



TECHNICAL MEMORANDUM #2

DATE: July 31, 2023

TO: Zachary Horowitz | ODOT

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SUBJECT: TPR Modeling and Analysis Guides Update

Tech Memo #2: Modeling and Analysis Procedures Document Project #22129-005
Review and Summary

This memorandum summarizes a review of three modeling and analysis procedures documents to identify sections of the documents impacted by recent Oregon Administrative Rules (OARs) changes related to DLCD's Climate Friendly and Equitable Communities (CFEC) rulemaking process. The purpose of this review was to identify where new or recently modified OARs might influence transportation analysis, modeling processes or procedures in the following documents:

- Oregon Analysis Procedure Manual (OAPM)
- Modeling Application Guide (MAG)
- Modeling Procedure Manual for Land Use Changes (MPMLUC)

The following text provides a high-level summary of each document, the purpose of the document and the intended audience. In addition, for each document, the attached table provides details for each chapter/section regarding:

- OARs that are likely most applicable to a specific section of the modeling or analysis document.
- Whether the OAR changes potentially require new guidance in the chapter/section.
- What the potential analysis and procedures impact may be.
- Other notes or ideas for discussion.

This review will help inform and focus future guidance updates.

OREGON ANALYSIS PROCEDURE MANUAL (OAPM)

OAPM PURPOSE

The OAPM "...provides the current methodologies, practices and procedures for conducting long term analysis of Oregon Department of Transportation [ODOT] plans and projects."¹ The OAPM is an online document that is intended to be updated as analysis techniques and project requirements change over time.

OAMP SUMMARY

The OAPM documents current methodologies, practices and procedures for conducting analysis of ODOT plans and projects. The 19 chapters of the manual have been generally organized to follow the progression of analysis conducted for a typical transportation plan or project, starting with project scoping through traffic analysis documentation. At the time of this document review, the most recent update to the OAPM occurred on April 4, 2023.

INTENDED AUDIENCE

The OAPM is intended to "...be utilized by ODOT staff as well as external consultants and contractors conducting and reviewing plans, projects and/or studies for ODOT. It also applies to work performed under ODOT Grants"² Or where ODOT funds are being used.

MODELING APPLICATION GUIDE (MAG)

MAG PURPOSE

The MAG is "...intended as a guide for use in preparing model application requests for ODOT TPAU [Transportation Planning and Analysis Unit] travel demand models. The purpose of this guidance is to ensure integrity and a confident and reliable outcome in the final product for the Project Manager (PM), the analyst and the requestor. The objective of this document is to provide guidance for applying travel demand models and reasoning through travel demand model output including expected output checks."³

MAG SUMMARY

The MAG documents typical applications for travel demand models and documents a process for reviewing travel demand model inputs and outputs. There are specific examples in the MAG of typical application types, which may need to be updated based on recent OAR changes and

¹ <https://www.oregon.gov/odot/planning/pages/apm.aspx>

² https://www.oregon.gov/odot/Planning/Documents/APMv2_Preface.pdf

³ Modeling Application Guide, April 2019, pg. 1

expected changes to modeling TSP scenarios. The MAG also describes internal TPAU roles and responsibilities, processes for tracking model applications and documenting and interpreting analyses.

INTENDED AUDIENCE

The MAG is intended for internal ODOT training, with a focus on ODOT TPAU project managers and analysts.

MODELING PROCEDURE MANUAL FOR LAND USE CHANGES (MPMLUC)

MPMLUC PURPOSE

The purpose of the MPMLUC is to provide information about "...commonly accepted practices for the application of travel models and model output data for the analysis of transportation impacts of proposed land use changes."⁴ The document is intended to "...provide standardized and consistent guidance on when and how to apply models and how to use model output to analyze the impacts of proposed land use changes."⁴ The MPMLUC can take into account general applications for modeling land use, which may include both proposed land use changes (such as Comprehensive Plan amendments and zone changes that would trigger traditional Transportation Planning Rule analysis) or development by right.

