

Aberdeenshire Council Ellon Capacity Study

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1 INTRODUCTION

1.1 Background

In 2005, SIAS Limited completed the development of an S-Paramics model for the town of Ellon. This base model was representative of the year 2004, and validated well for both the AM and PM peaks. Aberdeenshire Council reviewed the models and considered them fit for purpose. The base model development was reported in November 2005. (*Ellon Base Model Development, Model Development and Validation Report, SIAS Ref. TPELLON/64382*)

A series of option tests were then carried out considering traffic management changes for the town centre. In all, five options were evaluated, with a Do-Minimum network developed based on Local Plan information to represent a future year of 2010 (*Ellon S-Paramics Model Testing – Technical Report, SIAS Ref. TPELLON/63666*).

This briefing note provides findings for the subsequent Ellon Capacity Study.

1.2 Objectives

The main objectives of this study were to:

- gauge the impact on traffic congestion and the road infrastructure of local planning aspirations for Ellon in the medium and long term
- assess any additional infrastructure interventions which might be required to reasonably accommodate the local planning aspirations

The Ellon study area and key locations are illustrated in Figure 1.1.



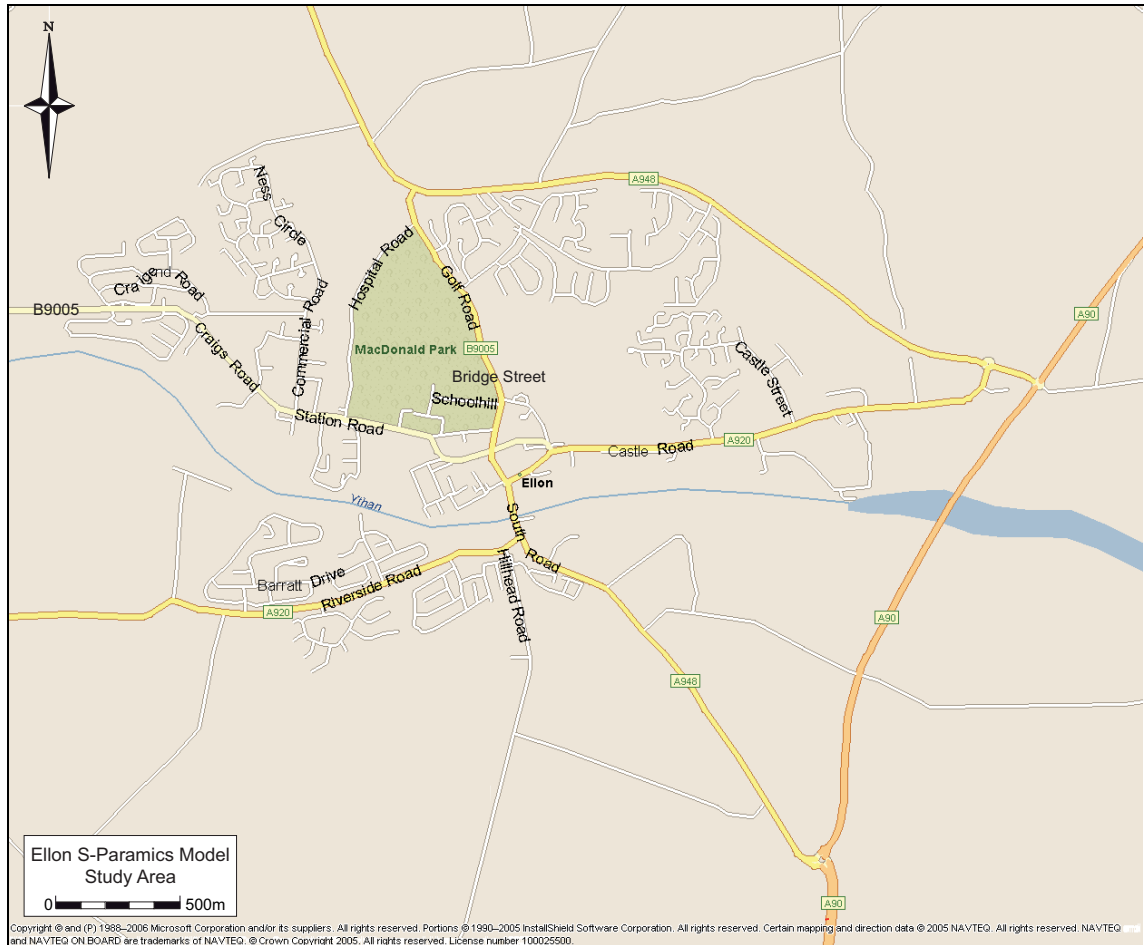


Figure 1.1 : Study Area

2 BASE AND REFERENCE CASE MODELS

2.1 Base Model

The Ellon models currently represent the following AM and PM peak periods at a base year of October 2004:

- AM Peak Period - 07:00-10:00
- PM Peak Period - 15:30-18:30

The peak hours were calculated from the traffic survey counts as:

- AM Peak Hour - 08:00-09:00
- PM Peak Hour - 16:30-17:30

2.2 Reference Case Model

As part of the work undertaken in August 2005, SIAS developed a 2010 future year model based on advice from Aberdeenshire Council planning officials. It was important to review the suitability of the 2010 model and the development and infrastructure content before progressing to the main future year scenarios under consideration in this study at 2015 and 2027.



The 2010 reference case network reflects the committed schemes as would be at 2010, this includes the trip generation/attraction and distribution for new developments and committed infrastructure.

The reference case network for 2010 used in the August 2005 testing included the following developments, illustrated in Figure 2.1.

- 31,850sqm GFA of industrial unit
- 13,825sqm GFA of business park
- 4470sqm GFA of supermarket (located opposite P&R)
- 628 housing units completed at Knockothie by 2006
- 46 flats at CH3 in local plan
- 25 houses CH2 in local plan
- 30 houses at P1 not currently in local plan - linked to CH2

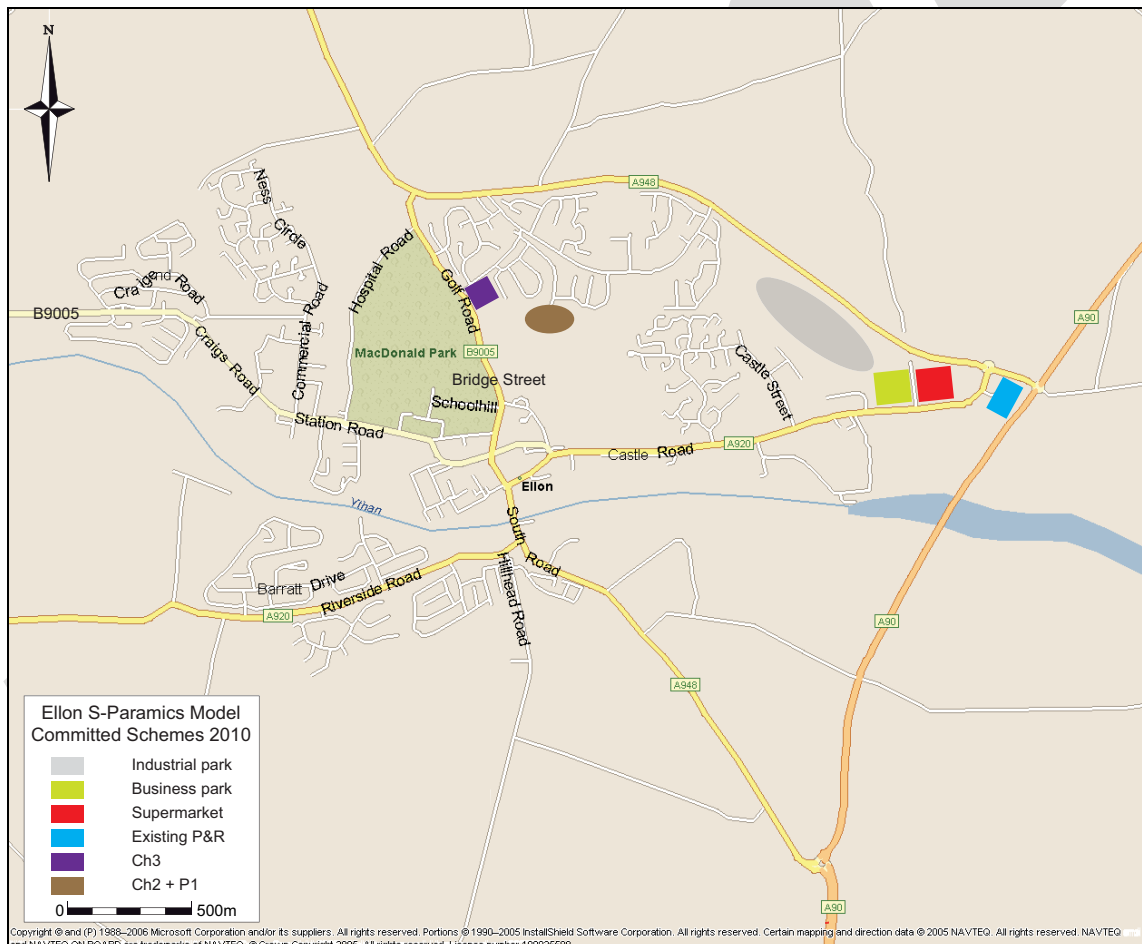


Figure 2.1 : 2010 Committed Schemes

2.3 Conversion to Periodic

The 2004 base AM and PM peak models were developed as stand alone models which means that any option testing would require to be coded separately into each model. It is possible to combine the models into a single periodic model so that the AM and PM share the same basic



The advantages of converting the model to a periodic model are realised when a series of option tests are required. In the periodic network the revised coding is done only once whereas in the stand alone models each revision requires to be done twice, independently for both AM and PM networks.

The 2004 AM and PM peak models were combined and the resultant periodic model checked using screenlines and queue length comparisons to ensure its validity.

The same process was carried out for the 2010 reference case model, combining the individual peak models to produce a periodic model.

3 FUTURE YEAR DEVELOPMENT

3.1 Development Content

Aberdeenshire Council have provided the aspirational development proposals for Ellon and the year of implementation. Figure 3.1 illustrates the locations of the developments. The following are to be considered:

- A - 850 dwellings
- B - 400 dwellings
- C - 350 dwellings
- D - 500 dwellings
- E - 18.3 HA split 25%/75% for business/industry
- F - 12.8 HA split 25%/75% for business/industry

The future years to be considered are 2015 and 2027 with the following content (100% occupancy unless stated). Advice from Aberdeenshire Council suggested that for business developments, a GFA (Gross Floor Area) of 4,000 square metres per hectare be assumed, for industrial developments a GFA of 2,200 square metres per hectare should be assumed.

- 2015 - A, E (40% occupancy) and F (40% occupancy)
- 2027 - A, B, C, D, E (75% occupancy) and F (75% occupancy)

NRTF Low growth has been applied to the A90 north and south movement:

- 2015 - Lights 1.09557 Heavies 1.15885
- 2027 - Lights 1.19859 Heavies 1.50950



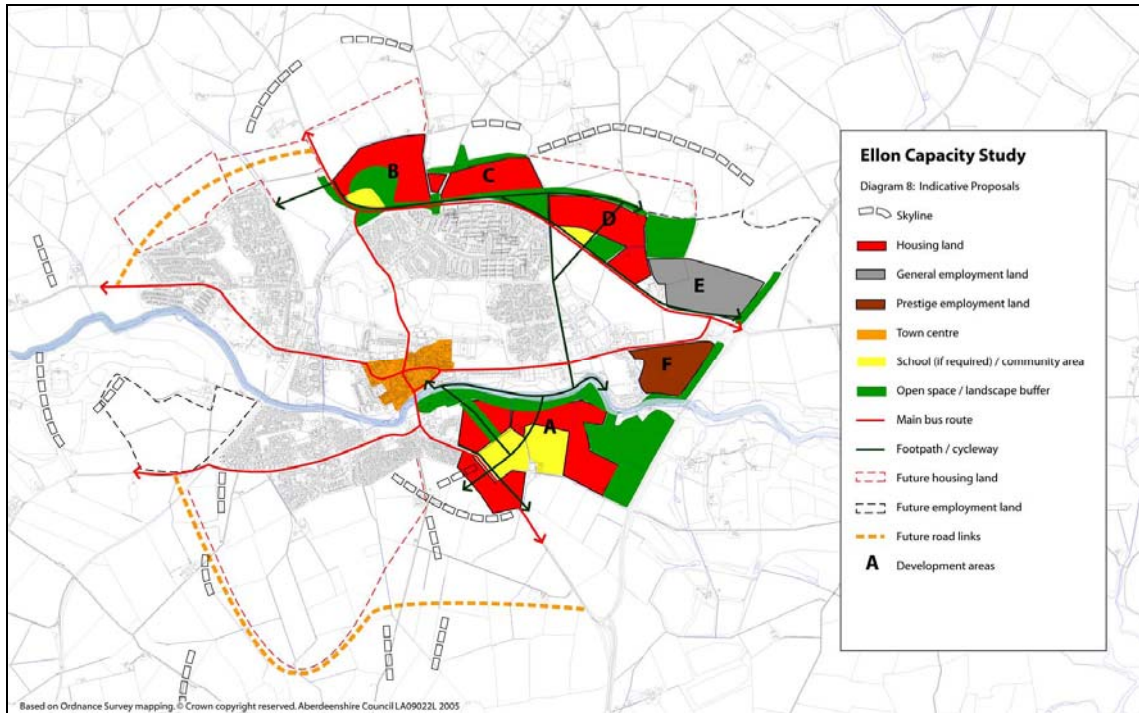


Figure 3.1 : 2027 Forecast Development Scenario Locations Provided by Aberdeenshire Council

The new housing developments use the same trip rates used in the development of the 2010 reference case model. For new business and industry developments, trip rates from TRICS were applied. The trip rates used are shown in Table 3.1.

Table 3.1 : Trip Rates

	AM Peak (07:00-10:00)			PM Peak (15:30-18:30)		
	Arr	Dept	Total	Arr	Dept	Total
Housing	0.39	1.1	1.49	1.18	0.71	1.89
Business	1.90	0.46	2.36	0.46	1.72	2.18
Industry	1.06	0.48	1.54	0.46	0.98	1.43

The trip rates shown above were then used to generate the number of trips, to and from each of the new developments. The trip totals generated are shown in Table 3.2 and 3.3 for 2015 and 2027 respectively.

Table 3.2 : 2015 Trip Generation

Development	Zone	AM		PM	
		Arrivals	Departures	Arrivals	Departures
A	101	332	935	1003	604
B	102	-	-	-	-
C	103	-	-	-	-
D	104	-	-	-	-
E	105	267	92	88	244
F	106	187	64	62	171
Total		786	1092	1153	1019



Table 3.3 : 2027 Trip Generation

Development	Zone	AM		PM	
		Arrivals	Departures	Arrivals	Departures
A	101	332	935	1003	604
B	102	156	440	472	284
C	103	137	385	413	249
D	104	195	550	590	355
E	105	501	173	165	458
F	106	350	121	116	320
Total		1671	2603	2759	2270

The distribution of housing, and business/industry trips in the base model was evaluated, and applied to the new development traffic. The 2004 base distributions are shown in Table 3.4 and 3.5 for the AM and PM peaks. The distributions assumed for the new developments are shown in Table 3.6 and 3.7 for the AM and PM peaks.

