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<b>Project:</b>	SEWTM – M4 J34 to A48 Link WeITAG Stage 2		
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<b>Approved by:</b>	P Chase	<b>To:</b>	Arcadis
<b>Subject:</b>	SEWTM Modelling Approach		

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## 1 Introduction

### 1.1 Purpose

Mott MacDonald (working with Arup) has been commissioned by Transport for Wales to undertake strategic transport modelling for the M4 J34 to A48 Link using the South East Wales Transport Model (SEWTM), following a request from Arcadis working on behalf of Vale of Glamorgan Council. Strategic modelling is required to support a WeITAG Stage 2 study for the scheme.

This Technical Note has been prepared to summarise the modelling approach adopted for the study, including validation checks, network coding assumptions, and outputs delivered. It is expected that this Note will be included as an appendix to the WeITAG stage report.

### 1.2 South East Wales Transport Model (SEWTM)

SEWTM is a multi-modal disaggregate demand model focused on South East Wales, covering the eleven unitary authority areas of Blaenau Gwent, Bridgend, Caerphilly, Cardiff, Merthyr Tydfil, Monmouthshire, Neath Port Talbot, Newport, Rhondda Cynon Taf, Torfaen, and Vale of Glamorgan. The model comprises separate highway and public transport assignment models linked together with a demand model. The model was commissioned by Welsh Government in 2015 and has been developed by a team led by Mott MacDonald, and including Arup, RAND Europe, and David Simmonds Consultancy.

The SEWTM has been designed to:

- Understand the current travel patterns in South East Wales and the performance of the transport system;
- Monitor changes in travel patterns over time;
- Predict future travel patterns and conditions on the transport network;
- Assess the impacts of possible interventions in the transport system in a consistent manner;
- Assess the impacts of land use changes such as new housing developments and employment locations in a consistent manner; and
- Provide inputs required for transport appraisals and business cases.

The model represents an average weekday for four time periods: an AM average hour between 0700 and 0930, an inter-peak (IP) average hour between 0930 and 1530, an average PM hour between 1530 and 1800 and an off-peak (OP) average hour between 1800 and 0700. The assignment models can also represent peak hours within the AM and PM peak periods. Peak hours are the single hours during which the

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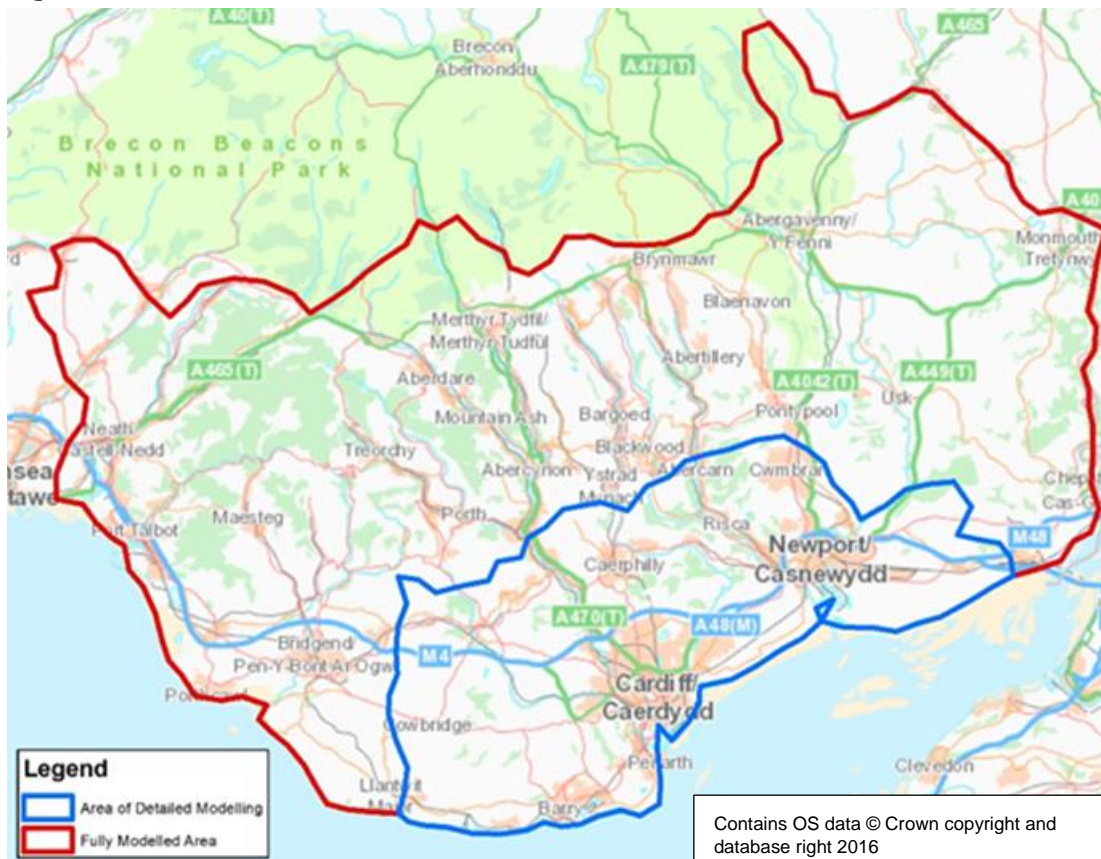
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highest volume of trips are undertaken; between 0745 and 0845, and between 1630 and 1730. The SEWTM base year is 2015, with forecast years of 2026 and 2036 currently available.

