Introduction to transport modelling

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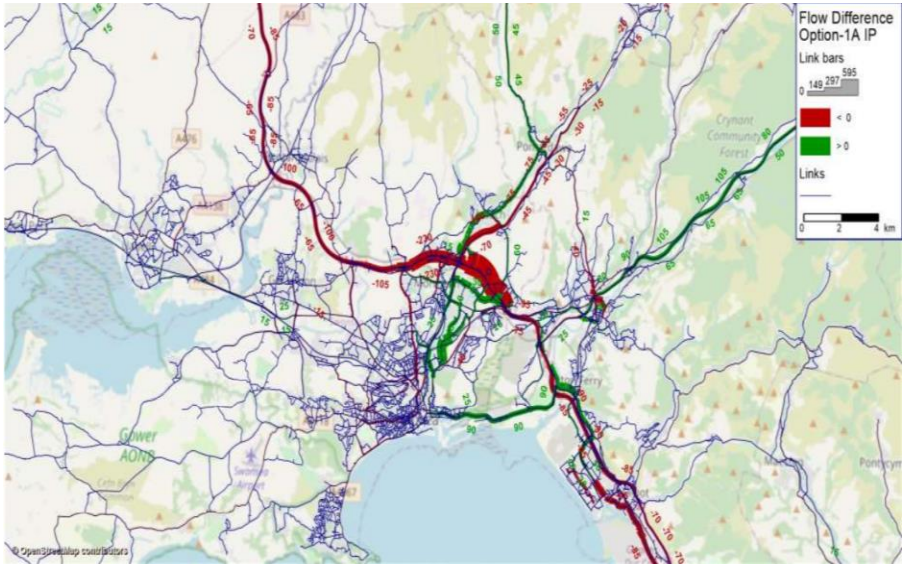
TRANSPORT FOR WALES

Contents

Definitions for words shown in bold can be found in the glossary

What are transport models?

Transport models are digitised, mathematical representations of all or part of a **transport system** and the movements made by people on that system. Transport models are used to evaluate existing conditions and to project future effects and needs. They can represent different **modes of transport** and show the user the conditions for a defined **base year** or for forecast conditions in future years and at different time periods, such as **peak periods.**



Benefits

- Demonstrating how the **transport system** is used.
- Helping to forecast the consequences of different transport and land use policies.
- Supporting transport investment decision-making.

Transport for Wales (TfW), working with the Welsh Government, has developed three separate **strategic transport models** covering all of Wales. Together these are known as the Wales Regional Transport Models.

The models have been developed in line with UK transport analysis guidance.

Figure – example of traffic flow output from the South West and Mid Wales Transport Model

Types of transport models

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Types of transport models

Strategic transport models

- Cover large areas such as regions, local authorities, cities and towns.
- Include all the main transport routes such as motorways, main roads, bus and rail routes.
- Generally used to test large transport schemes or area-wide policies.
- The Wales Regional Transport Models are examples of strategic transport models.
- Strategic transport models are used by the Welsh Government and TfW to test options for the Wales Metro schemes at a regional level.

Local transport models

- Cover specific areas, usually including detailed road junction layouts.
- Local models are typically used for operational assessments such as testing new junction layouts, or new traffic signals and timings.
- Local models are used by the Welsh Government and local authorities to test different ways of allocating road space and to test options for reducing delays at junctions.

Types of transport models

Highway model

- Represent journeys that use the highway (road) network within a particular area.
- May include strategic routes (motorways and A-roads) and other roads (B-roads and local roads).
- These models include car, light goods vehicle (LGV) and heavy goods vehicle (HGV) movements.
- Car journeys may be categorised by journey purpose such as commuting, business, education, leisure.

