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Guidelines

Auditing Process for Operational Modelling

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Disclaimer

This document is specific to Western Australia. It is intended to be a guide for traffic modelling practitioners and managers undertaking traffic modelling work seeking approvals from Network Operations Directorate, Main Roads.

The process provided in this document is accurate and relevant at the time of production.

This document only outlines the process for traffic model submission and approval. Receiving approval for traffic modelling does not constitute approval for the project as a whole. The application of the process outlined in this document does not guarantee that the traffic modelling developed will be fit for purpose or be automatically approved or supported by Main Roads.

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1 INTRODUCTION

The Auditing Process for Operational Modelling has been developed by Main Roads' Network Operations (NOD) directorate, to outline the traffic modelling audit process for projects requiring approvals for regulatory devices.

This process describes the audit process that applies to traffic models being submitted for Main Roads' Traffic Signal Approval Policy (TSAP).

The process can be used for other projects to ensure quality models are developed. This can be discussed with the Operational Modelling and Visualisation Team at the scope meeting.

This document should be read in conjunction with Main Roads' Operational Modelling Guidelines, which details modelling best practice, to ensure consistency in the quality of all models received and assessed by Main Roads.

1.1 Document Structure

This document is designed to give a common structure for modelling submissions using Main Roads' supported traffic model software. The structure of this document is detailed below:

- Section 1: Background and Purpose
- Section 2: Process Overview
- Section 3: Steps
- Section 4: Online Forms and Templates.

It is intended that this document will be reviewed and updated as required to ensure its currency, usefulness and relevance for practitioners, and to incorporate innovative thinking and advancements in traffic and transport modelling.

1.2 Modelling Requirements

The requirement for traffic modelling is outlined by The Western Australian Planning Commission's Transport Impact Assessment Guidelines (August 2016) and in the Transport Modelling Guidelines for Development in Activity Centres produced by Department of Transport's (DoT).

A number of Main Roads' policies and guidelines detail the need for traffic modelling assessment or define traffic modelling requirements, such as Vehicular Signals Policy and Traffic Signals Approval Policy (please refer to Main Roads website for copies of these policies).

The purpose of the *Operational Modelling Guidelines* is to ensure consistency in traffic modelling practice and to promote the production of accurate modelling outputs that will result in high-quality project design and assessment that easily transitions into operations.

The *Transport Modelling Code of Conduct*, developed by the Australian Institute of Traffic Planning and Management (AITPM), aims to promote consistency in transport modelling practices in the transport planning industry and encourage ethical behaviour. The code is intended for modelling practitioners and the consumers of their services.

Any parties undertaking traffic modelling for Main Roads' approval must do so in accordance with industry standards as set out in Main Roads' Operational Modelling Guidelines and AITPM's Transport Modelling Code of Conduct.

1.3 Purpose

The purpose of this document is to detail the auditing process for operational modelling. This includes the various steps of model development and when and how Main Roads will carry out model audits. This provides transparency for all parties as it explains their roles and responsibilities in the model audit steps.

This process may also be used for projects other than operational modelling and is decided by the Project Manager. If the traffic model ultimately requires regulatory approval this process is recommended to reduce the risk of doing significant updates to the traffic model at a later date.

2 AUDITING PROCESS OVERVIEW

This section provides an overview of the Main Roads' auditing process for operational modelling and the roles involved in the process.