SEWTM geographical coverage is shown in Figure 1. The M4 J34 to A48 Link, as well as the wider area in which the greatest transport impacts are likely to be felt, is within the Area of Detailed Modelling. This is the area of the transport model within which significant impacts of interventions are more certain. Within this area the model represents all trips (demand), model zones are small and highly disaggregated, the transport network is detailed, and junction modelling is included.

**Figure 1: SEWTM modelled area**



Source: Mott MacDonald

### 1.3 Approach Overview

An overall approach to the strategic modelling, which is proportionate to the scale of the scheme and current development stage, was agreed with Arcadis in advance:

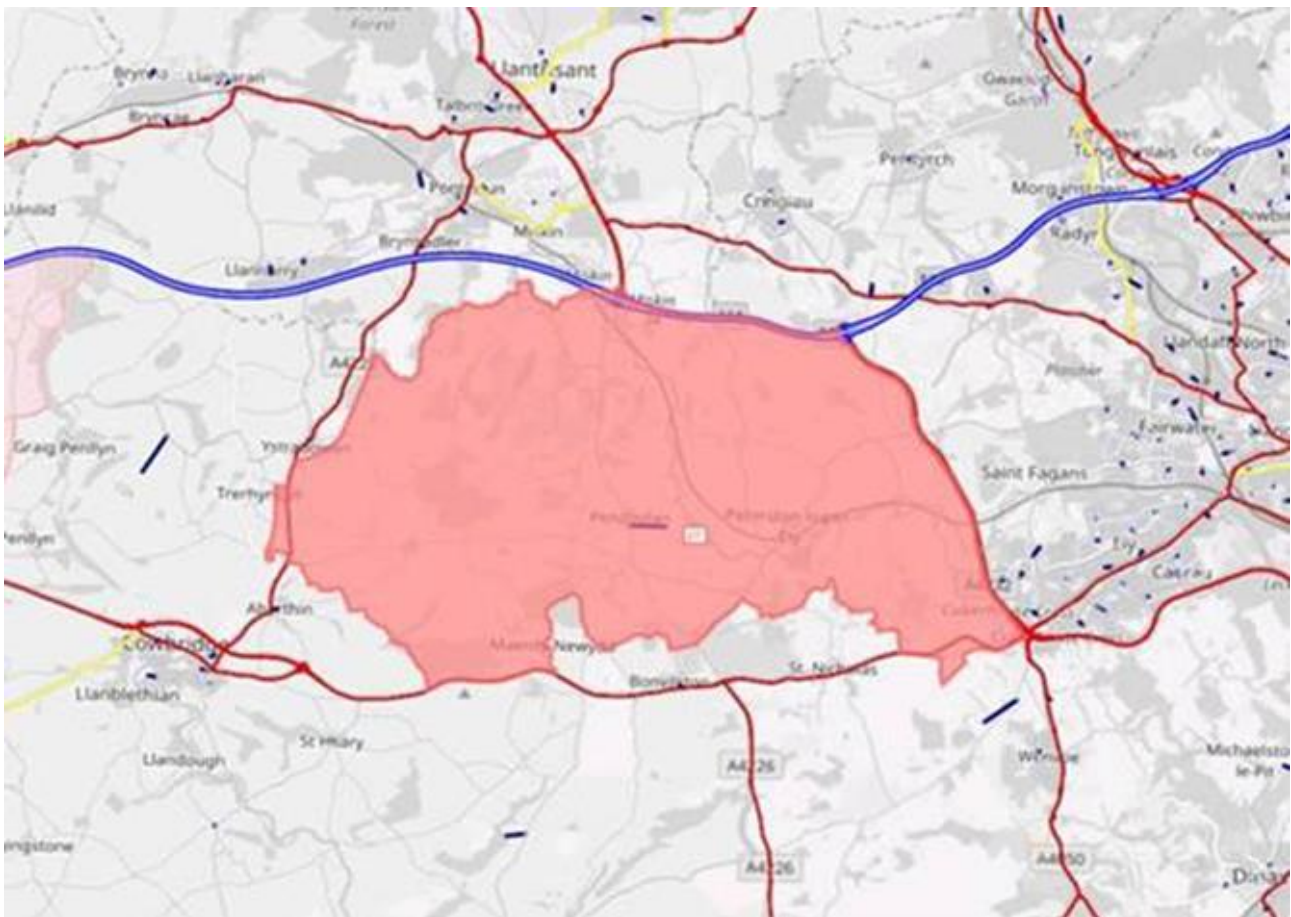
- Running the highway component of SEWTM only; and
- 2036 forecast year only, with model outputs used to complete a single year TUBA assessment.