MPMLUC SUMMARY

The MPMLUC was finalized in February 2012. The MPMLUC provides a high-level discussion of what a travel demand model is and how to apply a travel demand model. The MPMLUC sections "...correspond to a logical sequence of questions that a model user or analyst may have regarding the use of a model for the analysis. By applying the guidelines within each section to the specific needs of the analysis, the manual user is taken through a step-by-step process for deciding whether to use a model and if so, how to do this in the appropriate way."⁴

INTENDED AUDIENCE

The MPMLUC is intended to be used by ODOT staff, local agencies, consultants and others looking for information on how to use ODOT's travel forecasting models. The MPMLUC "...is structured from the perspectives of:

1. A model user who is considering how to best apply a model to produce data for the analysis of transportation impacts, and
2. A transportation analyst who is trying to decide whether a model is the appropriate tool, and if so, what types of output should be used."⁴

⁴ https://www.oregon.gov/odot/Planning/Documents/ModelingProceduresManual_LandUseChanges.pdf

| Version 2/ Revision Date | Chapter | Title | Chapter Purpose (per APM) | Do OAR changes potentially require new guidance in this chapter? | Potential A&P Impacts | Most Applicable OARs | Notes/Discussion Questions/Ideas |
|-----------------------------|---------|--|--|--|---|--|--|
| 7/19/2018 | 1 | ODOT Information | This chapter is an overview of ODOT, how it is organized and where transportation analysis is within the organization. This section also lists some of the typical units and groups that analysts may need to work with. | No | | | |
| 5/17/2022 | 2 | Scoping Projects | The purpose of this chapter is to provide guidance to identify the various steps for scoping the analysis of a transportation study or project. | Yes | Section 2.3 discusses types of work and section 2.4 discusses tools, which may need to be updated to reflect changes in other chapters. | 660-012 | -Consistency item to reflect changes in other chapters |
| 6/8/2022 | 3 | Transportation System Inventory | This chapter provides guidance in the selection criteria and collection methods of appropriate inventory data types for use in transportation analysis. Inventory data are the foundation that all other later decisions are based on, so it is important that the scope of the data collection is appropriate and adequate to support the needs/outcomes of the plan or project. | Yes | Section 3.4.4 discusses traffic counts needs for TSPs. Consider updating chapter to discuss all inventory needs for TSPs by adding an appendix to list CFECT TSP inventory needs or referencing TSP Guidelines for additional inventory needs. | 660-012-0505 660-012-0605 | -May overlap with TSP Guidelines -Overlap with multimodal inventory collection project - Updating Section 3.2 and 3.3 to include all inventory needs for TSPs (non-CFEC and CFEC TSPs) could create a need of cascades elsewhere and result in inconsistencies with other sections. |
| 9/22/2019 | 4 | Safety | The purpose of this document is to provide guidance on safety analysis procedures for specific transportation planning and project development applications with a safety component. | Yes | Bicycle and pedestrian risk factors could be consolidated in this chapter. | 660-012-0505 660-012-0520 660-012-0605 660-012-0620 | -Updated and consistent safety analysis procedures are a priority for traffic design activities. |
| 11/18/2022 | 5 | Developing Existing Year Volumes | This chapter will outline procedures for developing 30th highest hour volumes (30HV) and average daily traffic volumes (ADT) for planning and project level analysis. Existing and count-level data are also needed to support other volume –related analysis inputs such as peak hour factors and truck percentages. This chapter also provides the basis for developing the future volumes shown in Chapter 6. | No | | | -Committee comment: Reconsider methods for calculating 30th highest hour. Current methods apply ADT variations to peak hour which may be higher than variations in the peak hours themselves. This tends to overestimate vehicular demand, possibly resulting in more identified need for capacity improvements than necessary. |
