TECHNICAL NOTE 1

DATE:	June 2023	**CONFIDENTIALITY:**	Internal
SUBJECT:	Junction Modelling		
PROJECT:	70104118 - Hywel Dda Land Services	**AUTHOR:**	David Fifer, Palash Shukla
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INTRODUCTION

Background

Hywel Dda University Health Board (HDdUHB) are proposing to construct a new Urgent and Planned Care Hospital as part of their estate strategy designed to support a future model of care based around a network of integrated health & wellbeing centres and community hospitals.

The new Urgent and Planned Care Hospital in the South of the region would be the main site for the network of hospitals providing urgent and planned care services across the Health Board catchment area, offer a more centralised model for all acute services and will also include specialist mental health facilities.

To facilitate the construction of the Urgent and Planned Care Hospital, HDdUHB are carrying out due diligence on a shortlist of sites across South-West Wales to allow the selection of the most appropriate site. The sites are as follows:

- Whitland Spring Gardens (formerly site 12);
- Whitland Ty Newydd (formerly site 17); and
- St Clears, Tenby Road (formerly site C).

It is proposed to use the South-West and Mid-Wales Transport Model (SWMWTM) to assess the impacts of the planned Urgent and Planned Care Hospital on traffic and travel patterns. The SWMWTM is a regional, multi-modal transport model, and comprises: a highway assignment component representing travel by car (business, commute and other purposes), and road freight (light goods vehicles (LGVs) and heavy goods vehicles (HGVs)); a public transport assignment component including bus, rail and national coach services; and a variable demand model (VDM). It has a base year of 2019 and represents a neutral month of October.

This Technical Note documents the use of outputs from SWMWTM in combination with observed traffic data to complete junction modelling for junctions in the vicinity of the proposed junctions. The three alternative proposed sites are shown in Figure 1. This note builds on the outcomes of SWMWTM Forecasting Technical Note[1] completed for this project.