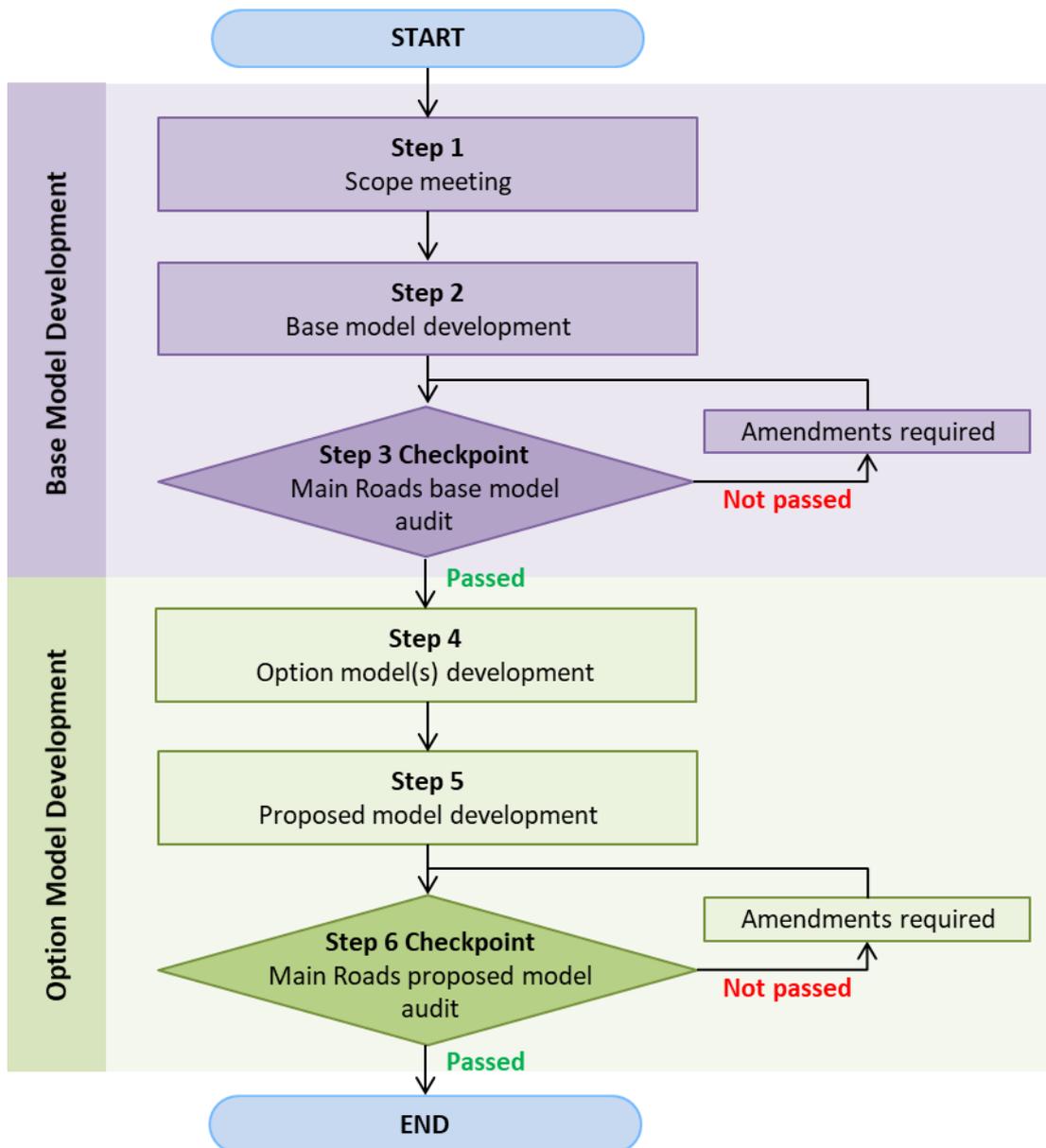
The auditing process includes six steps:

- **Step 1** – scope meeting
- **Step 2** – base model development
- **Step 3** – Main Roads' base model audit (checkpoint)
- **Step 4** – option model(s) development
- **Step 5** – proposed model development, and
- **Step 6** – Main Roads' proposed model audit (checkpoint).

For any project that could have an impact on traffic, early engagement with Main Roads is essential in order to ensure that modelling activities are supported. This will also reduce the potential for delays during the model audit steps.