## 2 Zoning and Network Structure

The zoning structure within the scheme area has been reviewed. Model zone 27 (highlighted in Figure 2) is the main zone in the study area. All villages local to the scheme and the Renishaw factory are included within this zone.

The zone boundaries are based on the LSOA (Lower Layer Super Output Area) in this area and the zone is connected to the highway network near to Pendoylan village. Having such a large zone could have an impact on the local assignment of trips within this area of the model. However, given the rural nature of the zone, the level of trip generation is relatively low (compared to the rest of the model area) and therefore the zone size is unlikely to have a significant impact on the results of this high-level analysis of the proposed scheme. However, this is an area that could be developed further in any future modelling work for the scheme.

**Figure 2: Extent of Model Zone 27**



Source: Arup / Mott MacDonald

Within SEWTM, all lower rank, non-strategic routes are modelled as fixed low speed links. In this case the existing road between M4 J34 and A48 was modelled as such in the Base and Do-Minimum scenarios. Considering the existing characteristics of this road and sections with a single track/passing places specifically, this approach was deemed as appropriate in the development phase of the model.

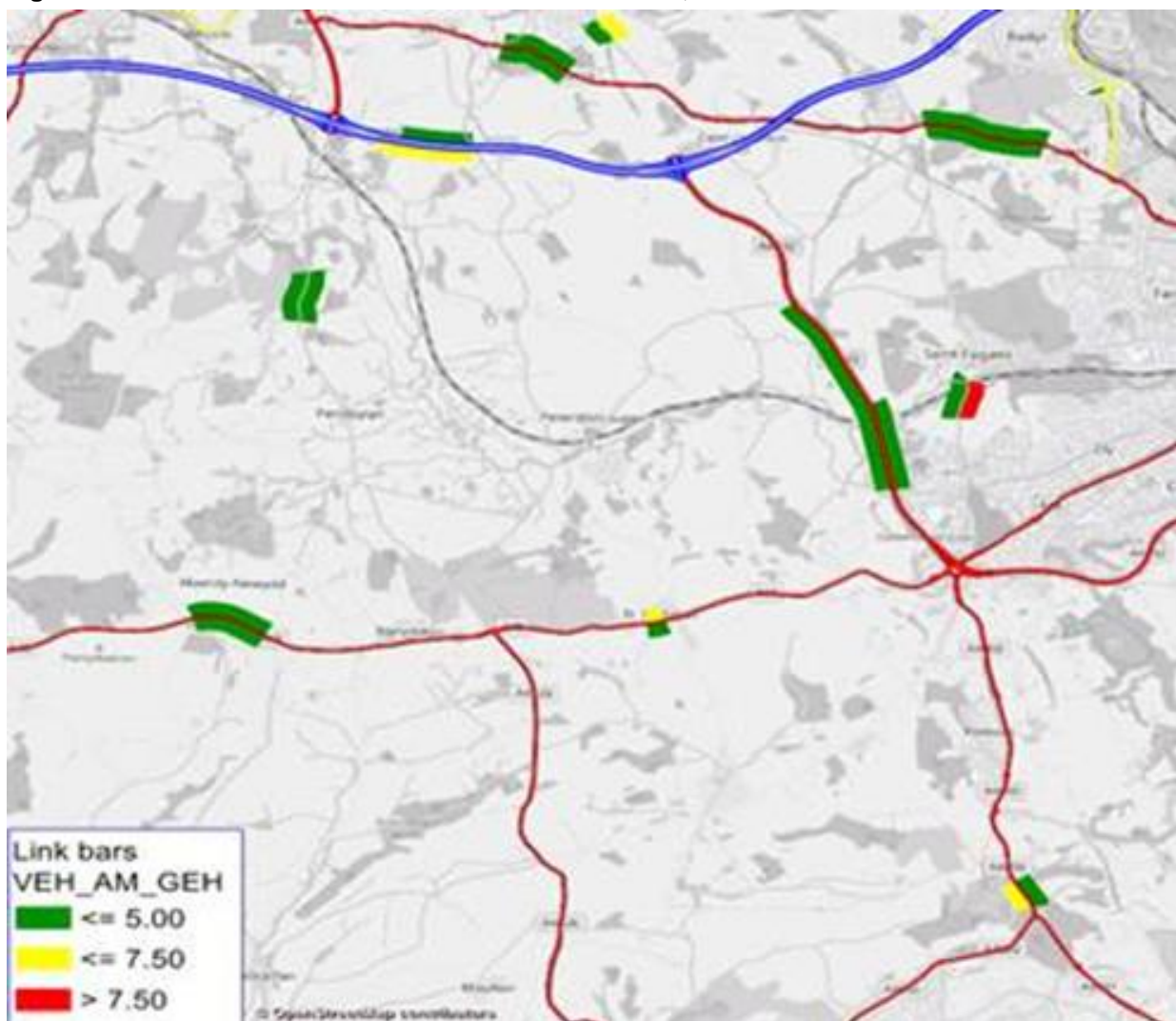
### 3 Highway Validation

A review of 2015 base year highway model performance in the study area has been undertaken. The review indicated that the model presented a good level of validation in terms of screenlines and link flow volumes on most validation points in the area around the scheme. This includes the existing road section adjacent to the scheme and the A48 west of the scheme. Link validation results for all time periods, based on the standard GEH statistic, are shown in Figure 3, Figure 4 and Figure 5.

The link flow volumes on the A48 to the east of the scheme did not validate quite as well and are slightly underestimated in the base year.

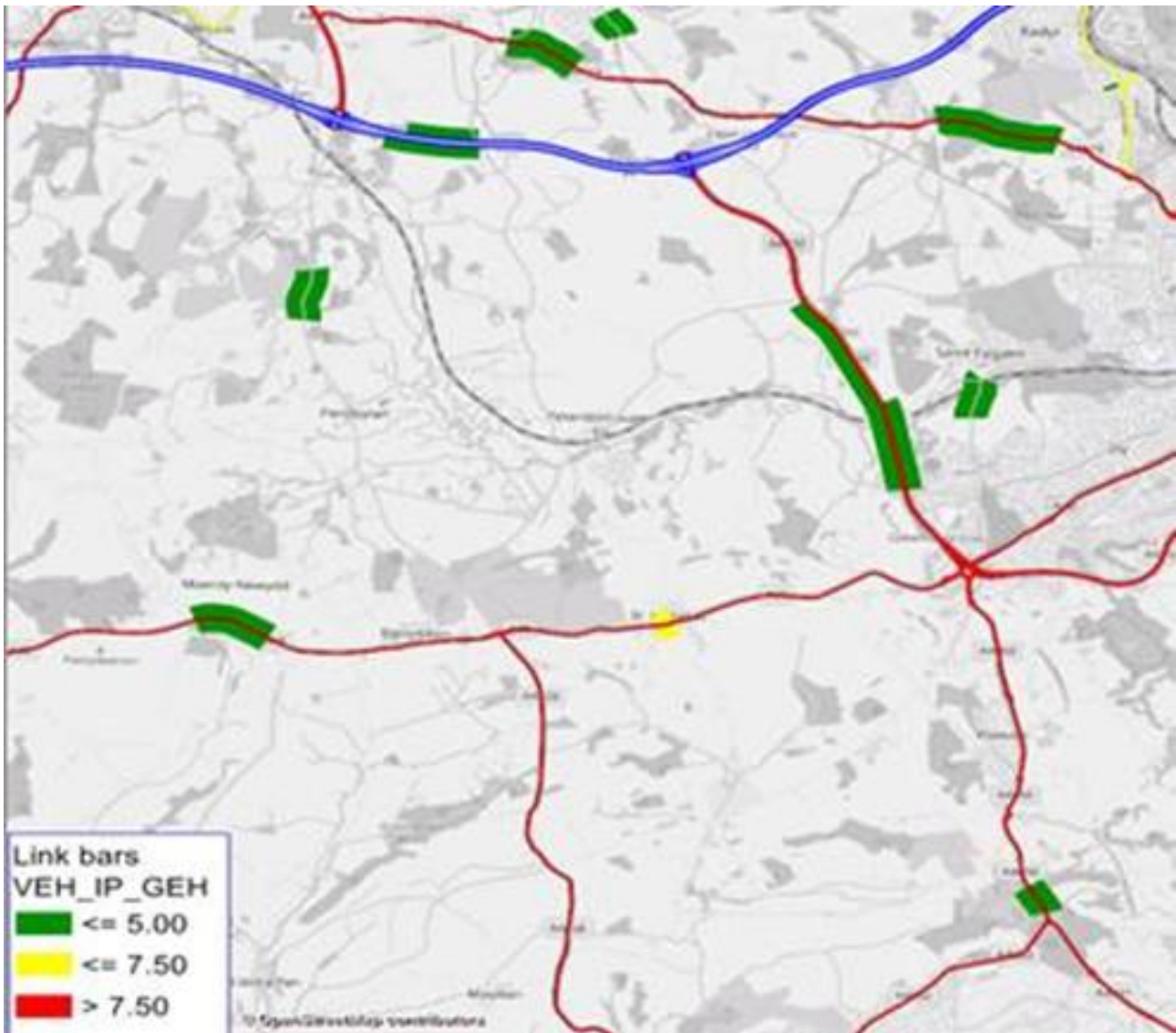
The model journey times were analysed along strategic routes. Routes in proximity of the proposed scheme (A48, A4232 and M4) display a good level of validation across all time periods.