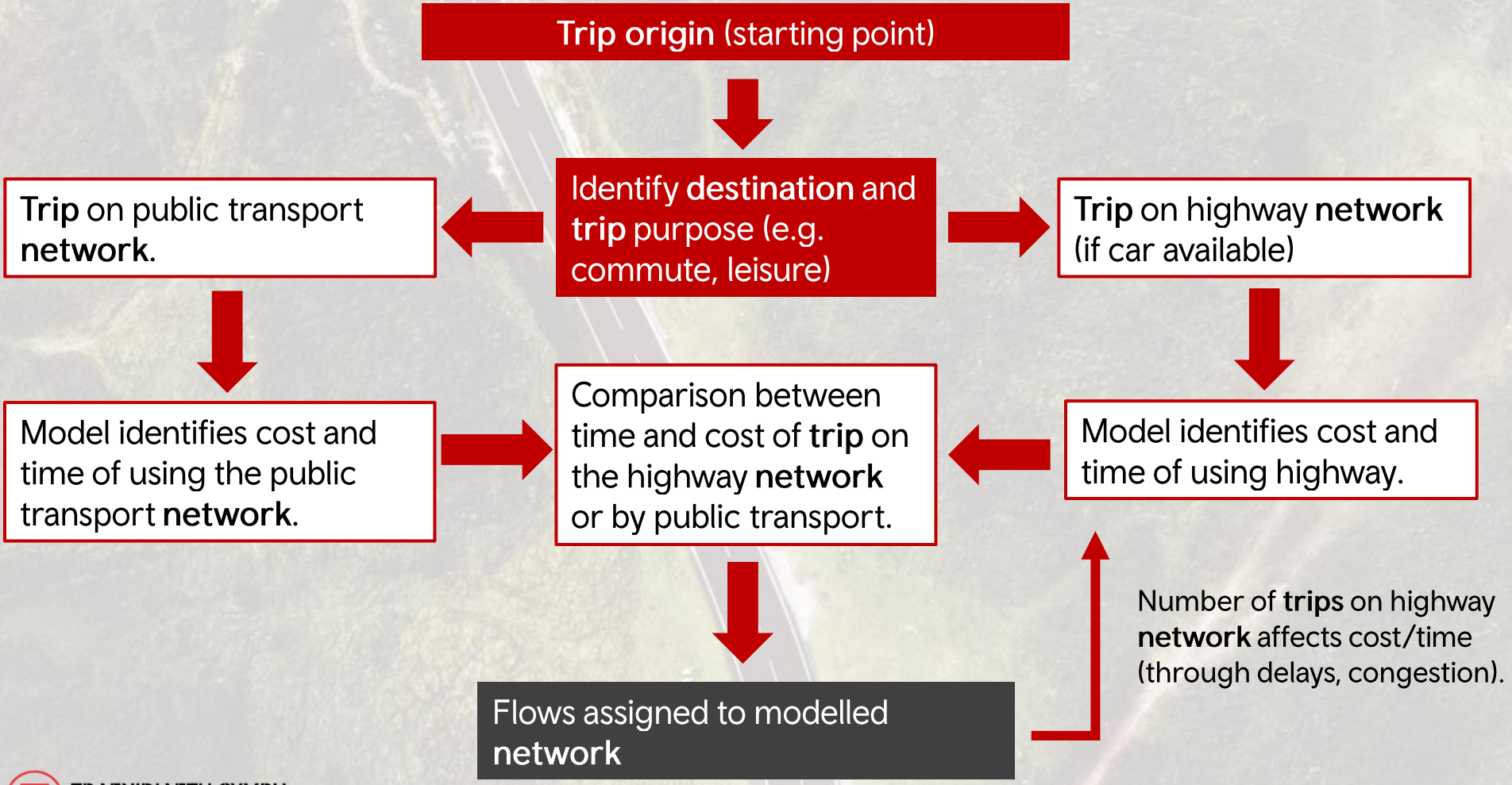
Public transport model

- Represent journeys that use the rail and bus networks, often down to the level of individual bus journeys and rail services.
- Walking and cycling are often also included as ways of accessing the public transport network.

Demand model

- Represent the trips that take place across all modes of transport.
- A demand model will assign a trip based on cost/time analysis to a particular mode of transport between the start and end of that trip.
- It allows the transport model user to test options that affect both the public transport and highway networks.
- For example, a new rail station will increase demand for rail while at the same time reducing demand on the highway network.