Figure 2-1 details the steps of the auditing process for operational modelling.

Figure 2-1: Model Auditing Process



As detailed in the flow chart, there are two audits carried out by Main Roads:

- Step 3 – The base model audit will confirm whether the model can be used for option models development.
- Step 6 – Proposed model audit will confirm if the model is suitable for submission to Main Roads for project approval.

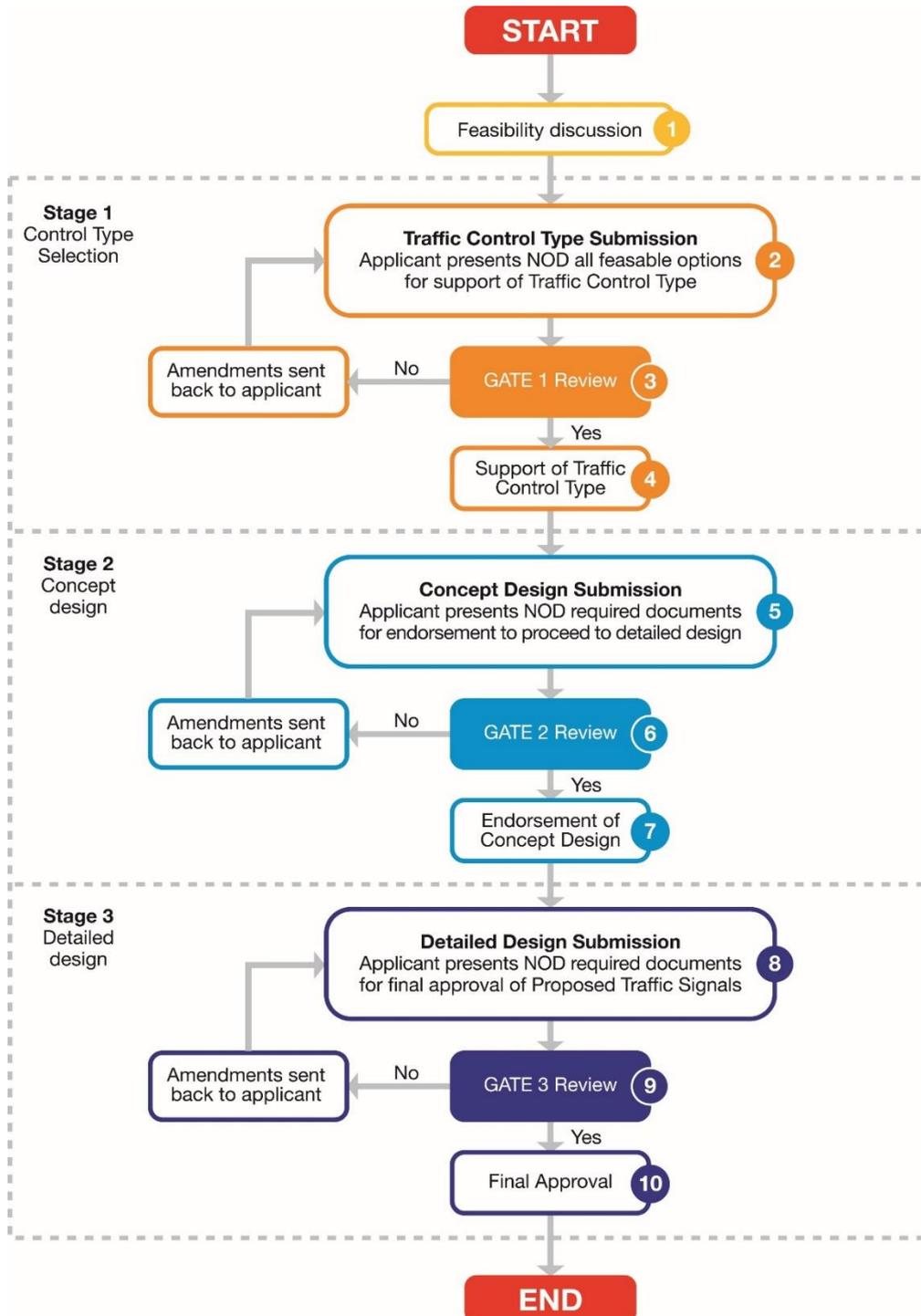
2.1 Traffic Signal Approval Policy

The *Auditing Process for Operational Modelling* was developed to outline the traffic modelling audit process for projects requiring approvals for regulatory devices.

