Preparing for Model Development

The model development process ensures that a travel demand model accurately mirrors the observed travel patterns and needs of the area being simulated. This chapter discusses the early stages of the process including identifying stakeholders, establishing a collaboration plan, scoping the model development process, and drafting the scope document.

Identifying Stakeholders

The model development process begins with identifying the right stakeholders to be part of the project team. The FDOT District Model Coordinator (DCM) or other lead agency if not FDOT, identifies stakeholders needed for new model development or consults and considers current stakeholders for existing model updates. Potential stakeholders include:

- FDOT Central and District Offices

- Metropolitan Planning Organizations

- Regional Planning Councils

- Federal Highway Administration

- Local/regional governments

- Transit agencies

- Toll authorities

- Model development and other consultants who prepare and analyze results

Establishing a Collaboration Plan

Establishing and documenting a process early provides structure for developing the model to meet the needs of the users and stay within funding considerations. Having a collaboration plan that identifies the right people early, reduces the potential for misunderstandings, miscommunication, and potential delays as well as acclimates new staff to the project more quickly when staff attrition or turnover happens. As the development progresses, documentation provides context on decisions made earlier in the update, supporting the iterative process. A solid collaboration plan should consider and answer the following questions:

- **Who will own and manage the model?**

  Ownership and management responsibilities should be addressed at the start, whether a new model is being built or an existing model is being updated. In Florida, model ownership and management are often the responsibility of FDOT or the local MPO(s). The owner of the model leads the project team, hires consultants if needed, and oversees the development process. The owner of the model also is responsible for housing the model upon completion and managing the maintenance of the model as needed.

- **Who will develop the model?**

  FDOT generally hires consultants to develop the model. In coordination with the applicable MPO, staff from FDOT and consultant team, if applicable, work together to identify important policies, applications, and unique characteristics to be evaluated with the model.

- **How will collaboration happen?**

  Collaboration can happen through stand alone meetings, project team meetings, district model coordinator meetings, project advisory committee meetings, or meetings of larger groups such as the model user groups.

  - *The **project team** includes the model owners project manager, their staff, and applicable/interested stakeholders.*

  - *FDOT **district model coordinators** are a liaison between the project team and FDOT as well as resources to each other for learning tips and best practices.*

  - *Creating a **project advisory committee** can be helpful to have a group familiar and invested in the success of the model development that assists with decision making and information sharing.*

  - ***Model users groups** are a great sounding board for before, during, and following model development. Model users groups provide a local forum to facilitate and promote the understanding and proper application of travel demand models. These groups include members from the region who are familiar with and often experts in modeling the transportation and demographic patterns of the region. In some of Florida's most active users groups, details of model development are often discussed with model developers, FDOT and MPO staff, and model users. Direct communication between all involved parties allows model developers and their stakeholders to address problems and identify solutions quickly. More information on Florida's model user groups can be found on the Florida Transportation Forecasting Resource Hub.*

- **How will model development be funded?**

  Any agencies or organizations that are funding the model development need to be involved throughout the development process, whether in an advisory or active development role. The responsibilities for funding the model, including the related data, can significantly impact data collection and model structure. Model development funding determines the number and quality of resources (including data) available to the team, the degree of technological innovation that may be integrated, and the complexity of the model. Increased funding creates more opportunities for progress in model development.

- **Who will use the model and how?**

  Uses of the model span multiple activities within FDOT such as project development and environment (PD&E), traffic studies, and transportation systems management and operations (TSM&O) and needs of other organizations such as toll authorities, regional planning councils, and local governments . FDOT and stakeholders need to understand how the model will be used at the outset to accommodate potential needs within the constraints of data availability and funding.

Scoping the Model Development Process

The lead agency as determined in the collaboration process (often FDOT or other lead agency, such as a MPO) will work with stakeholders to determine the extent of the model development/update. To begin, the lead agency will

- **Assemble** the potential project team, including applicable stakeholders and the need for consultants;

- **Define** the roles of each member of the project team. Determining who will be responsible for each component of the development depends on the skills and resources available within the team;

- **Engage** the project team, including stakeholders, in discussions on the goals, expectations, and needs in the model development/ update process; and

- **Document** the collaborative process summarizing conversations on pertinent information such as funding, data sources, chosen methodologies, and other agreed-upon decisions.

Initial Scoping Meetings

The following topics should be discussed in the initial scoping meetings to establish goals, expectations, and needs for model development.