How do transport models work?



Primary baseline data

Transport models are developed using a significant amount of data.
Primary data has been collected by TfW and the Welsh Government for the Wales Regional Transport Models.

Link counts – data collected on roads and on rail and bus routes, to identify the number of vehicles or passengers using each section of the transport system. Two specific link count methods on roads are:

- **Automatic Traffic Count (ATC)** – undertaken using rubber tubes across the road that count the number of vehicles (and vehicle axles) that pass over them. These are normally for 24 hours a day over a two-week period.

- **MCC Manual Classified Count (MCC)** – typically collected from camera footage, recording the vehicles passing and later counted by a person or specialist software. This data is often collected for a 12- hour period and provides a detailed breakdown of the number of each vehicle type such as car, bus, heavy goods vehicle (HGV) etc.

Face-to-face interviews – used to obtain a sample of individual journey information, detailing start and end locations, purpose of the journey, how the journey is made, ticket types used and frequency of journey.

Boarding and alighting counts – counts of the number of people using public transport such as rail or bus. They are collected at stations or bus stops and represent the number of people using the services.

Secondary baseline data

Secondary baseline data is available from external sources that have been used for model development.

Mobile phone data (MPOD) – anonymised information on the start and end points of journeys made, collated by mobile phone network operators based on communications between individual phones and cell towers.

In-vehicle journey time data – this is generally gathered from on-board GPS devices and is used to determine the average speeds of vehicles at different times of day on each road within the modelled region.

MOIRA data – rail station and route usage statistics based on ticket sales.

Traffic Wales data – traffic flow data covering the main routes at all times of day.

Local authority data – Includes traffic counts, traffic signal timings, car park occupancy counts.

Go Safe Data/locally sourced traffic and public transport data – speed and count data provided for a variety of routes.

Census – provides supplementary information for the whole of Wales, including the mode of transport used for journeys to work.

Building a transport model

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Base year

Collect baseline data – traffic and/or public transport

→

Identify suitable model time periods from data (AM peak, inter-peak, PM peak and 24 hour)

→

Build network that represents existing conditions

↓

Assign the baseline demand data onto the transport network

→

Validate the model against collected traffic data using industry standards and guidelines

→

Base model completed: Undertake assessment and analysis

Future years

Base year model – validated and calibrated model that represents the existing conditions.

Develop an '**uncertainty log**' which identifies all possible developments and transport schemes within the modelled area and the likelihood of the scheme or development being completed.

Based on the level of development, and any key schemes proposed along the **network**, identify forecast years – this is done in consultation with key stakeholders including the Welsh Government and local authorities.

Using the '**uncertainty log**' identify the locations and size of all likely developments within the model for each forecast year– stakeholders are part of this identification process.

Apply increase in **demand** based on type of development at key locations and apply general growth based on the National Trip End Model (UK Government guidance).