Figure 2-2 summarises the different Stages for *Traffic Signal Approval*. Gate Reviews are observed for each stage and include the submission of traffic models by the Applicant to Main Roads.

The model audit process is undertaken at each *TSAP* Gate Review when modelling work is required.

Figure 2-2: Traffic Signal Approval Process



2.2 Model Audit Roles and Responsibilities

Generally, an interested party, hereby referred to as the ‘Applicant’ (normally the Project Manager of the proposed scheme), engages a modeller to develop traffic modelling to either confirm the viability of a proposal, or to test a range of options.

As there are numerous roles involved in the model auditing process, it is important to identify who is assigned to each role and to understand their responsibilities throughout the process.

Table 2-1 identifies the roles involved in the model audit and provides a description of each role and the responsible party. Model audit roles must be discussed at the scope meeting.

Table 2-1: Model audit roles and responsibilities

Role	Responsible party
Applicant	Applicant (A) <ul style="list-style-type: none"> Developer / Department of Transport / Local Government Agency / Main Roads / Public Transport Authority / Project Manager
	Modeller (M) <ul style="list-style-type: none"> As assigned by Applicant
Main Roads	Auditing Process Coordinator (APC) <ul style="list-style-type: none"> Traffic Management Services branch for local roads in metropolitan area Area Performance team for state roads in metropolitan area Regional branches for roads in regional areas
	Model Auditor (MA) <ul style="list-style-type: none"> Traffic Management Services branch for local roads in metropolitan and regional areas Area Performance team or Operational Modelling and Visualisation team for state roads
	Future Traffic Flow Reviewer (FTR) <p>Responsible Area within Planning and Technical Services (PTS) Directorate:</p> <ul style="list-style-type: none"> Development applications and small projects: Statutory Road Planning Large Projects / Structure plans and Major Projects (Transport Portfolio): Network Planning and Development <p>Responsible Area within Network Operations Directorate (NOD) i.e. direct submission from council for Traffic Signal Approval:</p> <ul style="list-style-type: none"> Local road intersections: Traffic Management Services* State Road intersections or likely affecting state roads: Area Performance team* Regional Areas: Regional branches* <p><i>*initial check is carried out by the responsible area in NOD but further information / clarification from PTS may be requested</i></p>

It is the responsibility of the Applicant to liaise with all roles to ensure there is project context (detailed background of issues) during the lifecycle of the project.

3 MODEL AUDIT STEPS

This section provides details on the six steps of the Main Roads' auditing process for operational modelling.

3.1 Step 1 – Scope Meeting

A meeting¹ is required to define the modelling scope. This will include, but is not limited to the following:

- Purpose of the project.
- Existing problems identified on site.
- Modelling level (for example macroscopic, mesoscopic, microscopic).
- Model software type.
- Extent of the model.
- Roles and responsibilities.
- Model level of detail (for example if Sidra is being used for signal timing inputs for a simulation model, the Sidra may not need to be a fully calibrated and validated model).
- Data inputs and model outputs for calibration and validation of the base model in accordance with Main Roads' *Operational Modelling Guidelines*.
- Availability of existing traffic models.
- Availability of current traffic flow data.
- Methodologies to obtain data for input into the traffic model (for example Saturation Flows / Traffic Data).
- Feasible options to be considered. Please refer to *TSAP*.
- Future traffic estimation methodology.
- Any other factors that may cause an impact on the project.
- Alternative methods / modelling options.
- Agreement of documentation to be followed (*Operational Modelling Guidelines* and *Auditing Process for Operational Modelling*).