The distributions shown in bold in Tables 3.6 and 3.7 indicate those which were assigned as shared trips, between new housing and new employment areas – for example in the base model, 20% of housing departures were destined for zones in Ellon (other Ellon, see Table 3.4), in the new development traffic demand matrices this 20% is assumed to be destined for the new employment developments (see Table 3.6) and becomes a shared trip between the new housing and new employment areas.

Table 3.4 : AM 2004 Base Distribution

AM		Housing Departures	Industry & Business Departures	Housing Arrivals	Industry & Business Arrivals
External	A90 S	17%	8%	13%	11%
	A90 N	7%	4%	13%	30%
	A948 N	1%	0%	7%	8%
	B9005	2%	2%	19%	6%
	A920	23%	10%	9%	3%
	Lintmill Brae	0%	0%	2%	2%
Internal	Retail	23%	71%	8%	10%
	Park & Ride	5%	1%	0%	0%
	Other Ellon	20%	2%	29%	30%

Table 3.5 : PM 2004 Base Distribution

PM		Housing Departures	Industry & Business Departures	Housing Arrivals	Industry & Business Arrivals
External	A90 S	11%	1%	19%	7%
	A90 N	10%	5%	4%	1%
	A948 N	7%	26%	2%	0%
	B9005	13%	3%	4%	0%
	A920	6%	2%	19%	19%
	Lintmill Brae	1%	0%	0%	0%
Internal	Retail	10%	30%	28%	62%
	Park & Ride	0%	0%	0%	0%
	Other Ellon	42%	32%	25%	11%



Table 3.6 : AM New Development Distribution

AM		Housing Departures	Industry & Business Departures	Housing Arrivals	Industry & Business Arrivals
External	A90 S	17%	8%	13%	11%
	A90 N	7%	4%	13%	30%
	A948 N	1%	0%	7%	8%
	B9005	2%	2%	19%	6%
	A920	23%	10%	9%	3%
Internal	Lintmill Brae	0%	0%	2%	2%
	Retail	23%	0%	0%	0%
	Park & Ride	5%	1%	0%	0%
	Other Ellon	0%	0%	0%	0%
New Development	Housing	0%	73%	0%	40%
	Employment	20%	0%	38%	0%

Table 3.7 : PM New Development Distribution

PM		Housing Departures	Industry & Business Departures	Housing Arrivals	Industry & Business Arrivals
External	A90 S	11%	1%	19%	7%
	A90 N	10%	5%	4%	1%
	A948 N	7%	26%	2%	0%
	B9005	13%	3%	4%	0%
	A920	6%	2%	19%	19%
Internal	Lintmill Brae	1%	0%	0%	0%
	Retail	10%	0%	28%	0%
	Park & Ride	0%	0%	0%	0%
	Other Ellon	0%	0%	0%	0%
New Development	Housing	0%	62%	0%	73%
	Employment	42%	0%	25%	0%

The number of shared trips in both 2015 and 2027 are shown in Table 3.8.

Table 3.8 : New Housing and Employment Shared Trips

	2015		2027	
	AM	PM	AM	PM
Housing Trips	1,267	1,607	3,130	3,970
Employment Trips	610	565	1,144	1,059
Total Trips	1,877	2,172	4,274	5,029
Shared Trips	317	358	782	1,246
% Shared Trips	17%	16%	18%	25%
Total New Trips	1,561	1,814	3,492	3,783

Traffic growth from 2004 to 2010, 2015 and 2027 is shown in Table 3.9. This traffic growth includes the new trips detailed in Table 3.8 and NRTF low growth on the A90.

Table 3.9 : Traffic Growth

Year	AM			PM		
	Matrix Total	Growth from 2004	% Growth	Matrix Total	Growth from 2004	% Growth
2004	8,744			11,601		
2010	11,305	2,561	29%	14,738	3,137	21%
2015	12,912	4,168	48%	16,613	5,012	34%
2027	15,091	6,347	73%	18,794	7,193	62%



Existing profiles from similar zones in the base model were used for each of the new developments.

4 MODEL TESTING

4.1 2015 Do-Minimum

The 2015 Do-Minimum model is built from the 2010 Reference Case model. The developments included in this scenario are A, E (40%) and F (40%). Links were added to the model where necessary to allow connection of the new development zones. Figure 4.1 shows the 2015 Do-Minimum network.

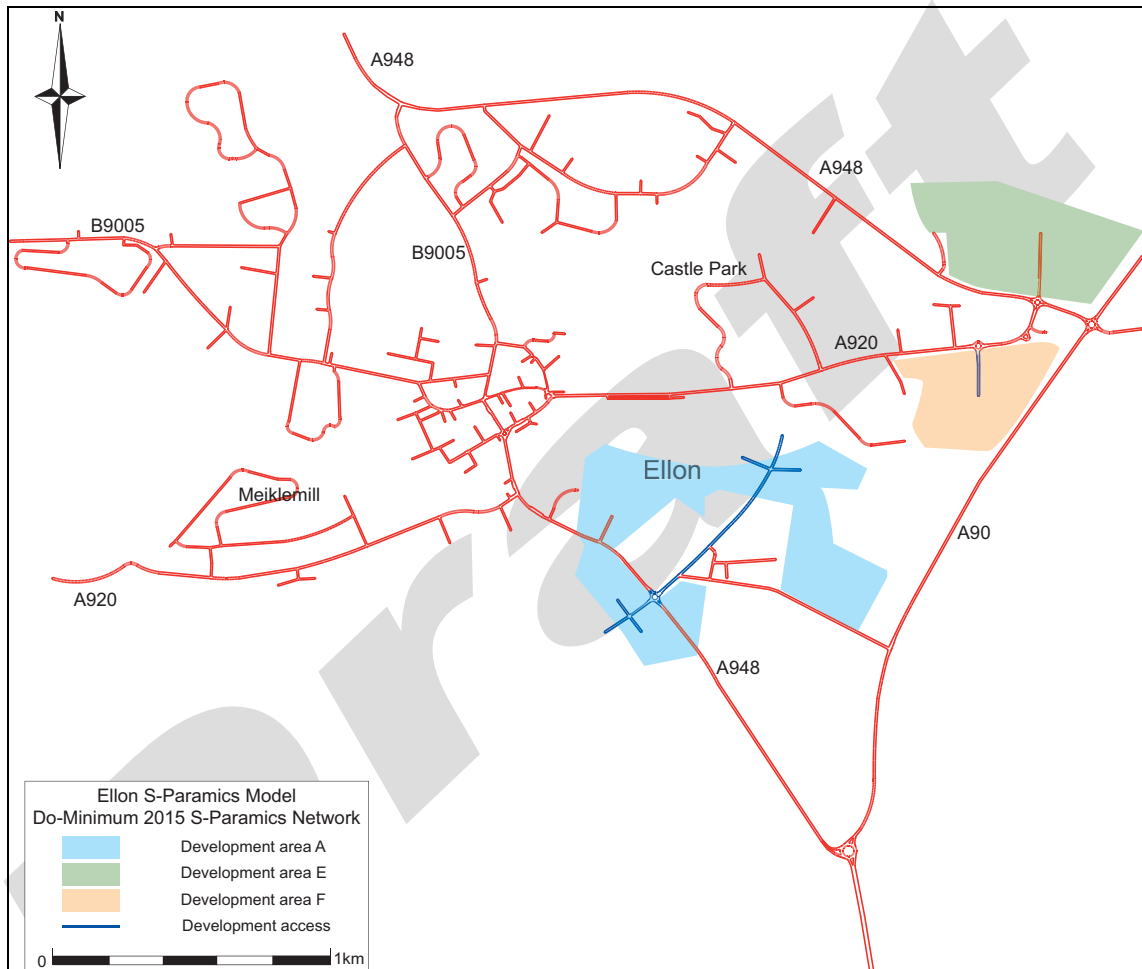


Figure 4.1 : 2015 Do-Minimum Network

4.2 2015 Do-Something

The 2015 Do-Something model includes the addition of a new link road from Castle Road (A920), connecting with South Road (A948) and continuing to Riverside Road (A920). This route would incorporate a new river crossing. Figure 4.2 shows the Do-Something network.



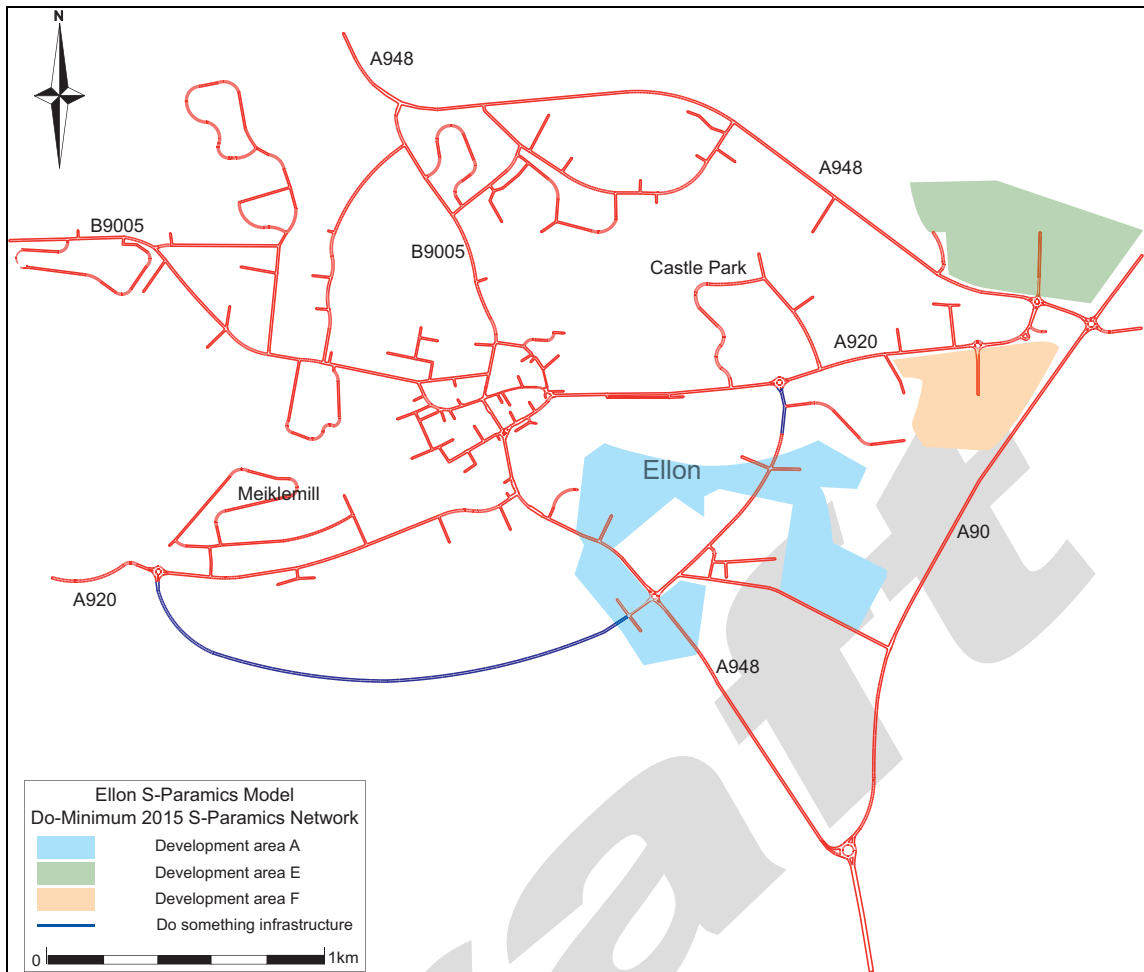


Figure 4.2 : 2015 Do-Something Network

4.3 2027 Do-Minimum

The 2027 Do-Minimum scenario is based on the 2015 Do-Something, and includes the additional housing developments B, C and D, plus A, E (75%) and F (75%).

Figure 4.3 shows the 2027 Do-Minimum.



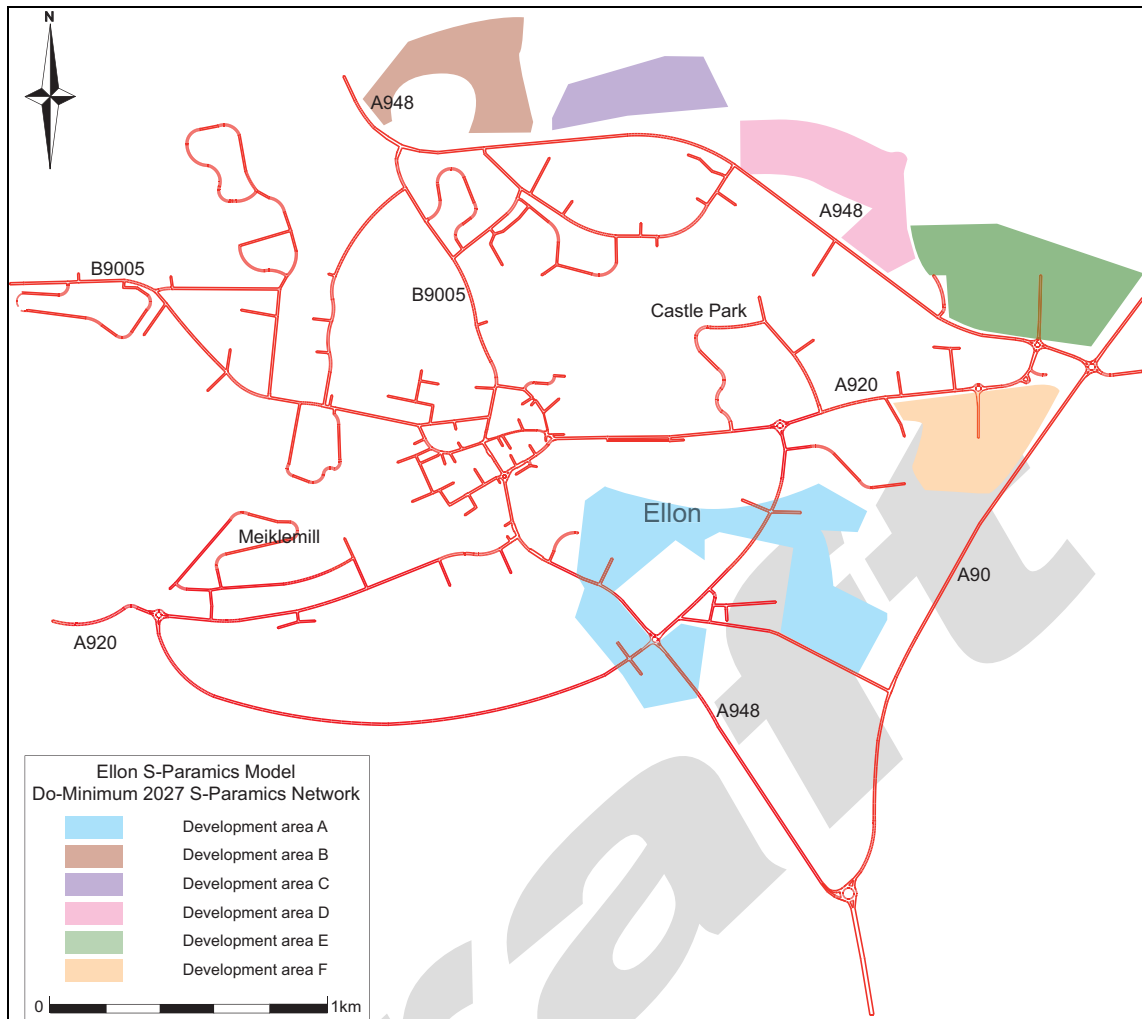


Figure 4.3 : 2027 Do-Minimum Network

4.4 Model Observations

4.4.1 2015 Do-Minimum

In the AM peak, significant queueing is observed on the B9005 northbound, Market St westbound and Station Rd eastbound, intermittently throughout the model period.