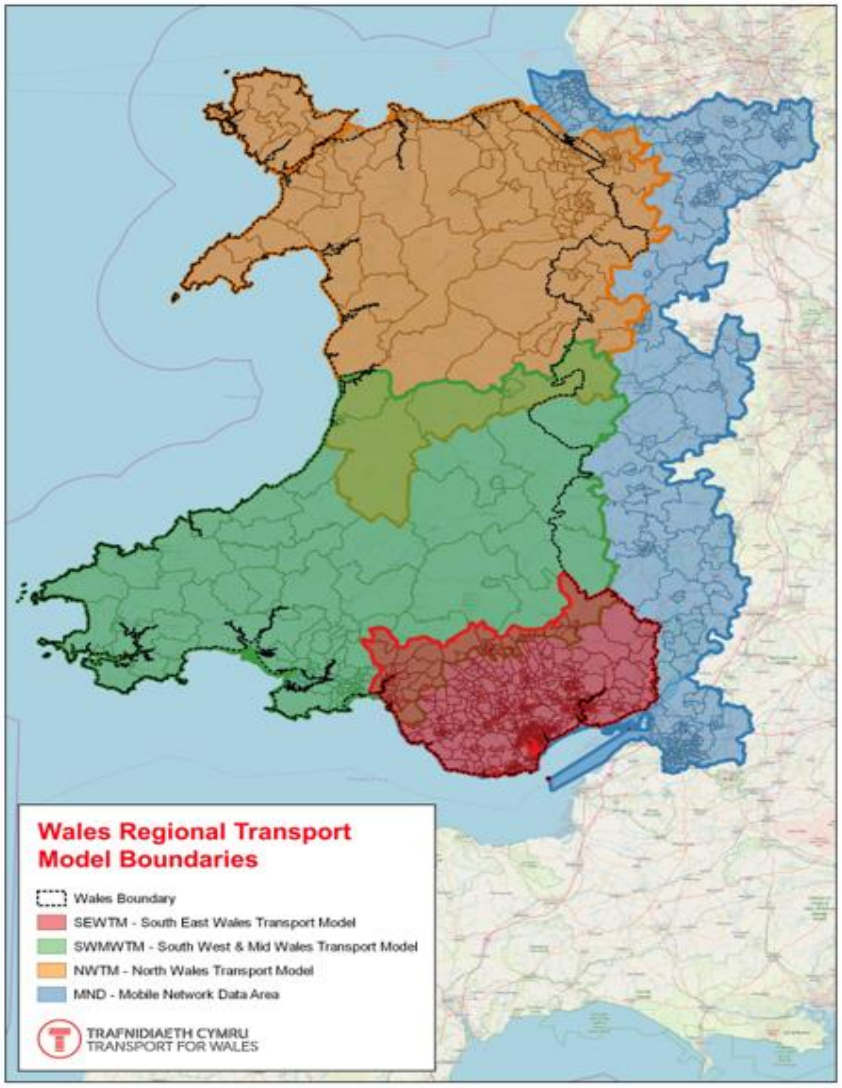
Wales Regional Transport Models

Three **strategic transport models** have been developed covering all of Wales:

- **NWTM** – North Wales Transport Model
- **SWMWTM** - South West and Mid Wales Transport Model
- **SEWTM** – South East Wales Transport Model

These are owned by the Welsh Government and managed, maintained and updated by Transport for Wales.

Strategic **Multi-Modal** Transport Models represent both highway and public transport across Wales



Purpose of Wales Regional Transport Models

Improve consistency and quality of the evidence base for transport decision-making throughout Wales.

Provide the highest standard of tools available to assess current and future transport policies and projects.

Reduce the need to commission ad-hoc or scheme-specific strategic models and provide a robust and consistent set of models for all of Wales.

Uses by Welsh Government, TfW and local authorities

- Testing scenarios for potential future behaviour changes on transport (such as increased working from home or reductions in the number of business trips in a post Covid-19 world)

- Assessing development cumulative impact and supporting plan-making such as the development of Local Development Plans
- Quantified evidence for WelTAG Stages 1-3
- Database of detailed trip-making information
- Supporting scheme specific appraisals such as economic appraisals

- Supporting scheme development and statutory processes
- Supporting decision-making and major policy interventions

Our transport models

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North Wales Transport Model (NWTM)

The North Wales Transport Model covers the area highlighted in blue (fully modelled area).

There are five areas of detailed modelling highlighted in red:

- Wrexham – Deeside
- Rhyl – Llandudno
- Bangor – Caernarfon
- Welshpool
- Aberystwyth

Multi-modal (car, bus, rail) and some walking and cycling is included in this model.

