



TECHNICAL NOTE 1

DATE:	August 2023	CONFIDENTIALITY:	Internal
SUBJECT:	SWMWTM Forecasting Results		
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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-west of Wales would centralise all specialist children and adult services. It will 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.

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 an update of the South-West and Mid-Wales Transport Model (SWMWTM) focusing on the area around, and within the towns Whitland and St Clears associated with the delivery of three proposed sites, as shown in Figure 1. Both towns are located in the county of Carmarthenshire and are connected by the A40, which connects them to Carmarthen to the east, and Haverfordwest to the west. The update builds on two previous technical notes, as follows:

- The SWMWTM Base Year Model Review technical note¹.
- The SWMWTM Base Year Model Updates technical note².

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² \\uk.wspgroup.com\central data\Projects\700553xx\70055354 - South West Wales Strategic Transport Model\03 WIP\13- Hywel Dda\Start File\SWMWTM Update TN v1.0.docx

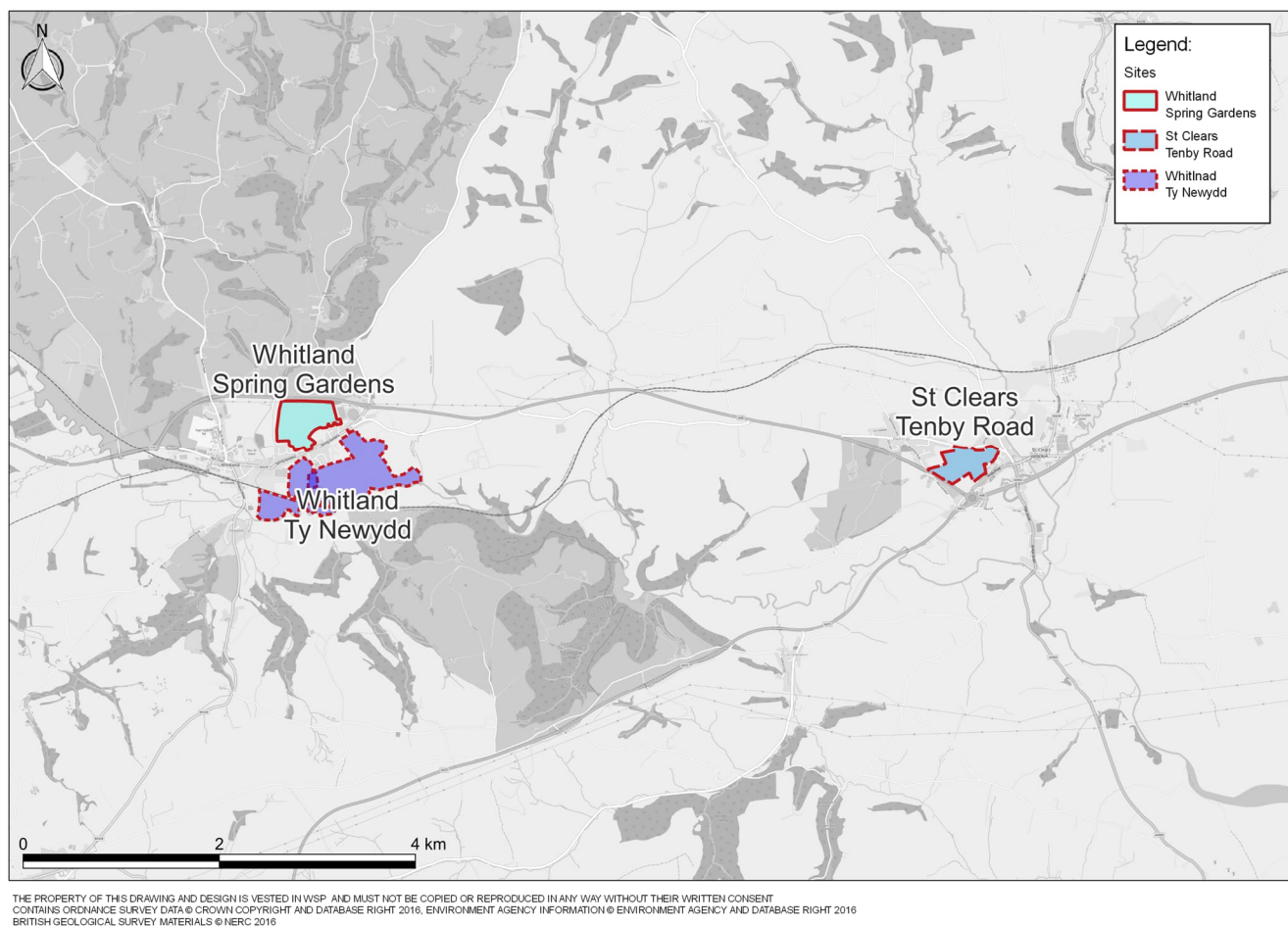


Figure 1 - Proposed site locations

FORECAST ASSUMPTIONS

Forecast years

Transport forecasts have been developed for a single, 2027, forecast year. This forecast year is an existing, standard, forecast year developed as part of the SWMWTM Foundation Case forecasting and represents the closest available forecast year to the likely completion date of any new Urgent and Planned Care Hospital.

Demand forecasting

BACKGROUND GROWTH

This section provides a summary of the development of the forecast trip matrices for the SWMWTM foundation case, focusing on the modelled year 2027, and these matrices are also considered for this study as the starting point. The forecast matrices were developed using the following data sources:

- TEMPro version 7.2 software, using the NTEM v7.2 datasets;
- Land use data collated from local authorities within the study area; and

- Road Traffic Forecast 2018 data

The trip rates were derived by extracting information from the National Trip End Model (NTEM) via TEMPro. This involved adjusting the number of households and jobs within the TEMPro program and extracting the predicted number of trips from NTEM. Trip rates were then determined for each local authority, travel mode, and trip purpose. The travel modes considered in the analysis are:

- Car driver;
- Active travel (cycling and walking);
- Public Transport (bus and rail); and
- Park and Ride.

The trip purposes are:

- Home-Based Work (HBW);
- Home-Based Employers Business (HBEB);
- Home-Based Education (HBEd);
- Home-Based Other (HBO);
- Non-Home-Based Employers Business (NHBEB); and
- Non-Home-Based Other (NHBO).

For trip distribution, the existing distribution from the zone in which the development is located was utilized. If the model zone's distribution was deemed unsuitable, a nearby zone was selected. This process involved adjusting the existing base year trip ends to match the total of the base year plus the development trip ends. Additionally, the matrices were factored up to account for background growth, development trips, and constrained to growth for each local authority area. This, essentially, ensures that the total growth across the model is line with the national planning policy.

These methodologies and data sources have been employed to develop the forecast trip matrices, providing a foundation for analysing travel patterns and transportation impacts in the SWMWTM as well as this study.

A summary table of the total forecast growth by matrix type (PA and OD) and time period is presented in below Table 1

Table 1 Forecast Matrix Growth Summary

Matrix Type	Time Period	Base Trips	2027 Forecast Trips	2027 Growth
PA	Avg. Weekday	889,885	951,437	6.92%
OD	AM	16,582	17,486	5.45%
OD	IP	23,936	25,127	4.98%
OD	PM	23,569	24,967	5.93%
OD	OP	2,516	2,644	5.07%

Growth factors for the LGV and HGV vehicle classes have been calculated from the RTF18. A table of the growth factors is presented below in Table 2

Table 2 LGV and HGV Growth Factors

Road Type	LGV Growth Factor, 2019 to 2027	HGV Growth Factor, 2019 to 2027
Motorway	1.102	1.031
Trunk A	1.102	1.031
Average	1.102	1.031

A full table of the LGV and HGV forecast year trips are provided below in Table 3

Table 3 LGV and HGV Forecast Year 2027 Trips

Year	Period	LGV	HGV
2027	AM	24,868	2,895
	IP	19,743	2,725
	PM	20,346	1,409

NEW DEVELOPMENT ZONES

There are three locations being considered for the new hospital: two in Whitland and one in St Clears. The sites are known as Whitland Spring Gardens (formerly Site 12), Whitland Ty Newydd (formerly Site C), and St Clears Tenby Road (formerly Site 17). Three empty development zones were added to the SWMWTM to enable accurate loading of trips, and calculation of travel costs, for each of the sites, as detailed in the SWMWTM Base Year Model Updates technical note.

In the base year, and do-nothing, scenarios there were no trips trip allocated to the development zones. In the test scenarios, the development zone representing the Urgent and Planned Care site being assessed has trips added to it, with a reduction in demand at existing hospital sites. The forecasting of reference demand for the development zones is documented in the next section.

HOSPITAL DEMAND

The travel demand to be relocated to the proposed new Urgent and Planned Care hospital sites was informed by previous analysis undertaken by WSP for HDdUHB and documented in the Technical Note 'Trip Distribution Methodology and Summary Note'³.

The assumption on impacted hospital travel demand presented in the Trip Distribution Methodology and Summary Note was that the construction of a new hospital will result in the relocation of 68% of staff from Glangwili Hospital, and 65% of staff from Withybush Hospital. On this basis, for this study, it has been assumed that 68% of journeys to and from Glangwili Hospital, and 65% of journeys to and from Withybush Hospital, will be relocated to the new hospital location (which will either be Whitland: Spring Gardens, Whitland: Ty Newydd or St Clears Tenby Road). This assumption was applied equally to both commute trips and 'other' trips (assumed to be patients and visitors) to and from the existing hospitals. Employer's

³ Trip Distribution Methodology and Summary Note, WSP, March 2023, <\\uk.wspgroup.com\central\data\Projects\70104xxx\70104118 - Hywel Dda Land Services\03 WIP\TP Transport\Technical Note\70104118 - Hywel Dda Transport Technical Note Final.pdf>.

business and goods vehicle trips were unchanged as these represented low numbers of trips in the SWMWTM.

Commute Demand

Journey-to-work (JtW) postcode data was available for all employees at Glangwili and Withybush Hospitals. This data provided the postcode of each staff member working at each hospital. The postcode data were geolocated to SWMWTM model zones and aggregated to calculate the number of employees produced at each zone in the model and travelling to the existing hospital zones.

National Travel Survey (NTS) data was analysed to calculate commute trip rates. Data for Wales has not been available in the NTS since 2011/12. However, analysis showed that the commute trip rates in England and Wales were similar in 2011/12 and, therefore, it has been assumed that the same would be true in 2018/19, which is the latest available reliable year of data prior to the Covid-19 pandemic impacting survey results. The commute trip rates, calculated by dividing the trips per person, per year, from the NTS data by 253 peak weekdays in a year, are shown in Table 4.

Table 4: Commute trip rates applied to JtW data

Region	Year	Trips per Person per Year	% of Total Trips	Trip Rate
Wales	2011/12	146	15%	0.58
England	2011/12	146	15%	0.58
England	2018/19	142	15%	0.56

The 2018/19 England commute trip rate of 0.56 was applied to the JtW data to calculate commute tours to the existing hospital sites. Based on the numbers of staff at the existing hospital sites from the postcode data, the daily tours shown in Table 5 were calculated.

Table 5: Existing hospital JtW tours

Hospital	Staff	JtW Tours
Glangwili	2,614	1,470
Withybush	1,588	893

Analysis of the 2027 SWMWTM reference demand matrices showed that the number of commute tours to the existing hospital sites did not match the magnitude of demand as suggested by the JtW data. This is not unexpected given that the SWMWTM demand matrices were built from mobile phone data and won't reliably capture the exact origins and destinations of trips, and that the application of trip growth from the National Trip End Model (NTEM), and other national sources, will lead to growth being spread over wider areas rather than concentrated on specific employment sites.

However, to understand the impacts of providing a new hospital site in either Whitland or St Clears it is important to assess an accurate level of demand accessing each of the proposed sites. For the purposes of modelling the potential impacts of the proposed new hospital sites, the following method was therefore applied:

- The daily home-based work tours to the SWWMTM zones containing Glangwili and Withybush hospitals were factored down to reflect 68% of workers being relocated from Glangwili Hospital and 65% of workers being relocated from Withybush Hospital. The same factors were applied across all production zones, regardless of location, for all tours attracted to each of the hospital zones.
- The daily home-based work tours calculated from the JtW data were added into the test scenario matrices in the relevant development zone for the proposed site being tested. The tours were factored so that only 68% of tours to Glangwili Hospital and 65% of tours to Withybush Hospital were added into the matrices to reflect the quantum of workers being relocated. Tours were distributed to different modes and traveller types based on the existing SWWMTM matrices.

The above methodology leads to a higher level of demand being forecast in the test scenarios, with one of the proposed sites implemented, than in the 'do-nothing' scenario, where no hospital site is developed. A comparison of the final numbers of commute tours in each scenario is shown in Table 6.

Table 6: Change in commute tours in test scenario

Hospital	Commute Tours in Do-Nothing	Commute Tours in Test Scenario	Change
Glangwili	440	141	-299
Withybush	309	108	-201
Proposed Site in Whitland or St Clears	0	2,363	+2,363

There are around 1,900 additional commute tours in the test scenario reference demand matrices in comparison to the do-nothing reference demand matrices. Approximately 500 daily tours are removed from the existing hospital sites whilst over 2,300 daily tours are added to the proposed hospital site.

Other Demand

There was no additional data to inform the relocation of non-commuting demand to the proposed new hospital sites. Therefore, the relocation of trips related to other trip purposes focused only on the demand held within the 'other' demand segment, which were assumed to be related to patients and visitors to the hospital. No updates were made to employer's business, education, or goods vehicles trips to and from the existing hospital sites.

Only the demand existing within the 2027 SWWMTM reference demand matrices was updated. Trips were moved based on the same proportions as the assumed numbers of workers being relocated to the new hospital sites (as documented in the Trip Distribution Methodology and Summary Note and described in the previous section). A comparison of the daily home-based 'other' tours in the reference demand matrices is shown in Table 7.

Table 7: Change in 'other' tours in test scenario

Hospital	'Other' Tours in Do-Nothing	'Other' Tours in Test Scenario	Change
Glangwili	966	309	-657
Withybush	828	290	-538
Proposed Site in Whitland or St Clears	0	1,196	+1,196

The total number of 'other' tours in the reference demand is consistent between the do-nothing and test scenarios but approximately 1,200 tours are relocated from the existing hospital sites to the proposed new hospital site.

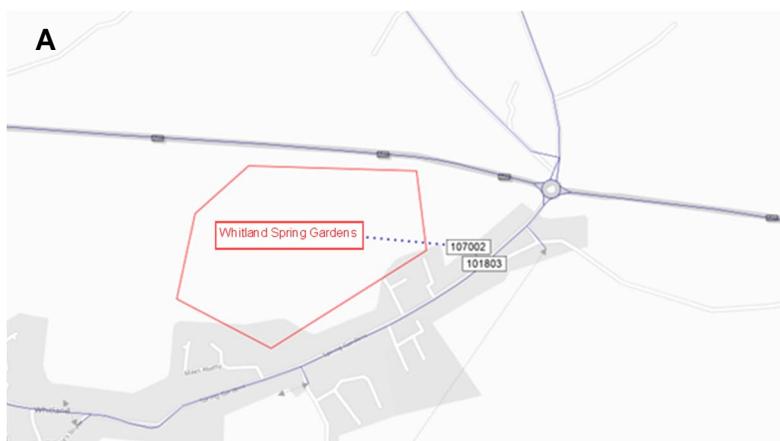
Supply forecasting

DO-NOTHING

In addition to the changes made in the Model Updates Technical Note, three new zones were added, one each for each of the potential new sites. The new zones were then connected to the highway network by links being added off existing nodes and connected to the zones by a connector. Site accesses are shown below in Figure 2 A, B, C.

For Whitland Spring Gardens (Figure 2 – B) a link was added on Spring Gardens Road off node 101803. For Whitland Ty Newydd (Figure 2 - A) a link was added at the North end of Spring Gardens Road off node 101115 and then connected to the zone. St Clears Tenby Road (Figure 2 – C) was connected to the network by a link added off node 102009 and a connector.

In the public transport model, the station at St Clears was reintroduced into the model, it was assumed that all trains that stopped at Whitland would also stop at St Clears. The arrival times for the new stop at St Clears station were interpolated from the arrival and departure times of the services between Whitland and Carmarthen.



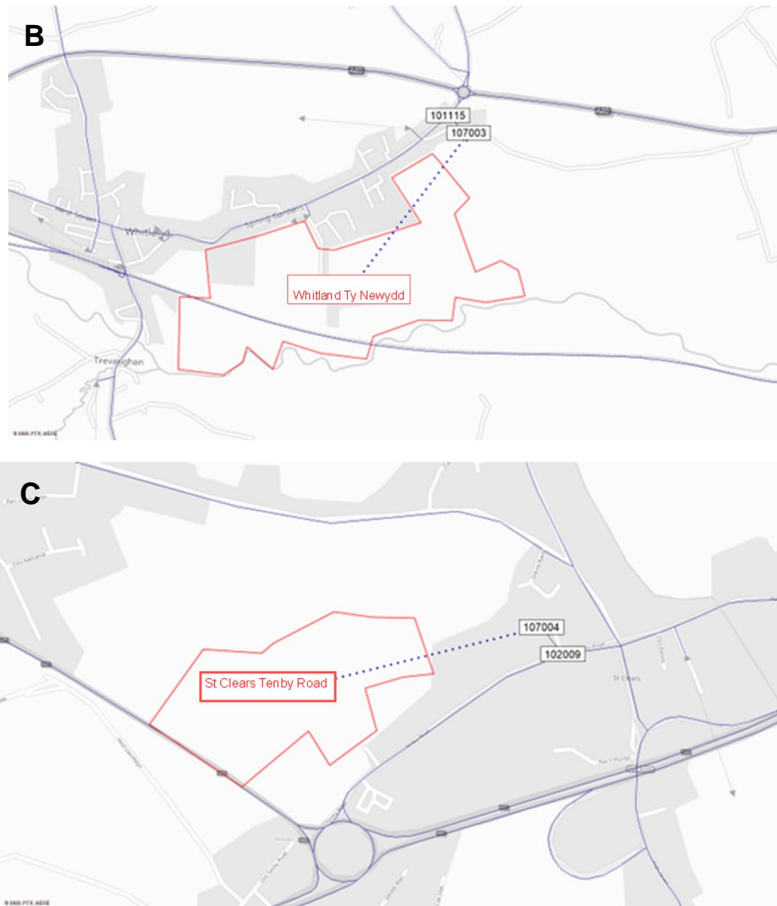


Figure 2: Images of Site Access in the Do Nothing Scenario

DO-SOMETHING SCENARIOS (TEST)

For the tested site in each scenario the site access changes made to the Do-Nothing scenario were replaced so the site access matched the site access given in the site access drawings.

In Whitland Spring Gardens (refer to Figure 3), the Do-Nothing site access required an update. The road access from Spring Gardens was removed, and a new access to the site was created by splitting the link between Llanboidy Rd Roundabout and the Blackbridge Roundabout, which represents the A40 around

Whitland. This modification involved the addition of a 3-arm roundabout. Two of the roundabout arms serve as connections to the A40, while the third arm serves as the access to the site.

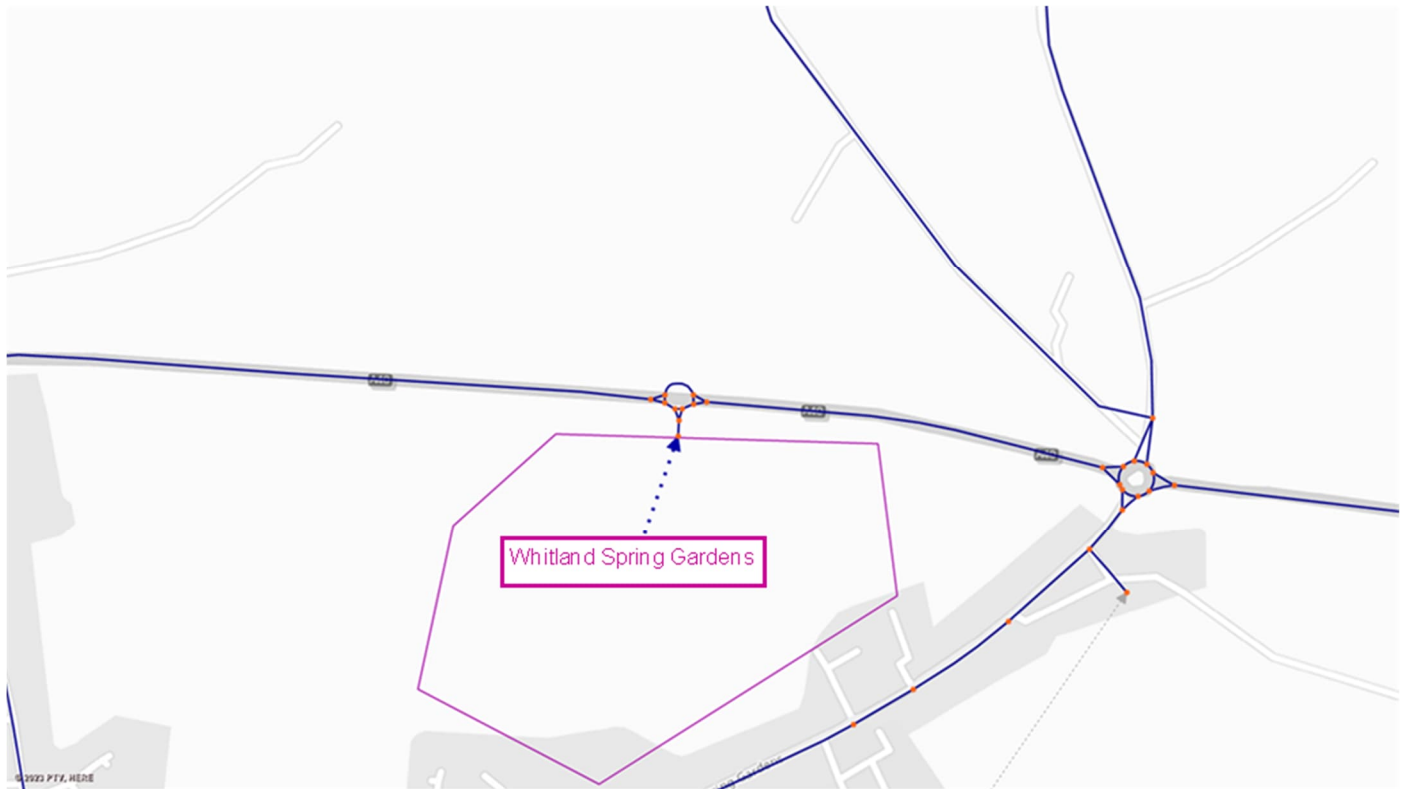


Figure 3: Whitland Spring Gardens Scenario Site Access

For Whitland Ty Newydd, (refer Figure 4) no changes were needed as the site access added in the Do Nothing reflects the designed site access.