In the PM peak, significant queueing is observed on the B9005 northbound, A920 eastbound, Castle Rd westbound and A90 Northbound. The town centre area is congested throughout much of the PM period, with queueing observed on streets such as Bridge St, Schoolhill Rd, Station Rd, Union St and Ythan Terrace.

4.4.2 2015 Do-Something

In the AM peak no significant congestion is observed.

In the PM peak, queueing is observed on the B9005 northbound but queue lengths are greatly reduced compared to the 2015 Do-Minimum. Congestion in the town centre area is also significantly reduced.

4.4.3 2027 Do-Minimum

In the AM peak, some congestion is observed in the town centre area, on Union St, Station Rd and Bridge St.



In the PM peak the town centre area is congested for much of the period, and queueing is also observed on the A90 northbound and the A948 southbound at the roundabout to the south of Ellon.

4.5 Results

The model outputs were analysed based on five runs for each scenario. Two aspects of the network were assessed in order to gauge the operation of the scenario. These were:

- Journey times on key routes
- Queue lengths at key locations

4.6 Journey Time Analysis

Seven journey time routes were assessed in both the AM and PM peak periods:

- A90 NB – A90/A948 roundabout to A90/A920 roundabout
- A90 SB – A90/A920 roundabout to A90/A948 roundabout
- A948 NB – A90/A948 roundabout to South Rd/ Market St junction
- A948 SB – South Rd/ Market St junction to A90/A948 roundabout
- Golf Rd NB – B9005/ Golf Rd junction to Golf Rd/ A948 junction
- Golf Rd SB – Golf Rd/ A948 junction to B9005/ Golf Rd junction
- Castle Rd WB – A948/ A920 junction to A920/ Market St junction



Journey time routes are illustrated in Figure 4.4.

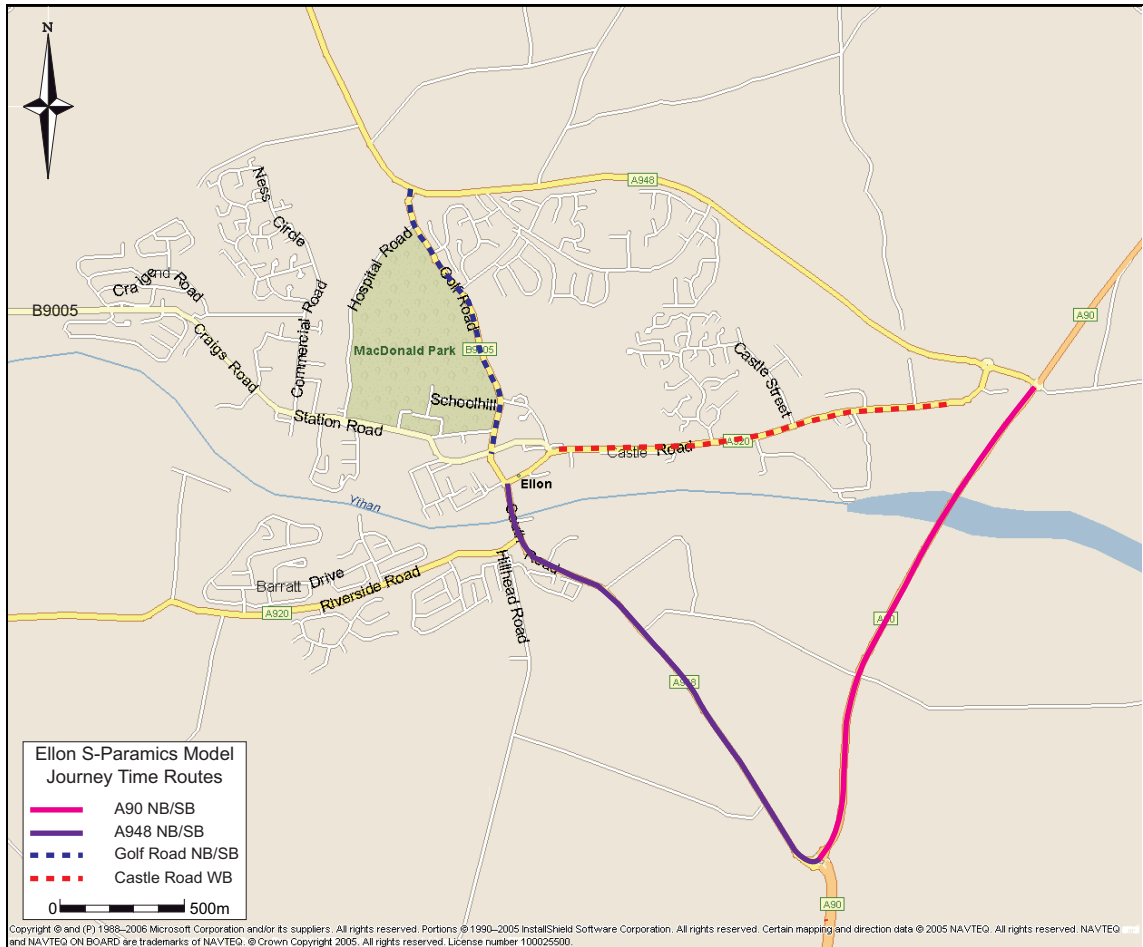


Figure 4.4 : Journey Time Routes



AM peak journey times are shown in Figures 4.5 to 4.11.

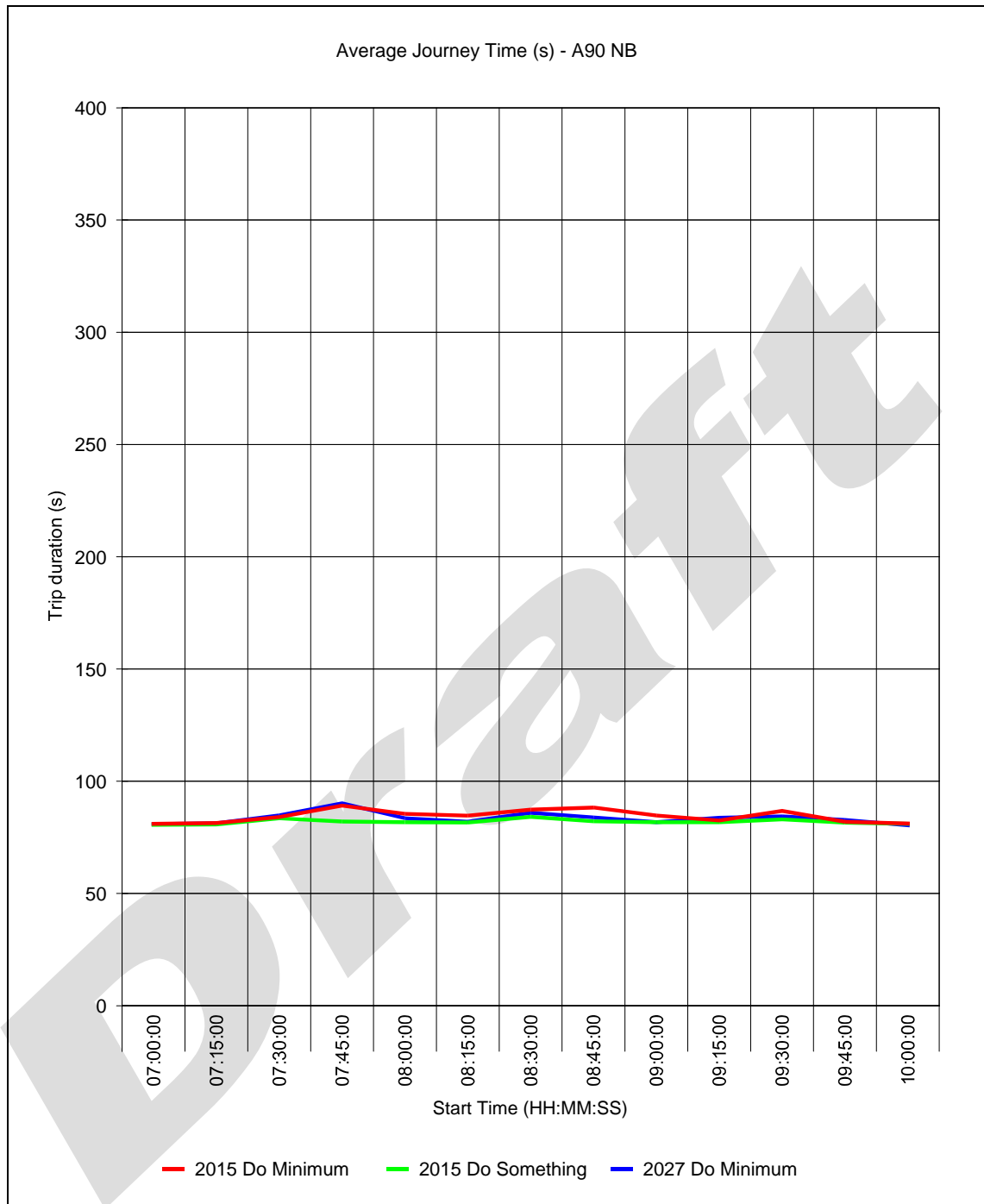


Figure 4.5 : AM Peak – A90 Northbound

Figure 4.5 shows no significant difference in journey time between the 2015 Do-Minimum and Do-Something scenarios and the 2027 Do-Minimum on the A90 northbound in the AM peak.



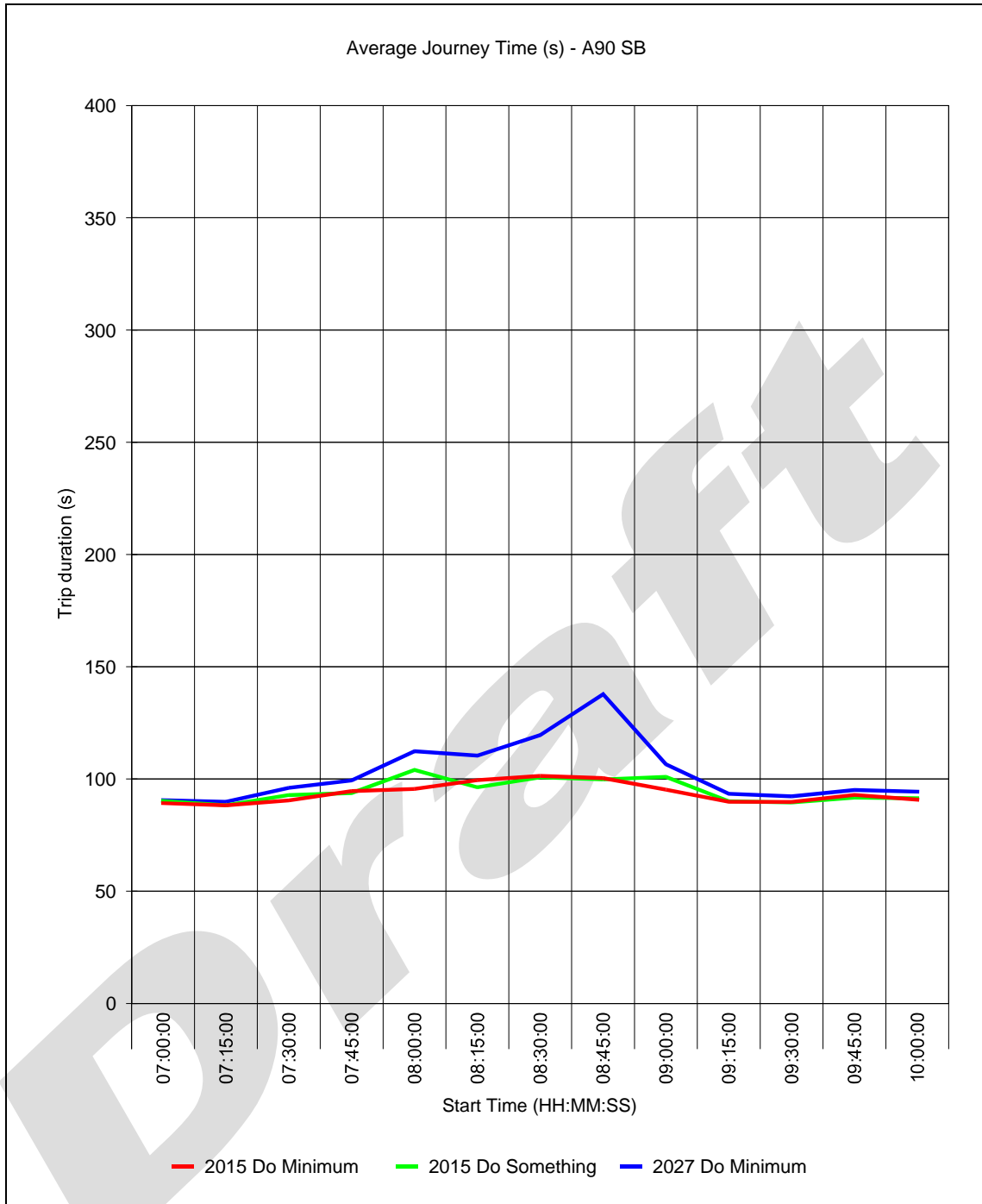


Figure 4.6 : AM Peak – A90 Southbound

Figure 4.6 shows no significant difference in journey time between the Do-Minimum and Do-Something scenarios on the A90 southbound in the AM peak, and an increase of approximately 25s at 08:45 in 2027.



