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Travel Forecasting Model Suitability for Environmental Impact Analysis

Technical Guidance – 1.1.22

INTRODUCTION

This document describes how criteria were developed to help determine whether a travel forecasting model is suitable to perform analysis for environmental review. The intent of developing these criteria and performing an assessment is to start a dialogue with public agencies or other transportation network owners and operators about the potential 'benchmarks' that could be used to assess model suitability for this purpose. Input is welcome on how to improve this benchmarking framework.

Model suitability (or adequacy) has two basic elements.

1. **Desired confidence in the forecasts** or level of concern associated with mis-identifying impacts and associated mitigation.
2. **Risk of legal challenge** associated with inadequately analyzing environmental impacts due to use of models that do not meet benchmark expectations.

Agencies with a high risk of legal challenges will likely be concerned about both elements, while agencies with less legal risk should still be concerned about the first element, since it is also relevant for all other transportation analysis based on model forecasts.

ENVIRONMENTAL IMPACT ANALYSIS EXPECTATIONS

Two of the better-known laws in environmental impact analysis include the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). Both laws intend to provide agencies with adequate and complete information to assess the environmental consequences of proposed actions prior to making decisions. Neither law is prescriptive about transportation analysis methodology; however, past court decisions have raised awareness about technical adequacy and completeness.

Various agencies have issued technical guidance on forecasting expectations for environmental impact analysis compliance. For NEPA, the Environmental Review Toolkit website below developed by the Federal Highway Administration (FHWA) contains specific expectations for travel and land use forecasting analysis in NEPA.

https://www.environment.fhwa.dot.gov/nepa/Travel_LandUse/forecasting_reviewer_guidance.aspx

As stated in the introduction on this website, the reviewer guidance combined with the "Interim Guidance on the Application of Travel and Land Use Forecasting in NEPA" is intended to facilitate the development of adequate NEPA documents.[1]

[1] Available at https://www.environment.fhwa.dot.gov/NEPA/Travel_LandUse/travel_landUse_rpt.aspx.

For CEQA, while the implementing Guidelines contain clear expectations for environmental analysis as noted below, they are silent about what data, analysis methods, models, and mitigation approaches are adequate for transportation impacts.

CEQA Guidelines – Expectations for Environmental Impact Analysis

§ 15003 (F) = fullest possible protection of the environment…
§ 15003 (I) = adequacy, completeness, and good-faith effort at full disclosure…
§ 15125 (C) = EIR must demonstrate that the significant environmental impacts of the proposed project were adequately investigated…
§ 15144 = an agency must use its best efforts to find out and disclose…
§ 15151 = sufficient analysis to allow a decision which intelligently takes account of environmental consequences…

All of these suggest using state of the practice, and in some cases, best practice methodology to ensure that environmental impacts are accurately identified and that mitigation is appropriately specified. Further, these expectations have been routinely recognized by California courts as the context for determining whether an analysis is deemed adequate.

In most states, travel forecasts are generated using multiple forms of models, which can range from simple spreadsheets of historical data, to complex computer models with numerous input variables. When applying a travel forecasting model for a proposed project, a variety of factors may determine model suitability:

- Complexity of the transportation network and number of operating modes.
- Available data (e.g., traffic counts, transit passenger boarding counts, land use types and densities, demographic data, etc.).
- Land use context (e.g., urban, suburban, rural setting, level of mix of use, balance and match of jobs versus workers, etc.).
- Planned changes in the transportation network (particularly to major roads or transit systems).
- Availability of resources to develop and apply travel demand models.
- Population and employment levels.
- Congestion levels.
- Regulatory requirements.
- Types of technical and policy questions posed by decision makers.
- Desired level of confidence in the analysis findings.
- Anticipated level of legal scrutiny.

