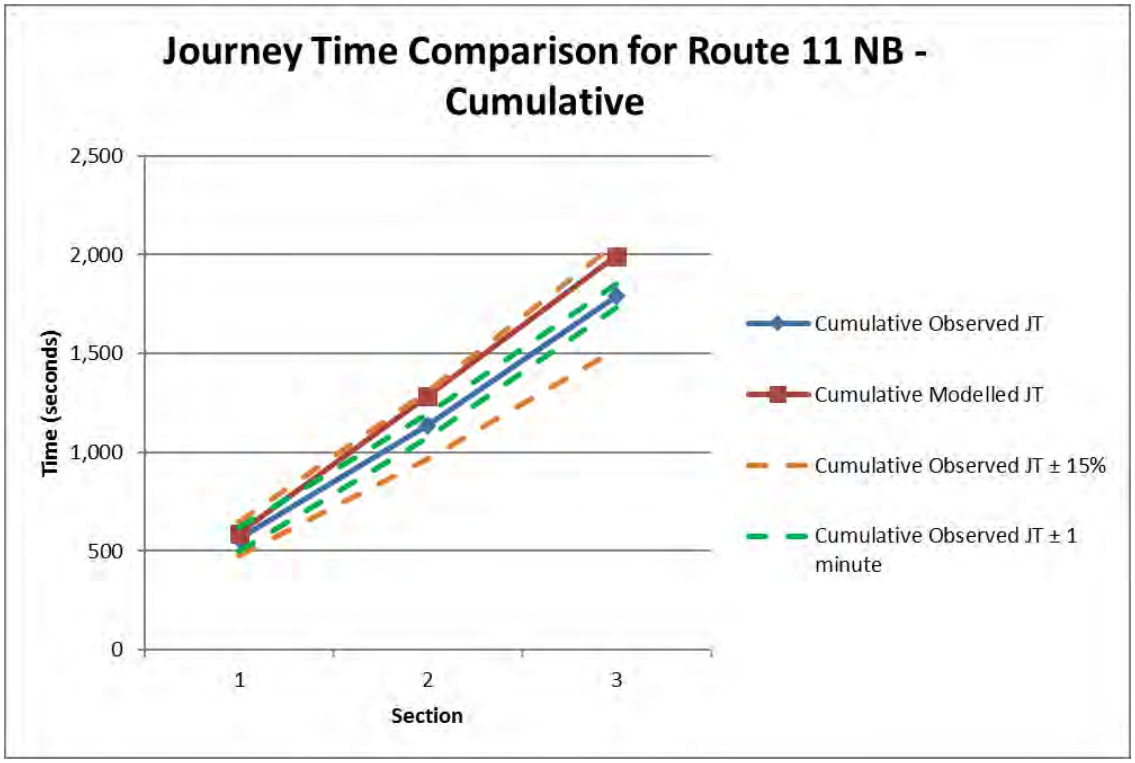

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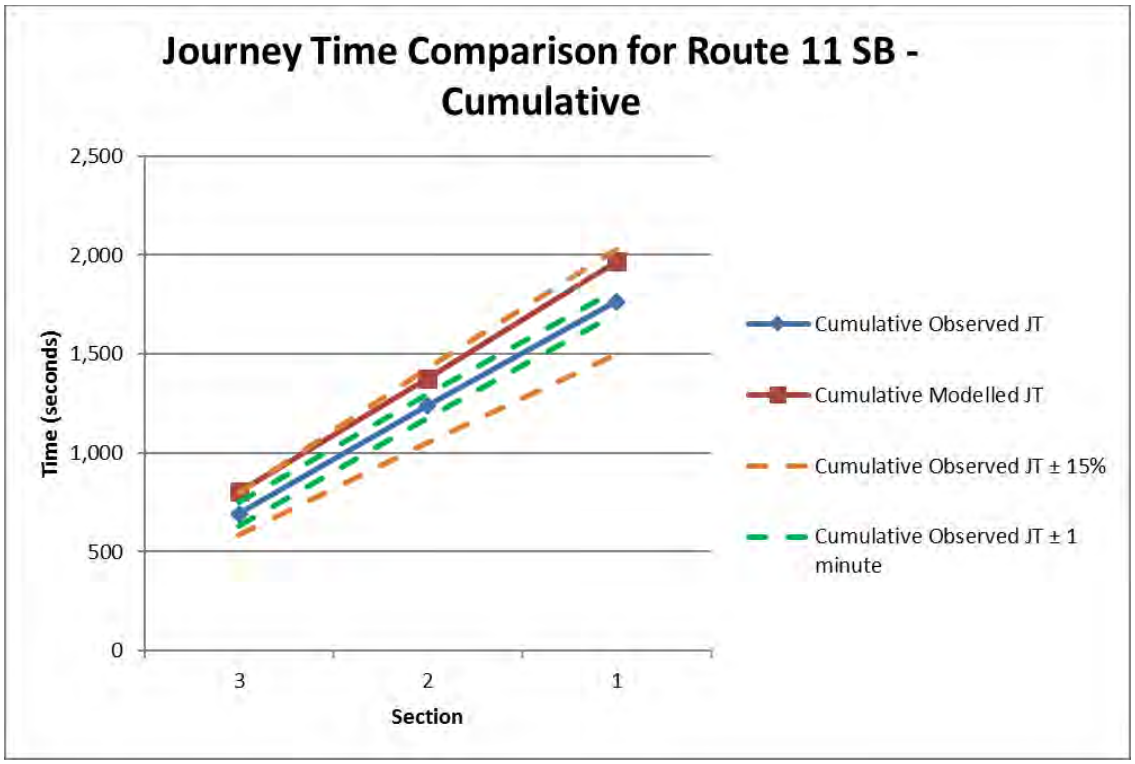

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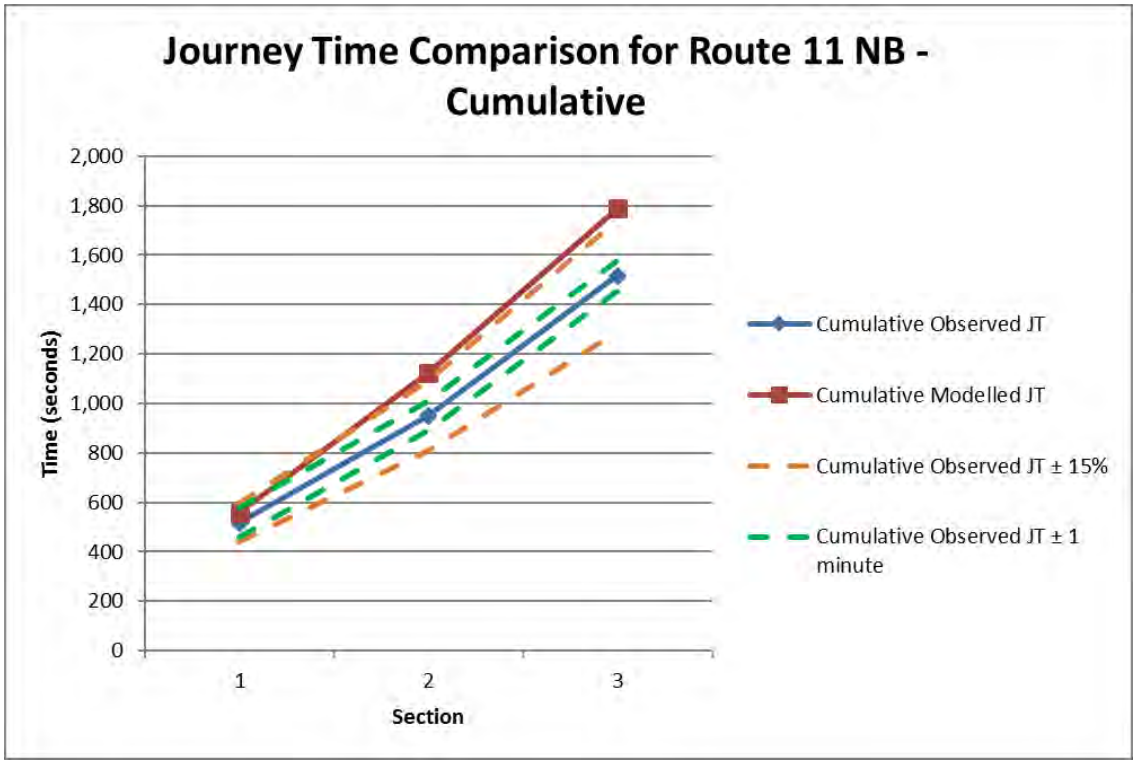

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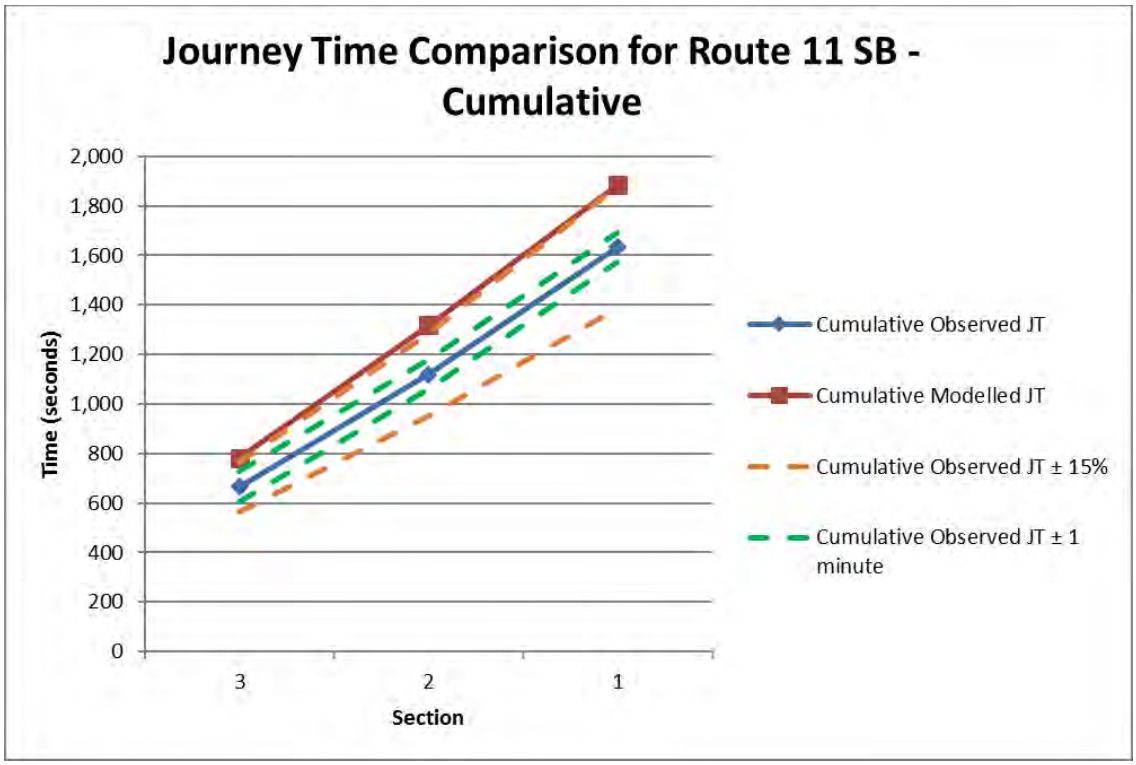

