Appendix G Future Year Modelling Report

Future Year Modelling Report

Distribution Centre Penllergaer

Hydrock now Stantec

Prepared for:
Stoford Properties Ltd

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Table of Contents

Document control sheet ..... **i**
1 Introduction **3**
1.1 Commission 3
1.2 Development Proposal 3
1.3 Base Model Calibration and Validation 3
1.4 Purpose of this Report 3
1.5 Report Structure 3

2 Do Minimum Forecasting Methodology **5**
2.1 Introduction 5
2.2 Demand Forecasting 5
2.2.1 Outline Methodology 5
2.3 Committed Development Sites 5
2.3.1 Traffic Growth 7
2.3.2 Effective Traffic Growth 9
2.3.3 Committed Highway Schemes and Infrastructure 9

3 With Development Forecasting Methodology **10**
3.1 Introduction 10
3.2 Development Proposal 10
3.3 Vehicle Trip Generation and Distribution 10
3.4 Site Access 11
3.5 Assignment of Development Trips 11

4 Modelling Results **12**
4.1 Introduction 12
4.2 Network Wide Model Statistics 12
4.2.1 Analysis of Network Wide Model Statistics 15
4.3 Journey Time Analysis 15

5 Mitigation Modelling **19**
5.1 Mitigation Scheme 19
5.2 Mitigation Modelling Results 20
5.3 Network Wide Model Statistics 20
5.3.1 Analysis of Network Wide Model Statistics 26
5.4 Journey Time Analysis 27
5.5 Junction Statistics 30
5.5.1 M4 Junction 47 Penllergaer Interchange 31
5.5.2 M4 Junction 46 33
5.5.3 Penllergaer Business Park Roundabout 36
5.5.4 A48 Clasemont Road / Pant Lasau Road 38
5.5.5 Analysis of Junction Statistics 39

6 Summary and Conclusion **41**
6.1 Introduction 41
6.2 Future Year Modelling 41
6.3 Conclusion 41

List of Tables

Table 1: Summary of Committed Development Sites 6
Table 2: Estimated Residential Summary 7
Table 3: NTM / TEMPro Search Criteria 8

List of Figures

Figure 1: Journey Time Routes 16

1 Introduction

1.1 Commission

Stantec has been appointed by Stoford Properties Ltd to undertake Aimsun modelling of proposals to provide a distribution centre on land south of the A48 at Penllergaer.

1.2 Development Proposal

The proposed development will accommodate a floor area of 12,465sqm, located within Penllergaer Business Park, with vehicular access provided from the A48 as outlined within the Transport Assessment.

1.3 Base Model Calibration and Validation

The base model has been calibrated and validated to meet all relevant criteria set out by TAG Unit M3.1. This is documented in full in the corresponding Model Validation Report[1].

1.4 Purpose of this Report

This report sets out the methodology adopted in developing the future year scenarios for the proposed development and describes the data that has been outputted from the model.

1.5 Report Structure

This report is structured as follows:

- Section 2 sets out a summary of the Do Minimum forecasting methodology and approach taken to derive the future year matrices
- Section 3 sets out a summary of the modelling methodology and the approach taken to derive the With Development future year matrices associated with the proposed development
- Section 4 presents the results of the microsimulation Aimsun modelling
- Section 5 presents proposed mitigation and associated modelling results

[1] *Distribution Centre, Penllergaer – Model Validation Report*, Hydrock now Stantec, 03 June 2025

- Section 6 summarises and concludes the report.

2 Do Minimum Forecasting Methodology

2.1 Introduction

This section sets out a summary of the Do Minimum forecasting methodology and approach taken to derive the future year matrices.

2.2 Demand Forecasting

2.2.1 Outline Methodology

The following outline methodology has been used to estimate the forecast year traffic demand for the 2027 opening year and 2037 future year scenarios:

- All committed and/or allocated sites to be included in the forecast year scenarios have been agreed with Swansea Council
- The trip generation for each site has been taken from the relevant Transport Assessments
- NTEM growth factors at district level have been derived from TEMPro with alternative development assumptions to avoid double counting of development trips.

2.3 Committed Development Sites

A list of committed developments was provided by Swansea Council. A summary of the committed development sites included in the forecast year scenarios is set out in Table 1. It is noted that whilst the Transport Assessments presented peak hour development trips only, these have been factored using TRICS data to provide hourly profiled trip matrices covering the modelling periods (07:00 to 10:00 and 15:00 to 19:00). This provides a robust assessment.

Table 1: Summary of Committed Development Sites

Ref	Site Name	Size	Units Already Built	Build Out Rate		Total Vehicle Trips (Units: vehicles)					
						AM Peak Hour			PM Peak Hour		
				2027	2037	Arr.	Dep.	Tot.	Arr.	Dep.	Tot.
1	Land North of Llewellyn Road Penllergaer, Swansea	166 dwellings	150 dwellings	166	166	14	61	75	45	22	67
2	Land North of Garden Village, Swansea	750 residential dwellings and 500 puplis school)	70 dwellings	210	750	239	338	576	286	177	466
3	Land South of the A4240 Parc Mawr Penllergaer Swansea	850 dwellings	100 dwellings	300	850	195	366	560	243	179	421

2.3.1 Traffic Growth

NTM/TEMPro locally adjusted core traffic growth factors have been derived from TEMPro v8.0. Given that the committed development sites outlined above represent a significant amount of future growth in Penllergaer, alternative planning assumptions have been applied in TEMPro to avoid double counting, as agreed with Swansea Council.

This has been done by reducing the future housing projections for the Swansea 004 MSOA based on the projected number of residential dwellings as a result of each respective committed development site.

This approach will avoid the double-counting of traffic on the basis that the excluded sites are calculated explicitly as set out at section 2.2 of this report. With reference to committed development phasing schedule set out in Table 1, a summary of the projected number of residential dwellings expected to be delivered, including the estimated year of delivery, is set out in Table 2.

Table 2: Estimated Residential Summary

Future Assessment Year Scenario	Dwellings Built
2027	340
2037	1,546

Having regard to the content of Table 2, locally adjusted traffic growth factors have been sourced from NTM/TEMPro based on based on the criteria set out in Table 3.

Table 3: NTM / TEMPro Search Criteria

Scenario	Core
Result Type	Trip ends by time period
Area Definition	Swansea 004
Base Year	2025
Future Year	2027 / 2037
Trip Purpose	All purposes
Area Type	All
Road Type	All
Transport Mode	Car driver
Trip end Type	Origin/Destination

The resulting factors used for cars are summarised in Table 4.

Table 4: NTEM / TEMPro Adjusted Growth Factors

Assessment Year	NTM Adjusted Growth Factor	
	AM Peak	PM Peak
2027	0.9707	0.9637
2037	0.8734	0.8385

As shown in Table 4 the level of committed development is in excess of any expected background growth. The adjusted growth factors suggest that a 3% (2027) and 13% (2037) reduction should be applied to the base trips in the model before adding on the committed development flows. In order to undertake a robust assessment no growth has been applied to the base year trips and the growth comes solely from the committed developments which far outweighs the NTEM adjusted growth factors.

2.3.2 Effective Traffic Growth

Based on the additional committed development traffic and growth in background traffic, a summary of the effective traffic growth in Swansea 004 MSOA by year and time period is presented in Table 5.

Table 5: Summary of Effective Traffic Growth

Time Period	2025	Effective Growth | Absolute Increase (% Increase)	
		2027	2037
AM Peak (07:00 – 10:00)	26,350	+285 (+1.1%)	+1,086 (+5.2%)
PM Peak (15:00 – 19:00)	33,865	+331 (+1.0%)	+1,242 (+4.6%)

2.3.3 Committed Highway Schemes and Infrastructure

As discussed with Swansea Council there were no committed and / or planned highway schemes or transport infrastructure in the study area that is expected to come forward between 2025 and 2037.

3 With Development Forecasting Methodology

3.1 Introduction

This section sets out a summary of the modelling methodology and the approach taken to derive the With Development future year matrices associated with the proposed development.

3.2 Development Proposal

The proposed development would seek to provide a distribution warehouse of approximately 12,465sqm. Vehicular access to the development is proposed to be provided from the existing roundabout on the A48 with small changes to the internal roundabout within Penllergaer Business Park.

3.3 Vehicle Trip Generation and Distribution

The vehicle trip generation and distribution is outlined within the Transport assessment and broken down per trip purpose. The total trip generation per vehicle is summarised in Table 6.

Table 6: Proposed Development Vehicle Trip Generation

Time Period	LGV		HGV	
	Arr.	Dep.	Arr.	Dep.
AM Peak Period				
07:00 to 08:00	216	216	11	11
08:00 to 09:00	216	216	11	11
09:00 to 10:00	216	216	11	11
PM Peak Period				
15:00 to 16:00	216	216	11	11
16:00 to 17:00	216	216	11	11
17:00 to 18:00	216	216	11	11
18:00 to 19:00	216	216	11	11

3.4 Site Access

The development is proposed to be accessed from a new layout at the Business Park internal roundabout, along with the existing simple priority-controlled junction. The proposed access arrangement has been coded into the Aimsun model based on the access arrangements as detailed within the Transport Assessment. The access arrangements are illustrated on Screenshot 1.

Screenshot 1: Aimsun Coding of Proposed Access Arrangement within Penllergaer Business Park



3.5 Assignment of Development Trips

Development trips have been assigned to arrive and depart to/from the site access onto the network. Three new centroids have been connected to the proposed site accesses in order for development trips to be assigned onto the network, with cars, LGVs and HGVs assigned to their relevant access points.