According to *Transportation and Land Development*, 2nd Edition, ITE, 2002, the appropriate model depends on the size of the project and its ability to affect the surrounding area. As projects increase in size, the likelihood of needing a complex model (such as a four-step model) increases because of the number of variables that influence travel demand and transportation network operations. The study area can also influence the type of model needed, especially if congestion occurs or if multiple transportation modes operate within the study area. Either of these conditions require robust models that can account for the myriad of travel demand responses that can occur from land use or transportation network changes.

Other relevant national guidance on model applications and forecasting is the *NCHRP Report 765, Analytical Travel Forecasting Approaches for Project-Level Planning and Design*, Transportation Research Board, 2014. This is a detailed resource with many applicable sections. A few direct

excerpts worth noting about forecasting expectations for model applications are listed below.

- *A travel forecasting model should be sensitive to those policies and project alternatives that the model is expected to help evaluate.*

- *A travel forecasting model should be capable of satisfying validation standards that are appropriate to the application.*

- *Project-level travel forecasts, to the extent that they follow a conventional travel model, should be validated following the guidelines of the Travel Model Validation and Reasonableness Checking Manual, Second Edition from FHWA. Similar guidelines are provided in NCHRP Report 716. This level of validation is necessary, but not sufficient, for project-level forecasts. Project-level forecasts often require better accuracy than can be obtained from a travel model alone.*

- *The model should be subject to frequent recalibrations to ensure that validation standards are continuously met.*

The bullets above set high expectations for models that are challenging to meet. A strict adherence to this guidance and similar guidance from California listed below require verification of a model's static and dynamic validation in the study area.

- *2017 Regional Transportation Plan Guidelines for Metropolitan Planning Organizations*, California Transportation Commission, January 18, 2017.

- *Transportation Analysis Framework, First Edition, Evaluating Transportation Impacts of State Highway System Projects*, Caltrans, September 2020.

While static validation follows conventional statistical testing to compare model volume estimates to observed volumes, dynamic validation is all about sensitivity and reasonableness. The dynamic validation would include sensitivity tests related to the type of project under investigation. This testing verifies that the model's outputs change in the appropriate direction and magnitude when making input variable changes like those necessary to represent the project. Absent dynamic validation, model users would not have verification that the model design produces reasonable results.

Model Assessment

To assess existing travel forecasting models, the information above can be used as the basis for developing specific benchmark criteria related to model adequacy. The recommended criteria below are organized into two components covering model ownership and maintenance plus model performance.

Model ownership and maintenance

To assess the status of model ownership and maintenance, agencies can be asked about their control of the following model components.

- Model documentation – Does the agency have complete model documentation? This criterion relies on the availability of documentation about the model's development including its estimation, calibration, and validation as well as a user's guide. Responsible agencies will prepare complete documentation to document the model's performance, limitations, and how to apply it appropriately for both land use and transportation projects
- Model files – Does the agency maintain the model input and output files?
- Model distribution – Does the agency control the distribution of the model files to users and maintain version control for all applications?

Public agencies that develop travel forecasting models for planning and impact analysis must maintain those models and should control the key aspects of documentation and distribution including version control to help users understand the most current and appropriate versions for project specific applications.

Model conditions and performance against select guidance criteria

Model testing and frequent updates are essential to understand model performance to assess reasonableness and sensitivity for environmental impact analysis applications.

- Completed calibration and validation within the past 5 years – recent calibration and validation is essential for ensuring the model accurately captures evolving changes in travel behavior. Per NCHRP Report 765, "The model should be subject to frequent recalibrations to ensure that validation standards are continuously met."
- Demonstrated sensitivity to demand effects across demographic, land use, and multimodal network changes - validation reporting should be checked for static and dynamic tests per guidance such as the *2017 Regional Transportation Plan Guidelines for Metropolitan Transportation Planning Organizations* and *Travel Model Validation and Reasonableness Checking Manual, Second Edition* cited above. The dynamic validation is particularly essential so that forecast reviewers have knowledge about the model's suitability for the type of project under analysis within the specific study area.