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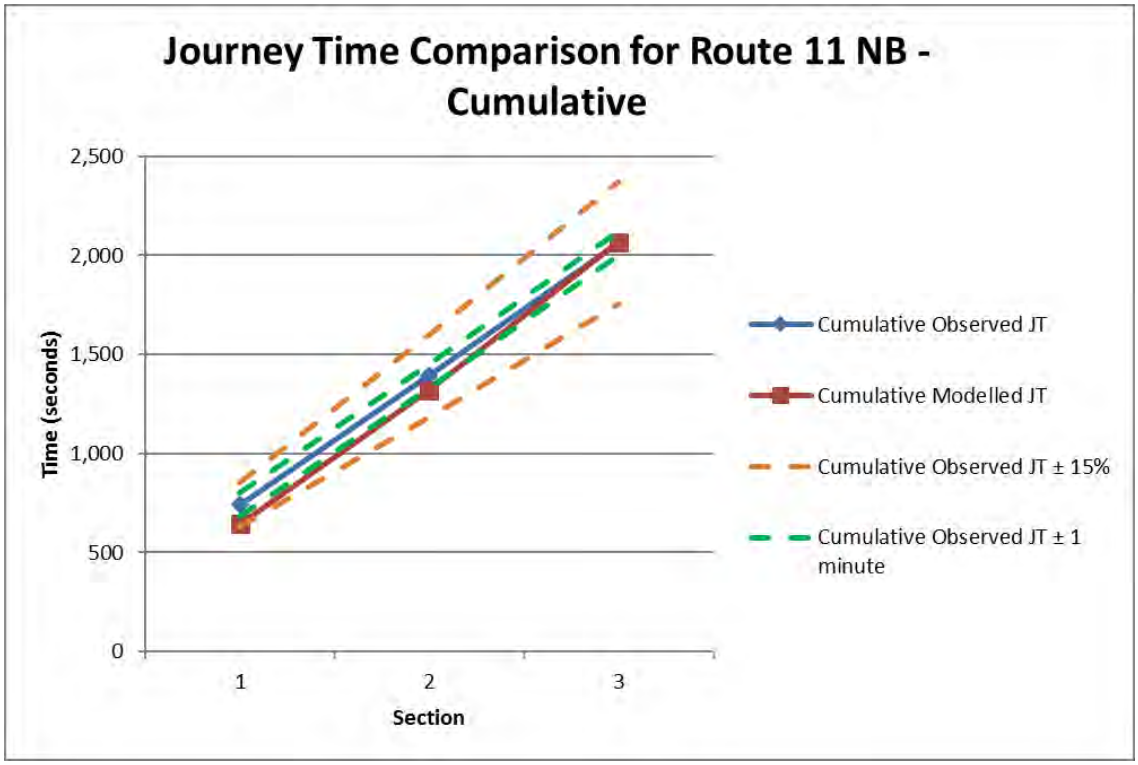

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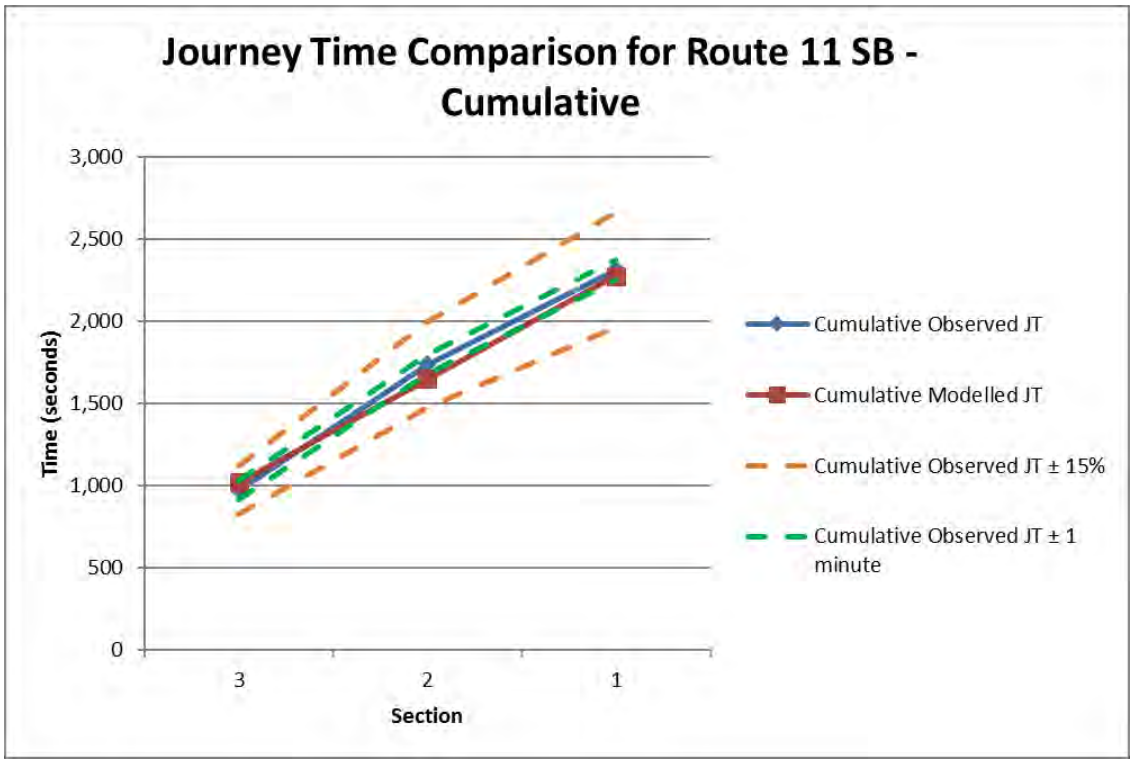

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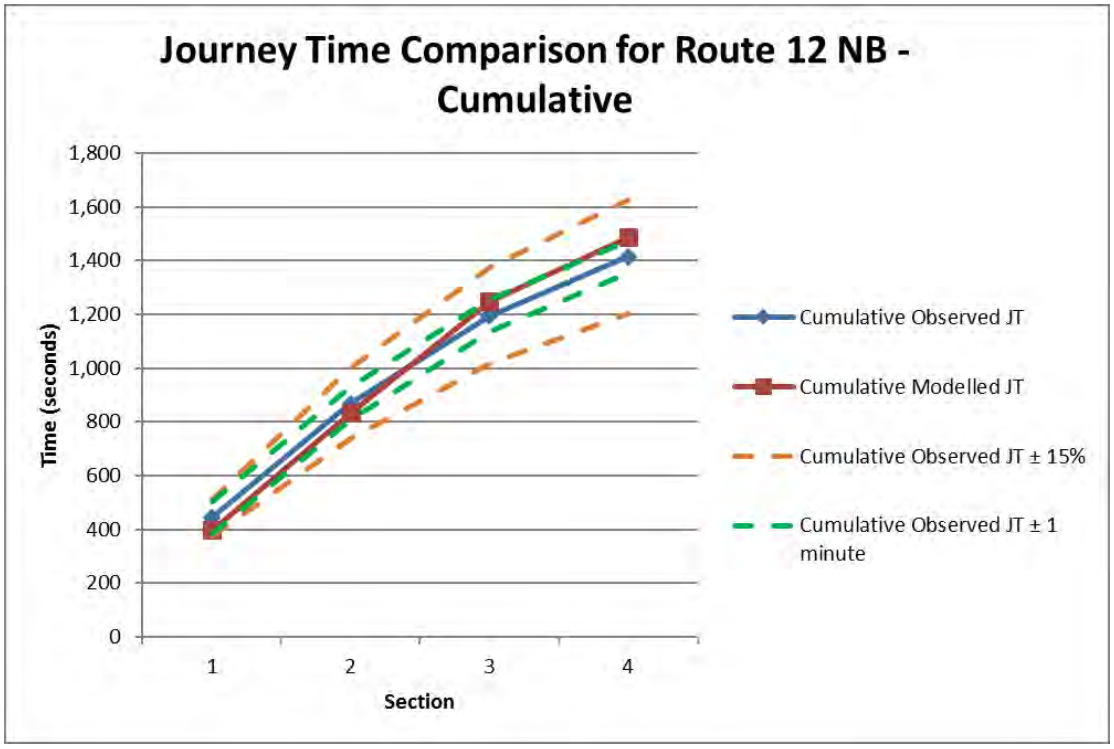

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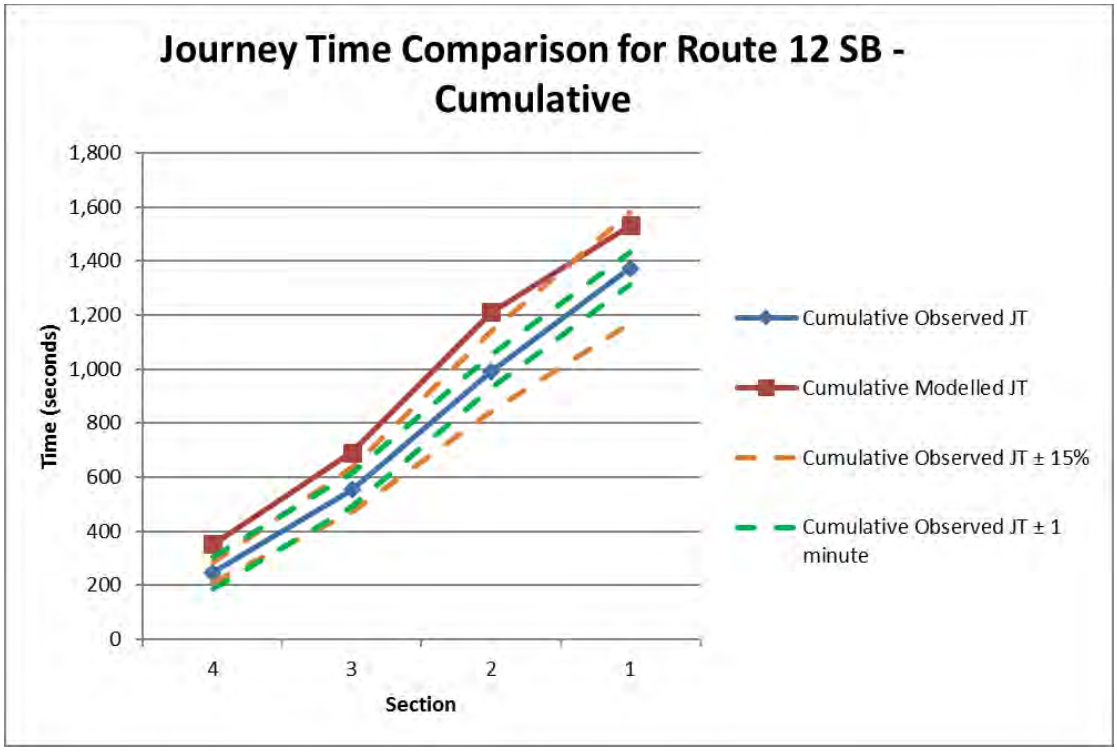

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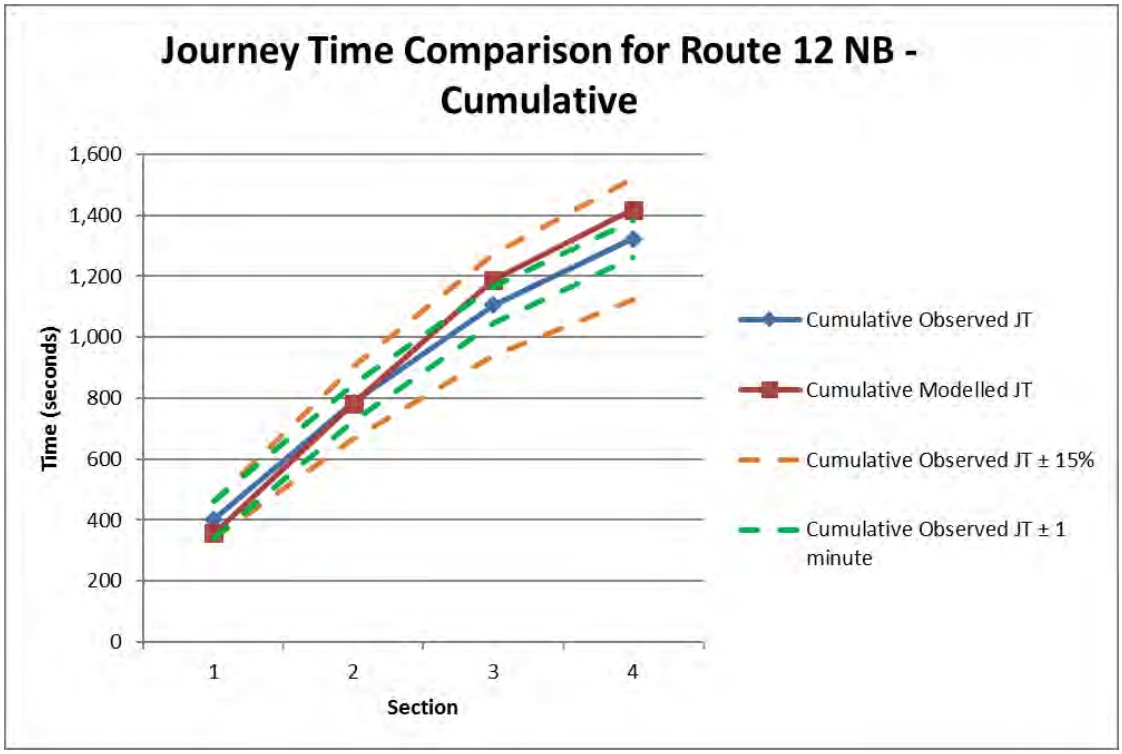