| 6/8/2022 | 6 | Future Year Forecasting | Design Hour Volumes (DHV) are used for ODOT planning and project level analyses. These are based on the existing year volumes developed in Chapter 5. The DHV is generally defined as the future year 30th highest hour (30 HV). Depending on scope and complexity of the analysis, different future methodologies are needed from simple historical trends to complex travel demand models. This chapter will outline the procedures for developing DHV and future Average Daily Traffic (ADT) used for ODOT planning and project level analysis. In addition, the processes for developing pavement design traffic volumes are also discussed. | Yes | - Section 6.12 discusses urban travel demand models and latent/induced demand procedures and will need to be updated. - Differences between traditional four-step travel demand models and activity-based travel demand models should be noted. - Consider adding guidance in this chapter (or Chapter 17) to discuss modeling best practices for CFEC. | 660-012 | -Other sections (6.10 and 6.11) are not applicable since they are intended for areas outside of MPOs where models are not established - Some general changes to travel demand models may be more appropriate for Chapter 17 - Consider best practices guidance (e.g., model feedbacks, when to use SWIM for land use/induced demand) and other areas for consistency in application (e.g., suggested actions to reduce risk). - Consider revisions to the latent/induced demand to discuss best practices in limitations with activity based and traditional four-step models). Also consider non-private vehicle forecasting and TEDM, ITS, etc. |
| 3/16/2020 | 7 | System Planning Analysis | The purpose of this chapter is to illustrate the different types of system planning analysis and related tools, applications, limitations, and data needs. These methods are recommended for use in larger scale planning studies. | Yes | In particular, the following sections will likely be impacted by recent OAR changes: - Section 7.2, which discusses typical tool applications for various types of system planning analysis - Section 7.3, which discusses the HERS-ST tool, which includes fleet assumptions and emissions calculations. - Section 7.4, which discusses the SWIM model, - Section 7.5, which discusses travel demand models (both activity based and traditional four-step models) | 660-012, 660-044 | - This may be the best existing chapter to implement elements of Div 44 and Scenario Planning, as needed. There is an update planned for this chapter to add in a section for VisionEval so that could interface well with anything we care to add on scenario planning - Update currently planned for this chapter to add a section to discuss VisionEval scenario planning tool. - Consider how content in this chapter integrates with existing ODOT Climate Office scenario planning resources |
| 7/19/2020 | 8 | Mesosopic Analysis | The purpose of this chapter is to provide an overview of methods and tools available to apply mesoscopic analysis. The information provided in this chapter is intended to provide the user with the information required to understand the general approach for scoping project methodology and understanding the differences between various methods along with limitations and advantages of using each method. | Yes | Scoping considerations for mesoscopic modeling may be added or modified in this chapter. | 660-012 | -Chapter is high level and would not have detailed procedures, but may require some references to changes - May require cross-reference or consideration with some performance measures. - Consider if this chapter should cover speed distributions/validations for use in MOVES model - Consider if discussion around VMT per capita calculations should be added for mesoscopic models. |
| 3/16/2020 | 9 | Transportation Analysis Performance Measures | Performance measures in this chapter are grouped into categories. Transportation can be measured in terms of its primary functions such as safety, accessibility and mobility. This chapter is limited to performance measures commonly reported out using APM methods and tools. These measures are used in plans and projects to identify needs, compare scenarios and alternatives, and identify benefits and impacts. The chapter focuses on facility level performance measures. System level performance measures generated by APM tools are discussed at a higher level. | Yes | Many of the OAR changes are focused on performance measures, so this chapter will need to be updated to capture changes. This will likely feature the toolkit of options that will be developed through this project. | 660-012-0215 | -A clear understanding of updated performance measures, and their impact on analysis processes, is a priority to support the identification and evaluation of effective traffic solutions |
| 6/8/2022 | 10 | Analyzing Alternatives | This chapter provides guidance on facility level alternative transportation analysis for corridor plans, refinement plans, and project development with or without National Environmental Policy Act (NEPA) involvement. | Yes | Establish criteria used to conduct enhanced review (consider adding as an appendix). | 660-012-0830 | -Is there a better place in the OAPM to capture -0830 requirements and/or is this captured in the TSP Guidelines? -A consistent approach to alternatives analysis is a priority to support the identification and evaluation of effective traffic solutions |