[1] 70104118 - SWMWTM Forecasting Technical Note v2.0.pdf

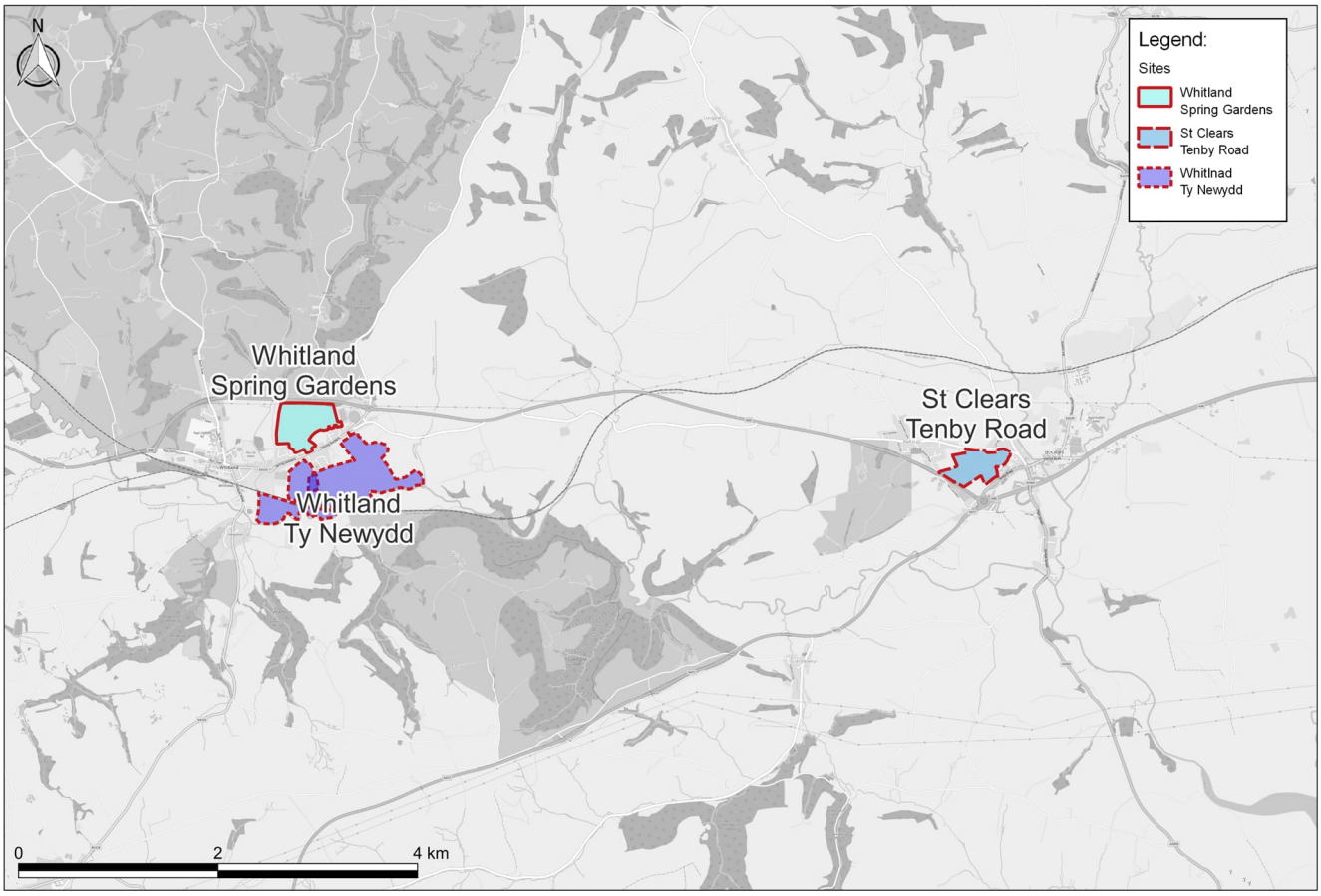


Figure 1 - Proposed site locations

Scope of Junction Modelling

JUNCTION LOCATIONS

Figure 2 provides the location of the junctions where assessments have been completed. These junctions are the locations where flow changes brought about by the Urgent and Planned Care Hospital are material and likely to impact the operation of the junction. Five of the six junction shown in Figure 2 are existing junctions, junction 12 is a proposed new roundabout provided to access Whitland Spring Gardens shown in Figure 1. The layout tested is shown in Appendix 1.

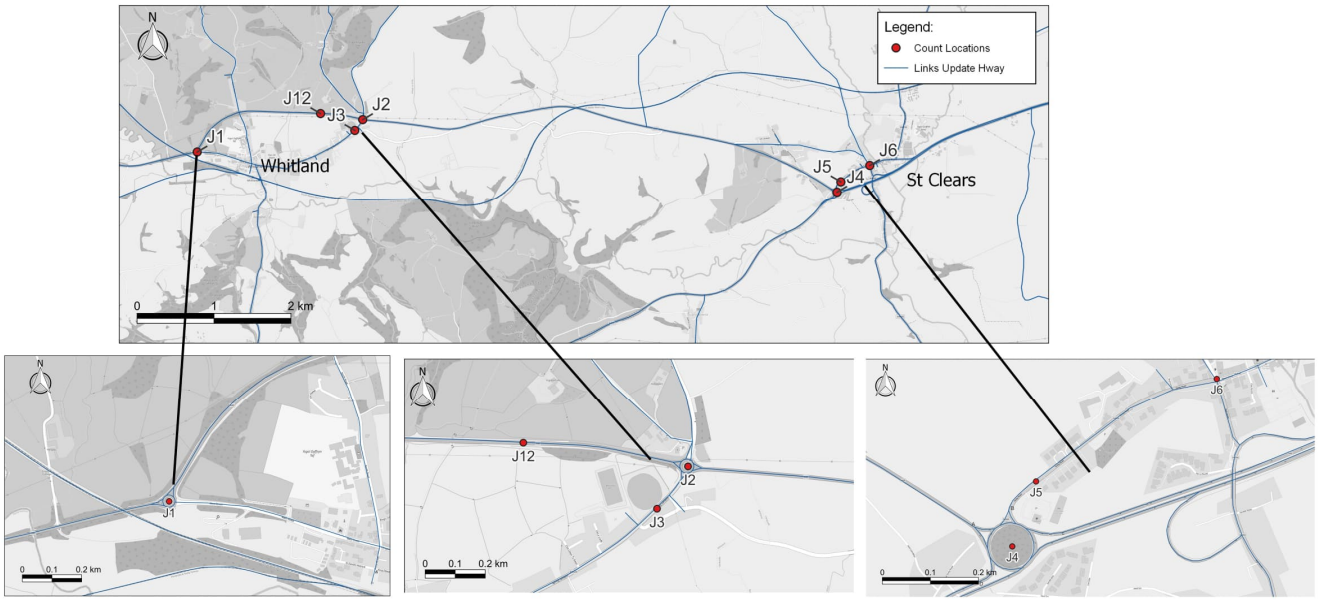


Figure 2 - Junction location plan

SCENARIOS TESTED

Table 1 details the scenarios which have been tested with junction modelling.