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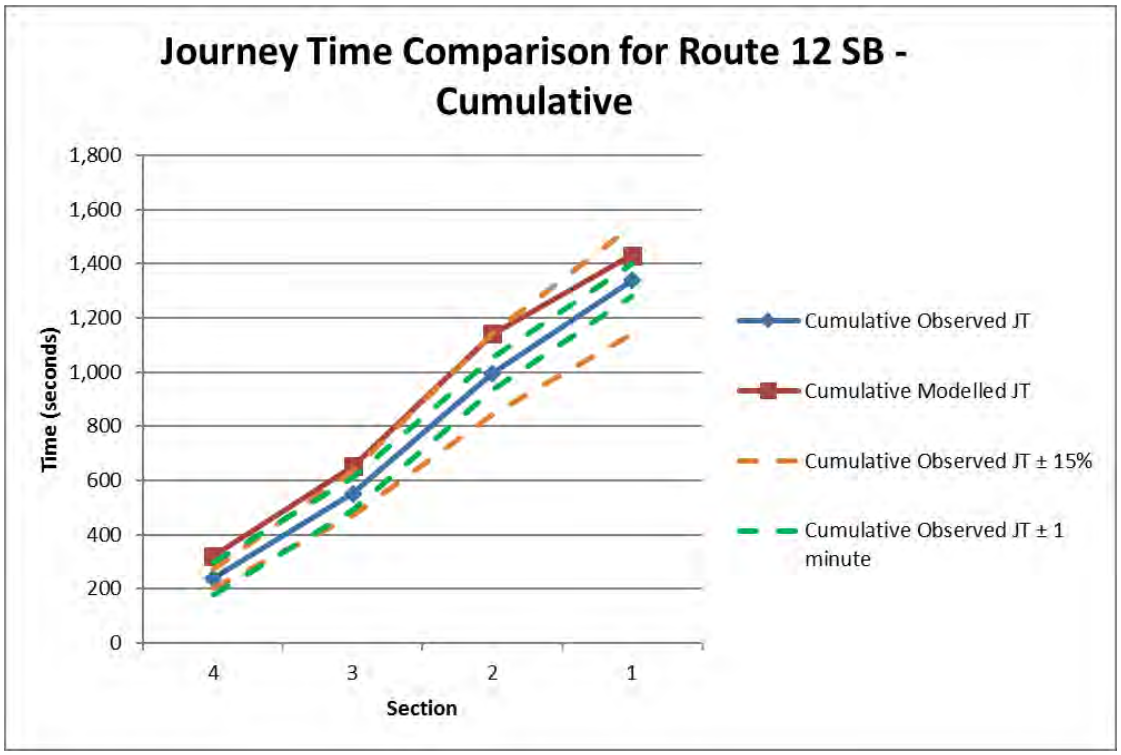

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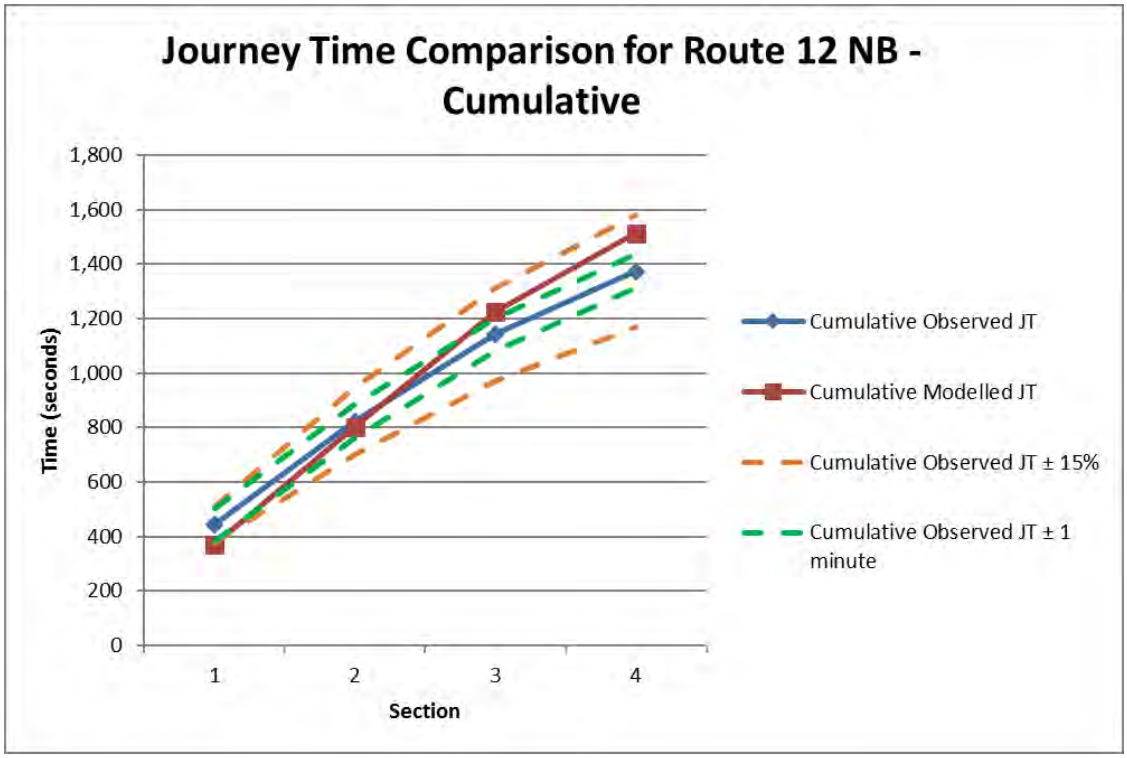

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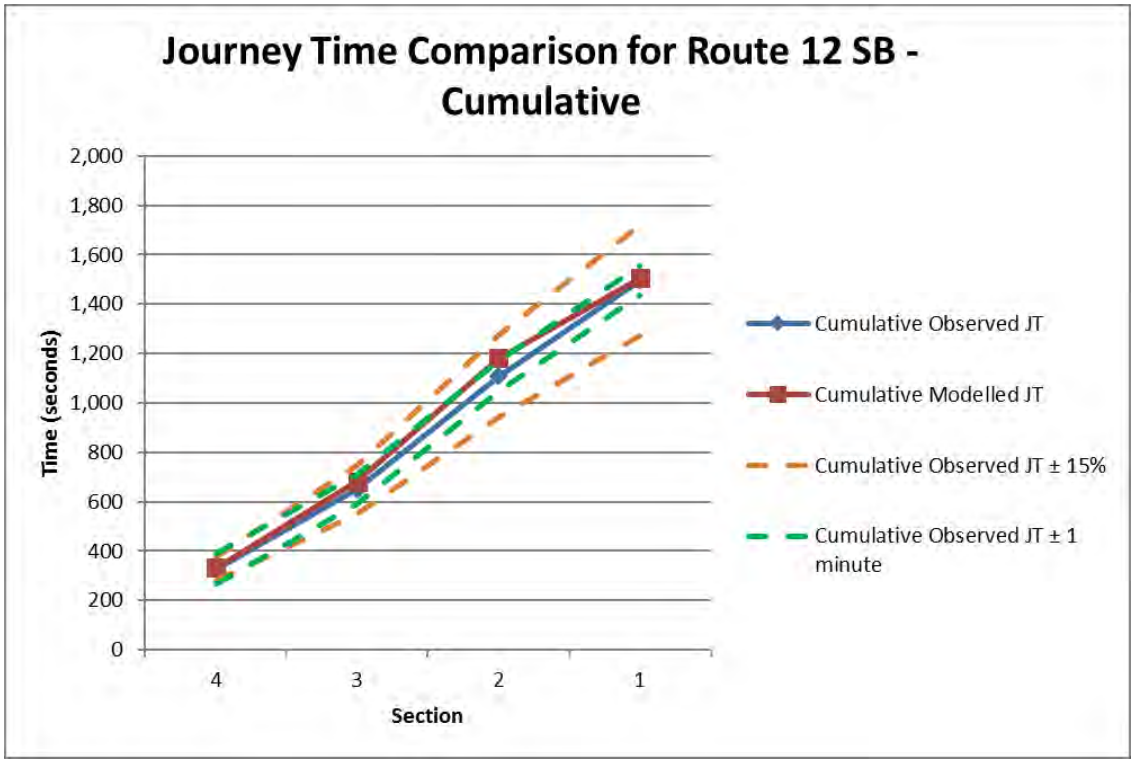

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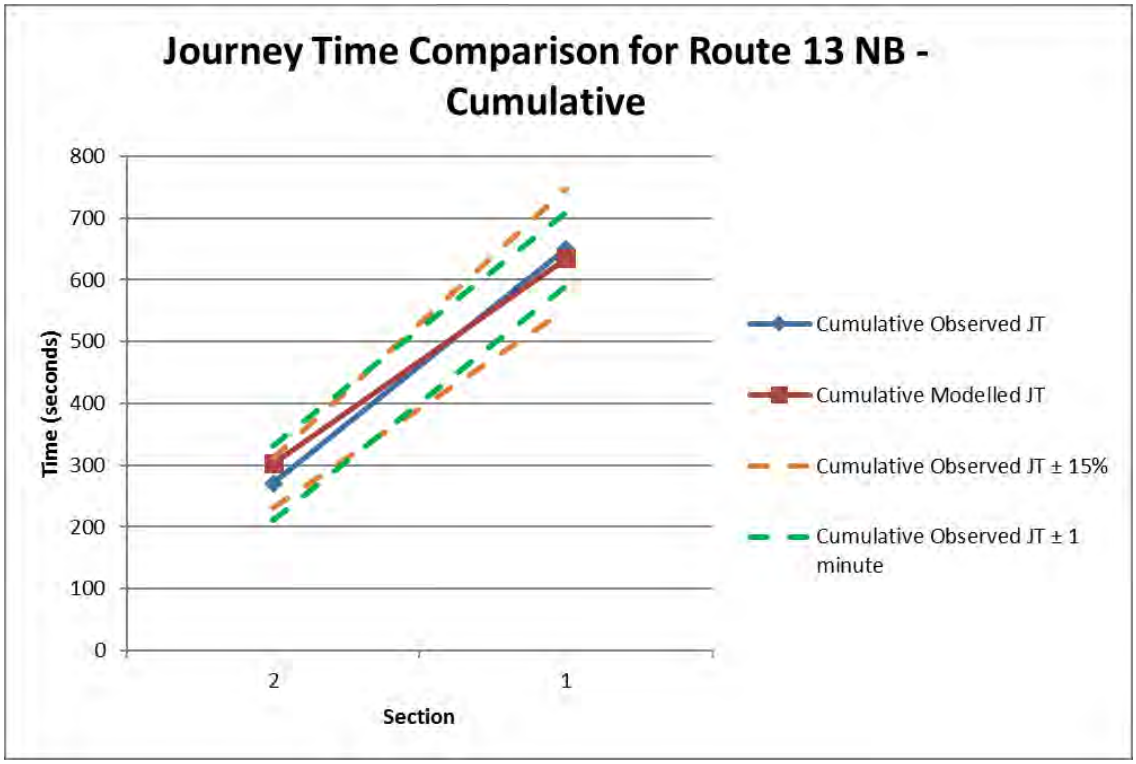