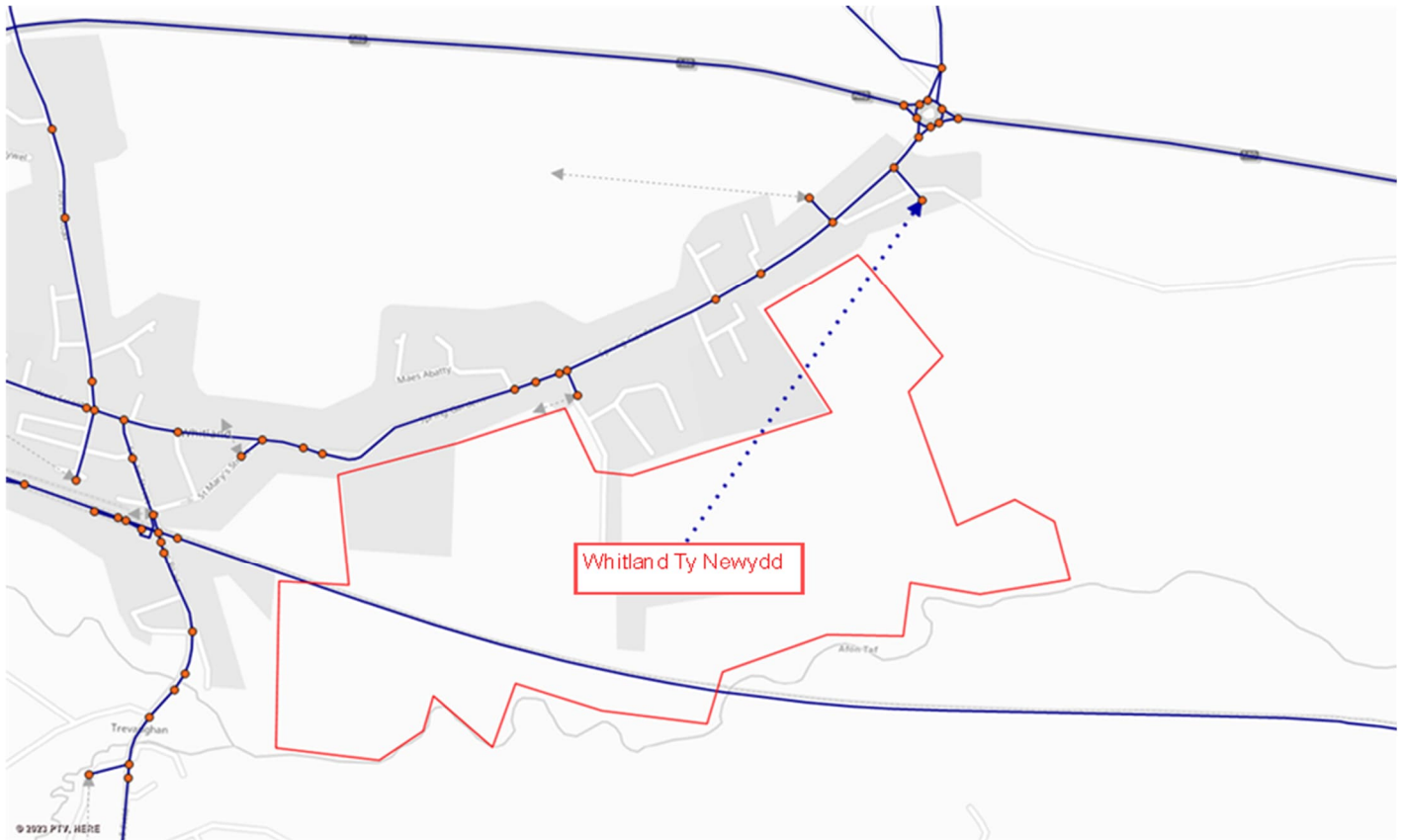


Figure 4: Whitland Ty Newydd Scenario Site Access

For St Clears Tenby Road, the Do-Nothing access was replaced with two different access points. The first access point was added to the A40 for Eastbound traffic, by introducing a new link off node 102857. This access is limited to left-in/left-out movements, meaning that traffic entering the site via this link can only turn left, while the traffic exiting the Whitland Ty Newydd can only turn left towards the A40 heading Eastbound.

A second access point was established on Tenby Road. This involved splitting link 1004973 and creating a new link from the new node to the site. This access point is dedicated to inbound traffic only, allowing vehicles to enter the site from Tenby Road.



Figure 5: St Clears Tenby Road Scenario Site Access

In the public transport model, each site was connected to the nearest rail station and nearby bus stops in each direction. For Sites Whitland Spring Gardens and Whitland Ty Newydd, the nearest rail station was Whitland Station. As for St Clears Tenby Road, the nearest rail station was St Clears Station. These rail stations served as the primary connection points for the respective sites, along with the availability of nearby bus stops in each direction.

Generalised cost parameters

In accordance with the 2019 Base Year model, the generalised costs used in the various components of the SWMWTM model suite have been created using the TAG Databook v1.13.1 as an input, ensuring consistency with the Base Year.

Generalised costs are used as a basis for determining route choice in the SWMWTM highway assignment model component. The generalised cost is a combination of travel time, vehicle operating costs and any additional road user charges combined with a Value of Time (VoT), which is specific to each journey purpose and mode.

Each private transport system in the SWMWTM (Car Business, Car Commute, Car Other, LGV, and HGV) has a defined cost-function. The cost-function determines the overall cost of each available path between an origin-destination pair, thus affecting the balance of trips on each path.

Within the 'Impedance' function in VISUM, the generalised cost coefficients of time and distance have been input in pence per second x 100 and pence per metre x 100 respectively, as shown below.

Table 8: Highway generalised cost parameters (2027 Forecast Year)

Demand Segment	AM Peak		Inter Peak		PM Peak	
	Time (pence per sec)	Distance (pence per m)	Time (pence per sec)	Distance (pence per m)	Time (pence per sec)	Distance (pence per m)
Commuting	38.3030	0.6329	38.9258	0.6329	38.4351	0.6329
Employer's Business	57.1153	1.1958	58.5273	1.1958	57.9395	1.1958
Other	26.4261	0.6329	28.1500	0.6329	27.6736	0.6329
Education*	26.4261	0.6329	28.1500	0.6329	27.6736	0.6329
LGV	41.3917	1.4627	41.3917	1.4627	41.3917	1.4627
HGV	94.8121	3.5077	94.8121	3.5077	94.8121	3.5077

Variable demand modelling

The SWMWTM VDM (Variable Demand Model) incorporates changes in travel costs to model the corresponding changes in travel behaviour. The responses modelled by the VDM include mode choice and destination choice.

In variable demand modelling systems like the SWMWTM VDM, there is an iterative process between the demand model and the assignment (or supply) models. This iteration is necessary because the volume of demand affects travel times, which in turn influence the volume of demand. Monitoring the convergence of this iterative process is crucial to ensure reliable and accurate model outputs.

To measure convergence between the demand and supply models, the TAG Unit M2.1 §6.3 recommends using the demand/supply gap criterion. This criterion is calculated as follows:

$$GAP = \frac{\sum_{\alpha} C(X_{\alpha}^n) |D(C(X_{\alpha}^n)) - X_{\alpha}^n|}{\sum_{\alpha} C(X_{\alpha}^n) X_{\alpha}^n} \times 100$$

where:

X_{α}^n is cell α in the previous assignment matrix for iteration n

$C(X_{\alpha}^n)$ is cell α in the generalised costs resulting from assigning that matrix

$D(C(X_{\alpha}^n))$ is cell α in the matrix output by the demand model using costs $C(X_{\alpha}^n)$

α represents every single combination of origin, destination, demand segment and mode

According to TAG Unit M2.1, a gap value of less than 0.1% can be achieved in many cases, and remedial steps should be taken when gap values exceed 0.2% (such as increasing assignment accuracy).

The calculation of the demand/supply gap is integrated into the VISUM VDM procedures, with a stopping criterion of the gap value being lower than 0.1% across the entire model. The same parameters used during the development of the VDM are employed in this process.

By monitoring convergence and maintaining a low demand/supply gap, the SWMWTM VDM ensures more reliable and consistent model outputs, which are crucial for subsequent analyses such as economic appraisal, traffic impact assessments.

FORECAST RESULTS

Model convergence

Well converged models are required to provide stable, consistent, and robust model results and to differentiate between changes related to an intervention from those associated with model instability or noise. This section outlines the convergence and stability performance of the traffic forecasts.

DEMAND MODEL CONVERGENCE

The convergence at each iteration for the Do Nothing and the respective Do Something scenarios have been detailed in Table 3. It is seen that the gap value at the end of the final iteration is lower than 0.1% which is in line with the TAG guidance.

Table 9: Demand model convergence statistics for the Do-Nothing and site scenarios

Iteration	Do Nothing	DS1 Whitland Spring Gardens	DS2 Whitland Ty Newydd	DS3 St Clears Tenby Road
0	2.1928	2.1618	2.1583	2.2000
1	0.0915	0.0961	0.1027	0.1020
2	-		0.0408	0.0395

ASSIGNMENT CONVERGENCE

Before the results of any traffic assignment are used to influence decisions, the stability (and degree of convergence) of the assignment must be confirmed. Both the highway and Public Transport assignment models must suitably converge, to achieve robust assignment results, whilst the VDM must demonstrate convergence in the demand-supply loop.

HIGHWAY ASSIGNMENT MODEL (HAM)

As noted in TAG Unit M3.1, most advanced assignment models involving explicit modelling of junctions do not guarantee complete mathematical convergence through the iterative assignment procedure. Therefore, an appropriate point in the iterative process where flows and costs are judged to be sufficiently stable must be adopted. This is the case for the SWMWTM highway assignment component, where convergence has been monitored across two separate properties:

- Proximity of the assignment (%GAP); and
- Stability of the assignment, judged by the change in flows and costs between successive iterations.

TAG Unit M3.1 sets out minimum criteria that are judged to produce robust assignment results that are achievable for very large models. These are presented in **Error! Reference source not found.** below, alongside the criteria selected for SWMWTM. Within VISUM, the 'WebTAG compliant' assignment options are utilised in SWMWTM to ensure that these criteria are met.

Table 10: Convergence measures and criteria

Measure	TAG Unit M3.1	SWMWTM target
Proximity	%GAP <0.1%	%GAP <0.1%
Stability , of which...		
... %Links with flows changing by less than 1%	98%	98%
... %Turns with flows changing by less than 1%	-	98%
... %Links with costs changing by less than 1%	98%	98%
... %Turns with costs changing by less than 1%	-	98%

These parameters were used in the development of the 2019 Base Year highway assignment models and have been retained for the forecast years to ensure consistency.

PUBLIC TRANSPORT ASSIGNMENT MODEL (PTAM)

The public transport modelling criteria are set out in TAG unit M3-2. There are no specified criteria for convergence within the guidance. For the forecast year models, the same parameters as used for the 2019 Base Year public transport assignment were retained and the assignments were monitored to ensure that performance was robust.

ASSIGNMENT CONVERGENCE

The highway assignment convergence at each iteration for the Do Nothing and the respective Do Something scenarios have been detailed in *Error! Reference source not found.*. The parameters that have been reviewed at the assignement level are % GAP, Link flows, turn flows, link costs and turn costs.

Table 11: Highway assignment converegence staistics

Assignment Loops	AM				IP				PM			
	DN	DS1 Whitland Spring Gardens	DS2 Whitland Ty Newydd	DS3 St Clears Tenby Road	DN	DS1 Whitland Spring Gardens	DS2 Whitland Ty Newydd	DS3 St Clears Tenby Road	DN	DS1 Whitland Spring Gardens	DS2 Whitland Ty Newydd	DS3 St Clears Tenby Road
Gap%												
1	0.0190%	0.0190%	0.0170%	0.0156%	0.0411%	0.0468%	0.0293%	0.0201%	0.0449%	0.0080%	0.0224%	0.0237%
2	0.0126%	0.0144%	0.0115%	0.0465%	0.0392%	0.0405%	0.0224%	0.0161%	0.0355%	0.0073%	0.0174%	0.0142%
3	0.0122%	0.0130%	0.0112%	0.0242%	0.0357%	0.0365%	0.0193%	0.0170%	0.0269%	0.0071%	0.0171%	0.0111%
4	0.0121%	0.0121%	0.0114%	0.0088%	0.0302%	0.0361%	0.0182%	0.0177%	0.0236%	0.0071%	0.0127%	0.0110%
Link Flows												
1	0.967	0.971	0.977	0.972	0.979	0.982	0.975	0.979	0.962	0.963	0.965	0.972
2	0.983	0.986	0.985	0.974	0.974	0.984	0.977	0.987	0.992	0.999	0.988	0.984
3	0.998	0.999	1.000	0.979	0.979	0.986	0.981	0.984	0.990	0.999	1.000	1.000
4	0.999	0.989	1.000	0.989	0.984	0.982	0.985	0.984	0.989	1.000	0.992	1.000
Turn Flows												
1	0.966	0.969	0.975	0.970	0.979	0.981	0.976	0.979	0.960	0.962	0.963	0.970
2	0.982	0.984	0.984	0.974	0.974	0.983	0.977	0.986	0.991	0.999	0.988	0.984
3	0.998	0.999	0.999	0.980	0.979	0.985	0.980	0.983	0.989	0.999	1.000	1.000
4	0.999	0.988	1.000	0.989	0.983	0.982	0.984	0.983	0.989	1.000	0.991	1.000
Link Costs												
1	0.997	0.997	0.998	0.997	0.998	0.998	0.999	0.998	0.996	0.997	0.997	0.997
2	0.998	0.998	0.998	0.997	0.998	0.999	0.999	0.999	0.999	1.000	0.998	0.998
3	1.000	1.000	1.000	0.997	0.998	0.999	0.999	0.999	0.999	1.000	1.000	1.000
4	1.000	0.998	1.000	0.998	0.999	0.999	0.999	0.999	0.998	1.000	0.999	1.000
Turn Costs												
1	0.998	0.998	0.999	0.999	0.999	0.998	0.998	0.998	0.997	0.998	0.998	0.998
2	0.998	0.999	0.998	0.998	0.998	0.999	0.999	0.999	0.999	1.000	0.999	0.999
3	1.000	1.000	1.000	0.998	0.998	0.999	0.999	0.999	0.999	1.000	1.000	1.000
4	1.000	0.999	1.000	0.999	0.999	0.999	0.999	0.999	0.999	1.000	0.999	1.000

Demand

This section details the post VDM demand for the Do-Nothing and the three Do-something scenarios. Table 12 provides a summary for each user class across the forecast scenarios.

Table 12: Matrix Totals by Mode

User Class	AM				IP				PM			
	DN	Whitland Spring Gardens / DS1	Whitland Ty Newydd / DS2	St Clears Tenby Road / DS3	DN	Whitland Spring Gardens / DS1	Whitland Ty Newydd / DS2	St Clears Tenby Road / DS3	DN	Whitland Spring Gardens / DS1	Whitland Ty Newydd / DS2	St Clears Tenby Road / DS3
CB	13,378	9,372	13,363	9,354	9,374	8,274	9,362	8,258	8,270	9,372	8,256	13,378
CC	57,629	14,883	58,012	14,881	14,802	56,720	14,882	56,712	56,300	14,883	56,719	57,629
CO	74,711	93,824	74,695	93,824	93,832	82,779	93,814	82,759	82,781	93,824	82,768	74,711
LGV	24,868	19,743	24,868	19,743	19,743	20,346	19,743	20,346	20,346	19,743	20,346	24,868
HGV	2,895	2,725	2,895	2,725	2,725	1,409	2,725	1,409	1,409	2,725	1,409	2,895
PuT Business	2,675	2,505	2,792	2,830	2,518	2,092	2,680	2,238	2,132	2,505	2,269	2,675
PuT Commute	0	0	0	0	0	0	0	0	0	0	0	0
PuT Others	8,779	3,349	8,993	3,350	3,278	7,069	3,349	7,089	6,908	3,349	7,069	8,779

The total number of car business trips across the model is similar across the site scenarios to the Do-Nothing scenario across all peaks. Mostly there are small decreases in the total number of trips except in the PM period where the Whitland Spring Gardens scenario has a small increase in the number of trips. For public transport trips there are some more significant differences between the test scenarios and the Do-Nothing. There are increases in trips for the Whitland Ty Newydd and St Clears Tenby Road scenarios in all peaks. For the Whitland Spring Gardens scenario there is a reduction in trips compared with the Do-Nothing scenario. The demand proportion of each user class across the Do-Nothing and Do-Something remains constant within each time period.

Commuting trips are increased in all scenarios compared with the Do-Nothing scenario, this occurs for all periods and for both car and public transport trips. For other car trips there is all little difference between the Do-Nothing and the other scenarios across the peaks. Other public transport trips are more varied, across the three periods the Whitland Ty Newydd and the St Clears Tenby Road AM scenarios are similar to the Do-Nothing scenario. The inter peak period has lower trips for the St Clears Tenby Road and Whitland Spring Gardens scenarios, but in the PM period St Clears Tenby Road has an increase in trips whereas there is a decrease in trips for the Whitland Spring Gardens scenario.

Hospital trip ends

This section details the daily trip ends at each hospital site across all user classes comparing the existing and the proposed new sites.

Table 13 lists the daily trips for the existing hospitals and Table 14 details the daily trip ends for the proposed hospital sites.

Table 13: Daily Trip Ends by Mode at Existing Site (Do-Nothing)

Site	CB	CC	CO	LGV	HGV	PuT_B	PuT_C	PuT_O
Glangwili Hospital	416	1,054	1,597	613	71	8	116	461
Withybush Hospital	82	251	376	97	15	2	61	205

Table 14: Daily trip ends by mode at proposed new sites (Do-Something)

Site	CB	CC	CO	LGV	HGV	PuT_B	PuT_C	PuT_O
Whitland Spring Gardens	0	4,081	1,092	0	0	0	609	270
Whitland Ty Newydd	0	4,071	1,052	0	0	0	614	271
St Clears Tenby Road	0	3,998	1,085	0	0	0	700	401

For all three of the proposed sites they all result in an increase in commuting trips to the sites when compared with the existing sites. For other trips to the sites there is a reduction in trips to the proposed sites compared with the existing sites for both car trips and public transport trips. Whitland Spring Gardens and Whitland Ty Newydd have similar numbers of trips to the sites for the different modes but St Clears Tenby Road has slightly lower car trips then the other two sites but significantly higher public transport trips.

Table 15 below shows the trip arrivals and departures to the hospital sites by Car across the different peak hours based on the highway assignment model.

Table 15: Arrival and depatures from existing hospital sites and proposed new sites - Car

Site	Arrivals			Departures		
	AM	IP	PM	AM	IP	PM
Glangwili Hospital	238	98	77	58	105	199
Withybush Hospital	48	26	19	12	26	44

Whitland Spring Gardens	560	105	51	24	102	580
Whitland Ty Newydd	558	102	51	24	100	575
St Clears Tenby Road	550	103	51	24	101	568

Table 16 details the trip shows the trip arrivals and departures to the hospital sites by public transport modes mode across the different peak periods based on the public transport model.

Table 16: Arrival and Departures from existing hospital sites and proposed site - PT

Site	Arrivals			Departures		
	AM	IP	PM	AM	IP	PM
Glangwili Hospital	32	125	90	63	128	63
Withybush Hospital	13	56	37	35	64	24
Whitland Spring Gardens	16	117	210	267	101	40
Whitland Ty Newydd	16	118	211	269	102	40
St Clears Tenby Road	20	153	254	323	136	54

Public transport passenger flows

Below Figure 9 to Figure 14 show plots of the flow difference between each site scenario and the Do-Nothing scenario, plots are shown for each site across the three peaks. Labels are only displayed on the plots for links where the absolute flow difference was greater than twenty.