4 Modelling Results

4.1 Introduction

The following section presents the results of the Aimsun modelling.

To assess the impact of the proposed development, a 2027 opening year and 2037 future year has been assessed. The following scenarios have initially been modelled:

- 2027/2037 Do Minimum: Base traffic + consented committed developments.
- 2027/2037 With Development: Base traffic + consented committed developments + proposed development

4.2 Network Wide Model Statistics

Network statistics provide a strategic overview of the performance of the whole network. These statistics have been extracted to understand the wider network impacts across each of the modelled scenarios. The following statistics are reported:

- **Total travel time per vehicle (unit: s):** mean time it takes for vehicles to travel through the network in the modelled time period. This includes the total travel time in virtual queues.
- **Delay time (unit: s/km):** mean delay incurred by vehicles travelling through the network in the modelled time period and is calculated as the difference between actual travel time and free flow travel.
- **Speed (unit: km/h):** mean speed of vehicles in the network.
- **Stop time (unit: s/km):** mean amount of time that vehicles are stationary.
- **Density (unit: veh/km):** the mean number of vehicles per km of road space and is an indicator of queuing and congestion.
- **Mean Queue (unit: veh):** the mean number of vehicles in queuing in the model, averaged over the modelled period.
- **Flow (unit: veh/h):** mean number of vehicles that pass through the network in the modelled time period.
- **Vehicles Out (unit: veh):** number of vehicles that have left the network during the simulation period.
- **Vehicles In (unit: veh):** number of vehicles inside the network when the simulation period finishes.
- **Vehicles Waiting to Enter (unit: Veh):** number of vehicles that are waiting to enter the network.

The network wide model statistics for each future assessment year scenario are summarised in Table 7 and Table 8.

Table 7: Network Statistics | AM Peak Period (07:00 – 10:00)

Statistic	Units	2025 Base	2027 Do Minimum	2027 With Dev	Absolute Change (% Change)	2037 Do Minimum	2037 With Dev	Absolute Change (% Change)
Total Travel Time	sec/km	77	81	89	+8.0 (+9.8%)	96	102	+5.6 (+5.9%)
Delay	sec/km	27	31	39	+7.6 (+24.4%)	46	51	+5.4 (+11.7%)
Density	veh/km	7	8	9	+1.0 (+12.7%)	10	10	+0.8 (+8.6%)
Mean Queue	veh	88	110	153	+42.5 (+38.6%)	209	246	+37.1 (+17.7%)
Speed	km/h	60	58	56	-2.7 (-4.5%)	53	51	-1.9 (-3.6%)
Stop Time	sec/km	17	21	28	+6.6 (+31.6%)	32	37	+4.8 (+15.0%)
Flow	veh/h	8,811	8,907	9,361	+453.6 (+5.1%)	9,077	9,485	+408.6 (+4.5%)
Vehicles Out	veh	26,433	26,722	28,083	+1360.8 (+5.1%)	27,230	28,456	+1225.9 (+4.5%)
Vehicles In	veh	360	372	411	+39.0 (+10.5%)	737	779	+41.7 (+5.7%)
Vehicles Waiting to Enter	veh	1	1	1	+0.3 (+50.0%)	234	366	+131.8 (+56.3%)

Notes: absolute difference (relative difference)

Table 8: Network Statistics | PM Peak Period (15:00 – 19:00)

Statistic	Units	2025 Base	2027 Do Minimum	2027 With Dev	Absolute Change (% Change)	2037 Do Minimum	2037 With Dev	Absolute Change (% Change)
Total Travel Time	sec/km	76	80	96	+16.2 (+20.3%)	104	129	+24.9 (+23.9%)
Delay	sec/km	26	29	45	+15.9 (+54.8%)	53	78	+24.9 (+46.9%)
Density	veh/km	7	7	9	+1.6 (+22.6%)	10	13	+3.1 (+30.0%)
Mean Queue	veh	78	96	185	+89.0 (+93.0%)	201	383	+182.6 (+91.0%)
Speed	km/h	59	58	54	-3.4 (-5.9%)	50	46	-3.8 (-7.5%)
Stop Time	sec/km	16	18	33	+14.7 (+80.0%)	32	55	+22.8 (+70.3%)
Flow	veh/h	8,497	8,579	9,020	+440.6 (+5.1%)	8,849	9,178	+328.6 (+3.7%)
Vehicles Out	veh	33,986	34,316	36,078	+1762.3 (+5.1%)	35,398	36,712	+1314.4 (+3.7%)
Vehicles In	veh	304	310	381	+71.1 (+23.0%)	508	875	+366.6 (+72.1%)
Vehicles Waiting to Enter	veh	0	0	1	+0.2 (+50.0%)	1	227	+226.1 (+45220.0 %)

Notes: absolute difference (relative difference)

4.2.1 Analysis of Network Wide Model Statistics

In 2027, the modelling shows that the proposed development is predicted to increase network delay by +7.6s per km in the AM peak and +15.9s in the PM peak. This equates to an increase in network-wide mean queueing of +42.5 and +89.0 vehicles and a decrease in network-wide speed of -2.7km/h and -3.4km/h. In terms of network throughput (which is an indicator of network capacity), reasonably small variations in the number of vehicles either queueing inside the model (vehicles inside) and vehicles queueing outside of the model (vehicles waiting to enter) is predicted. These results suggest that in the AM peak the network would operate broadly similar with the development in place, however in the PM peak the impacts would be more noticeable.

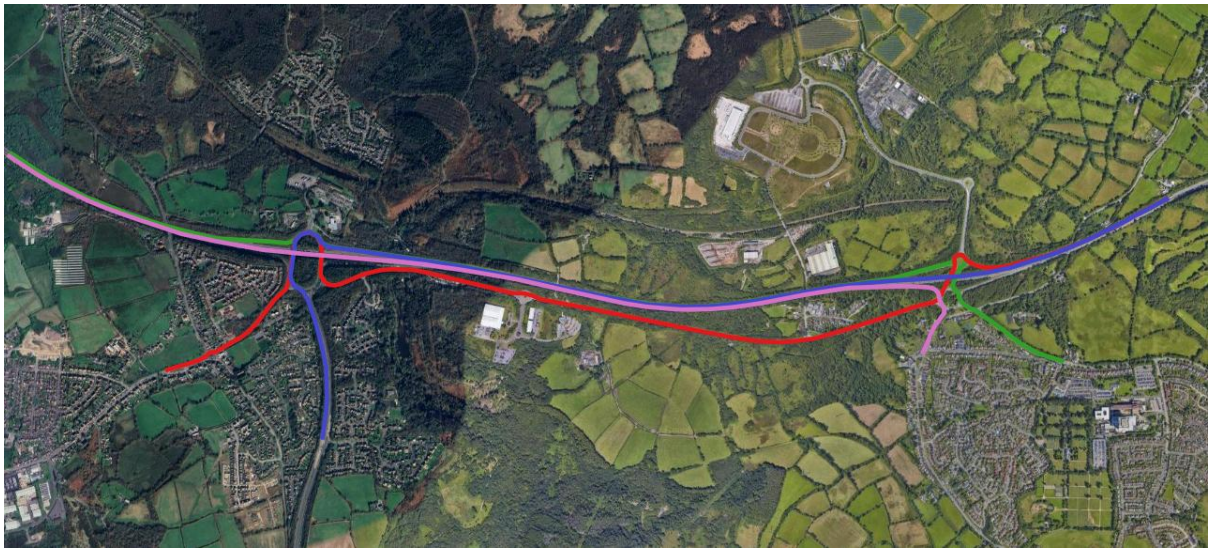
In 2037, the modelling shows that the proposed development is predicted to increase network delay by +5.4s per km in the AM peak and +24.9s in the PM peak. This equates to an increase in network-wide mean queueing of +37.1 and +182.6 vehicles and a decrease in network-wide speed of -1.9km/h and -3.8km/h. In terms of network throughput (which is an indicator of network capacity), there are noticeable issues with vehicles waiting to enter in both peak periods with the development in place (366 and 227 vehicles). Whilst this also occurs in the Do Minimum AM peak (234 vehicles) the development increases this suppressed demand. These results suggest that the development gives rise to noticeable impacts on the wider highway network which are likely to require mitigation.

4.3 Journey Time Analysis

Journey time statistics have been extracted from Aimsun for the pre-defined journey time validation routes for each future assessment year scenario in order to understand the impact of the proposed development. A total of eight journey time routes have been analysed that cover key routes and congested junctions within the model. The journey time routes defined are illustrated on Figure 1 and are listed below:

- Route 1A - M4 west to A48 east (via M4)
- Route 1B - A48 west to M4 east (via M4)
- Route 2A - A4240 Gorseinon Road to M4 east (via A48)
- Route 2B - M4 east to A4240 Gorseinon Road (via A48)
- Route 3A - A483 to M4 east (via M4)
- Route 3B - A4 east to A483 (via M4)
- Route 4A - B4489 Swansea Road to M4 west (via M4)
- Route 4B - M4 west to B4489 Swansea Road (via M4)

Figure 1: Journey Time Routes



In validating transport models, it is usual practice to consider that journey times that are modelled to within 15% of observed journey times (or within 1 minute if higher than 15%) are acceptable. This is because journey times can typically vary by 15% from day-to-day with shorter journey times experiencing much larger relative variations. This threshold has therefore been adopted for the purpose of this analysis in order to determine whether the proposed development would give rise to a material impact on journey times.

