Virginia Department of Transportation (VDOT)

Travel Model Improvement Program Peer Review

Report Date: June 2015

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Virginia Department of Transportation (VDOT)

Peer Review

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16. Abstract This report details the proceedings of a peer review of the Virginia Department of Transportation's (VDOT) statewide transportation model. The peer review was intended to provide guidance to the VDOT Transportation and Mobility Planning Division on their statewide model, which is currently under development.		
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1.0 Introduction

1.1 Disclaimer

The views expressed in this document do not represent the opinions of FHWA and do not constitute an endorsement, recommendation or specification by FHWA. The document is based solely on the discussions that took place during the peer review sessions and supporting technical documentation provided by Virginia Department of Transportation (VDOT).

1.2 Acknowledgements

The FHWA would like to acknowledge the peer review members for volunteering their time to participate in this peer review. Panel members include:

- Alan Horowitz – University of Wisconsin-Milwaukee
- Becky Knudson – Oregon Department of Transportation (ODOT)
- Subrat Mahapatra – Maryland State Highway Administration (MDSHA)
- Jeremy Raw – Federal Highway Administration (FHWA)
- Janie Temple – Texas Department of Transportation (TxDOT)
- Scott Thomson – Kentucky Transportation Cabinet (KYTC)
- Ken Cervenka – Federal Transit Administration (FTA) – Peer Review Advisor

Additional biographical information of each peer review panel member is located in Appendix C.

1.3 Report Purpose

This peer review was supported by the Travel Model Improvement Program (TMIP), sponsored by FHWA. TMIP sponsors peer reviews in order that planning agencies can receive guidance from and ask questions of officials from other planning agencies across the nation. The peer review process is specifically aimed at providing feedback to agencies on travel modeling endeavors.

The primary objective of the VDOT peer review was for VDOT Transportation and Mobility Planning Division to receive guidance on their statewide model, which is currently under development.

The peer review panel convened for one day (11/3/14). During that time, VDOT presented background information, presented a list of questions to the panelists(see Section 3.3), and asked for guidance on development of their statewide model. The panel discussed these items and offered a series of formal recommendations to VDOT.

1.4 Report Organization

The remainder of this report is organized into the following sections.

- *Overview of the Virginia Department of Transportation (VDOT)* – This section highlights the responsibilities of the agency as well as some key characteristics of the state of Virginia.
- *VDOT Statewide Modeling* – This section discusses VDOT's existing model, overall design and plan for development of their new statewide model, and the agency's goals for the current peer review.

- *Peer Review Discussion* – This section details the key discussions had by the peer review with VDOT, including panel responses to the questions VDOT posed to the panel members.
- *Peer Review Panel Recommendations* – This section highlights the official recommendations made by the peer review panel. Some of the key discussion points are revisited here, but some new details are also added.

Three appendices are also included.

- *Appendix A* – List of Peer Review Panel Participants
- *Appendix B* – Peer Review Meeting Agenda
- *Appendix C* – Peer Review Panel Member Biographies

2.0 Overview of Virginia Department of Transportation (VDOT)

2.1 State of Virginia

Virginia consists of 95 counties and the population of the state has grown from 7.1 million in 2000 to 8.0 million in 2010, an increase of about 13% (according to the Census Bureau). Median household income is approximately $64,000.

Virginia contains 15 Metropolitan Planning Organizations (MPOs), three of which are only partially contained in Virginia. Table 2-1 shows a complete list of MPOs in the state.

Table 2-1: Virginia Metropolitan Planning Organizations (MPOs)

MPO	State(s)	Major City	Area (sq. mi.)	2010 Census Population
Blacksburg-Christiansburg-Montgomery Area MPO	VA	Christiansburg	113	79,260
Bristol MPO	TN, VA	Bristol	266	93,307
Central Virginia MPO	VA	Lynchburg	353	153,316
Charlottesville-Albemarle MPO	VA	Charlottesville	195	113,074
Danville MPO	VA	Martinsville	198	65,689
Fredericksburg Area MPO	VA	Fredericksburg	698	275,639
Hampton Roads Transportation Planning Organization	VA	Chesapeake	2,082	1,618,505
Harrisonburg-Rockingham MPO	VA	Staunton	106	74,365
Kingsport MPO	TN, VA	Kingsport	281	125,260
National Capital Region Transportation Planning Board	DC, MD, VA	Washington	3,111	4,991,324
Richmond Area MPO	VA	Richmond	1,482	934,060
Roanoke Valley MPO	VA	Roanoke	229	227,507
Staunton-Augusta-Waynesboro MPO	VA	Augusta	124	74,964
Tri Cities Area MPO	VA	Petersburg	313	149,029
Winchester-Frederick County MPO	VA	Winchester	103	78,440

According to the existing statewide travel model, most travel within the state is short distance in nature, with 95% of passenger trips under 100 miles in length. While long-distance trips make up only 5% of all trips, they account for over 25% of the VMT in the state (at least on arterials and freeways). Richmond tends to generate more long-distance intrastate trips than other areas, while Virginia Beach is a key attraction for long-distance intrastate travel. Intrastate passenger rail is a relatively small market compared with auto.