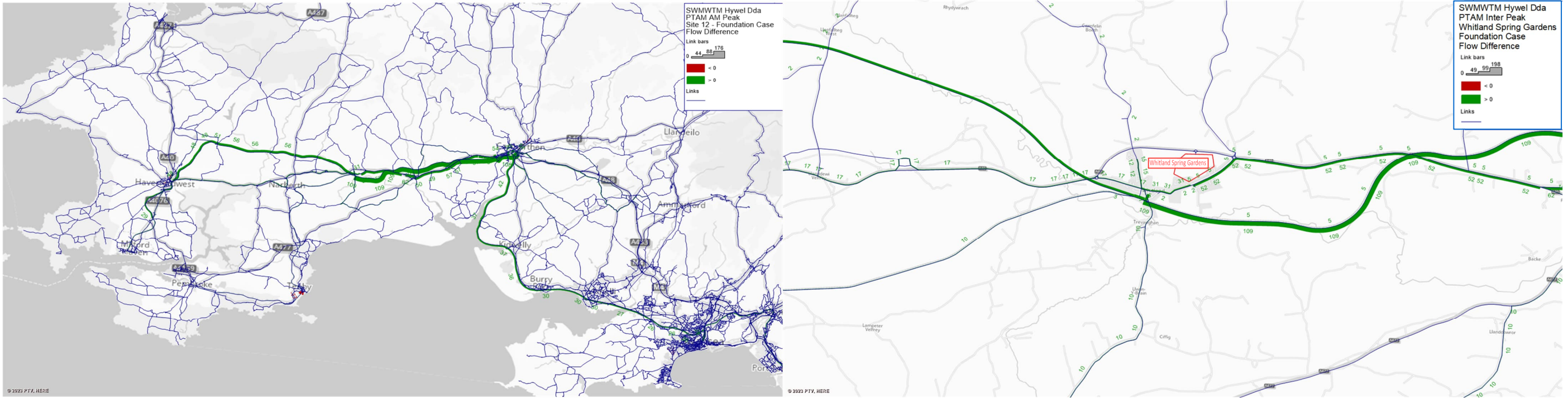


Figure 6: Flow difference plots between Whitland Spring Gardens and the Do-Nothing for public transport in the AM peak

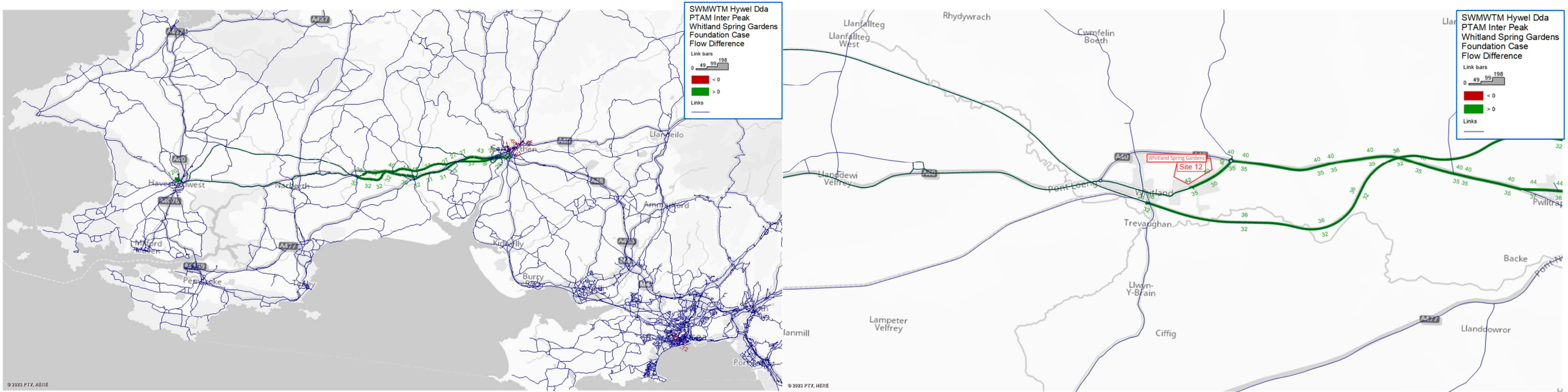


Figure 7: Flow difference plots between Whitland Spring Gardens and the Do-Nothing for public transport in the inter peak

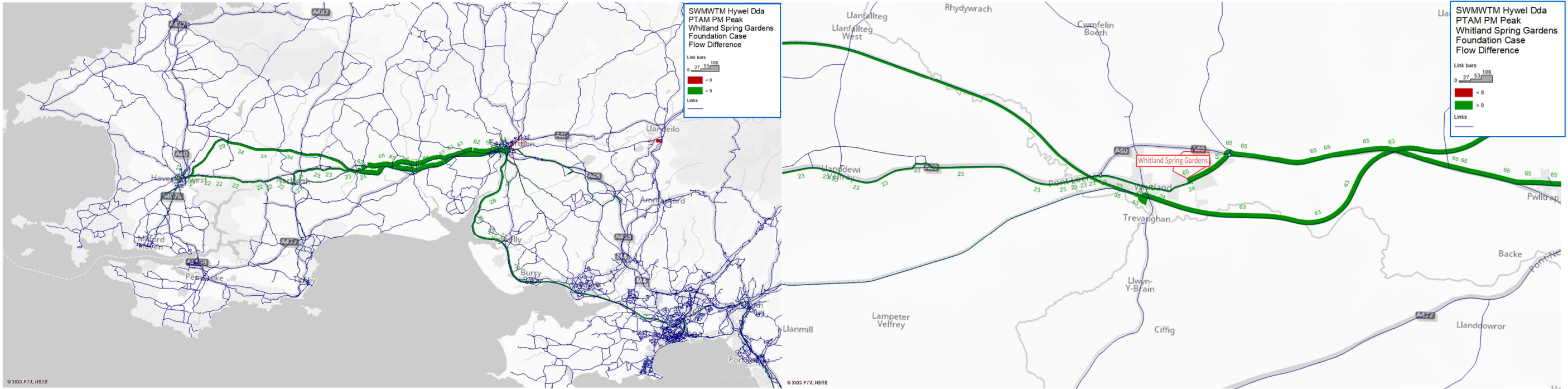


Figure 8: Flow difference plots between Whitland Spring Gardens and the Do-Nothing for public transport in the PM peak

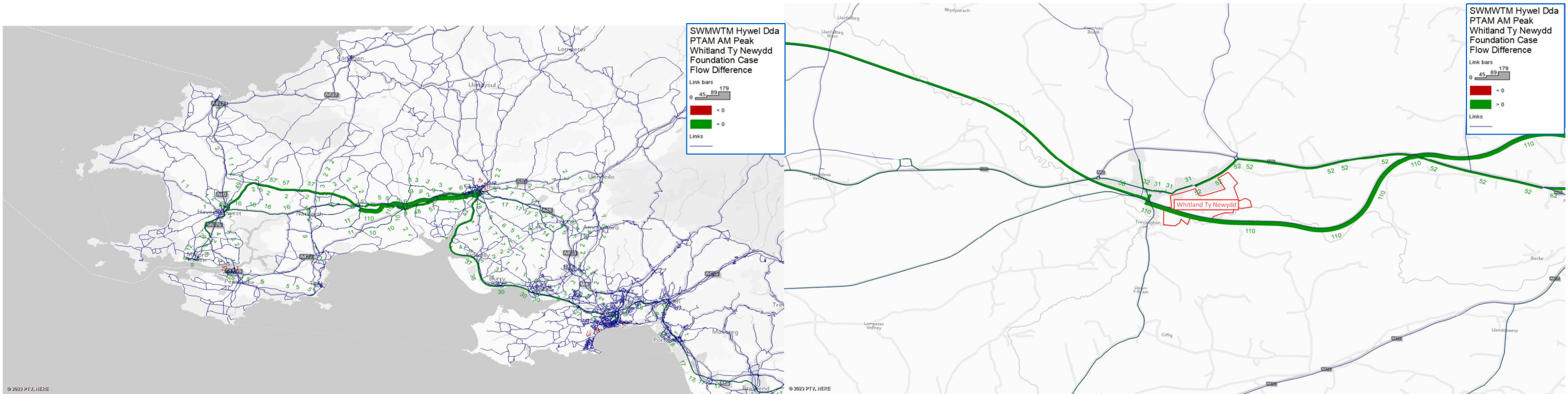


Figure 9: Flow difference plots between Whitland Ty Newydd and the Do-Nothing for public transport in the AM peak

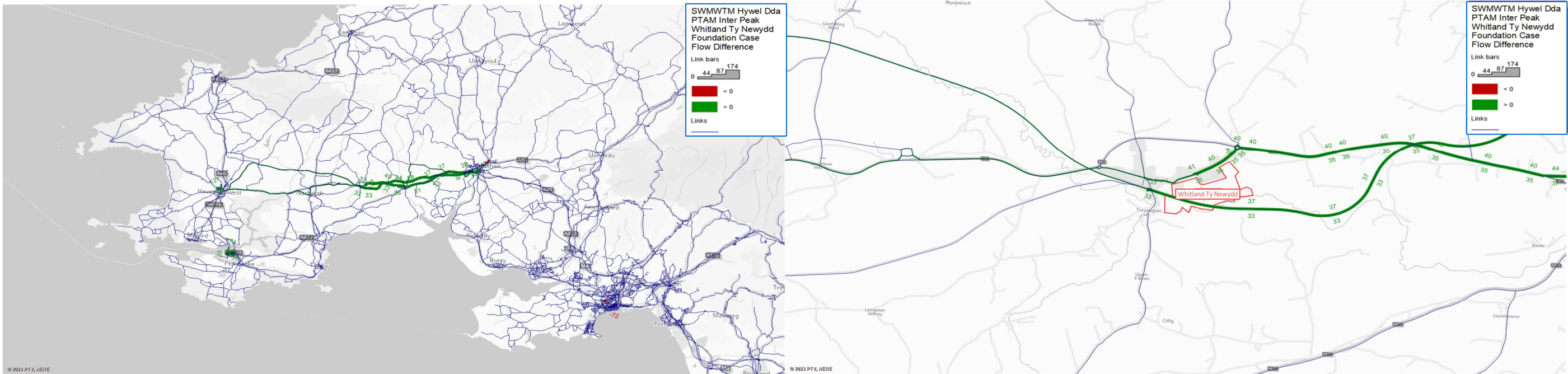


Figure 10: Flow difference plots between Whitland Ty Newydd and the Do-Nothing for public transport in the inter peak

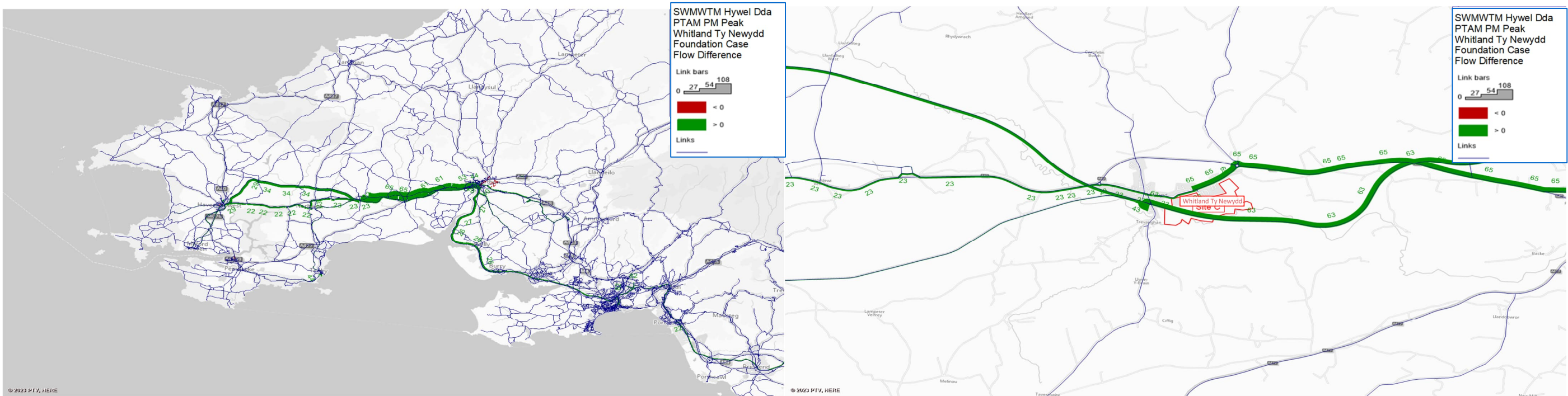


Figure 11: Flow difference plots between Whitland Ty Newydd and the Do-Nothing for public transport in the PM peak

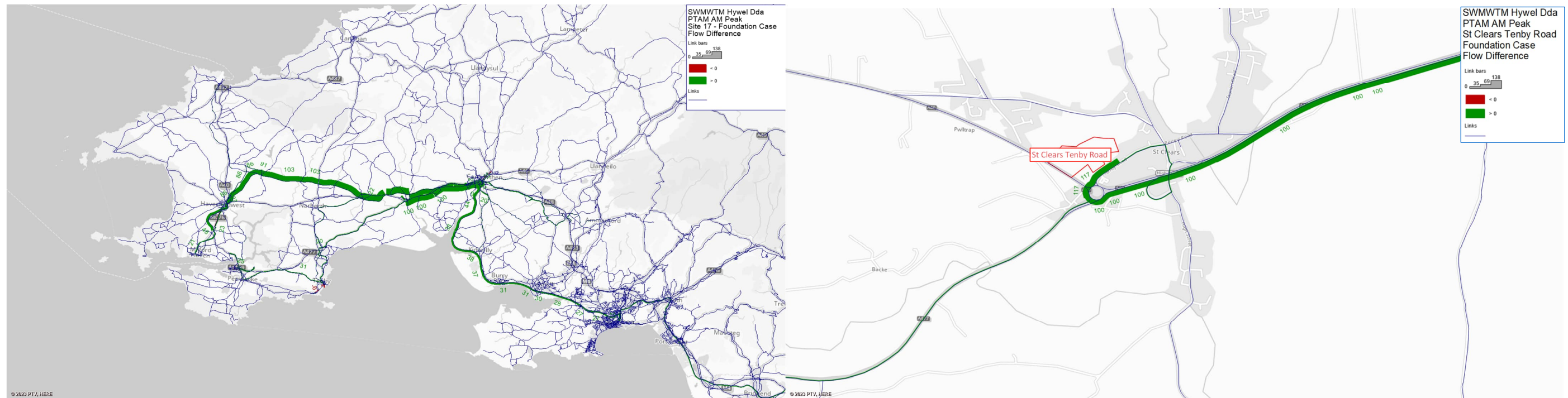


Figure 12: Flow difference plots between St Clears Tenby Road and the Do-Nothing for public transport in the AM peak

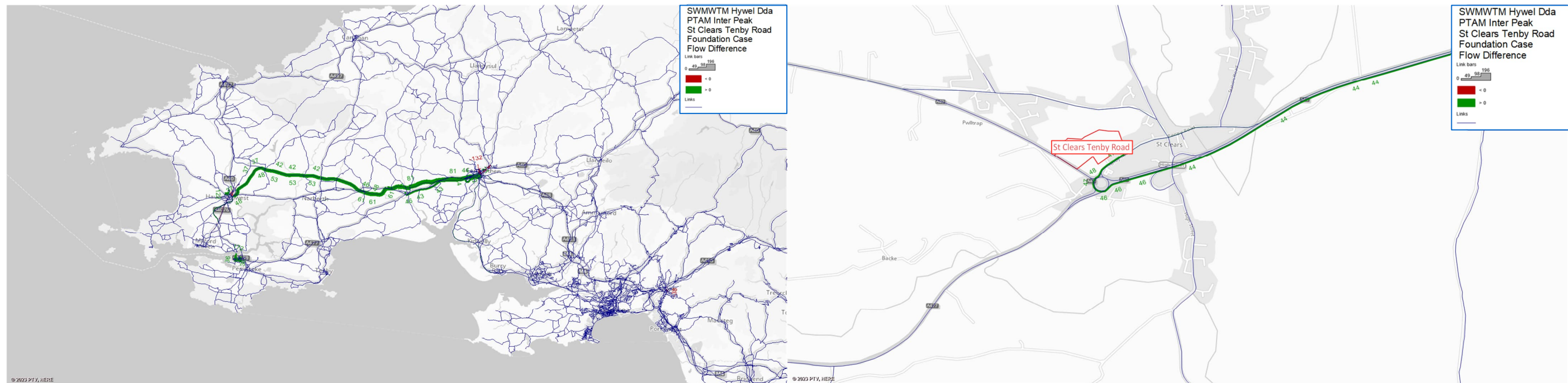


Figure 13: Flow difference plots between St Clears Tenby Road and the Do-Nothing for public transport in the inter peak

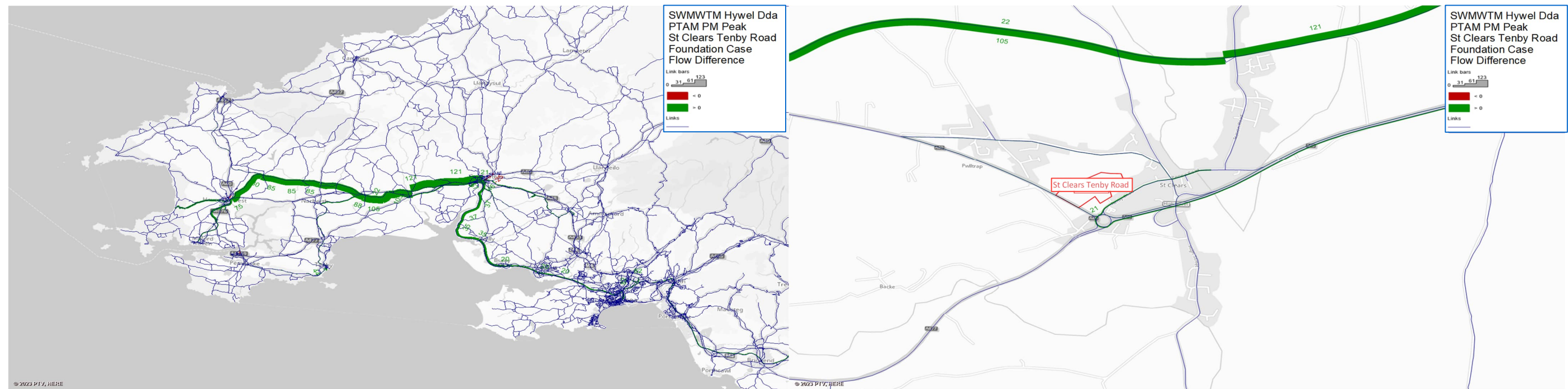


Figure 14: Flow difference plots between St Clears Tenby Road and the Do-Nothing for public transport in the PM peak

Across the site scenarios there is an increase in public transport use around Whitland and St Clears compared with the Do-Nothing scenario, in the AM peak the increased traffic is generally travelling toward the site and in the PM peak generally travelling away from the site. In the inter peak period there is an even split in those traveling to and from the site. Across all scenarios and peaks the largest increase in flow occurs between the sites and Carmarthen and occurs for both rail and bus travel there is also an increase in PT usage between Haverfordwest and the sites which occurs in the AM and PM peaks.

Whitland Spring Gardens, as with Whitland Ty Newydd, in the AM peak has the largest increase in flows by rail from Carmarthen, there are also increased rail flows from Swansea and from Haverfordwest. Flows from Carmarthen by bus have the largest bus increases but bus flows from around Whitland also increase including from Haverfordwest and areas surrounding Whitland. The AM peak mostly has increased flows directed toward the site. For the interpeak the increases in flow toward and away from the site are more equal, the largest increases are for rail and bus travel between Whitland and Carmarthen, with there being a small increase for rail and bus between Whitland and Haverfordwest also. The PM peak has large increases in flow away from the site with the largest flow increases occurring from Whitland to Carmarthen by both rail and bus. Rail flows from Carmarthen to Swansea and Whitland to Haverfordwest increase. Bus travel from Whitland to Haverfordwest also increases but the increased bus flows from surrounding areas does not occur in the PM peak.

Whitland Ty Newydd in the AM peak has increased bus and rail flows from Carmarthen to the site, the rail increase is greater than the bus increase, there is a smaller flow increases in rail travel from Haverfordwest from Swansea to the site in the interpeak period there are increased flows to and from the site, with the largest increase between Whitland Ty Newydd and Carmarthen, with bus seeing a slightly larger increase than rail. There is a small increase in travel from Haverfordwest by both rail and bus as well. The PM peak has a large increase in flows away from the site mostly to Carmarthen with rail and bus having similar increases in flows. The increased flow to Haverfordwest from the site is greater for bus than for rail, there is an increase in flow by rail from Carmarthen to Swansea as well.

St Clears Tenby Road in the AM peak also has increased bus and rail flows toward the Site, which in this scenario is in St Clears, with large increases in flows by bus and rail from Carmarthen but there is also an increase in rail flows from Haverfordwest of a similar sized increase. Rail flows from Swansea to Carmarthen also increase and there is a small increase in flows from Pembroke by bus to the site. In the interpeak flow increases both to and from the site, with rail seeing larger increased flows than the bus flows. In the PM peak there are large increases in flows away from the site, rail flows from St Clears to Carmarthen and Haverfordwest large increases by similar amounts. Rail flows from Carmarthen to Swansea also increase, there is a small increase in bus flow from the St Clears to Carmarthen.