Notwithstanding this, whilst a development may give rise to a material impact on journey times, this does not necessarily mean that it should automatically be considered to be severe in the context of Paragraph 116 of the NPPF. Rather it suggests that drivers would experience an increase in journey time that is beyond what they would expect to encounter on a day-to-day basis. However, it does provide a minimum threshold below which a journey time impact should not be considered to be severe. Determining the severity of an increase is subjective and should be considered on a case-by-case basis, however for the purpose of this assessment the severity of an impact is defined as:

- For journey times less than 600s (ten minutes) an impact of ≥ 180s (three minutes) is considered severe.
- For journey times more than 600s (ten minutes) an impact of ≥ 30% is considered severe.
- For journey times of exactly 600s (ten minutes) both of the criteria set out above would apply.

Table 9 and Table 10 presents the peak period journey time impact (both absolute and relative) for each future assessment year scenario, compared to the corresponding scenario with the proposed development in place. Note these statistics also include wait time in virtual queues to capture any suppressed demand outside of the model.

Table 9: Journey Time Analysis | AM Peak | 07:00 – 10:00

Route	2025 Base	2027 Do Minimum	2027 With Dev	Absolute Change (% Change)	2037 Do Minimum	2037 With Dev	Absolute Change (% Change)
Route 01-A	04:19	04:19	04:22	00:03 (1.3%)	04:18	04:21	00:03 (1.0%)
Route 01-B	04:09	04:11	04:20	00:05 (2.1%)	05:33	05:41	00:08 (2.5%)
Route 02-A	07:53	10:24	12:58	02:34 (24.7%)	23:16	27:49	04:34 (19.6%)
Route 02-B	06:27	06:30	07:19	00:50 (12.8%)	06:22	07:14	00:52 (13.7%)
Route 03-A	05:12	05:34	06:31	00:57 (17.0%)	07:14	08:34	01:20 (18.4%)
Route 03-B	04:55	05:32	05:46	00:14 (4.3%)	09:41	09:47	00:06 (1.1%)
Route 04-A	03:28	03:28	03:48	00:20 (9.6%)	04:52	05:16	00:24 (8.2%)
Route 04-B	03:58	03:58	04:01	00:03 (1.4%)	03:58	04:00	00:02 (1.0%)

Table 10: Journey Time Analysis | PM Peak | 15:00 – 19:00

Route	2025 Base	2027 Do Minimum	2027 With Dev	Absolute Change (% Change)	2037 Do Minimum	2037 With Dev	Absolute Change (% Change)
Route 01-A	04:06	04:07	04:09	00:02 (0.9%)	04:07	04:08	00:01 (0.5%)
Route 01-B	04:26	04:37	05:01	00:24 (8.6%)	06:25	07:05	00:40 (10.4%)
Route 02-A	07:30	08:09	09:06	00:57 (11.7%)	11:52	17:19	05:27 (45.9%)
Route 02-B	07:16	08:03	16:11	08:08 (101.1%)	15:26	33:58	18:32 (120.1%)
Route 03-A	04:39	04:46	05:17	00:31 (10.9%)	05:51	07:29	01:38 (27.9%)
Route 03-B	04:45	05:30	05:45	00:15 (4.7%)	09:31	10:04	00:33 (5.8%)
Route 04-A	03:58	04:14	06:59	02:45 (65.0%)	06:06	09:59	03:54 (64.0%)
Route 04-B	03:47	03:47	03:50	00:02 (1.0%)	03:48	03:49	00:02 (0.7%)

4.3.1 Analysis of Journey Times

Across all of the time periods and scenarios assessed, the modelling suggests that in the 2027 scenario the proposed development would give rise to some moderate impacts, particularly in the PM peak period. In the 2037 scenario it is shown that the development flows give rise to severe impacts on the highway network, in particular on Route 2B where the A48 traffic struggles to egress onto Junction 47 interchange.

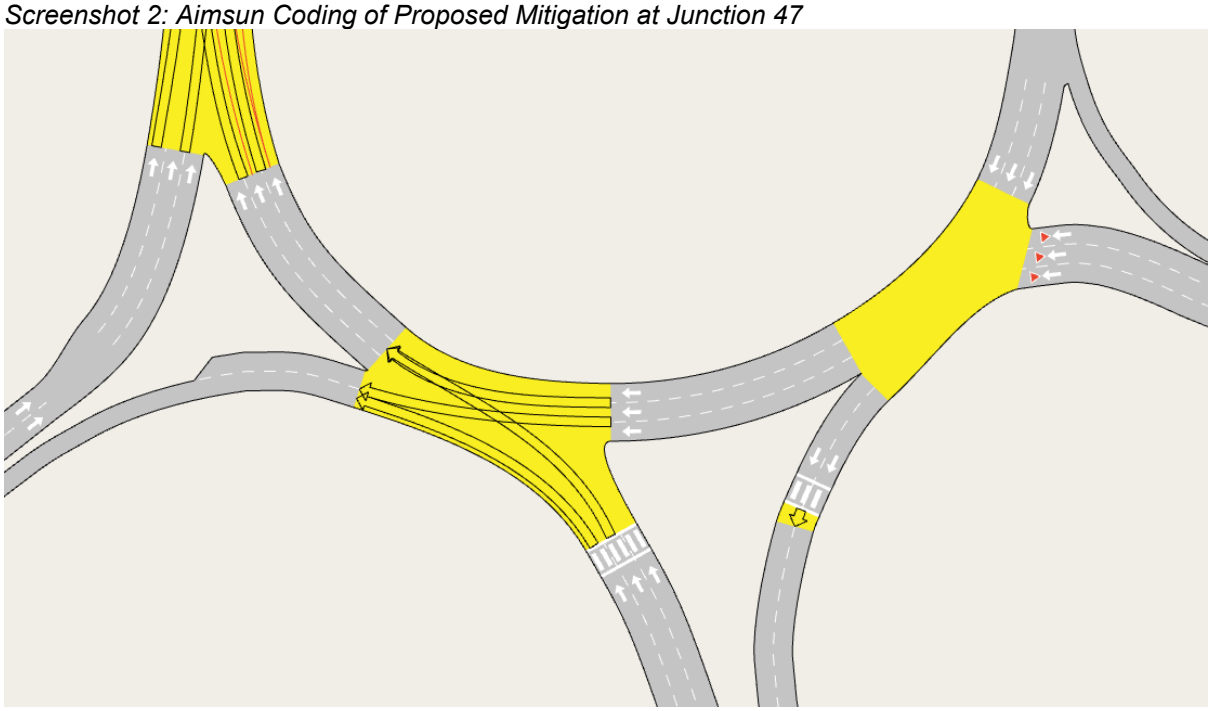
5 Mitigation Modelling

5.1 Mitigation Scheme

As outlined in Section 3, the future year network is significantly congested as a result of the proposed development. In particular, the A48 east approach to Junction 47 Penllergaer Interchange becomes heavily congested with vehicles unable to egress onto the roundabout. This behaviour is not unusual and currently occurs when queues extend back on the circulatory with no yellow box on street. As such, given the impact of the development it is considered that mitigation is required in this area. Various options were tested, including providing a yellow box at the junction to allow the A48 east approach to exit, however this caused congestion issues around the roundabout which severely impacted the junction.

The proposed mitigation is therefore to provide an additional lane on the southern circulatory along with a two-lane flared exit to the A48 south. The proposed layout is detailed within the Transport Assessment, whilst the model coding is shown on Screenshot 2.

Screenshot 2: Aimsun Coding of Proposed Mitigation at Junction 47



5.2 Mitigation Modelling Results

The following section presents the results of the mitigation modelling.

To assess the impact of the proposed development, a 2027 opening year and 2037 future year has been assessed. The following scenarios have been modelled:

- 2027/2037 Do Minimum: Base traffic + consented committed developments.
- 2027/2037 With Development Mitigation: Base traffic + consented committed developments + proposed development + mitigation

5.3 Network Wide Model Statistics

Network statistics provide a strategic overview of the performance of the whole network. These statistics have been extracted to understand the wider network impacts across each of the modelled scenarios.

The network wide model statistics for each future assessment year scenario are summarised in Table 11 and Table 12.

Table 11: Network Statistics | AM Peak Period (07:00 – 10:00)

Statistic	Units	2025 Base	2027 Do Minimum	2027 With Dev + Mitigation	Absolute Change (% Change)	2037 Do Minimum	2037 With Dev+ Mitigation	Absolute Change (% Change)
Total Travel Time	sec/km	77	81	80	-1.4 (-1.7%)	96	85	-10.8 (-11.3%)
Delay	sec/km	27	31	30	-1.5 (-4.9%)	46	35	-11.0 (-24.0%)
Density	veh/km	7	8	8	-0.0 (-0.4%)	10	8	-1.4 (-14.5%)
Mean Queue	veh	88	110	94	-16.4 (-14.9%)	209	121	-88.8 (-42.4%)
Speed	km/h	60	58	59	+0.4 (+0.6%)	53	57	+3.4 (+6.3%)
Stop Time	sec/km	17	21	20	-1.3 (-6.3%)	32	24	-8.5 (-26.4%)
Flow	veh/h	8,811	8,907	9,364	+456.4 (+5.1%)	9,077	9,612	+534.8 (+5.9%)
Vehicles Out	veh	26,433	26,722	28,091	+1369.1 (+5.1%)	27,230	28,835	+1604.4 (+5.9%)
Vehicles In	veh	360	372	392	+20.3 (+5.5%)	737	447	-290.7 (-39.4%)
Vehicles Waiting to Enter	veh	1	1	1	+0.3 (+50.0%)	234	309	+74.6 (+31.9%)

Notes: absolute difference (relative difference)