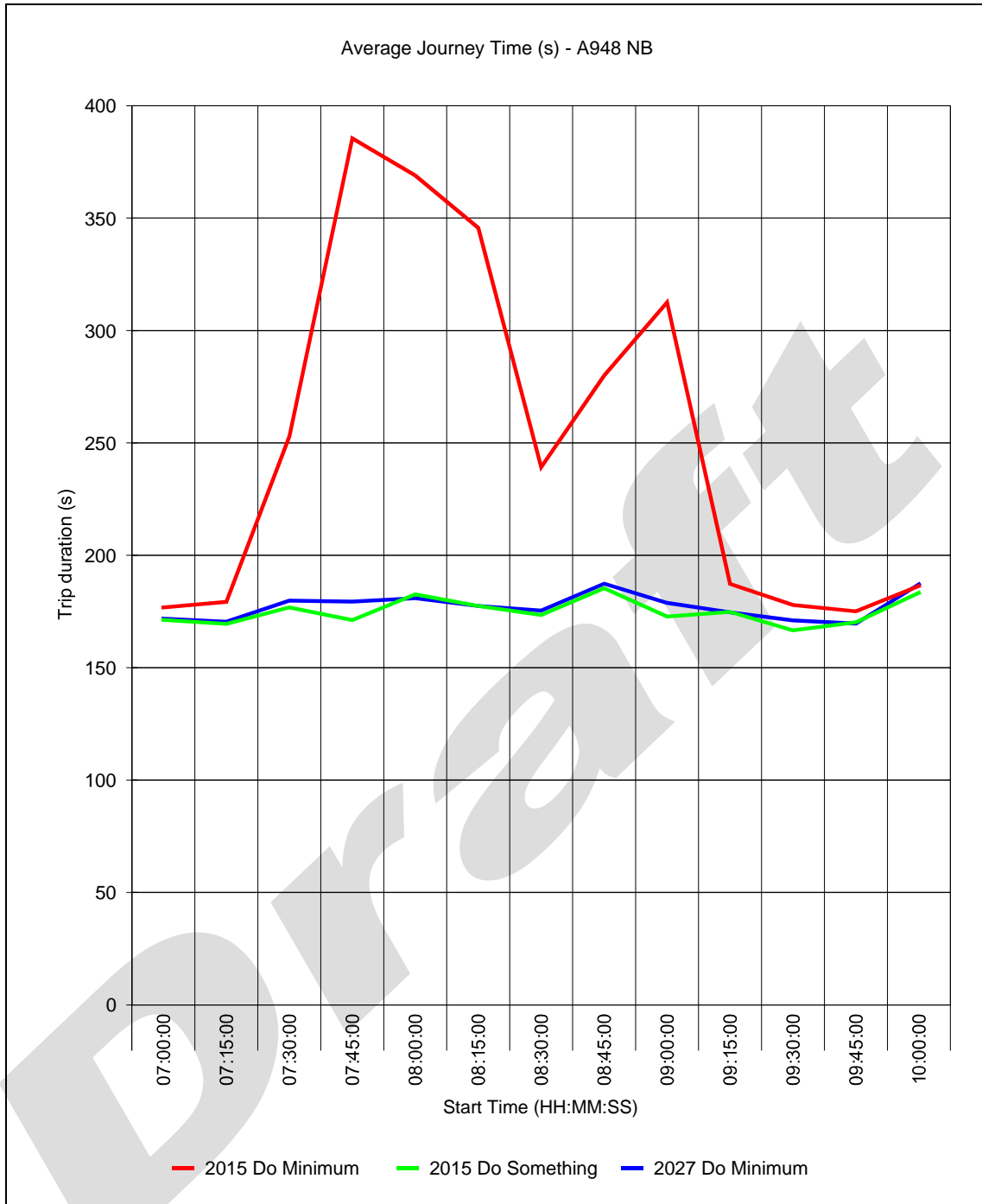


Figure 4.7 : AM Peak – A948 Northbound

Figure 4.7 shows that in the 2015 Do-Minimum, on the A948 northbound in the AM peak the journey time reached a peak of approximately 380 seconds (6mins 20s) between 07:45 and 08:00. In the 2015 Do-Something this was reduced to approximately 175 seconds (2mins 55s). The 2027 Do-Minimum showed similar journey times to the 2015 Do-Something.



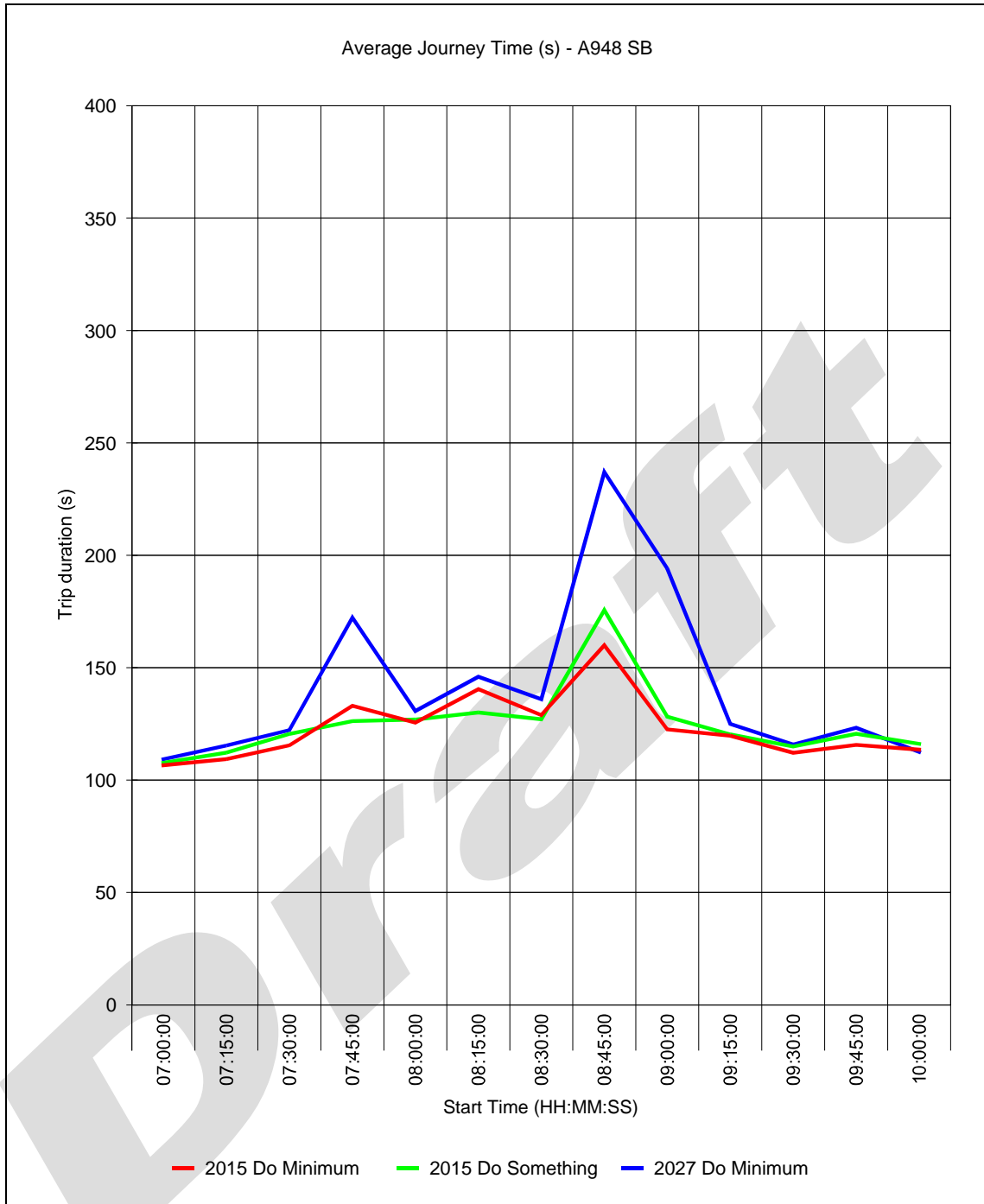


Figure 4.8 : AM Peak – A948 Southbound

Figure 4.8 shows no significant difference in journey time between the 2015 Do-Minimum and Do-Something scenarios on the A948 southbound in the AM peak. The 2027 Do-Minimum shows an increase of approximately 60s at 08:45.



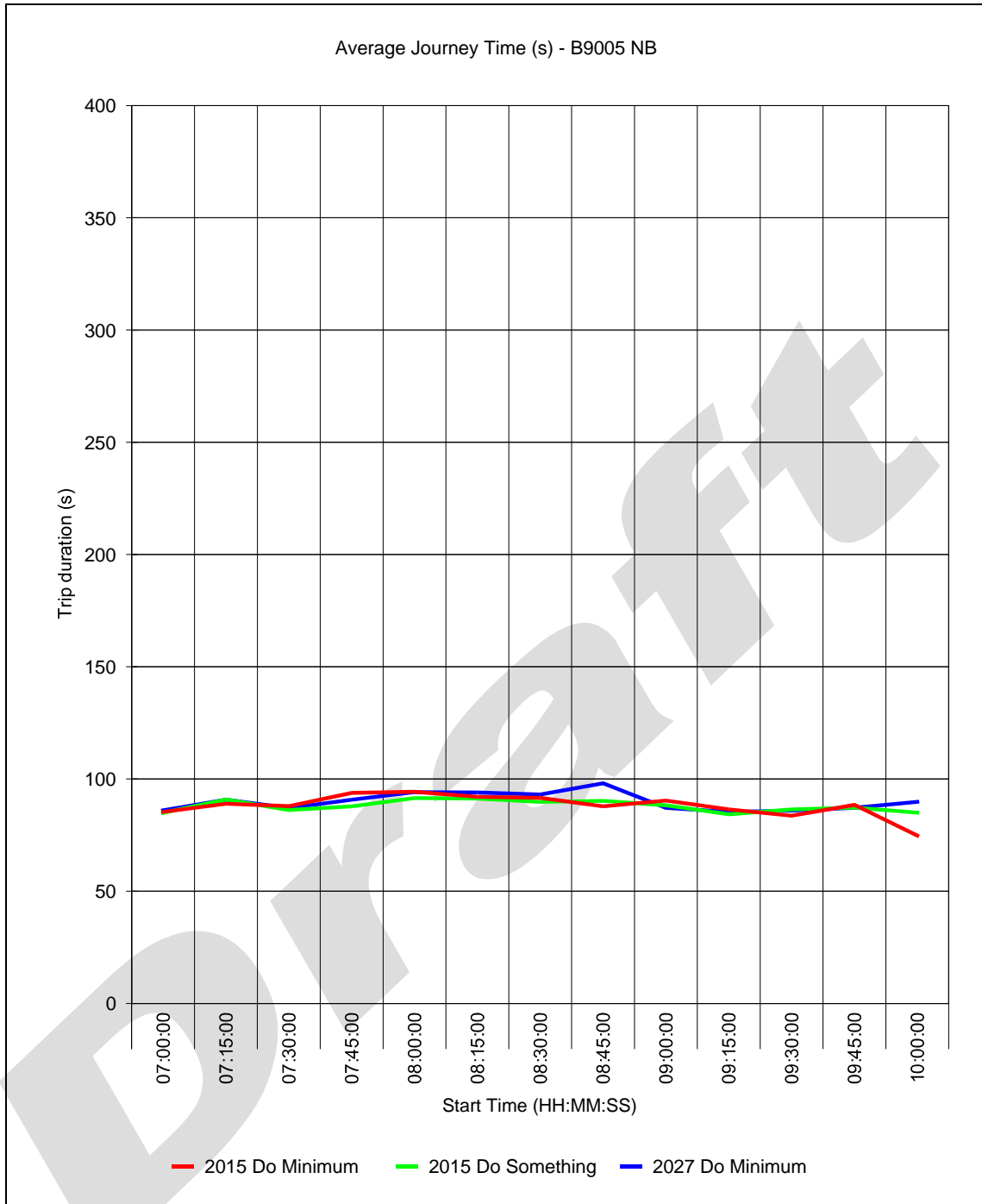


Figure 4.9 : AM Peak – B9005 Northbound

Figure 4.9 shows all three scenarios have very similar journey times on the B9005 northbound in the AM peak



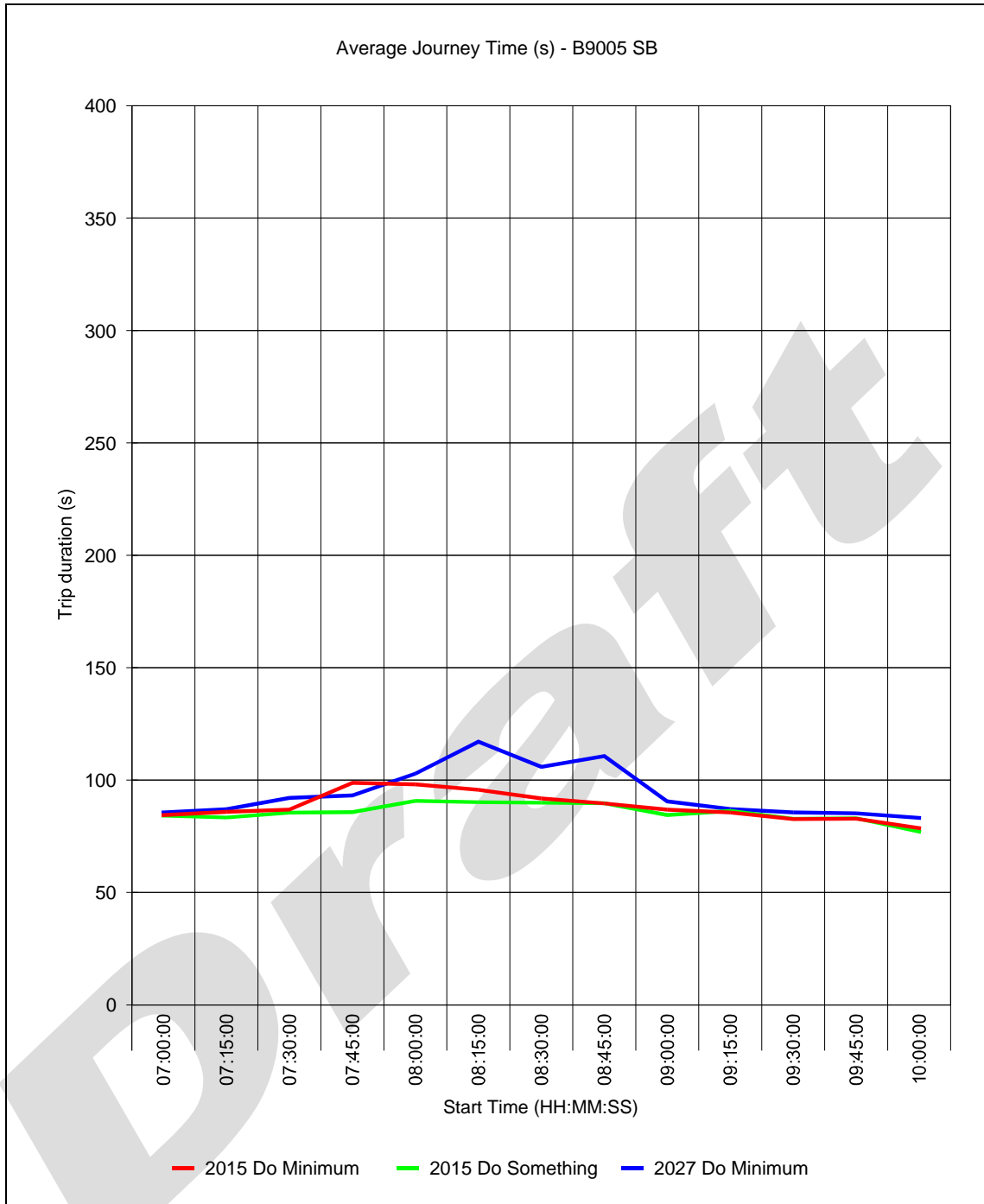


Figure 4.10 : AM Peak – B9005 Southbound

Figure 4.10 shows all three scenarios have a similar journey time on the B9005 southbound, with the 2027 Do-Minimum journey time approximately 20s longer between 08:15 and 08:45.