The scope meeting provides opportunity for collaboration between parties to discuss innovative solutions before any work is undertaken. Agreed modelling scope should be recorded in the Modelling Instruction Form (refer to Section 4.1).

3.1.1 Step 1 Roles and Responsibilities

Step 1 includes the following actions:

1. **A** provides project information and a draft *Modelling Instruction Form* to **APC**.
2. **A** and **APC** arrange a scope meeting to define modelling requirements. **A**, **M**, **APC**, **MA** and **FTR** attend.
3. **A** and **M** finalise the *Modelling Instruction Form* and submit to **APC** and **MA**.
4. **MA** agrees the modelling inputs and desired outputs with **APC**.

¹ "Meeting" in this document refers to any type of meeting such as in person, web conference or email communications.

5. **APC** reviews and signs the *Modelling Instruction Form* for endorsement of the modelling requirements.
6. **A** signs *Modelling Instruction Form* for agreement of the modelling requirements.

3.1.2 Step 1 Outcome(s)

The outcomes of Step 1 are:

- Agreement of modelling scope.
- Endorsed and agreed Modelling Instruction Form.

3.2 Step 2 – Base Model Development

At this step the base model is developed by **M**. It is recommended that **M** refers to Main Roads' *Operational Modelling Guidelines* and *TSAP* prior to developing the base model. **M** must meet the modelling requirements as agreed in the *Modelling Instruction Form* and / or *TSAP* (if for Traffic Signal Approval).

A submission package should be prepared as part of the base model development. It must include:

- An electronic version of the calibrated and validated base model(s).
- Endorsed and agreed *Modelling Instruction Form* (refer to Step 1).
- All raw input data used in the traffic model, for example:
 - traffic survey(s)
 - site observation notes (e.g. observed queue length, measured saturation flows, demand dependent and alternative signal phases and driver behaviour)
 - SCATS History File(s)
 - SCATS traffic flows, and
 - drawings, e.g. LM drawings and SCATS graphics.
- Any calculations, in a spreadsheet format, for example:
 - peak hour estimation
 - PCU calculations
 - saturation flow factor(s), and
 - average signal timings
- Marked up drawings or pictures indicating how the measured parameters were determined, for example, turning radius, lane width and length.
- *Base Model Audit Checklist* (refer to Section 4.2).
- Draft base modelling report to confirm data inputs (including calibration and validation details) and assumptions in the development of the base model (refer to Section 4.3).

The base model must be reviewed by an experienced senior modeller prior to submission to Main Roads.

3.2.1 Step 2 Roles and Responsibilities

Step 2 includes the following actions:

1. **M** develops the base model and populates the Base Model Audit Checklist (refer to Section 4.2).
2. **M** sends the base model submission package to **A**.
3. **A** confirms submission package is complete then forwards the base model submission package to **APC** and **MA**.
4. **APC** or **MA** acknowledge the receipt of the model submission package.

3.2.2 Step 2 Outcome(s)

The outcome of Step 2 is the base model submission package.

3.3 Step 3 – Checkpoint – Main Roads Base Model Audit

Step 3 is the audit of the base model by a *Model Auditor*. This is the first Main Roads checkpoint of the auditing process.

The audit will only commence when all of the required information has been submitted to the *Auditing Process Coordinator* and *Model Auditor*. The Applicant should allow ten business days for a model audit to be undertaken. However, the Applicant will be notified if there is any delay expected due to other commitments.