Table 12: Network Statistics | PM Peak Period (15:00 – 19:00)

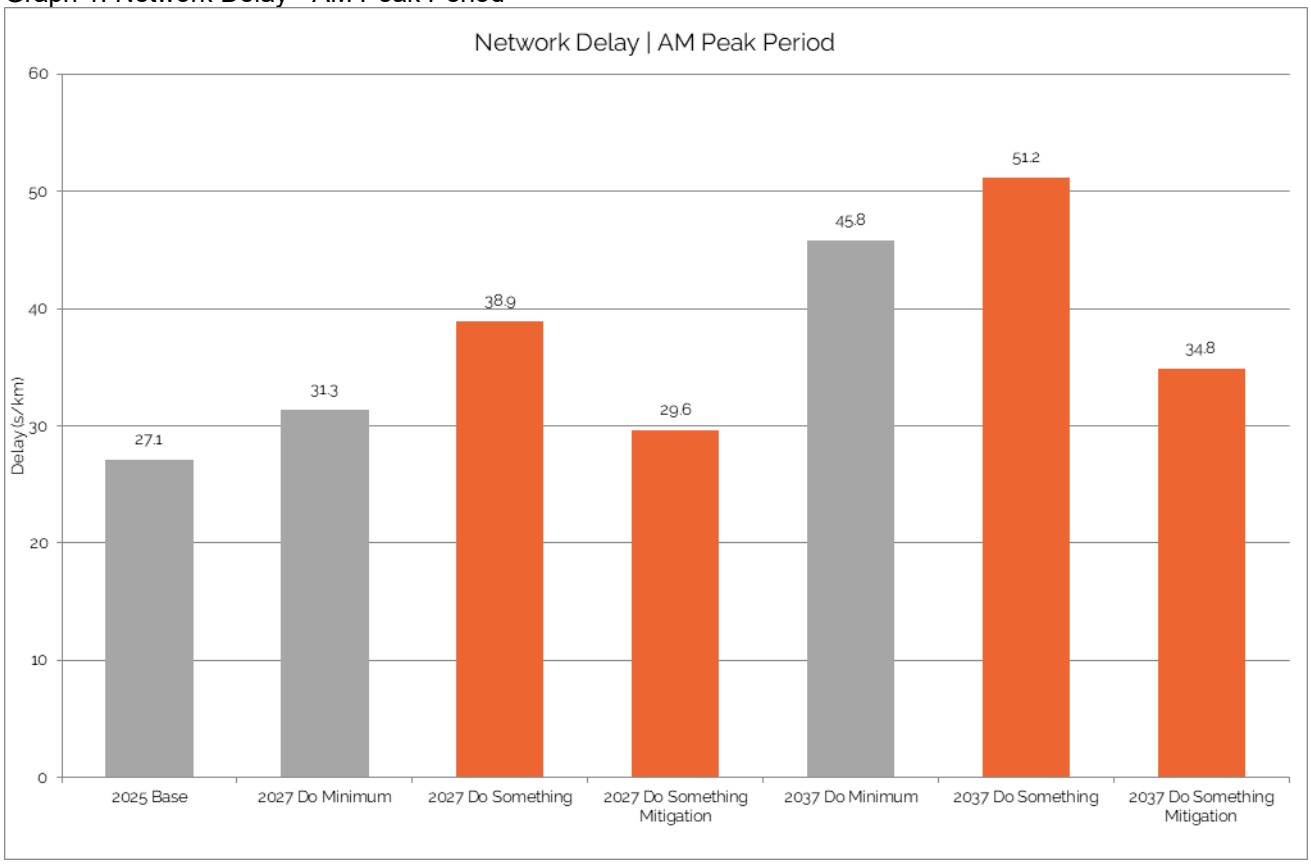
Statistic	Units	2025 Base	2027 Do Minimum	2027 With Dev + Mitigation	Absolute Change (% Change)	2037 Do Minimum	2037 With Dev+ Mitigation	Absolute Change (% Change)
Total Travel Time	sec/km	76	80	78	-2.0 (-2.4%)	104	85	-18.9 (-18.2%)
Delay	sec/km	26	29	27	-2.2 (-7.7%)	53	34	-19.2 (-36.1%)
Density	veh/km	7	7	7	-0.3 (-3.5%)	10	8	-2.6 (-25.1%)
Mean Queue	veh	78	96	76	-19.9 (-20.8%)	201	103	-97.5 (-48.6%)
Speed	km/h	59	58	59	+1.3 (+2.2%)	50	57	+6.6 (+13.2%)
Stop Time	sec/km	16	18	18	-0.6 (-3.4%)	32	24	-8.9 (-27.4%)
Flow	veh/h	8,497	8,579	9,027	+448.3 (+5.2%)	8,849	9,333	+483.3 (+5.5%)
Vehicles Out	veh	33,986	34,316	36,109	+1793.0 (+5.2%)	35,398	37,331	+1933.1 (+5.5%)
Vehicles In	veh	304	310	334	+24.5 (+7.9%)	508	375	-133.3 (-26.2%)
Vehicles Waiting to Enter	veh	0	0	1	+0.2 (+50.0%)	1	14	+13.8 (+2760.0 %)

Notes: absolute difference (relative difference)

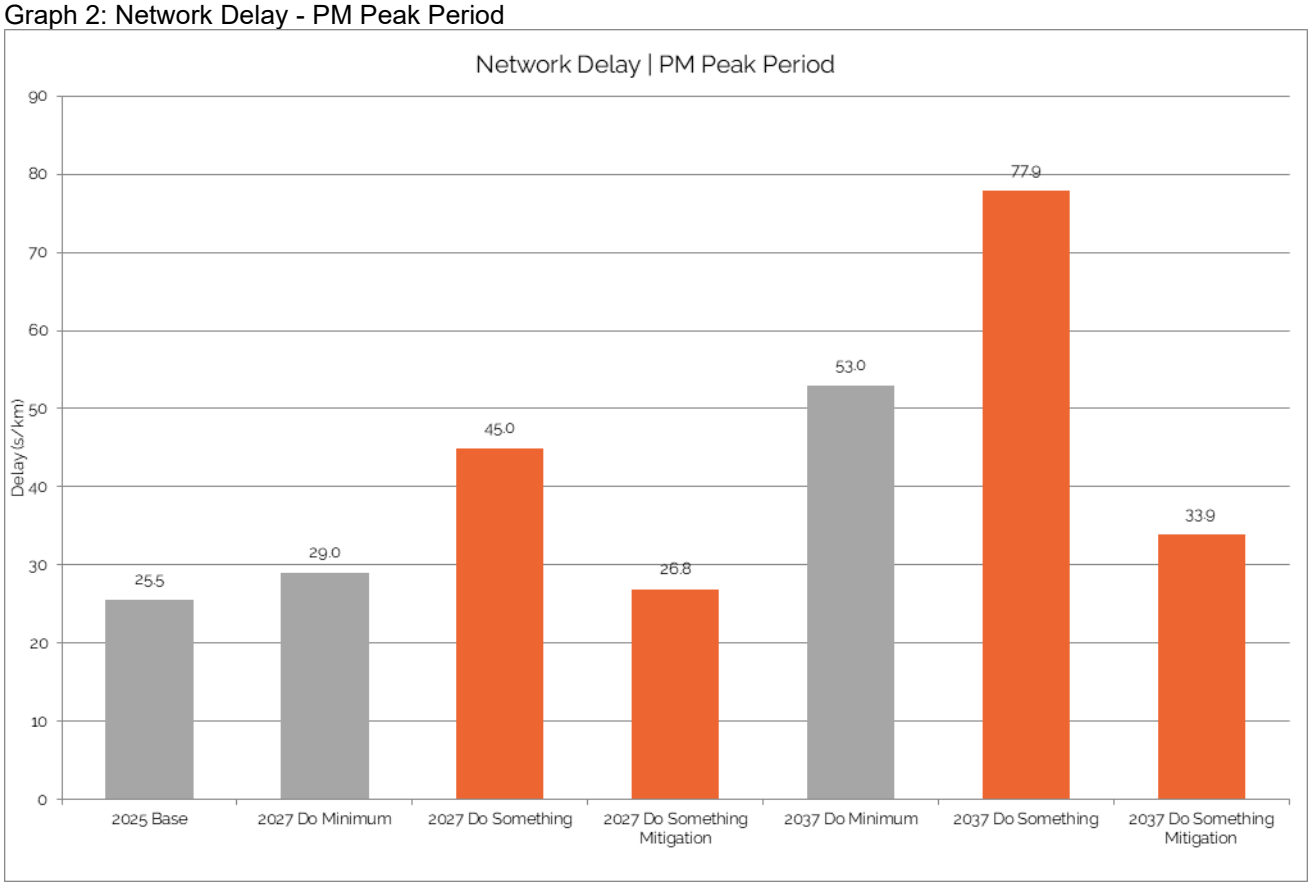
In order to better understand the network statistics some of these have been presented as graphs, as set out below:

- **Delay (unit: sec / km):** Graph 1 and Graph 2 present the average delay incurred by vehicles travelling through the network in the modelled time period and is calculated as the difference between actual travel time and free flow travel. These graphs provide an overview of model performance and can be used as a general indicator of network conditions.
- **Network Throughput (unit: veh):** Graph 3 and Graph 4 present stacked bar charts showing vehicles that have passed through the model, the vehicles inside the model, and vehicles waiting to enter the model. These give an overview of the state of the network at the end of the simulation period. The sum of these statistics is equal to the overall demand, with the number of vehicles inside the network and waiting to enter the network giving an indication of whether the network is operating within capacity.