According to the statewide model, the largest freight movements in terms of tonnage are by trucks with about 60% of the market. Rail accounts for 35% of freight movement, while water (4%) and air (less than 1%) account for the remainder. Only slightly greater than half of freight movements within the state originate or terminate (or both) within the state, with the remainder being through movements.

A key piece of legislation related to travel improvement projects in Virginia is the Virginia House Bill 2 (HB 2), signed into law in 2014. HB 2 requires the development of a prioritization process for projects funded by the Commonwealth Transportation Board (CTB). According to HB 2, the "prioritization process shall be based on an objective and quantifiable analysis that considers, at a minimum, the following factors relative to the cost of a project or strategy: congestion mitigation, economic development, accessibility, safety, and environmental quality." The CTB shall select projects for funding pursuant to the provisions of this Act beginning in 2016.

2.2 VDOT Responsibilities

The Transportation and Mobility Planning Division (TMPD) of VDOT maintains the Virginia Transportation Modeling (VTM) Program. One of the primary goals of the VTM is to assist in the maintenance of models and enhancement of modeling practice in the state, including at the MPO level. It also serves as a peer exchange for discussing modeling techniques and procedures with local and regional agencies and it sponsors modeling training. The group also developed a manual of modeling policies and procedures[1] for the state.

One of the primary responsibilities of the TMPD is the maintenance of several of the state's MPO models. However, district planners and MPO staff also have key roles in maintaining these models, as illustrated in Figure 2-1. Figure 2-2 shows the location of each regional model in Virginia, and the agency responsible for maintaining each model. In total, 12 models are maintained by VDOT's central office staff. The statewide model was the focus of the peer review meeting.

[1] VDOT Travel Demand Modeling Policies and Procedures, 2014. http://www.virginiadot.org/projects/resources/vtm/VTM_Policy_Manual.pdf.

