
3108	0	0	0	0	0	0	0	0	0	0
3109	0	1.07467	0.13301	0.29295	0	0	0	0.27718	0	0.00935
3110	0	6.19034	0.0002	0.12806	0.00024	0.02352	0	45.59797	0.40675	0

Total

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	233	900	384	28	0	4095	35	247	0	5922.995
3102	0	0	0	0	0	0	0	0	0	0	0	0
3103	0	886	0	0	1	0	0	902	68	5	0	1863.92
3104	0	521	0	0	0	0	0	195	9	37	0	761.613
3105	0	571	87	17	0	0	0	36	2	148	0	861.6476
3106	0	0	0	0	0	0	0	0	0	0	0	0
3107	0	3547	754	465	39	3	0	0	0	412	0	5221.15
3108	0	0	0	0	0	0	0	0	0	0	0	0
3109	0	37	94	81	7	0	0	9	0	1	0	229.9947
3110	0	47	0	1	163	7	0	483	72	0	0	772.8851
3111	0	0	0	0	0	0	0	0	0	0	0	0
	0	5609.511	1168.946	1464.754	594.2155	38.57377	0	5721.434	187.4945	849.277	0	

2031_DS_Core_AM

Car Commute

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	153.9204	574.5421	100.9274	0.01392	0	443.9703	0	13.53084	64.56456
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	59.99658	0.05457	4.11197	147.7161	0	0	281.9761	0	11.18551	0.97598
3104	0	168.9824	0.49275	0	0.29701	0	0	71.96801	0	11.81488	0.85713
3105	0	25.95106	106.9871	15.413	0	0	0	0.14535	0	10.26038	0.64312
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	259.4481	746.9191	344.2578	0.1048	0.01463	0	0	0	26.8784	59.39194
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	0	0	0	0	0	0	0	0	0	0
3110	0	6.5687	12.62727	246.9599	33.36266	0.00632	0	50.59691	0	0	0
3111	0	0.35077	0.04436	1.2691	1.46387	0.00368	0	49.80695	1.96047	0	0

Car Business

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	26.91344	200.3216	23.57748	0.00536	0	731.236	32.41983	6.90934	88.81243
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	30.33211	0.00188	3.64809	28.46343	0	0	64.21144	8.04728	0.52241	4.46359
3104	0	126.9421	0.05428	0	0.00445	0	0	24.98219	15.06687	1.07265	13.95305
3105	0	12.7849	17.60928	1.45104	0	0	0	0.02107	2.75338	2.07392	3.69012
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	320.8799	125.0629	71.49931	0.00724	0.00577	0	0	22.05538	10.18059	53.73156
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	1.24007	0.35022	2.31896	0.29602	0	0	3.30483	0	0	2.03624
3110	0	6.38838	1.07172	29.33227	2.06078	0.00074	0	14.77313	0	0	17.97957
3111	0	3.02892	0.13037	2.38314	0.54757	0.00012	0	25.50938	16.12403	0.88457	0

Car Other

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	69.65453	279.8423	38.57298	0.00162	0	1261.222	0.60705	6.43554	20.86062
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	30.84448	0.03483	3.30751	104.5034	0	0	114.2029	18.33152	11.90429	16.79688
3104	0	149.6137	0.42395	0	1.04354	0	0	52.86002	32.34785	17.76992	26.0048
3105	0	14.65736	73.59443	11.95146	0	0	0	0.05125	13.0464	16.63857	11.96153
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	1290.977	262.9853	135.5243	0.03849	0.00318	0	0	1.44166	43.67002	61.67928
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	0.06181	1.80557	5.94779	1.65752	0.00045	0	0.5724	0	0	5.06668
3110	0	4.40597	14.57226	114.2978	14.6824	0.00282	0	55.75429	0	0	5.17906
3111	0	0.34443	1.25518	6.03899	2.53867	0.00202	0	37.49541	25.80138	0.41003	0

LGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	44.48373	116.487	23.49532	0.01405	0	530.7963	0	4.9802	7.10316
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	13.24358	0.01231	2.26391	20.24692	0	0	45.58999	0	1.76356	0
3104	0	69.70509	0.06827	0	0.10173	0	0	17.43358	0	3.32256	0.0027
3105	0	11.82692	21.04804	1.02212	0	0	0	0.01911	0	4.93251	0.08982
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	284.8327	103.4078	33.02608	0.00395	0.01399	0	0	0	15.03783	20.92674
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	0	0	0	0	0	0	0	0	0	0
3110	0	2.45149	5.36389	31.0851	4.54087	0.00542	0	19.23599	0	0	0
3111	0	0.74613	0.00545	0.06079	0.84713	0.00184	0	47.84819	0	0	0

OGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	80.76481	155.543	0.21829	0.02733	0	1150.448	36.64051	6.9231	104.9633
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	49.75841	0.00543	0.54201	0.11056	0	0	20.7255	2.24257	0.12317	2.06799
3104	0	117.7772	0.00751	0	0.03737	0	0	8.48464	6.33888	0.56869	6.41225
3105	0	0.28897	0.08191	0.03983	0	0	0	0.0107	0.00248	0.00996	0.00594
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	1183.006	156.1541	32.74546	0	0.05018	0	0	9.79266	64.1791	43.85812
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	16.78376	0.56454	10.15641	0.00556	0.00069	0	15.77882	0	0	9.73546
3110	0	2.09223	2.44577	26.74579	0.02072	0.00439	0	18.98961	0	0	5.18183
3111	0	17.62096	0.41729	9.80046	0.01026	0.00182	0	69.56863	5.52322	1.64179	0

Total

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	376	1327	187	0	0	4118	70	39	286	6401.75
3102	0	0	0	0	0	0	0	0	0	0	0	0
3103	0	184	0	14	301	0	0	527	29	25	24	1104.329
3104	0	633	1	0	1	0	0	176	54	35	47	946.8121
3105	0	66	219	30	0	0	0	0	16	34	16	381.0631
3106	0	0	0	0	0	0	0	0	0	0	0	0
3107	0	3339	1395	617	0	0	0	0	33	160	240	5783.791
3108	0	0	0	0	0	0	0	0	0	0	0	0
3109	0	18	3	18	2	0	0	20	0	0	17	77.6838
3110	0	22	36	448	55	0	0	159	0	0	28	748.786
3111	0	22	2	20	5	0	0	230	49	3	0	331.4874
	0	4283.932	2031.397	2473.936	551.5045	0.18034	0	5229.589	250.5434	295.6243	658.9955	

2031_DS_Core_PM

Car Commute

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	62.59747	254.0205	132.1472	0.3555	0	470.295	0	40.52752	26.946
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	386.2097	0	0.03918	2.82088	0	0	368.9059	0	0.67915	0.0041
3104	0	279.2141	0.14392	0	0.0213	0	0	103.9815	0	5.43106	0.02062
3105	0	194.726	63.22836	5.21837	0	0	0	15.95398	0	16.20906	0.13729
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	437.3398	228.2604	126.4053	25.77258	0.85766	0	0	0	108.1682	17.53146
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	0	0	0	0	0	0	0	0	0	0
3110	0	9.61908	0.065	1.61097	25.21393	0.00139	0	27.52253	0	0	0
3111	0	4.27868	0.00002	0.00677	3.1566	0.00065	0	95.87579	0.44597	0	0

Car Business

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	38.46638	132.4195	63.5596	0.14459	0	347.3586	2.84952	17.50054	25.44938
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	121.5586	0	0.01013	0.15628	0	0	64.73256	0.90501	0.19385	0.13367
3104	0	88.87043	0.02691	0	0.00379	0	0	18.90773	1.31904	0.66515	0.57752
3105	0	56.92482	12.9728	1.41515	0	0	0	1.26661	1.71624	0.93753	1.26296
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	274.9047	52.69422	33.30122	3.06479	0.19369	0	0	3.43075	28.20246	12.69584
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	24.49901	0.03504	10.59643	2.30986	0	0	25.2912	0	0	10.15232
3110	0	3.83606	0.00603	0.53141	0.14314	0.00077	0	8.71573	0	0	2.16532
3111	0	34.83192	0.015	6.89093	3.67742	0.0002	0	88.19071	3.3294	14.52136	0

Car Other

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	102.6293	370.4154	174.9836	0.3838	0	1833.535	0.23429	26.80918	30.24155
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	233.3112	0.00018	0.0064	1.65398	0	0	379.7086	2.62145	3.15198	0.48176
3104	0	201.0206	0.20326	0	0.02208	0	0	130.715	3.97459	8.51651	1.27824
3105	0	115.1975	96.05141	13.58959	0	0	0	29.39481	6.64183	23.02138	5.51471
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	1466.22	359.0019	275.2455	9.52217	1.27641	0	0	0.39268	138.0951	34.81327
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	0.66157	1.55185	45.77955	17.50446	0.00144	0	2.20953	0	0	44.42207
3110	0	7.453	0.39611	10.62007	39.70309	0.00392	0	53.27206	0	0	1.20684
3111	0	17.33105	0.14728	19.50841	54.35281	0.00348	0	105.2505	12.96177	7.59115	0

LGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	27.83853	63.06557	10.28089	17.59609	0	336.2352	0	15.0683	14.17755
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	57.87012	0.00015	0.00312	0.30821	0	0	37.16662	0	0.27492	0
3104	0	44.80554	0.05253	0	0.0009	0	0	9.18854	0	1.18039	0
3105	0	21.31656	11.10296	0.45955	0	0	0	6.6627	0	1.41247	0.1169
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	408.339	50.21768	21.33627	0.43214	0.88192	0	0	0	19.13482	19.3661
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	0	0	0	0	0	0	0	0	0	0
3110	0	5.68159	0.34017	1.02646	1.90349	3.10394	0	8.78463	0	0	0
3111	0	4.43901	0	0	0.43302	0.72054	0	33.27446	0	0	0

OGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	13.54153	86.68132	0.00265	0.12871	0	1132.234	11.15213	5.58337	40.37267
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	49.59926	0	0.00128	0.02845	0	0	52.36196	1.60333	0.15417	0.78222
3104	0	89.58241	0.02697	0	0.00357	0	0	5.00016	2.86554	0.36627	2.86188
3105	0	0.40063	0.09787	0.08672	0	0	0	0.07532	0.00864	0.01866	0.01589
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	1051.139	42.6667	11.65445	0	0.00716	0	0	6.51107	8.74919	12.88522
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	5.90174	0.01766	5.078	0.00005	0.00269	0	7.71204	0	0	3.91052
3110	0	1.02404	0.00959	0.27615	0.00013	0.00522	0	12.58835	0	0	0.59646
3111	0	11.22747	0.0102	4.92194	0.00035	0.01727	0	42.85926	2.46781	4.19241	0

Total

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	245	907	381	19	0	4120	14	105	137	5927.828
3102	0	0	0	0	0	0	0	0	0	0	0	0
3103	0	849	0	0	5	0	0	903	5	4	1	1767.438
3104	0	703	0	0	0	0	0	268	8	16	5	1000.848
3105	0	389	183	21	0	0	0	53	8	42	7	703.1552
3106	0	0	0	0	0	0	0	0	0	0	0	0
3107	0	3638	733	468	39	3	0	0	10	302	97	5290.71
3108	0	0	0	0	0	0	0	0	0	0	0	0
3109	0	31	2	61	20	0	0	35	0	0	58	207.637
3110	0	28	1	14	67	3	0	111	0	0	4	227.4267
3111	0	72	0	31	62	1	0	365	19	26	0	576.9316
	0	5709.333	1164.415	1502.222	573.1834	25.68704	0	5855.227	65.43106	496.3562	310.1203	

2048_Core_DM_DS_AM

DS

Car Commute

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	309.3174	642.9522	132.0333	0.46503	0	634.1981	16.66162	6.85286	74.58574
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	85.30172	1.67388	34.08587	311.9321	0.09689	0	152.9649	40.63979	13.42053	39.40686
3104	0	142.656	4.64184	0	0.01985	0.00185	0	61.02254	75.31539	72.93495	88.58799
3105	0	26.24571	157.7934	3.84516	0	0	0	0.14858	5.67966	10.45289	14.79966
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	283.933	933.8927	411.8944	0.58004	0.01917	0	0	21.31423	56.60178	68.16408
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	1.38835	0.15984	4.90509	0.66422	0.00538	0	3.30871	0	0.04022	9.45999
3110	0	2.71421	53.32358	293.9429	76.69119	0.21098	0	97.36951	0	0	82.28889
3111	0	2.97825	3.41194	31.63701	9.5659	1.19153	0	122.2601	83.96376	5.69595	0

Car Business

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	42.49793	209.736	20.01591	5.32679	0	691.7976	17.19309	6.94883	36.67628
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	69.84221	0.08039	5.26561	39.37281	0.28965	0	77.42197	1.84826	2.01735	1.30845
3104	0	157.5989	0.37741	0	0.01469	0.00005	0	17.72161	2.12089	18.65461	5.14869
3105	0	17.17882	12.17282	0.77185	0	0	0	0.03516	0.02734	1.62639	0.4247
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	310.728	114.903	69.73893	0.05231	0.01188	0	0	7.84225	13.6274	23.58196
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	1.63702	0.08367	2.16473	0.1403	0.03794	0	4.6326	0	0.0297	3.96884
3110	0	3.55542	4.97843	43.93571	7.66333	1.4279	0	35.42658	0	0	11.7495
3111	0	4.70397	0.05102	2.28513	0.40716	0.21057	0	46.77301	3.47625	3.28821	0

Car Other

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	116.6027	286.5753	37.2639	11.68363	0	1438.904	0.25261	6.11856	25.7006
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	69.02444	1.30173	21.48436	170.269	1.32379	0	109.7974	8.16368	26.09617	14.20711
3104	0	143.7978	3.07978	0	0.04812	0.00227	0	24.62166	15.13552	86.96057	51.17091
3105	0	19.79209	104.9189	3.32628	0	0	0	0.06405	1.30835	11.34155	18.81713
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	1357.297	271.1223	123.0783	0.23539	0.05354	0	0	0.39694	49.8222	45.01555
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	0.03739	0.88729	5.90701	0.82364	0.27108	0	0.31899	0	0.02586	9.35376
3110	0	4.04684	26.9235	148.7534	43.32883	6.85505	0	101.9024	0	0	20.79758
3111	0	0.26403	2.91121	25.44201	6.71264	2.07909	0	59.68114	19.32176	3.41428	0

LGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	61.22582	114.1823	2.62974	31.39364	0	622.4322	0	7.91989	11.93751
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	17.77128	0.21379	2.9976	26.89351	0.30882	0	31.17043	0	2.89154	0.0022
3104	0	52.31062	0.25719	0	0.00194	0.00616	0	11.87203	0	8.4647	3.31815
3105	0	15.2322	23.38	0.40321	0	0	0	0.02143	0	1.752	2.30991
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	291.4886	112.0752	34.74532	0.03451	0.04982	0	0	0	12.17497	18.81964
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	0	0	0	0	0	0	0	0	0	0
3110	0	2.5635	7.34664	26.64793	0.78875	7.39852	0	43.85513	0	0	1.26785
3111	0	0.0269	0.22406	0.62518	0.25212	0.91137	0	39.17945	0	0	0

OGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	85.77089	158.1268	0.00659	0.25442	0	1212.422	79.21463	13.37744	137.5605
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	42.22829	0.03849	1.05914	0.11347	0.00482	0	16.75683	5.78217	0.78095	3.96496
3104	0	88.12267	0.02691	0	0.00898	0.01065	0	6.97346	8.95732	4.13073	9.67799
3105	0	0.31194	0.0627	0.02276	0	0	0	0.01253	0.00536	0.00888	0.00778
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	1022.648	145.193	37.25671	0.00095	0.05474	0	0	16.09015	36.00018	40.40543
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	33.6935	0.90133	15.63819	0.00031	0.01352	0	40.6965	0	0.01326	21.95758
3110	0	0.44794	1.96631	18.77122	0.00065	0.02766	0	31.54466	0	0	17.91806
3111	0	29.18656	0.48962	13.39528	0.0006	0.01395	0	92.22733	5.64905	7.02179	0

Total

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	615.4147	1411.573	191.9495	49.12351	0	4599.754	113.322	41.21758	286.4607	7308.81
3102	0	0	0	0	0	0	0	0	0	0	0	0
3103	0	284.1679	3.30828	64.89258	548.5809	2.02397	0	388.1115	56.4339	45.20654	58.88958	1451.62
3104	0	584.486	8.38313	0	0.09358	0.02098	0	122.2113	101.5291	191.1456	157.9037	1165.77
3105	0	78.76076	298.3279	8.36926	0	0	0	0.28175	7.02071	25.18171	36.35918	454.301
3106	0	0	0	0	0	0	0	0	0	0	0	0
3107	0	3266.095	1577.186	676.7136	0.9032	0.18915	0	0	45.64357	168.2265	195.9867	5930.94
3108	0	0	0	0	0	0	0	0	0	0	0	0
3109	0	36.75626	2.03213	28.61502	1.62847	0.32792	0	48.9568	0	0.10904	44.74017	163.166
3110	0	13.32791	94.53846	532.0512	128.4728	15.92011	0	310.0983	0	0	134.0219	1228.43
3111	0	37.15971	7.08785	73.38461	16.93842	4.40651	0	360.121	112.4108	19.42023	0	630.929
	0	4300.75	2606.28	2795.6	888.567	72.0122	0	5829.53	436.36	490.507	914.362	

DM

Car Commute

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	204.8623	698.5255	138.4146	3.69983	0	611.0775	7.66445	173.4266	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	70.94691	3.54492	48.40297	360.9767	1.42705	0	146.8107	24.14935	0.01943	
3104	0	171.5843	13.3611	0	0.02228	0.00878	0	106.8249	21.50376	32.44138	
3105	0	26.4836	164.5548	13.03818	0	0	0	0.6712	0.00304	6.52383	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	273.154	916.5551	524.611	1.59405	0.3844	0	0	0.02141	76.55281	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	3.96861	150.4246	150.2788	6.45989	0.17331	0	20.57336	0	0.27384	
3110	0	0.0354	0.69955	7.0041	18.76598	0.49439	0	187.2422	23.98665	0	
3111											

Car Business

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	30.16818	221.6863	24.1354	8.24776	0	738.0352	2.48301	17.09726	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	40.08426	0.14315	7.0429	45.37275	2.95832	0	61.59395	3.19669	0.00557	
3104	0	188.4426	0.74633	0	0.01579	0.00046	0	43.80174	3.64061	5.97836	
3105	0	15.7867	13.43887	1.83305	0	0	0	0.15168	0.00007	0.69267	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	311.8439	110.9853	87.51598	0.11183	0.04367	0	0	0.00303	13.81273	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	1.91482	15.9306	16.57411	0.52166	0.18829	0	5.40145	0	0.01296	
3110	0	0.02547	0.05471	0.76114	1.25484	0.47172	0	48.10979	0.74841	0	
3111											

Car Other

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	83.51723	316.397	38.08944	14.00753	0	1481.545	5.43501	58.67159	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	52.65145	1.95219	38.07438	200.5399	10.64186	0	97.13053	27.555	0.05927	
3104	0	180.4377	7.57399	0	0.06054	0.01958	0	73.52071	32.47633	42.10185	
3105	0	17.43423	118.5572	9.48461	0	0	0	0.3353	0.0048	10.3864	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	1384.715	297.1584	160.451	0.57327	0.20045	0	0	0.01528	53.58985	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	6.32011	91.36408	90.79459	5.38463	1.9595	0	25.24543	0	0.24252	
3110	0	0.02582	0.59128	6.22509	12.21192	5.23765	0	103.4779	27.77667	0	
3111											

LGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	41.68636	128.665	5.54048	29.06124	0	634.6779	5.73886	22.71709	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	15.11983	0.44454	5.23783	28.86288	0.91049	0	29.54727	8.95876	0.00525	
3104	0	59.85643	0.52649	0	0.00372	0.01729	0	24.1505	4.12011	4.08772	
3105	0	14.45121	28.09143	0.88047	0	0	0	0.10037	0.0034	2.78584	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	295.0539	102.2161	47.03128	0.07217	0.15591	0	0	0.00123	20.59921	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	3.54511	34.2144	25.18702	0.03253	0.15278	0	1.48074	0	0.04208	
3110	0	0.01023	0.20379	1.40825	0.6109	4.12812	0	57.3653	5.55995	0	
3111											

OGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	62.46996	159.7105	0.00391	0.27152	0	1009.869	6.8739	35.867	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	27.31219	0.04365	1.05461	0.10591	0.01049	0	18.99771	10.47575	0.00019	
3104	0	94.35619	0.04468	0	0.00997	0.01428	0	12.35949	2.53657	1.18043	
3105	0	0.32018	0.06126	0.02508	0	0	0	0.01329	0.00011	0.00336	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	951.2988	139.1449	42.24049	0.00101	0.05555	0	0	0.00021	21.87838	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	0.58609	13.76345	10.23977	0	0.00366	0	0.40222	0	0.02156	
3110	0	0.01393	0.08265	1.31415	0.00022	0.01765	0	49.38177	0.70299	0	
3111											

Total

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	422.7041	1524.984	206.1838	55.28788	0	4475.204	28.19523	307.7796	0	7020.34
3102	0	0	0	0	0	0	0	0	0	0	0	0
3103	0	206.1146	6.12845	99.81269	635.8582	15.94821	0	354.0802	74.33555	0.08971	0	1392.37
3104	0	694.6772	22.25259	0	0.1123	0.06039	0	260.6574	64.27738	85.78974	0	1127.83
3105	0	74.47592	324.7035	25.26139	0	0	0	1.27184	0.01142	20.3921	0	446.116
3106	0	0	0	0	0	0	0	0	0	0	0	0
3107	0	3216.066	1566.06	861.8497	2.35233	0.83998	0	0	0.04116	186.433	0	5833.64
3108	0	0	0	0	0	0	0	0	0	0	0	0
3109	0	16.33474	305.6971	293.0743	12.39871	2.47754	0	53.1032	0	0.59296	0	683.679
3110	0	0.11085	1.63198	16.71273	32.84386	10.34953	0	445.5769	58.77467	0	0	566.001
3111	0	0	0	0	0	0	0	0	0	0	0	0
	0	4207.78	2649.18	2821.7	889.749	84.9635	0	5589.89	225.635	601.077	0	

2048_Core_DM_DS_PM

DS

Car Comm

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	56.68822	240.5393	160.7011	22.48966	0	542.4524	4.09614	28.96567	33.5088
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	433.2313	0.12126	13.63455	37.12934	0	0	335.4131	0.04945	1.74468	0.27028
3104	0	199.8241	0	0	0.04413	0	0	86.99082	0.41839	1.36115	0.55368
3105	0	310.5593	56.29022	3.84876	0	0	0	41.76606	2.76287	27.69584	10.54518
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	515.6563	217.4135	191.3658	87.89042	12.75441	0	0	5.86121	81.05397	43.88214
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	22.94379	0.1428	91.99886	9.72591	1.32368	0	37.45562	0	0	62.35215
3110	0	12.04161	0.05796	2.19109	22.80977	3.48786	0	67.00249	0	0	6.82001
3111	0	25.53301	0.0902	48.01694	12.19718	1.79129	0	126.7004	20.21783	81.38762	0

Car Business

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	48.87571	183.8775	65.875	19.90341	0	411.9676	3.59629	23.1385	25.29473
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	101.611	0.0328	3.04369	1.20146	0	0	63.0447	0.01303	0.12391	0.01253
3104	0	64.62408	0	0	0.00753	0	0	17.79055	0.17784	0.27415	0.08045
3105	0	83.79778	8.99954	1.05782	0	0	0	4.98509	0.51159	2.68329	0.6641
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	301.3075	57.55989	66.36018	8.71377	2.80947	0	0	3.99419	32.18056	20.75028
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	16.94987	0.00608	3.24072	0.22778	0.06836	0	16.26221	0	0	3.69656
3110	0	5.05542	0.00556	0.29635	0.43243	0.09573	0	10.54267	0	0	2.95458
3111	0	25.04827	0.00222	2.37626	0.44709	0.13012	0	47.08335	4.37515	13.71166	0

Car Other

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	106.0747	392.5537	163.7736	46.26497	0	2295.833	0.27586	21.8364	20.8096
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	272.0696	0.16672	5.75229	82.49852	0	0	339.6338	0.1066	1.55476	0.22997
3104	0	137.1862	0	0	0.02883	0	0	101.1464	0.79102	3.04692	0.68788
3105	0	168.2295	62.78514	10.07146	0	0	0	40.14262	4.67977	50.41389	14.44054
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	1735.103	443.8933	336.6665	31.54672	10.17322	0	0	0.40894	124.4276	50.19623
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	0.31557	1.49696	27.75591	2.61236	0.73473	0	1.14394	0	0	30.0633
3110	0	11.30493	0.39951	12.22008	42.1091	9.98424	0	53.57913	0	0	4.58742
3111	0	12.67765	0.11355	22.13412	17.03322	4.73957	0	115.6787	28.15582	14.16849	0

LGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	20.78528	44.84605	20.32062	13.22873	0	404.7518	0	10.77045	5.77895
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	61.57649	0.0668	0.70971	5.21445	0	0	36.35867	0	0.26477	0
3104	0	28.87089	0	0	0.00083	0	0	8.01711	0	0.32579	0.01971
3105	0	25.47123	6.55763	0.42587	0	0	0	9.15684	0	3.29854	0.61105
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	476.804	55.06305	27.78545	2.24998	1.65837	0	0	0	23.09098	11.57456
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	0	0	0	0	0	0	0	0	0	0
3110	0	6.0365	0.29633	1.055	4.54316	2.59863	0	7.99967	0	0	0
3111	0	2.29239	0	0.00666	0.72486	0.53533	0	34.15995	0	0	0

OGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	13.55991	61.92884	0.0456	0.09665	0	1242.849	25.4805	7.08838	44.77047
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	45.57146	0.00361	0.46636	0.02448	0	0	36.85132	1.32735	0.05955	0.03383
3104	0	46.60324	0	0	0.00024	0	0	4.98621	3.90675	0.19545	2.18867
3105	0	0.58385	0.08793	0.05487	0	0	0	0.09293	0.0176	0.01703	0.0256
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	1074.85	35.59822	14.38477	0	0.01258	0	0	14.31392	10.62359	23.94363
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	13.75728	0.03012	4.92308	0.00199	0.00409	0	21.3125	0	0	5.32802
3110	0	0.99521	0.00928	0.22298	0.00156	0.00347	0	12.71025	0	0	2.46694
3111	0	17.88945	0.01939	4.45721	0.00445	0.01039	0	56.76344	6.65398	9.68625	0

Total

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	245.9838	923.7454	410.7159	101.9834	0	4897.854	33.44879	91.7994	130.1626	6835.69
3102	0	0	0	0	0	0	0	0	0	0	0	0
3103	0	914.0599	0.39119	23.6066	126.0683	0	0	811.3016	1.49643	3.74767	0.54661	1881.22
3104	0	477.1085	0	0	0.08156	0	0	218.9311	5.294	5.20346	3.53039	710.149
3105	0	588.6417	134.7205	15.45878	0	0	0	96.14354	7.97183	84.10859	26.28647	953.331
3106	0	0	0	0	0	0	0	0	0	0	0	0
3107	0	4103.72	809.5279	636.5627	130.4009	27.40805	0	0	24.57826	271.3767	150.3468	6153.92
3108	0	0	0	0	0	0	0	0	0	0	0	0
3109	0	53.96651	1.67596	127.9186	12.56804	2.13086	0	76.17427	0	0	101.44	375.874
3110	0	35.43367	0.76864	15.9855	69.89602	16.16993	0	151.8342	0	0	16.82895	306.917
3111	0	83.44077	0.22536	76.99119	30.4068	7.2067	0	380.3858	59.40278	118.954	0	757.013
	0	6256.37	1193.29	1820.27	780.137	154.899	0	6632.62	132.192	575.19	429.142	

DM

Car Comm

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	57.851	248.5467	172.1742	11.7356	0	521.0112	13.05175	56.39003	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	458.6253	0.02191	5.74588	3.19031	0	0	342.6965	18.4649	1.72017	
3104	0	204.1944	0	0	0.04472	0	0	75.93401	6.72222	1.82703	
3105	0	295.067	59.91768	3.8588	0	0	0	39.44662	2.78198	41.89784	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	510.0702	216.23	202.4188	97.48736	7.65278	0	0	0.00654	121.9741	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	12.20866	7.03149	22.33791	2.29591	0.15807	0	7.68703	0	0.20866	
3110	0	6.48815	0.00863	0.58984	53.66614	3.53392	0	194.4271	26.90414	0	
3111											

Car Business

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	48.41282	185.3668	67.99384	16.82022	0	408.8809	6.93487	35.88293	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	102.0212	0.00531	0.76532	0.12211	0	0	60.325	1.52083	0.14505	
3104	0	69.61343	0	0	0.00782	0	0	15.87013	1.10254	0.40568	
3105	0	76.45872	9.74355	1.18829	0	0	0	4.46323	0.38749	4.85966	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	299.6068	51.13189	68.61965	8.68072	2.41273	0	0	0.00332	42.68048	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	3.2883	1.48381	2.31814	0.01021	0.00251	0	0.86603	0	0.00538	
3110	0	8.74547	0.00174	0.05168	1.2423	0.30426	0	36.65638	2.09531	0	
3111											

Car Other

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	103.2374	405.8304	166.6412	41.08671	0	2292.272	20.91628	57.73767	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	294.5194	0.03909	1.5134	1.90896	0	0	362.0928	38.58549	1.23957	
3104	0	146.7018	0.00019	0	0.028	0	0	93.13306	15.62089	4.71158	
3105	0	154.3953	65.77826	10.31015	0	0	0	34.64368	7.26869	75.72036	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	1727.963	463.0599	357.5622	30.71667	9.23547	0	0	0.02498	207.4441	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	12.23531	53.05553	80.74386	8.57563	2.08977	0	5.0776	0	0.26062	
3110	0	31.60058	0.09411	1.50014	117.0969	28.17617	0	208.9028	76.51311	0	
3111											

LGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	18.86854	44.91781	19.89346	13.72871	0	403.8132	6.92189	21.1654	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	65.42221	0.00516	0.50495	0.49675	0	0	31.35186	6.35598	0.20467	
3104	0	28.63589	0.0002	0	0.00085	0	0	7.19598	1.53981	0.56693	
3105	0	25.75797	6.81621	0.40737	0	0	0	8.28875	0.34473	6.41321	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	485.0622	53.62081	28.25172	2.22282	1.75635	0	0	0.0011	42.44922	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	7.36744	1.75994	4.8529	0.06672	0.04587	0	0.21618	0	0.00412	
3110	0	5.73885	0.00371	0.09528	9.10227	6.03799	0	46.58383	4.24135	0	
3111											

OGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	7.39304	53.99401	0.04534	0.09984	0	1144.402	6.5277	24.24779	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	38.66593	0.00026	0.33473	0.01772	0	0	25.5532	19.37776	0.04356	
3104	0	46.68184	0	0	0.00028	0	0	4.64565	0.47941	1.17477	
3105	0	0.71337	0.08686	0.05874	0	0	0	0.06278	0.03169	0.0263	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	948.8903	25.31208	14.34265	0.00103	0.01304	0	0	0.00049	25.28391	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	1.17336	0.08099	0.30948	0	0	0	0.00936	0	0.00396	
3110	0	5.02923	0.00027	0.56994	0.00583	0.01303	0	45.486	0.54901	0	
3111											

Total

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
3101	0	0	235.7628	938.6557	426.748	83.47108	0	4770.379	54.35249	195.4238	0
3102	0	0	0	0	0	0	0	0	0	0	0
3103	0	959.254	0.07173	8.86428	5.73585	0	0	822.0193	84.30496	3.35302	0
3104	0	495.8274	0.00039	0	0.08167	0	0	196.7788	25.46487	8.68599	0
3105	0	552.3923	142.3426	15.82335	0	0	0	86.90506	10.81458	128.9174	0
3106	0	0	0	0	0	0	0	0	0	0	0
3107	0	3971.592	809.3547	671.195	139.1086	21.07037	0	0	0.03643	439.8318	0
3108	0	0	0	0	0	0	0	0	0	0	0
3109	0	36.27307	63.41176	110.5623	10.94847	2.29622	0	13.8562	0	0.48274	0
3110	0	57.60228	0.10846	2.80688	181.1135	38.06537	0	532.0561	110.3029	0	0
3111	0	0	0	0	0	0	0	0	0	0	0
	0	6072.94	1251.05	1747.91	763.736	144.903	0	6421.99	285.276	776.695	0

2048 AM_Dev Only

OD	2048 AM	FINAL TABLE - TOTAL PCUs										
	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	total
3101	0	0	0	0	0	0	0	0	92	12	113	216
3102	0	0	0	0	0	0	0	0	0	0	0	0
3103	0	50	0	0	19	0	0	0	51	6	63	189
3104	0	0	0	0	0	0	0	0	106	13	130	249
3105	0	0	0	0	0	0	0	0	10	1	12	23
3106	0	0	0	0	0	0	0	0	0	0	0	0
3107	0	0	12	0	0	0	0	0	52	7	64	134
3108	0	0	0	0	0	0	0	0	0	0	0	0
3109	0	20	3	37	2	0	0	57	0	10	39	168
3110	0	15	2	27	2	0	0	41	60	0	86	232
3111	0	33	4	60	3	0	0	92	138	41	0	371
total	0	118	21	124	26	0	0	190	508	89	505	

2048 PM_Dev Only

OD	2048 PM											
	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	total
3101	0	0	0	0	0	0	0	0	44	25	57	126
3102	0	0	0	0	0	0	0	0	0	0	0	0
3103	0	20	0	0	4	0	0	15	1	0	1	41
3104	0	0	0	0	0	0	0	0	3	2	5	10
3105	0	0	1	0	0	0	0	0	14	8	18	40
3106	0	0	0	0	0	0	0	0	0	0	0	0
3107	0	0	19	0	0	0	0	0	35	20	46	121
3108	0	0	0	0	0	0	0	0	0	0	0	0
3109	0	46	1	80	10	0	0	76	0	72	100	384
3110	0	2	0	4	0	0	0	4	8	0	18	36
3111	0	49	1	86	10	0	0	82	42	190	0	460
total	0	117	22	170	24	0	0	176	148	317	244	

2031_KPT_Core_AM

Car Commute

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	200.3923	559.1155	102.1676	0.01431	0	461.801	14.22685	16.70997	34.47023	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	64.65031	0.10554	5.74626	164.4198	0.00015	0	267.317	45.25962	12.31302	40.50254	
3104	0	168.2097	0.84993	0	0.02615	0	0	64.29955	113.4189	8.66689	106.1733	
3105	0	25.41817	114.4418	15.24774	0	0	0	0.20738	11.43331	9.3478	13.99209	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	256.6932	742.1028	364.7386	0.09301	0.01501	0	0	27.93625	29.08135	89.65171	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	1.22843	0.30376	6.41709	0.91125	0	0	4.06463	0	0	8.19051	
3110	0	6.94631	7.86069	201.3056	34.28404	0.00987	0	82.60681	0	0	46.68943	
3111	0	4.96904	1.58022	40.40228	6.1844	0.00186	0	55.1957	98.06306	2.49596	0	4761

Car Business

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	28.89083	191.4747	23.91483	0.00537	0	743.1294	14.80819	7.42345	29.95585	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	39.02293	0.00614	4.40163	26.87811	0.00001	0	62.0227	1.73394	0.63382	1.13605	
3104	0	127.4806	0.08819	0	0.00469	0	0	21.61855	5.27957	1.02597	6.03502	
3105	0	13.04372	13.98419	1.24666	0	0	0	0.02814	0.19174	1.63714	0.34038	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	322.7444	111.5291	73.80659	0.00725	0.00585	0	0	9.23268	9.78518	25.28138	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	1.57253	0.17482	3.20332	0.19631	0	0	4.95877	0	0	4.11445	
3110	0	7.19935	0.60471	26.11232	2.16628	0.00075	0	28.71732	0	0	9.17447	
3111	0	7.19535	0.01672	4.07701	0.34301	0.00006	0	29.71367	7.08082	2.10969	0	2059

Car Other

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	78.28034	270.2444	40.0169	0.00166	0	1277.159	0.23796	6.96558	8.40647	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	34.18322	0.06264	4.52495	111.0546	0.00012	0	115.5781	7.70765	14.91892	10.97724	
3104	0	148.112	0.68803	0	0.0554	0	0	47.8576	22.07801	14.41256	31.01073	
3105	0	14.85404	84.72778	11.71447	0	0	0	0.06436	2.75342	10.10602	3.99214	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	1300.862	257.6157	139.4343	0.03847	0.0033	0	0	0.59875	40.84616	58.96158	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	0.04644	1.08919	7.25488	1.00616	0.00094	0	0.66532	0	0	8.29647	
3110	0	4.65471	5.95934	100.2643	14.74714	0.00443	0	74.29434	0	0	6.32273	
3111	0	0.43609	1.47028	31.89891	4.50684	0.00275	0	34.23833	22.68549	1.77809	0	4493

LGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	46.04018	116.6442	24.78775	0.01423	0	536.954	0	7.29243	2.99505	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	14.01663	0.01529	2.5198	22.29549	0.00016	0	48.7016	0	1.78495	0	
3104	0	68.99585	0.11657	0	0.09907	0	0	16.79836	0	2.61166	0.01207	
3105	0	11.91599	20.04754	0.94996	0	0	0	0.01783	0	4.83086	0.06273	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	285.8447	101.8507	34.80917	0.00844	0.01388	0	0	0	15.69589	18.56695	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	0	0	0	0	0	0	0	0	0	0	
3110	0	2.85831	4.81712	27.52835	4.52148	0.00541	0	26.62673	0	0	0	
3111	0	0.02529	0.00994	0.05703	0.10968	0.0014	0	38.90066	0	0	0	1513

OGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	83.55274	156.9741	0.22053	0.02964	0	1164.756	82.17403	7.04527	146.6277	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	49.21554	0.00697	0.70825	0.1204	0.00003	0	24.35695	5.50856	0.1388	4.83411	
3104	0	109.4347	0.0232	0	0.03778	0.00003	0	7.63347	14.07542	0.60142	14.26575	
3105	0	0.29022	0.08161	0.04057	0	0	0	0.01084	0.00555	0.00985	0.00903	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	1192.319	160.2225	33.07301	0	0.05113	0	0	21.21367	50.53345	51.19906	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	37.16927	1.16531	21.21156	0.01222	0.00162	0	36.35404	0	0	21.01577	
3110	0	2.09944	2.11025	25.5604	0.02093	0.00434	0	19.71088	0	0	11.67311	
3111	0	37.33605	0.87551	20.60441	0.01346	0.00232	0	87.95732	11.81872	3.74829	0	3722

Total

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	437	1294	191	0	0	4184	111	45	222	6485.92
3102	0	0	0	0	0	0	0	0	0	0	0	0
3103	0	201	0	18	325	0	0	518	60	30	57	1209.38
3104	0	622	2	0	0	0	0	158	155	27	157	1122.097
3105	0	66	233	29	0	0	0	0	14	26	18	387.0451
3106	0	0	0	0	0	0	0	0	0	0	0	0
3107	0	3358	1373	646	0	0	0	0	59	146	244	5826.466
3108	0	0	0	0	0	0	0	0	0	0	0	0
3109	0	40	3	38	2	0	0	46	0	0	42	170.6251
3110	0	24	21	381	56	0	0	232	0	0	74	787.4617
3111	0	50	4	97	11	0	0	246	140	10	0	557.9057
	0	4361.043	2073.761	2503.312	585.2694	0.19063	0	5384.316	539.5221	284.5504	814.9361	

2031_KPT_Core_PM

Car Commute

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	64.65712	243.7146	142.0806	0.37037	0	477.2712	3.98416	42.76379	31.06438	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	423.7363	0.126	0.27258	15.63689	0	0	378.4235	3.12503	1.94272	0.24451	
3104	0	278.8708	0.04086	0	0.02357	0	0	104.6635	4.54118	6.70429	5.06406	
3105	0	198.8356	74.08748	6.36217	0	0	0	16.41381	5.71283	20.9521	7.63167	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	450.1095	216.7026	128.1828	23.67097	1.00048	0	0	5.41644	110.7032	29.33848	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	18.54878	0.18196	102.7516	11.76788	0	0	34.26468	0	0	53.58964	
3110	0	9.80791	0.06646	0.78469	22.6112	0.00134	0	33.14505	0	0	6.12579	
3111	0	23.22291	0.11668	6.90745	10.99846	0.00089	0	139.1063	13.51047	62.01077	0	4074

Car Business

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	40.40186	132.0495	65.88638	0.14545	0	349.6291	3.50196	23.73353	21.93836	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	98.54814	0.0268	0.06253	0.42169	0	0	61.57638	1.00091	0.19178	0.10026	
3104	0	82.65331	0.00622	0	0.00419	0	0	17.9192	1.24041	0.89535	1.0431	
3105	0	58.00538	12.00689	1.46664	0	0	0	1.34299	1.47173	1.20238	0.85899	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	278.1745	46.09044	34.10797	3.07065	0.24715	0	0	3.82032	33.01566	16.02265	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	13.43231	0.00888	5.31657	0.30431	0	0	15.32069	0	0	3.88869	
3110	0	5.40323	0.00559	0.31257	0.12731	0.00064	0	11.05928	0	0	2.78757	
3111	0	21.37879	0.00328	3.64576	0.52127	0.00018	0	43.29063	2.59914	12.99588	0	1536

Car Other

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	110.0156	370.7575	184.3653	0.40067	0	1839.708	0.27042	29.19683	16.89288	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	257.1496	0.01344	0.04237	36.72668	0	0	393.5066	4.4522	2.73373	0.52595	
3104	0	193.93	0.05108	0	0.02432	0	0	126.0417	5.77029	10.97627	6.46715	
3105	0	117.1202	101.4947	17.50576	0	0	0	28.67733	6.89726	29.3799	8.19122	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	1481.495	358.7721	279.4858	9.66446	1.39893	0	0	0.41063	134.9129	34.85316	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	0.2645	1.55253	29.10932	4.51735	0.0018	0	1.10668	0	0	26.76333	
3110	0	7.09691	0.34435	5.22489	34.35989	0.00435	0	57.88087	0	0	4.52634	
3111	0	12.17046	0.09956	11.87242	7.81853	0.00486	0	96.36649	19.50963	9.39741	0	6530

LGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	27.04544	55.77607	13.08385	15.08091	0	341.2217	0	16.50081	8.02503	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	63.06794	0.00193	0.01212	1.3215	0	0	40.46672	0	0.3875	0	
3104	0	42.31548	0.01388	0	0.00097	0	0	9.08109	0	1.41165	0	
3105	0	22.58407	11.38175	0.47144	0	0	0	7.27675	0	1.87873	0.0719	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	408.8833	51.13951	22.1526	0.54324	0.78662	0	0	0	23.43932	9.37239	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	0	0	0	0	0	0	0	0	0	0	
3110	0	5.67395	0.0127	0.75508	2.13247	2.46876	0	9.22011	0	0	0	
3111	0	2.7332	0	0	0.18866	0.31675	0	30.54799	0	0	0	1249

OGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	14.34835	87.09453	0.00277	0.1294	0	1135.94	24.92204	6.2728	51.40115	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	49.6435	0.00004	0.00839	0.03	0	0	57.74547	4.3159	0.20666	2.17105	
3104	0	96.23563	0.01471	0	0.00415	0	0	5.53513	6.69385	0.53926	6.62052	
3105	0	0.41709	0.10121	0.08876	0	0	0	0.07603	0.01905	0.01886	0.02708	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	1049.921	46.1353	11.87078	0	0.00721	0	0	14.39412	8.77267	17.4143	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	13.10006	0.02994	9.1642	0.00011	0.00595	0	19.24738	0	0	7.46869	
3110	0	1.00981	0.00986	0.28266	0.00013	0.00532	0	12.55572	0	0	1.43699	
3111	0	18.31159	0.02439	8.88993	0.00033	0.01793	0	52.34418	4.37724	9.45652	0	2857

Total

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	256	889	405	16	0	4144	33	118	129	5991.644
3102	0	0	0	0	0	0	0	0	0	0	0	0
3103	0	892	0	0	54	0	0	932	13	5	3	1899.965
3104	0	694	0	0	0	0	0	263	18	21	19	1015.397
3105	0	397	199	26	0	0	0	54	14	53	17	760.0298
3106	0	0	0	0	0	0	0	0	0	0	0	0
3107	0	3669	719	476	37	3	0	0	24	311	107	5345.5
3108	0	0	0	0	0	0	0	0	0	0	0	0
3109	0	45	2	146	17	0	0	70	0	0	92	371.7078
3110	0	29	0	7	59	2	0	124	0	0	15	237.2398
3111	0	78	0	31	20	0	0	362	40	94	0	624.7569
	0	5803.852	1177.131	1576.502	591.91	22.39596	0	5947.972	141.9572	602.5932	381.9273	

2031_KPT_Sens_AM

Car Commute

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	201.349	569.4862	99.8438	0.01426	0	476.5465	14.20136	16.03329	28.54398	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	67.33807	0.12409	5.46883	194.3372	0	0	270.7488	43.81328	11.99961	39.43862	
3104	0	168.4061	1.18773	0	0.02734	0	0	62.98388	112.961	8.41331	105.6478	
3105	0	25.78889	110.8273	16.85258	0	0	0	0.17154	11.23607	8.50432	14.06833	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	256.0784	727.1591	399.9419	0.15746	0.01489	0	0	27.99855	28.80907	88.25957	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	1.14544	0.03697	5.97689	0.69243	0	0	3.12523	0	0	9.6119	
3110	0	3.31329	1.41713	73.4747	20.10272	0.00508	0	72.43564	0	0	46.75521	
3111	0	3.7613	0.18452	9.4213	2.75733	0.00141	0	35.86127	99.91769	2.8682	0	4608