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|------------------|-----|------------------------------------|---|-------|---|--|--|
| 2/19/2020 | 11 | Segment and Facility Analysis | To assure that mobility targets and other key indicators of mobility are explicitly integrated into freeway and highway analyses in the state of Oregon, this chapter provides a range of procedures that are scaled to reflect analysis complexity, regional context, and study scope. These methods are anchored in national policy and guidance documents, including the Highway Capacity Manual (HCM) 6th Edition and its companion Planning and Preliminary Engineering Applications Guide (PPEAG). However, the methods have been customized through the incorporation of Oregon specific default values and best practices that reflect the diverse nature of Oregon's freeway and highway operations, including differences between urban and rural facilities. The guidance in this chapter considers project context, project type, data availability, and level of effort needed to conduct an evaluation. The goal of the guidance is to balance resource needs and complexity with desired analysis outcomes and performance measures. | Maybe | Facility analyses are mentioned in 660-012-0325 as an area that require review. There may be a need to provide an analytical procedures in this chapter. | | - OHP/development review guidelines may suggest performance measurers/thresholds that align with CFEC that would influence analysis. |
| 3/16/2020 | 12 | Unsignalized Intersection Analysis | This chapter presents commonly used unsignalized intersection deterministic analysis procedures and identifies specific methodologies and input parameters to be used on ODOT projects. Simulation procedures are covered in APM Chapter 15. Software settings are covered in Appendix 12/13. Topics covered include: <ul style="list-style-type: none"> • Turn Lane Criteria • Unsignalized Intersection Capacity Analysis • Traffic Signal Warrants • Estimating Vehicle Queue Lengths at Unsignalized Intersections | Maybe | -Consider need for procedures to include accounting for additional/increased pedestrians, bicyclists, and/or transit use? for the signalized analysis, are queue jumps etc. mentioned? Signal progression for bicyclist instead of vehicles? | | -Can envision changes to these chapters based on other changes to the APM |
| 10/22/2020 | 13 | Signalized Intersection Analysis | This chapter presents commonly used signalized intersection deterministic analysis procedures and identifies specific methodologies and input parameters to be used on ODOT projects. Simulation procedures are covered in APM Chapter 15. Software settings are covered in Appendix 12/13. Topics covered include: <ul style="list-style-type: none"> • Turn Lanes at Signalized Intersections • Signalized Intersection Capacity Analysis • Signal Progression Analysis • Estimating Queue Lengths at Signalized Intersections | Maybe | -Consider need for procedures to include accounting for additional/increased pedestrians, bicyclists, and/or transit use? for the signalized analysis, are queue jumps etc. mentioned? Signal progression for bicyclist instead of vehicles? | | -Can envision changes to these chapters based on other changes to the APM |
| 3/17/2020 | 14 | Multimodal Analysis | In order to truly quantify the operation of a roadway segment, all of the modes that use it need to be analyzed. This includes pedestrians, bicycles, transit in addition to automobiles and trucks. This chapter will eventually cover a range of different multimodal analysis types and modal considerations that will apply to plans and projects of all detail levels. | Yes | Multimodal gap summary is discussed in the OARs but not currently included in Chapter 14. | 660-012-0325 660-012-0505 660-012-0605 | - To what degree do definitions and process need to be standardized? What flexibility within the local TSP update? -Ped and Bike LTS methods may change |
| 3/17/2020 | 15 | Traffic Simulation Models | This chapter currently presents instruction on calibration of microsimulation models created in Trafficware's SimTraffic and a brief overview of the other simulation models and parameters used in ODOT projects. | No | | | Update in progress at time of review, mainly to integrate Vissim protocol into APM directly. |
| Not yet complete | 16 | Environmental Traffic Data | This chapter presents the general outline for the needs and creation of common traffic data inputs requested for the Air Quality and Noise Analysis sections of the Environmental Impact Statement (EIS) or Environmental Assessment (EA) and for Categorical Exclusion (Class 2) projects as applicable. Traffic data needs for GHG scoping and project-level analyses are also covered. | Yes | This chapter is being updated to discuss induced/latent demand and impacts on GHG consistent with latest CFEC rules. | 660-012 660-044 | Chapter 16 not yet complete at time of review but the draft document was reviewed. The Noise section of the draft is not expected to substantially change but the GHG section is expected to still undergo some revisions. |
| 3/16/2020 | 17 | Travel Demand Modeling | The purpose of this chapter is to provide an overview for non-modelers of building and applying travel demand forecasting models. Modeling practice continues to evolve: methods and tools vary in their level of maturity at any given time. For example, ABM (Activity Based Models) which are discussed further below, are just starting to be created and used in Oregon. This chapter focuses on travel demand modeling tools currently used in Oregon in TSPs, corridor plans, refinement plans, and project development. Post-processing of model volumes is addressed in Chapter 6. System level modeling for statewide applications, RTPs or Scenario Planning is discussed in Chapter 7. Mesoscopic modeling topics such as focusing, windowing, dynamic traffic assignment, and peak spreading are addressed in Chapter 8. For information on more advanced model topics, contact TPAU. | Yes | Many of the OAR changes influence assumptions and processes for travel demand modeling. This Chapter will need to be updated to include elements such as: - VMT calculation - Modeling CFAs - Incorporating trip reduction/TDM strategies - Incorporating parking changes | 660-012 | - This chapter is primarily focused on the "non-modeler", so consider adding more detailed information on CFEC modeling best practices into an appendix. |
| 1/27/2020 | 18 | Operational Analysis | The purpose of this chapter is to provide an overview of transportation system management and operations (TSMO) program elements, methods, strategies and analysis tools. The chapter guides users on integrating established TSMO procedures, analytical tools and data into existing planning processes and project development. | Yes | Discussion could be added in this section on how to incorporate trip reduction strategies, TDM policies, ITS/TSMO programs, etc. into modeling (or in Chapter 17) | 660-012-0145 | - Consider post-processing/off-model tools for consistency (some review in the 2018 OMSC GHG Modeling and Analysis Tools Overview document) |
| Not yet complete | 19 | Traffic Analysis Documentation | This chapter presents an overview of the basic elements that document the assumptions, methods, findings and recommendations of traffic analyses, report types, and reviewing analysis documentation of others. | Yes | The basic elements may need to be updated to reflect the enhanced review process outlined in OARs. This could be accommodated in an appendix to this chapter. | 660-012-0830 | Not yet complete at time of review but not expected to substantially change from working draft that was reviewed. |
| N/A | N/A | Other | N/A | Yes | - Equity analysis not documented in APM but could be. - Could consider this being a section in Chapter 10, as Chapter 10 covers an assortment of other techniques (e.g. Practical design, benefit-cost analyses, etc.) | 660-012-0135 | -To what degree does this analysis need to be standardized and consistent? - How can equity analysis account for the varying equity definitions used at the local, state and federal levels? |