3.3.1 Step 3 Roles and Responsibilities

Step 3 includes the following actions:

1. **MA** audits the base model (includes internal checks of model by Main Roads' teams with local knowledge of the area). **MA** provides feedback to **A**, **M** and **APC** using the *Base Model Audit Checklist* (refer to Section 4.2)*.
2. **M** amends the base model and provides additional information to **A**, **APC** and **MA** if required*.
3. **M** finalises the base modelling report once all comments from **MA** have been addressed and sends formal base modelling package to **A**, **APC** and **MA**.
4. **MA** audits the base modelling package and advises **APC**. When audit is passed, **MA** prepares *Base Model Audit Memorandum*, lists any special conditions if required, signs the memorandum and submits to **A**, **APC** and **M**.
5. **A** can proceed to Step 4.

*Actions 1 and 2 could be an iterative process between the **MA** and **M** until the model meets model validation requirements. **A** must be aware that the base model may need to be resubmitted to **MA** by **M**; for each submission **MA** has ten business days to respond. The formal modelling package provides a complete set of works that includes the base model and any relevant information pertaining to its model build, calibration, validation and audit.

3.3.2 Step 3 Outcome(s)

The outcomes of Step 3 are:

- Formal base modelling package that has that has passed audit.
- Signed Base Model Audit Memorandum (valid for 12 months from model pass date).

3.4 Step 4 – Option Model(s) Development

Step 4 is the development of option models to identify the preferred option for the project; This step must be followed even if there is only a single option. It also ensures the base model is still valid, that the future traffic estimation is agreed and the design has been commented on prior the submission of the proposed model in Step 5.

When option modelling is ready to proceed, a meeting² is required to confirm the modelling scope. This will include, but is not limited to the following:

- Validity of the base model and if the conditions set out in the base model audit have been addressed.
- Options to be tested and review if the *Modelling Instruction Form* needs to be updated.
- Scenario years to be modelled.
- Future traffic flow estimation methodology (drafted by **M** prior to the meeting).
- Assessment criteria. (Refer to *Traffic Signal Approval Policy*)

It is important to ensure that the Step 3 base model is still valid, that is, the base model audit pass date is less than 12 months old with no significant local network changes, unless agreed otherwise during the scope meeting. The consequences of not updating the base model should be discussed at the meeting to determine if this would significantly influence the outcome of the option model testing.

If the base model is no longer valid, the model must be updated and audited again before option testing can commence.

Following testing of the options, the option model's outputs must be compared to identify the preferred option to progress to detailed design. A meeting must be arranged with Main Roads to discuss the option model outputs and agree on the preferred option, justifying why the option was chosen taking into consideration of aspects such as safety, network performance, cost and experience of all road users.

3.4.1 Step 4 Roles and Responsibilities

Step 4 includes the following actions:

1. When options modelling is ready to proceed, **A** contacts **APC** to arrange a meeting to define modelling requirements and agree option model scenarios. **A**, **M**, **APC**, **MA** and **FTR** attend the meeting.
2. If base modelling update is required, **M** updates the base model package and submits to **MA** to audit. **MA** audits the amended base model, following the process set out in Step 3. **MA** advises **A**, **M** and **APC** when passed.
3. **M** prepares the future traffic estimation methodology and calculations and submits to **APC** and **FTR**.
4. **FTR** audits the future traffic estimation methodology and calculations prior to the option testing.
5. **M** uses the audited base model and audited future traffic estimation to develop the options model(s). **M** submits the option analysis to **A** for review.

² "Meeting" in this document refers to any type of meeting such as in person, web conference or email communications.

6. When **A** is satisfied with the option analysis, **A** provides the analysis to **APC**, **M**, **MA** and **FTR** and arranges a meeting to discuss the analysis.
7. **APC** reviews the modelling outputs and design such as signals and signs/line prior meeting, a minimum of five working days is required.
8. **A**, **M**, **APC**, **MA** and **FTR** attend meeting to agree on which option to progress as the proposed model.

3.4.2 Step 4 Outcome(s)

The outcomes of Step 4 are:

- Agreed future traffic calculations.
- Agreement of preferred option(s) to be modelled.