Car Business

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	28.55892	193.5064	23.43991	0.00544	0	743.9512	14.79533	7.38652	29.044	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	41.64084	0.00588	5.03383	27.23735	0	0	66.16615	1.53222	0.62445	1.10601	
3104	0	127.5481	0.08838	0	0.00473	0	0	21.56936	5.22471	1.0139	5.98742	
3105	0	13.26715	14.22037	1.71007	0	0	0	0.02274	0.18775	1.4927	0.30716	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	322.6482	106.311	80.61807	0.00861	0.00582	0	0	9.26822	9.70847	24.9638	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	1.38688	0.01849	3.0291	0.1528	0	0	4.18971	0	0	4.46742	
3110	0	2.09288	0.07237	12.17739	1.3705	0.00052	0	23.82053	0	0	9.44066	
3111	0	6.5924	0.00519	2.97343	0.26802	0.00002	0	23.65679	7.31696	2.96415	0	2036

Car Other

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	78.91967	274.004	38.56221	0.00169	0	1279.392	0.23616	6.84377	4.57732	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	34.27426	0.15747	4.84211	116.6779	0	0	116.5119	7.6308	14.68976	10.41659	
3104	0	147.9193	0.79171	0	0.41771	0	0	47.71062	22.03884	14.22785	30.89888	
3105	0	15.05633	83.58888	13.5433	0	0	0	0.05476	2.57689	9.5337	3.83797	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	1300.438	253.4504	146.2496	0.04681	0.00328	0	0	0.59641	40.49883	57.77573	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	0.03449	0.41881	6.96848	0.84661	0.00093	0	0.46373	0	0	9.27383	
3110	0	3.46531	1.3734	39.89643	9.38032	0.00179	0	60.08816	0	0	6.54335	
3111	0	0.37158	0.35856	11.19147	2.84795	0.00186	0	30.11878	22.86642	2.0969	0	4388

LGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	46.59882	118.4529	24.04634	0.01424	0	537.6041	0	6.39645	2.10419	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	14.05544	0.0889	2.74223	22.30846	0	0	51.69411	0	1.75423	0	
3104	0	69.27074	0.13902	0	0.1036	0	0	16.79519	0	2.57412	0.01193	
3105	0	11.93412	21.20141	1.16101	0	0	0	0.02133	0	4.81769	0.02723	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	283.8986	99.53996	36.53773	0.00713	0.01372	0	0	0	15.26005	18.79011	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	0	0	0	0	0	0	0	0	0	0	
3110	0	2.24706	1.03638	14.51489	3.50999	0.00484	0	24.91278	0	0	0	
3111	0	0.00588	0.00775	0.04837	0.04149	0.00007	0	31.95038	0	0	0	1488

OGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	88.63138	157.527	0.22268	0.0272	0	1164.336	82.05753	7.03357	140.4224	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	48.93199	0.01019	0.66861	0.12522	0	0	50.25616	5.12601	0.13726	4.75984	
3104	0	106.6422	0.03835	0	0.03789	0	0	7.38883	14.13459	0.60108	14.31308	
3105	0	0.29005	0.08055	0.04273	0	0	0	0.01084	0.00555	0.00965	0.00903	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	1192.454	164.1561	34.9637	0	0.05146	0	0	20.61858	52.52544	45.59646	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	35.16192	0.80873	20.37025	0.01224	0.0015	0	36.36872	0	0	22.34238	
3110	0	1.28068	0.31359	16.32179	0.01839	0.00375	0	16.92259	0	0	11.75883	
3111	0	35.07242	0.29572	19.89916	0.01242	0.00153	0	61.23798	12.15439	5.83613	0	3700

Total

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	444	1313	186	0	0	4202	111	44	205	6504.717
3102	0	0	0	0	0	0	0	0	0	0	0	0
3103	0	206	0	19	361	0	0	555	58	29	56	1284.475
3104	0	620	2	0	1	0	0	156	154	27	157	1117.119
3105	0	66	230	33	0	0	0	0	14	24	18	386.4599
3106	0	0	0	0	0	0	0	0	0	0	0	0
3107	0	3356	1351	698	0	0	0	0	58	147	235	5845.422
3108	0	0	0	0	0	0	0	0	0	0	0	0
3109	0	38	1	36	2	0	0	44	0	0	46	166.9059
3110	0	12	4	156	34	0	0	198	0	0	74	480.0729
3111	0	46	1	44	6	0	0	183	142	14	0	434.9672
	0	4343.811	2033.572	2299.616	589.6255	0.1753	0	5339.088	538.4954	284.6545	791.101	

2031_KPT_Sens_PM

Car Commute

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	65.88168	247.0892	137.3456	0.30252	0	495.8021	3.98519	41.77918	25.8292	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	360.764	0.14247	1.2316	41.86543	0	0	380.7095	0.03927	0.09651	0.10088	
3104	0	309.3011	0.28456	0	0.02165	0	0	92.79228	0.51241	0.18687	0.44718	
3105	0	201.1214	84.2991	8.21748	0	0	0	8.18855	1.97757	7.23478	5.31087	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	453.964	217.1644	131.3247	27.0347	0.89977	0	0	5.53997	115.3439	25.45038	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	18.23692	0.15676	20.48084	9.37601	0	0	32.43789	0	0	122.6318	
3110	0	9.25631	0.05542	0.29135	1.04211	0.00099	0	18.54054	0	0	6.37302	
3111	0	23.23576	0.10386	0.7093	4.17535	0.00034	0	67.17756	24.17318	68.81512	0	3927

Car Business

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	41.42916	131.7527	65.94643	0.12808	0	351.8191	3.46403	22.92319	18.95384	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	78.76766	0.02918	0.18766	0.70806	0	0	64.91036	0.00829	0.00516	0.00541	
3104	0	97.54818	0.02733	0	0.00382	0	0	16.64708	0.25383	0.01503	0.05913	
3105	0	55.97753	12.64047	1.62378	0	0	0	0.73462	0.21062	0.47468	0.36033	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	279.855	46.28492	33.47886	3.06997	0.22169	0	0	3.91467	35.08683	13.54116	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	13.29401	0.00594	3.38402	0.23681	0	0	14.97227	0	0	4.81081	
3110	0	5.17111	0.00524	0.01681	0.02223	0.00054	0	8.77493	0	0	2.93626	
3111	0	21.20432	0.00302	0.0448	0.29838	0.00004	0	27.46417	5.81552	14.45495	0	1506

Car Other

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	111.973	369.9924	184.4088	0.3415	0	1853.429	0.26815	26.8703	13.18962	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	211.9006	0.08001	0.51212	79.77831	0	0	404.9464	0.09801	0.22854	0.11084	
3104	0	220.0644	0.39001	0	0.02298	0	0	120.2319	1.06474	0.38058	0.50891	
3105	0	113.6522	117.4403	28.45201	0	0	0	5.87499	2.57261	13.0975	5.23968	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	1492.871	359.0902	276.7517	9.67522	1.26609	0	0	0.45105	140.8638	21.73839	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	0.26077	0.10109	17.44927	4.01274	0.00178	0	0.95716	0	0	36.63413	
3110	0	6.71482	0.3071	0.65227	5.46663	0.00337	0	39.58836	0	0	4.59367	
3111	0	12.47162	0.07496	0.342	1.4504	0.00274	0	31.40656	32.68466	10.61213	0	6396

LGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	27.53599	55.70876	23.52148	4.63536	0	344.0713	0	16.96634	6.22831	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	53.95121	0.00888	0.04835	3.62629	0	0	48.76123	0	0.02139	0	
3104	0	49.02326	0.05587	0	0.00136	0	0	8.78542	0	0.14538	0	
3105	0	21.05779	11.8269	0.50439	0	0	0	4.68606	0	0.88299	0	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	409.6505	50.84433	21.78841	0.98671	0.32861	0	0	0	24.01331	9.36737	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	0	0	0	0	0	0	0	0	0	0	
3110	0	5.36887	0.00681	0.03516	0.37438	0.06062	0	7.21438	0	0	0	
3111	0	1.81328	0	0	0.01749	0.00153	0	15.14096	0	0	0	1229

OGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	14.75805	87.0563	0.00221	0.12999	0	1138.043	24.92245	6.30106	50.35184	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	37.25369	0.00037	0.05454	0.0516	0	0	70.67062	0.65922	0.00448	0.03456	
3104	0	103.7474	0.03309	0	0.00597	0	0	3.31741	6.5033	0.04687	2.21557	
3105	0	0.41817	0.11208	0.09068	0	0	0	0.07494	0.01911	0.01116	0.0192	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	1054.018	44.85805	11.85348	0	0.00718	0	0	14.74006	9.07404	18.29963	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	12.96579	0.02183	10.97292	0.00003	0.00596	0	15.01795	0	0	7.89864	
3110	0	0.99495	0.00049	0.09837	0.00007	0.00258	0	12.24611	0	0	1.6613	
3111	0	18.13249	0.00737	9.02271	0.00012	0.00722	0	29.606	7.7808	9.70333	0	2836

Total

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	262	892	411	6	0	4183	33	115	115	6015.136
3102	0	0	0	0	0	0	0	0	0	0	0	0
3103	0	743	0	2	126	0	0	970	1	0	0	1842.373
3104	0	780	1	0	0	0	0	242	8	1	3	1034.645
3105	0	392	226	39	0	0	0	20	5	22	11	714.4044
3106	0	0	0	0	0	0	0	0	0	0	0	0
3107	0	3690	718	475	41	3	0	0	25	324	88	5364.712
3108	0	0	0	0	0	0	0	0	0	0	0	0
3109	0	45	0	52	14	0	0	63	0	0	172	346.3242
3110	0	28	0	1	7	0	0	86	0	0	16	137.8772
3111	0	77	0	10	6	0	0	171	70	104	0	437.954
	0	5754.028	1208.04	1471.219	604.5493	8.3485	0	5735.041	141.6587	565.6394	404.902	

2031_DM_SENS_AM

Car Commute

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	
3101	0	0	169.7823	605.7722	108.4263	0.01444	0	443.0899	15.15665	72.42102	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	62.96633	0	3.62391	165.5956	0	0	315.3852	23.01656	0.01331	
3104	0	180.9832	0.21887	0	0.31834	0	0	72.83114	17.2284	0.98529	
3105	0	25.59224	111.6199	21.79358	0	0	0	0.30571	0.13249	14.04345	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	252.4301	823.273	407.371	0.1616	0.01494	0	0	0.01187	64.90839	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	3.32076	25.5671	11.31601	0.10765	0.00007	0	0.57912	0	0.02106	
3110	0	0.38959	2.8717	54.94335	20.97938	0.00611	0	129.4115	31.94006	0	4260.941

Car Business

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	
3101	0.0	0.0	24.9	198.3	23.3	0.0	0.0	742.3	3.6	13.9	
3102	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3103	0.0	25.6	0.0	3.6	32.8	0.0	0.0	69.1	1.0	0.0	
3104	0.0	137.2	0.0	0.0	0.0	0.0	0.0	26.3	1.5	0.2	
3105	0.0	13.1	15.8	2.2	0.0	0.0	0.0	0.0	0.0	1.6	
3106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3107	0.0	323.0	115.8	82.1	0.0	0.0	0.0	0.0	0.0	16.9	
3108	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3109	0.0	1.8	1.6	1.6	0.0	0.0	0.0	0.3	0.0	0.0	
3110	0.0	0.6	0.2	7.5	1.2	0.0	0.0	28.4	1.6	0.0	1919.058

Car Other

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	
3101	0	0	69.03928	281.4542	38.70136	0.00171	0	1275.834	6.11466	33.29614	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	36.65568	0.00028	3.17261	109.3529	0	0	127.3307	21.8314	0.0259	
3104	0	160.6909	0.21033	0	1.1201	0	0	54.9412	24.19164	1.37734	
3105	0	14.96639	75.44365	15.94458	0	0	0	0.07491	0.22311	21.10739	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	1301.644	296.3698	152.6353	0.06305	0.00331	0	0	0.00959	78.93272	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	3.59258	41.09853	18.89041	0.46986	0.00005	0	1.35074	0	0.0364	
3110	0	0.49295	1.41952	34.54269	17.43675	0.00269	0	107.7493	32.99235	0	4462.834

LGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	
3101	0	0	42.08667	124.6334	21.26815	0.01437	0	536.2579	5.33452	22.97501	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	16.20368	0.00028	2.42749	20.55852	0	0	63.33343	4.24405	0.0037	
3104	0	73.56627	0.03987	0	0.10766	0	0	19.06448	4.09311	0.28206	
3105	0	11.90501	22.41241	1.52372	0	0	0	0.02268	0.06569	8.6101	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	285.5281	110.6974	37.33104	0.006	0.01609	0	0	0.00124	32.87176	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	2.35336	9.93565	3.16263	0.0357	0.00004	0	0.24891	0	0.00167	
3110	0	0.50311	1.48975	12.30531	4.55755	0.00576	0	66.42967	4.93313	0	1573.448

OGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	
3101	0	0	79.79893	158.7983	0.22265	0.0272	0	1162.066	7.20687	30.96002	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	34.65601	0.00013	0.53557	0.11145	0	0	30.04485	0.60506	0.00014	
3104	0	124.0671	0.00497	0	0.03938	0	0	8.72511	0.72279	0.31134	
3105	0	0.29065	0.07918	0.043	0	0	0	0.01054	0.00003	0.01337	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	1190.312	161.5924	34.01017	0	0.05171	0	0	0.0001	69.08186	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	0.48227	1.26121	0.57503	0	0.00005	0	0.06434	0	0.00134	
3110	0	1.57985	1.41709	15.81845	0.02301	0.00364	0	52.1879	0.98598	0	3168.788

Total

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	386	1369	192	0	0	4160	37	174	0	6317.048
3102	0	0	0	0	0	0	0	0	0	0	0	0
3103	0	176	0	13	328	0	0	605	51	0	0	1173.816
3104	0	677	0	0	2	0	0	182	48	3	0	911.391
3105	0	66	225	42	0	0	0	0	0	45	0	379.0699
3106	0	0	0	0	0	0	0	0	0	0	0	0
3107	0	3353	1508	713	0	0	0	0	0	263	0	5837.173
3108	0	0	0	0	0	0	0	0	0	0	0	0
3109	0	12	79	36	1	0	0	3	0	0	0	129.7427
3110	0	4	7	125	44	0	0	384	72	0	0	636.8291
3111	0	0	0	0	0	0	0	0	0	0	0	0
	0	4286.568	2206.052	2297.909	567.0167	0.174	0	5333.761	208.7423	484.8469	0	

2031_DM_SENS_PM

Car Commute

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	
3101	0	0	56.50792	244.2911	141.9123	0.29423	0	486.1431	11.24417	80.09981	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	386.7838	0.01716	0.15556	2.71169	0	0	384.7708	3.63782	1.10663	
3104	0	313.5283	0	0	0.02358	0	0	81.7224	1.14392	1.22058	
3105	0	197.5891	52.70432	7.31704	0	0	0	3.62494	0.04331	15.29606	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	438.8839	235.1829	118.3857	42.69358	0.70756	0	0	0.00349	129.5096	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	15.08695	8.91218	6.45982	0.81843	0.00004	0	0.06626	0	0.29826	
3110	0	5.03477	0	0.30025	2.9909	0.00186	0	96.87137	24.44729	0	3600.545