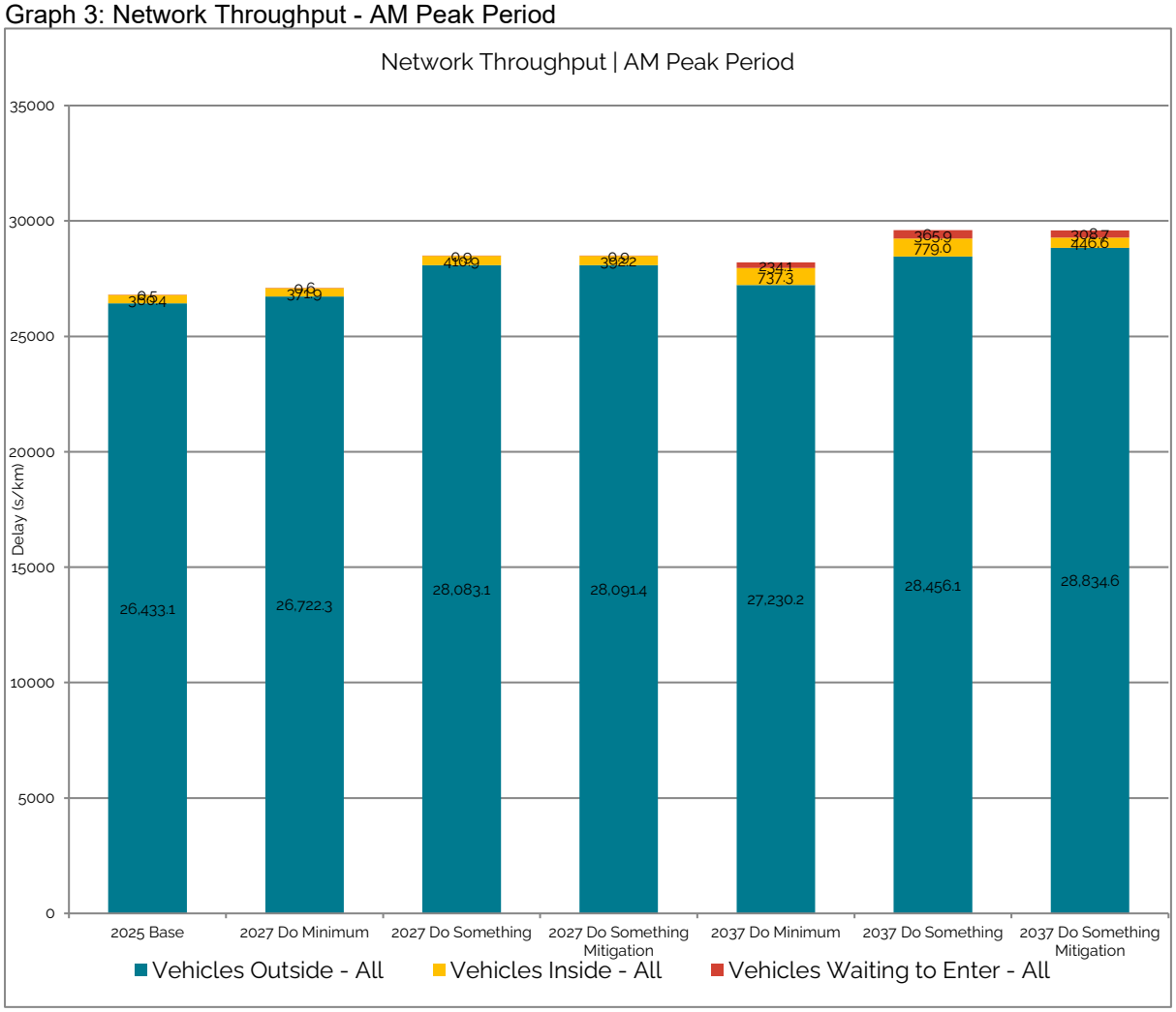
Graph 1: Network Delay - AM Peak Period



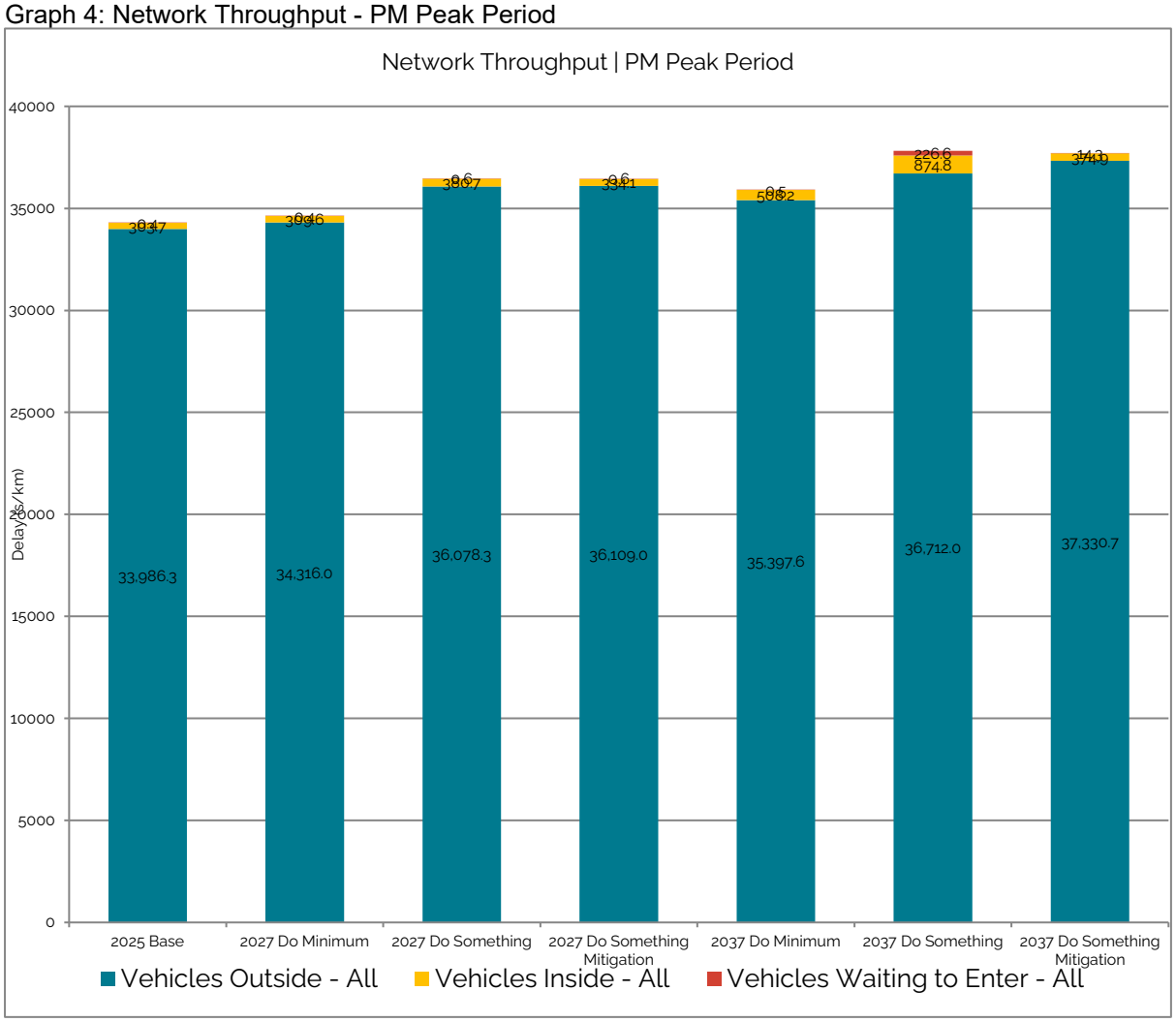
Graph 2: Network Delay - PM Peak Period



Graph 3: Network Throughput - AM Peak Period



Graph 4: Network Throughput - PM Peak Period



5.3.1 Analysis of Network Wide Model Statistics

In 2027, the modelling shows that the proposed development with mitigation is predicted to reduce network delay by -1.7s per km in the AM peak and -2.2s in the PM peak compared to the Do Minimum scenario. This equates to a reduction in network-wide mean queueing of -16.4 and -19.9 vehicles and an increase in network-wide speed of +0.4km/h and +1.3km/h. In terms of network throughput (which is an indicator of network capacity), reasonably small variations in the number of vehicles either queueing inside the model (vehicles inside) and vehicles queueing outside of the model (vehicles waiting to enter) is predicted. The results show that the proposed mitigation more than offsets the impact of the proposed development.

In 2037, the modelling shows that the proposed development is predicted to reduce network delay by -11.0s per km in the AM peak and -19.2s in the PM peak. This equates to a decrease in network-wide

mean queueing of -88.8 and -97.5 vehicles and an increase in network-wide speed of +3.4km/h and +6.6km/h. In terms of network throughput (which is an indicator of network capacity), there are noticeable increases in vehicles out and a reduction in vehicles in, which highlights that, where previously there were still vehicles inside the model at the end of the peak period due to congestion, these vehicles are now travelling through the model. The results show that the proposed mitigation more than offsets the impact of the proposed development, particularly in the 2037 scenario when there is more congestion and delay in the network due to committed developments.