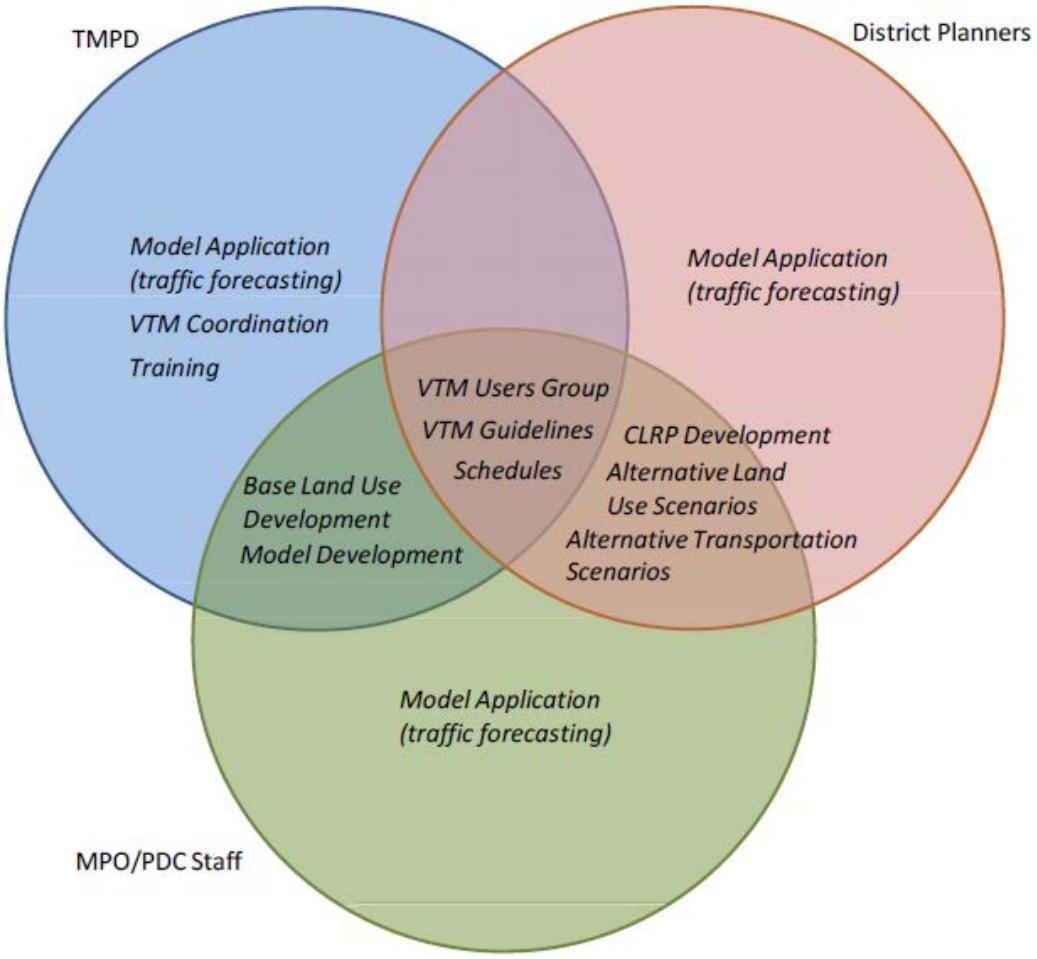

Figure 2-1: Stakeholder Roles in Transportation Model Maintenance

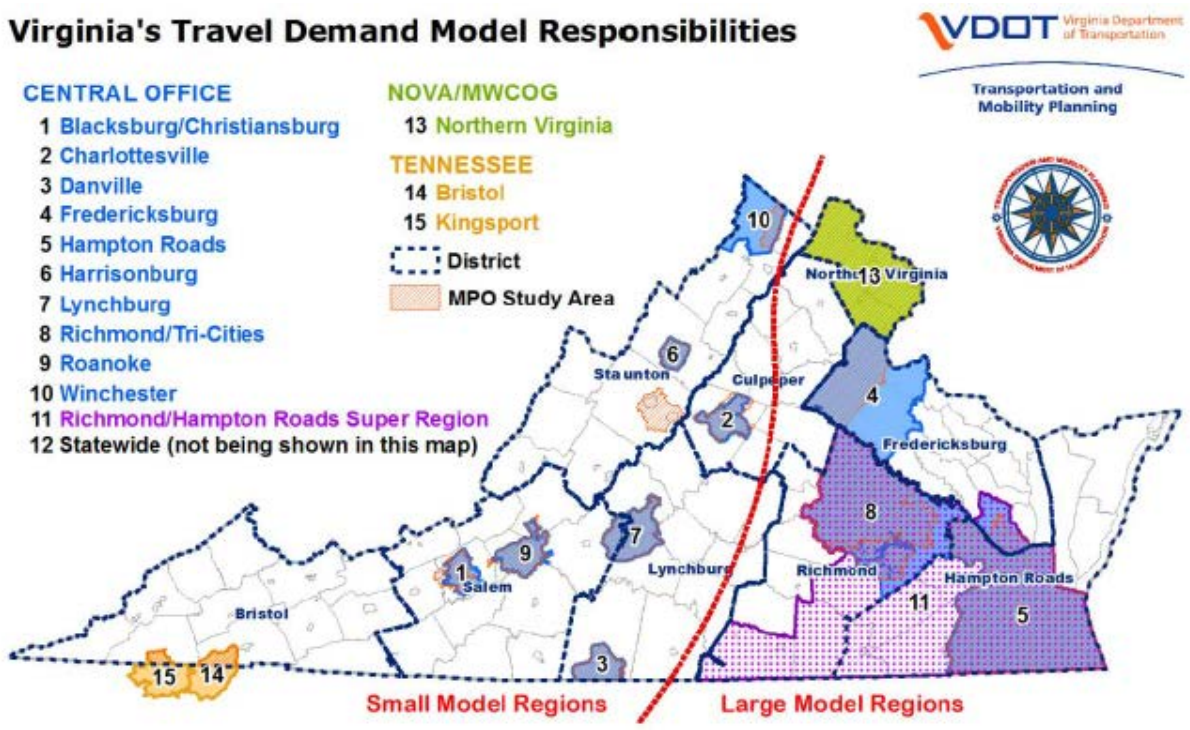

Figure 2-2: Virginia Transportation Model Responsibilities

2.3 Role of the Office of Intermodal Planning and Investment

A key partner for VDOT is the Virginia Office of Intermodal Planning and Investment (OIPI). OIPI leads transportation planning for the state. The OIPI's goals are "to provide solutions that link existing systems, promote the coordination of transportation investments and land use planning, reduce congestion, improve safety, mobility, and accessibility, and provide for greater travel options."[2] The OIPI serves as an advisory group to the Virginia Commonwealth Transportation Board (CTB) and the state's Secretary of Transportation.