Car Business

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	
3101	0.0	0.0	34.8	134.2	65.9	0.1	0.0	350.2	4.8	44.3	
3102	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3103	0.0	77.7	0.0	0.0	0.1	0.0	0.0	59.4	0.5	0.1	
3104	0.0	100.0	0.0	0.0	0.0	0.0	0.0	14.6	0.4	0.1	
3105	0.0	52.8	14.3	1.6	0.0	0.0	0.0	0.4	0.0	0.7	
3106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3107	0.0	276.0	43.5	33.0	3.0	0.1	0.0	0.0	0.0	38.2	
3108	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3109	0.0	4.1	1.5	1.1	0.0	0.0	0.0	0.0	0.0	0.0	
3110	0.0	6.2	0.0	0.0	0.1	0.0	0.0	19.2	1.0	0.0	1384.357

Car Other

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	
3101	0	0	104.4154	376.8919	183.2326	0.31628	0	1840.899	8.74747	81.59279	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	233.0446	0.03034	0.16648	2.00224	0	0	422.8743	16.97369	1.18755	
3104	0	221.8089	0	0	0.0182	0	0	104.6803	4.0239	1.85284	
3105	0	111.7433	102.0806	20.93032	0	0	0	2.27655	0.23817	27.03209	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	1465.423	378.81	274.4118	9.59305	1.08762	0	0	0.00784	195.2648	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	9.23396	42.68544	44.77881	4.54088	0.00032	0	0.04039	0	0.36286	
3110	0	19.28121	0.05729	0.50085	53.49146	0.00602	0	119.6798	61.77646	0	6550.093

LGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	
3101	0	0	25.00253	58.75869	27.69425	0.22887	0	342.1201	5.64144	36.63586	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	57.9338	0.00299	0.01181	0.50306	0	0	45.30805	2.0386	0.10071	
3104	0	50.36042	0	0	0.00106	0	0	7.82624	0.75628	0.26967	
3105	0	20.8793	10.50076	0.5943	0	0	0	0.15985	0.03213	1.39468	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	411.1761	47.85632	20.64055	1.17331	0.14771	0	0	0.00025	41.55032	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	6.75533	1.46341	2.0637	0.09481	0.00065	0	0.00328	0	0.01385	
3110	0	6.05636	0.00278	0.04185	2.66997	0.01349	0	36.59168	4.80403	0	1277.875

OGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	
3101	0	0	13.79493	87.41171	0.00213	0.1302	0	1137.918	3.73429	19.89679	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	31.61967	0.00024	0.00812	0.04108	0	0	56.75658	0.72163	0.05601	
3104	0	102.9873	0	0	0.00733	0	0	2.38197	0.09072	0.11764	
3105	0	0.41367	0.09349	0.08898	0	0	0	0.07451	0	0.02715	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	1057.728	27.16938	11.72559	0	0.0065	0	0	0	25.17687	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	1.06591	0.09986	0.24606	0	0	0	0.00008	0	0.01053	
3110	0	6.4843	0.00015	0.14008	0.00012	0.02034	0	33.81669	0.52877	0	2622.593

Total

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	235	902	419	1	0	4157	34	262	0	6009.835
3102	0	0	0	0	0	0	0	0	0	0	0	0
3103	0	787	0	0	5	0	0	969	24	3	0	1788.389
3104	0	789	0	0	0	0	0	211	6	4	0	1009.973
3105	0	383	180	31	0	0	0	7	0	44	0	644.9472
3106	0	0	0	0	0	0	0	0	0	0	0	0
3107	0	3649	733	458	56	2	0	0	0	430	0	5328.308
3108	0	0	0	0	0	0	0	0	0	0	0	0
3109	0	36	55	55	5	0	0	0	0	1	0	151.8061
3110	0	43	0	1	59	0	0	306	93	0	0	502.2041
3111	0	0	0	0	0	0	0	0	0	0	0	0
	0	5687.732	1201.439	1446.412	545.314	3.22766	0	5650.502	157.3499	743.4859	0	

2031_DS_SENS_AM

Car Commute

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	148.8106	595.2372	101.5636	0.01416	0	456.9053	0	13.67661	67.27836	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	65.4305	0.0882	5.35921	164.2408	0.00008	0	284.6243	0	11.81854	0.99015	
3104	0	178.7726	0.50825	0	0.30859	0.00003	0	72.57436	0	11.61905	0.89326	
3105	0	25.59278	105.6655	17.6337	0	0	0	0.15902	0	9.73619	0.63642	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	255.883	732.3597	392.4286	0.08748	0.01466	0	0	0	25.91611	55.15675	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	0	0	0	0	0	0	0	0	0	0	
3110	0	3.55621	1.44306	101.9642	25.97666	0.00489	0	50.22578	0	0	0	
3111	0	0.10926	0.00252	0.08533	0.13938	0.00017	0	45.83233	1.98956	0	0	4033

Car Business

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	25.72388	203.9569	23.71397	0.00544	0	740.2855	32.59337	6.98636	90.23055	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	37.11096	0.00427	4.81312	29.64292	0.00001	0	65.52516	8.08782	0.55092	4.7152	
3104	0	132.4982	0.05239	0	0.00475	0	0	24.31763	15.68888	1.09148	14.53714	
3105	0	12.69314	17.26069	1.82266	0	0	0	0.02198	2.76527	2.01754	3.70712	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	321.9673	132.9904	79.91653	0.00527	0.0058	0	0	22.08995	9.99829	40.54753	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	1.13854	0.04462	2.13263	0.29067	0	0	2.91453	0	0	2.5203	
3110	0	1.84761	0.08169	15.12199	1.74512	0.00064	0	15.39377	0	0	18.68326	
3111	0	1.47256	0.00409	2.01664	0.41864	0.00001	0	24.95394	16.66244	1.00091	0	2218

Car Other

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	66.62833	287.2904	38.89741	0.00165	0	1276.202	0.59679	6.50766	23.12084	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	32.8941	0.06741	4.52906	110.8979	0.00007	0	117.3816	18.81274	12.42811	17.1837	
3104	0	156.1287	0.46929	0	1.07903	0.00003	0	53.26688	33.64807	18.30605	27.05245	
3105	0	14.5409	72.71316	13.77104	0	0	0	0.04187	13.06903	15.93405	11.98344	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	1298.403	263.1898	146.5582	0.03168	0.00319	0	0	1.41676	42.77159	56.21387	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	0.04742	0.36014	5.66361	1.61589	0.00045	0	0.50195	0	0	6.79772	
3110	0	3.46268	1.42073	54.42039	10.31214	0.0015	0	58.51106	0	0	5.3149	
3111	0	0.06494	0.14792	4.36758	1.53279	0.00039	0	33.98744	26.521	0.44121	0	4470

LGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	44.40906	122.4675	21.79013	0.01422	0	537.1402	0	5.02716	6.82202	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	14.3017	0.05778	2.76052	21.9562	0	0	50.89193	0	1.80557	0	
3104	0	72.413	0.06387	0	0.1055	0	0	17.86551	0	3.43277	0.00083	
3105	0	11.87416	20.41149	1.27223	0	0	0	0.0144	0	4.91171	0.00816	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	286.7126	103.4818	36.70311	0.00713	0.01401	0	0	0	14.6481	19.78839	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	0	0	0	0	0	0	0	0	0	0	
3110	0	2.3439	1.15953	18.01693	3.53146	0.00484	0	21.04752	0	0	0	
3111	0	0.01279	0	0	0.01082	0.00015	0	42.18853	0	0	0	1511

OGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	84.43678	158.0293	0.22128	0.02696	0	1163.359	37.03365	6.99949	101.9388	
3102	0	0	0	0	0	0	0	0	0	0	0	
3103	0	50.89126	0.0074	0.73488	0.12343	0	0	24.51564	2.32363	0.12779	2.12378	
3104	0	122.9019	0.01023	0	0.03888	0	0	8.5339	6.59256	0.57383	6.68387	
3105	0	0.29015	0.08059	0.04242	0	0	0	0.01054	0.0025	0.01018	0.00593	
3106	0	0	0	0	0	0	0	0	0	0	0	
3107	0	1189.496	163.4583	34.36954	0	0.05097	0	0	9.52293	56.76108	37.34403	
3108	0	0	0	0	0	0	0	0	0	0	0	
3109	0	16.14542	0.37284	9.36761	0.00556	0.00067	0	16.34151	0	0	10.21016	
3110	0	1.82529	0.35535	18.32477	0.01822	0.00372	0	19.21482	0	0	5.29108	
3111	0	16.19038	0.13615	9.03573	0.00604	0.00082	0	67.79219	5.62842	2.18797	0	3468

Total

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	370	1367	186	0	0	4174	70	39	289	6495.942
3102	0	0	0	0	0	0	0	0	0	0	0	0
3103	0	201	0	18	327	0	0	543	29	27	25	1169.818
3104	0	663	1	0	2	0	0	177	56	35	49	982.0337
3105	0	65	216	35	0	0	0	0	16	33	16	380.6999
3106	0	0	0	0	0	0	0	0	0	0	0	0
3107	0	3352	1395	690	0	0	0	0	33	150	209	5830.314
3108	0	0	0	0	0	0	0	0	0	0	0	0
3109	0	17	1	17	2	0	0	20	0	0	20	76.47224
3110	0	13	4	208	42	0	0	164	0	0	29	460.6257
3111	0	18	0	16	2	0	0	215	51	4	0	304.941
	0	4329.013	1988.478	2350.213	560.3193	0.16953	0	5292.541	255.0454	287.2863	637.78	

2048_DM_SENS_AM

Car Commute

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	
3101	0	0	231.4809	689.2718	140.4511	0.66141	0	615.7202	7.15274	146.4251	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	61.09582	6.17798	84.36734	366.8937	1.71668	0	145.6725	14.48283	0.02014	
3104	0	179.5038	4.38174	0	0.08288	0.01504	0	121.4778	23.86742	22.22902	
3105	0	27.01589	158.9572	15.40397	0	0	0	0.83054	0.00293	8.57345	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	270.4928	940.1008	511.8453	1.71964	0.05599	0	0	0.12223	78.593	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	2.22068	66.19621	78.47782	1.57301	0.01294	0	8.67451	0	0.06165	
3110	0	0.03442	0.11411	1.02059	0.60851	0.00014	0	155.0059	37.59486	0	5228.457

Car Business

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	
3101	0.0	0.0	32.7	222.5	27.2	2.5	0.0	740.6	2.3	15.0	
3102	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3103	0.0	35.8	0.3	9.7	46.7	2.0	0.0	61.9	1.8	0.0	
3104	0.0	191.7	0.4	0.0	0.0	0.0	0.0	48.3	3.3	4.2	
3105	0.0	16.3	13.6	2.1	0.0	0.0	0.0	0.3	0.0	0.8	
3106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3107	0.0	310.4	115.0	85.7	0.1	0.0	0.0	0.0	0.0	14.9	
3108	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3109	0.0	1.3	4.8	8.5	0.1	0.0	0.0	3.6	0.0	0.0	
3110	0.0	0.0	0.0	0.1	0.1	0.0	0.0	41.0	0.9	0.0	2068.85

Car Other

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	
3101	0	0	93.55399	313.1948	46.59278	4.54975	0	1488.062	4.77491	50.15356	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	46.80531	3.78688	53.05195	210.6043	6.90257	0	96.39197	19.7924	0.03861	
3104	0	184.368	2.93798	0	0.10704	0.02334	0	81.04601	32.62071	28.5563	
3105	0	18.30492	115.9259	10.21311	0	0	0	0.79056	0.00463	11.60886	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	1381.955	304.7011	154.5681	0.66892	0.05237	0	0	0.12048	58.43335	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	5.41014	63.94097	66.37331	2.65949	0.26283	0	16.73671	0	0.09252	
3110	0	0.026	0.06134	0.63748	0.55079	0.00007	0	82.9837	30.5122	0	5095.51

LGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	
3101	0	0	51.86674	122.1255	7.2795	27.38567	0	635.1149	5.51605	18.94344	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	14.47492	0.92362	6.36171	30.26097	1.85101	0	31.55246	6.49373	0.00474	
3104	0	59.55178	0.29828	0	0.007	0.01806	0	27.12613	3.94069	3.16181	
3105	0	14.69468	28.51086	0.87169	0	0	0	0.15668	0.00057	3.87991	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	295.1165	111.522	40.50626	0.11048	0.08169	0	0	0.02887	21.65345	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	2.83584	22.44153	13.77981	0.02333	0.05203	0	2.56563	0	0.00797	
3110	0	0.0103	0.03218	0.19771	0.19619	0.04462	0	51.29627	5.93804	0	1670.814

OGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	
3101	0	0	78.50834	165.5917	0.00538	0.27201	0	1304.808	7.01271	29.65338	
3102	0	0	0	0	0	0	0	0	0	0	
3103	0	25.53875	0.12964	2.11488	0.11841	0.0105	0	20.59683	7.67117	0.00053	
3104	0	95.57541	0.0398	0	0.01079	0.01387	0	16.28847	1.25872	1.14542	
3105	0	0.3254	0.06516	0.02338	0	0	0	0.01348	0.00011	0.00367	
3106	0	0	0	0	0	0	0	0	0	0	
3107	0	1029.313	147.8397	36.98449	0.00239	0.05717	0	0	0.02252	24.53344	
3108	0	0	0	0	0	0	0	0	0	0	
3109	0	0.51789	7.03628	2.34565	0	0.00264	0	0.14779	0	0.00068	
3110	0	0.01322	0.01658	0.2434	0.00023	0.00378	0	46.70023	0.7863	0	3053.363

Total

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	488	1513	222	35	0	4784	27	260	0	7329.075
3102	0	0	0	0	0	0	0	0	0	0	0	0
3103	0	184	11	156	655	12	0	356	50	0	0	1424.097
3104	0	711	8	0	0	0	0	294	65	59	0	1137.659
3105	0	77	317	29	0	0	0	2	0	25	0	449.2995
3106	0	0	0	0	0	0	0	0	0	0	0	0
3107	0	3287	1619	830	3	0	0	0	0	198	0	5937.37
3108	0	0	0	0	0	0	0	0	0	0	0	0
3109	0	12	164	170	4	0	0	32	0	0	0	382.7583
3110	0	0	0	2	1	0	0	377	76	0	0	456.7361
3111	0	0	0	0	0	0	0	0	0	0	0	0
	0	4270.829	2608.317	2698.305	884.7672	48.59382	0	5845.512	217.9585	542.7106	0	

2048_DS_SENS_AM

Car Commute

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111		
3101	0	0	335.2834	643.2052	150.7989	0.41058	0	646.4051	14.07934	6.57473	24.76943		
3102	0	0	0	0	0	0	0	0	0	0	0		
3103	0	72.84135	6.57874	86.06152	281.8431	0.12925	0	190.2594	34.08347	12.58483	32.67922		
3104	0	137.6735	0.8471	0	0.03406	0.00303	0	55.20877	77.62955	76.84997	90.55216		
3105	0	31.30547	143.6978	5.07123	0	0	0	0.12615	7.78634	16.39072	15.99094		
3106	0	0	0	0	0	0	0	0	0	0	0		
3107	0	280.3788	945.6293	458.7334	1.26058	0.05421	0	0	21.22433	54.90363	46.9936		
3108	0	0	0	0	0	0	0	0	0	0	0		
3109	0	0.7453	0.09124	3.25184	0.63788	0.00185	0	3.14974	0	0	10.55907		
3110	0	0.24452	17.49404	106.8787	34.59175	0.26045	0	74.09127	0	0	71.41224		
3111	0	1.35804	1.36247	15.83512	3.98801	0.20507	0	59.45228	86.88079	6.31145	0		5506