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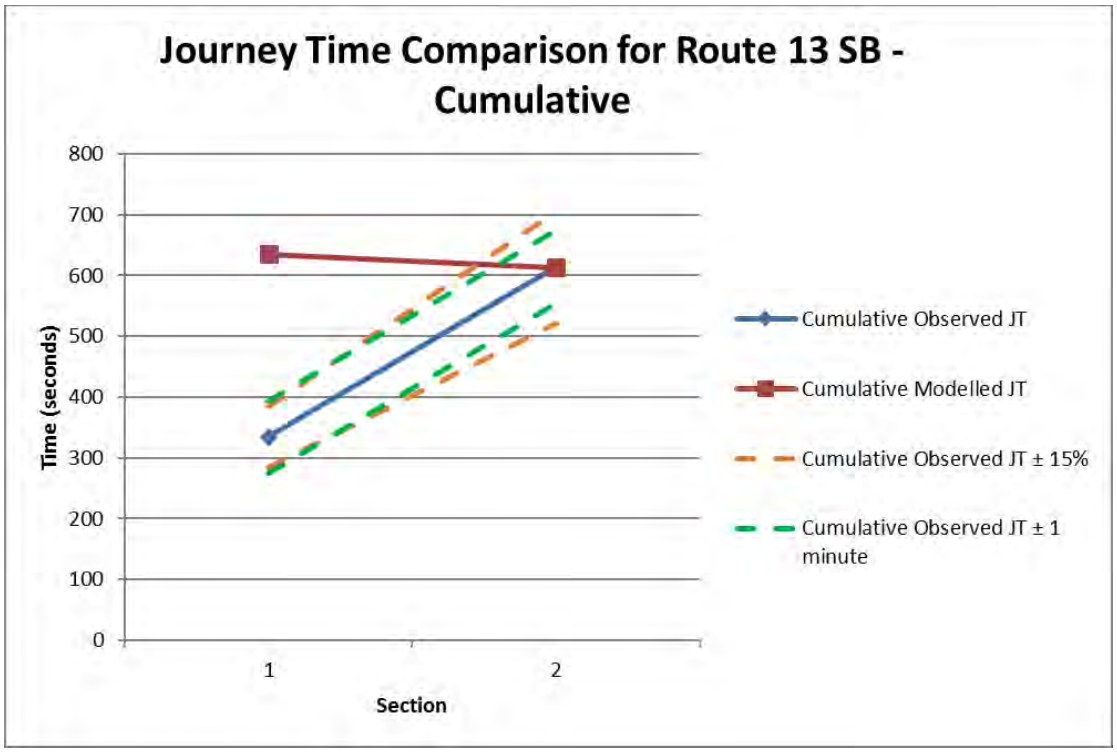

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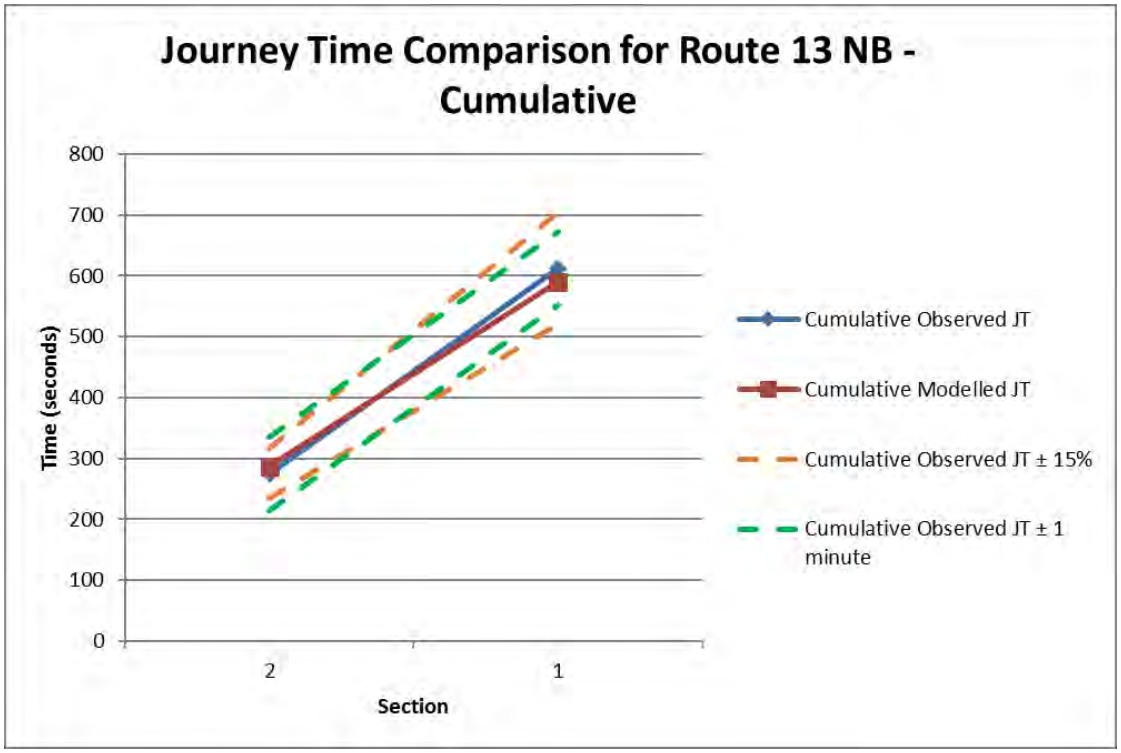

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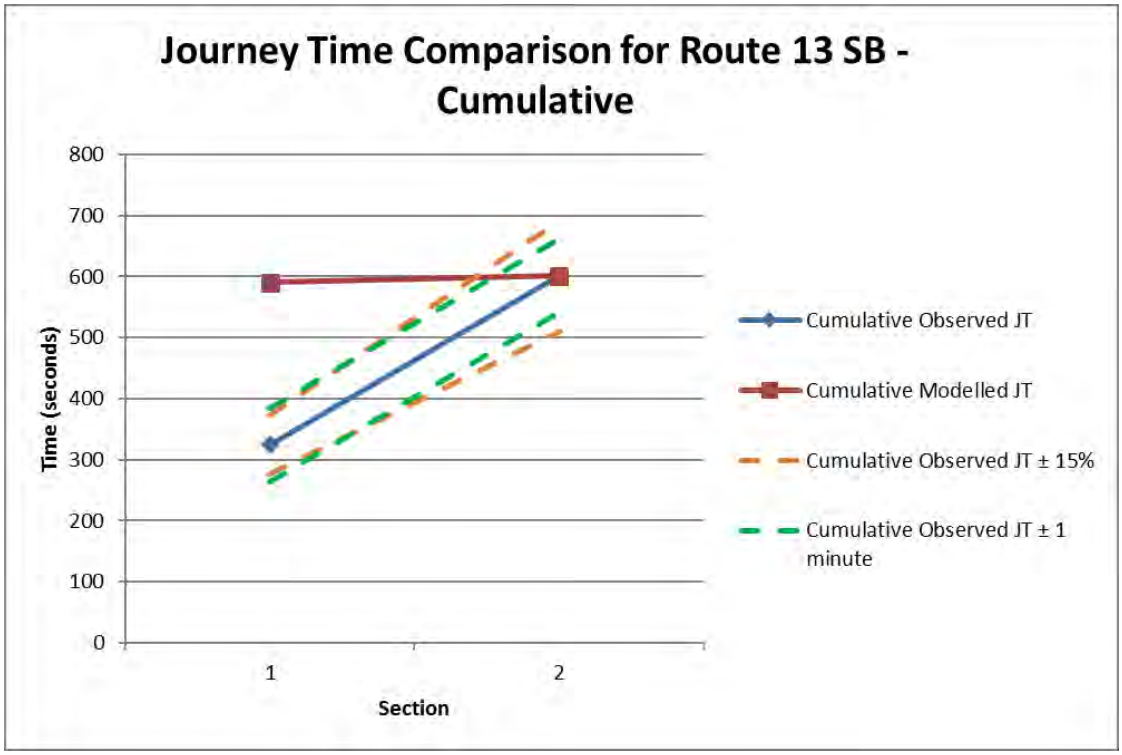

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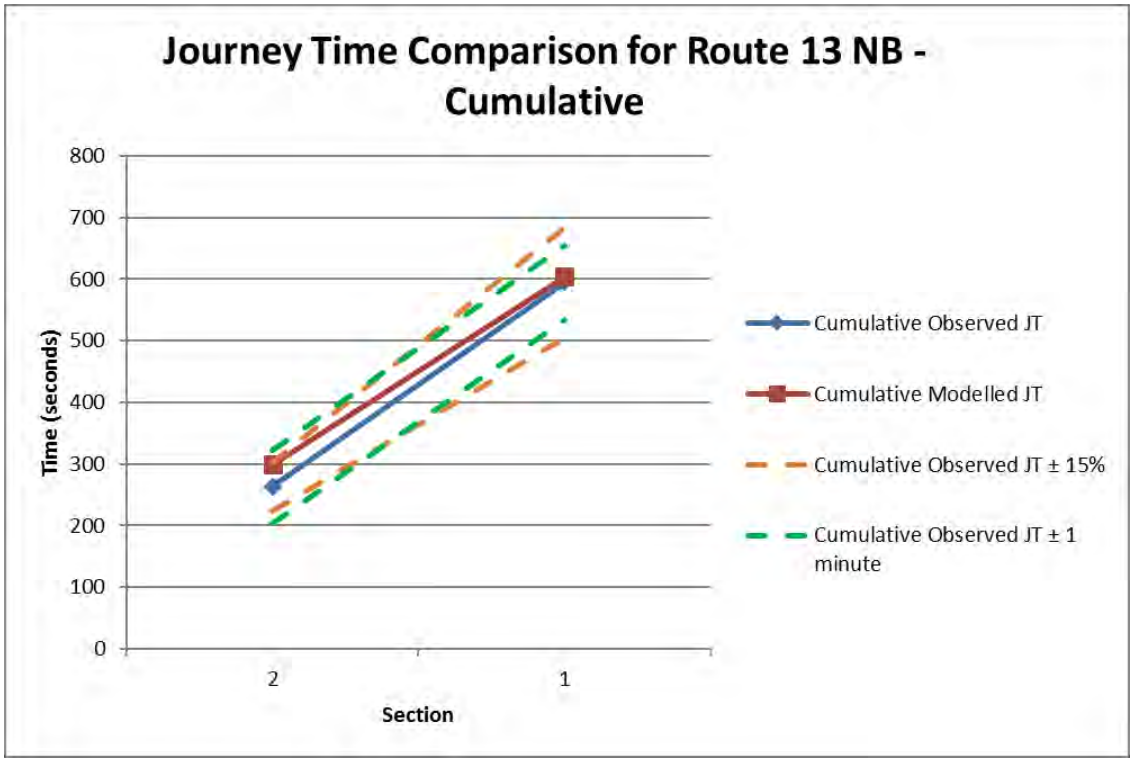