**Figure 3: Base Year Model Link Validation – All Vehicles, AM 2015**



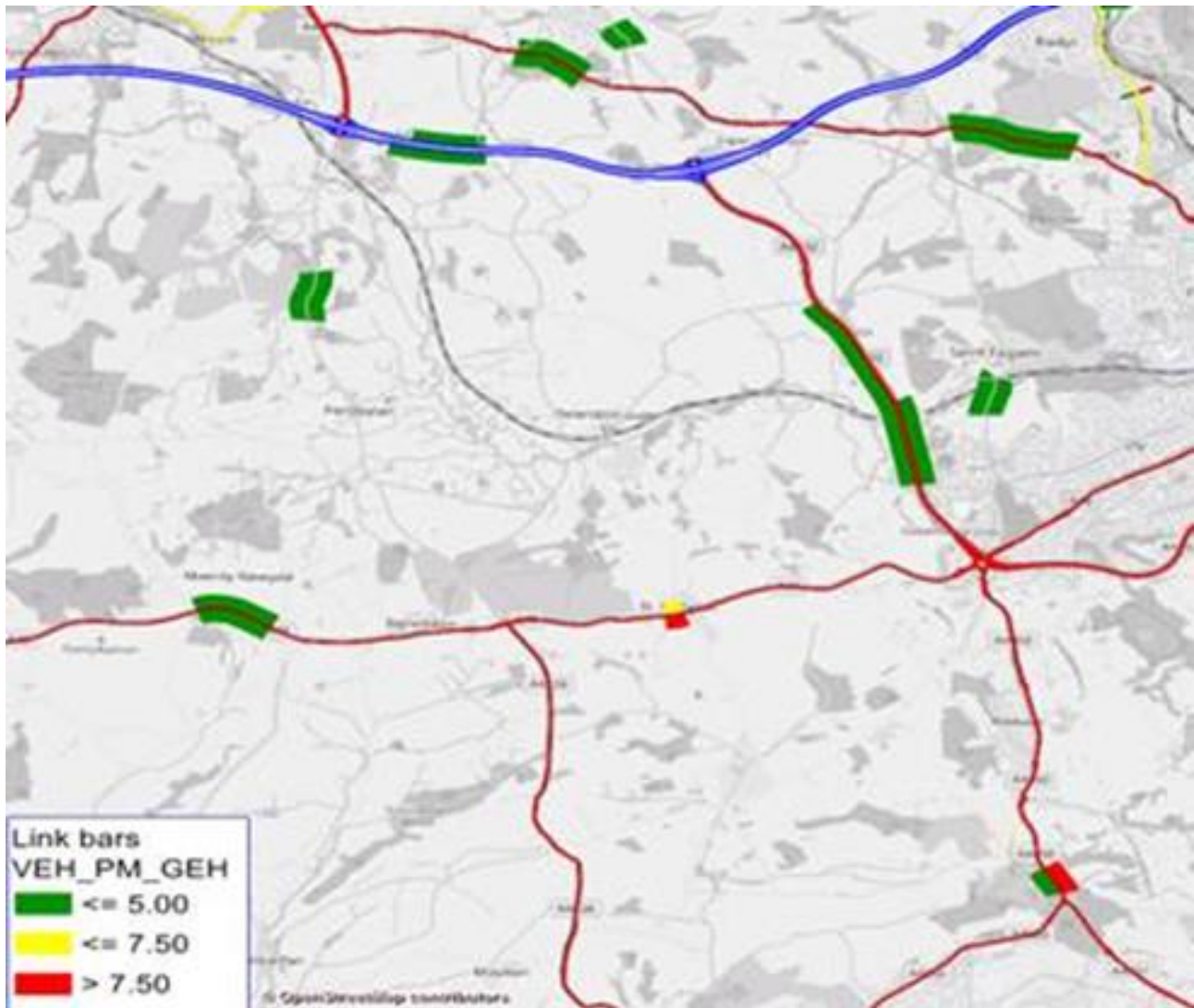
Source: Arup / Mott MacDonald

Figure 4: Base Year Model Link Validation – All Vehicles, Inter-Peak 2015



Source: Arup / Mott MacDonald

Figure 5: Base Year Model Link Validation – All Vehicles, PM 2015



Source: Arup / Mott MacDonald

## 4 Do-Minimum Networks

The 2036 Do-Minimum highway networks in SEWTM already include the following schemes:

- Five Mile Lane Scheme, involving a range of improvements to the A4226 between Sycamore Cross and Weycock Cross;
- A465 Dualling between Gilwern and Dowlais Top; and
- M4 Junction 32 improvements, including a new dedicated left turn lane from the M4 westbound.

Additionally, the following schemes and amendments have now been included as part of Do-Minimum network updates:

- Eastern Bay Link Stage 1 between the Butetown Tunnel and Ocean Way; and
- Revised A4226 Five Mile Lane coding, to incorporate the latest information outlined in the Five Mile Lane Transport Assessment, provided by Arcadis. Changes were made to the road characteristics and junction control settings including new signal phasing and timings.

## 5 Do-Something Networks

The 2036 Do-Something networks consist of the revised Do-Minimum network with the additional coding of the M4 J34 to A48 link road. The following assumptions are made in terms of modelling the proposed scheme:

- Single carriageway link classification and speed-flow curve (60mph/100km design speed);
- The section of the scheme road 450 metres north of the A48 Sycamore Cross junction is coded as suburban single carriageway link classification and speed-flow curve (40mph/64km design speed);
- No adjustments were made to the coding of Sycamore Cross junction signals to account for the new scheme road section; and