Car Business

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111		
3101	0	0	44.55784	208.8361	23.36768	0.06505	0	698.9857	16.98361	6.7787	30.7934		
3102	0	0	0	0	0	0	0	0	0	0	0		
3103	0	56.89205	0.20892	8.8385	33.49438	0.00765	0	85.61893	1.30116	1.84553	0.94572		
3104	0	159.3402	0.07704	0	0.0162	0.00019	0	21.92192	2.39023	19.28913	5.39561		
3105	0	19.12562	9.87471	0.98875	0	0	0	0.03066	0.04514	2.08612	0.50488		
3106	0	0	0	0	0	0	0	0	0	0	0		
3107	0	310.2625	115.8536	74.49732	0.12745	0.01052	0	0	7.42926	13.54271	18.79973		
3108	0	0	0	0	0	0	0	0	0	0	0		
3109	0	0.94232	0.03889	1.48135	0.14128	0.00043	0	4.51654	0	0	5.13008		
3110	0	0.37814	1.90672	21.46239	5.0949	0.0272	0	30.6926	0	0	11.06577		
3111	0	2.07956	0.01193	0.98957	0.22785	0.00606	0	25.81692	3.74058	3.60621	0		2120

Car Other

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111		
3101	0	0	129.8005	288.1245	48.38902	0.11735	0	1442.995	0.17951	5.78671	2.4059		
3102	0	0	0	0	0	0	0	0	0	0	0		
3103	0	58.49383	3.39023	58.67349	163.7592	0.13728	0	121.8114	6.64892	24.17239	11.96585		
3104	0	144.5526	0.48444	0	0.05992	0.00579	0	29.40918	16.00477	95.48512	59.12402		
3105	0	21.94028	99.03371	3.41874	0	0	0	0.05853	1.75417	16.59192	17.57863		
3106	0	0	0	0	0	0	0	0	0	0	0		
3107	0	1362.921	281.1703	127.8861	0.3875	0.0187	0	0	0.37861	51.79343	33.42851		
3108	0	0	0	0	0	0	0	0	0	0	0		
3109	0	0.01694	0.56926	4.3335	0.96018	0.00343	0	0.30421	0	0	10.64112		
3110	0	1.22378	11.63331	70.66493	25.58902	0.17341	0	74.34248	0	0	11.1516		
3111	0	0.09137	1.27579	12.79178	3.0981	0.12711	0	26.49739	19.85781	3.70313	0		5009

LGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111		
3101	0	0	57.24942	121.6881	32.80988	0.125	0	624.222	0	7.59616	0.9417		
3102	0	0	0	0	0	0	0	0	0	0	0		
3103	0	15.97958	0.54636	6.87949	25.80333	0.07339	0	46.26641	0	2.91051	0.00419		
3104	0	51.48523	0.05757	0	0.00225	0.00577	0	12.76983	0	9.25272	4.04488		
3105	0	15.45209	20.27627	0.56644	0	0	0	0.01791	0	2.12573	2.14775		
3106	0	0	0	0	0	0	0	0	0	0	0		
3107	0	291.6231	108.1358	41.82772	0.10635	0.0268	0	0	0	13.15696	13.31563		
3108	0	0	0	0	0	0	0	0	0	0	0		
3109	0	0	0	0	0	0	0	0	0	0	0		
3110	0	1.42921	2.52612	13.66955	4.59562	0.05267	0	38.44905	0	0	0		
3111	0	0.00696	0.03539	0.14539	0.2272	0.02164	0	17.85844	0	0	0		1609

OGV

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111		
3101	0	0	87.89637	158.3199	0.05508	0.20904	0	1254.004	79.05804	12.85996	133.89		
3102	0	0	0	0	0	0	0	0	0	0	0		
3103	0	41.00474	0.08086	2.70543	0.10924	0.00715	0	33.74983	4.58309	0.87416	3.60278		
3104	0	85.89864	0.00932	0	0.00814	0.01111	0	6.64368	9.00251	4.08257	9.53675		
3105	0	0.32103	0.06222	0.02299	0	0	0	0.01245	0.00546	0.00907	0.00772		
3106	0	0	0	0	0	0	0	0	0	0	0		
3107	0	1020.869	152.448	37.15018	0	0.05562	0	0	16.06469	36.15257	31.04743		
3108	0	0	0	0	0	0	0	0	0	0	0		
3109	0	31.79588	0.44904	10.74718	0.00267	0.01091	0	44.10188	0	0	24.08442		
3110	0	0.36762	1.034	8.97855	0.00399	0.01834	0	24.88706	0	0	18.07083		
3111	0	27.1654	0.28159	8.19631	0.00321	0.01	0	74.2802	7.02881	8.15398	0		3512

Total

	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	
3101	0	0	655	1420	255	1	0	4667	110	40	193	7340.618
3102	0	0	0	0	0	0	0	0	0	0	0	0
3103	0	245	11	163	505	0	0	478	47	42	49	1540.447
3104	0	579	1	0	0	0	0	126	105	205	169	1185.165
3105	0	88	273	10	0	0	0	0	10	37	36	454.4276
3106	0	0	0	0	0	0	0	0	0	0	0	0
3107	0	3266	1603	740	2	0	0	0	45	170	144	5969.665
3108	0	0	0	0	0	0	0	0	0	0	0	0
3109	0	34	1	20	2	0	0	52	0	0	50	158.7084
3110	0	4	35	222	70	1	0	242	0	0	112	684.4618
3111	0	31	3	38	8	0	0	204	118	22	0	422.7289
	0	4246.206	2581.96	2612.921	841.594	2.39205	0	5768.957	434.1402	515.4708	752.5816	

Appendix N

TRICS - TRIP RATES

Calculation Reference: AUDIT-100301-201026-1018

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 03 - RESIDENTIAL
Category : K - MIXED PRIV HOUS (FLATS AND HOUSES)

MULTI-MODAL TOTAL VEHICLES

Selected regions and areas:

02	SOUTH EAST		
	ES	EAST SUSSEX	1 days
	HC	HAMPSHIRE	1 days
	WS	WEST SUSSEX	1 days
04	EAST ANGLIA		
	CA	CAMBRIDGESHIRE	1 days
05	EAST MIDLANDS		
	NT	NOTTINGHAMSHIRE	1 days
07	YORKSHIRE & NORTH LINCOLNSHIRE		
	NE	NORTH EAST LINCOLNSHIRE	1 days
09	NORTH		
	CB	CUMBRIA	1 days

This section displays the number of survey days per TRICS® sub-region in the selected set

Primary Filtering selection:

This data displays the chosen trip rate parameter and its selected range. Only sites that fall within the parameter range are included in the trip rate calculation.

Parameter: No of Dwellings
Actual Range: 64 to 132 (units:)
Range Selected by User: 64 to 132 (units:)

Parking Spaces Range: All Surveys Included

Parking Spaces per Dwelling Range: All Surveys Included

Bedrooms per Dwelling Range: All Surveys Included

Percentage of dwellings privately owned: All Surveys Included

Public Transport Provision:
Selection by: Include all surveys

Date Range: 01/01/10 to 07/11/16

This data displays the range of survey dates selected. Only surveys that were conducted within this date range are included in the trip rate calculation.

Selected survey days:

Monday	2 days
Tuesday	1 days
Thursday	4 days

This data displays the number of selected surveys by day of the week.

Selected survey types:

Manual count	7 days
Directional ATC Count	0 days

This data displays the number of manual classified surveys and the number of unclassified ATC surveys, the total adding up to the overall number of surveys in the selected set. Manual surveys are undertaken using staff, whilst ATC surveys are undertaking using machines.

Selected Locations:

Suburban Area (PPS6 Out of Centre)	3
Edge of Town	4

This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and Not Known.

Selected Location Sub Categories:

Industrial Zone	1
Residential Zone	5
No Sub Category	1

This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village, Out of Town, High Street and No Sub Category.

Secondary Filtering selection:

Use Class:

C3	7 days

This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose, which can be found within the Library module of TRICS®.

Population within 500m Range:
All Surveys Included

Population within 1 mile:

1,001 to 5,000	1 days
5,001 to 10,000	3 days
20,001 to 25,000	2 days
25,001 to 50,000	1 days

This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:

25,001 to 50,000	3 days
75,001 to 100,000	1 days
125,001 to 250,000	2 days
250,001 to 500,000	1 days

This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:

0.6 to 1.0	2 days
1.1 to 1.5	4 days
1.6 to 2.0	1 days

This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling, within a radius of 5-miles of selected survey sites.

Travel Plan:

Yes	1 days
No	6 days

This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place, and the number of surveys that were undertaken at sites without Travel Plans.

PTAL Rating:

No PTAL Present	7 days

This data displays the number of selected surveys with PTAL Ratings.

LIST OF SITES relevant to selection parameters

1 CA-03-K-01 MIXED HOUSES & FLATS CAMBRIDGESHIRE
WEASANHAM LANE
WISBECH
FENLAND
Edge of Town
Residential Zone
Total No of Dwellings: 100
Survey date: MONDAY 07/09/15 Survey Type: MANUAL

2 CB-03-K-01 FLATS & TERRACED CUMBRIA
BRIDGE LANE
CARLISLE

Edge of Town
Industrial Zone
Total No of Dwellings: 66
Survey date: THURSDAY 12/06/14 Survey Type: MANUAL

3 ES-03-K-01 MIXED HOUSES & FLATS EAST SUSSEX
LEWES ROAD
UCKFIELD
RIDGEWOOD
Edge of Town
Residential Zone
Total No of Dwellings: 64
Survey date: THURSDAY 14/07/16 Survey Type: MANUAL

4 HC-03-K-06 HOUSES & FLATS HAMPSHIRE
ROMSEY ROAD
SOUTHAMPTON
MAYBUSH
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total No of Dwellings: 91
Survey date: THURSDAY 02/10/14 Survey Type: MANUAL

5 NE-03-K-01 BLOCK OF FLATS NORTH EAST LINCOLNSHIRE
LADYSMITH ROAD
CLEETHORPES

Suburban Area (PPS6 Out of Centre)
Residential Zone
Total No of Dwellings: 67
Survey date: TUESDAY 06/05/14 Survey Type: MANUAL

6 NT-03-K-02 MIXED HOUSES NOTTINGHAMSHIRE
CASTLE BRIDGE ROAD
NOTTINGHAM

Suburban Area (PPS6 Out of Centre)
No Sub Category
Total No of Dwellings: 132
Survey date: MONDAY 07/11/16 Survey Type: MANUAL

7 WS-03-K-03 MIXED HOUSES & FLATS WEST SUSSEX
LITTLEHAMPTON ROAD
WORTHING
WEST DURRINGTON
Edge of Town
Residential Zone
Total No of Dwellings: 111
Survey date: THURSDAY 12/05/16 Survey Type: MANUAL

This section provides a list of all survey sites and days in the selected set. For each individual survey site, it displays a unique site reference code and site address, the selected trip rate calculation parameter and its value, the day of the week and date of each survey, and whether the survey was a manual classified count or an ATC count.

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIV HOUS (FLATS AND HOUSES)
MULTI-MODAL TOTAL VEHICLES
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	7	90	0.082	7	90	0.257	7	90	0.339
08:00 - 09:00	7	90	0.117	7	**90**	**0.317**	7	90	0.434
09:00 - 10:00	7	90	0.120	7	90	0.116	7	90	0.236
10:00 - 11:00	7	90	0.127	7	90	0.174	7	90	0.301
11:00 - 12:00	7	90	0.116	7	90	0.114	7	90	0.230
12:00 - 13:00	7	90	0.149	7	90	0.136	7	90	0.285
13:00 - 14:00	7	90	0.151	7	90	0.127	7	90	0.278
14:00 - 15:00	7	90	0.116	7	90	0.171	7	90	0.287
15:00 - 16:00	7	90	0.211	7	90	0.143	7	90	0.354
16:00 - 17:00	7	90	0.200	7	90	0.146	7	90	0.346
17:00 - 18:00	7	**90**	**0.287**	7	90	0.155	7	**90**	**0.442**
18:00 - 19:00	7	90	0.231	7	90	0.138	7	90	0.369
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			1.907			1.994			3.901

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

Parameter summary

Trip rate parameter range selected:	64 - 132 (units:)
Survey date date range:	01/01/10 - 07/11/16
Number of weekdays (Monday-Friday):	7
Number of Saturdays:	0
Number of Sundays:	0
Surveys automatically removed from selection:	0
Surveys manually removed from selection:	0

This section displays a quick summary of some of the data filtering selections made by the TRICS® user. The trip rate calculation parameter range of all selected surveys is displayed first, followed by the range of minimum and maximum survey dates selected by the user. Then, the total number of selected weekdays and weekend days in the selected set of surveys are show. Finally, the number of survey days that have been manually removed from the selected set outside of the standard filtering procedure are displayed.

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIV HOUS (FLATS AND HOUSES)
MULTI-MODAL TAXIS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	7	90	0.000	7	90	0.000	7	90	0.000
08:00 - 09:00	7	90	0.005	7	90	0.006	7	90	0.011
09:00 - 10:00	7	**90**	**0.008**	7	**90**	**0.008**	7	**90**	**0.016**
10:00 - 11:00	7	90	0.003	7	90	0.003	7	90	0.006
11:00 - 12:00	7	90	0.003	7	90	0.005	7	90	0.008
12:00 - 13:00	7	90	0.003	7	90	0.002	7	90	0.005
13:00 - 14:00	7	90	0.005	7	90	0.006	7	90	0.011
14:00 - 15:00	7	90	0.005	7	90	0.005	7	90	0.010
15:00 - 16:00	7	90	0.003	7	90	0.002	7	90	0.005
16:00 - 17:00	7	90	0.005	7	90	0.005	7	90	0.010
17:00 - 18:00	7	90	0.002	7	90	0.003	7	90	0.005
18:00 - 19:00	7	90	0.005	7	90	0.005	7	90	0.010
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.047			0.050			0.097

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIV HOUS (FLATS AND HOUSES)
MULTI-MODAL OGVS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

Time Range	ARRIVALS			DEPARTURES			TOTALS		
	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	7	90	0.002	7	90	0.002	7	90	0.004
08:00 - 09:00	7	90	0.003	7	90	0.000	7	90	0.003
09:00 - 10:00	7	90	0.000	7	90	0.005	7	90	0.005
10:00 - 11:00	7	90	0.008	7	90	0.006	7	90	0.014
11:00 - 12:00	7	90	0.000	7	90	0.002	7	90	0.002
12:00 - 13:00	7	90	0.002	7	90	0.000	7	90	0.002
13:00 - 14:00	7	90	0.003	7	90	0.002	7	90	0.005
14:00 - 15:00	7	90	0.003	7	90	0.005	7	90	0.008
15:00 - 16:00	7	90	0.000	7	90	0.000	7	90	0.000
16:00 - 17:00	7	90	0.000	7	90	0.000	7	90	0.000
17:00 - 18:00	7	90	0.000	7	90	0.000	7	90	0.000
18:00 - 19:00	7	90	0.000	7	90	0.000	7	90	0.000
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.021			0.022			0.043