The OIPI is particularly important with respect to HB 2, described above. Both OIPI and VDOT recognize the importance of an application and policy sensitive statewide travel demand model to support the project prioritization process emphasized by HB 2. Because of this, OIPI would like a higher degree of comfort with the accuracy of the statewide model. In the past, they have experienced problems with models, so looking back to assess what made previous models successful or unsuccessful is important as is willingness to try new approaches and techniques. The OIPI listed several items of particular importance for the development of the new statewide model:

- Wants the model to accurately forecast where people are going and how long it is taking them.
- Would like the model to be dynamic, with the ability to incorporate new data and new tools as they become available.
- Would like to use the model for the multimodal long-range plan.

[2] Code of Virginia, § 2.2-229. Office of Intermodal Planning and Investment of the Secretary of Transportation. http://law.lis.virginia.gov/vacode/title2.2/chapter2/section2.2-229/.

- Use the model for HB 2 project prioritization.
- Would like the model to be understandable to the general public.

With this in mind, VDOT's goal is to operationalize their new statewide model before HB 2 becomes effective in July 2016, and is working with OIPI to do so.

3.0 VDOT Statewide Modeling

3.1 Existing Model

The existing statewide travel demand model used by VDOT was developed in 2005. The primary model area includes the entire state and surrounding areas. Overall, the model includes 1,000 primary traffic analysis zones (TAZs) located within the state, and an additional 600 external TAZs. Those primary TAZs within the state are further broken into over 6,000 sub-TAZs. The network contains nearly 250,000 links and over 100,000 nodes. The TAZ structure and network are shown in Figure 3-1.