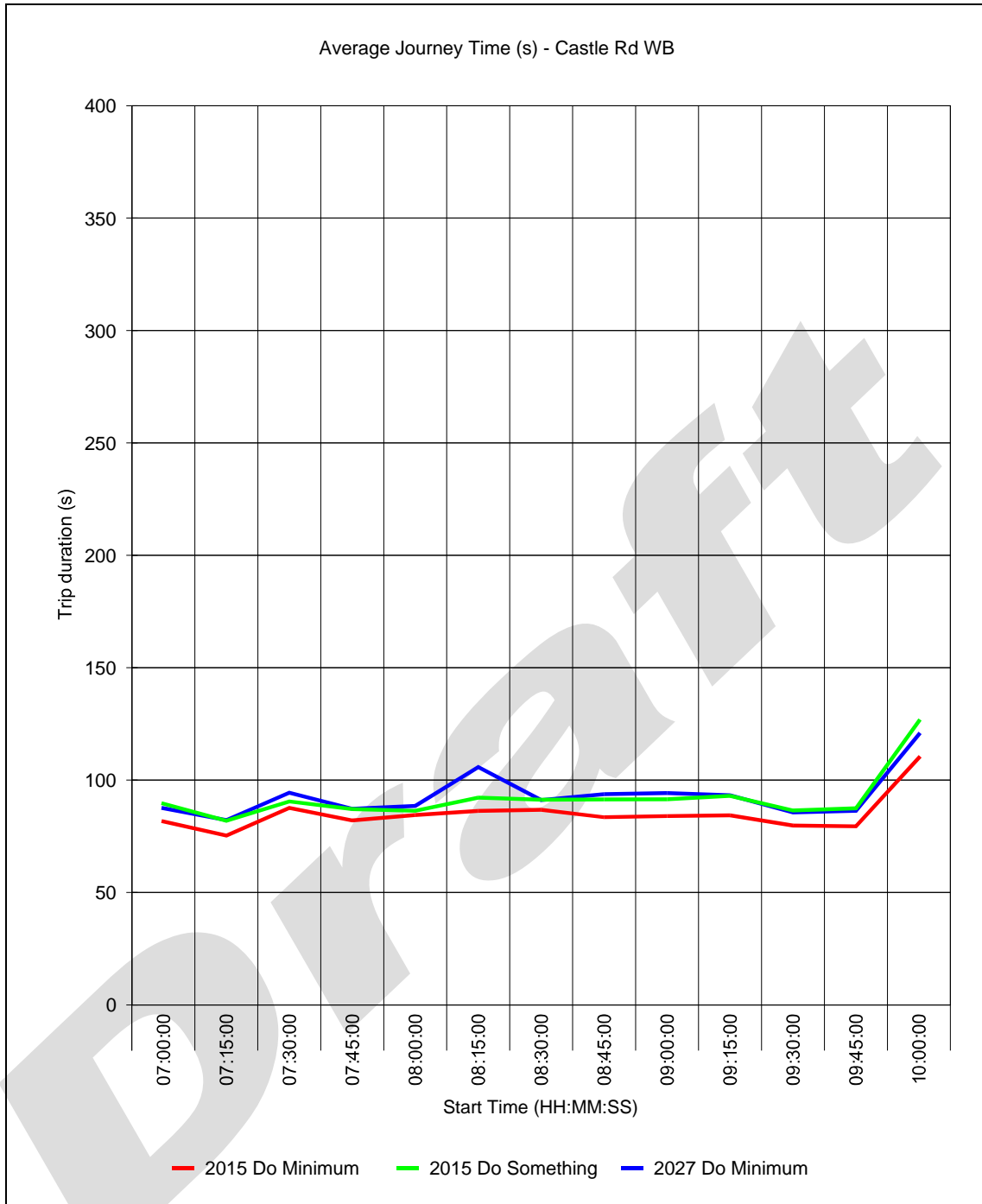


Figure 4.11 : AM Peak – Castle Rd Westbound

Figure 4.11 shows there is no significant difference in journey time between the three scenarios.

PM peak journey times are shown in Figures 4.12 to 4.17.



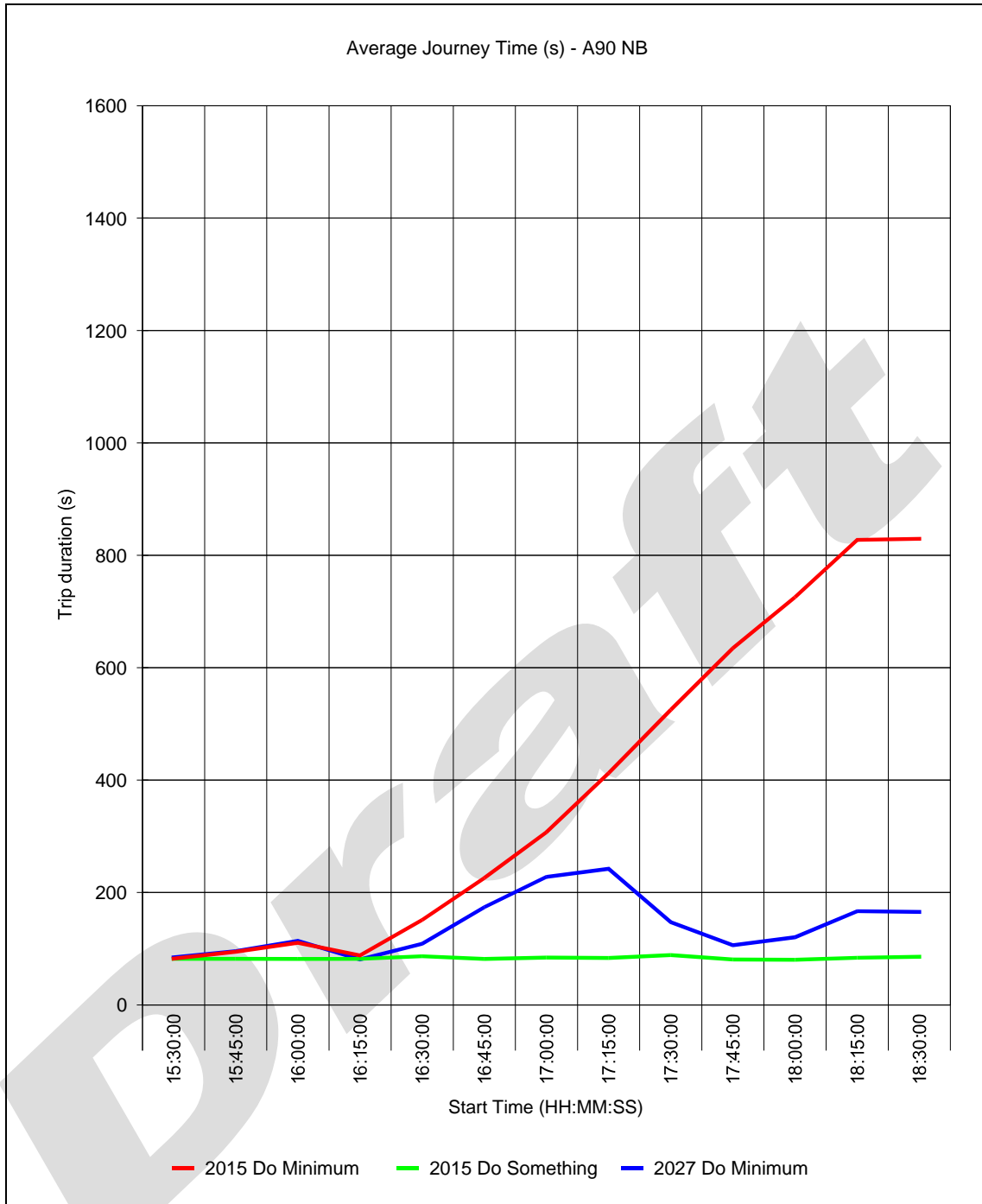


Figure 4.12 : PM Peak – A90 Northbound

Figure 4.12 shows that in the PM peak, the 2015 Do-Minimum journey time on the A90 northbound reaches approximately 800 seconds (13mins 20s). In the 2015 Do-Something scenario this reduces to less than 85 seconds throughout the model period. In the 2027 Do-Minimum this increases to just over 200s (3mins 20s) between 17:00 and 17:15.



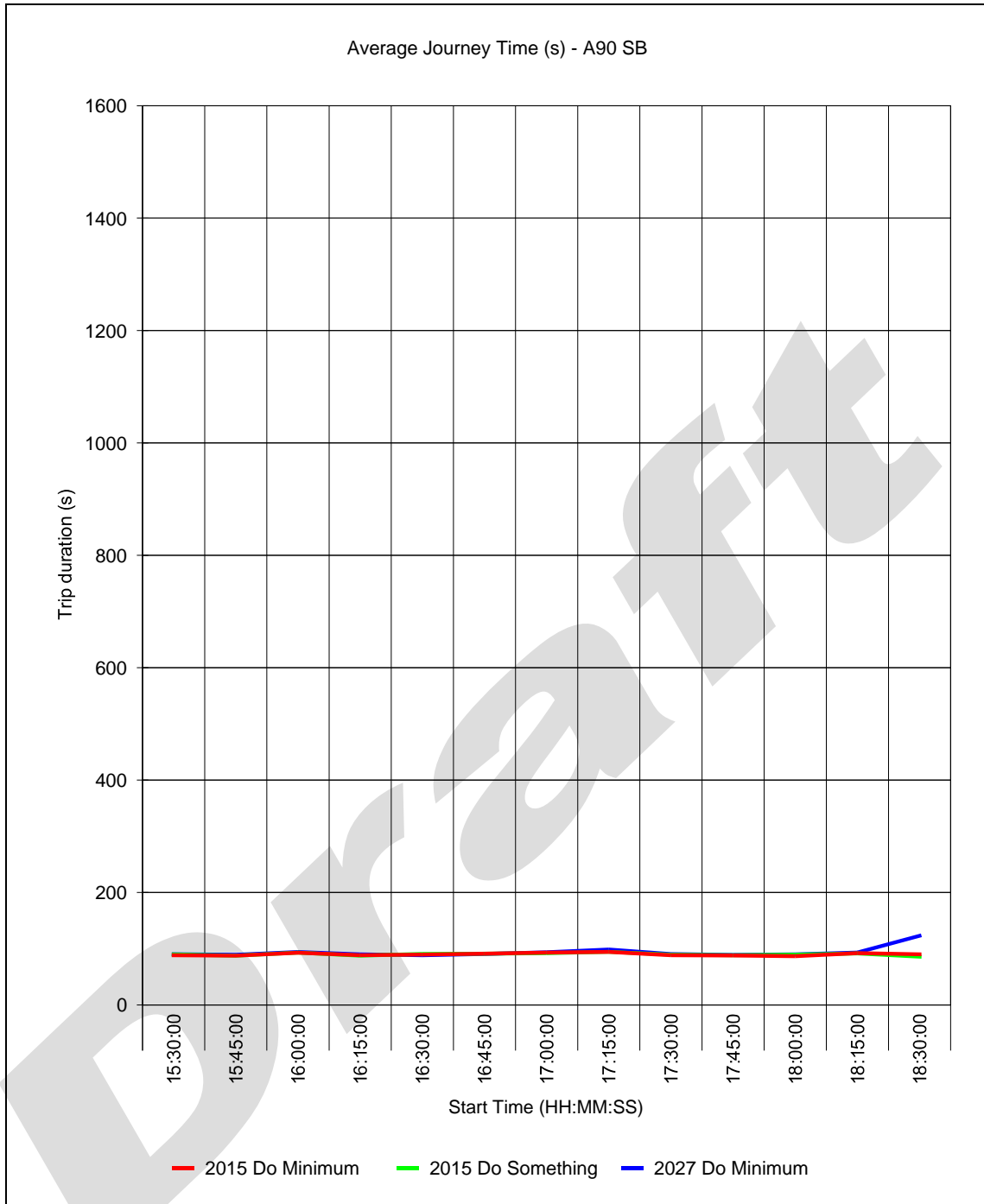


Figure 4.13 : PM Peak – A90 Southbound

Figure 4.13 shows that there is no significant difference in journey time between the 2015 Do-Minimum and Do-Something scenarios and the 2027 Do-Minimum on the A90 southbound in the PM peak.



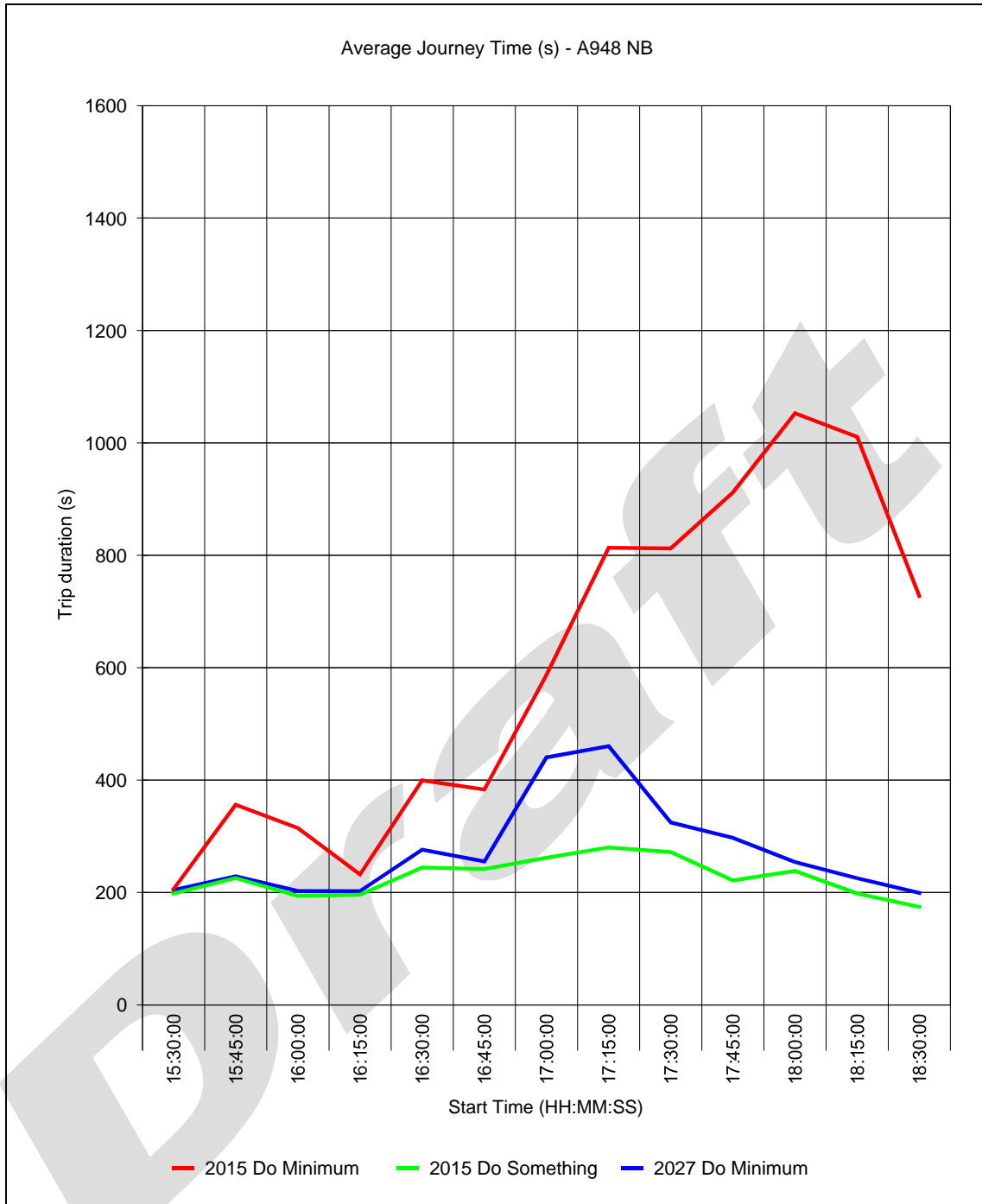


Figure 4.14 : PM Peak – A948 Northbound

Figure 4.14 shows that in the PM peak the journey time on the A948 northbound reaches approximately 1,300 seconds (21mins 40s) in the 2015 Do-Minimum scenario. In the 2015 Do-Something this is reduced to approximately 250 seconds (4mins 10s) throughout the model period. This increases to approximately 450 seconds (7mins 30s) between 17:00 and 17:15 in the 2027 Do-Minimum.