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIV HOUS (FLATS AND HOUSES)
MULTI-MODAL PSVS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	7	90	0.000	7	90	0.000	7	90	0.000
08:00 - 09:00	7	90	0.002	7	90	0.002	7	90	0.004
09:00 - 10:00	7	90	0.000	7	90	0.000	7	90	0.000
10:00 - 11:00	7	90	0.000	7	90	0.000	7	90	0.000
11:00 - 12:00	7	90	0.000	7	90	0.000	7	90	0.000
12:00 - 13:00	7	90	0.000	7	90	0.000	7	90	0.000
13:00 - 14:00	7	90	0.000	7	90	0.000	7	90	0.000
14:00 - 15:00	7	90	0.002	7	90	0.002	7	90	0.004
15:00 - 16:00	7	90	0.002	7	90	0.002	7	90	0.004
16:00 - 17:00	7	90	0.000	7	90	0.000	7	90	0.000
17:00 - 18:00	7	90	0.000	7	90	0.000	7	90	0.000
18:00 - 19:00	7	90	0.000	7	90	0.000	7	90	0.000
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.006			0.006			0.012

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIV HOUS (FLATS AND HOUSES)
MULTI-MODAL CYCLISTS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	7	90	0.006	7	90	0.024	7	90	0.030
08:00 - 09:00	7	90	0.008	7	**90**	**0.032**	7	**90**	**0.040**
09:00 - 10:00	7	90	0.002	7	90	0.008	7	90	0.010
10:00 - 11:00	7	90	0.000	7	90	0.008	7	90	0.008
11:00 - 12:00	7	90	0.003	7	90	0.002	7	90	0.005
12:00 - 13:00	7	90	0.006	7	90	0.005	7	90	0.011
13:00 - 14:00	7	90	0.006	7	90	0.003	7	90	0.009
14:00 - 15:00	7	90	0.005	7	90	0.002	7	90	0.007
15:00 - 16:00	7	90	0.010	7	90	0.006	7	90	0.016
16:00 - 17:00	7	90	0.010	7	90	0.008	7	90	0.018
17:00 - 18:00	7	90	0.010	7	90	0.005	7	90	0.015
18:00 - 19:00	7	**90**	**0.019**	7	90	0.003	7	90	0.022
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.085			0.106			0.191

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIV HOUS (FLATS AND HOUSES)
MULTI-MODAL VEHICLE OCCUPANTS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	7	90	0.100	7	90	0.303	7	90	0.403
08:00 - 09:00	7	90	0.138	7	**90**	**0.501**	7	**90**	**0.639**
09:00 - 10:00	7	90	0.160	7	90	0.163	7	90	0.323
10:00 - 11:00	7	90	0.177	7	90	0.235	7	90	0.412
11:00 - 12:00	7	90	0.157	7	90	0.162	7	90	0.319
12:00 - 13:00	7	90	0.201	7	90	0.187	7	90	0.388
13:00 - 14:00	7	90	0.197	7	90	0.171	7	90	0.368
14:00 - 15:00	7	90	0.152	7	90	0.220	7	90	0.372
15:00 - 16:00	7	90	0.374	7	90	0.204	7	90	0.578
16:00 - 17:00	7	90	0.298	7	90	0.219	7	90	0.517
17:00 - 18:00	7	**90**	**0.414**	7	90	0.219	7	90	0.633
18:00 - 19:00	7	90	0.325	7	90	0.192	7	90	0.517
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			2.693			2.776			5.469

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIV HOUS (FLATS AND HOUSES)
MULTI-MODAL PEDESTRIANS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	7	90	0.019	7	90	0.074	7	90	0.093
08:00 - 09:00	7	90	0.029	7	90	**0.130**	7	90	0.159
09:00 - 10:00	7	90	0.033	7	90	0.049	7	90	0.082
10:00 - 11:00	7	90	0.014	7	90	0.038	7	90	0.052
11:00 - 12:00	7	90	0.017	7	90	0.033	7	90	0.050
12:00 - 13:00	7	90	0.030	7	90	0.033	7	90	0.063
13:00 - 14:00	7	90	0.059	7	90	0.048	7	90	0.107
14:00 - 15:00	7	90	0.049	7	90	0.073	7	90	0.122
15:00 - 16:00	7	90	**0.139**	7	90	0.049	7	90	**0.188**
16:00 - 17:00	7	90	0.079	7	90	0.030	7	90	0.109
17:00 - 18:00	7	90	0.087	7	90	0.040	7	90	0.127
18:00 - 19:00	7	90	0.057	7	90	0.030	7	90	0.087
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.612			0.627			1.239

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIV HOUS (FLATS AND HOUSES)
MULTI-MODAL BUS/TRAM PASSENGERS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	7	90	0.000	7	90	0.017	7	90	0.017
08:00 - 09:00	7	90	0.014	7	90	0.024	7	90	0.038
09:00 - 10:00	7	90	0.000	7	90	0.006	7	90	0.006
10:00 - 11:00	7	90	0.002	7	90	0.010	7	90	0.012
11:00 - 12:00	7	90	0.002	7	90	0.003	7	90	0.005
12:00 - 13:00	7	90	0.005	7	90	0.002	7	90	0.007
13:00 - 14:00	7	90	0.006	7	90	0.000	7	90	0.006
14:00 - 15:00	7	90	0.008	7	90	0.005	7	90	0.013
15:00 - 16:00	7	90	0.032	7	90	0.019	7	90	0.051
16:00 - 17:00	7	90	0.003	7	90	0.002	7	90	0.005
17:00 - 18:00	7	90	0.010	7	90	0.003	7	90	0.013
18:00 - 19:00	7	90	0.010	7	90	0.003	7	90	0.013
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.092			0.094			0.186

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIV HOUS (FLATS AND HOUSES)
MULTI-MODAL TOTAL RAIL PASSENGERS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	7	90	0.000	7	90	0.008	7	90	0.008
08:00 - 09:00	7	90	0.000	7	90	0.010	7	90	0.010
09:00 - 10:00	7	90	0.000	7	90	0.003	7	90	0.003
10:00 - 11:00	7	90	0.000	7	90	0.000	7	90	0.000
11:00 - 12:00	7	90	0.000	7	90	0.000	7	90	0.000
12:00 - 13:00	7	90	0.000	7	90	0.000	7	90	0.000
13:00 - 14:00	7	90	0.000	7	90	0.003	7	90	0.003
14:00 - 15:00	7	90	0.002	7	90	0.000	7	90	0.002
15:00 - 16:00	7	90	0.002	7	90	0.000	7	90	0.002
16:00 - 17:00	7	90	0.000	7	90	0.000	7	90	0.000
17:00 - 18:00	7	90	0.002	7	90	0.000	7	90	0.002
18:00 - 19:00	7	90	0.000	7	90	0.000	7	90	0.000
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.006			0.024			0.030

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIV HOUS (FLATS AND HOUSES)
MULTI-MODAL PUBLIC TRANSPORT USERS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	7	90	0.000	7	90	0.025	7	90	0.025
08:00 - 09:00	7	90	0.014	7	90	0.033	7	90	0.047
09:00 - 10:00	7	90	0.000	7	90	0.010	7	90	0.010
10:00 - 11:00	7	90	0.002	7	90	0.010	7	90	0.012
11:00 - 12:00	7	90	0.002	7	90	0.003	7	90	0.005
12:00 - 13:00	7	90	0.005	7	90	0.002	7	90	0.007
13:00 - 14:00	7	90	0.006	7	90	0.003	7	90	0.009
14:00 - 15:00	7	90	0.010	7	90	0.005	7	90	0.015
15:00 - 16:00	7	90	0.033	7	90	0.019	7	90	0.052
16:00 - 17:00	7	90	0.003	7	90	0.002	7	90	0.005
17:00 - 18:00	7	90	0.011	7	90	0.003	7	90	0.014
18:00 - 19:00	7	90	0.010	7	90	0.003	7	90	0.013
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.096			0.118			0.214

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIV HOUS (FLATS AND HOUSES)
MULTI-MODAL TOTAL PEOPLE
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	7	90	0.125	7	90	0.426	7	90	0.551
08:00 - 09:00	7	90	0.189	7	**90**	**0.696**	7	**90**	**0.885**
09:00 - 10:00	7	90	0.195	7	90	0.230	7	90	0.425
10:00 - 11:00	7	90	0.193	7	90	0.290	7	90	0.483
11:00 - 12:00	7	90	0.179	7	90	0.200	7	90	0.379
12:00 - 13:00	7	90	0.242	7	90	0.227	7	90	0.469
13:00 - 14:00	7	90	0.268	7	90	0.225	7	90	0.493
14:00 - 15:00	7	90	0.216	7	90	0.300	7	90	0.516
15:00 - 16:00	7	**90**	**0.556**	7	90	0.279	7	90	0.835
16:00 - 17:00	7	90	0.390	7	90	0.258	7	90	0.648
17:00 - 18:00	7	90	0.521	7	90	0.266	7	90	0.787
18:00 - 19:00	7	90	0.410	7	90	0.228	7	90	0.638
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			3.484			3.625			7.109

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIV HOUS (FLATS AND HOUSES)
MULTI-MODAL CARS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	7	90	0.054	7	90	0.206	7	90	0.260
08:00 - 09:00	7	90	0.074	7	90	**0.244**	7	90	**0.318**
09:00 - 10:00	7	90	0.079	7	90	0.078	7	90	0.157
10:00 - 11:00	7	90	0.076	7	90	0.116	7	90	0.192
11:00 - 12:00	7	90	0.073	7	90	0.062	7	90	0.135
12:00 - 13:00	7	90	0.106	7	90	0.094	7	90	0.200
13:00 - 14:00	7	90	0.089	7	90	0.079	7	90	0.168
14:00 - 15:00	7	90	0.070	7	90	0.122	7	90	0.192
15:00 - 16:00	7	90	0.149	7	90	0.097	7	90	0.246
16:00 - 17:00	7	90	0.136	7	90	0.087	7	90	0.223
17:00 - 18:00	7	90	**0.203**	7	90	0.105	7	90	0.308
18:00 - 19:00	7	90	0.173	7	90	0.097	7	90	0.270
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			1.282			1.387			2.669

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIV HOUS (FLATS AND HOUSES)
MULTI-MODAL LGVS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	7	90	0.022	7	90	0.014	7	90	0.036
08:00 - 09:00	7	90	0.013	7	90	0.013	7	90	0.026
09:00 - 10:00	7	90	0.019	7	90	0.008	7	90	0.027
10:00 - 11:00	7	90	0.027	7	90	0.035	7	90	0.062
11:00 - 12:00	7	90	0.016	7	90	0.017	7	90	0.033
12:00 - 13:00	7	90	0.017	7	90	0.017	7	90	0.034
13:00 - 14:00	7	90	0.022	7	90	0.014	7	90	0.036
14:00 - 15:00	7	90	0.017	7	90	0.016	7	90	0.033
15:00 - 16:00	7	90	0.019	7	90	0.024	7	90	0.043
16:00 - 17:00	7	90	0.014	7	90	0.025	7	90	0.039
17:00 - 18:00	7	90	0.022	7	90	0.013	7	90	0.035
18:00 - 19:00	7	90	0.011	7	90	0.006	7	90	0.017
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.219			0.202			0.421

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIV HOUS (FLATS AND HOUSES)
MULTI-MODAL MOTOR CYCLES
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	7	90	0.000	7	90	0.000	7	90	0.000
08:00 - 09:00	7	90	0.000	7	90	0.000	7	90	0.000
09:00 - 10:00	7	90	0.000	7	90	0.000	7	90	0.000
10:00 - 11:00	7	90	0.000	7	90	0.000	7	90	0.000
11:00 - 12:00	7	90	0.002	7	**90**	**0.002**	7	**90**	**0.004**
12:00 - 13:00	7	90	0.000	7	90	0.000	7	90	0.000
13:00 - 14:00	7	90	0.000	7	90	0.002	7	90	0.002
14:00 - 15:00	7	90	0.000	7	90	0.000	7	90	0.000
15:00 - 16:00	7	90	0.000	7	90	0.000	7	90	0.000
16:00 - 17:00	7	90	0.000	7	90	0.000	7	90	0.000
17:00 - 18:00	7	**90**	**0.003**	7	90	0.000	7	90	0.003
18:00 - 19:00	7	90	0.000	7	90	0.000	7	90	0.000
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.005			0.004			0.009

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 03 - RESIDENTIAL
Category : L - MIXED AFFORD HOUS (FLATS AND HOUSES)
MULTI-MODAL TOTAL VEHICLES

Selected regions and areas:

02	SOUTH EAST		
	ES	EAST SUSSEX	1 days
	HC	HAMPSHIRE	1 days
09	NORTH		
	TW	TYNE & WEAR	1 days

This section displays the number of survey days per TRICS® sub-region in the selected set

Primary Filtering selection:

This data displays the chosen trip rate parameter and its selected range. Only sites that fall within the parameter range are included in the trip rate calculation.

Parameter: No of Dwellings
Actual Range: 19 to 59 (units:)
Range Selected by User: 19 to 59 (units:)

Parking Spaces Range: All Surveys Included

Parking Spaces per Dwelling Range: All Surveys Included

Bedrooms per Dwelling Range: All Surveys Included

Percentage of dwellings privately owned: All Surveys Included

Public Transport Provision:
Selection by: Include all surveys

Date Range: 01/01/10 to 17/11/15

This data displays the range of survey dates selected. Only surveys that were conducted within this date range are included in the trip rate calculation.

Selected survey days:
Tuesday 2 days
Thursday 1 days

This data displays the number of selected surveys by day of the week.

Selected survey types:
Manual count 3 days
Directional ATC Count 0 days

This data displays the number of manual classified surveys and the number of unclassified ATC surveys, the total adding up to the overall number of surveys in the selected set. Manual surveys are undertaken using staff, whilst ATC surveys are undertaking using machines.

Selected Locations:
Suburban Area (PPS6 Out of Centre) 2
Edge of Town 1

This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and Not Known.

Selected Location Sub Categories:
Residential Zone 3

This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village, Out of Town, High Street and No Sub Category.

Secondary Filtering selection:

Use Class:
C3 3 days

This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose, which can be found within the Library module of TRICS®.

Population within 500m Range:
All Surveys Included

Secondary Filtering selection (Cont.):

Population within 1 mile:

5,001 to 10,000	1 days
25,001 to 50,000	2 days

This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:

75,001 to 100,000	1 days
100,001 to 125,000	1 days
250,001 to 500,000	1 days

This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:

0.6 to 1.0	2 days
1.1 to 1.5	1 days

This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling, within a radius of 5-miles of selected survey sites.

Travel Plan:

Yes	2 days
No	1 days

This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place, and the number of surveys that were undertaken at sites without Travel Plans.

PTAL Rating:

No PTAL Present	3 days

This data displays the number of selected surveys with PTAL Ratings.

LIST OF SITES relevant to selection parameters

1 ES-03-L-01 HOUSES & FLATS EAST SUSSEX
HUGHENDEN ROAD
HASTINGS
ORE VALLEY
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total No of Dwellings: 51
Survey date: TUESDAY 17/11/15 Survey Type: MANUAL

2 HC-03-L-02 HOUSES/FLATS HAMPSHIRE
HUNTS POND ROAD
NEAR FAREHAM
TITCHFIELD
Edge of Town
Residential Zone
Total No of Dwellings: 59
Survey date: TUESDAY 09/11/10 Survey Type: MANUAL

3 TW-03-L-01 SEMI-DET/TERRACED/FLATS TYNE & WEAR
JOHNSON STREET
GATESHEAD

Suburban Area (PPS6 Out of Centre)
Residential Zone
Total No of Dwellings: 19
Survey date: THURSDAY 03/10/13 Survey Type: MANUAL

This section provides a list of all survey sites and days in the selected set. For each individual survey site, it displays a unique site reference code and site address, the selected trip rate calculation parameter and its value, the day of the week and date of each survey, and whether the survey was a manual classified count or an ATC count.