All sites have increased bus and rail flows, the largest increases generally came from Carmarthen by either bus or rail with rail being the largest increase. There are small increases in flow between Sites C, 12 and Haverfordwest but for St Clears Tenby Road there is a much larger increase in rail flows between St Clears and Haverfordwest with increases at a similar volume to those rail flows between the site and Carmarthen. For all Sites in the AM and PM peaks there is an increase in rail flows between Carmarthen and Swansea.



Below Table 17 and Table 18 show the boarding and alighting values of rail stops with boarding and alighting values exceeding 100 which are called at by rail routes that stop at Whitland and St Clears. Values for the other stops called on these routes can be found in the Appendix A.

Table 19 and Table 20 show the boarding and alighting at bus stions which are connected to the proposed sites across the three periods and in each scenario.

Table 17: Boarding Values for the main rail stations along the Wales Main Line

Stop Number	Name	AM Boarding				IP Boarding				PM Boarding			
		DN	DS1 Whitland Spring Gardens	DS2 Whitland Ty Newydd	DS3 St Clears Tenby Road	DN	DS1 Whitland Spring Gardens	DS2 Whitland Ty Newydd	DS3 St Clears Tenby Road	DN	DS1 Whitland Spring Gardens	DS2 Whitland Ty Newydd	DS3 St Clears Tenby Road
38	Abergavenny	184	184	184	184	154	154	154	154	126	126	126	126
239	Bridgend	600	601	601	601	401	401	401	400	412	412	412	412
508	Cardiff Central	1332	1340	1340	1339	1097	1098	1098	1097	1056	1059	1059	1058
609	Carmarthen	203	271	272	250	288	314	314	318	178	186	187	183
1349	Haverfordwest	55	74	75	93	68	73	73	90	47	49	49	54
1585	Llanelli	286	289	289	292	223	224	224	224	131	131	131	131
1899	Neath	392	392	392	392	261	262	262	262	182	182	182	182
1917	Newport (S Wales)	267	269	269	269	317	318	318	317	299	303	303	303
2065	Port Talbot Parkway	274	274	274	274	259	259	260	259	138	138	138	138
2327	Shrewsbury	208	209	209	209	312	313	312	313	183	183	183	183
2505	Swansea	971	987	987	988	870	871	871	870	822	828	828	828
2857	Whitland	43	52	52	46	52	106	107	54	33	140	141	35
4000	St Clears	17	17	17	37	20	20	20	166	8	8	8	237

Table 17 shows the boarding values of the main rail stops along the West Wales mainline and for the stations at Whitland and St Clears. The table shows that for most of the stations there is almost no change in the boarding values for all scenarios and peaks. But Whitland station sees a small boarding increase in the AM peaks for Whitland Spring Gardens and Whitland Ty Newydd scenarios, and very large increases in the inter peak and PM peaks. In these scenarios the St Clears station is unchanged. The St Clears Tenby Road scenario has a large increase has a large increase in boarding at St Clears station in the PM and interpeak periods and a smaller increase in the AM peak. The station at Carmarthen also sees an increase in boarding in all peaks for all scenarios, the AM peak has the largest increase across the peaks, the station at Haverfordwest has increased boarding in the AM peaks for all Do Something scenarios and in the interpeak St Clears Tenby Road has an increase that is not seen in the Whitland Ty Newydd and 12 scenarios. Swansea station also has a small increase across the Do Something scenarios with the AM peaks having the largest increase for that station.

Table 18: Alighting Values for the main rail stations along the Wales Main Line

Stop Number	Name	AM Alighting				IP Alighting				PM Alighting			
		DN	DS3 Whitland Spring Gardens	DS1 Whitland Ty Newydd	DS2 St Clears Tenby Road	DN	DS3 Whitland Spring Gardens	DS1 Whitland Ty Newydd	DS2 St Clears Tenby Road	DN	DS3 Whitland Spring Gardens	DS1 Whitland Ty Newydd	DS2 St Clears Tenby Road
38	Abergavenny	159	159	159	160	153	153	154	153	135	135	135	135
239	Bridgend	549	549	549	549	395	395	395	395	432	433	433	433
508	Cardiff Central	1443	1450	1449	1448	1033	1034	1034	1033	978	982	982	981
609	Carmarthen	216	221	221	227	270	298	299	341	153	183	184	235
1349	Haverfordwest	101	102	102	105	99	110	111	139	47	68	68	99
1585	Llanelli	149	152	152	154	237	238	238	239	251	251	251	251
1899	Neath	268	267	267	267	204	204	204	204	324	324	324	325
1917	Newport (S Wales)	300	301	301	301	320	321	321	321	265	270	270	269
2065	Port Talbot Parkway	236	236	236	236	219	219	219	219	280	280	280	280
2327	Shrewsbury	203	203	203	203	324	325	325	325	176	176	176	176
2505	Swansea	800	807	807	806	739	740	740	740	673	682	682	685
2857	Whitland	28	204	207	28	29	74	75	31	25	45	45	27
4000	St Clears	20	20	20	235	23	25	25	111	11	13	13	45

Alighting values for most of the main rail stations shown in Table 18 have little to no changes in the number of people alighting across the scenarios and peaks. Whitland has a large increase in alighting passengers in the AM peak for the Whitland Spring Gardens and Whitland Ty Newydd scenarios the interpeak and PM peak have a slight increase as well, the station in Whitland has almost no change in the St Clears Tenby Road scenarios as St Clears Tenby Road is in St Clears. St Clears station is largely unchanged in Whitland Spring Gardens and Whitland Ty Newydd scenarios as the sites are in Whitland. But for St Clears Tenby Road scenario there is a large increase in alighting for St Clears station in the AM peak and slight increases in the interpeak and PM periods. Carmarthen station also has increased alighting values across all peaks and scenarios, but St Clears Tenby Road scenario has the largest increase in and alighting values for the three do something scenarios. Haverfordwest had little change in the AM peak for all scenarios but in the interpeak and PM peak periods there is an increase in alighting for all scenarios with the largest increase in the St Clears Tenby Road scenarios. Swansea has small increase in alighting in the AM and PM peaks.

The boarding and alighting values shown in Table 17 and Table 18 follow the same trends shown in the flow difference plots (Figure 9 to Figure 14) it shows that in the AM peak most trips are to the site shown by increased alighting values in the AM peak for the stations nearest to the site tested in each scenario, in the PM peak trips are travelling away from the sites shown by the increased boarding values for the station nearest each site. An increase in rail trips between the site and Carmarthen are shown as Whitland, St Clears and Carmarthen have the largest increases in boarding and alighting. The increased boarding in Haverfordwest and Swansea in the AM peak and increased alighting in the PM peak show increased rail trips from these stations as shown in the flow difference plots. The Tables also show that St Clears Tenby Road results in more rail trips than Whitland Spring Gardens and Whitland Ty Newydd which don't result in as large of an increase in boarding and alighting values.

Table 19: Bus Boarding for Stops Connected to the Proposed Sites

Stop Number	Name	AM Boarding				IP Boarding				PM Boarding			
		DN	DS1 Whitland Spring Gardens	DS1 Whitland Ty Newydd	DS3 St Clears Tenby Road	DN	DS1 Whitland Spring Gardens	DS1 Whitland Ty Newydd	DS3 St Clears Tenby Road	DN	DS1 Whitland Spring Gardens	DS1 Whitland Ty Newydd	DS3 St Clears Tenby Road
2857	Whitland	43	52	52	46	52	54	107	54	33	35	141	35
4000	St Clears	17	17	17	37	20	166	20	166	8	237	8	237
911224	Bryngwenllian (after), Spring Gardens, Whitland	6	8	8	6	4	4	24	4	1	1	25	1
911242	Bryngwenllian (before), Spring Gardens, Whitland	6	10	10	6	9	9	49	9	4	4	70	4
911930	Business Park (before), Tenby Road, St Clears	0	0	0	0	0	5	0	5	0	11	0	11

Table 20: Bus Alighting for Stops Connected to the Proposed Sites

Stop Number	Name	AM Alighting				IP Alighting				PM Alighting			
		DN	DS1 Whitland Spring Gardens	DS1 Whitland Ty Newydd	DS3 St Clears Tenby Road	DN	DS1 Whitland Spring Gardens	DS1 Whitland Ty Newydd	DS3 St Clears Tenby Road	DN	DS1 Whitland Spring Gardens	DS1 Whitland Ty Newydd	DS3 St Clears Tenby Road
2857	Whitland	28	204	207	28	29	31	75	31	25	27	45	27
4000	St Clears	20	20	20	235	23	111	25	111	11	45	13	45
911224	Bryngwenllian (after), Spring Gardens, Whitland	2	55	54	2	9	8	45	8	7	7	21	7
911242	Bryngwenllian (before), Spring Gardens, Whitland	2	32	32	2	4	4	20	4	1	1	4	1
911930	Business Park (before), Tenby Road, St Clears	0	0	0	101	0	46	0	46	0	18	0	18

The tables above show that for all sites there is a greater increase in rail trips to the site than there are in bus trips it also indicates a mix in modes in how they travel as boarding and alighting values do not add up to similar values this means that people are arriving by one mode and using a different mode to leave, this can be seen for St Clears Tenby Road where for the Tenby Road stop 165 people alight at the stop but only 16 board over the day. Only bus stops next to each of the sites are affected as shown with the Tenby road stop, which is adjacent to St Clears Tenby Road, which has no change for the Whitland Ty Newydd and 12 scenarios but is changed in the St Clears Tenby Road scenario.



Highway Flows

Figure 18 to Figure 23 below show flow difference plots for each scenario and peak period comparing the flow of the site against the flow of the Do-Nothing scenario. For each of the scenario peak plots two images are shown one of the South West Wales region and one of the site and immediate highway network, in the plots labels for absolute differences of less than twenty have been hidden.

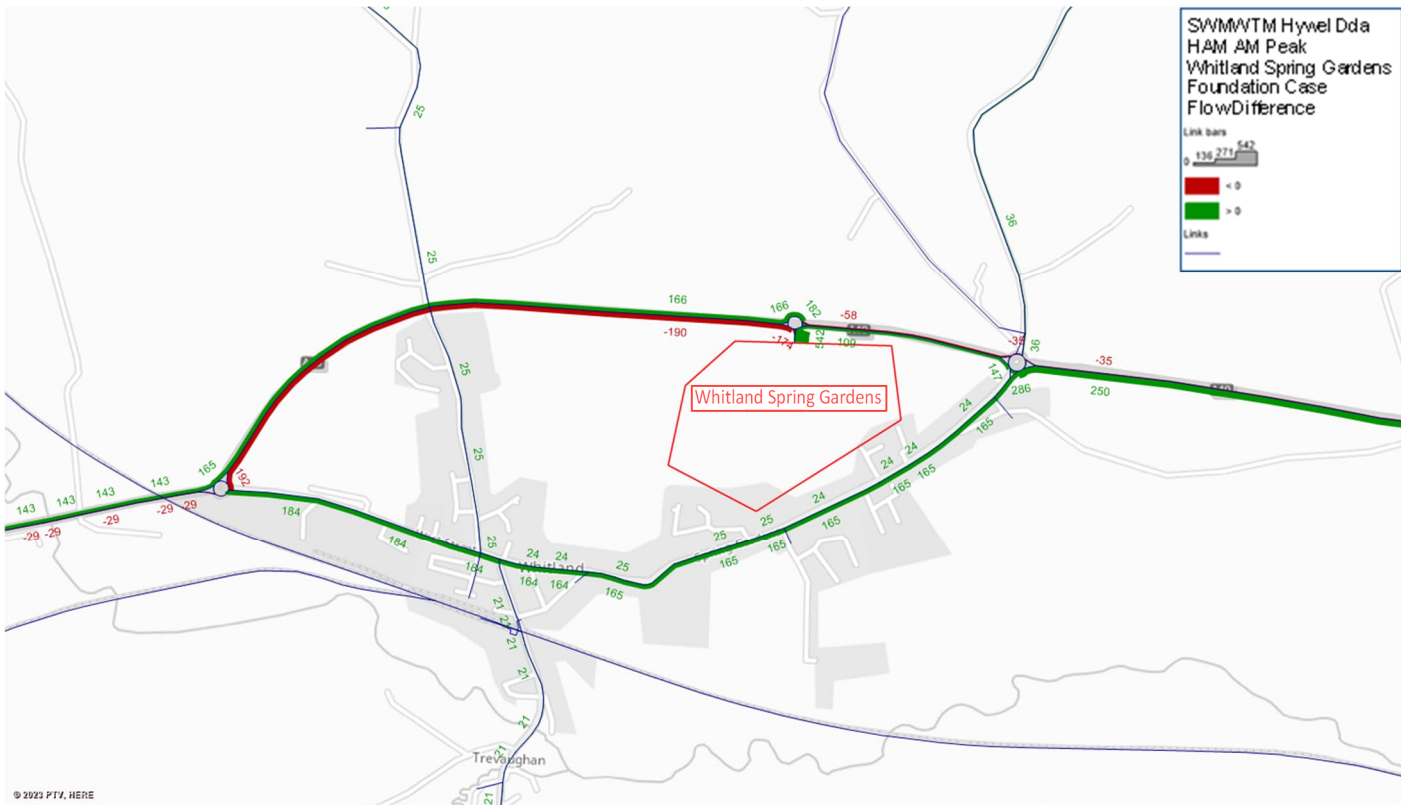
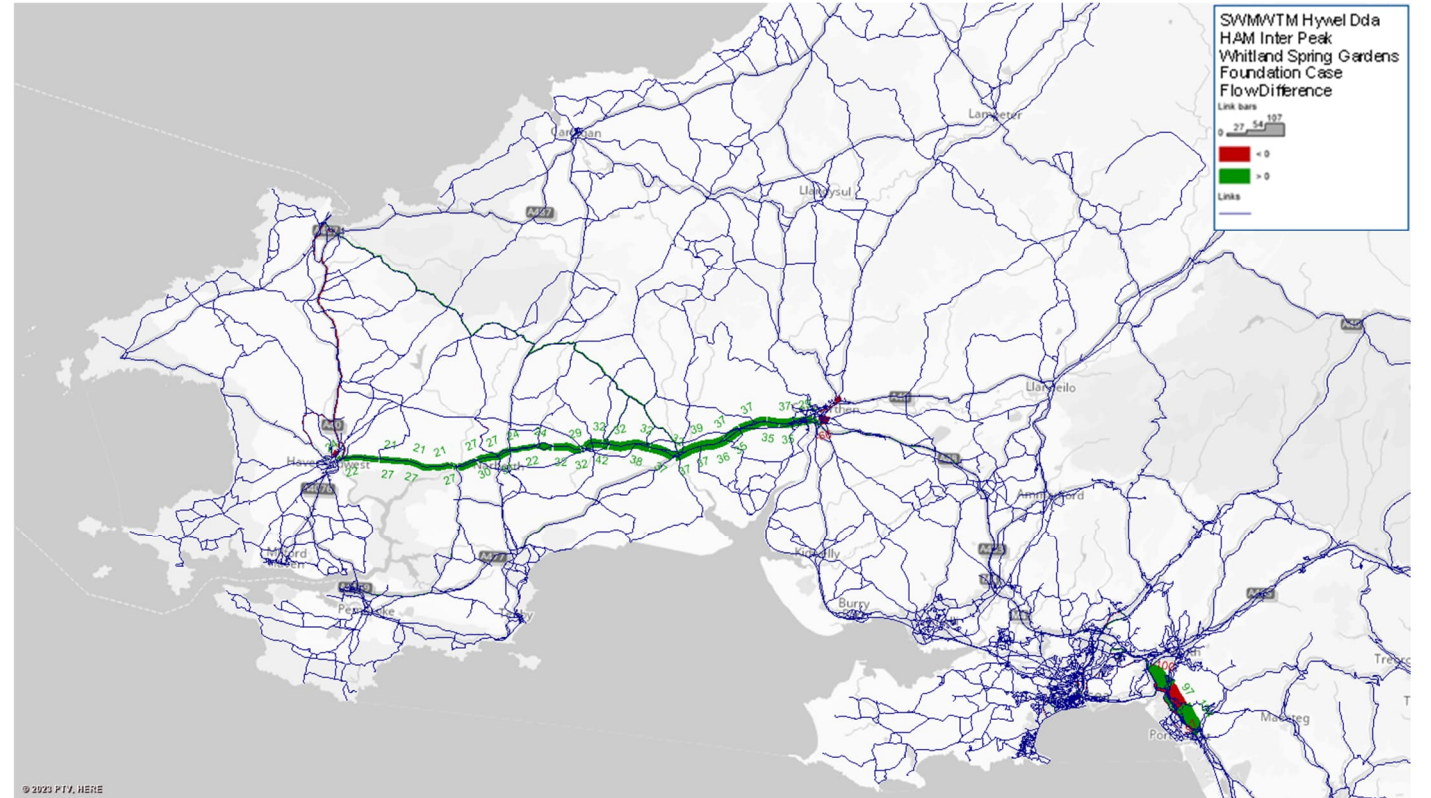
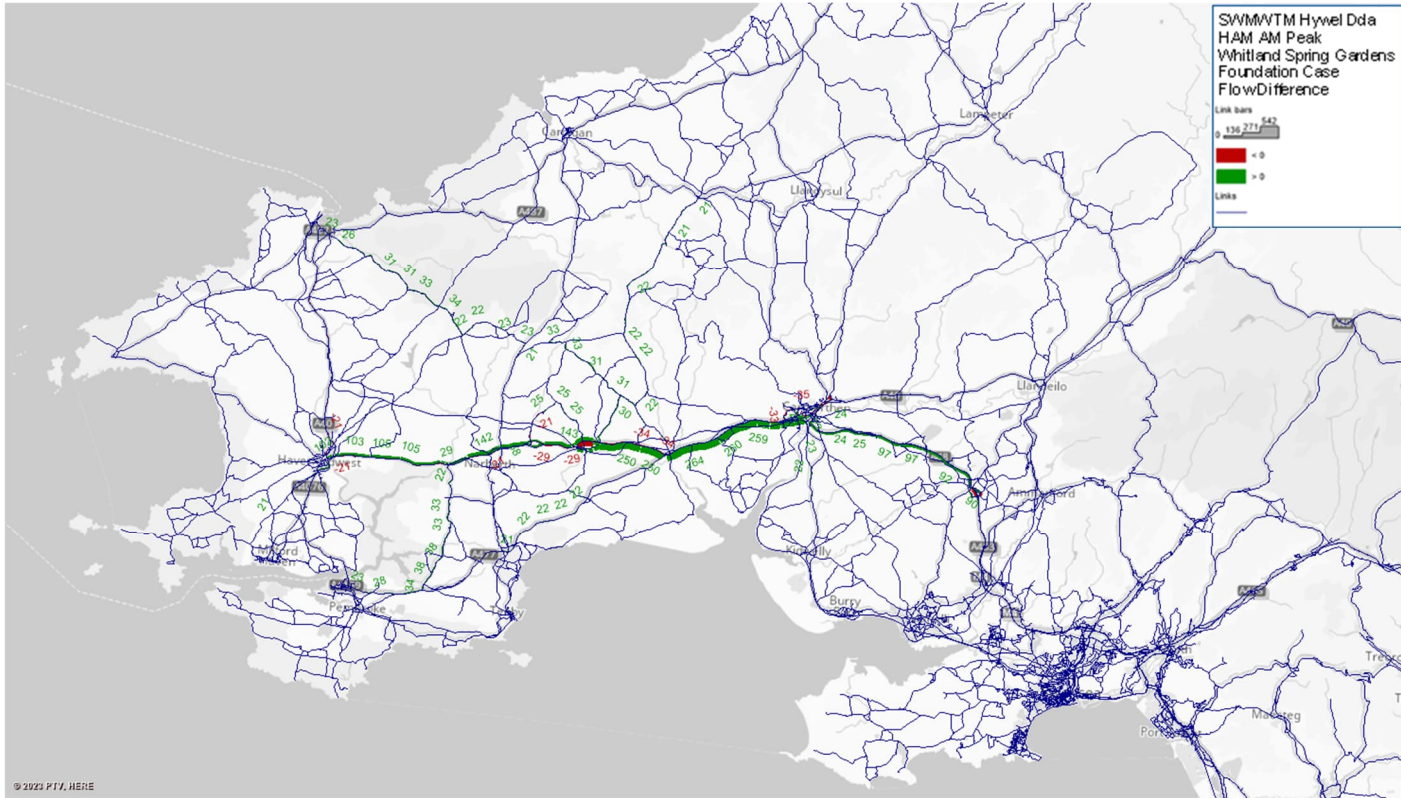


Figure 15: Flow difference plots between Whitland Spring Gardens and the Do-Nothing for highway flows in the AM peak



Figure 16: Flow difference plots between Whitland Spring Gardens and the Do-Nothing for highway flows in the inter peak