The junctions analysed in this study are:

- Junction 1 – Blackbridge Roundabout (Whitland)
- Junction 2 – Llanboidy Rd Roundabout (Whitland)
- Junction 3 - Spring Gardens (Near Whitland Cricket Club)
- Junction 4 - A40 A477 Rdbt (St Clears)
- Junction 5 – Tenby Road (St Clears)
- Junction 12 – A40 (West of Llanboidy Rd Roundabout, Whitland)

Table 1 Junction Model Scenarios

Junction	2023	2027 flows	+ Whitland Spring Gardens	+ Whitland Ty Newydd	+ St Clears, Tenby Road
1	✓	✓	✓	✓	✓
2	✓	✓	✓	✓	✓
3	✓	✓	x	x	✓
4	✓	✓	✓	✓	✓
5	✓	✓	x	✓	x
Junction 12	x	x	✓	x	x

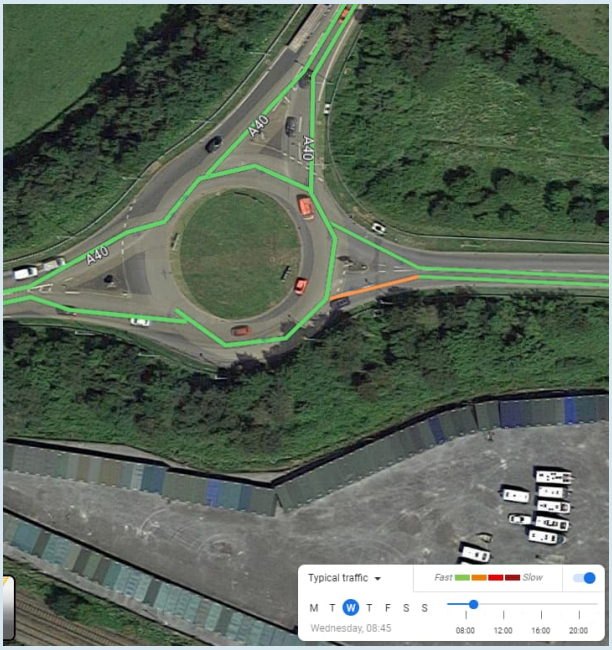
APPROACH

Base model setup

Each junction has been modelled in Junctions 10 software. Junctions 10 is the latest version of TRL's industry-standard package for modelling roundabouts, priority junctions and simple signalised junctions. Models for each location have been built using available CAD mapping to take geometric measurements and ensure each location is represented accurately.

For junction 1 to junction 5, the model has been built initially using current flows obtained from surveys completed in May 2023 and described in further detail in SWMWTM Forecasting Technical Note. The delays and level of service on each arm have been reviewed and compared to typical conditions shown in Google Maps. For the AM peak, the comparison has been made with typical conditions at 08:45 and for the PM peak the comparison was made at 17:45. This step has been completed to provide confidence that the model is performing realistically and able to forecast future conditions. As junction 12 has not been constructed, it is not possible to complete this step at this location. At each of the five junctions modelled with 2023 flows, the model results are consistent with typical conditions. All models operate within capacity with no significant queuing on any arm. A summary of the comparison is provided in Table 2 below.

Table 2 Model comparison with Google typical traffic conditions, AM peak

Junction	Google Typical Conditions	2023 Model Queue	
1		A40 (NE) West St A40 (W)	0.5 veh 0.1 veh 0.5 veh

Junction	Google Typical Conditions	2023 Model Queue
2		Unnamed Rd 0.1 veh A40 (E) 0.8 veh B4328 0.2 veh A40 (W) 0.4 veh
3		Minor arm, left 0.0 veh Minor arm, right 0.0 veh B4328 right turn 0.0 veh