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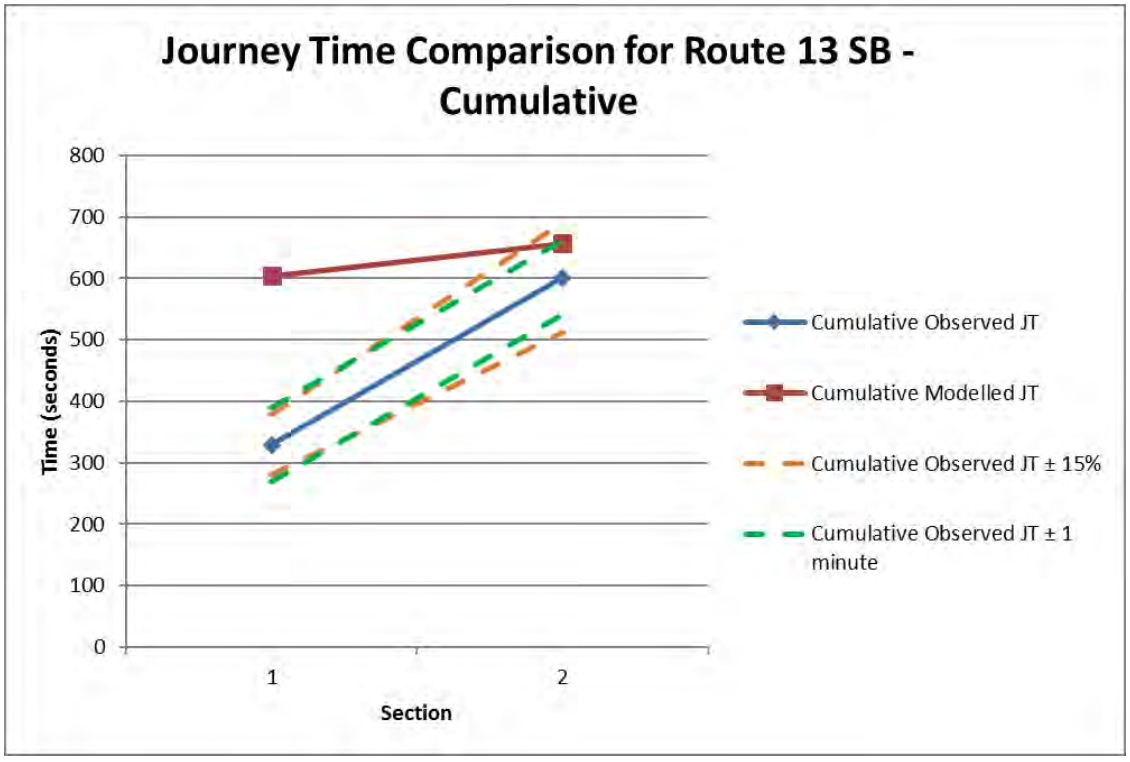

PM Route 13 SB

Graphics for Route 14 are not included because this route only includes one section.

Appendix N Variable Demand Model Specification Note

JACOBS

Memorandum

Date	12/04/2018
To	Betty Leow (DfT)
From	Wei Cui (Jacobs)
Subject	**Variable Demand Modelling Approach for Project Preston Western Distributor**

1. Introduction

Jacobs has been commissioned to update the modelling and economics for the Preston Western Distributor (PWD) project, which is a key project within the Central Lancashire Highways and Transport Masterplan adopted by the County Council. The scheme comprises a new 4 kilometre dual carriageway road linking the A583 Preston to Blackpool principal road at Lea with the M55 motorway at Bartle and includes a new junction, Junction 2, on the M55. The implementation of the schemes aims to support delivery of the Preston local plan and improve access between the Enterprise zone at Warton and the Strategic Road Network.

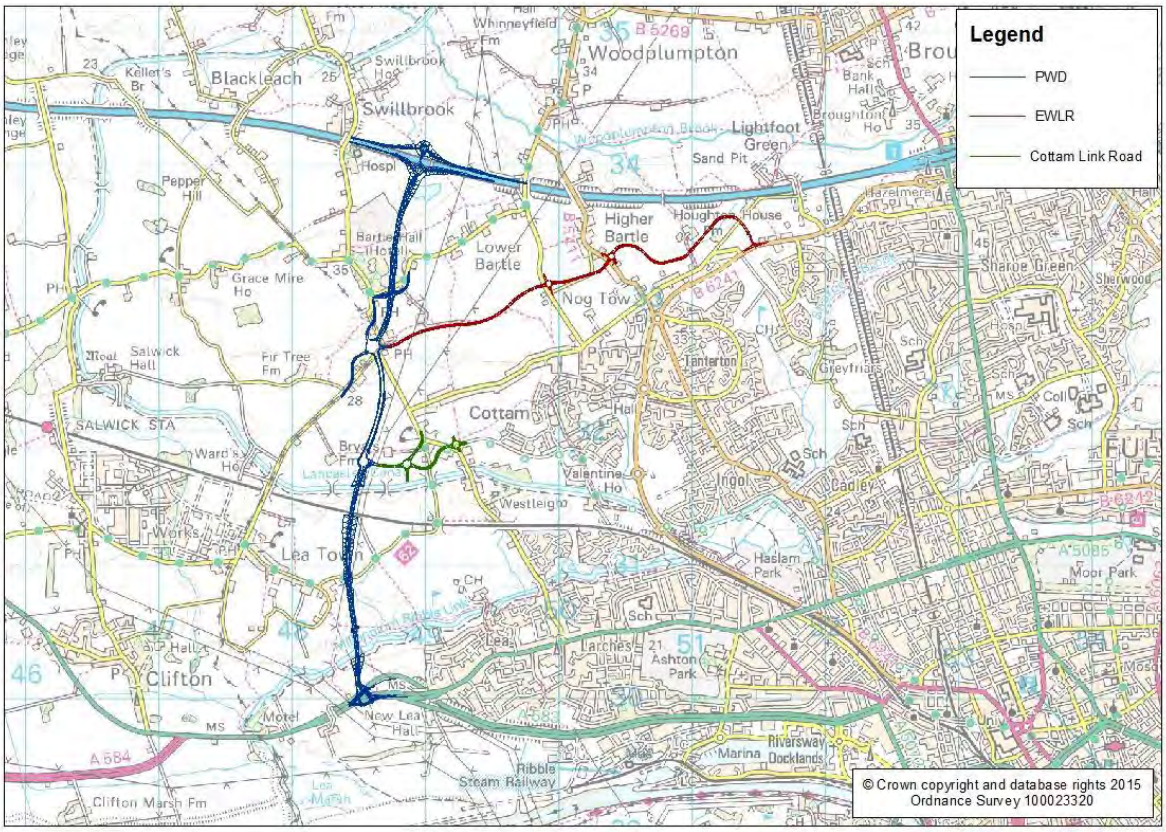

Figure 1.1 : Preston Western Distributor – Scheme Route

It has been agreed that despite the results of the VDM test previously undertaken for the Outline Business Case and given the size of the scheme it would be a risk to pursue the scheme to Full Approval without undertaking VDM. This note sets out the proposed approach for Variable Demand Modelling (VDM) for the Preston Western

Distributor project. The detailed analyses have been provided in this note to demonstrate the appropriateness of the choice of the model to be employed.

Prior to any VDM testing process, decision has to be made on the treatment of the model. In our case, given that this is not a large and complex scheme, the focus is on:

1) whether it should be a single mode modelling or a multi-modal modelling; and
2) whether the VDM should be set up on a Production/Attraction basis or an Origin/Destination basis;

To answer the above questions, the following steps have been undertaken:

1) Local usage of public transport;
2) Modal shift significance test;
3) WebTAG Unit M2 scoping tests;
4) Discussion on P/A model and O/D model; and
5) Proposed Action.

2. Analyses

2.1 Local Usage of Public Transport

Given that the majority of the demand in this area comes from the commuting purpose, Census 2011 journey to work data has therefore been used to analyse the local usage of Public Transport. As shown in Table 2.1, private car is the predominant mode of transport and the main method of commuting in comparison to the public transport alternatives within the Preston District. The percentage of people driving to work by car (59% and 63%) and as a passenger (7%, 6%) is significantly larger than rail (1%, 3%) and bus (11%, 8%) for Preston and North West respectively.

Method of Travel to Work	Percentage of People in Employment		
	Preston	North West	England and Wales
Driving a car / van	59%	63%	58%
Passenger in car / van	7%	6%	5%
Bus	11%	8%	7%
Train	1%	3%	5%
Walking	14%	11%	11%
Cycling	2%	2%	3%
Other (including working from home)	6%	7%	11%

Table 2.1 : Method of Travel to Work (Census 2011)

Another analyses which has been undertaken is to understand the distribution of the journey to work demand in this study area. Figure 2.1 and Figure 2.2 show the top ten travel to work movements from and to the Preston area. The majority of the movements occur within Preston. For the north, the south and the North west area where the rail line is accessible and that could be affected by the scheme, the demand distribution is relatively low. It reassures that the impact from the rail is minor.

The Preston urban area has a local bus network connecting local communities and the city centre. The frequency is 3 or 4 buses per hour. The journey time spent by bus comparing to car is much longer for most of journey plan. For example, from Preston city centre to Cottam, based on the Google map API, car takes 13 minutes and the bus takes 37 minutes due to the longer service route and stopping times. It verifies that bus is not a popular mode in this area.

Seen from the above evidence, Public Transport is not a viable alternative to the car and subsequently mode choice is unlikely to be impacted by the scheme.