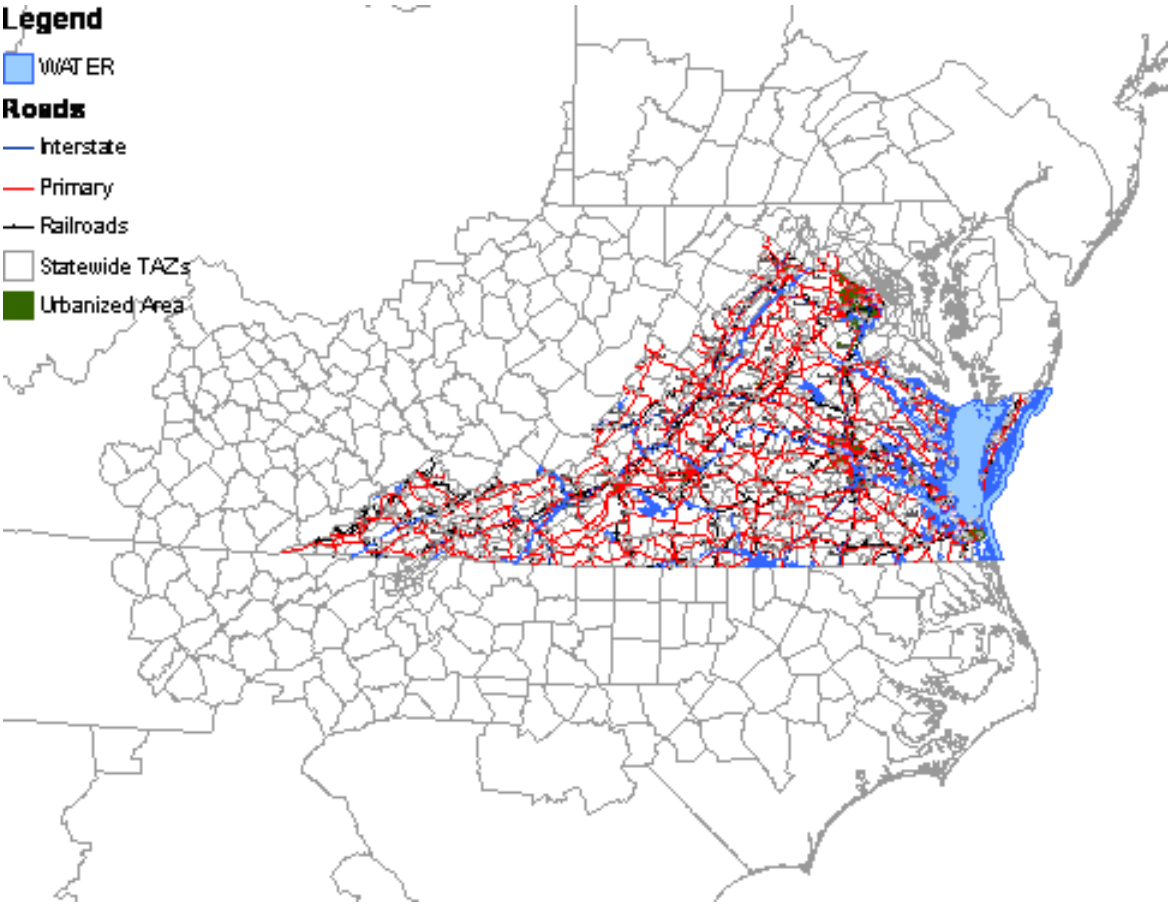

Figure 3-1: Modeling Geography of Existing Virginia Statewide Model

Like many statewide models, trips are segmented into different types. The two primary categories are passenger and freight travel. Passenger trip segmentations are shown in Table 3-1.

Table 3-1: Existing VDOT Statewide Model Trip Segmentation

Trip Type	Distance	Purpose
Person Trips	Long-Distance	Business
		Tourist
		Other
	Short-Distance	Home-based work
		Home-based other
		Non-home-based

3.2 Statewide Transportation Model Improvement Plan

In large part due to the introduction of HB 2, VDOT is developing a new statewide transportation model. Moreover, the timeframe for completing model development is relatively short, only 12 months.

Modeling Needs & Objectives

In planning for development of the new statewide model, VDOT identified several modeling capabilities and policies that the model should be sensitive to:

- **Toll Modeling**
- **Time of Day**
- **Freight**
- **Metrics** – congestion levels, economic indicators, accessibility, safety, environmental quality.

Due to the short timeframe for model development, VDOT developed a six-component plan for development of the model:

- Data Development
- Project Management and Coordination
- Passenger Model Development
- Freight Model Development
- Model Validation/Calibration
- Documentation and Training

Data Development

The data development task will focus on several key data items needed for model development, including development of the TAZ structure, network development, socioeconomic data, data related to passenger travel, and calibration/validation data.

The TAZ structure will cover all of Virginia, using TAZ boundaries consistent with the state's regional models and Census boundaries. Some aggregation of these boundaries will be required. In addition, the TAZ structure will be extended to neighboring counties, and an even more detailed geography in neighboring districts in Washington, D.C. and Maryland, due to

strong interactions that occur in that area. For freight modeling, the TAZ system will extend to all of the contiguous U.S., Mexico, and Canada, though at a relatively rough geographic scale.

The highway network will be developed using the HERE network, with speed and capacity lookup tables based on area and facility types. For out-of-state travel, the Freight Analysis Framework (FAF) network will be used. Transit network data will consider both intercity and urban transit systems, and will be based on the Virginia Department of Rail and Public Transportation (DRPT) network.

Socioeconomic data will mostly consist of population, household, and employment data, and will come from Census 2010, Census Transportation Planning Products (CTPP), and ACS survey data. In addition, data from the state's MPOs, the Virginia Employment Commission (VEC), and the Center for Public Service of the University of Virginia will be used.

Passenger travel information will primarily come from the National Household Travel Survey (NHTS) 2008-2009. Virginia purchased an add-on from that survey, so the data is richer than it would otherwise be. In addition, AirSage Data and special generator data will also be considered. AirSage data will be particularly useful for validation and for developing estimates of external travel and some long-distance interchanges in the state. Special generator data will come from traffic flow data to/from airports, seaports, and intermodal rail terminals.

Several sources of data can be used for calibration and validation of the model. These include INRIX speed and travel time data, HERE data, vehicle counts, as well as other sources.

Passenger Model Development

The passenger model will be split into two key components: short-distance trips (less than 50 miles) and long-distance trips (greater than 50 miles). The overall model structure will use a variant of the traditional 4-step procedure, including trip generation, destination choice, mode choice, time-of-day split, and traffic assignment. The overall modeling process will closely resemble VDOT's recommended travel demand model process defined in their manual, and as shown in Figure 3-2.