- **Model development timeline**
  Timelines for model application projects may limit the ability to incorporate all

the model enhancements that partner agencies desire. All stakeholders involved must work together regarding improvements being built into the model. Discuss:

- *Is this a new model being developed or an existing model being updated?*

- *When does the model need to be complete?*

- *What is a reasonable time frame to incorporate all the needed/desired components?*

- **Identify additional model components to be included**
  Additional components add to the complexity of the model development but are sometimes needed to deliver the outputs desired for an area or region. Additional model components also add to the cost of model development. All stakeholders should agree on whether additional components will be included. Discuss:

  - *Are there plans to study fixed guideway transit corridors for the plan update?*

    - *If yes, the model will need transit networks, path building, mode choice, and transit assignment steps.*

  - *What advancements must be included in the model, and, where applicable, what limitations in the previous model should be corrected?*

    - *Available technology (software platforms) often improves in its capability between model updates, so it's important to consider where improvements can be integrated into the updated model to expand its functionality.*

      - *Any optimization of the software platform used for the model may require initial setup, which will add to the model development timeline.*

  - *Is there a large influx of visitors to the area?*

    - *Visitors add to the region's traffic volumes, contributing to congestion (during peak and off-peak hours), wear and tear on infrastructure, and overall travel demand.*

- **Model structure**
  The questions the model will be expected to answer and the best approach to answering those questions should be discussed. Discuss:

  - *Can the questions the model will be expected to address be accommodated by the 4-Step process, or will another approach, such as activity-based modeling, be required?*

- **Acceptable run time**
  The amount of time the model needs to run considering the agreed-upon timeline and needs of the model. Discuss:

  - *What is an acceptable run time? Under 8 hours, under 12 hours, or something different?*

- **Model accuracy**
  This refers to how close a model's result is to actual travel conditions, determined by comparing the model's results to observed data. For more information on model accuracy, refer to Chapter 2 of Using the Model.

  Several areas in Florida share a single regional model for multiple MPOs and/or FDOT Districts. When multiple MPOs use the same model, model accuracy goals can be impacted. Some partners might desire higher accuracy within their jurisdiction, but this can only be achieved at the expense of compromising regional model validity. For instance, increasing the accuracy of a model for one jurisdiction might require making assumptions or simplifications that are not valid for the entire region. Other options may include project/jurisdiction-specific subarea validation. Discuss:

  - *What size region will this model cover?*

  - *Does this model involve multiple MPOs of varying sizes?*

- **Model validation standards**
  Typical model standards have been determined using Federal modeling research and guidelines as well as input from Florida modeling experts. Refer to Appendix X of the Travel Demand Modeling Manual for modeling standards.

  If freight plays a significant role in the local economy, it is recommended that truck modeling standards and procedures be carefully considered. There are occasions where model standards may need to be adjusted for specific situations. All stakeholders should discuss any potential instance where diversion from established standards might be needed. Discuss:

  - *Will the model development adhere to model standards or is consideration needed for diversion from typical standards?*

- **Model output format**
  The format of the model output should be discussed to ensure the outputs are informative and useful during post-processing. All stakeholders should agree to the format of the outputs. Discuss:

  - *What is the format that will be used for outputs? Consider:*

    - *What type of files will the model output? (Ex., CSV, DBF, TXT, etc.)*

- *How can the outputs be structured for non-modelers to interpret and use easily?*

  o *Are there any post-processing tools that will need to use the model outputs as inputs? What format does the tool require?*

  - *The Environmental Protection Agency's (EPA) Motor Vehicle Emission Simulator (MOVES) uses travel demand model outputs as inputs and requires them to be formatted specifically.*

- **Data sets**
  All stakeholders should brainstorm and discuss the data needed for model development, including data for any additional agreed upon components. There are many publicly available data sets such as Census, American Community Survey, and FDOT traffic count data. However, there are just as many needed/desired data sets that must be purchased. Stakeholders should determine the data required and the potential cost(s) of the data before model development begins. Also, future year population and employment control totals must be established by the development team, along with how those future values will be allocated throughout the region. Discuss:

  o *Will the model need private-sourced employment data?*

  o *Are household and/or roadside travel survey data expected to be available?*

  - *If a household travel survey is conducted, model estimation and calibration will be required.*

  - *If a roadside survey is conducted, new assumptions will result in the validation of external trips.*

  o *If freight plays a significant role in the local economy, it is recommended that a reasonable sample of truck counts be added to the model network.*

  o *How much growth is reasonable for the region? Where is the growth anticipated to happen?*

  - *Are there any significant housing developments on the horizon? Are any new major employers coming to the area?*

- **Travel demand modeling software**
  The modeling software that will be used to develop and run the model should be agreed upon by the stakeholders. These stakeholders should have the capability to review and check any modeling work performed outside the agency, such as by consultants. Consider:

  o *What software is needed/desired to develop and run the model?*

o *How do model outputs interact with other software applications, such as microsimulation?*