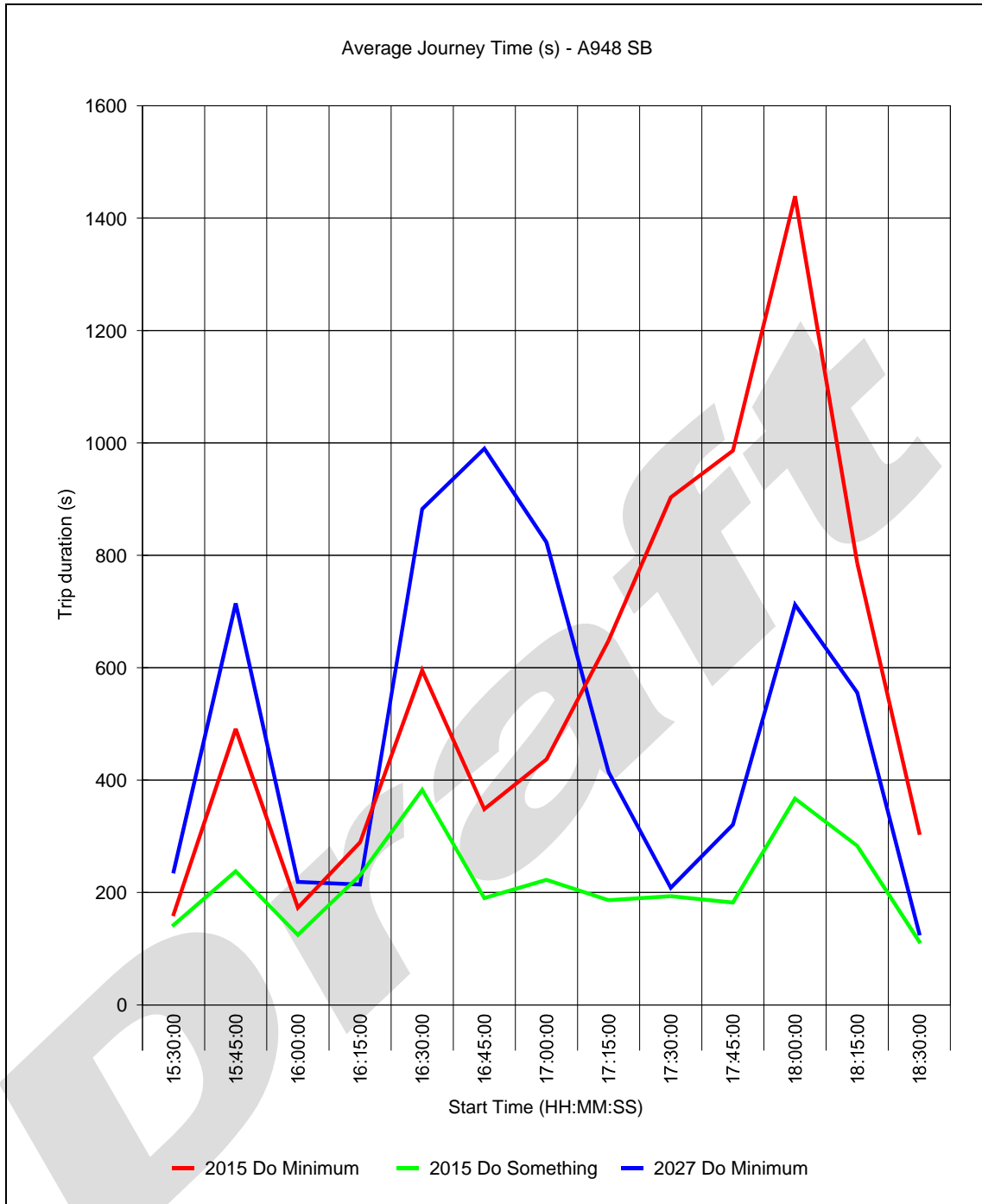


Figure 4.15 : PM Peak – A948 Southbound

Figure 4.15 shows that in the 2015 Do-Minimum scenario the journey time on the A948 southbound reaches 1,400 seconds (23mins 20s) by 18:00. In the 2015 Do-Something scenario this is reduced throughout the model period. The increase in traffic by 2027 causes the journey time to increase to approx 1,000 seconds (16mins 40s) at 16:45.



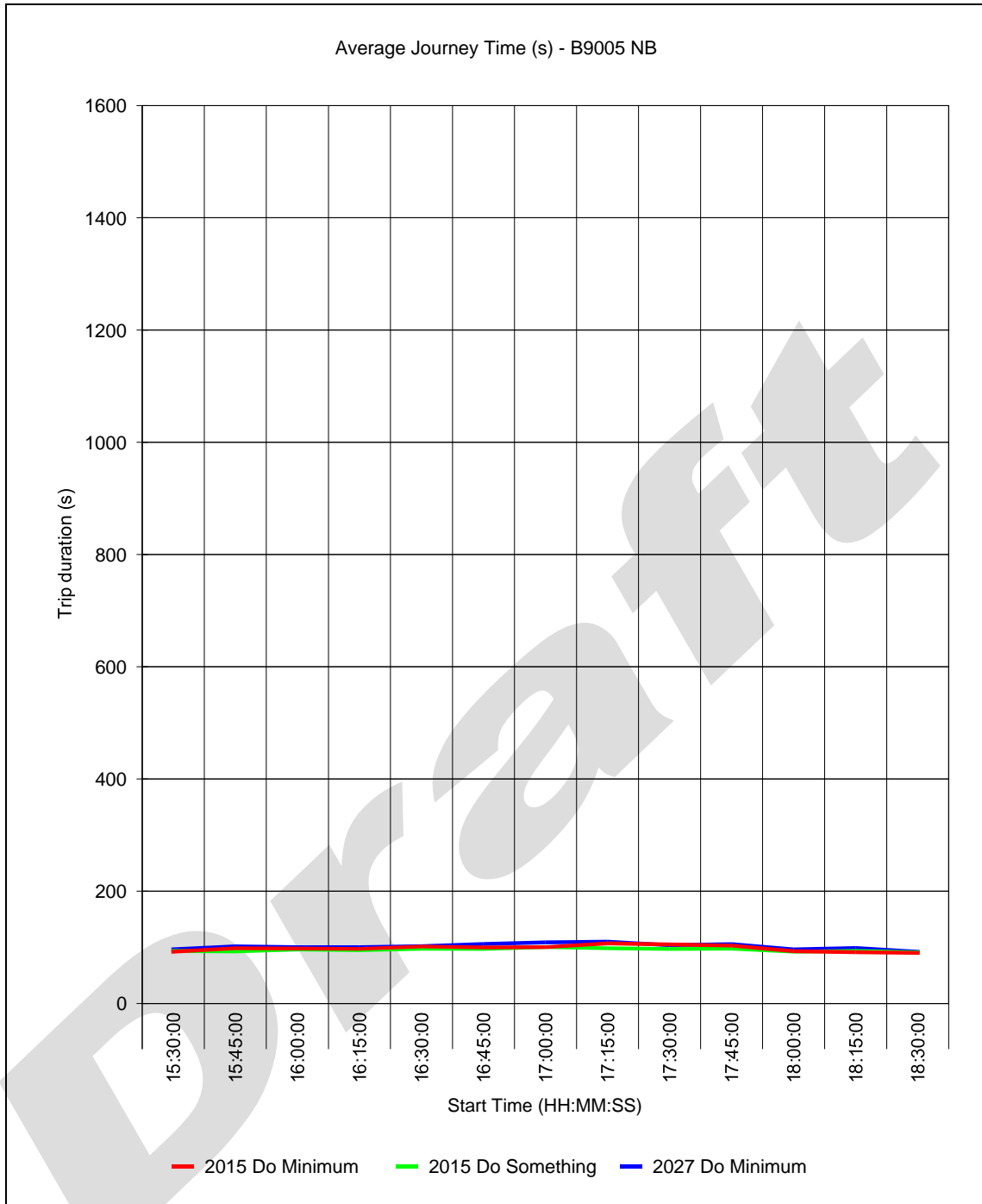


Figure 4.16 : PM Peak – B9005 Northbound

Figure 4.16 shows there is no significant queueing on the B9005 northbound in the PM peak.



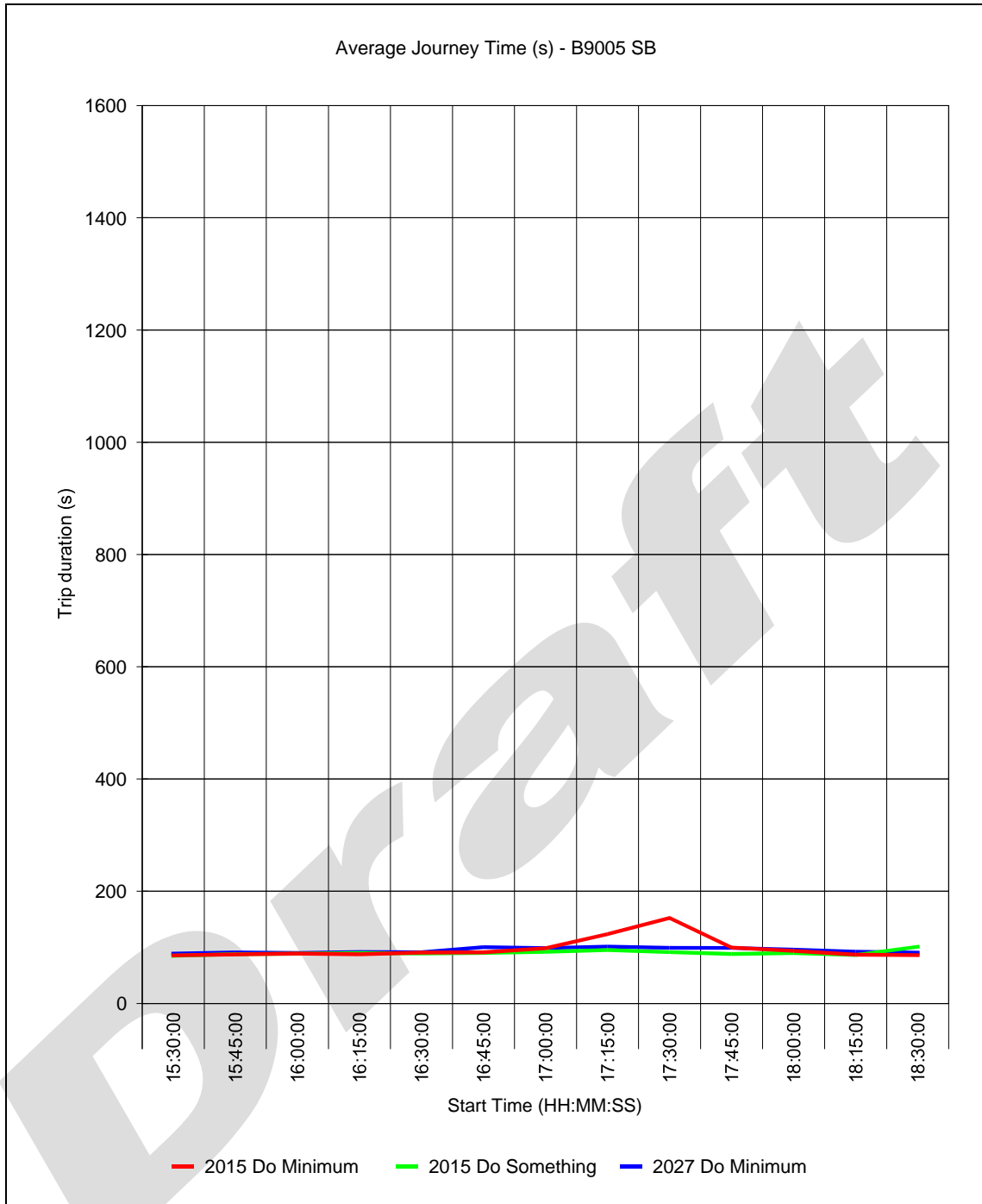


Figure 4.17 : PM Peak – B9005 Southbound

Figure 4.17 shows there is no significant queueing on the B9005 southbound in the PM peak.



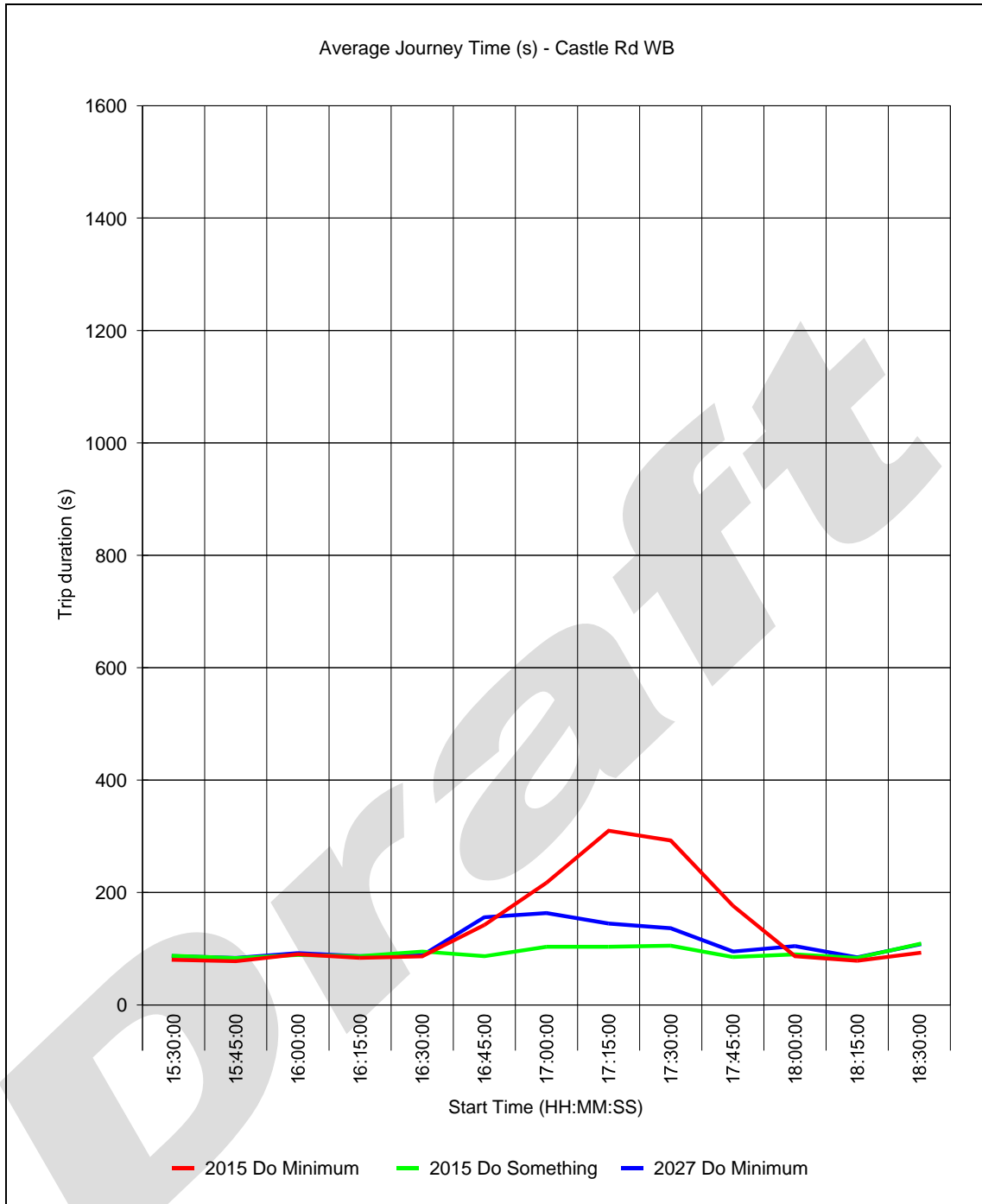


Figure 4.18 : PM Peak – Castle Rd Westbound

Figure 4.18 shows the journey time on Castle Rd westbound in the 2015 Do-Minimum is 300 seconds (5mins) at 17:15. in the 2015 Do-Something and 2027 Do-Minimum this reduces to 100 seconds (1min 40s) and 175 seconds (2mins 55s) respectively.