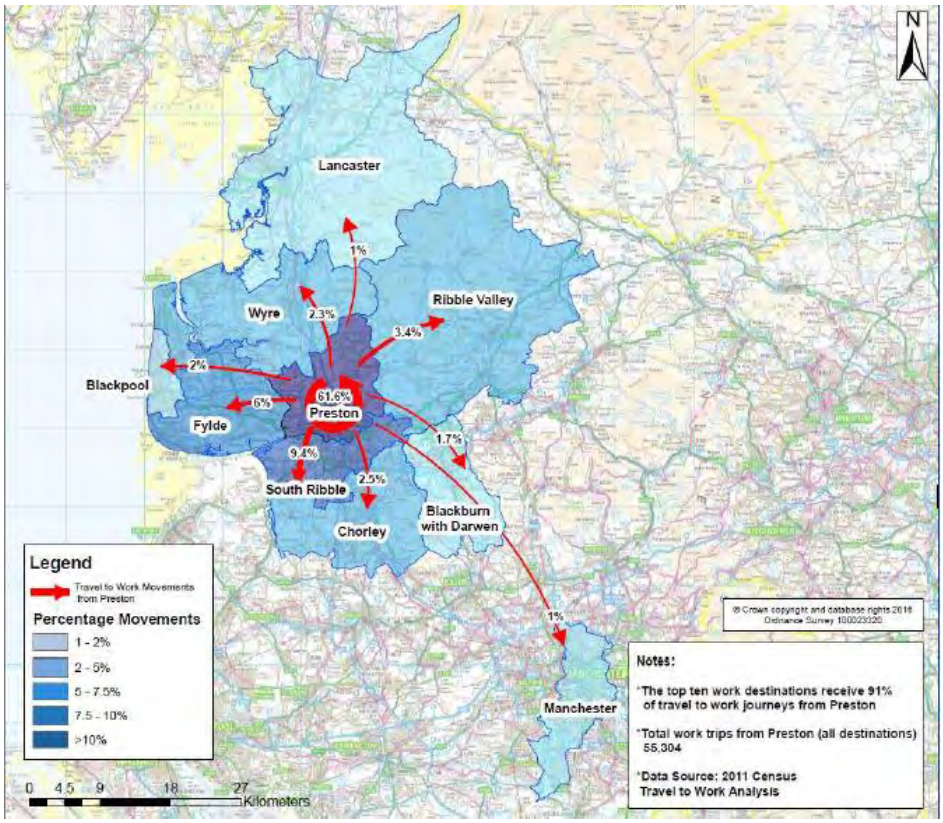

Figure 2.1 : Top Ten Travel to Work Movements from Preston

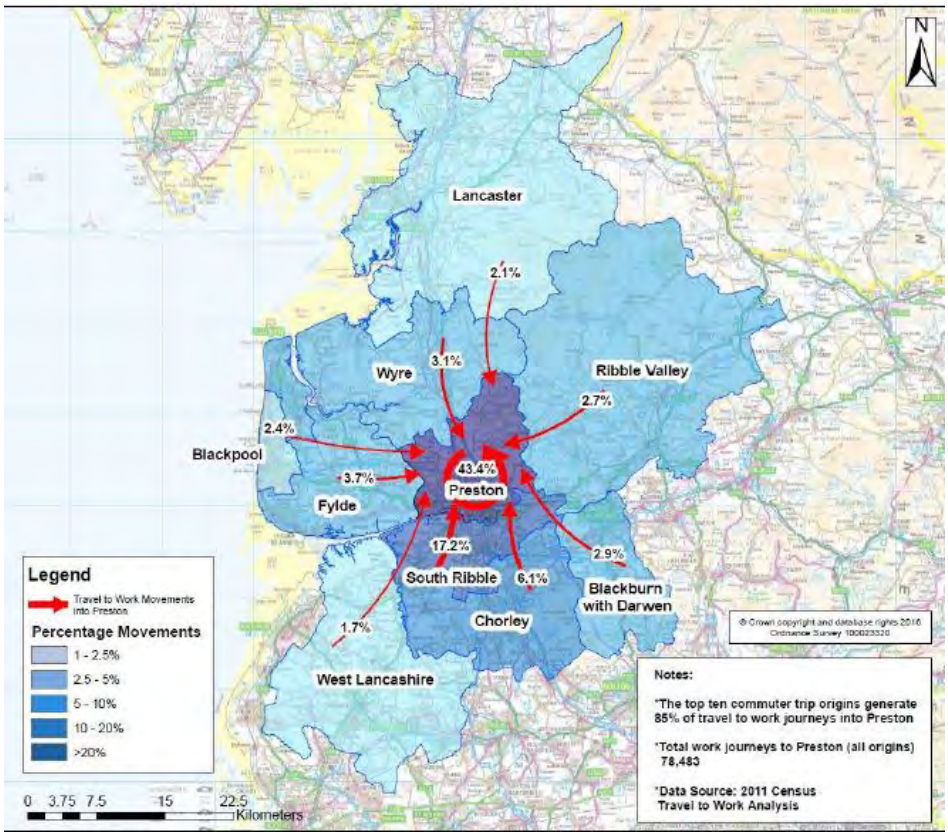

Figure 2.2 : Top Ten Travel Movements to Work into Preston

2.2 Modal Shift Significance Test

Further to the above local information, a Mode Shift Significance Test outlined in WebTAG Unit M2 has also been undertaken to provide further evidence on whether a highway only model is needed or a multi-modal model is required.

The WebTAG Unit M2 has specified that:

"For each zone-to-zone movement, using available data, estimate the approximate modal split between car and public transport, and the change in costs expected to arise from the scheme for each mode.

The modal impact may be considered significant if, for any zone to zone movement where the car share is below 75%, the cost change between modes is more than one minute, or, where the car share is between 75% and 85%, the cost change is more than two minutes, or, where the car share is above 85%, the cost change is more than four minutes.

If on this basis no zone-to-zone movement demonstrates significant modal impact, then this is prima facie evidence for not requiring a mode choice model."

2.2.1 Modal Split

To assess the modal split between car and public transport, the census 2011 journey to work dataset was used. The data were analysed at the model zone level and the mode share was calculated for each movement. The data has also been aggregated into sector level for the reporting purpose. Figure 2.3 and Figure 2.4 illustrate the definition of the sectors used for this analyses.

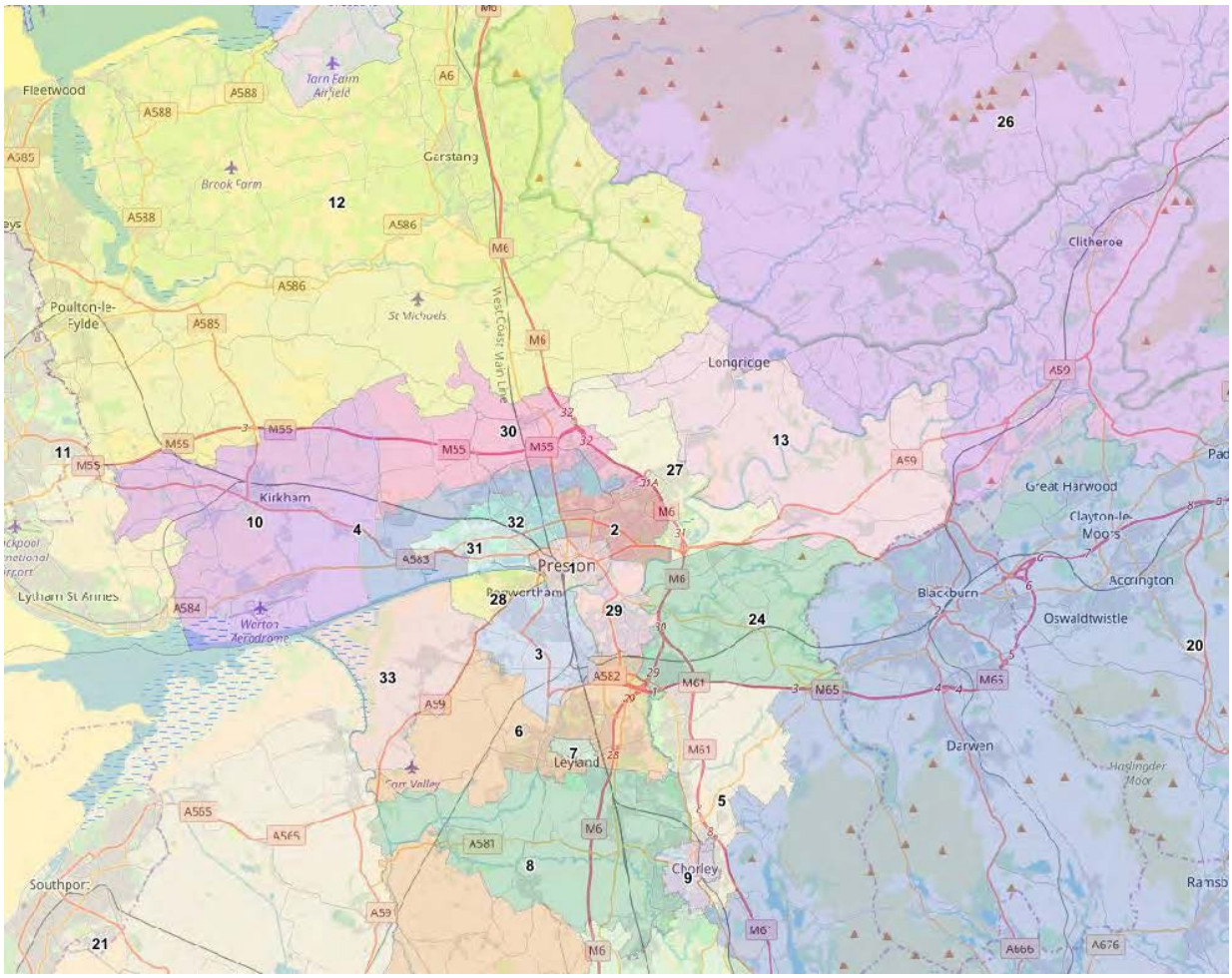

Figure 2.3 : Definition of the Sectors - Preston Area

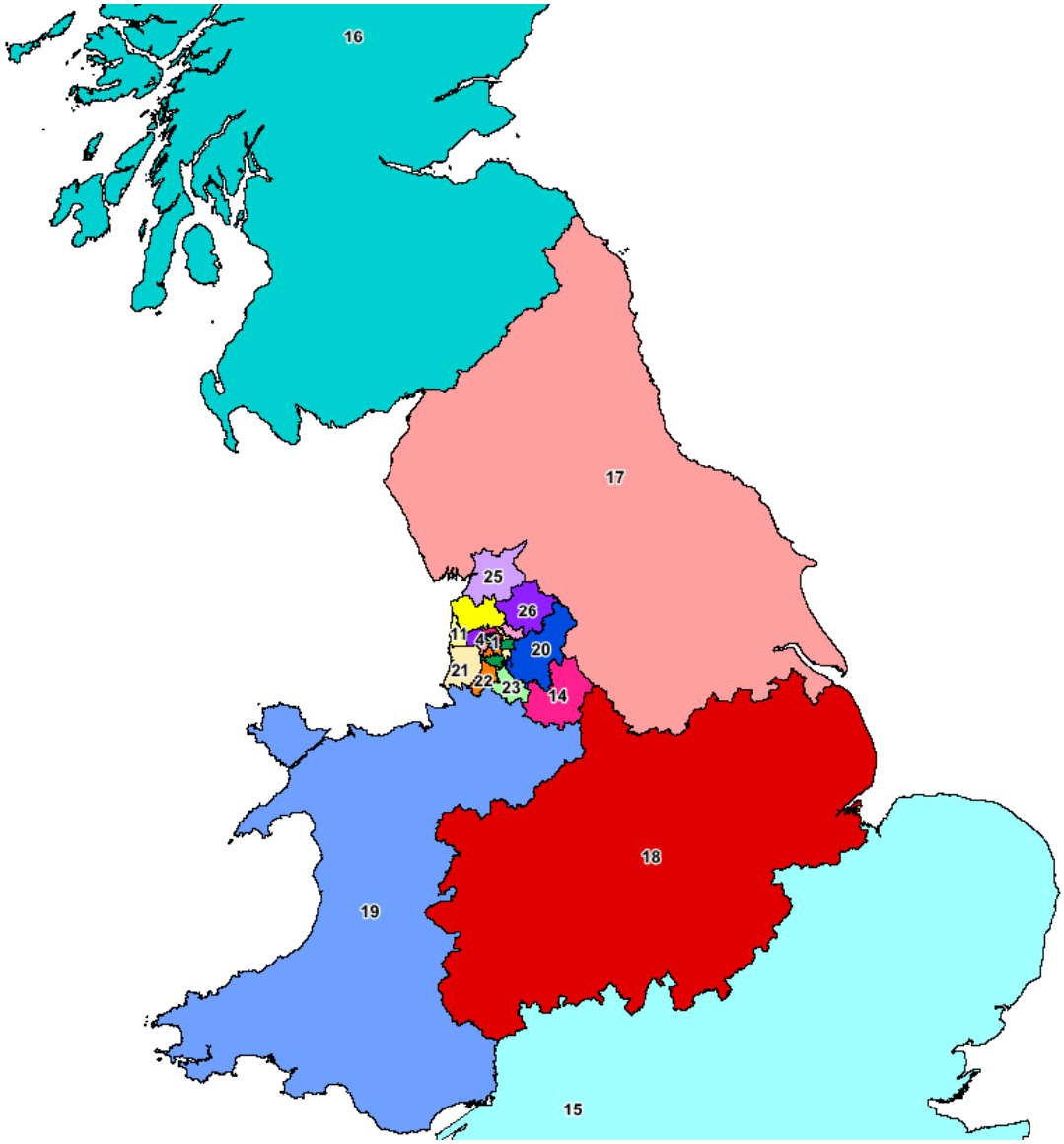

Figure 2.4 : Definition of the Sectors – Wider Area

Table 2.2 provides the percentages of the car mode shares for the sector to sector movements. Sector 1 is Preston city centre area, the car mode share from/to Preston city centre rangesbetween 59% and 92%. Most of the lower car mode shares and higher public transport shares appear for the movements from or to sector 14 and sector 15. It makes sense because sector 14 is the Manchester area and sector 15 is the Southeast and Southwest area including major cities with good public transport services, for example, London, therefore, higher proportion of public transport commuting is expected. The sector summary does not include sector 16 which is the Scotland area. It is because the data source that was used for the analyses is the Census 2011 data for England and Wales, not including Scotland. We will not expect high commuting demand between Scotland and Preston.