It is noted that in the 2037 Do Minimum AM peak scenario there are 234 vehicles waiting to enter the network. This reflects the increased congestion as a result of committed developments and background growth in the area. The vehicles waiting to enter are mainly located on the A4240 approach as a result of the additionally committed development flows and queueing back from the pedestrian crossing. In the model, this is assumed to be called every 70 seconds. Whilst this frequency of pedestrian crossing calls may occur around the opening and closing times of the adjacent primary school, it is unlikely to occur during the rest of the peak period. However, this means that the model represents a robust worst case scenario. In the With Development scenario, the virtual queue is increased as a result of the development, again this is likely to be overestimating the impact given the robust assumptions for the pedestrian crossing. Whilst there is an increase in virtual queue, as seen in table 13, the journey time analysis shows this equates to an increase of only 7.5% (this includes any delay incurred in the virtual queue). It is therefore considered that this is not a material impact.

5.4 Journey Time Analysis

Table 13 and Table 14 presents the peak period journey time impact (both absolute and relative) for each future assessment year scenario, compared to the corresponding scenario with the proposed development and mitigation in place. Note these statistics also include wait time in virtual queues to capture any suppressed demand outside of the model.

Table 13: Journey Time Analysis | AM Peak | 07:00 – 10:00

Route	2025 Base	2027 Do Minimum	2027 With Dev Mitigation	Absolute Change (% Change)	2037 Do Minimum	2037 With Dev Mitigation	Absolute Change (% Change)
Route 01-A	04:19	04:19	04:23	00:05 (1.8%)	04:18	04:22	00:03 (1.4%)
Route 01-B	04:09	04:11	04:19	00:08 (3.4%)	05:33	04:15	-01:18 (-23.4%)
Route 02-A	07:53	10:24	11:07	00:43 (6.9%)	23:16	25:00	01:44 (7.5%)
Route 02-B	06:27	06:30	07:09	00:37 (9.6%)	06:22	06:56	00:34 (9.0%)

Route 03-A	05:12	05:34	05:00	-00:32 (-9.7%)	07:14	06:11	-01:04 (-14.6%)
Route 03-B	04:55	05:32	03:56	-01:36 (-28.9%)	09:41	03:59	-05:42 (-58.9%)
Route 04-A	03:28	03:28	03:42	00:13 (6.5%)	04:52	03:46	-01:06 (-22.5%)
Route 04-B	03:58	03:58	04:02	00:05 (1.9%)	03:58	04:01	00:03 (1.3%)

Table 14: Journey Time Analysis | PM Peak | 15:00 – 19:00

Route	2025 Base	2027 Do Minimum	2027 With Dev Mitigation	Absolute Change (% Change)	2037 Do Minimum	2037 With Dev Mitigation	Absolute Change (% Change)
Route 01-A	04:06	04:07	04:09	00:02 (0.9%)	04:07	04:09	00:02 (0.7%)
Route 01-B	04:26	04:37	04:49	00:12 (4.3%)	06:25	04:57	-01:29 (-23.0%)
Route 02-A	07:30	08:09	08:45	00:36 (7.4%)	11:52	14:45	02:53 (24.3%)
Route 02-B	07:16	08:03	05:53	-02:10 (-26.9%)	15:26	07:28	-07:58 (-51.6%)
Route 03-A	04:39	04:46	04:20	-00:25 (-8.9%)	05:51	04:36	-01:14 (-21.2%)
Route 03-B	04:45	05:30	03:57	-01:32 (-28.0%)	09:31	04:03	-05:28 (-57.5%)
Route 04-A	03:58	04:14	07:04	02:50 (66.9%)	06:06	07:05	00:59 (16.2%)
Route 04-B	03:47	03:47	03:49	00:02 (1.0%)	03:48	03:50	00:02 (0.8%)

5.4.1 Analysis of Journey Times

Across all of the time periods and scenarios assessed, the modelling suggests that in the 2027 scenario the proposed development with mitigation would overall provide a net benefit to the network with a total reduction of -16 and -25 seconds when averaged across all routes. The largest residual journey time increase occurs for Route 04-A in the PM peak period, where journey times are forecast to increase by 2 minutes and 50 seconds. However, this increase is offset by reductions on other routes. Similarly, in the 2037 scenario it is shown that the development with mitigation also provides an overall net benefit to the network with a reduction in total journey time when averaged across all routes of around 6 and 12 minutes in each peak period.

5.5 Junction Statistics

As agreed with Swansea Council, key junctions have been identified where detailed junction statistics have been extracted for all future assessment year scenarios with and without the proposed development in place. Table 15 explains the statistics that are presented.

- Junction 47 Penllergaer Interchange
- M4 Junction 46
- Penllergaer Business Park / A48
- A48 Clasemont Road / Pant Lasau Road.

Table 15: Individual Arm Statistics Description

Statistic	Units	Analytical Use
Flow	veh/h	This shows the actual traffic flow on each arm of the junction.
Delay	S	This shows the delay experienced by each vehicle on each arm of the junction and is calculated as the difference between the actual travel time and free-flow travel time.
Mean Queue	Veh	This shows the time-averaged mean queue.
Speed	km/h	This shows the average speed on each arm of the junction.

It should be noted that the approach arms analysed are defined manually and cover multiple sections of the model on approach to the junctions assessed. These sections are usually selected based on the animated simulation of the model and cover the links where queueing and congestion would occur at the junction in consideration. In congested models, defining the assessment sections is more subjective as queues can extend well beyond the extent of the junction assessed. For this reason, it is important to consider the assessment of journey times alongside any isolated junction statistics. Individual arm statistics showing the impact (both absolute and relative) compared to the corresponding Do Minimum scenario are presented in Table 16 to Table 23.

5.5.1 M4 Junction 47 Penllergaer Interchange

Table 16: Junction Statistics | M4 Junction 47 Penllergaer Interchange | AM Peak Period

Statistic	2027 Do Minimum	2027 With Dev Mitigation	Absolute Change (% Change)	2035 Do Minimum	2035 With Dev Mitigation	Absolute Change (% Change)
Arm A: Services						
Flow	205.7	206.1	0.4 (0.2%)	205.7	206.1	0.4 (0.2%)
Delay	6.0	6.3	0.3 (5.1%)	6.4	13.4	7.0 (110.1%)
Mean Queue	0.8	0.8	0.0 (2.2%)	0.8	0.8	0.0 (2.4%)
Speed	28.4	28.0	-0.4 (-1.4%)	27.5	27.2	-0.3 (-1.2%)
Arm B: M4 East						
Flow	902.6	904.3	1.7 (0.2%)	890.0	972.9	83.0 (9.3%)
Delay	111.9	24.9	-87.0 (-77.7%)	254.2	26.5	-227.6 (-89.6%)
Mean Queue	11.5	2.2	-9.3 (-81.0%)	30.9	2.5	-28.4 (-92.0%)
Speed	10.8	11.9	1.1 (9.9%)	9.8	11.6	1.8 (18.5%)
Arm C: A48 East						
Flow	265.2	377.3	112.1 (42.3%)	265.2	377.3	112.1 (42.3%)
Delay	25.0	13.9	-11.1 (-44.5%)	27.5	15.5	-12.0 (-43.6%)
Mean Queue	0.8	0.5	-0.3 (-35.7%)	0.9	0.6	-0.3 (-29.8%)
Speed	14.9	19.3	4.4 (29.9%)	13.7	17.9	4.2 (30.4%)
Arm D: A483						
Flow	1,437.0	1,471.0	34.0 (2.4%)	1,529.8	1,563.6	33.8 (2.2%)
Delay	90.2	54.7	-35.5 (-39.4%)	94.4	60.5	-33.9 (-35.9%)
Mean Queue	6.0	3.3	-2.7 (-44.3%)	18.2	9.9	-8.3 (-45.8%)
Speed	16.5	17.2	0.7 (4.2%)	16.4	17.0	0.6 (3.6%)
Arm E: A48 Southwest						
Flow	978.9	1,011.1	32.1 (3.3%)	1,054.7	1,066.1	11.4 (1.1%)
Delay	48.0	26.9	-21.1 (-44.0%)	46.5	23.7	-22.8 (-49.0%)
Mean Queue	4.7	2.6	-2.1 (-45.2%)	4.8	2.3	-2.6 (-53.1%)

Statistic	2027 Do Minimum	2027 With Dev Mitigation	Absolute Change (% Change)	2035 Do Minimum	2035 With Dev Mitigation	Absolute Change (% Change)
Speed	12.9	16.0	3.1 (23.6%)	12.9	16.3	3.4 (26.6%)
Arm F: M4 West						
Flow	545.2	590.4	45.2 (8.3%)	567.6	612.9	45.3 (8.0%)
Delay	37.8	54.7	16.8 (44.5%)	41.2	64.6	23.4 (56.9%)
Mean Queue	2.5	3.7	1.2 (49.5%)	2.7	4.5	1.8 (67.0%)
Speed	9.6	8.1	-1.6 (-16.1%)	9.2	7.5	-1.6 (-17.6%)

Table 17: Junction Statistics | M4 Junction 47 Penllergaer Interchange | PM Peak Period