4.7 Queue Length Analysis

Queue lengths were assessed at three key locations in the network:

- A90 NB – queue length from the A90/A948 roundabout
- A948 NB – queue length from the A948/A920 junction
- A920 EB – queue length from the A920/ A948 junction



Queue length locations are illustrated in Figure 4.19.

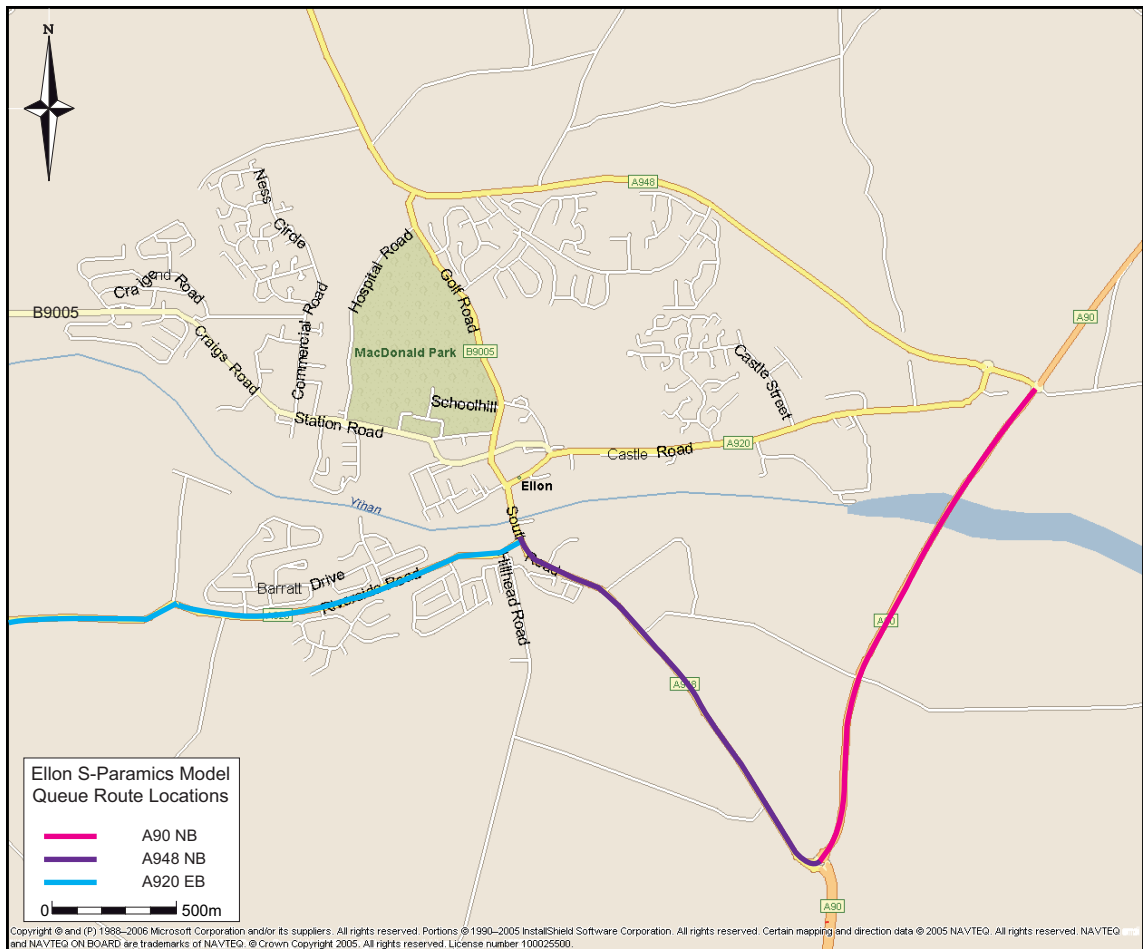


Figure 4.19 : Queue Locations



Results for the AM peak are shown in Figures 4.20 to 4.22.

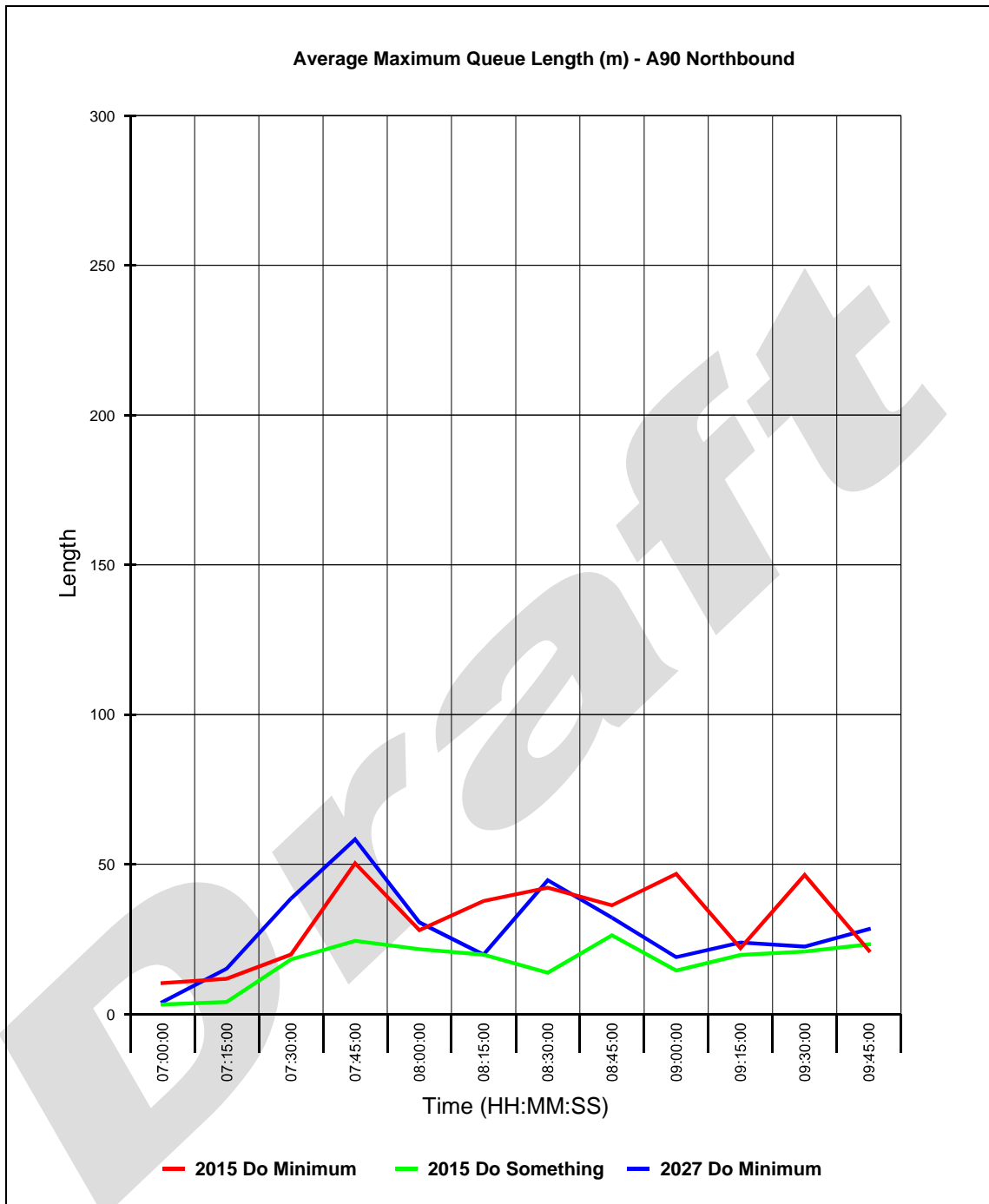


Figure 4.20 : AM Queueing – A90 Northbound

Figure 4.20 shows that in the 2015 Do-Something, queueing on the A90 northbound is reduced by approximately 25m by introducing the improvements, compared to the 2015 Do-Minimum. Queueing in the 2027 Do-Minimum is similar to the 2015 Do-Minimum.



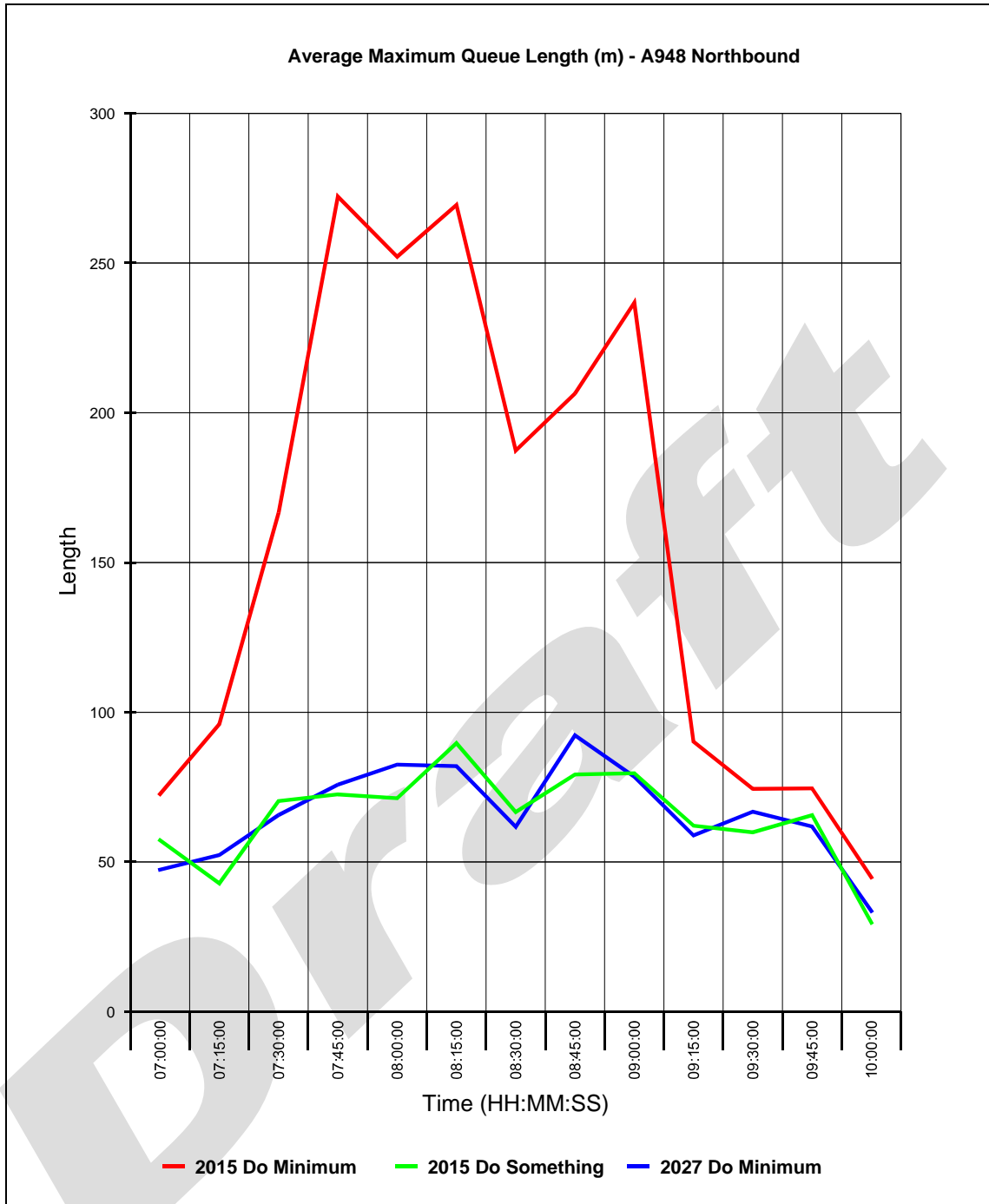


Figure 4.21 : AM Queueing – A948 Northbound

Figure 4.21 shows that in the 2015 Do-Minimum scenario significant queuing was observed on the A948 northbound, reaching approximately 270m at 08:15. This is reduced to less than 100m throughout the PM period in the 2015 Do-Something and 2027 Do-Minimum scenarios.



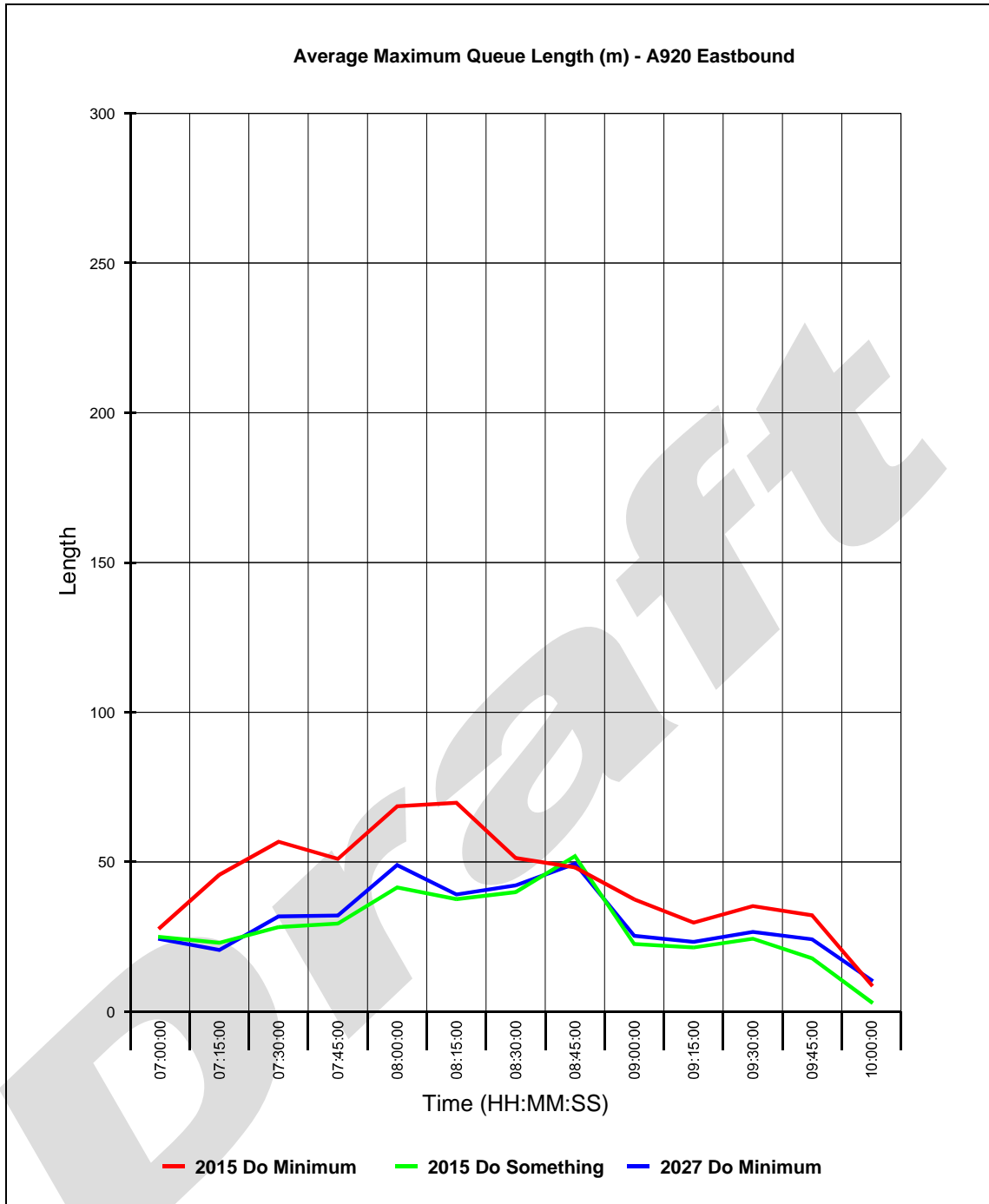


Figure 4.22 : AM Queueing – A920 Eastbound

Figure 4.22 shows that in the AM peak, queueing on the A920 eastbound is reduced by approximately 25m by introducing the improvements in the 2015 Do-Something model, compared to the 2015 Do-Minimum. Queueing in the 2027 Do-Minimum is similar to the 2015 Do-Something.