| Revision Date: April 2019 | Chapter | Title | Chapter Purpose | Do OAR changes potentially require new guidance in this chapter? | Potential A&P Impacts | Most Applicable OARs | Notes/Discussion Questions/Ideas |
|---------------------------|---------|--------------------------------------|--|--|---|--|---|
| | 1 | Introduction | Introduces document purpose, need and objective. Discusses roles and responsibilities for internal TPAU project manager and analyst and the general review process. | No | | | |
| | 2 | Typical Application Types | Summarizes typical model request application categories and outlines typical steps. | Yes | - Section 2.12 may need to be updated to document new procedures for demand model scenario analysis. - New sections may be needed to add new example categories of model applications that will become more typical based on changes to the OARs (e.g. VMT analysis, GHG modeling, CFAs) | 660-012-0160 660-012-0320 660-012-0905 660-044-0030 | -Potential landing spot for CFA case study - Consider additional detail procedures for latent/induced demand in this section (or in APM). |
| | 3 | Travel Model Input Review | Describes reviews to consider for travel demand model inputs, focusing specifically on Transportation Analysis Zones (TAZs), land use data, and transportation networks. | Yes | - Section 3.2 describes land use and socioeconomic data to be reviewed and may need to be updated to reflect new procedures associated with CFAs | 660-012-0320 | -Potential need to document how land use and socioeconomic data interface with VE and scenario planning (statewide assumptions and potential need for dynamic updates like a wiki or website) -VE/Scenario planning should add "transportation" data. This includes information like parking coverage/rages, land miles, etc. that need to be consistent in both tools. VE typically drawing from the regional travel model. -Potential checks related to consistency of model networks for VMT comparison purposes |
| | 4 | Sub-model Outputs and Logical Checks | Describes reviews and logic checks to consider for travel demand model outputs. | Yes | - Section 4.6 includes a discussion of reviews to consider for VMT analysis, which may need to be refined based on changes to OARs. | 660-012-0160 | -Consider adding QC checks related to project-level analysis that report on GHG/MOVES (i.e., speed changes by vehicle group) |
| | 5 | Model Application Tracking | Summarizes the critical components to tracking and storing a model application. | No | | | |
| | 6 | Write-up - Interpretation & Analysis | Provides direction for what information to include in a write-up to help interpret results. | No | | | |