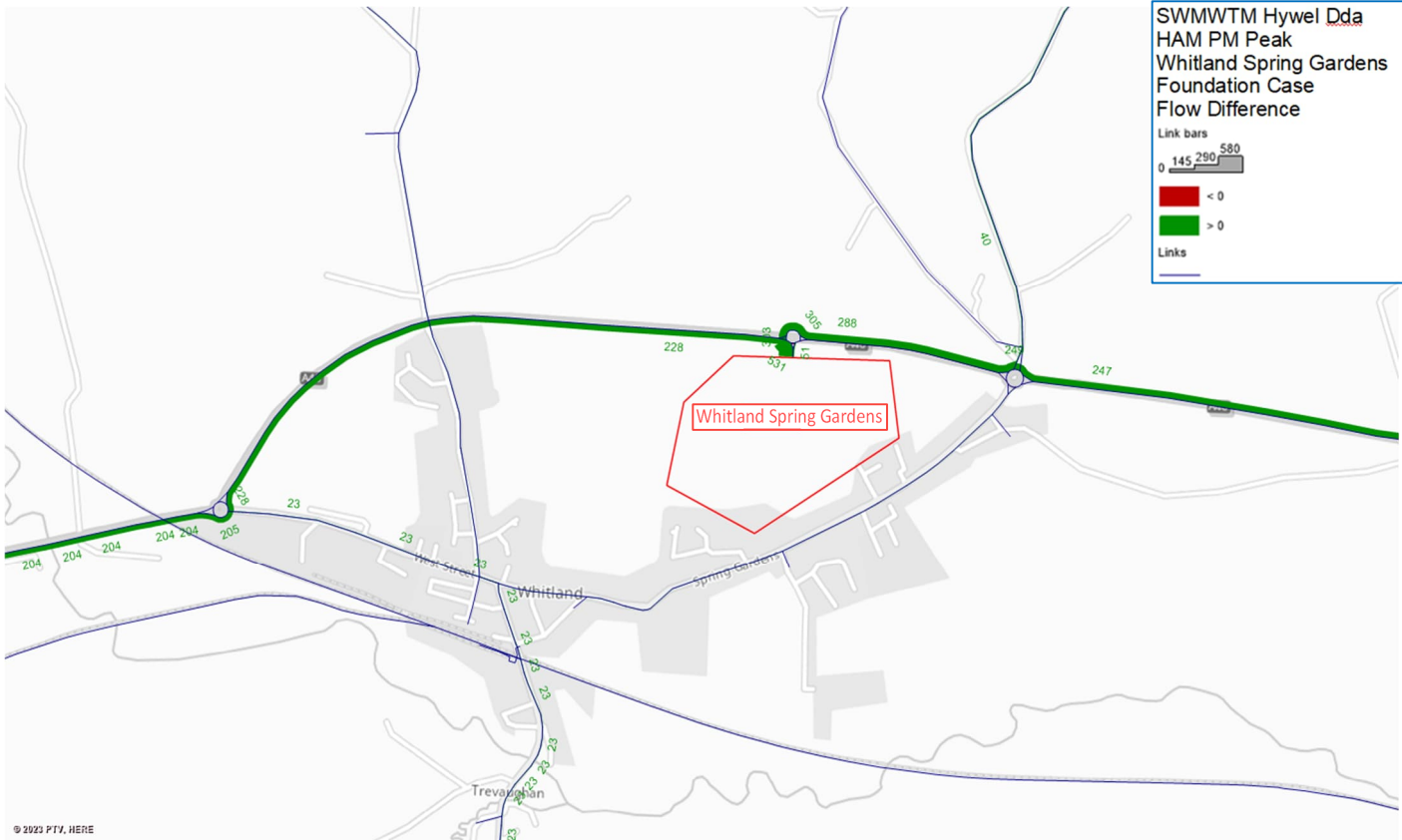
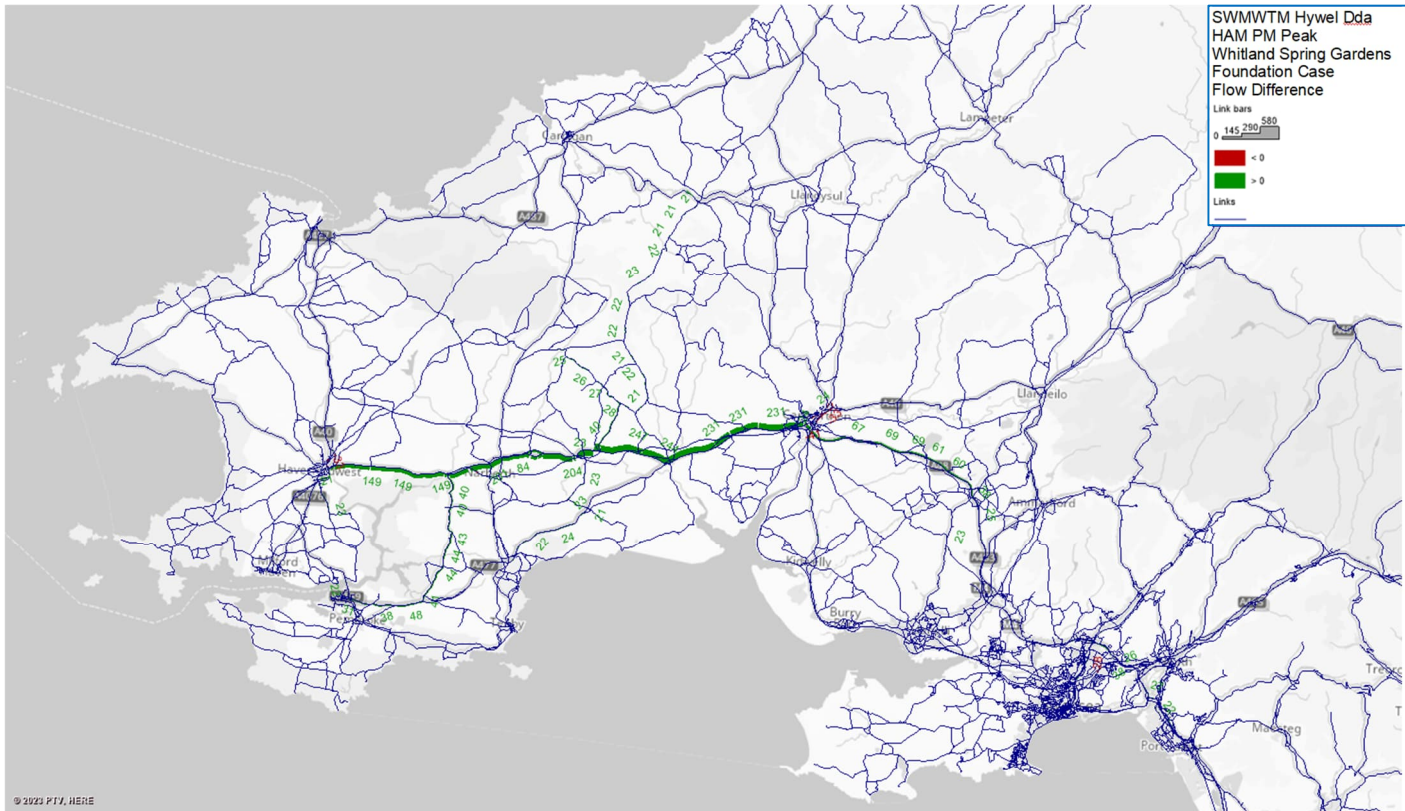


Figure 17: Flow difference plots between Whitland Spring Gardens and the Do-Nothing for highway flows in the PM peak

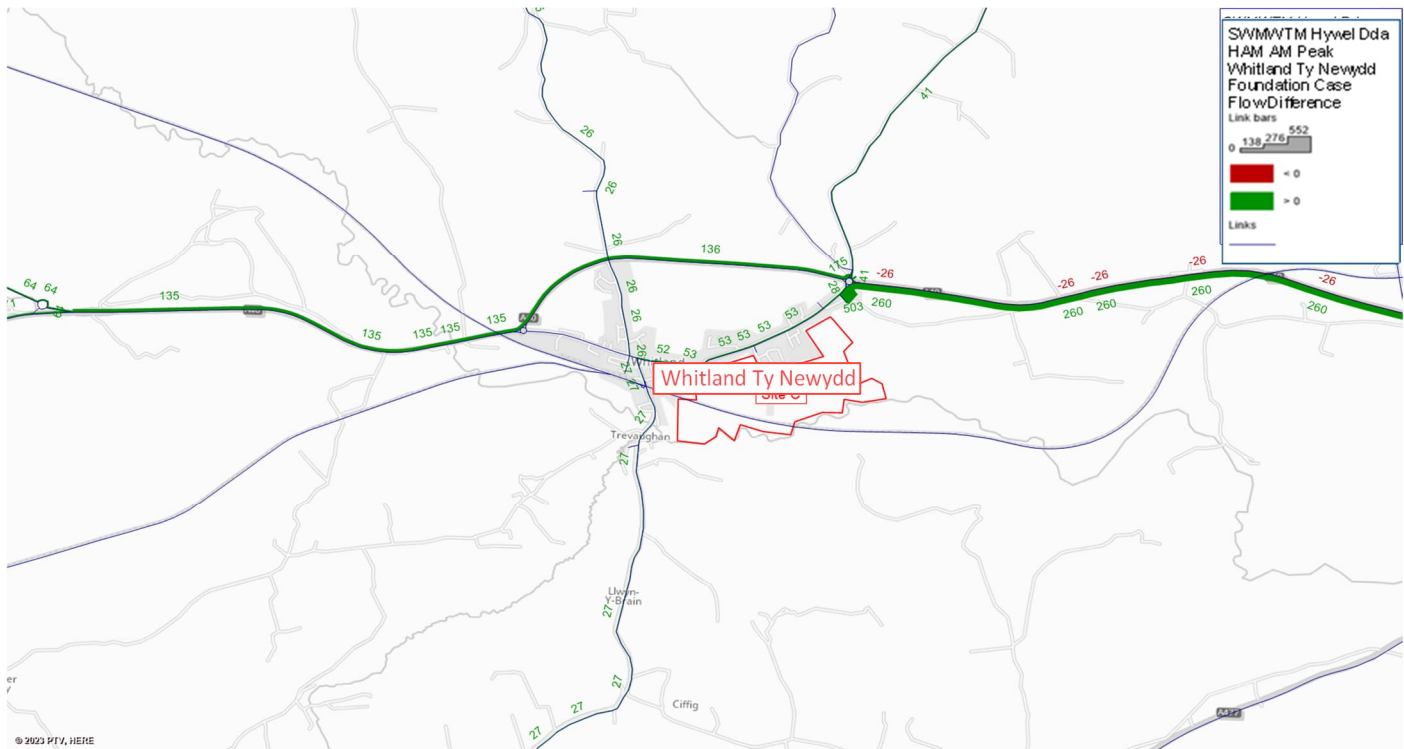
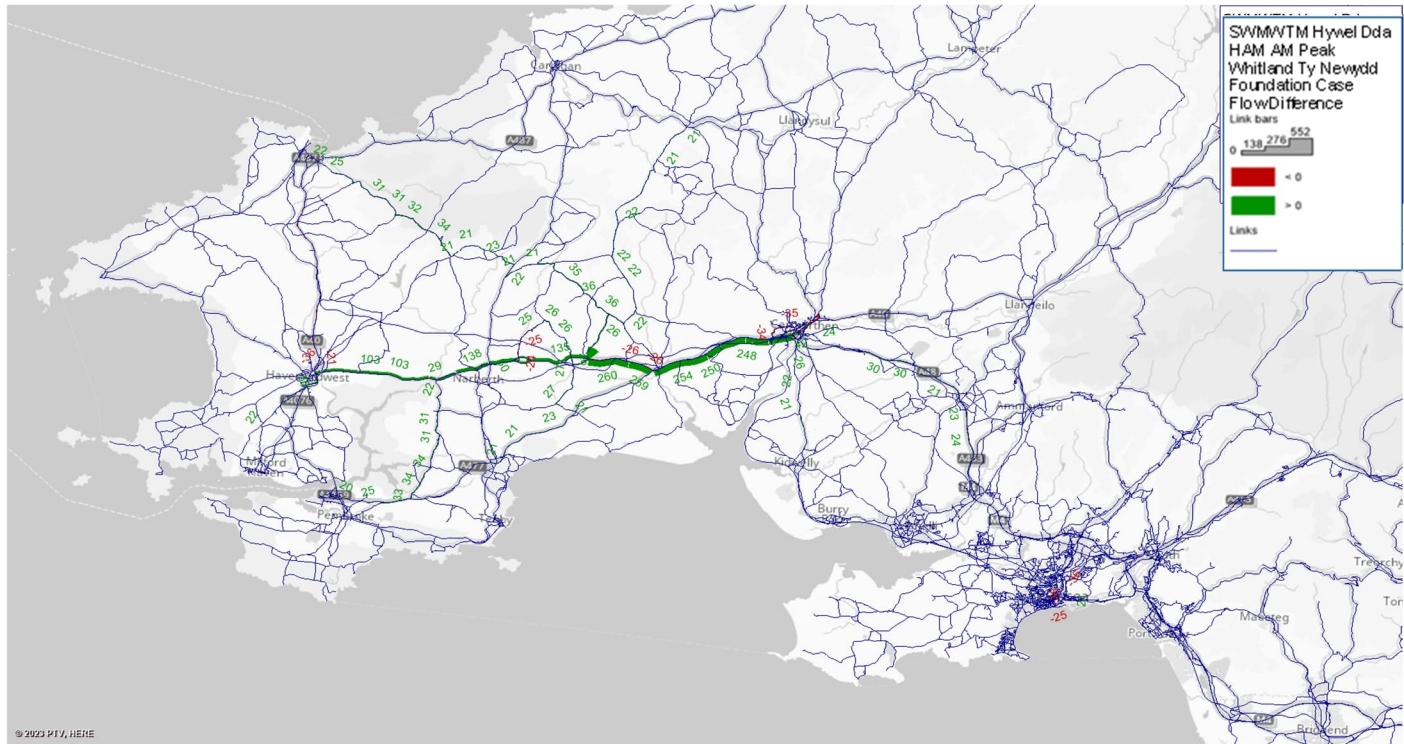


Figure 18: Flow difference plots between Whitland Ty Newydd and the Do-Nothing for highway flows in the AM peak



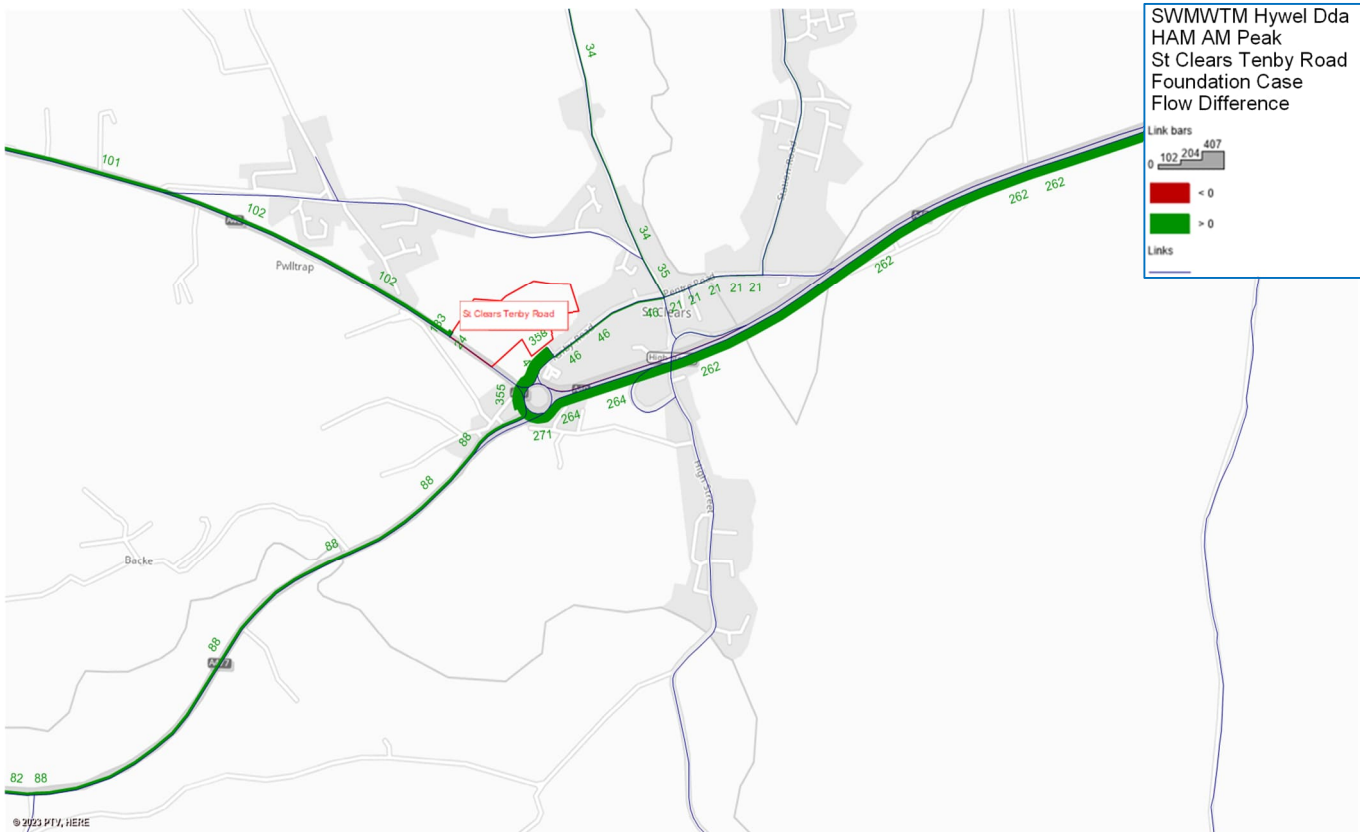
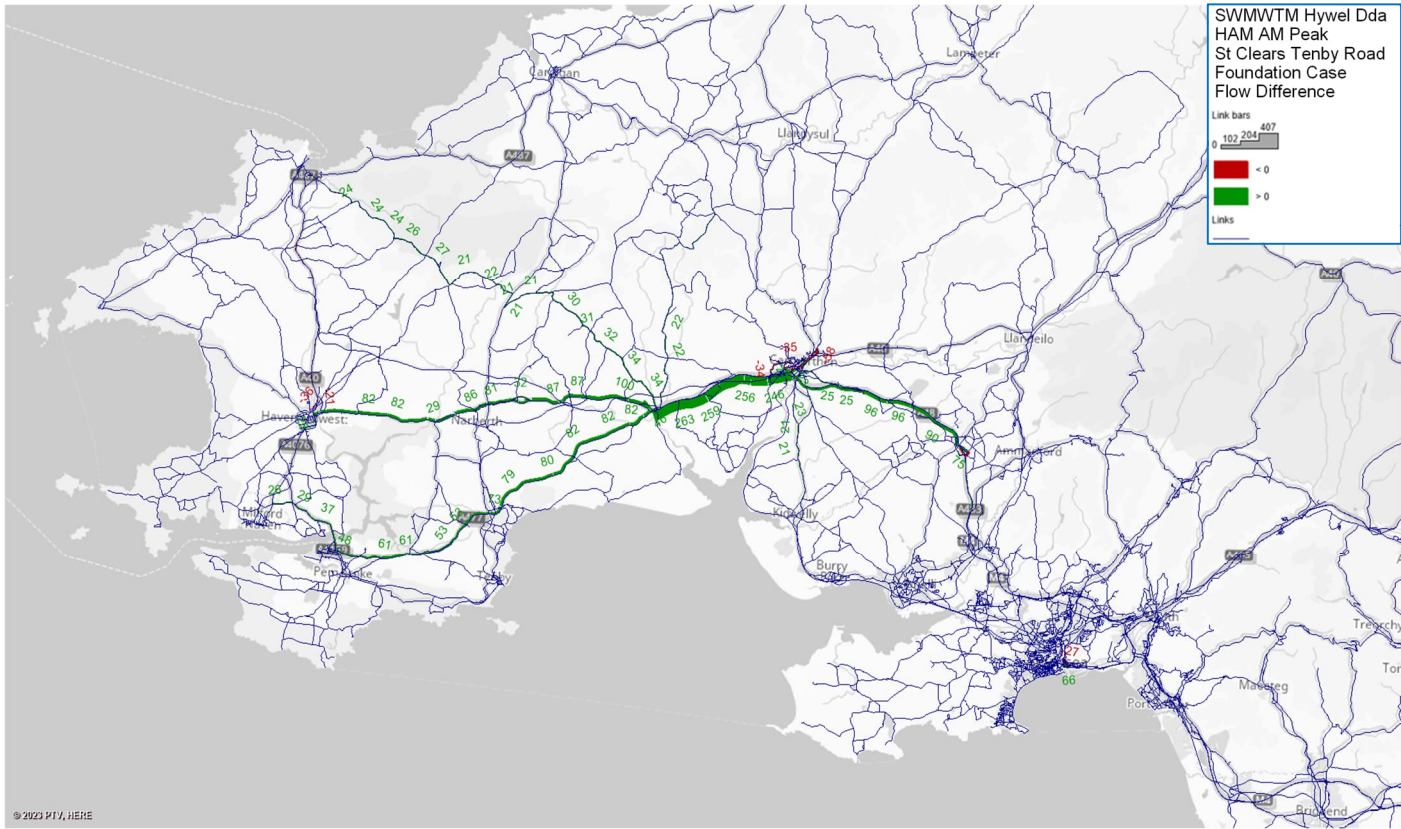


Figure 21: Flow difference plots between St Clears Tenby Road and the Do-Nothing for highway flows in the AM peak

