

# How to Scope and Tender a Transport Modelling Project

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# Disclaimer

The views and opinions expressed in this paper are those of the author alone and do not necessarily reflect the views, opinions and policies of the Department of Planning, Transport and Infrastructure or the South Australian Government

# Why carry out Transport Modelling at all?

There are three principle ways to forecast transport impacts of land uses:

- Ask people ( ‘stated preference’ )
- Observe people ( ‘revealed preference’ )
- Mathematical models

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Michael Wegener, Professor of Urban and Transport Planning, University of Dortmund



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Mathematical models are the only method by which the effects of individual policies can be analysed keeping all other factors fixed.

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# What is a Transport Model?

- A **system** that attempts to predict human behaviour based on the information revealed by a set of observed data
- A **process** that receives a set of assumptions and input data and processes this to create a set of results that can be analysed
- **Allows complex systems to be understood** and their behaviour predicted within the scope of the model

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James Parrott, Voyager/MASTEM Introductory Training Course



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# What is a Transport Model?

- A **tool** that converts readily available forecasting assumptions into forecasts of demand (number of trips) and supply (level of service/ cost of travel) on the transport network
  - Constrained by the availability of forecasting data, technical expertise and resources on one side and the appraisal outputs required on the other.
- A **tool** that provides the evidence base for the appraisal of transport interventions and investments

# Key questions: Is modelling necessary for the project?

- What are the project objectives?
- Why is the analysis required?
- What are the characteristics of the project being analysed?
- What questions should the analysis answer?

- Are the transport problems identified?
- What are the scenarios to be studied/ tested?
- What are the design years?
- Who are the recipients of the results/ who will approve the model?

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Transport Modelling Guidelines, NSW Transport, Roads and Maritime Services



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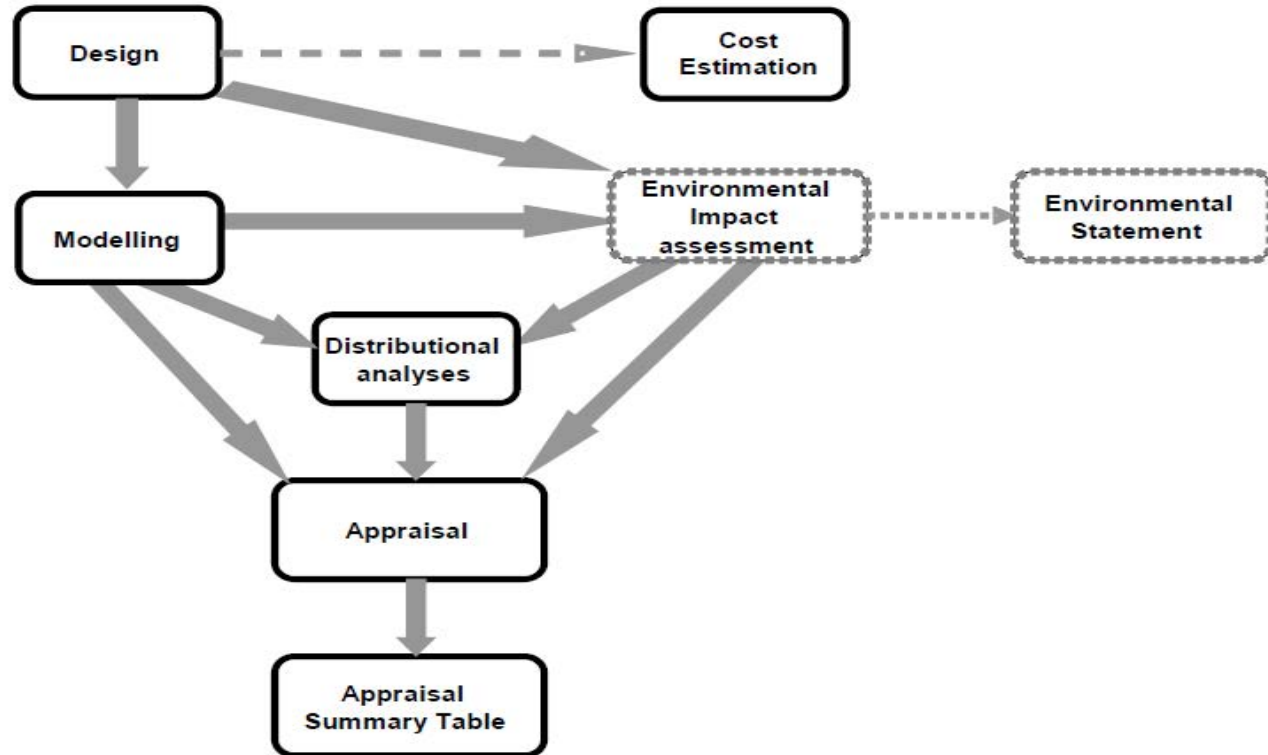
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- What data and information are required for the model and are these data available, affordable and practical?
- What modelling outputs are required?
- What is the peak period (or representative time period that covers project criteria) to be modelled?
- What are the potential benefits/ uses of the model beyond the project?