TRIP RATE for Land Use 03 - RESIDENTIAL/L - MIXED AFFORD HOUS (FLATS AND HOUSES)
MULTI-MODAL TOTAL VEHICLES
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	3	43	0.101	3	43	**0.326**	3	43	0.427
08:00 - 09:00	3	43	0.155	3	43	0.287	3	43	0.442
09:00 - 10:00	3	43	0.186	3	43	0.209	3	43	0.395
10:00 - 11:00	3	43	0.171	3	43	0.147	3	43	0.318
11:00 - 12:00	3	43	0.209	3	43	0.209	3	43	0.418
12:00 - 13:00	3	43	0.178	3	43	0.109	3	43	0.287
13:00 - 14:00	3	43	0.163	3	43	0.202	3	43	0.365
14:00 - 15:00	3	43	0.171	3	43	0.264	3	43	0.435
15:00 - 16:00	3	43	0.380	3	43	0.256	3	43	0.636
16:00 - 17:00	3	43	**0.473**	3	43	0.287	3	43	**0.760**
17:00 - 18:00	3	43	0.333	3	43	0.248	3	43	0.581
18:00 - 19:00	3	43	0.264	3	43	0.155	3	43	0.419
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			2.784			2.699			5.483

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

Parameter summary

Trip rate parameter range selected:	19 - 59 (units:)
Survey date date range:	01/01/10 - 17/11/15
Number of weekdays (Monday-Friday):	3
Number of Saturdays:	0
Number of Sundays:	0
Surveys automatically removed from selection:	0
Surveys manually removed from selection:	0

This section displays a quick summary of some of the data filtering selections made by the TRICS® user. The trip rate calculation parameter range of all selected surveys is displayed first, followed by the range of minimum and maximum survey dates selected by the user. Then, the total number of selected weekdays and weekend days in the selected set of surveys are show. Finally, the number of survey days that have been manually removed from the selected set outside of the standard filtering procedure are displayed.

TRIP RATE for Land Use 03 - RESIDENTIAL/L - MIXED AFFORD HOUS (FLATS AND HOUSES)
MULTI-MODAL TAXIS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	3	43	0.000	3	43	0.000	3	43	0.000
08:00 - 09:00	3	43	0.000	3	43	0.000	3	43	0.000
09:00 - 10:00	3	43	0.000	3	43	0.000	3	43	0.000
10:00 - 11:00	3	43	0.000	3	43	0.000	3	43	0.000
11:00 - 12:00	3	43	0.000	3	43	0.000	3	43	0.000
12:00 - 13:00	3	43	0.008	3	43	0.008	3	43	0.016
13:00 - 14:00	3	43	0.000	3	43	0.000	3	43	0.000
14:00 - 15:00	3	43	0.000	3	43	0.000	3	43	0.000
15:00 - 16:00	3	43	0.000	3	43	0.000	3	43	0.000
16:00 - 17:00	3	43	0.008	3	43	0.008	3	43	0.016
17:00 - 18:00	3	43	0.008	3	43	0.000	3	43	0.008
18:00 - 19:00	3	43	0.000	3	43	0.008	3	43	0.008
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.024			0.024			0.048

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/L - MIXED AFFORD HOUS (FLATS AND HOUSES)
MULTI-MODAL OGVS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	3	43	0.000	3	43	0.000	3	43	0.000
08:00 - 09:00	3	43	0.000	3	43	0.000	3	43	0.000
09:00 - 10:00	3	43	0.000	3	43	0.000	3	43	0.000
10:00 - 11:00	3	43	0.000	3	43	0.000	3	43	0.000
11:00 - 12:00	3	43	0.008	3	43	0.000	3	43	0.008
12:00 - 13:00	3	43	0.000	3	43	0.000	3	43	0.000
13:00 - 14:00	3	43	0.000	3	43	0.008	3	43	0.008
14:00 - 15:00	3	43	0.000	3	43	0.000	3	43	0.000
15:00 - 16:00	3	43	0.000	3	43	0.000	3	43	0.000
16:00 - 17:00	3	43	0.000	3	43	0.000	3	43	0.000
17:00 - 18:00	3	43	0.000	3	43	0.000	3	43	0.000
18:00 - 19:00	3	43	0.000	3	43	0.000	3	43	0.000
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.008			0.008			0.016

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/L - MIXED AFFORD HOUS (FLATS AND HOUSES)
MULTI-MODAL CYCLISTS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	3	43	0.000	3	43	0.008	3	43	0.008
08:00 - 09:00	3	43	0.000	3	43	0.031	3	43	0.031
09:00 - 10:00	3	43	0.008	3	43	0.031	3	43	0.039
10:00 - 11:00	3	43	0.008	3	43	0.016	3	43	0.024
11:00 - 12:00	3	43	0.008	3	43	0.000	3	43	0.008
12:00 - 13:00	3	43	0.008	3	43	0.008	3	43	0.016
13:00 - 14:00	3	43	0.000	3	43	0.000	3	43	0.000
14:00 - 15:00	3	43	0.000	3	43	0.000	3	43	0.000
15:00 - 16:00	3	43	0.016	3	43	0.008	3	43	0.024
16:00 - 17:00	3	43	0.016	3	43	0.000	3	43	0.016
17:00 - 18:00	3	43	0.031	3	43	0.000	3	43	0.031
18:00 - 19:00	3	43	0.023	3	43	0.000	3	43	0.023
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.118			0.102			0.220

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/L - MIXED AFFORD HOUS (FLATS AND HOUSES)
MULTI-MODAL VEHICLE OCCUPANTS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	3	43	0.124	3	43	**0.473**	3	43	0.597
08:00 - 09:00	3	43	0.202	3	43	0.473	3	43	0.675
09:00 - 10:00	3	43	0.240	3	43	0.256	3	43	0.496
10:00 - 11:00	3	43	0.178	3	43	0.178	3	43	0.356
11:00 - 12:00	3	43	0.248	3	43	0.240	3	43	0.488
12:00 - 13:00	3	43	0.209	3	43	0.140	3	43	0.349
13:00 - 14:00	3	43	0.194	3	43	0.202	3	43	0.396
14:00 - 15:00	3	43	0.186	3	43	0.271	3	43	0.457
15:00 - 16:00	3	43	0.527	3	43	0.287	3	43	0.814
16:00 - 17:00	3	**43**	**0.636**	3	43	0.333	3	**43**	**0.969**
17:00 - 18:00	3	43	0.442	3	43	0.295	3	43	0.737
18:00 - 19:00	3	43	0.302	3	43	0.233	3	43	0.535
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			3.488			3.381			6.869

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/L - MIXED AFFORD HOUS (FLATS AND HOUSES)
MULTI-MODAL PEDESTRIANS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	3	43	0.008	3	43	0.016	3	43	0.024
08:00 - 09:00	3	43	0.039	3	43	**0.178**	3	43	0.217
09:00 - 10:00	3	43	0.093	3	43	0.093	3	43	0.186
10:00 - 11:00	3	43	0.023	3	43	0.047	3	43	0.070
11:00 - 12:00	3	43	0.039	3	43	0.031	3	43	0.070
12:00 - 13:00	3	43	0.031	3	43	0.008	3	43	0.039
13:00 - 14:00	3	43	0.031	3	43	0.054	3	43	0.085
14:00 - 15:00	3	43	0.023	3	43	0.016	3	43	0.039
15:00 - 16:00	3	43	0.132	3	43	0.116	3	43	0.248
16:00 - 17:00	3	43	**0.178**	3	43	0.078	3	43	**0.256**
17:00 - 18:00	3	43	0.054	3	43	0.062	3	43	0.116
18:00 - 19:00	3	43	0.023	3	43	0.023	3	43	0.046
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.674			0.722			1.396

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/L - MIXED AFFORD HOUS (FLATS AND HOUSES)
MULTI-MODAL BUS/TRAM PASSENGERS
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	3	43	0.016	3	43	0.008	3	43	0.024
08:00 - 09:00	3	43	0.000	3	43	0.039	3	43	0.039
09:00 - 10:00	3	43	0.000	3	43	0.023	3	43	0.023
10:00 - 11:00	3	43	0.000	3	43	0.016	3	43	0.016
11:00 - 12:00	3	43	0.008	3	43	0.000	3	43	0.008
12:00 - 13:00	3	43	0.023	3	43	0.016	3	43	0.039
13:00 - 14:00	3	43	0.016	3	43	0.023	3	43	0.039
14:00 - 15:00	3	43	0.023	3	43	0.023	3	43	0.046
15:00 - 16:00	3	43	0.023	3	43	0.000	3	43	0.023
16:00 - 17:00	3	43	0.000	3	43	0.000	3	43	0.000
17:00 - 18:00	3	43	0.008	3	43	0.000	3	43	0.008
18:00 - 19:00	3	43	0.016	3	43	0.008	3	43	0.024
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.133			0.156			0.289

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

TRIP RATE for Land Use 03 - RESIDENTIAL/L - MIXED AFFORD HOUS (FLATS AND HOUSES)

MULTI-MODAL TOTAL RAIL PASSENGERS

Calculation factor: 1 DWELLS

BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	3	43	0.000	3	43	0.016	3	43	0.016
08:00 - 09:00	3	43	0.000	3	**43**	**0.023**	3	**43**	**0.023**
09:00 - 10:00	3	43	0.000	3	43	0.023	3	43	0.023
10:00 - 11:00	3	43	0.000	3	43	0.000	3	43	0.000
11:00 - 12:00	3	43	0.000	3	43	0.000	3	43	0.000
12:00 - 13:00	3	43	0.000	3	43	0.000	3	43	0.000
13:00 - 14:00	3	43	0.000	3	43	0.000	3	43	0.000
14:00 - 15:00	3	43	0.000	3	43	0.000	3	43	0.000
15:00 - 16:00	3	43	0.008	3	43	0.000	3	43	0.008
16:00 - 17:00	3	43	0.008	3	43	0.000	3	43	0.008
17:00 - 18:00	3	43	0.008	3	43	0.000	3	43	0.008
18:00 - 19:00	3	**43**	**0.023**	3	43	0.000	3	43	0.023
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.047			0.062			0.109

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

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TRIP RATE for Land Use 03 - RESIDENTIAL/L - MIXED AFFORD HOUS (FLATS AND HOUSES)

MULTI-MODAL PUBLIC TRANSPORT USERS

Calculation factor: 1 DWELLS

BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	3	43	0.016	3	43	0.023	3	43	0.039
08:00 - 09:00	3	43	0.000	3	43	**0.062**	3	43	**0.062**
09:00 - 10:00	3	43	0.000	3	43	0.047	3	43	0.047
10:00 - 11:00	3	43	0.000	3	43	0.016	3	43	0.016
11:00 - 12:00	3	43	0.008	3	43	0.000	3	43	0.008
12:00 - 13:00	3	43	0.023	3	43	0.016	3	43	0.039
13:00 - 14:00	3	43	0.016	3	43	0.023	3	43	0.039
14:00 - 15:00	3	43	0.023	3	43	0.023	3	43	0.046
15:00 - 16:00	3	43	0.031	3	43	0.000	3	43	0.031
16:00 - 17:00	3	43	0.008	3	43	0.000	3	43	0.008
17:00 - 18:00	3	43	0.016	3	43	0.000	3	43	0.016
18:00 - 19:00	3	43	**0.039**	3	43	0.008	3	43	0.047
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.180			0.218			0.398

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

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TRIP RATE for Land Use 03 - RESIDENTIAL/L - MIXED AFFORD HOUS (FLATS AND HOUSES)
MULTI-MODAL TOTAL PEOPLE
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	3	43	0.147	3	43	0.519	3	43	0.666
08:00 - 09:00	3	43	0.240	3	43	**0.744**	3	43	0.984
09:00 - 10:00	3	43	0.341	3	43	0.426	3	43	0.767
10:00 - 11:00	3	43	0.209	3	43	0.256	3	43	0.465
11:00 - 12:00	3	43	0.302	3	43	0.271	3	43	0.573
12:00 - 13:00	3	43	0.271	3	43	0.171	3	43	0.442
13:00 - 14:00	3	43	0.240	3	43	0.279	3	43	0.519
14:00 - 15:00	3	43	0.233	3	43	0.310	3	43	0.543
15:00 - 16:00	3	43	0.705	3	43	0.411	3	43	1.116
16:00 - 17:00	3	43	**0.837**	3	43	0.411	3	43	**1.248**
17:00 - 18:00	3	43	0.543	3	43	0.357	3	43	0.900
18:00 - 19:00	3	43	0.388	3	43	0.264	3	43	0.652
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			4.456			4.419			8.875

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

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TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 02 - EMPLOYMENT
Category : F - WAREHOUSING (COMMERCIAL)
MULTI-MODAL TOTAL VEHICLES

Selected regions and areas:

01	GREATER LONDON		
	HD	HILLINGDON	1 days
	HO	HOUNSLOW	1 days
02	SOUTH EAST		
	EX	ESSEX	1 days
03	SOUTH WEST		
	DV	DEVON	1 days

This section displays the number of survey days per TRICS® sub-region in the selected set

Primary Filtering selection:

This data displays the chosen trip rate parameter and its selected range. Only sites that fall within the parameter range are included in the trip rate calculation.

Parameter: Gross floor area
Actual Range: 6560 to 50000 (units: sqm)
Range Selected by User: 6560 to 50000 (units: sqm)

Parking Spaces Range: All Surveys Included

Public Transport Provision:
Selection by: Include all surveys

Date Range: 01/01/12 to 03/04/19

This data displays the range of survey dates selected. Only surveys that were conducted within this date range are included in the trip rate calculation.

Selected survey days:

Wednesday	2 days
Thursday	1 days
Friday	1 days

This data displays the number of selected surveys by day of the week.

Selected survey types:

Manual count	4 days
Directional ATC Count	0 days

This data displays the number of manual classified surveys and the number of unclassified ATC surveys, the total adding up to the overall number of surveys in the selected set. Manual surveys are undertaken using staff, whilst ATC surveys are undertaking using machines.

Selected Locations:

Suburban Area (PPS6 Out of Centre)	1
Edge of Town	2
Free Standing (PPS6 Out of Town)	1

This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and Not Known.

Selected Location Sub Categories:

Industrial Zone	3
Out of Town	1

This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village, Out of Town, High Street and No Sub Category.

Secondary Filtering selection:

Use Class:

B8	4 days

This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose, which can be found within the Library module of TRICS®.

Filter by Use Class Breakdown:
All Surveys Included

Secondary Filtering selection (Cont.):

Population within 500m Range:
All Surveys Included
Population within 1 mile:

1,000 or Less	1 days
10,001 to 15,000	1 days
20,001 to 25,000	1 days
25,001 to 50,000	1 days

This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:

125,001 to 250,000	2 days
500,001 or More	2 days

This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:

0.6 to 1.0	2 days
1.1 to 1.5	2 days

This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling, within a radius of 5-miles of selected survey sites.

Travel Plan:

Yes	2 days
No	2 days

This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place, and the number of surveys that were undertaken at sites without Travel Plans.

PTAL Rating:

No PTAL Present	2 days
1b Very poor	1 days
2 Poor	1 days

This data displays the number of selected surveys with PTAL Ratings.