Statistic	2027 Do Minimum	2027 With Dev Mitigation	Absolute Change (% Change)	2035 Do Minimum	2035 With Dev Mitigation	Absolute Change (% Change)
Arm A: Services						
Flow	166.4	166.5	0.1 (0.1%)	166.4	166.5	0.1 (0.1%)
Delay	4.1	4.8	0.7 (18.3%)	4.7	5.4	0.7 (15.7%)
Mean Queue	0.7	0.7	0.0 (4.9%)	0.7	0.7	0.0 (4.9%)
Speed	32.0	30.0	-2.0 (-6.4%)	31.0	29.0	-2.0 (-6.6%)
Arm B: M4 east						
Flow	1,329.5	1,329.9	0.4 (0.0%)	1,400.4	1,413.1	12.7 (0.9%)
Delay	91.4	18.9	-72.5 (-79.3%)	172.7	20.5	-152.2 (-88.1%)
Mean Queue	13.0	2.3	-10.7 (-82.4%)	28.1	2.5	-25.7 (-91.3%)
Speed	18.4	18.2	-0.3 (-1.4%)	17.4	17.9	0.6 (3.3%)
Arm C: A48 east						
Flow	320.9	433.4	112.6 (35.1%)	295.7	433.6	137.9 (46.6%)
Delay	148.0	16.5	-131.5 (-88.9%)	496.8	83.2	-413.6 (-83.3%)
Mean Queue	9.3	0.8	-8.5 (-91.0%)	36.6	6.6	-30.0 (-81.9%)
Speed	9.7	18.8	9.1 (93.2%)	5.9	14.3	8.5 (143.6%)
Arm D: A483						



Statistic	2027 Do Minimum	2027 With Dev Mitigation	Absolute Change (% Change)	2035 Do Minimum	2035 With Dev Mitigation	Absolute Change (% Change)
Flow	1,298.3	1,330.8	32.5 (2.5%)	1,377.0	1,409.6	32.6 (2.4%)
Delay	49.6	30.2	-19.4 (-39.1%)	55.2	43.6	-11.6 (-21.0%)
Mean Queue	2.7	1.7	-1.0 (-37.6%)	7.9	2.5	-5.4 (-68.3%)
Speed	14.5	16.3	1.9 (12.8%)	14.3	15.9	1.5 (10.8%)
Arm E: A48 Southwest						
Flow	811.1	843.2	32.1 (4.0%)	909.3	936.1	26.8 (2.9%)
Delay	25.1	22.7	-2.4 (-9.7%)	27.1	23.9	-3.3 (-12.1%)
Mean Queue	2.2	2.1	-0.2 (-7.2%)	2.6	2.3	-0.2 (-9.4%)
Speed	13.2	14.5	1.3 (9.9%)	13.0	14.3	1.2 (9.4%)
Arm F: M4 West						
Flow	462.6	505.8	43.2 (9.3%)	487.9	531.1	43.2 (8.8%)
Delay	23.6	28.4	4.9 (20.6%)	24.1	29.6	5.5 (23.0%)
Mean Queue	1.3	1.6	0.3 (27.5%)	1.3	1.7	0.4 (30.0%)
Speed	14.0	11.0	-3.0 (-21.4%)	13.8	10.6	-3.2 (-23.2%)

5.5.2 M4 Junction 46

Table 18: Junction Statistics | M4 Junction 46 | AM Peak Period

Statistic	2027 Do Minimum	2027 With Dev Mitigation	Absolute Change (% Change)	2035 Do Minimum	2035 With Dev Mitigation	Absolute Change (% Change)
Arm A: B4489 North						
Flow	142.9	143.2	0.3 (0.2%)	142.9	143.2	0.3 (0.2%)
Delay	2.4	2.7	0.3 (13.1%)	2.5	5.2	2.8 (113.0%)
Mean Queue	0.1	0.1	0.0 (0.2%)	0.1	0.1	0.0 (26.0%)
Speed	41.3	40.4	-0.9 (-2.2%)	41.1	40.5	-0.6 (-1.4%)
Arm B: M4 East						
Flow	529.6	573.2	43.6 (8.2%)	529.6	573.5	43.9 (8.3%)
Delay	46.6	79.6	33.0 (70.9%)	35.0	63.5	28.5 (81.3%)

Statistic	2027 Do Minimum	2027 With Dev Mitigation	Absolute Change (% Change)	2035 Do Minimum	2035 With Dev Mitigation	Absolute Change (% Change)
Mean Queue	3.6	6.5	2.9 (80.4%)	2.7	5.2	2.4 (88.1%)
Speed	31.8	27.6	-4.3 (-13.4%)	33.5	28.4	-5.1 (-15.3%)
Arm C: A48 Southeast						
Flow	581.7	615.9	34.2 (5.9%)	581.5	616.2	34.7 (6.0%)
Delay	2.9	3.9	1.0 (36.1%)	2.9	3.8	0.9 (32.2%)
Mean Queue	0.3	0.5	0.2 (46.1%)	0.4	0.5	0.1 (12.7%)
Speed	34.1	30.0	-4.2 (-12.2%)	34.3	30.3	-3.9 (-11.5%)
Arm D: B4489 Swansea Road						
Flow	454.6	490.9	36.3 (8.0%)	454.6	490.8	36.2 (8.0%)
Delay	6.9	13.5	6.6 (95.7%)	7.0	15.5	8.5 (120.2%)
Mean Queue	0.8	1.7	1.0 (126.2%)	0.8	2.0	1.2 (155.7%)
Speed	23.0	19.7	-3.3 (-14.5%)	22.8	19.6	-3.2 (-14.2%)
Arm E: A48 West						
Flow	262.9	378.0	115.1 (43.8%)	256.6	370.5	113.9 (44.4%)
Delay	20.2	26.5	6.2 (30.8%)	18.9	22.0	3.1 (16.5%)
Mean Queue	1.1	1.6	0.5 (48.9%)	0.9	1.3	0.4 (43.2%)
Speed	37.5	36.4	-1.1 (-3.0%)	38.6	37.9	-0.7 (-1.8%)
Arm F: M4 West						
Flow	420.3	420.0	-0.3 (-0.1%)	419.5	419.1	-0.5 (-0.1%)
Delay	7.1	8.8	1.6 (22.8%)	7.0	8.5	1.5 (21.5%)
Mean Queue	0.8	0.9	0.1 (12.4%)	0.8	0.8	0.1 (9.8%)
Speed	54.7	52.7	-2.0 (-3.7%)	54.9	53.0	-1.8 (-3.3%)



Table 19: Junction Statistics | M4 Junction 46 | PM Peak Period

Statistic	2027 Do Minimum	2027 With Dev Mitigation	Absolute Change (% Change)	2035 Do Minimum	2035 With Dev Mitigation	Absolute Change (% Change)
Arm A: B4489 North						
Flow	139.7	140.0	0.3 (0.3%)	139.7	140.0	0.4 (0.3%)
Delay	3.4	3.8	0.4 (11.5%)	3.5	3.6	0.1 (3.6%)
Mean Queue	0.2	0.2	0.0 (13.8%)	0.2	0.2	0.0 (-18.6%)
Speed	38.6	37.7	-0.9 (-2.3%)	38.3	38.0	-0.3 (-0.9%)
Arm B: M4 East						
Flow	375.8	422.0	46.1 (12.3%)	376.1	422.0	45.9 (12.2%)
Delay	6.8	8.7	1.9 (28.0%)	7.0	8.4	1.4 (20.7%)
Mean Queue	0.7	0.8	0.2 (23.4%)	0.7	0.8	0.1 (8.8%)
Speed	52.9	49.8	-3.1 (-5.8%)	52.6	50.3	-2.3 (-4.3%)
Arm C: A48 Southeast						
Flow	923.7	955.1	31.4 (3.4%)	923.2	955.4	32.1 (3.5%)
Delay	4.0	5.8	1.7 (43.3%)	4.0	5.8	1.8 (44.3%)
Mean Queue	0.7	1.0	0.3 (35.4%)	0.7	0.9	0.2 (27.1%)
Speed	30.4	25.8	-4.6 (-15.2%)	30.5	25.7	-4.8 (-15.8%)
Arm D: B4489 Swansea Road						
Flow	468.7	505.7	36.9 (7.9%)	469.0	505.8	36.9 (7.9%)
Delay	22.4	112.7	90.3 (402.8%)	23.6	112.4	88.8 (375.4%)
Mean Queue	2.9	15.9	13.0 (454.0%)	3.0	15.8	12.8 (422.5%)
Speed	17.3	11.2	-6.1 (-35.3%)	17.1	11.2	-6.0 (-34.8%)
Arm E: A48 West						
Flow	167.4	279.5	112.1 (67.0%)	167.3	278.9	111.6 (66.7%)
Delay	15.9	16.8	1.0 (6.0%)	15.6	16.7	1.1 (7.2%)
Mean Queue	0.8	1.0	0.2 (27.8%)	0.8	1.0	0.2 (30.2%)
Speed	39.9	39.3	-0.6 (-1.6%)	40.3	39.4	-0.9 (-2.3%)
Arm F: M4 West						
Flow	337.5	337.4	-0.1 (0.0%)	337.5	337.1	-0.4 (-0.1%)

Statistic	2027 Do Minimum	2027 With Dev Mitigation	Absolute Change (% Change)	2035 Do Minimum	2035 With Dev Mitigation	Absolute Change (% Change)
Delay	7.5	8.7	1.2 (15.7%)	7.8	8.5	0.8 (9.8%)
Mean Queue	0.8	0.8	0.1 (6.7%)	0.8	0.8	0.0 (4.0%)
Speed	54.0	52.5	-1.6 (-2.9%)	53.6	52.6	-1.0 (-1.8%)

5.5.3 Penllergaer Business Park Roundabout

Table 20: Junction Statistics | Penllergaer Business Park Roundabout | AM Peak Period