- What previous relevant modelling work has been undertaken in the vicinity and is it appropriate to reuse it?
- What are the risks and implications of likely errors in the modelling results?
- Who is accountable for the integrity of the modelling results?

# Where modelling fits into the appraisal process



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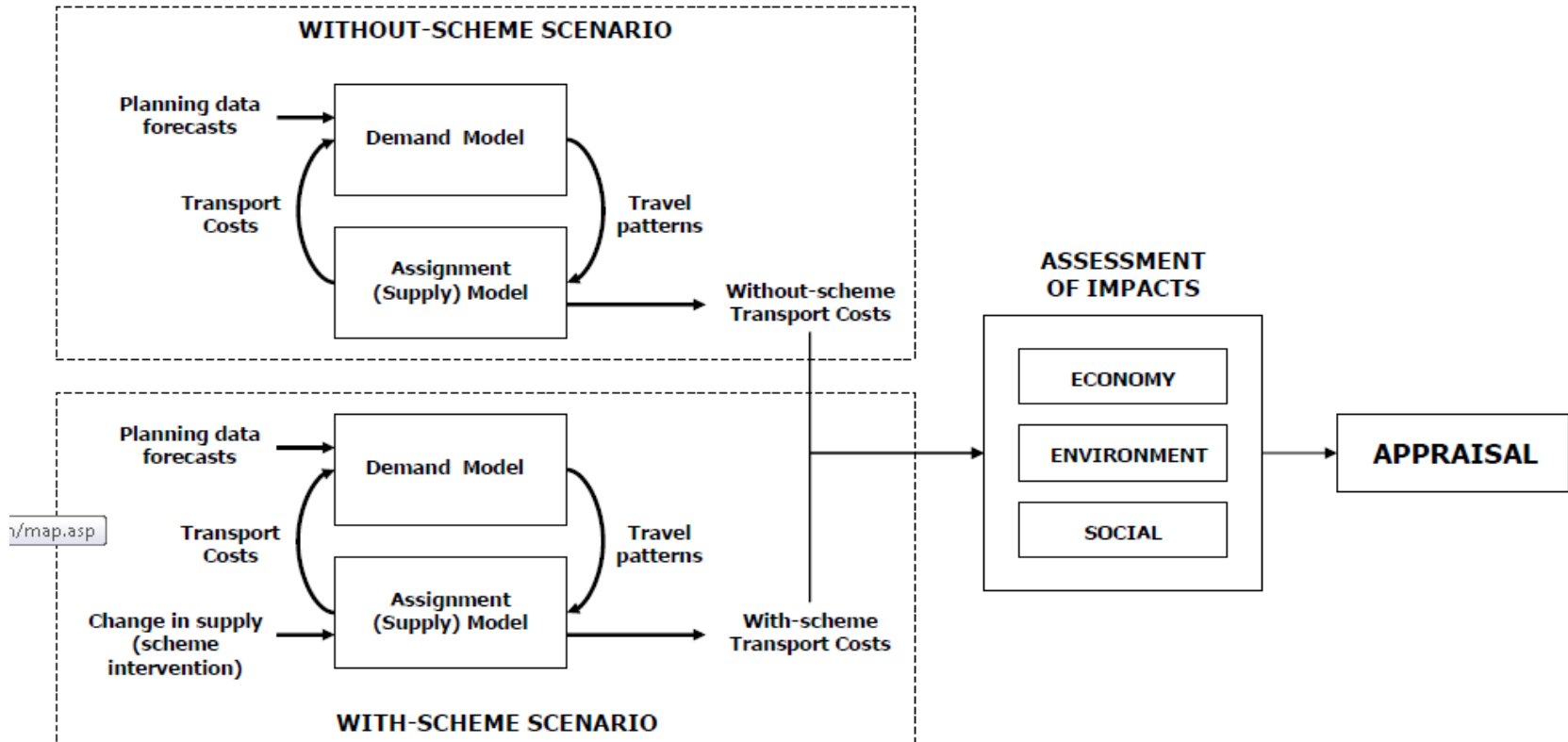
Transport Analysis Guidance, WebTAG, UK