| Revision Date: Feb 2012 | Section | Title | Chapter Purpose (per MPMLUC) | Do OAR changes potentially require new guidance in this chapter? | Potential A&P Impacts | Most Applicable OARs | Notes/Discussion Questions/Ideas |
|-------------------------|---------|---|---|--|---|--|--|
| | A | Introduction | Introduces purpose, audience and organization of document. | No | | | |
| | B | What are the questions to be answered? | This section helps the analyst frame the questions to be answered about the impacts of a proposed land use change. Several important questions common to many proposed changes are discussed, including consistency with Transportation System Plan (TSP) population and employment totals, consistency with local transportation plans, effects on ODOT facilities, and environmental impacts. | Yes | - This section discusses land use change impacts on VMT, which may need to be revised and expanded to be consistent with the latest OAR changes and VMT analysis procedures. - This section also discusses performance standards and may need to be updated to be consistent with OAR changes. - In a section on Consistency with Local Transportation Plans, OAR 660-012-0060(1) is cited, which has been recently modified. - This section mentions Environmental Impacts, which may need to be updated to reference new VMT procedures associated with OAR changes. | 660-012-0160 660-012-0320 660-012-0905 660-044-0030 | -Section references ODOT Development Review Guidelines -Potential CFA land use considerations including: 1) How establish land use and socioeconomic assumptions within CFA, and 2) How adjust land use forecasts in other areas to retain established control totals |
| | C | What is a travel forecasting model? | Background information is provided about various aspects of travel forecasting models, such as model components and input data, model development, accuracy of model outputs, and the use of model outputs with other tools. | Yes | - This section cites FHWA recommended VMT calibration targets (from 1997), which may need to be updated to reflect latest guidance. | 660-012-0160 660-044-0030 | |
| | D | Can a model help answer the questions? | Criteria are presented for determining whether a model is the appropriate tool for analyzing a specific proposed land use change. One set of criteria can be used to decide whether a model is applicable for the analysis, while a second set of criteria answer the question about whether a model is the best tool for the analysis. | Yes | - Consider adding text to discuss how answers to the questions in this section may differ if the area is within an MPO or within a CFA | 660-012-0160 660-012-0320 660-012-0905 660-044-0030 | -Section references ODOT Development Review Guidelines - Consider a flowchart to help answer interaction with CFAs |
| | E | What types of model output are available? | The different types of model output available for the analysis of various proposed land use changes are described. Examples of outputs that may be used to answer the questions outlined in Section B are provided, as well as information on how the outputs can be organized by geographic scale, network scale, time period, and travel market segment. | Yes | - This section discusses examples of travel demand model outputs and could be updated to include a robust discussion of VMT consistent with OAR changes. - This section discusses consistency with transportation plans primarily based on LOS and v/c ratio and could be updated to include a discussion of VMT. - This section lists model-supported performance measures which could be updated to include VMT. | 660-012-0160 | -Opportunity to cross reference the APM Performance Measures chapter and list those measures that could be output from the travel demand model |
| | F | How should the model be applied? | Model application guidelines are presented for four types of proposed land use changes: site development proposals, zoning changes, comprehensive plan updates, and land use changes within interchange management plan areas. | Yes | - Consider adding a section to discuss latent/induced demand - Consider updating the section "Representation of Mixed-Land Uses" to incorporate CFAs. - Consider adjustments to the "External Trip-Making" section to capture the new VMT definition. - Consider updating the "Development of Interim Year Forecasts" section to discuss cumulative/over-time GHG in MOVES analysis (or reference to APM). | 660-012-0160 660-012-0320 660-012-0905 660-044-0030 | - Information is general in nature and likely does not need to be updated to be consistent with new guidance. -Section references ODOT Development Review Guidelines |
| | G | How should the model output be used? | Guidelines about how to use model output data for analysis and presentation purposes are provided. | No | | | - Information is general in nature and likely does not need to be updated to be consistent with new guidance. |
| | H | Glossary of terms | | | | | |