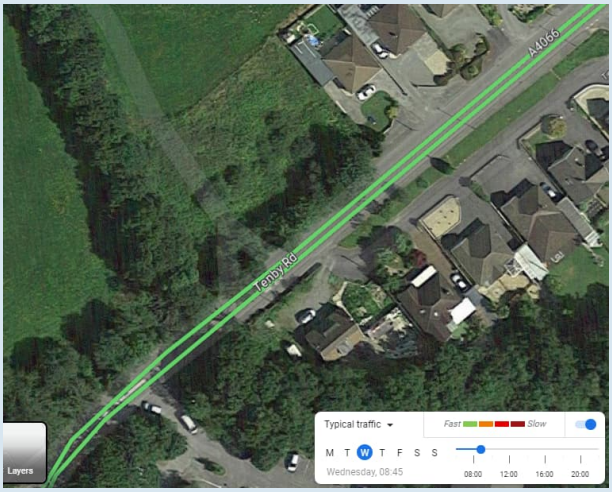
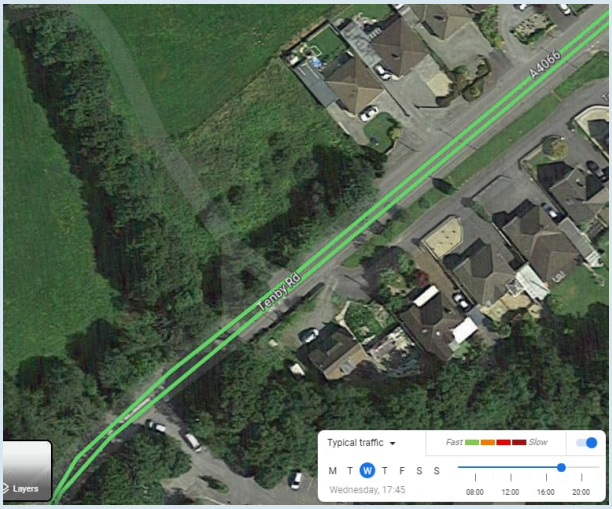
Junction	Google Typical Conditions	2023 Model Queue	
4		Tenby Rd A40 (E) A477 A40 (W)	0.4 veh 0.7 veh 0.3 veh 0.7 veh
5		Minor arm, left Minor arm, right A4066 right turn	0.1 veh 0.9 veh 0.1 veh

Table 3 Model comparison with Google typical traffic conditions, PM peak

Junction	Google Typical Conditions	2023 Model Queue
1		A40 (NE) 0.3 veh West St 0.1 veh A40 (W) 0.6 veh
2		Unnamed Rd 0.0 veh A40 (E) 0.5 veh B4328 0.2 veh A40 (W) 0.5 veh

3		Minor arm, left Minor arm, right B4328 right turn	0.0 veh 0.0 veh 0.0 veh
4		Tenby Rd A40 (E) A477 A40 (W)	0.3 veh 0.6 veh 0.3 veh 0.7 veh

5		Minor arm, left 0.0 veh Minor arm, right 0.6 veh A4066 right turn 0.1 veh

Model Results

Forecast flows for a range of scenarios covering the three site proposals in 2027 have been entered into the models for each junction location. More detail on the derivation of these flows are provided in the SWMWTM Forecasting Technical Note. The following section provides the results for these models.

JUNCTION 1

The Junctions 10 model results for junction 1 are provided in Table 4.

Table 4 Junction 1 Model Results

	AM peak				PM Peak			
	Queue (veh)	Ratio Flow to Capacity	Delay (s)	Level of service	Queue (veh)	Ratio Flow to Capacity	Delay (s)	Level of service
Do Minimum								
A40 (NE)	0.5	0.33	3.62	A	0.4	0.28	3.13	A
West St	0.1	0.11	3.44	A	0.1	0.07	3.11	A
A40 (W)	0.6	0.37	3.77	A	0.7	0.40	3.72	A
Whitland Ty Newydd								
A40 (NE)	0.5	0.33	3.64	A	0.6	0.37	3.51	A
West St	0.1	0.11	3.44	A	0.1	0.08	3.33	A
A40 (W)	0.8	0.43	4.11	A	0.7	0.40	3.75	A
Whitland Spring Gardens								
A40 (NE)	0.5	0.31	3.53	A	0.8	0.44	3.93	A
West St	0.1	0.12	3.41	A	0.1	0.08	3.5	A
A40 (W)	0.9	0.47	4.38	A	0.7	0.40	3.73	A
St Clears, Tenby Road								
A40 (NE)	0..5	0.32	3.58	A	0.7	0.42	3.81	A
West St	0.1	0.11	3.41	A	0.1	0.08	3.49	A
A40 (W)	0.9	0.46	4.32	A	0.7	0.4	3.73	A

The model results suggest that junction 1 operates satisfactorily in all scenarios and the traffic flow impacts can be accommodated by the existing junction in the two modelled peaks on a typical neutral weekday.