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# Mechanisms of a Transport Model



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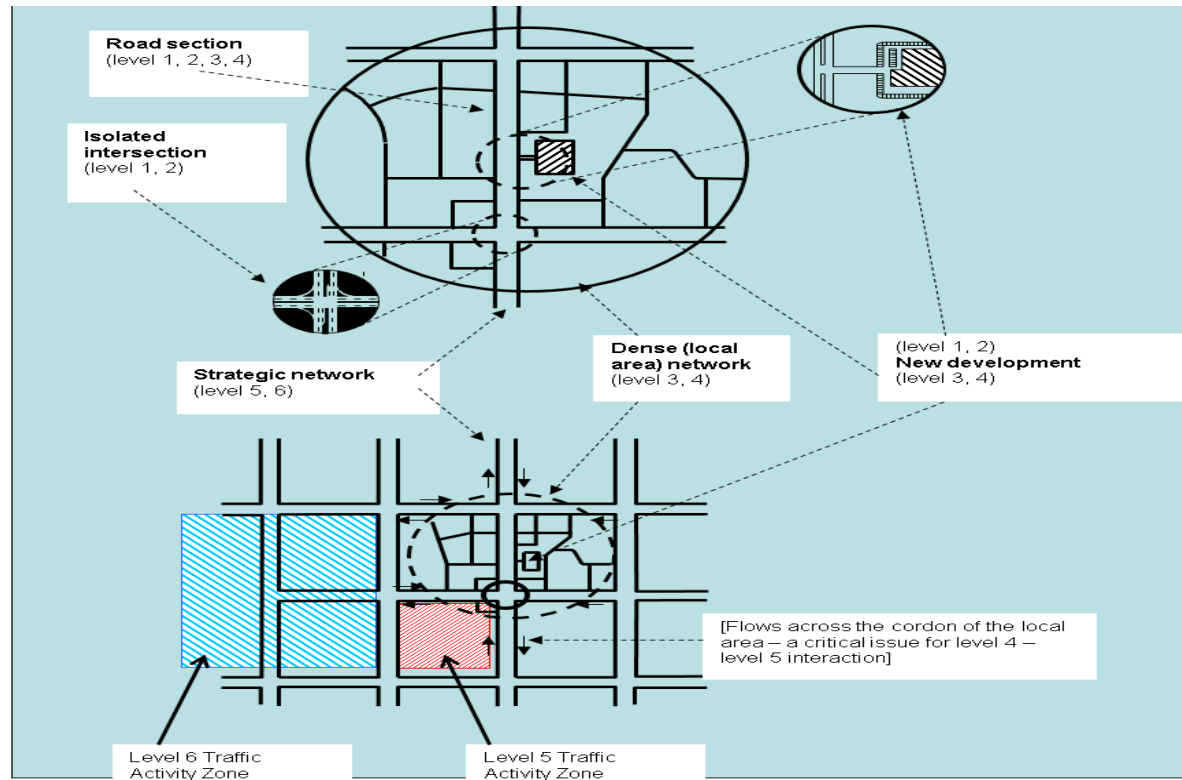


# The Transport Modelling Project Brief should:

- Provide the **background** to the Project outlining the nature of identified problems and their likely solutions
- Clearly outline the **objectives/ outcomes** that the models must meet.
- Clearly outline the **definition and geographic size** of the study area

- Define **alternative scenarios** using different assumptions to the core scenario given the complexity of interactions between demand and supply in transport systems
- Describe the **availability of data** and existing models and the need to update and (re)calibrate and validate models
- Outline the need to **conduct new surveys**
- Specify the **timescale for model development and application**
- Clearly outline the proposed **model structures** (macro, meso, micro) and the mechanisms to ensure consistent information flows between them