Statistic	2027 Do Minimum	2027 With Dev Mitigation	Absolute Change (% Change)	2035 Do Minimum	2035 With Dev Mitigation	Absolute Change (% Change)
Arm A: A48 East						
Flow	270.4	384.4	114.0 (42.1%)	270.5	384.3	113.9 (42.1%)
Delay	1.8	3.1	1.3 (70.1%)	1.8	3.0	1.2 (66.2%)
Mean Queue	0.0	0.1	0.0 (N/A)	0.0	0.0	0.0 (N/A)
Speed	48.5	41.5	-7.0 (-14.3%)	48.5	42.0	-6.5 (-13.4%)
Arm B: Penllergaer Business Park						
Flow	3.1	115.1	112.0 (3574.5%)	3.1	115.1	112.0 (3574.5%)
Delay	1.1	1.1	0.0 (2.0%)	1.0	1.1	0.1 (12.5%)
Mean Queue	0.0	0.0	0.0 (N/A)	0.0	0.0	0.0 (N/A)
Speed	39.5	38.8	-0.8 (-2.0%)	40.0	38.8	-1.2 (-3.0%)
Arm C: A48 West						
Flow	266.2	382.2	115.9 (43.5%)	258.9	368.5	109.7 (42.4%)
Delay	2.9	3.7	0.8 (26.5%)	2.9	3.6	0.7 (24.4%)
Mean Queue	0.0	0.1	0.0 (N/A)	0.0	0.1	0.0 (N/A)
Speed	49.4	45.7	-3.7 (-7.4%)	49.3	45.7	-3.5 (-7.1%)

Table 21: Junction Statistics | Penllergaer Business Park Roundabout | PM Peak Period

Statistic	2027 Do Minimum	2027 With Dev Mitigation	Absolute Change (% Change)	2035 Do Minimum	2035 With Dev Mitigation	Absolute Change (% Change)
Arm A: A48 East						
Flow	302.1	414.1	112.0 (37.1%)	302.1	414.1	112.0 (37.1%)
Delay	1.8	2.9	1.1 (64.5%)	4.3	3.0	-1.3 (-30.2%)
Mean Queue	0.0	0.1	0.0 (N/A)	0.2	0.1	0.0 (-31.1%)
Speed	49.4	43.1	-6.3 (-12.7%)	48.7	43.1	-5.6 (-11.5%)
Arm B: Penllergaer Business Park						
Flow	15.5	128.2	112.7 (728.1%)	15.5	128.1	112.7 (727.9%)
Delay	1.2	1.3	0.0 (0.6%)	1.8	1.3	-0.4 (-24.4%)
Mean Queue	0.0	0.0	0.0 (N/A)	0.0	0.0	0.0 (1507.5%)
Speed	38.3	37.9	-0.5 (-1.3%)	38.1	38.0	-0.1 (-0.3%)
Arm C: A48 West						
Flow	135.2	246.2	111.1 (82.2%)	135.1	244.8	109.7 (81.1%)
Delay	2.2	3.1	0.9 (40.3%)	2.2	3.1	0.9 (39.3%)
Mean Queue	0.0	0.1	0.0 (N/A)	0.0	0.1	0.0 (N/A)
Speed	49.2	45.3	-3.9 (-7.9%)	49.2	45.4	-3.8 (-7.7%)

5.5.4 A48 Clasemont Road / Pant Lasau Road

Table 22: Junction Statistics | A48 Clasemont Road / Pant Lasau Road | AM Peak Period#

Statistic	2027 Do Minimum	2027 With Dev Mitigation	Absolute Change (% Change)	2035 Do Minimum	2035 With Dev Mitigation	Absolute Change (% Change)
Arm A: Pant Lasau Road						
Flow	349.7	349.6	-0.1 (0.0%)	349.5	349.6	0.1 (0.0%)
Delay	16.3	18.6	2.3 (13.9%)	16.5	34.0	17.5 (106.2%)
Mean Queue	1.3	1.6	0.2 (16.7%)	1.4	1.4	0.1 (4.9%)
Speed	31.1	29.5	-1.6 (-5.3%)	31.1	29.6	-1.4 (-4.6%)
Arm B: Clasemont Road East						
Flow	392.8	427.2	34.4 (8.8%)	392.8	427.3	34.5 (8.8%)
Delay	7.6	10.9	3.3 (44.1%)	6.9	8.6	1.8 (26.0%)
Mean Queue	0.7	1.1	0.4 (64.0%)	0.6	0.9	0.3 (41.0%)
Speed	26.1	25.1	-1.1 (-4.1%)	26.4	25.6	-0.9 (-3.2%)
Arm C: Clasemont Road West						
Flow	1,039.9	1,073.4	33.5 (3.2%)	1,037.0	1,070.4	33.4 (3.2%)
Delay	4.7	5.0	0.3 (6.0%)	4.5	4.9	0.4 (8.1%)
Mean Queue	1.0	1.2	0.2 (18.2%)	1.1	1.2	0.1 (7.4%)
Speed	25.7	25.6	-0.2 (-0.6%)	25.8	25.6	-0.1 (-0.5%)

Table 23: Junction Statistics | A48 Clasemont Road / Pant Lasau Road | PM Peak Period

Statistic	2027 Do Minimum	2027 With Dev Mitigation	Absolute Change (% Change)	2035 Do Minimum	2035 With Dev Mitigation	Absolute Change (% Change)
Arm A: Pant Lasau Road						
Flow	577.5	577.6	0.1 (0.0%)	577.2	577.4	0.2 (0.0%)
Delay	8.4	12.3	3.9 (47.0%)	8.4	12.2	3.8 (44.9%)
Mean Queue	0.9	1.4	0.5 (61.9%)	0.9	1.4	0.5 (59.9%)
Speed	38.6	34.1	-4.6 (-11.9%)	38.6	34.3	-4.3 (-11.1%)
Arm B: Clasemont Road East						
Flow	458.8	489.8	31.0 (6.8%)	458.6	490.5	31.9 (7.0%)
Delay	12.7	22.7	10.0 (78.9%)	12.2	25.7	13.5 (111.2%)
Mean Queue	1.4	2.9	1.5 (104.4%)	1.4	3.4	2.0 (145.7%)
Speed	23.5	20.6	-2.9 (-12.5%)	23.5	20.3	-3.2 (-13.6%)
Arm C: Clasemont Road West						
Flow	627.9	663.4	35.5 (5.6%)	628.4	662.7	34.3 (5.5%)
Delay	3.6	3.6	0.1 (1.4%)	3.5	3.6	0.0 (1.0%)
Mean Queue	1.0	1.1	0.1 (12.0%)	1.0	0.9	-0.1 (-7.1%)
Speed	28.6	28.5	-0.1 (-0.2%)	28.6	28.5	-0.1 (-0.5%)

5.5.5 Analysis of Junction Statistics

5.5.5.1 M4 Junction 47 Penllergaer Interchange

Whilst an increase in flow is predicted on some arms of the junction, in particular the A48 East, this is not predicted to give rise a noticeable increase in mean queueing or delay. In all cases, any increase in delay is less 25s and any increase in queueing is less than two vehicles. In general, the results show significant decreases in delay of up to 413s and decreases in mean queue of up to 30 vehicles with the proposed development and mitigation in place compared to the Do Minimum scenario. These benefits are due to the proposed mitigation scheme adding capacity at the junction.

5.5.5.2 M4 Junction 46

Whilst an increase in flow is predicted on some arms of the junction, in particular the A48 West, this is not predicted to give rise to a noticeable increase in mean queuing or delay. In most cases, any increase in delay is less than 30s and any increase in queueing is less than three vehicles. Notwithstanding this, the B4489 results show a larger increase in delay of 90s in the 2027 and 2037 PM peak, however this equates to an increase in mean queue of only 13 vehicles.

5.5.5.3 Penllergaer Business Park

Whilst an increase in flow is predicted on all arms of the junction as a result of the proposed development, this is not predicted to give rise to a noticeable increase in mean queuing or delay. In all cases, any increase in delay is less than 2s and any increase in queueing is less than one vehicle.

5.5.5.4 A48 Clasemont Road / Pant Lassau Road

Whilst an increase in flow is predicted on the A48 Clasemont Road, this is not predicted to give rise to a noticeable increase in mean queuing or delay. In all cases, any increase in delay is less than 20s and any increase in queueing is less than two vehicles.

6 Summary and Conclusion

6.1 Introduction

Hydrock now Stantec has been appointed by Stoford Properties Ltd to undertake Aimsun modelling of proposals to provide a distribution centre on land south of the A48 at Penllergaer.

The proposed development will accommodate a floor area of 12,465sqm, located within Penllergaer Business Park, with vehicular access provided from the A48 as outlined within the Transport Assessment.

6.2 Future Year Modelling

The following scenarios have been modelled:

- 2027/2037 Do Minimum: Base traffic + Consented committed developments.
- 2027/2037 With Development: Base traffic + Consented committed developments + Proposed development
- 2027/2037 With Development Mitigation: Base traffic + Consented committed developments + Proposed development + Mitigation

6.3 Conclusion

The modelling demonstrates that the proposed development is predicted to increase congestion on the existing highway network, however as shown this impact can be mitigated with the proposed highway mitigation scheme. The proposed mitigation is predicted to lead to significant decreases in queueing, delay and journey times which leads to a general betterment of the network compared to the Do Minimum scenario.

The development would not therefore give rise to impacts that are considered to be severe and the proposed mitigation ensures the development provides a betterment to the existing highway network.

Appendices

With every community, we redefine what's possible.

Stantec is a global leader in sustainable engineering, architecture, and environmental consulting. The diverse perspectives of our partners and interested parties drive us to think beyond what's previously been done on critical issues like climate change, digital transformation, and future-proofing our cities and infrastructure. We innovate at the intersection of community, creativity, and client relationships to advance communities everywhere, so that together we can redefine what's possible.

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