3.5 Step 5 – Proposed Model Development

Step 5 is the development of the proposed model based on the preferred option identified in Step 4 after the proposed drawings have been finalised. The proposed model requires adjustments to take into account factors including:

- Road geometry modifications.
- Changes to lane use.
- Updated signal timings.
- Proposed changes to signal phasing.

A submission package should be prepared as part of the proposed model development. It must include:

- An electronic version of the audited base model package with the signed *Base Model Audit Memorandum*.
- An electronic version of the proposed model.
- Endorsed and agreed Modelling Instruction Form.
- All input data used in the traffic model, for example:
 - calculation of future traffic flows, and
 - proposed signal timings.
- Proposed design drawings.
- Proposed *Model Audit Checklist* (refer to Section 4.2).
- Draft proposed modelling report to document the development of the proposed traffic model, including input data and modelling assumptions (refer to Section 4.3).

The proposed model should be reviewed by an experienced senior modeller prior to submission to Main Roads.

3.5.1 Step 5 Roles and Responsibilities

Step 5 includes the following actions:

1. **M** develops the proposed model and populates the *Proposed Model Audit Checklist*.
2. **M** sends the proposed model submission package to **A**.
3. **A** confirms submission package is complete then forwards the proposed model submission package to **APC** and **MA**.
4. **APC / MA** acknowledge the receipt of the model submission package.

3.5.2 Step 5 Outcome(s)

The outcome of Step 5 is the proposed model submission package.

3.6 Step 6 – Checkpoint – Main Roads Proposed Model Audit

Step 6 is the audit of the proposed model by Model Auditor. This is the second checkpoint and final step of the auditing process.

The audit will only commence when all of the required information has been submitted to the Auditing Process Coordinator. The Applicant should allow ten business days for a model audit to be undertaken. However, the Applicant will be notified if there is any delay expected due to other commitments.

3.6.1 Step 6 Roles and Responsibilities

1. Step 6 includes the following actions:
2. **MA** audits the proposed model and provides feedback to **A**, **M** and **APC** using the *Proposed Model Audit Checklist**.
3. **M** amends the proposed model and provides additional information to **A**, **APC** and **MA** if required*.
4. **M** to finalise the proposed modelling report and *Model Summary Spreadsheet* once all comments from **MA** have been addressed and sends formal proposed modelling package to **A**, **APC** and **MA**.
5. **MA** audits the proposed modelling package and advises **APC**. If audit is passed **MA** signs *Proposed Model Audit Memorandum* and submits to **APC**.
6. **APC** advises **A** of the final outcome.

*Actions 1 and 2 could be an iterative process between the **MA** and **M** until the model quality meets Main Roads' requirements set out in Main Roads' *Operational Modelling Guidelines*. **A** must be aware that the proposed model may need to be resubmitted to **MA** by **M**; for each submission **MA** has ten business days to respond. The formal modelling package provides a complete set of works that includes the proposed model and any relevant information pertaining to its model build and audit.

3.6.2 Step 6 Outcome(s)

The outcomes of step 6 are:

- Signed Proposed Model Audit Memorandum.
- Formal proposed modelling package that has passed audit.

3.7 Model Audit Steps Matrix

Table 3-1 identifies each of the model audit roles and the responsible parties. This table summarises the required actions for each role and the order. As there are numerous roles involved in the model auditing process it is important to identify who is assigned to each role and to understand their responsibilities at each step of the model audit steps.

4 ONLINE FORMS AND TEMPLATES

This section outlines the various forms and templates associated with traffic model development and the model auditing process.

4.1 Modelling Instruction Form

The *Modelling Instruction Form* details traffic modelling requirements in terms of scenarios, data input and model outputs. It provides transparency for all parties from the start of the process.

The *Modelling Instruction Form* is available for download from the Main Roads' website.