JUNCTION 2

The Junctions 10 model results for junction 2 are provided in Table 5.

Table 5 Junction 2 Model Results

	AM peak				PM Peak			
	Queue (veh)	Ratio Flow to Capacity	Delay (s)	Level of service	Queue (veh)	Ratio Flow to Capacity	Delay (s)	Level of service
Do Minimum								
Unnamed Road	0.0	0.04	3.49	A	0.0	0.04	3.57	A
A40 (E)	0.5	0.34	3.40	A	0.5	0.38	3.64	A
B4238	0.2	0.15	3.23	A	0.2	0.16	3.40	A
A40 (W)	0.5	0.34	3.79	A	0.5	0.37	3.95	A
Whitland Ty Newydd								
Unnamed Road	0.1	0.07	4.09	A	0.0	0.04	3.58	A
A40 (E)	1.1	0.53	4.99	A	0.9	0.47	4.24	A
B4238	0.2	0.18	3.85	A	0.2	0.17	3.66	A
A40 (W)	0.7	0.42	4.56	A	0.6	0.37	3.98	A
Whitland Spring Gardens								
Unnamed Road	0.1	0.09	3.80	A	0.0	0.05	4.19	A
A40 (E)	1.7	0.63	6.33	A	0.6	0.38	3.64	A
B4238	0.3	0.21	4.38	A	0.2	0.16	3.37	A
A40 (W)	0.5	0.31	4.02	A	1.4	0.58	5.87	A
Site A								
Unnamed Road	0.1	0.11	4.37	A	0	0.05	4.23	A
A40 (E)	2.2	0.69	8.43	A	0.6	0.38	3.67	A
B4238	0.2	0.2	3.67	A	1.5	0.61	7.03	A
A40 (W)	0.8	0.46	4.92	A	0.7	0.43	4.96	A

Junction 2 performs acceptably under all scenarios in both modelled time periods on a typical neutral weekday, even though for all three sites the flows entering the junction increased significantly.

JUNCTION 3

The Junctions 10 model results for junction 3 are provided in Table 6.

Table 6 Junction 3 Model Results

	AM peak				PM Peak			
	Queue (veh)	Ratio Flow to Capacity	Delay (s)	Level of service	Queue (veh)	Ratio Flow to Capacity	Delay (s)	Level of service
Do Minimum								
Minor arm, left	0.0	0.02	6.25	A	0.0	0.01	5.91	A
Minor arm, right	0.0	0.02	8.47	A	0.0	0.01	8.27	A
B4328 right turn	0.0	0.02	5.69	A	0.0	0.02	5.31	A
St Clears, Tenby Road								
Minor arm, left	0.0	0.02	7.56	A	8.4	1.21	968.91	F
Minor arm, right	0.1	0.09	10.73	B	104.9	1.33	794.38	F
B4328 right turn	0.2	0.11	6.67	A	0.0	0.00	5.39	A

Junction model results indicate that the junction 3 operates with minimal delay in the future do minimum in both modelled time periods on a typical neutral weekday. This is due to the relatively low flows on the B4328 and very low flows turning into the side road.

Under the site 3 proposals, the operation of the junction deteriorates if left in its current configuration of a priority controlled junction, particularly in the PM peak where the junction is predicted to go over capacity on the minor arm. This will lead to queuing on the minor arm only. The B4328 is predicted to continue to operate without significant operational issues and further there is no impact predicted to be likely on the A40. If these queues are considered unacceptable on the minor arm, then a simple 3-stage signalised junction should be considered at this location.

JUNCTION 4

The Junctions 10 model results for junction 4 are provided in Table 7.