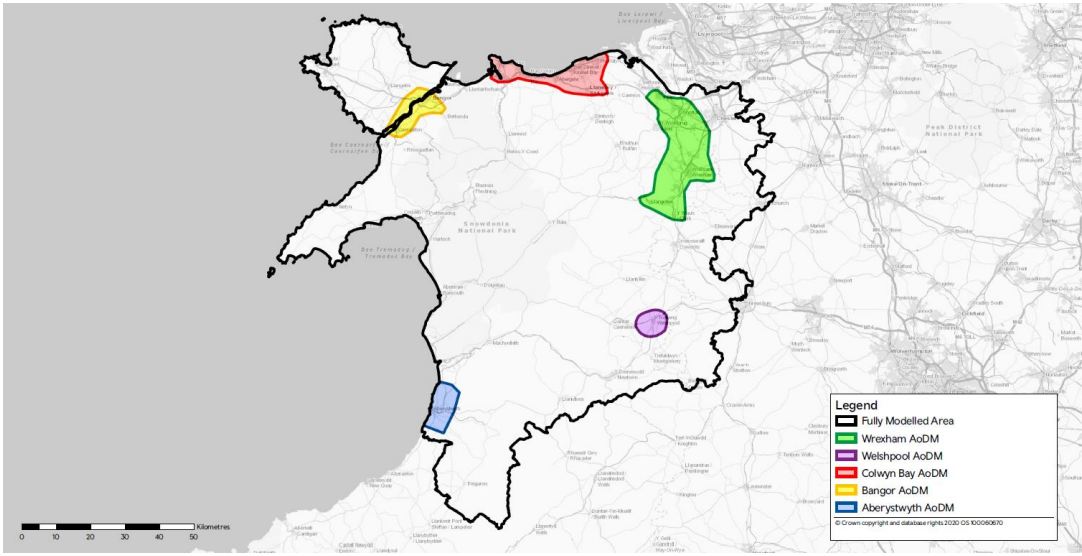
The model replicates a 2019 base year and forecasting to 2027 and 2042.

Key time periods

AM 8am-9am (peak hour)

Inter-Peak 10am-3pm (averaged)

PM 5pm-6pm (peak hour)



South West and Mid Wales Transport Model (SWMWTM)

The South West and Mid Wales Transport Model includes four areas of detailed modelling:

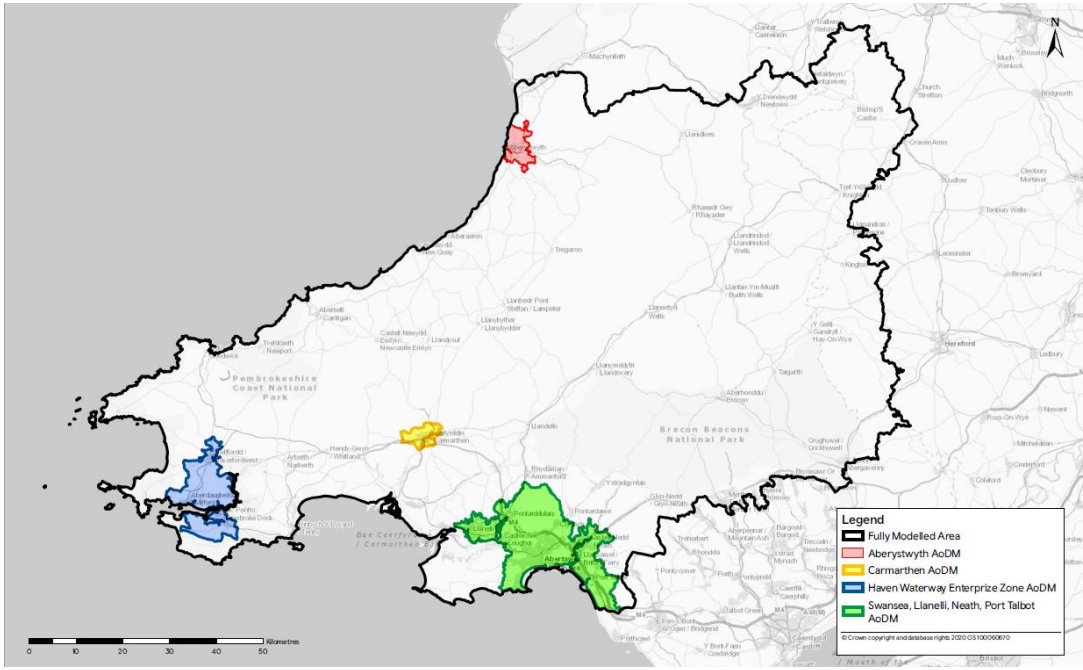
- Swansea, Llanelli, Neath, Port Talbot
- Carmarthen
- Aberystwyth
- Haven Waterways Enterprise Zone (Haverfordwest, Pembroke, Pembroke Dock and Milford Haven)

Multi-modal (car, bus, rail) and some walking and cycling is included in this model.