4.2 Model Audit Checklist

The purpose of the *Model Audit Checklist* is to ensure that the modeller has considered all of the key parameters in the development of the traffic model. There is an individual checklist for each of the Main Roads' supported operational modelling software packages including LinSig, SIDRA, Vissim and Aimsun. The checklist provides a record of the auditing process and ensures consistent checks between traffic models.

The *Model Audit Checklist* has been developed to be impartial and objective. Using the checklist in the development of the model assists in the auditing process, as it can identify where there are variations from the parameters recommended in the *Operational Modelling Guidelines* with justification provided by the modeller in the checklist comment section. Any variations should also be justified and documented in the modelling report.

Whilst the *Model Audit Checklist* primarily checks inputs for the traffic model, there are also checking criteria for the model outputs that should be audited. The Model Auditor will confirm these outputs with Main Roads' teams who have a local knowledge of the area.

The *Model Audit Checklist* is available for download from the Main Roads' website.

4.3 Modelling Report Templates

The *Modelling Report Template* contains the recommended modelling report structure to document all of the important information used in the development of a base or proposed traffic model.

It is important for the report to provide project context and background, detailing any necessary information that would assist in the audit of the base and proposed traffic models.

The base and proposed modelling report templates are available to download from the Main Roads' website.

4.4 Model Audit Memorandum

The purpose of the *Model Audit Memorandum* is to provide formal confirmation that the traffic model has passed the model audit and the conditions raised by the Model Auditor. The memorandum provides background information of the traffic model and where this has been stored within Main Roads for future reference. This memorandum is prepared and signed by the Model Auditor.

5 DEFINITIONS

Term	Definition
A	Applicant – Scheme owner
Aimsun	Traffic modelling software developed by Aimsun (formerly TSS).
AITPM	Australian Institute of Traffic Planning and Management
AP	Area Performance team, NOD, Main Roads
APC	Auditing Process Coordinator – Coordinates the auditing process.
DoT	Department of Transport, Western Australia
FTR	Future Traffic Flow Reviewer – checks that future traffic flow estimation methodology is acceptable
IDD	Infrastructure Delivery directorate, Main Roads
JCT	JCT Consultancy Ltd, developer of LinSig.
LG	Local government authority
LinSig	Traffic modelling software developed by JCT.
Main Roads	Main Roads Western Australia
MA	Model Auditor – Audits the base and proposed traffic models.
Model audit steps	A six-step approval process required by Main Roads for traffic modelling submissions.
M	Modeller – develops the traffic models for Applicant
MSR	Metropolitan and Southern Regions directorate, Main Roads
NOD	Network Operations directorate, Main Roads
NPD	Network Planning and Development team, PTS, Main Roads
OMV	Operational Modelling and Visualisation team, NOD, Main Roads
PTA	Public Transport Authority, Western Australia.
PTS	Planning Technical Services directorate, Main Roads.
RO&DS	Recognising Opportunities & Developing Solutions, Main Roads project process.

Term	Definition
ROM24	24-hr Regional Operations Model is Main Roads' strategic transport model.
RTE	Road and Traffic Engineering branch, PTS, Main Roads
SCATS	Sydney Coordinated Adaptive Traffic System
SIDRA	Traffic modelling software developed by Sidra Solutions.
SLR	Signs and Lines Reviewer – checks signs and lines drawings and recommends for approval.
SRP	Statutory Road Planning team, PTS, Main Roads
SVD	Selective Vehicle Detection
TMS	Traffic Management Services branch, NOD, Main Roads
TSAP	Traffic Signals Approval Policy, Main Roads
TSR	Traffic Signals Reviewer – checks signal changes and recommends for approval.
Vissim	Traffic modelling software developed by PTV.

6 REFERENCES AND RELATED DOCUMENTS

Document Number	Description
D17#669734	Traffic Signal Approval Policy v1.0
D20#211505	Operational Modelling Guidelines v2.0