Table 7 Junction 4 Model Results

	AM peak				PM Peak			
	Queue (veh)	Ratio Flow to Capacity	Delay (s)	Level of service	Queue (veh)	Ratio Flow to Capacity	Delay (s)	Level of service
Do Minimum								
Tenby Road	0.4	0.26	4.47	A	0.2	0.19	3.86	A
A40 (E)	0.6	0.38	2.364	A	0.7	0.40	2.48	A
A4777	0.4	0.28	2.28	A	0.3	0.25	2.02	A
A40 (W)	0.9	0.48	5.05	A	0.8	0.46	4.53	A
Whitland Ty Newydd								
Tenby Road	0.4	0.26	4.45	A	0.3	0.24	5.21	A
A40 (E)	1.6	0.61	4.02	A	0.8	0.43	2.79	A
AA4777	0.6	0.37	2.97	A	0.3	0.26	2.15	A
A40 (W)	1.1	0.53	6.45	A	6.2	0.87	18.00	C
Whitland Spring Gardens								
Tenby Road	0.4	0.26	4.43	A	0.3	0.21	4.38	A
A40 (E)	1.0	0.50	3.18	A	0.7	0.40	2.48	A
A4777	0.4	0.30	2.49	A	0.3	0.25	2.02	A
A40 (W)	0.80	0.45	4.88	A	1.17	0.63	6.59	A
St Clears, Tenby Road								
Tenby Road	0.4	0.26	4.45	A	0.3	0.21	4.41	A
A40 (E)	1	0.49	3.11	A	0.7	0.4	2.49	A
A4777	0.4	0.3	2.49	A	0.3	0.25	2.02	A
A40 (W)	0.8	0.46	4.93	A	1.7	0.64	6.67	A

The assessment at junction 4 shows good levels of service in both modelled peak on a typical neutral weekday. Under each of the site options, the level of service remains good apart from a moderate deterioration of conditions under Whitland Ty Newydd in the PM peak on the A40 (W). The arm is predicted to approach capacity with a ratio of flow to capacity of 0.87.

JUNCTION 5

The Junctions 10 model results for junction 5 are provided in Table 8.

Table 8 Junction 5 Model Results

	AM peak				PM Peak			
	Queue (veh)	Ratio Flow to Capacity	Delay (s)	Level of service	Queue (veh)	Ratio Flow to Capacity	Delay (s)	Level of service
Do Minimum								
Minor arm, left	0.1	0.08	8.89	A	0.0	0.05	7.51	A
Minor arm, right	0.9	0.48	14.93	B	0.6	0.38	11.82	B
A4066 right turn	0.1	0.06	6.23	A	0.1	0.07	6.34	A
Whitland Ty Newydd								
Minor arm, left	0.1	0.09	10.38	B	0.0	0.05	7.81	A
Minor arm, right	1.1	0.54	19.38	C	0.6	0.39	12.56	B
A4066 right turn	0.3	0.19	8.20	A	0.1	0.08	6.65	A

Under forecast flows, junction 5 is predicted to operate with good levels of service on a typical neutral weekday in the two modelled time periods. The junction is predicted to experience a slight deterioration in levels of service under flows for Whitland Ty Newydd, due to an increase in traffic accessing the site in the AM peak from the A4066 (NE).

JUNCTION 12

The Junctions 10 model results for junction 12 are provided in Table 9.

Table 9 Junction 12 Model Results

	AM peak				PM Peak			
	Queue (veh)	Ratio Flow to Capacity	Delay (s)	Level of service	Queue (veh)	Ratio Flow to Capacity	Delay (s)	Level of service
Whitland Ty Newydd								
Stream B-C	1.1	0.52	4.84	A	0.6	0.37	4.17	A
Stream B-A	1.5	0.60	7.72	A	0.6	0.40	4.63	A
Stream C-AB	0.0	0.02	3.46	A	0.1	0.64	9.90	A

Junction 12 is a new junction proposed to access Whitland Ty Newydd directly from the A40. The junction has not been tested without the development flows. The proposed junction is forecast to accommodate the A40 flows in addition to the predicted additional flows with good levels of service on all arms in both peaks on a typical neutral weekday.

SUMMARY AND CONCLUSIONS

Summary

Traffic flows from SWMWTM and observed traffic data have been used to complete junction modelling for several junctions in the vicinity of three alternative proposed Urgent and Planned Care Hospital sites.

Six locations have been tested in total using Junctions 10 software for a forecast year of 2029 on a typical neutral weekday in the AM and PM peak hours. The assessments have shown that there are a range of impacts on the road network around Whitland and St Clears. Generally, these impacts do not impact on the levels of service at each of the six junction locations.

The main exception is the access junction on the B4328 to the east of Whitland (junction 3) when Whitland Ty Newydd is brought forward. Poor levels service are predicted on the minor arm leading into the development site only, with good levels of service in both directions on the B4328.

Conclusions

Overall the impacts of the three sites are considered to be acceptable on a typical neutral weekday in the AM and PM peak hours. Consideration may need to be given to signalising the access to Whitland Ty Newydd from the B4328.