Queue results for the PM peak are shown in Figures 4.23 to 4.25.

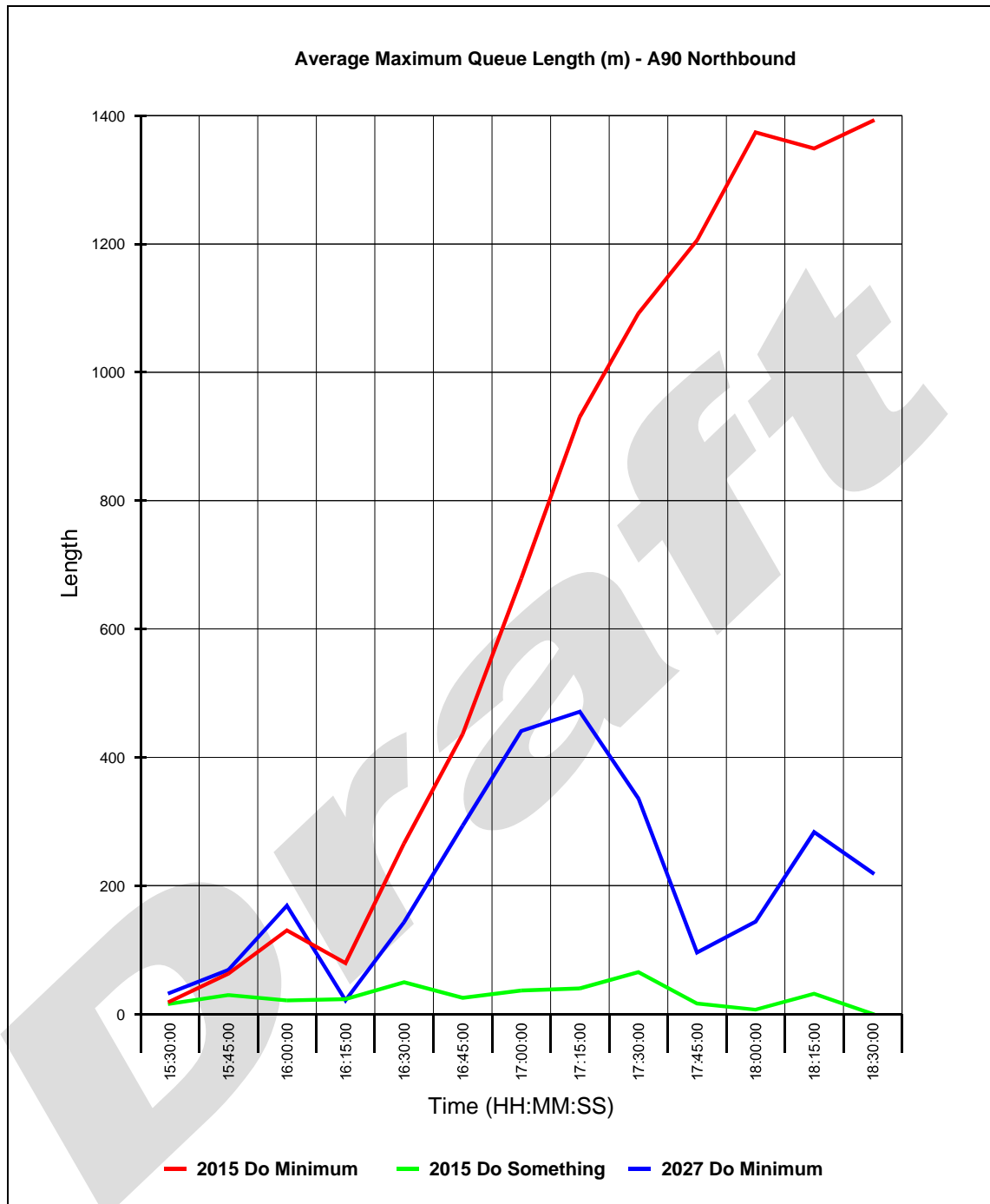


Figure 4.23 : PM Queueing – A90 Northbound

Figure 4.23 shows that queue lengths in the 2015 Do-Minimum model extend to approximately 1,200m at 18:15. This is reduced in the 2015 Do-Something model to less than 50m for the whole PM period. In the 2027 Do-Minimum queue lengths reach approximately 450m at 17:15.



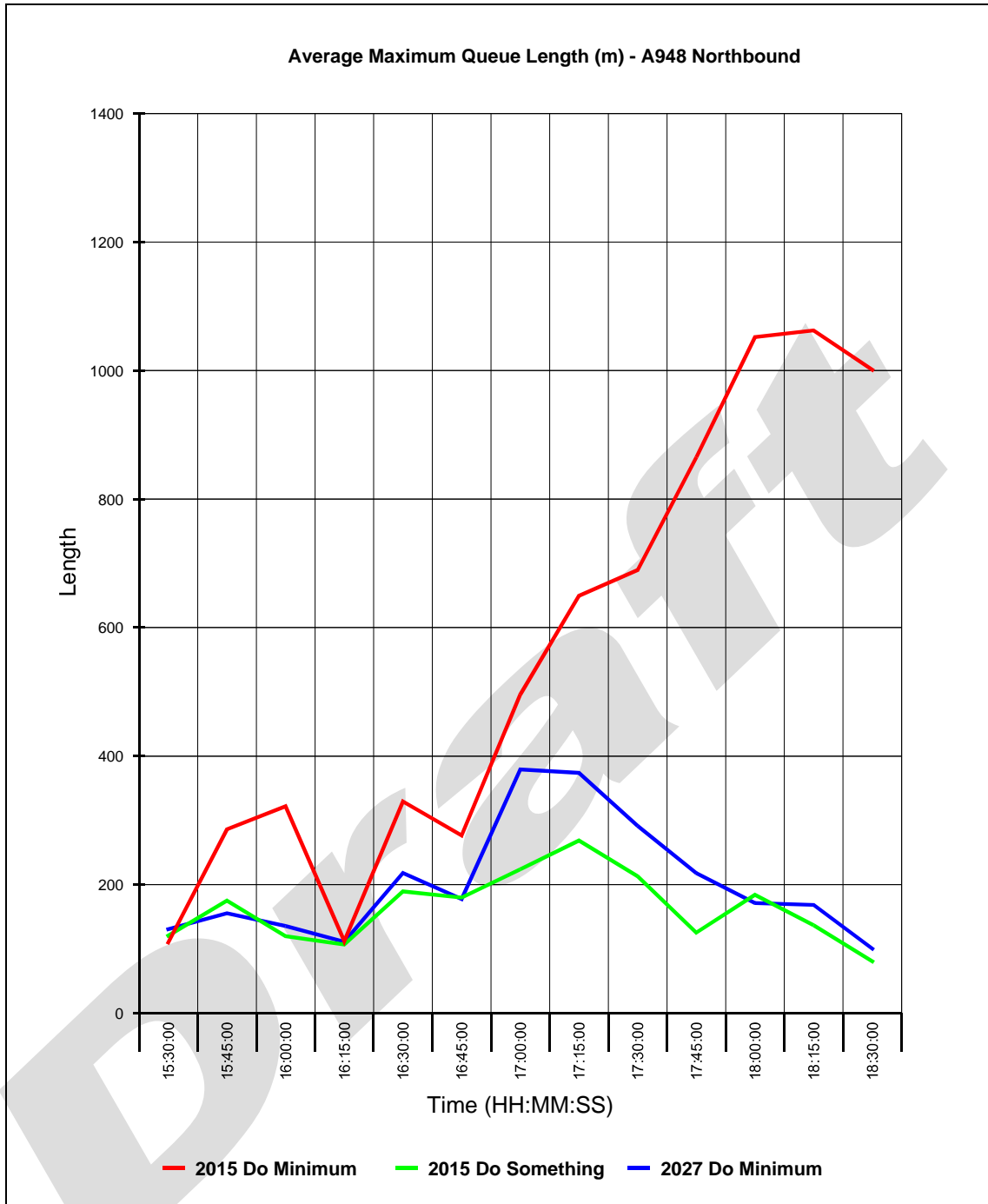


Figure 4.24 : PM Queueing – A948 Northbound

Figure 4.24 shows that in the 2015 Do-Minimum model queue lengths reach approximately 1,050m at 18:00 on the A948 northbound. In the 2015 Do-Something scenario this reduces to approximately 200m. In the 202 Do-Minimum queue lengths increase to approximately 400m at 17:00.



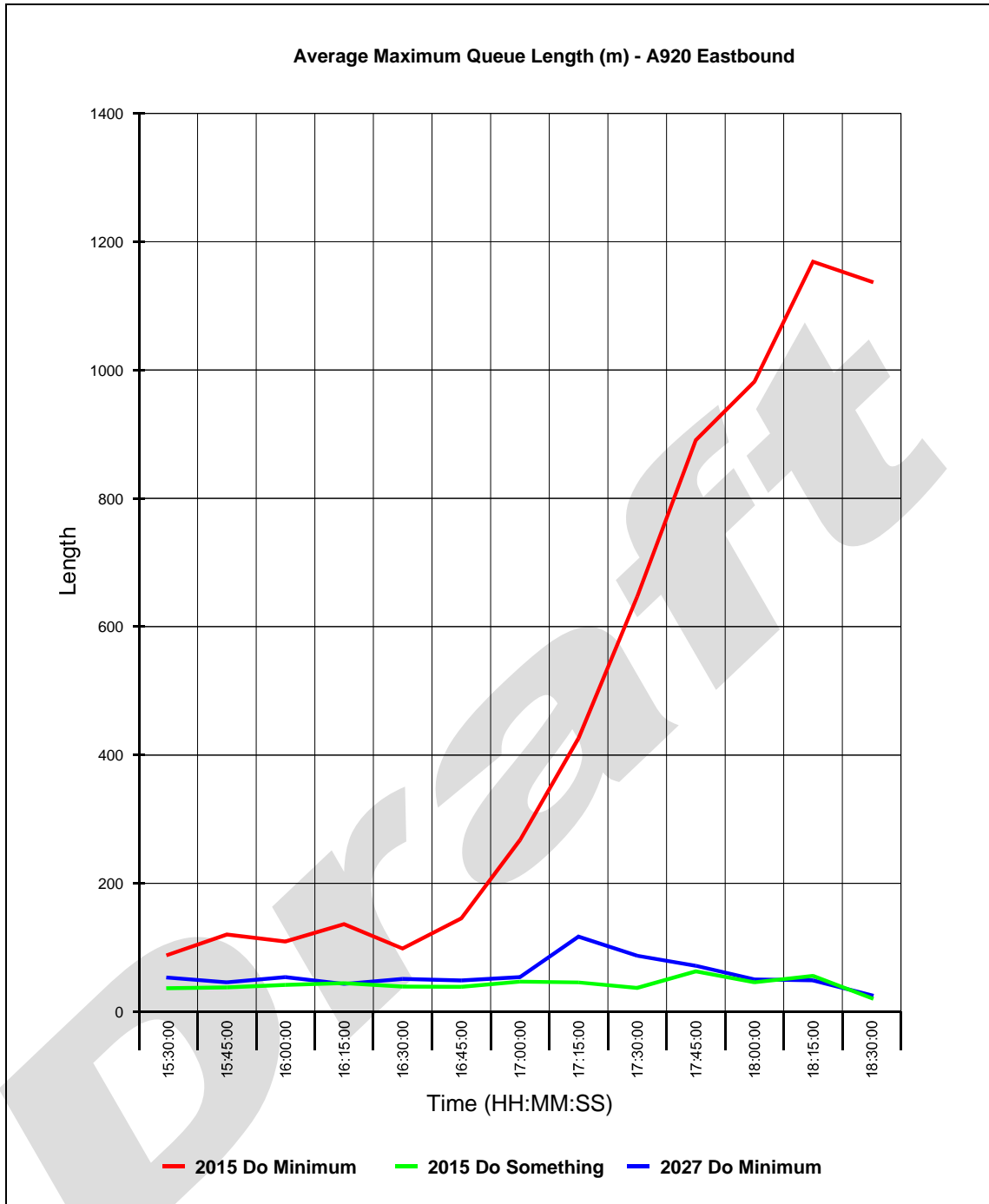


Figure 4.25 : PM Queueing – A920 Eastbound

Figure 4.25 shows queue lengths on the A920 eastbound in the PM peak reach approximately 900m in the 2015 Do-Minimum scenario. In the 2015 Do-Something scenario queue lengths do not exceed 50m throughout the PM period. Queue lengths in the 2027 Do-Minimum increase to approximately 100m at 17:15.



5 SUMMARY

5.1 Summary

With the inclusion of new developments, the 2015 Do-Minimum scenario is observed to be congested on the A948 northbound in the AM peak and on the A948 northbound, A90 northbound and A920 eastbound in the PM peak.

The 2015 Do-Something scenario, with the addition of a new link road from Castle Road (A920), connecting with South Road (A948) and continuing to Riverside Road (A920), shows significant benefits in the PM peak. Journey times and queue lengths are reduced at key locations, particularly northbound on the A90 and A948.

In 2027, the additional development traffic results in increased congestion in the town centre area in the PM peak. The results show journey times are generally only slightly increased compared to the 2015 Do-Something. Queue lengths are also similar to the 2015 Do-Something, with an increase in queue length observed on the A90 northbound in the PM peak, though it is still significantly shorter than the 2015 Do-Minimum.

The improvements implemented in the 2015 Do-Something scenario have been observed to provide sufficient capacity to allow the 2027 development traffic to operate, in the model network.

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