- **Computational power needs of desired model development**
  Models are computationally intensive tools with high memory requirements for data storage and processing memory. Often, the more complex the model, the more computational resources it requires. Some models require over 30 gigabytes of memory for storage alone and at least 256 gigabytes of RAM to run. This impacts how quickly the model can run and/or whether the model can complete a run (e.g., a computer with too little memory can cause a model to stall or crash). Consider:

  o *How many gigabytes of RAM are needed to run successfully?*

  o *How much memory is needed to store the model inputs and outputs?*

  o *Can local users effectively access and run the model?*

Drafting a Scope of Work

Model development is often contracted out to modeling consultants. Following discussion and decisions with the stakeholders, the FDOT District Modeling Coordinator or other lead agency should draft a scope to employ the work for model development. This scope should describe, in sufficient detail, the tasks to be completed to fully develop a model. Topics to consider when drafting a scope of work include:

- **Goals of this model development.** Consider:

  o 4-step model, activity-based approach, or another approach?

  o Attributes of motorized and non-motorized trip-making and mode choice behaviors

  o Model sensitivity

  o Model usability and friendliness

  o Need to summarize complex data in a simplified, user-friendly manner

  o Training and technical support needs

  o Identifying data parameters such as base and horizon years, data years agreed upon with stakeholders

- **Model development oversight**

  o Will a project advisory committee (PAC) or similar group be created and used to obtain and submit relevant data to support the model development?

- o If so, who will serve as the representative of the PAC to direct all the consultant work?

- **Determine/identify the data that will be collected**
    - Base and future year zonal data
        - Population
        - Employment
    - Network data
    - Traffic operation data
    - Travel time/speed data
    - Traffic counts
    - Transit ridership data
    - Transit operational data
    - Travel behavior data

- **Software for running the model**
    - o What software will be deployed for model development?
    - o Is conversion from an older or different software needed?
    - o Is validation needed to compare results in the conversion?
    - o Will a user-friendly interface be needed to expand the model's user base?

- **Model components such as model catalogs, scripts, and path-building scenarios**
    - o In a model update, will model components need to be updated to a new base year? Consider:
        - Model catalog updates
            - Folder structure
            - File naming
            - Attribute names
    - o Developing scripts
    - o Update path building parameters
        - Updates to travel time skims

- **Use of sub-models**

    o   Will sub-models be created as part of the model development?

        ▪   For example, external sub-model, truck sub-model.

- **Approach to calibration and validation of the model**

    o   What planning items will the model be used to evaluate? This impacts the extent and processes used during model calibration and validation.

    o   What calibration and validation metrics will be used for each step (if developing a 4-step model) such as for trip Generation, trip Distribution, and mode split? For each step, what calibration metrics need to be considered, i.e., destination choice for trip distribution?

    o   If developing an Activity Based Model (ABM), what are the calibration considerations, standards, and protocols for the probability models that comprise the full ABM specification?

    o   Will assignment metrics be at the total network level, by functional classification, by volume groups and districts, or will all reporting categories be used?

    o   Identify the procedures to be used for model estimation, calibration, validation, and sensitivity testing, The commonly used references is *NCHRP Report 716, 2012* and *FHWA/TMIP Travel Model Validation and Reasonability Checking Manual, 2010*.

    o   Based on the described references, model history and standard practices, identify and select the standards that will be used to assess the performance of the model and obtain buy in from all stakeholders.

- **Uses/applications for calibration**

    o   LRTP

    o   Subarea/corridor plans

    o   PD&E studies

    o   Others?

- **Sensitivity testing to determine reasonableness**

    o   How will model sensitivity testing be handled?

    o   What attributes will be altered to test the impact they have on the model outputs?

- **Model support services, such as technical support and training.**

  o   Will the consultant be required to provide model support services?

  o   Workshops should be considered to train users, such as the MPOs, on the various applications of the model and its outputs.

- **Documentation required for the development process**

  o   Description of estimation and development of model parameters.

  o   Model calibration, validation, and sensitivity test plan to establish the calibration targets for model variables, approach for validation, sensitivity/ propensity test of model variables

  o   Summarization of input data, calibrated parameters, comparisons of calibrated parameters to other areas, and model accuracy statistics.

  o   Users guide documenting how to operate and apply the model.

- **File clean up post development**

  o   Remove any temporary files that were generated during the model run.

  o   Ensure no file paths in the model are hard-coded but instead are relative to the user.

  o   Ensure model file structure is intuitive and consistent.

- **Purpose and frequency of meetings and communication**

  o   What types of meetings will be needed and what is the frequency?

  o   How will team progress meetings be conducted (virtual or in-person) and how often?

  o   Will workshops be required, what type (virtual or in-person), and how often?

  o   If a PAC is formed, will these be virtual or in-person?

  o   Will other communication be made outside meetings?

The resulting scope of work will serve as a guiding document throughout the model development process for both the consultants and the project team as a whole.

Next Steps

Once the stakeholders and project team are identified and the project is scoped, the project team should consult Chapter 3, Preparing Model Data. This chapter prepares the team for identifying, gathering, and vetting the data needed.