The model replicates a 2019 base year and forecasting to 2027 and 2042.

Key time periods

- AM 8am-9am (peak hour)
- Inter-Peak 10am-3pm (averaged)
- PM 5pm-6pm (peak hour)



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South East Wales Transport Model (SEWTM)

SEWTM has a fully modelled area that covers all of South East Wales and Neath Port Talbot.

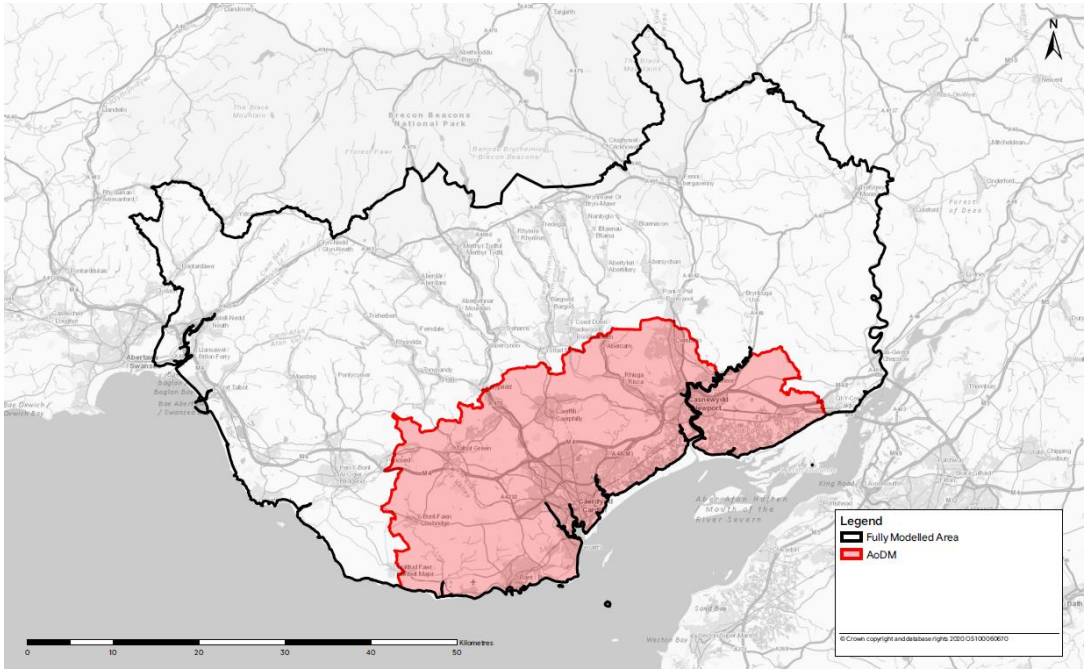
Area of detailed modelling covers Cardiff, Newport, most of the Vale of Glamorgan and the southern parts of the valleys. Towns covered by the area of detailed modelling include Barry, Caerphilly, Cwmbran and Penarth.

Multi-modal (car, bus, rail) and some walking and cycling is included in this model.

The model replicates a 2015 base year and forecasting to 2026, 2031 and 2036.