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
1	69%	78%	77%	67%	83%	81%	78%	82%	76%	92%	82%	84%	85%	62%	71%	73%	76%	80%	84%	92%	88%	77%	86%	74%	84%	75%	82%	73%	64%	79%	77%	77%
2	70%	81%	82%	74%	85%	85%	85%	87%	82%	93%	91%	88%	87%	75%	77%	80%	78%	84%	89%	94%	91%	82%	87%	89%	85%	82%	75%	80%	73%	78%	81%	86%
3	77%	90%	94%	92%	94%	95%	93%	96%	95%	97%	95%	96%	97%	80%	73%	94%	95%	94%	95%	99%	97%	95%	97%	89%	97%	91%	94%	92%	91%	95%	90%	95%
4	77%	90%	91%	89%	91%	94%	95%	96%	93%	98%	96%	96%	96%	85%	75%	86%	91%	93%	96%	97%	99%	95%	94%	94%	96%	91%	88%	86%	87%	89%	89%	95%
5	85%	95%	97%	93%	93%	95%	94%	92%	91%	99%	95%	99%	97%	81%	80%	93%	91%	96%	95%	97%	99%	93%	96%	96%	96%	96%	93%	91%	93%	91%	93%	99%
6	84%	93%	96%	94%	95%	95%	94%	96%	94%	98%	97%	97%	99%	84%	88%	93%	96%	95%	96%	98%	99%	95%	97%	92%	99%	96%	94%	92%	94%	92%	94%	97%
7	81%	94%	95%	92%	95%	96%	96%	95%	94%	98%	95%	97%	100%	81%	93%	95%	98%	96%	93%	98%	99%	94%	99%	86%	100%	98%	87%	90%	92%	90%	93%	98%
8	85%	95%	97%	92%	94%	96%	95%	95%	93%	97%	98%	96%	97%	82%	83%	92%	90%	96%	96%	97%	99%	94%	97%	93%	98%	96%	99%	92%	92%	91%	94%	98%
9	75%	92%	94%	89%	93%	92%	90%	92%	92%	97%	96%	96%	96%	77%	86%	89%	84%	96%	94%	94%	98%	93%	93%	88%	98%	94%	100%	88%	89%	88%	88%	100%
10	84%	92%	98%	96%	95%	97%	100%	96%	97%	96%	93%	97%	96%	83%	84%	91%	95%	96%	95%	97%	96%	92%	99%	95%	97%	92%	100%	91%	97%	96%	93%	97%
11	84%	93%	94%	96%	94%	94%	95%	94%	93%	96%	86%	92%	98%	83%	76%	88%	93%	93%	94%	93%	97%	91%	98%	90%	98%	95%	97%	93%	97%	94%	89%	100%
12	87%	96%	98%	97%	99%	98%	98%	98%	98%	98%	91%	94%	99%	84%	80%	93%	97%	95%	96%	97%	100%	95%	99%	96%	97%	98%	94%	93%	97%	96%	94%	100%
13	85%	93%	98%	96%	98%	99%	100%	97%	97%	98%	97%	98%	98%	88%	80%	95%	100%	96%	96%	100%	100%	98%	98%	98%	98%	96%	91%	92%	96%	95%	94%	100%
14	74%	92%	94%	91%	92%	93%	92%	94%	91%	96%	87%	94%	98%	77%	68%	81%	84%	92%	87%	81%	94%	90%	96%	79%	92%	93%	100%	97%	92%	88%	78%	96%
15	59%	71%	81%	37%	65%	78%	92%	98%	79%	87%	79%	78%	92%	68%	71%	75%	88%	81%	78%	72%	80%	77%	95%	69%	73%	75%	100%	39%	33%	87%	56%	100%
17	67%	94%	97%	77%	98%	97%	92%	94%	94%	93%	92%	90%	100%	80%	73%	85%	91%	88%	91%	86%	94%	90%	98%	93%	98%	95%	86%	88%	76%	94%	71%	100%
18	81%	88%	94%	72%	97%	95%	91%	91%	91%	96%	89%	94%	100%	80%	84%	91%	88%	95%	91%	90%	91%	88%	92%	80%	90%	86%	40%	85%	71%	96%	84%	77%
19	79%	95%	97%	94%	96%	95%	92%	96%	96%	98%	83%	94%	97%	87%	81%	88%	94%	88%	95%	81%	96%	93%	99%	89%	97%	96%	100%	96%	94%	91%	89%	90%
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24	82%	91%	98%	93%	94%	96%	95%	96%	93%	98%	95%	97%	98%	88%	74%	95%	100%	98%	97%	93%	100%	95%	96%	94%	96%	94%	100%	89%	93%	92%	91%	95%
25	68%	93%	92%	93%	91%	90%	92%	94%	86%	97%	95%	93%	95%	72%	71%	94%	91%	86%	92%	82%	98%	84%	95%	88%	94%	97%	95%	87%	95%	84%	79%	95%
26	87%	92%	98%	96%	99%	98%	96%	98%	98%	98%	95%	97%	97%	88%	76%	97%	96%	95%	97%	100%	100%	98%	98%	97%	96%	94%	89%	92%	96%	95%	94%	100%
27	68%	82%	90%	81%	91%	91%	90%	90%	89%	96%	98%	96%	93%	89%	81%	86%	86%	92%	94%	91%	97%	89%	92%	94%	91%	89%	90%	83%	81%	81%	81%	88%
28	80%	91%	96%	92%	90%	97%	99%	98%	98%	99%	93%	100%	97%	73%	46%	86%	100%	95%	94%	100%	100%	100%	99%	95%	97%	95%	97%	96%	91%	99%	92%	93%
29	77%	86%	94%	85%	91%	92%	89%	95%	91%	97%	93%	93%	95%	83%	83%	94%	93%	93%	96%	94%	97%	91%	95%	89%	96%	84%	95%	91%	85%	87%	87%	96%
30	80%	93%	94%	93%	88%	95%	98%	94%	92%	99%	98%	97%	98%	87%	80%	91%	93%	94%	96%	98%	98%	96%	97%	97%	97%	93%	100%	87%	92%	93%	92%	92%
31	75%	87%	92%	85%	91%	94%	96%	97%	95%	96%	94%	95%	95%	81%	80%	77%	72%	90%	95%	95%	98%	99%	92%	93%	95%	87%	96%	84%	83%	87%	86%	98%
32	71%	85%	85%	77%	83%	89%	91%	94%	91%	97%	93%	90%	92%	73%	67%	81%	88%	86%	89%	96%	96%	92%	88%	86%	91%	87%	75%	80%	73%	87%	85%	91%
33	89%	94%	96%	97%	98%	97%	97%	99%	98%	99%	99%	99%	100%	84%	91%	94%	93%	93%	97%	98%	99%	98%	98%	87%	100%	98%	95%	97%	96%	98%	95%	97%

Table 2.2 : Car Mode Shares at Sector Level

2.2.2 Change in Costs

The change in highway costs was extracted from the existing Preston SATURN model from the Do Minimum and the Do Something scenarios at the model zone level. The journey time data were analysed for year 2019, 2034 and 2041 for the AM peak period for the commuting purpose. The scheme area in the Interpeak period is less congested and subsequently the individual journey time savings in the Interpeak period are lower meaning that modal shift is even less likely to occur. The analyses results are shown in Table 2.3. The trip distribution pattern at journey time saving band is consistent through the years.

Year 2019

Time Savings (Mins)	Zone to Zone Movements	Number of trips	Trip Distribution
< 1	216621	42155	97.38%
1-2	14406	386	0.89%
2-3	4677	148	0.34%
3-4	3651	202	0.47%
4-5	2994	104	0.24%
5-6	3135	178	0.41%
6-7	2140	48	0.11%
> 7	3826	67	0.15%

Year 2034

Time Savings (Mins)	Zone to Zone Movements	Number of trips	Trip Distribution
< 1	207813	53903	96.75%
1-2	20659	880	1.58%
2-3	6406	189	0.34%
3-4	3799	280	0.50%
4-5	2809	118	0.21%
5-6	3393	157	0.28%
6-7	2077	105	0.19%
> 7	3781	79	0.14%

Year 2041

Time Savings (Mins)	Zone to Zone Movements	Number of trips	Trip Distribution
< 1	211988	70359	97.22%
1-2	20984	987	1.36%
2-3	7519	242	0.33%
3-4	3954	302	0.42%
4-5	2677	141	0.19%
5-6	3224	182	0.25%
6-7	2077	58	0.08%
> 7	4419	98	0.13%

Table 2.3 : Highway Journey Time Savings for Commuting Purpose

Table 2.4 summarises the car time savings at sector level. The analysis is based on the SATURN model sources and the demand weighted journey times were produced for both DM and DS in order to calculate the sector level time savings. The movements highlighted in red show positive time savings. Sector 4, 10, 31 and 15 have the most significant time savings. Except sector 15 which is the Southeast and Southwest area, all the other three sectors are in the west of Preston between M55 and River Ribble in the scheme area. It makes perfect sense that those areas were affected the most by the scheme and also an improved congestion relief in the local area can be seen due to the scheme Table 2.4 shows a representation of the time savings analyses for Year 2019 for the AM peak. More detailed time saving analyses can be found from the Economic Assessment report (EAR). The report has provided evidence of consistent time savings pattern by sector in all years and all time periods.

The public transport cost changes were not analysed in this study due to the following reasons:

1) The PWD scheme is a highway scheme, the effect of time savings for public transport is relatively low;
2) Public transport mode share is low comparing to car for the scheme affected area. Therefore, the public transport would not contribute much to the change in cost;
3) The rail is not expected to have obvious cost change after the implementation of the scheme; and
4) The main public transport mode in the study area is bus. Bus is not an attractive mode, given the significant longer journey time than car and low in frequency, described in section 2.1. In addition, change in cost for bus also needs to take account of the waiting time, penalty cost and access/egress time, all of which means bus is not a competitive mode and only takes up a small proportion of contribution to cost change.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
1	0.03	0.05	0.04	0.09	0.25	0.22	0.11	0.17	0.17	0.31	2.87	1.21	0.03	0.21	0.13	0.52	0.22	0.22	0.23	0.07	0.21	0.21	0.06	0.09	0.10	0.23	0.01	0.06	0.17	0.04	0.03	0.03
2	0.09	0.02	0.09	0.07	0.02	0.26	0.14	0.04	0.08	2.79	0.61	0.46	0.02	0.14	0.10	0.18	0.00	0.08	0.10	0.17	0.08	0.17	0.06	0.30	0.06	0.08	0.07	0.05	0.39	0.13	0.09	0.09
3	0.09	0.14	0.02	0.11	0.17	0.07	0.06	0.07	0.06	0.35	3.00	2.74	0.54	0.14	0.18	0.46	0.22	0.18	0.21	0.03	0.06	0.11	0.04	1.02	0.18	0.16	0.02	0.04	0.24	0.14	0.14	0.01
4	0.12	0.13	0.32	0.08	1.00	0.60	0.45	1.35	1.30	1.50	1.72	1.30	1.28	1.56	0.11	1.14	1.22	1.28	0.91	0.44	1.04	1.14	0.23	1.38	0.82	0.21	0.20	0.19	0.46	0.25	0.04	0.39
5	0.28	-0.16	0.09	1.08	0.00	0.06	0.07	0.01	0.00	3.27	-0.32	-0.13	-0.07	0.00	1.91	-0.02	0.00	0.00	0.00	0.06	0.00	0.00	0.00	-0.20	-0.09	0.02	0.05	0.03	0.67	4.52	0.69	0.09
6	0.20	0.28	0.12	0.66	0.04	0.04	0.04	0.02	0.02	1.26	-0.01	0.19	0.11	0.05	0.85	0.12	0.04	0.02	0.09	0.09	0.02	0.03	0.09	-0.09	0.08	0.17	0.01	0.11	4.52	1.64	0.34	0.04
7	0.18	0.34	0.11	0.65	0.01	0.04	0.00	0.00	-0.01	1.50	-0.04	-0.04	0.08	0.04	1.47	0.07	0.04	0.05	0.06	0.19	0.03	0.02	0.12	-0.08	0.04	0.17	0.09	0.12	0.73	2.24	0.26	0.11
8	0.17	0.21	0.15	0.79	0.00	0.04	0.03	0.00	0.00	2.29	-0.36	0.17	-0.10	-0.01	1.64	0.00	-0.02	-0.04	0.01	0.01	-0.01	0.00	0.06	-0.23	-0.12	0.00	0.06	0.08	0.65	0.78	0.97	0.08
9	0.07	0.00	0.06	0.88	0.00	0.02	0.03	0.00	0.00	2.60	-0.43	-0.26	-0.13	0.00	1.79	0.01	0.01	0.02	0.01	0.01	0.00	0.00	-0.01	-0.32	-0.21	-0.09	0.11	0.03	3.73	2.48	0.96	0.05
10	-0.72	-0.27	-1.47	1.16	2.02	-0.07	-0.55	1.48	1.88	0.08	0.20	0.45	3.30	2.36	2.14	2.85	2.71	2.40	3.94	-1.28	1.39	1.93	0.75	2.65	3.41	1.07	-0.70	-0.91	1.40	-0.66	1.93	-1.20
11	-0.04	0.42	2.38	0.74	-0.18	-0.17	-0.34	-0.10	-0.19	0.22	0.00	0.00	-0.15	-0.17	5.67	0.02	-0.18	-0.17	-0.15	-1.38	-0.08	-0.17	-0.17	0.04	-0.22	-0.27	1.29	0.23	0.62	-1.96	1.42	1.76
12	1.65	0.13	3.33	0.95	-0.17	0.60	0.03	-0.13	-0.19	0.53	0.01	0.00	-0.07	-0.16	2.34	0.04	-0.16	-0.17	-0.15	3.43	-0.15	-0.17	-0.16	0.04	-0.06	-0.22	3.40	-0.03	0.03	3.50	0.89	4.74
13	0.38	0.11	0.22	0.51	0.00	0.08	0.09	0.03	-0.01	3.18	0.07	0.04	0.00	0.00	0.46	0.00	0.00	-0.01	0.00	0.12	0.02	0.00	0.00	-0.06	0.00	0.03	0.13	0.15	0.07	5.53	0.48	0.10
14	0.28	0.53	0.21	0.34	0.00	0.04	0.03	0.01	0.00	1.99	-0.36	-0.21	-0.10	0.00	1.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.24	-0.13	-0.03	0.00	0.07	0.87	4.82	1.18	0.07
15	0.03	0.23	0.51	0.16	2.63	1.62	2.80	2.75	2.62	2.83	5.84	2.21	0.73	2.61	0.00	0.43	0.00	0.00	2.64	0.51	2.41	2.63	2.94	2.68	0.10	0.26	0.49	0.35	0.24	0.43	0.08	0.49
17	0.43	0.52	0.17	1.15	-0.03	0.04	0.05	-0.02	-0.04	2.73	-0.05	-0.01	0.05	0.00	1.41	0.00	0.00	0.00	0.00	0.00	0.01	0.06	-0.02	0.00	0.00	0.20	0.31	0.06	0.61	4.30	1.12	0.25
18	0.44	0.46	0.22	0.78	0.00	0.01	0.03	-0.01	0.00	3.03	-0.31	-0.23	-0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	-0.21	-0.01	0.00	0.21	0.15	0.71	4.66	1.02	0.07
19	0.28	0.22	0.20	1.46	0.00	0.01	0.03	-0.02	0.01	2.90	-0.29	-0.22	-0.03	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.04	-0.17	-0.06	0.05	0.24	0.12	1.13	3.10	1.07	0.05
20	0.32	0.44	0.17	0.91	-0.01	0.04	0.03	-0.03	-0.02	3.34	-0.29	-0.08	0.00	0.00	1.93	0.00	0.00	0.01	0.00	0.02	0.01	0.01	-0.01	-0.24	0.00	0.08	0.21	0.11	0.69	1.97	1.04	0.16
21	0.17	0.16	0.11	0.33	0.14	0.21	0.13	0.04	0.04	0.62	0.61	4.73	0.30	0.00	0.10	0.27	0.00	0.00	0.12	0.00	0.00	0.00	0.47	0.21	0.40	0.15	0.09	0.49	0.40	0.25	0.16	0.07
22	0.14	0.27	0.25	0.81	0.00	0.00	0.01	0.00	0.00	2.36	-0.28	-0.16	-0.01	0.00	1.84	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.08	-0.16	-0.05	0.07	0.05	0.27	0.81	0.17	0.37	0.05
23	0.34	0.28	0.18	1.42	0.00	0.04	0.03	0.00	0.00	2.78	-0.30	-0.15	-0.05	0.00	1.91	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.04	-0.18	-0.08	0.04	0.23	0.12	0.84	4.83	1.04	0.03
24	0.39	0.20	0.19	1.19	0.00	0.07	0.14	0.04	0.00	2.37	-0.23	0.03	0.06	-0.03	1.98	-0.03	0.00	0.03	-0.01	0.15	0.14	0.06	0.00	-0.10	0.04	0.10	0.42	0.11	0.56	2.41	0.62	0.22
25	1.06	0.54	0.83	1.25	-0.05	0.02	-0.01	-0.02	-0.06	3.71	-0.01	0.01	0.32	-0.05	1.98	0.00	-0.05	-0.05	-0.05	-0.02	-0.02	-0.05	-0.04	0.00	-0.02	0.50	1.23	0.01	1.10	4.80	1.28	1.15
26	0.29	0.20	0.34	0.60	0.00	0.08	0.10	0.03	-0.01	2.58	-0.16	-0.05	-0.01	0.01	0.83	-0.01	0.00	0.00	0.00	0.06	0.03	0.00	0.03	-0.02	0.00	0.01	0.14	0.06	0.25	0.38	0.70	0.12
27	0.32	0.08	0.13	0.17	0.00	0.08	0.08	0.03	-0.01	1.60	-0.14	-0.05	0.03	0.00	0.40	0.03	0.00	0.00	0.01	0.18	0.03	0.01	0.00	-0.02	0.01	0.01	0.19	0.10	0.18	1.00	0.24	0.12
28	0.02	0.06	0.00	0.03	0.41	0.10	0.06	0.03	0.18	1.89	1.02	2.74	0.24	0.21	-0.10	0.66	0.41	0.03	0.30	0.03	0.03	0.04	0.10	1.17	0.15	0.10	0.00	0.15	0.27	0.07	0.01	0.00
29	0.28	0.26	0.16	0.78	0.17	0.18	0.23	0.16	0.16	0.41	-0.15	-0.04	0.05	0.19	0.32	0.18	0.22	0.23	0.19	0.19	0.18	0.20	-0.01	-0.12	-0.03	0.19	0.18	0.01	0.38	0.42	0.35	0.25
30	0.15	-0.02	0.35	0.21	0.31	1.69	0.37	0.33	0.29	2.24	2.06	0.43	0.20	0.42	0.05	0.38	0.29	0.39	0.35	0.49	0.40	0.35	0.38	0.78	0.25	0.03	0.27	0.18	0.11	0.20	0.23	0.53
31	0.08	0.22	0.09	0.04	6.72	0.03	0.07	1.79	4.75	0.14	0.58	1.40	0.25	0.49	1.37	3.50	0.29	3.27	3.29	-0.08	-0.07	1.42	0.22	5.99	1.17	0.27	-0.02	0.19	0.73	0.02	0.08	-0.02
32	0.11	0.11	0.39	0.03	0.93	0.42	0.84	1.01	0.51	1.20	2.46	1.18	0.46	0.64	0.04	0.69	0.43	1.39	0.76	0.52	1.17	1.31	0.26	0.67	0.23	0.29	0.19	0.10	0.23	0.08	0.01	0.52
33	0.06	0.08	0.02	0.21	0.18	0.09	0.06	0.08	0.03	0.63	2.63	4.20	0.19	0.25	0.03	0.32	0.12	0.02	0.23	0.02	0.02	0.03	0.18	0.97	0.16	0.10	0.01	0.19	0.33	0.21	0.13	0.00

Table 2.4 : Journey Time Savings Year 2019 for Commuting Purpose at Sector Level (AM period)

2.2.3 WebTAG Modal Shift Significance Result

In combination of the modal split and the change in costs analyses, with reference to the WebTAG modal shift significance test criteria (see Table 2.5), **97%** of the movements have suggested that the modal impact is not significant and therefore a model simplification can be made to only have a Highway model. Only 3% of the movements have suggested to set up a multi-modal model.

Criteria	Car%		Time Savings (mins)	Solution
	less than	greater than	greater than	
1	75%		1	Significant
2	85%	75%	2	Significant
3		85%	4	Significant

* Otherwise single model

Table 2.5 : WebTAG Modal Shift Significance Test Criteria

2.3 WebTAG Unit M2 Scoping Tests

In addition to the above local evidence and the modal significance test, the logic tests outlined in TAG Unit M2 have also been used to inform a decision on whether or not a Public Transport model is required.

The results of the logical tests are summarised below:

1) Test 1 - Highway only scheme, so multi-modal model is not needed.
2) Test 2 - Highway only scheme. Scheme is expected to have limited impact on public transport demand due to high car mode share and the fact that public transport is not a viable alternative. Therefore, a public transport model and associated mode choice model is not required. Further evidence is provided in this note to support this conclusion.
3) Tests 3, 5 and 6 – It is not a public transport scheme and therefore not applicable.
4) Test 4 - Highway only scheme. Therefore, public transport model is not required.

Consequently, the above evidence leads us to the conclusion that a Public Transport Assignment model is not required.

2.4 Discussion on P/A Model and O/D Model

One of the core advantages of PA modelling is to ensure consistency of response among time periods. For example, the same amount of home-based trips going outbound will return home during the same day and people could shift modes due to the cost change through the day. In the absence of a mode choice model, which has been affirmed from the local information, modal significance test and the scoping test, this benefit is significantly reduced, meaning that the advantage of PA modelling only in this case relates to destination choice impacts. Given journey time differences are typically less than 4 minutes created by the scheme, as illustrated in Table 2.4, the benefits are even more modest.

Secondly, the process of the PA modelling would be time consuming. It involves massive work to calculate the tour factors, verify the accuracy of any required input data and test the consistency of the base year demand and those in the time period specific assignment models. It may introduce rounds of adjustments in order to make the PA demand right at the first place. The public enquiry is at the Summer time, we consider there is a strong chance that this can be achieved by modelling on an O-D basis, and get results finalised and suitably forecast and appraised over the next 3 months to inform this. We are not self-convinced that it could be achievable if a PA based approach needs to be adopted and a delay to the work is possibly unavoidable.

Taken into account the above reasons, a suggestion is made that it is more beneficial to build a O/D based variable demand model for the PWD FBC.

3. Proposed Actions

Based on the above evidence, our recommendation is to build a O/D based variable demand model for highway mode only using DIADEM5 software, subject to DfT's confirmation. The setup and the testing of the variable demand model will be in compliance with the WebTAG guidance. The realism test will be undertaken. The car fuel cost elasticity with the assumption of 10% fuel cost increase will be required. The car fuel cost elasticities will be calculated as both matrix-based and network-based. The car journey time elasticity tests will also be carried

out in line with the car fuel cost elasticity test. Public transport fare elasticity tests will not be required, given that the mode choice is not proposed for this study. Table 3.1 describes the models that will potentially be set up for the VDM modelling and those will not.

Modelled	Not Modelled
Trip Frequency (for optional trip purposes)	Mode choice
Trip Distribution	Time of day choice
Cost damping	Micro time choice

Table 3.1 : Scope of VDM

Trip distribution model is likely to be the key response and will therefore be incorporated along with trip frequency and cost damping.

The proposed scheme is unlikely to significantly impact the overall cost of travelling at different times of the day and therefore Macro Time of Day Choice is unlikely to be relevant, with Micro-time choice unlikely to be proportionate.

As discussed above, mode choice is not considered relevant in the context of the current levels of usage of public transport and the expected impacts of the scheme.

The demand input for the VDM will be based on highway assignment OD matrices for peak hours. The car user classes will be comprised of commute, business and other. The car user classes will be disaggregated into 6 demand segments for each peak hour, including 3 non-External to External demand matrices and 3 External to External demand matrices. The non-External to External matrices will be set up as cost dependant and the External to External matrices will be set up as fixed demand. The HGV and LGV demand will be treated as fixed demand.

The pivot-point approach will be adopted for the forecasting models. For the core scenarios, the forecast year models will pivot off the validated base year costs. The VOT and VOC parameter setups for DIADEM will be consistent with the setups for the corresponding highway assignment models.