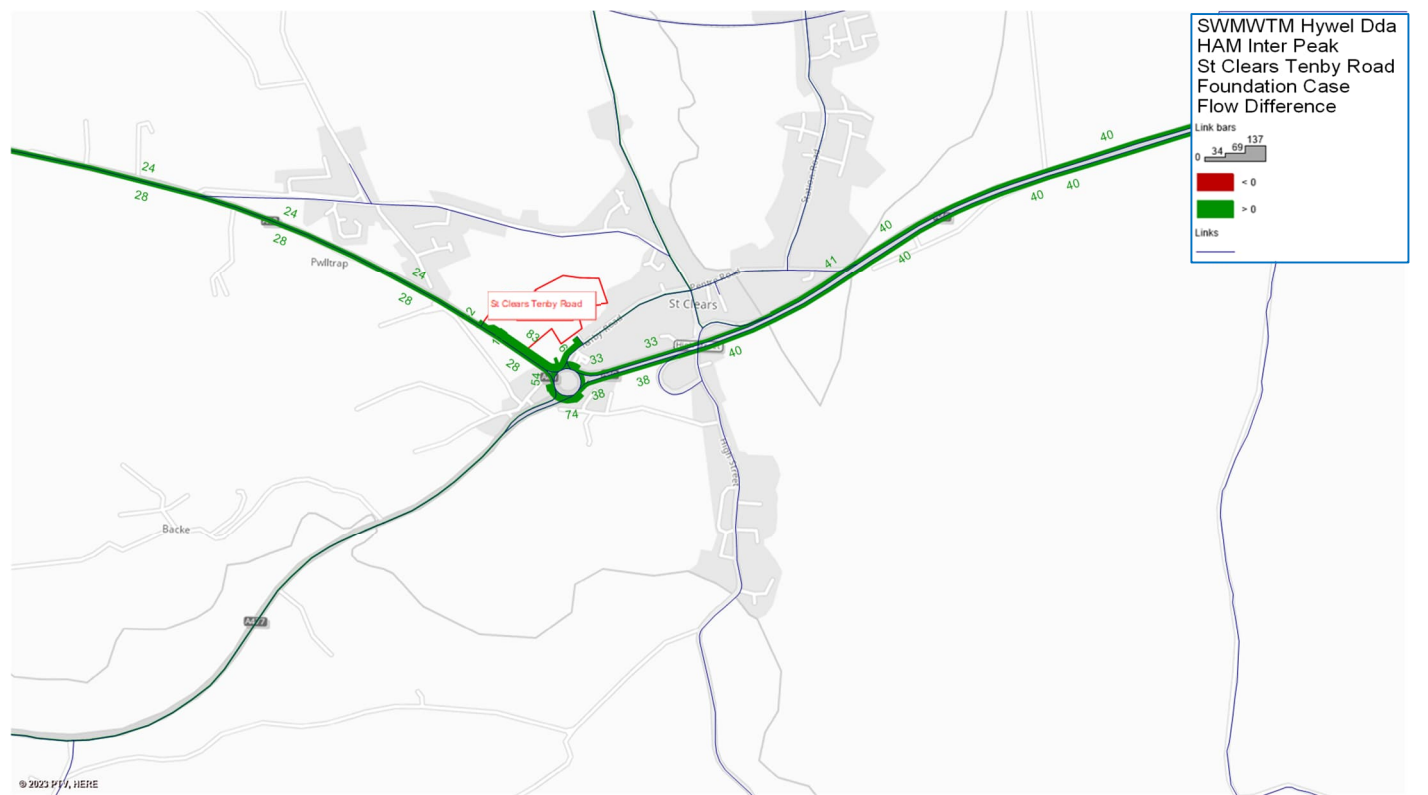
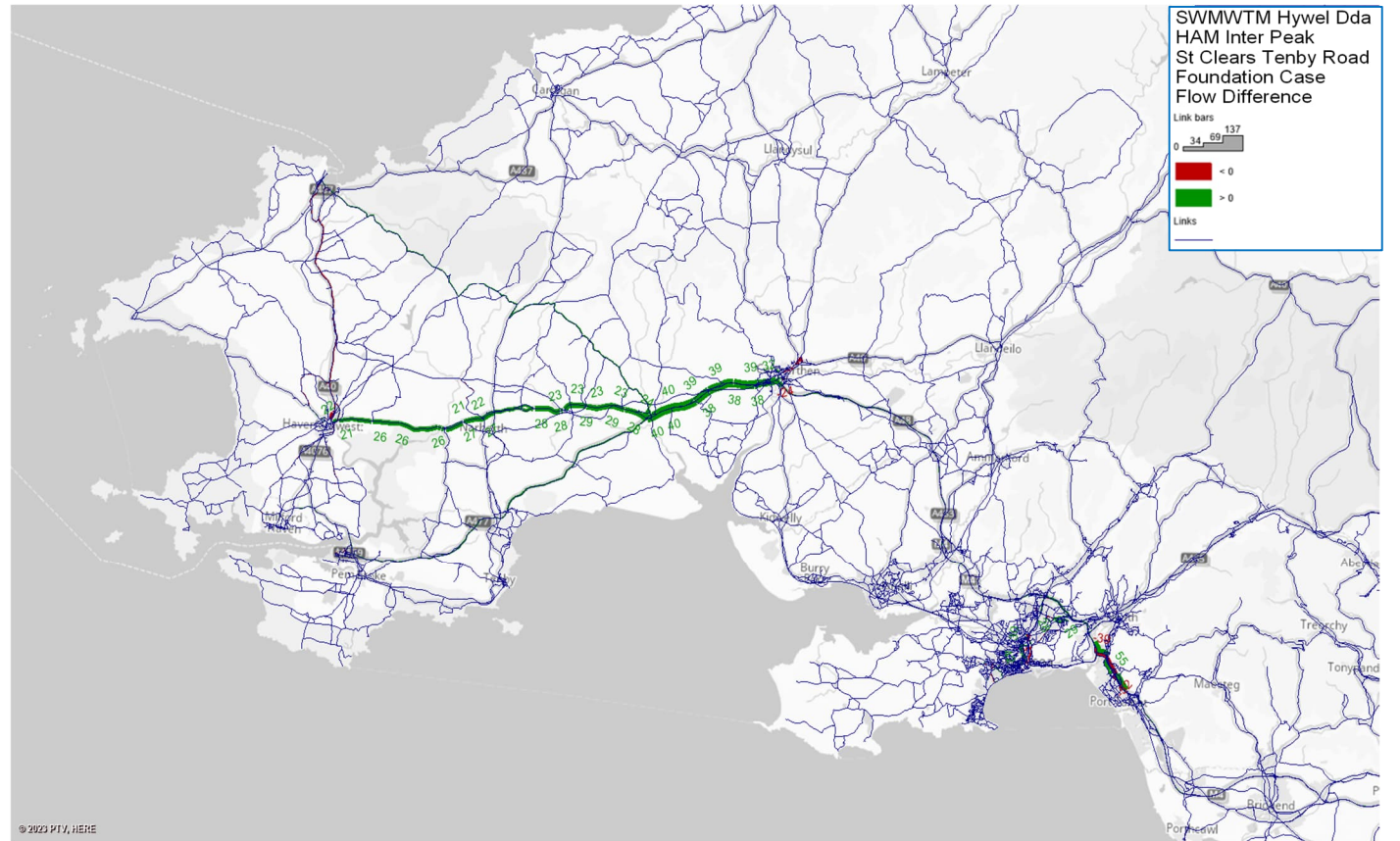


Figure 22: Flow difference plots between St Clears Tenby Road and the Do-Nothing for highway flows in the inter peak

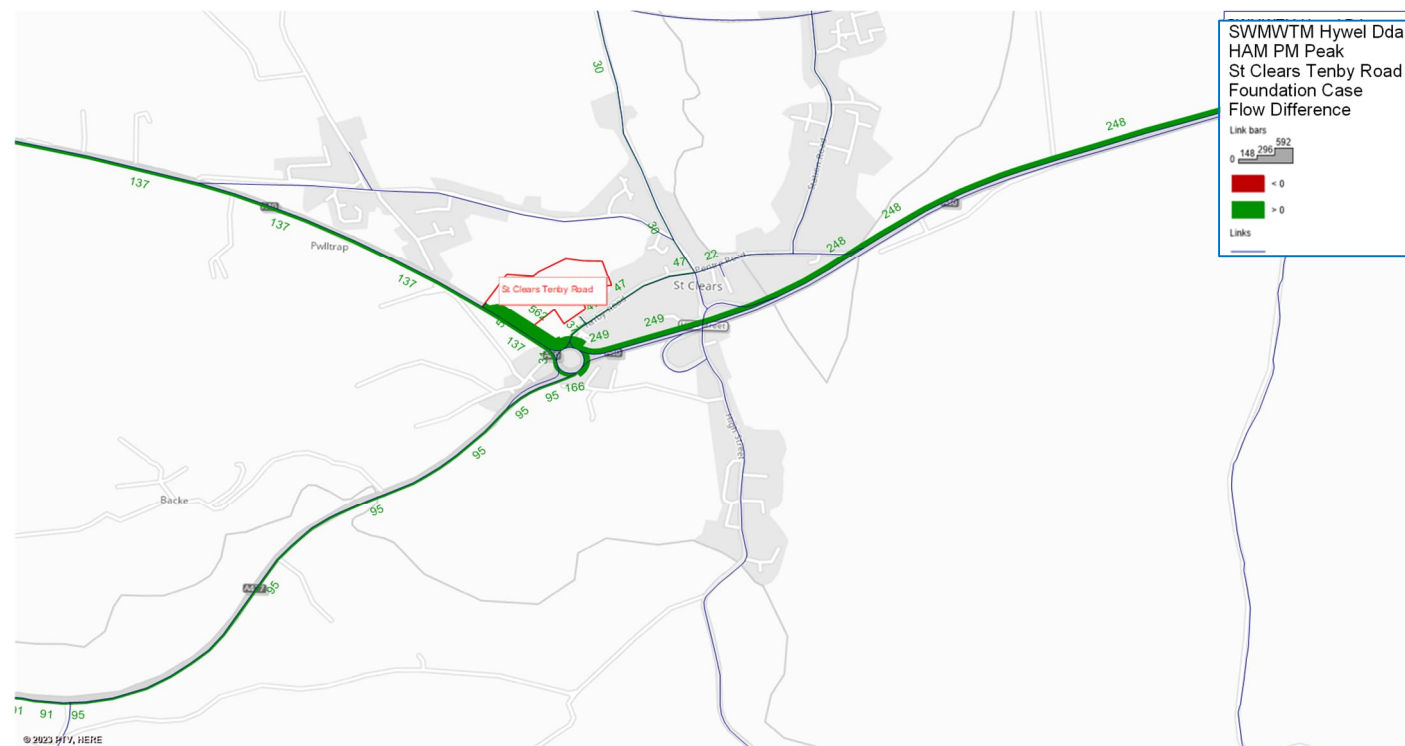
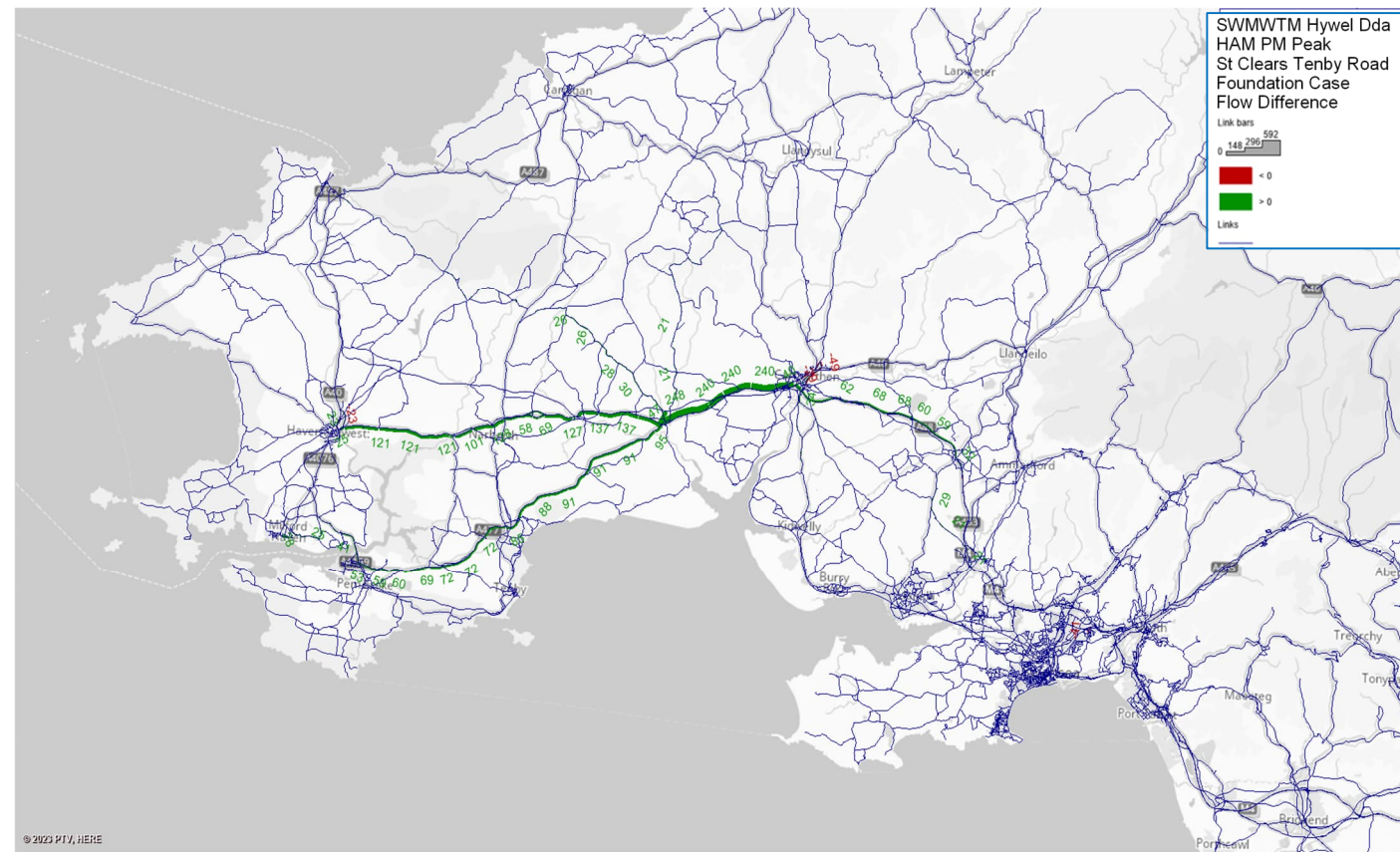


Figure 23: Flow difference plots between St Clears Tenby Road and the Do-Nothing for highway flows in the PM peak

For each of the scenario's the same observations in flow differences are shown in Figure 18 to Figure 23 above. Traffic along the A40 increased with the large flow increases between the sites and Haverfordwest and Carmarthen, this occurs in both directions and all the peaks. In the AM and PM peaks the increases were by similar amounts but in the inter peak the increase was by a smaller amount. In the AM peak the traffic increase was inbound toward the sites while in the PM peak the increases were outbound from the sites. The interpeak saw smaller increases both inbound to and outbound from the sites but in similar quantities. There is a higher traffic flow increase along the A40 between the sites and Carmarthen than there is between the Sites and Haverfordwest. In the AM peak there is an increase in traffic along B roads from Fishguard where some traffic has moved off the A40 between Fishguard and Haverfordwest onto B roads to access the sites.

Whitland Spring Gardens sees an increase in traffic through Whitland in the AM peak but by a smaller amount than for Whitland Ty Newydd, some of the traffic entering Whitland travels towards the A40 along West Street while others travel along Spring Gardens Road to access the site. This split is even with flow along Spring Gardens Road increasing by around 25 vehicles. In the inter peak period the increased flow is along the A40 and is evenly split in direction. For the PM peak there is an increase in flow along West Street from the A40 which then flows south past the station, with no increase in flow along Spring Gardens Road.

Under the assessment of Whitland Ty Newydd, the SWMWTM has predicted flow increases through Whitland from traffic using B roads to the North and South in the AM peak. Fifty additional vehicles travelled up Spring Gardens from Whitland to access the site. In the inter peak this does not occur but in the PM peak flow from the site through Whitland increases by about 40 vehicles, most heading South out of Whitland.

St Clears Tenby Road which is in St Clears has a smaller increase in traffic flow along the A40 between the site and Haverfordwest, in the AM and PM peaks. This smaller increase in flow along the A40 is due to vehicles from Pembroke travelling along the A477 to reach the site rather than using the A40. Flow along the A477 is increased by around 90 vehicles. There is some flow increase in St Clears of around fifty vehicles in the AM and PM peaks. In the AM peak there is a large increase in traffic of the A40 roundabout in St Clears on to Tenby Road which then enters the site. This large increase is caused by the large amount of traffic arriving to the site from the south and east. In the PM peak there is a large increase in flow onto the A40 west arm of the roundabout from the site, this increase is in excess of 500 vehicles but then splits between the different arms of the roundabout.

For all of the site's traffic along the A40 increases, in the AM peak the increased flow is travelling toward the site and in the PM, peak travelling away from the peak. The inter peak periods have smaller flow increases but both to and from the site. The largest increases are along the A40 between Carmarthen and the sites. There is an increase in travel along b roads to the sites from Fishguard in the AM peak which was using the A40. St Clears Tenby Road results in a smaller flow increase along the A40 between Haverfordwest and the site as flow from Pembroke moves along the A477 instead of the A40. For all sites there is increased flow through the towns with Sites C and 17 causing the largest increases of comparable amounts. Whitland Spring Gardens causes a smaller increase than Whitland Ty Newydd.

Turning flows

Due to limitations of the SWMWTM, traffic flows have not been used directly to assess the conditions on the road network with each of the site options.

Observed data for six junctions in the Whitland and St Clears area were gathered over two four-hour periods across on three consecutive days. The AM period started at 06:30 and finished at 10:30, the PM period started at 15:00 and finished at 19:00. The counts for the modelled time periods were then averaged across the three days to determine and average daily observed count.

The averaged observed counts were then compared with turning flows extracted from each scenario. The absolute difference between each of the site scenarios and the Do-Nothing scenarios was calculated.

Note that for Whitland Spring Gardens in the AM peak scenario, SWMWTM forecast traffic diverting from the A40 through Whitland. This response was considered unrealistic due to the current difference in journey times along the parallel A40 route and B4328 and the absence of delay on the A40 introduced by the proposals for Whitland Spring Gardens. These trips were therefore manually changed so that they used the A40 instead of driving through the centre of Whitland to derive the final flows for assessment.