# The Hierarchy of Transport Models



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Professor MAP Taylor, An Introduction to Travel Demand Modelling



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**Road section**  
(level 1, 2, 3, 4)

**Isolated intersection**  
(level 1, 2)

**Strategic network**  
(level 5, 6)

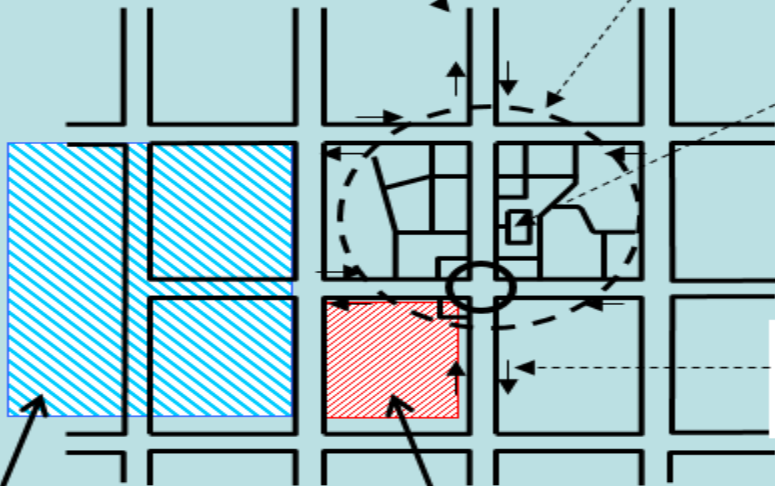
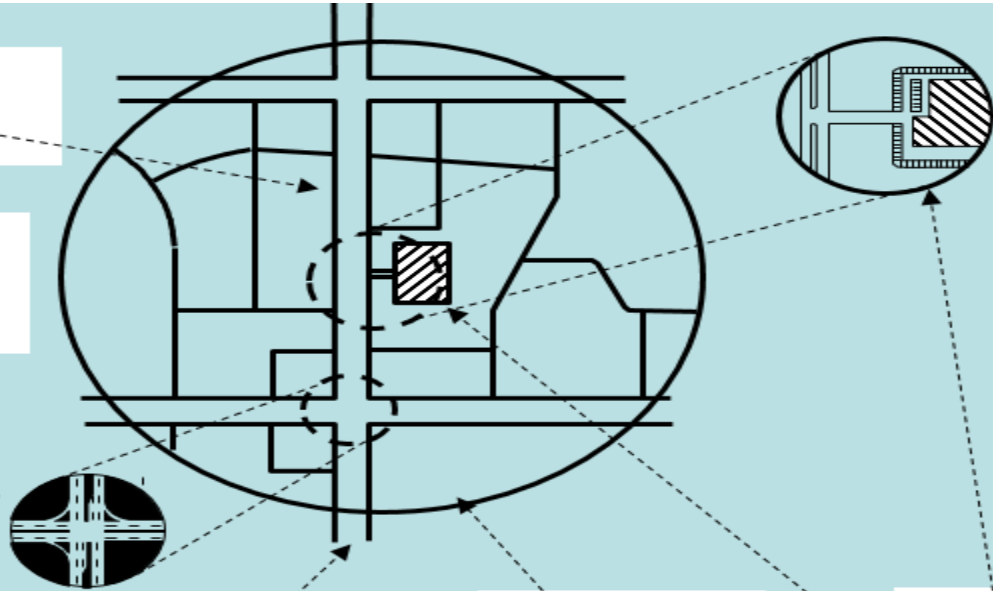
**Dense (local area) network**  
(level 3, 4)

(level 1, 2)  
**New development**  
(level 3, 4)

Level 6 Traffic Activity Zone

Level 5 Traffic Activity Zone

[Flows across the cordon of the local area – a critical issue for level 4 – level 5 interaction]



# Alternative Model Structures

- **Macro, Meso and Micro** simulation models
- **Land Use and Transport Interaction (LUTI)** models that account for the impact of transport on land use patterns (e.g. location of housing or employment, WEBS)
- **Activity-based models** that estimate the activity patterns of transport users over given time periods by location and travel mode
- **Dynamic assignment models** differ from static assignment models by allowing varying rates of demand on each link in the network at different times during the assignment period