Key time periods

- AM (07:00-09:30, with 07:45-08:45 peak)
- Inter-Peak (09:30-15:30 average)
- PM (15:30-18:00, with 16:30-17:30 peak)



Model outputs

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Model outputs

- Traffic flows
- Traffic speeds
- Highway delays
- Bus and rail passenger numbers
- Mode to/from rail station or bus stop (e.g. walk, cycle, car)
- Mode shares
- Trip lengths
- Traffic & passenger flow comparisons (between scenarios)
- Speed and delay comparisons
- Network pinch point identification
- Journey time analyses

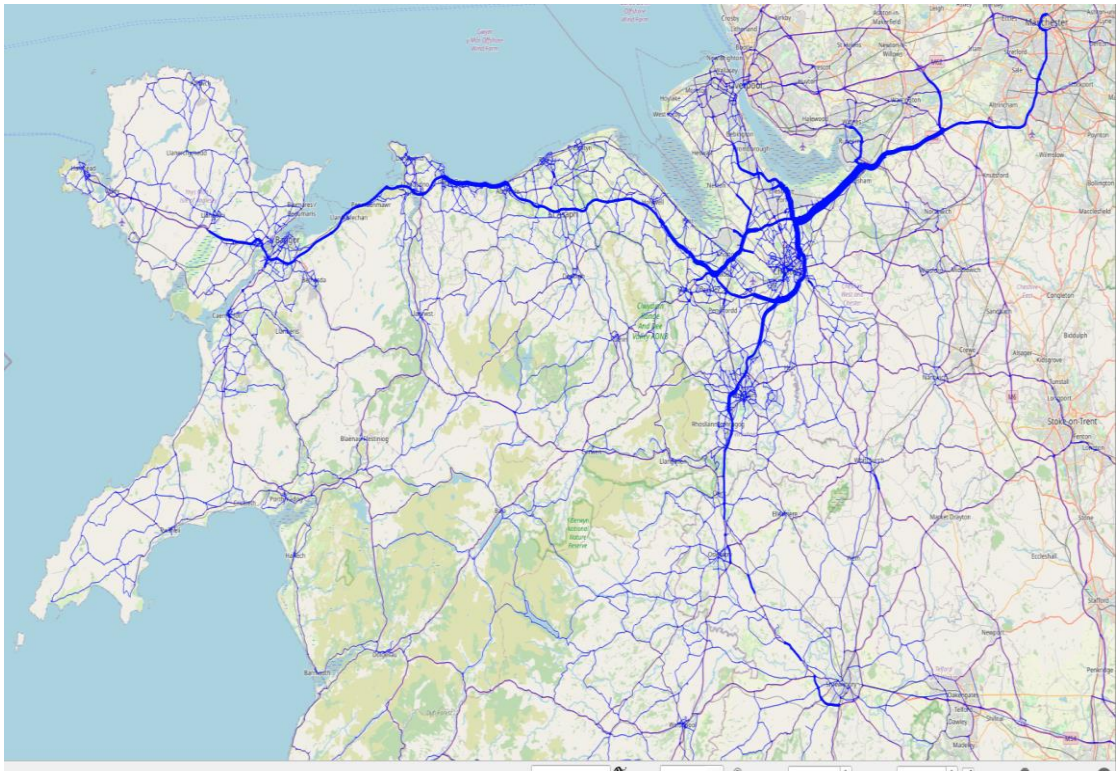

Figure - example of traffic flow comparison output from the North Wales Transport Model

Glossary

Transport system: Any form of transport (rail, car, bus etc) that allows people to move between different locations.

Modes of transport: Form of transport used such as rail, bus, car etc.

Base year: The year during which all baseline data was collected and the year to which the model is validated.

Peak periods: The busiest times on the transport system such as morning (AM) or afternoon (PM) peaks.

Strategic transport models: Transport models that represent larger areas, such as entire regions or cities, including the main road and public transport networks.

Network: The representation of the highway or public transport network that is used in the model, also known as the transport 'supply'.

Demand: Journeys/trips that people want to make on the transport network.

Uncertainty Log: A log of future developments within a study area including residential, employment, highway and public transport.

Origin: Starting location of a journey/trip.

Destination: End location of a journey/trip.

Trip(s): Describes the journeys made between two locations.

Baseline data: Any data which has been collected to help develop the model base year

Multi-modal: Representing different modes of transport, rail, bus, car etc.

Evidence base: The essential data and information needed to justify a decision on a current or future transport project.

WelTAG: The Welsh Governments appraisal process for assessing transport projects within Wales. There are five stages taking the project from an initial idea to being built and evaluated.