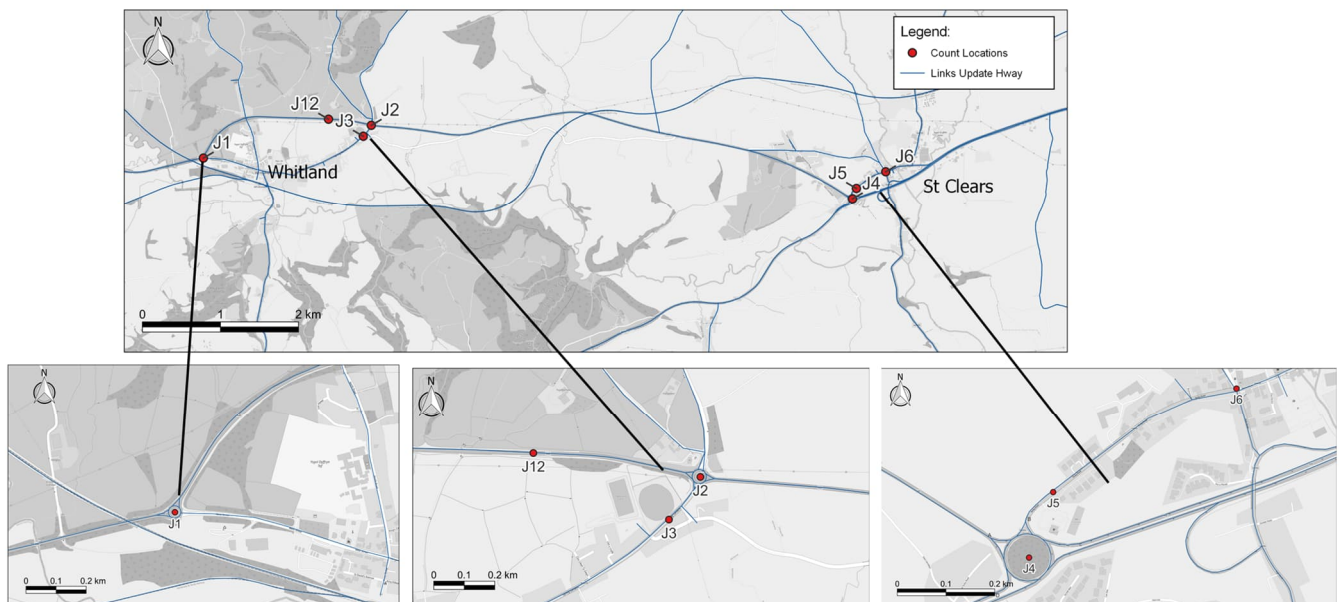


Figure 24: A map of the junction locations in Whitland and St Clears

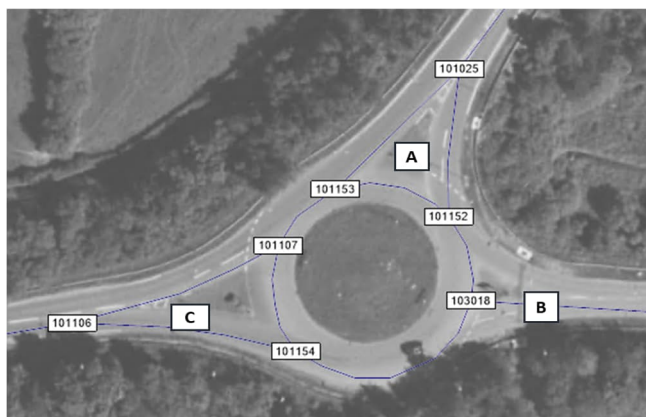


Figure 25: Junction 1 Arms

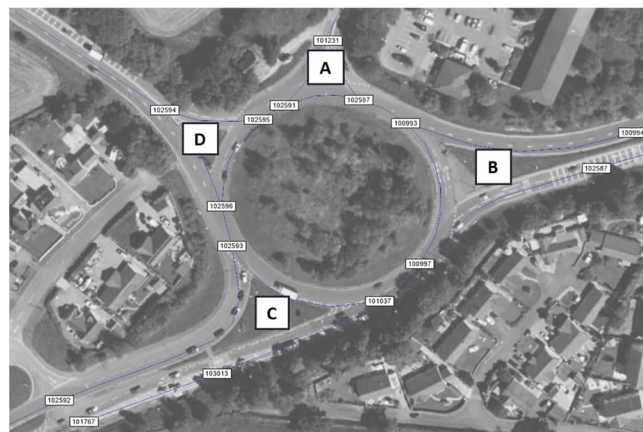


Figure 28: Junction 4 Arms

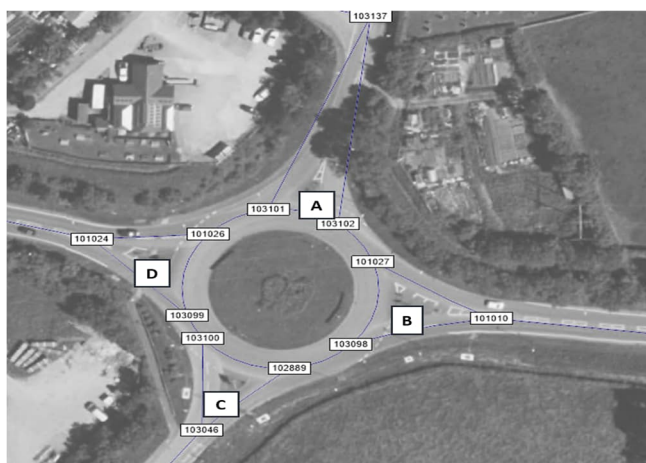


Figure 26: Junction 2 Arms



Figure 29: Junction 5 Arms

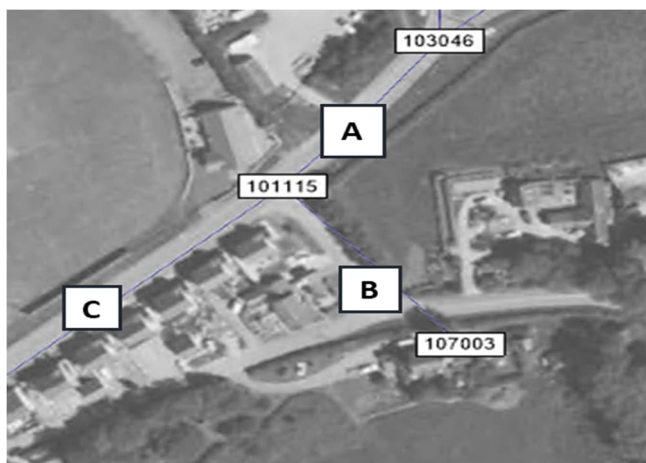


Figure 27: Junction 3 Arms

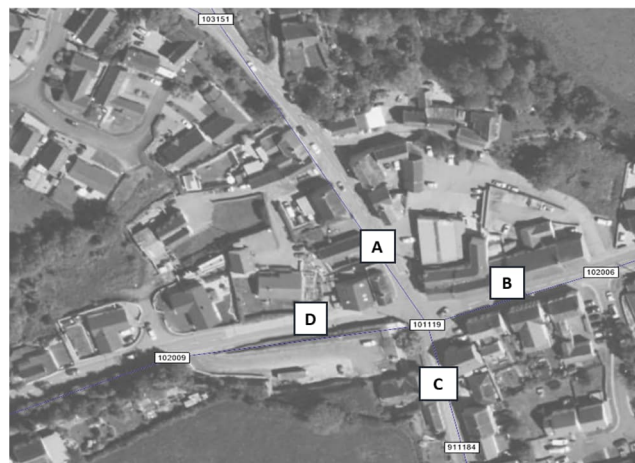


Figure 30: Junction 6 Arms

Table 21: Junction Turning flows for the 6 junctions for all scenarios and peaks

Junction Arm	AM Observed	Future DN	DS1 (Whitland Ty Newydd)	DS2 (St Clears Tenby Road)	DS3 (Whitland Spring Gardens)	PM Observed	Future DN	DS1 (Whitland Ty Newydd)	DS2 (St Clears Tenby Road)	DS3 (Whitland Spring Gardens)
Junction 1 Turning Flows										
A - A	1	0	0	0	0	0	0	0	0	0
B - A	17	0	0	0	22	11	0	0	0	1
C - A	342	401	537	488	545	314	347	350	353	348
A - B	14	0	0	0	1	8	0	0	0	23
B - B	1	0	0	0	0	1	0	0	0	0
C - B	100	113	112	113	112	88	98	98	98	98
A - C	416	445	434	449	420	343	415	616	542	620
B - C	97	117	116	116	113	75	85	85	85	85
C - C	1	0	0	0	0	1	0	0	0	0
Junction 2 Car Turning Flows										
A - A	0	0	0	0	0	0	0	0	0	0
B - A	9	0	0	0	0	14	0	0	0	0
C - A	25	26	27	26	26	41	42	82	42	42
D - A	6	6	6	6	7	17	17	17	17	56
A - B	16	0	0	0	0	7	0	0	0	0
B - B	1	0	0	0	0	0	0	0	0	0
C - B	141	144	183	157	168	127	139	403	139	138
D - B	360	422	357	509	364	416	470	458	476	717
A - C	40	40	82	40	39	26	28	31	28	28
B - C	165	175	452	174	173	133	140	179	149	152
C - C	1	0	0	0	0	1	0	0	0	0
D - C	4	0	201	0	0	10	0	14	0	2
A - D	10	10	9	10	46	6	7	6	6	9
B - D	408	439	421	442	691	339	412	377	540	397
C - D	9	0	7	0	1	9	0	237	0	0
D - D	0	0	0	0	0	0	0	0	0	0
Junction 3 Car Turning Flows										
A - A	0	0	0	0	0	0	0	0	0	0
B - A	7	7	30	7	7	4	4	546	4	4
C - A	168	173	197	186	198	177	190	189	190	189
A - B	2	2	525	2	2	6	6	55	6	6
B - B	0	0	0	0	0	0	0	0	0	0
C - B	7	7	37	7	7	8	8	9	8	8
A - C	209	216	214	215	214	164	173	180	182	187
B - C	9	9	10	9	9	6	6	39	6	6



Junction Arm	AM						PM				
	Observed	Future DN	DS1 (Whitland Ty Newydd)	DS2 (St Clears Tenby Road)	DS3 (Whitland Spring Gardens)		Observed	Future DN	DS1 (Whitland Ty Newydd)	DS2 (St Clears Tenby Road)	DS3 (Whitland Spring Gardens)
C - C	0	0	0	0	0		0	0	0	0	0
Junction 4 Car Turning Flows											
A - A	1	0	0	0	0		0	0	0	0	0
B - A	72	0	0	267	0		46	0	0	30	0
C - A	125	135	136	227	137		114	125	125	128	125
D - A	98	111	109	110	108		103	120	124	167	124
A - B	75	0	0	0	0		55	0	0	0	0
B - B	5	0	0	0	0		5	0	0	0	0
C - B	374	414	415	410	419		354	388	388	386	388
D - B	402	460	437	447	429		422	473	719	724	713
A - C	97	105	104	105	105		84	90	91	90	91
B - C	306	318	315	318	328		400	446	448	436	448
C - C	0	0	0	0	0		0	0	0	0	0
D - C	17	17	17	18	18		16	17	17	121	17
A - D	134	153	158	153	156		95	108	108	107	107
B - D	414	442	695	440	689		370	441	443	420	439
C - D	16	16	17	16	16		16	16	16	16	16
D - D	0	0	0	7	0		0	0	0	159	0
Junction 5 Car Turning Flows											
A - A	0	0	0	0	0		0	0	0	0	0
B - A	106	118	117	116	117		81	91	96	139	95
C - A	33	33	33	33	33		21	21	21	21	21
A - B	101	113	118	113	117		63	69	70	67	69
B - B	0	0	0	0	0		0	0	0	0	0
C - B	198	198	198	198	198		168	168	168	168	168
A - C	26	26	26	73	26		33	33	33	37	33
B - C	183	183	183	543	183		179	179	179	212	179
C - C	0	0	0	0	0		0	0	0	0	0
Junction 6 Car Turning Flows											
A - A	0	0	0	0	0		0	0	0	0	0
B - A	49	56	56	56	56		70	73	73	73	74
C - A	63	68	71	66	75		133	152	160	160	161
D - A	26	28	28	29	28		51	55	54	78	54
A - B	112	116	116	116	116		77	85	86	86	86
B - B	0	0	0	0	0		0	0	0	0	0
C - B	143	153	153	153	153		139	168	168	168	168
D - B	144	161	162	160	161		119	138	142	160	142

Junction Arm	AM						PM				
	Observed	Future DN	DS1 (Whitland Ty Newydd)	DS2 (St Clears Tenby Road)	DS3 (Whitland Spring Gardens)		Observed	Future DN	DS1 (Whitland Ty Newydd)	DS2 (St Clears Tenby Road)	DS3 (Whitland Spring Gardens)
A - C	135	148	165	159	165		88	96	95	95	95
B - C	45	52	52	52	52		60	66	66	66	66
C - C	0	0	0	0	0		0	0	0	0	0
	34	39	37	37	37		41	43	44	45	44
A - D	44	31	31	55	31		31	28	28	29	28
B - D	136	156	159	177	159		107	120	121	121	121
C - D	44	46	47	47	46		46	50	50	50	50
D - D	0	0	0	0	0		0	0	0	0	0

Figure 31: Flows Difference (Whitland Ty Newydd - Do-Nothing) for Whitland AM peak

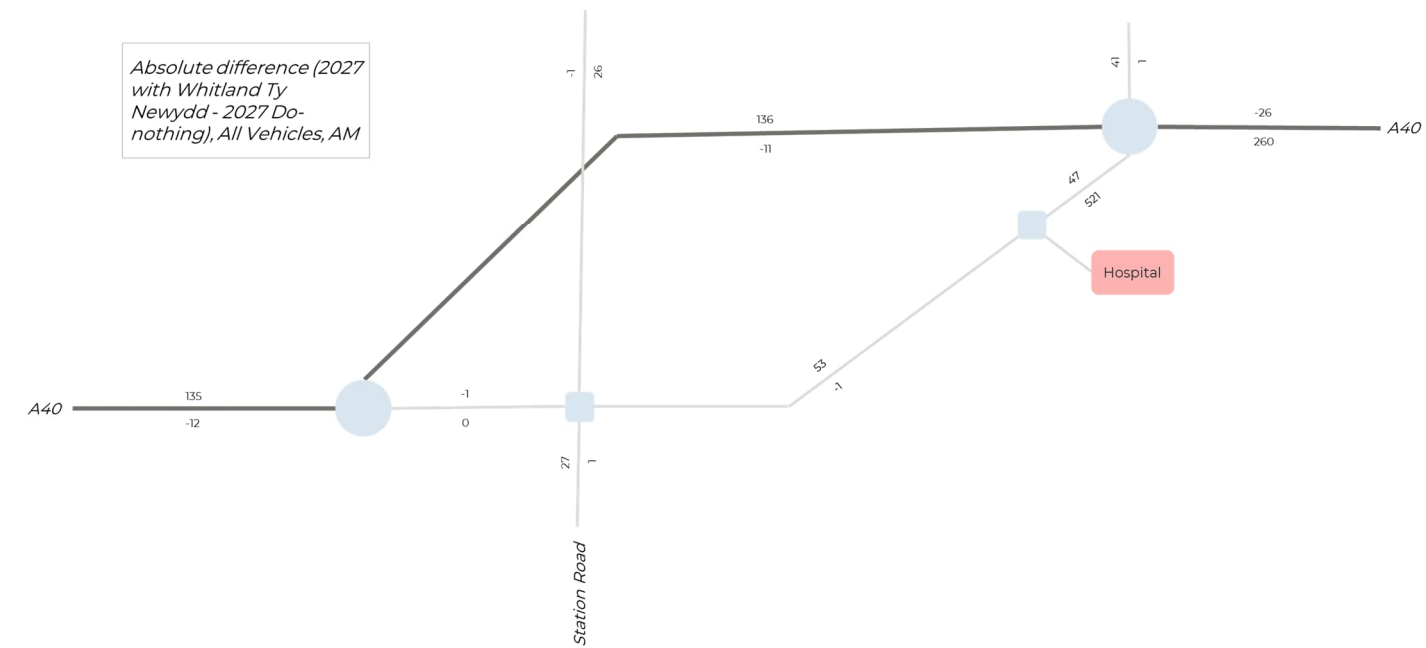


Figure 33: Flows Difference (Whitland Spring Gardens - Do-Nothing) for Whitland AM peak

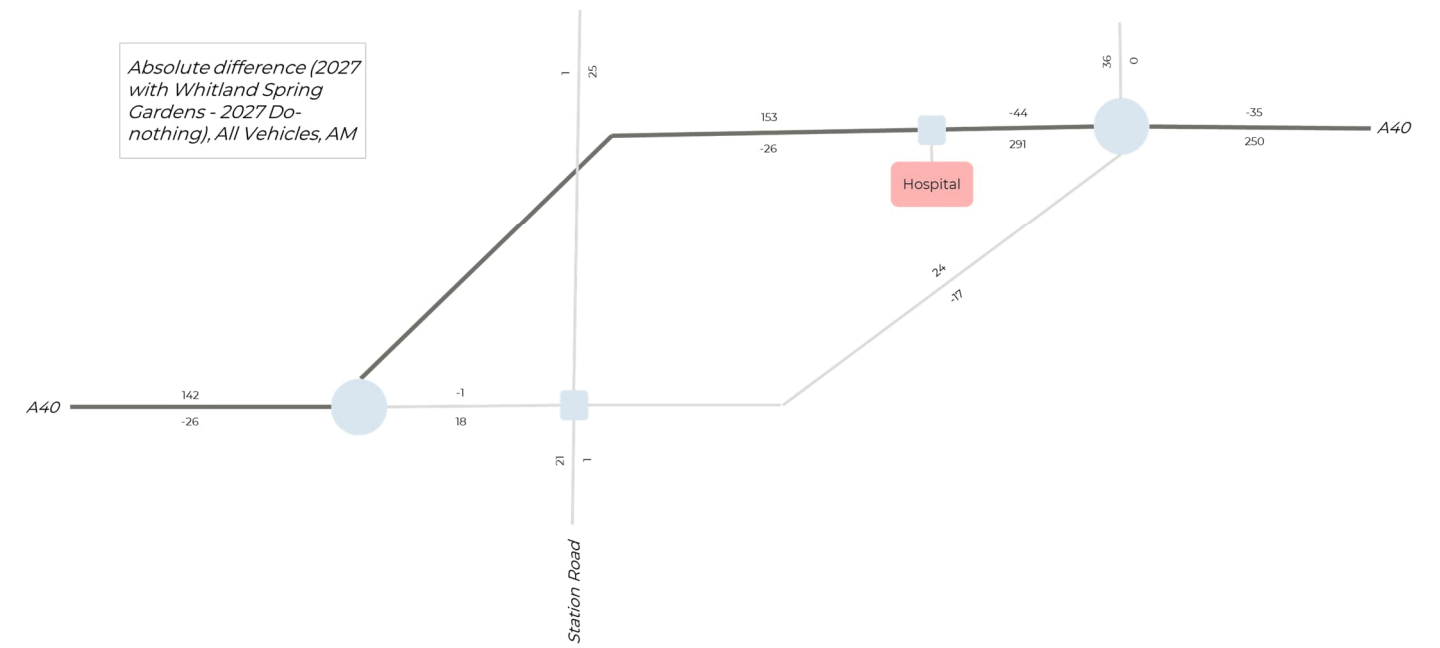


Figure 32: Flows Difference (St Clears Tenby Road - Do-Nothing) for Whitland AM peak

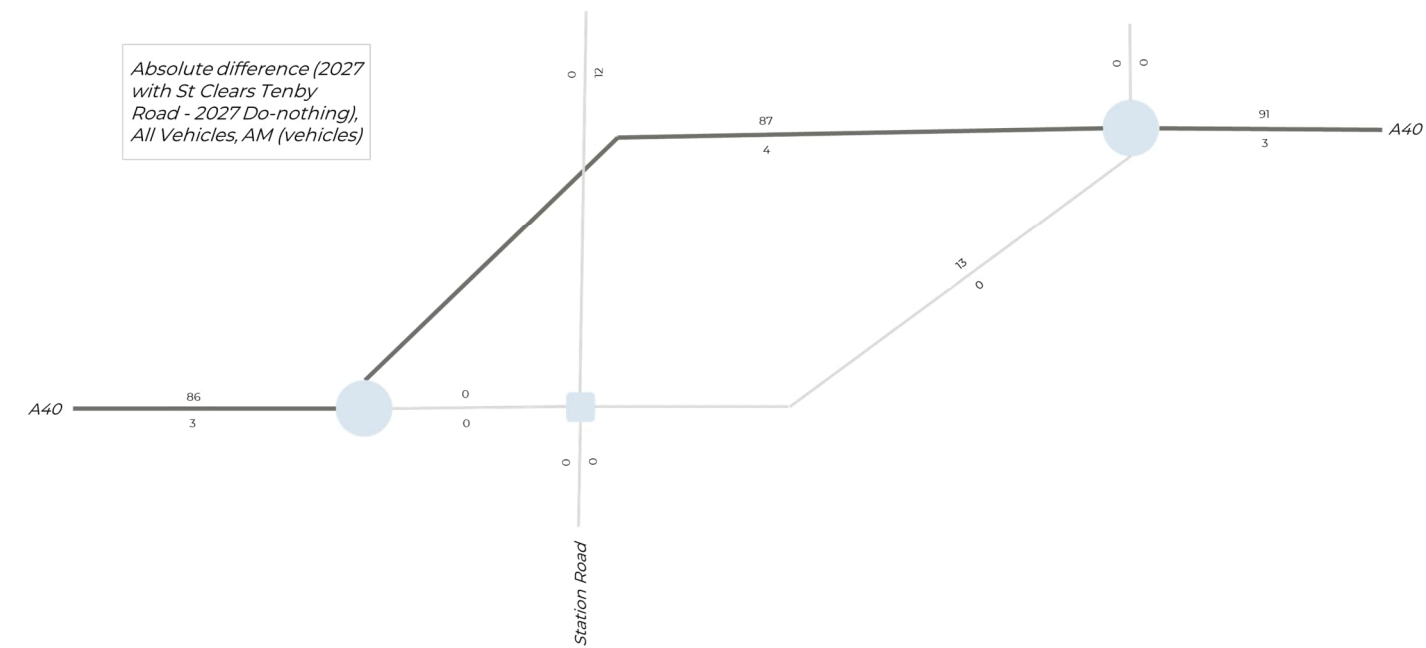


Figure 34: Flows Difference (Whitland Ty Newydd - Do-Nothing) for St Clears AM peak