- Due to the size of zones (and zone loading points) in the proximity of the scheme road, no intermediate junctions were coded along the scheme link.

## 6 Outputs

Mott MacDonald / Arup has issued the following information and model run outputs:

- GIS shapefiles containing modelled link vehicle flows (actual and demand for AM / Inter-Peak / PM) for:
  - 2015 Base
  - 2036 Do-Minimum
  - 2036 Do-Something
- Flow difference plots for AM, Inter-Peak, and PM time periods, comparing the 2036 Do-Minimum and 2036 Do-Something scenarios;
- Spreadsheet containing additional attributes describing model links characteristics;
- Full set of TUBA 1.9.9 input and output files for a single year (2036); and
- Highway hour to period factors to assist in forecasting Annual Average Daily Traffic (AADT) flows – AM (2.1977), Inter-Peak (6), PM (2.3768), and Off-Peak (13).

## 7 Considerations for WeITAG Stage 3

Future development work on the M4 J34 to A48 Link scheme, potentially as part of a WeITAG Stage 3 assessment, should consider the following options to refine the modelling:

- Additional journey time data could be collected and used for validation along the existing road between M4 J34 and the A48;
- Disaggregation of model zones local to the scheme road section, with the aim of helping to improve model validation on the A48 to the east of the scheme;
- Refining coding of the existing road in the Do-Minimum, considering the link speed and replicating the performance of the road, which on some sections is single track with passing places;
- Junction / signal optimisation at Sycamore Cross (A48) and M4 J34;
- Use of a cordoned version of SEWTM to remove the impacts of any model noise in the economic appraisal.