The Transport Modelling Project Brief should clearly define the scope of modelling required in terms of:

- **Geographic extent** – must be wide enough to address all potential issues .
- **Time periods** – am and pm peaks and inter-peaks as a minimum to suit all project phases from concept assessment to design

- **Data collection** – data from client sources, public realm, surveys, previous studies or related documentation
- **Calibration and validation** requirements (a Base Model Calibration and Validation Report) and the requirements for realism and sensitivity testing
- **Future network development** – specifying the “business as usual” and future scenario networks to be analysed

- Option and **scenario testing** – description of the options or scenarios to be tested (including the development of options)
- Details of **required modelling outputs** e.g. network operational statistics, intersection operation, travel times queues, congestion measures, traffic flows, crash analysis, economic analysis, wider economic benefits, emissions, etc.
- The required **accuracy and robustness of results/** recommendations

# The Transport Modelling Project Brief should :

- Specify the **timeframe for the work** and the key decision points in the project timeline
- Specify **Milestones** for the project and hold points for model review
- Specify the **Deliverables** required – model documentation (Base Model Calibration and Validation Report and Options Assessment Report) and the model(s) themselves

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- Provide details of the **Tender submission requirements** and the evaluation criteria and ratings to be used by the client
- Provide details of the **contractual arrangements** for the delivery of the model (s) and the roles and responsibilities of each party and sanctions for breaches.

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# Traps and Pitfalls – How to avoid being sued later on

- Guard against **Strategic Misrepresentation** caused by the use of inconsistent underpinning travel demand, mode choice and destination choice input assumptions at each level of modelling
- Guard against **Optimism Bias** caused by the use of historical trends modified by aspiration to develop assumptions about future levels of traffic demand at each level of modelling
- Mandate independent **Peer Reviews** of transport modelling:
  - To ensure correctness and completeness
  - To substantiate the quality of technical analysis
  - To uphold best-practice standards

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Modelling Best Practice, Rob Bain



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- Obtain evidence that the modeller acted in accordance with competent professional practice
- Verify that the modeller had reasonable grounds for their forecasts at the time (irrespective of whether they turn out to be right or hopelessly wrong)
- Make sure all of the forecasting assumptions are transparent along with the forecasting methodology that underpins them
- Resist adjusting forecasting inputs or assumptions based on client direction

# Traps and Pitfalls – How to avoid being sued later on by mitigating the risk:

- Of **errors in model inputs** by ensuring that they are transparent and straightforward to audit
- Of **not using models in accordance with their design** and underlying theory and purpose – any model is a simplification of reality
- Of not achieving an **appropriate representation of human behaviour** by carrying out:
  - **Validation** tests (comparing model outputs with observed data)
  - **Realism** tests (rerunning the model with some standard changes to inputs to check if model responses are realistic)
  - **Sensitivity** tests (rerunning the model with changes to model parameters to check that the model results are robust to changes in the parameters)

- **Bias** – systemic over-forecasting or under-forecasting of travel demand or costs that biases transport appraisal results
- **Uncertainty** – forecasts by their very nature are uncertain which creates risks that:
  - The benefits of a transport scheme are not as high as the forecasts suggests
  - The benefits of a transport scheme are higher than the forecast suggests leading to failure to intervene where necessary
  - The problems created by the transport scheme will be greater than the forecasts suggests
  - A cheaper investment than the one actually delivered would have been sufficient

# Most common basis of claim for lawsuits

- **Forecasts in the PDS were defective, misleading and made without reasonable grounds**
- **Forecasts that amounted to false, misleading and deceptive conduct**
- **Company engaged in fraudulent scheme to manipulate forecasts supporting a bond offering on a portfolio of toll roads**

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Ethics and advocacy in forecasting revisited – consultants in the dock, Rob Bain



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# Thank You

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# Discussion

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achieve outstanding client success



## CRITICAL REVIEW OF TRANSPORT MODELLING TOOLS

National Transport Modelling Working Group

March 2009



Transport  
Roads & Maritime  
Services

# Traffic Modelling Guidelines