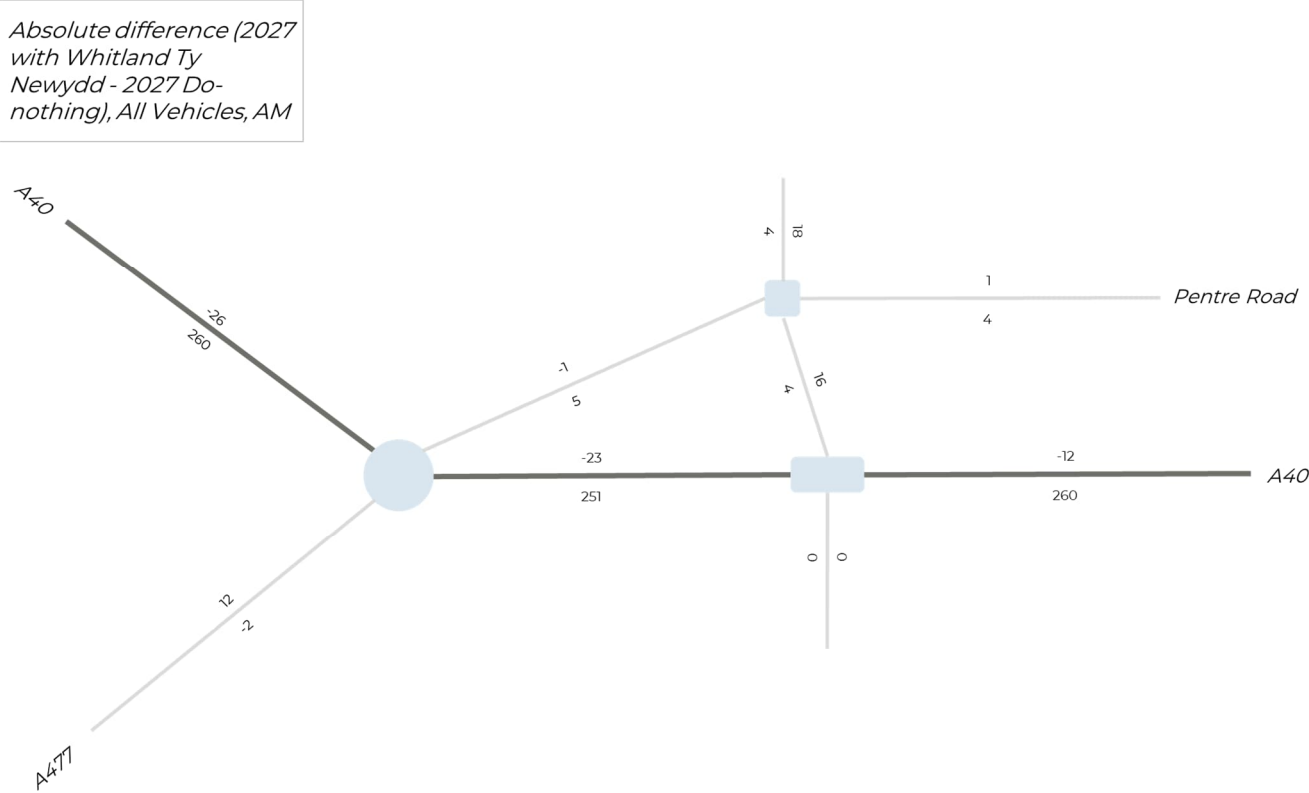


Figure 36: Flows Difference (Whitland Spring Gardens - Do-Nothing) for St Clears AM peak

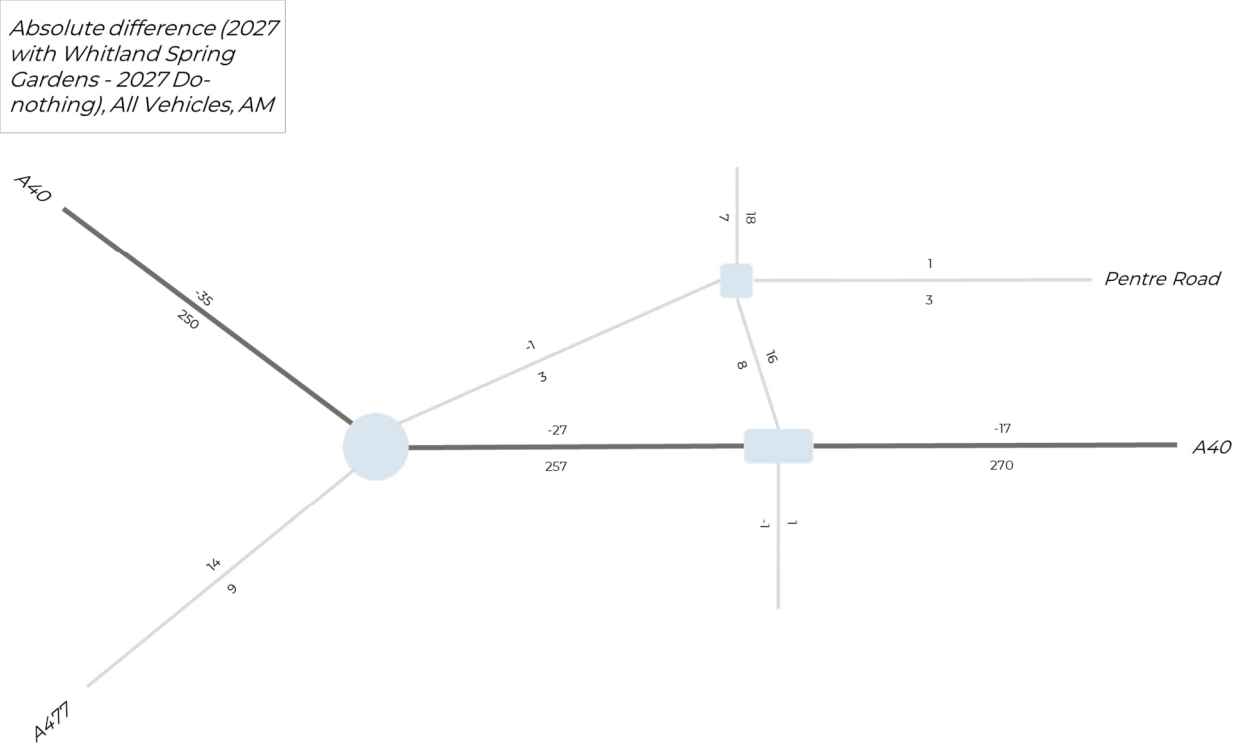
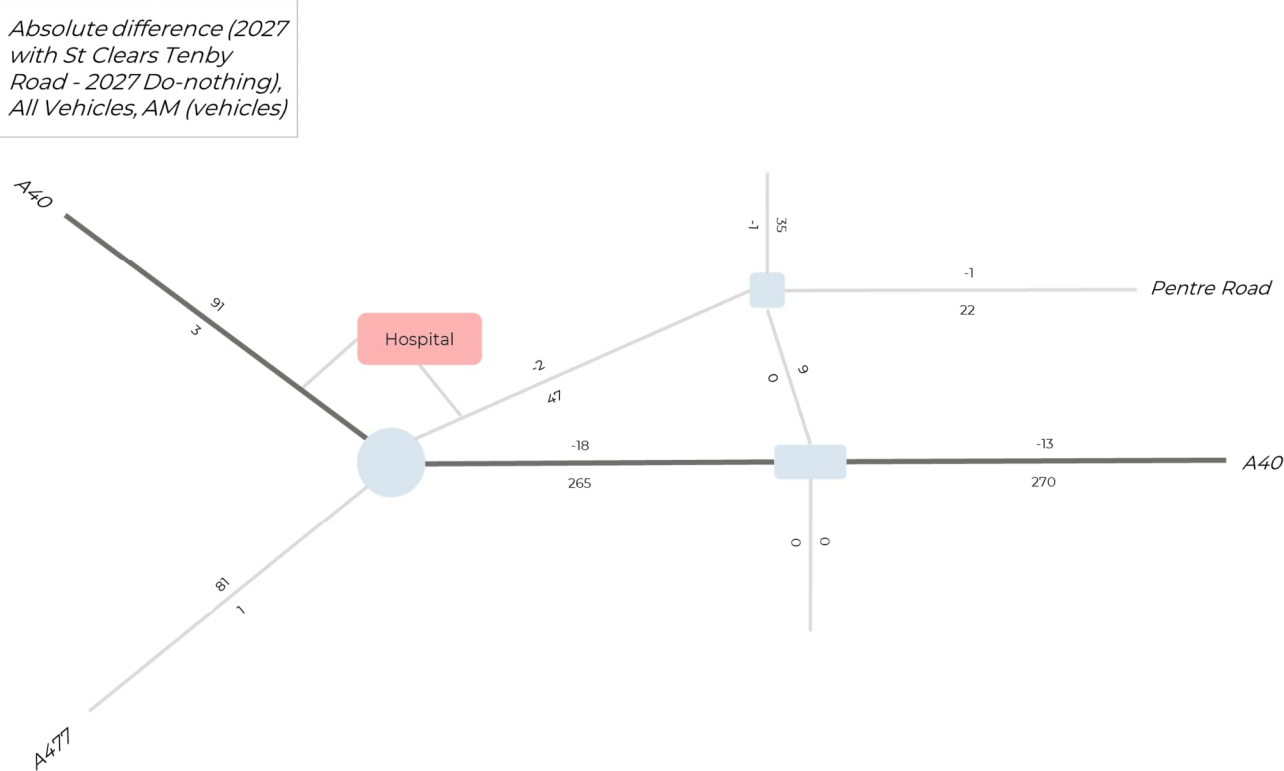


Figure 35: Flows Difference (St Clears Tenby Road - Do-Nothing) for St Clears AM peak



SUMMARY

Summary of forecast assumptions

Hywel Dda University Health Board are proposing to construct a new Urgent and Planned Care Hospital in South West Wales, and are carrying out due diligence on a shortlist of sites to facilitate construction. Three sites are proposed for development: Whitland Spring Gardens (formerly Site 12), Whitland Ty Newydd (formerly Site C), and St Clears Tenby Road (formerly Site 17). Transport modelling, using the South West and Mid-Wales Transport Model, has been undertaken to understand the strategic transport impacts of developing each site and provide an evidence base for the due diligence.

Transport forecasts were developed for a 2027 forecast year. The starting point for forecasting was the existing 2027 SWMWTM Foundation Case transport forecast. A do-nothing forecast was developed, representing a view of the future transport conditions without any development of a new hospital in the region. Test scenario forecasts were developed for each of the proposed sites, representing demand and network changes from the do-nothing associated with full build-out of the site being tested.

Variable demand modelling was applied to model any changes in travel behaviour resulting from the development of the new hospital site. Behaviour change was modelled for trips made to the proposed new hospital as well as for trips being made that weren't related to the new hospital.

The transport forecasts have been assessed to understand the changes in choices made by travellers, and the performance of the highway and public transport networks, when each of the hospital sites are developed.

Summary of forecast results

Due to the regional nature of the SWMWTM, traffic flows and junction performance have not been taken directly from the model. Instead forecast flows have been produced by calculating adjustments which are applied to observed traffic flows, for subsequent use in separate junction models. The background growth derived from SWMWTM is considered to be robust, the increase in flows arising from the three sites is considered to be realistic. The distribution and mode choice predicted by the SWMWTM appears reasonable.

Recommendations

The final derived flows can be taken forward for detailed junction modelling.

APPENDICES

Appendix A

RAIL STOP BOARDING VALUES

Table 22: Boarding values for Stations calledat along lines that stop at Whitland for all peaks

Stop Number	Name	AM Boarding				IP Boarding				PM Boarding			
		FC	DS1	DS2	DS3	FC	DS1	DS2	DS3	FC	DS1	DS2	DS3
			Whitland Spring Gardens	Whitland Ty Newydd	St Clears Tenby Road		Whitland Spring Gardens	Whitland Ty Newydd	St Clears Tenby Road		Whitland Spring Gardens	Whitland Ty Newydd	St Clears Tenby Road
38	Abergavenny	184	184	184	184	154	154	154	154	126	126	126	126
154	Baglan	17	17	18	17	22	22	22	22	31	31	31	31
239	Bridgend	600	601	601	601	401	401	401	400	412	412	412	412
325	Briton Ferry	22	22	22	22	13	13	13	13	7	7	7	7
508	Cardiff Central	1332	1340	1340	1339	1097	1098	1098	1097	1056	1059	1059	1058
592	Clarbeston Road	16	22	22	28	48	48	48	51	85	86	86	88
609	Carmarthen	203	271	272	250	288	314	314	318	178	186	187	183
655	Chepstow	4	4	4	4	6	6	6	6	5	5	5	5
661	Crewe	52	52	52	52	61	61	61	62	37	37	37	37
678	Craven Arms	16	16	16	16	42	42	42	42	16	16	16	16
708	Church Stretton	6	6	6	6	8	8	8	8	3	3	3	3
719	Clunderwen	9	9	9	13	19	19	19	19	15	15	15	15
728	Cwmbran	16	16	16	16	28	28	28	28	27	27	27	27
986	Fishguard Harbour	8	8	8	8	12	12	12	12	0	0	0	1
988	Fishguard & Goodwick	19	22	22	24	56	56	56	57	4	4	4	5
1052	Ferryside	17	22	22	23	12	13	13	13	29	30	30	29
1064	Gloucester	2	2	2	2	4	4	4	4	8	8	8	8
1162	Gowerton	63	64	64	64	41	41	41	41	31	31	31	31
1213	Hereford	42	42	42	42	81	81	81	81	65	65	65	65
1349	Haverfordwest	55	74	75	93	68	73	73	90	47	49	49	54
1406	Johnston (Pembrokeshire)	28	45	45	55	36	40	40	49	45	47	47	51
1437	Kilgetty	25	27	27	29	21	21	21	22	48	49	49	49
1494	Kidwelly	23	24	24	24	8	8	8	8	6	6	6	6
1504	Lamphey	2	2	2	2	4	5	5	4	4	4	4	4
1508	Llansamlet	20	20	20	20	18	18	18	18	40	40	40	40
1541	Leominster	4	4	4	4	12	12	12	12	5	5	5	5
1585	Llanelli	286	289	289	292	223	224	224	224	131	131	131	131
1652	Ludlow	9	9	9	9	18	18	18	18	14	14	14	14
1669	Lydney	1	1	1	1	1	1	1	1	1	1	1	1
1681	Manchester Piccadilly	50	50	50	50	46	46	46	46	38	38	38	38
1724	Milford Haven	25	37	37	46	33	33	33	36	33	34	34	35
1780	Manorbier	8	8	8	8	9	9	9	9	5	5	5	5
1825	Narberth	8	9	9	10	16	16	16	16	9	9	9	10
1899	Neath	392	392	392	392	261	262	262	262	182	182	182	182
1917	Newport (S Wales)	267	269	269	269	317	318	318	317	299	303	303	303

Stop Number	Name	AM Boarding				IP Boarding				PM Boarding			
		FC	DS1	DS2	DS3	FC	DS1	DS2	DS3	FC	DS1	DS2	DS3
			Whitland Spring Gardens	Whitland Ty Newydd	St Clears Tenby Road		Whitland Spring Gardens	Whitland Ty Newydd	St Clears Tenby Road		Whitland Spring Gardens	Whitland Ty Newydd	St Clears Tenby Road
1965	Pembrey & Burry Port	86	91	91	92	48	49	49	49	41	42	42	42
1966	Pencoed	20	20	20	20	10	10	10	10	15	15	15	15
2012	Pembroke	13	15	15	14	30	31	31	31	47	47	47	48
2013	Pembroke Dock	12	13	13	14	30	30	30	30	23	23	23	23
2021	Penally	18	18	18	18	12	12	12	12	45	45	45	45
2042	Pontypool & New Inn	7	7	7	7	25	25	25	25	25	25	25	25
2053	Prees	1	1	1	1	1	1	1	1	1	1	1	1
2065	Port Talbot Parkway	274	274	274	274	259	259	260	259	138	138	138	138
2090	Pontyclun	16	17	17	17	20	20	20	20	22	22	22	22
2094	Pyle	64	64	64	64	58	58	58	58	44	44	44	44
2270	Saundersfoot	5	6	6	6	11	11	11	12	17	17	17	17
2327	Shrewsbury	208	209	209	209	312	313	312	313	183	183	183	183
2347	Skewen	16	16	16	16	12	12	12	12	9	9	8	8
2435	Stockport	1	1	1	1	0	0	0	0	0	0	0	0
2472	Severn Tunnel Junction	1	1	1	1	3	3	3	3	3	3	3	3
2505	Swansea	971	987	987	988	870	871	871	870	822	828	828	828
2550	Tenby	53	55	55	56	77	77	77	77	101	101	101	101
2851	Whitchurch (Shrops)	0	0	0	0	1	1	1	1	1	1	1	1
2857	Whitland	43	52	52	46	52	106	107	54	33	140	141	35
4000	St Clears	17	17	17	37	20	20	20	166	8	8	8	237

RAIL STOP ALIGHTING VALUES

Table 23: Alighting values for Stations calledat along lines that stop at Whitland for all peaks

Stop Number	Name	AM Alighting				IP Alighting				PM Alighting			
		FC	DS1	DS2	DS3	FC	DS1	DS2	DS3	FC	DS1	DS2	DS3
			Whitland Spring Gardens	Whitland Ty Newydd	St Clears Tenby Road		Whitland Spring Gardens	Whitland Ty Newydd	St Clears Tenby Road		Whitland Spring Gardens	Whitland Ty Newydd	St Clears Tenby Road
38	Abergavenny	159	159	159	160	153	153	154	153	135	135	135	135
154	Baglan	26	26	26	26	112	112	112	111	31	30	30	30
239	Bridgend	549	549	549	549	395	395	395	395	432	433	433	433
325	Briton Ferry	12	12	12	12	10	10	10	10	16	16	16	16
508	Cardiff Central	1443	1450	1449	1448	1033	1034	1034	1033	978	982	982	981
592	Clarbeston Road	28	28	28	28	31	32	32	35	7	9	9	11
609	Carmarthen	216	221	221	227	270	298	299	341	153	183	184	235
655	Chepstow	3	3	3	3	8	8	8	8	4	4	4	4
661	Crewe	54	54	54	54	62	62	62	62	38	38	38	38
678	Craven Arms	11	11	11	11	44	44	44	44	20	20	20	20
708	Church Stretton	3	3	3	3	5	5	5	5	5	5	5	5
719	Clunderwen	16	16	16	16	17	17	17	17	6	8	8	9
728	Cwmbran	21	21	21	21	17	17	17	17	14	14	14	14
986	Fishguard Harbour	11	11	11	11	5	5	5	5	4	4	4	4
988	Fishguard & Goodwick	50	50	50	50	22	22	22	22	20	23	23	25
1052	Ferryside	9	9	9	9	9	9	9	10	6	7	7	8
1064	Gloucester	4	4	4	4	4	4	4	4	3	3	3	3
1162	Gowerton	65	65	65	64	80	80	80	80	79	80	80	81
1213	Hereford	84	84	84	84	68	68	68	68	53	54	54	54
1349	Haverfordwest	101	102	102	105	99	110	111	139	47	68	68	99
1406	Johnston (Pembrokeshire)	18	18	18	18	17	19	19	23	10	15	15	22
1437	Kilgetty	16	16	16	16	14	14	14	14	23	23	23	23
1494	Kidwelly	5	5	5	5	10	10	10	10	6	6	6	6
1504	Lamphey	3	3	3	4	4	4	4	4	3	3	3	3
1508	Llansamlet	12	11	12	12	12	12	12	12	38	38	38	38
1541	Leominster	8	8	8	8	8	8	8	8	7	7	7	7
1585	Llanelli	149	152	152	154	237	238	238	239	251	251	251	251
1652	Ludlow	18	18	18	18	26	26	26	26	13	13	13	13
1669	Lydney	2	2	2	2	1	1	1	1	1	1	1	1
1681	Manchester Piccadilly	63	63	63	63	53	53	53	53	42	42	42	42
1724	Milford Haven	35	35	35	35	28	29	29	31	14	17	18	25
1780	Manorbier	6	6	6	6	6	6	6	6	6	6	6	6
1825	Narberth	18	18	18	19	23	24	24	26	25	27	27	32
1899	Neath	268	267	267	267	204	204	204	204	324	324	324	325
1917	Newport (S Wales)	300	301	301	301	320	321	321	321	265	270	270	269
1965	Pembrey & Burry Port	59	59	59	59	59	61	61	63	59	68	68	72
1966	Pencoed	26	26	26	26	12	12	12	12	12	12	12	12
2012	Pembroke	20	20	20	20	38	39	39	39	19	21	21	22

Stop Number	Name	AM Alighting				IP Alighting				PM Alighting			
		FC	DS1	DS2	DS3	FC	DS1	DS2	DS3	FC	DS1	DS2	DS3
			Whitland Spring Gardens	Whitland Ty Newydd	St Clears Tenby Road		Whitland Spring Gardens	Whitland Ty Newydd	St Clears Tenby Road		Whitland Spring Gardens	Whitland Ty Newydd	St Clears Tenby Road
2013	Pembroke Dock	27	27	27	27	24	25	25	25	24	26	26	26
2021	Penally	10	11	10	11	38	38	38	38	37	38	38	38
2042	Pontypool & New Inn	7	7	7	7	8	8	8	8	7	6	6	6
2053	Prees	1	1	1	1	10	10	10	10	1	1	1	1
2065	Port Talbot Parkway	236	236	236	236	219	219	219	219	280	280	280	280
2090	Pontyclun	29	29	29	29	26	26	26	26	15	16	16	16
2094	Pyle	68	68	68	68	55	55	55	55	38	38	38	38
2270	Saundersfoot	6	6	6	6	9	9	9	9	7	8	8	7
2327	Shrewsbury	203	203	203	203	324	325	325	325	176	176	176	176
2347	Skewen	13	13	13	13	15	15	15	15	22	22	22	22
2435	Stockport	1	1	1	1	0	0	0	0	0	0	0	0
2472	Severn Tunnel Junction	2	2	2	2	3	3	3	3	3	3	3	3
2505	Swansea	800	807	807	806	739	740	740	740	673	682	682	685
2550	Tenby	58	58	58	58	80	80	80	80	114	115	115	116
2851	Whitchurch (Shrops)	0	0	0	0	1	1	1	1	1	1	1	1
2857	Whitland	28	204	207	28	29	74	75	31	25	45	45	27
4000	St Clears	20	20	20	235	23	25	25	111	11	13	13	45