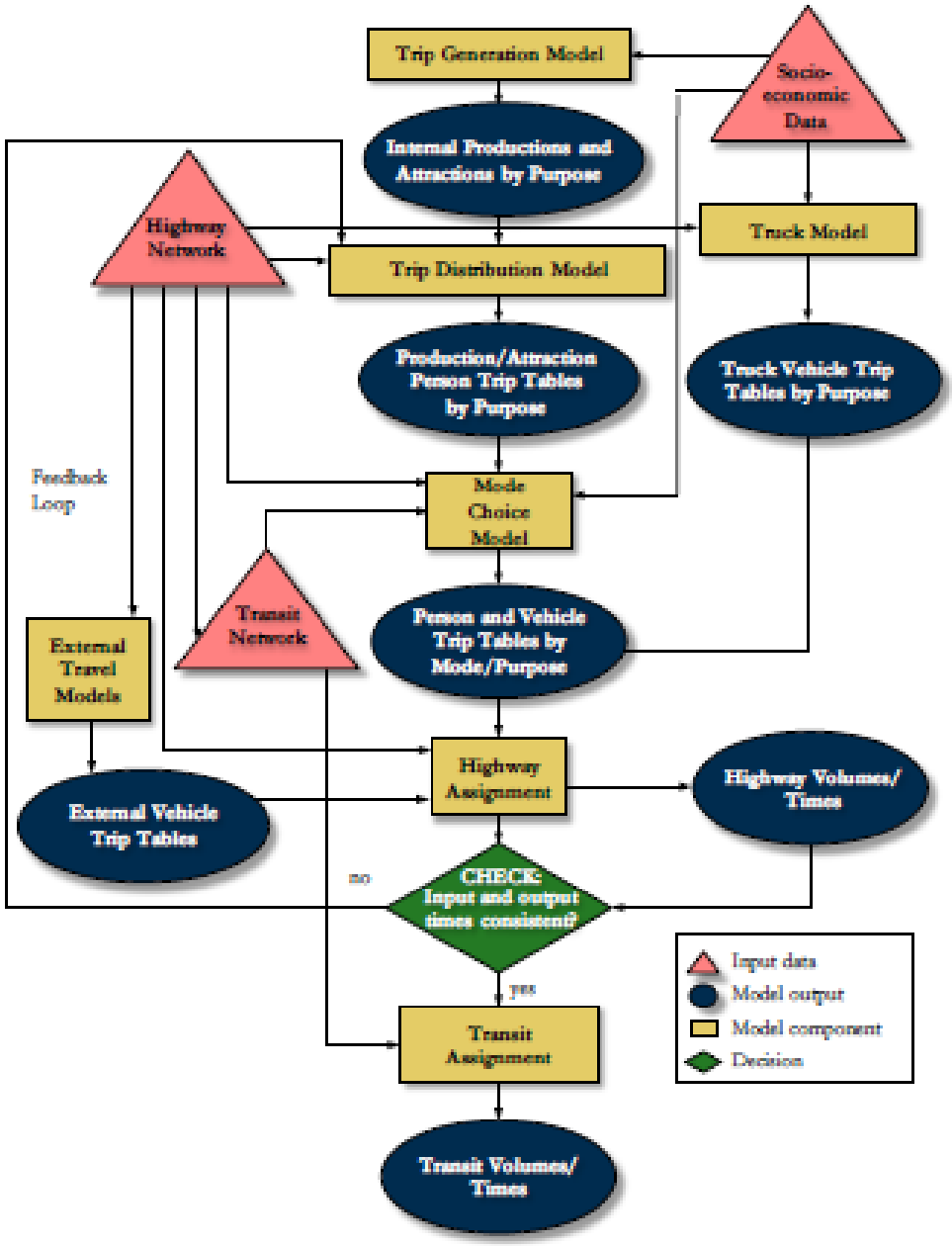

Figure 3-2: Example Four-Step Modeling Process[3]

Trip generation for short distance trips will be based on trip production and attraction rates. Internal-internal, internal-external, external-internal, and external-external trips will each be estimated separately. The model will consider six trip purposes: home-based work, home-based shop, home-based social/recreation, home-based other, non-home-based work, and non-home-based other. The trip generation rates in existing MPO models will be reviewed and incorporated as possible to ensure consistency between the statewide and MPO models.

[3] VDOT Travel Demand Modeling Policies and Procedures, 2014. http://www.virginiadot.org/projects/resources/vtm/VTM_Policy_Manual.pdf.

For long-distance trips, trip generation will be quite similar in many ways, using trip production and attraction rates, but it will also include two additional trip purposes, home-based business and home-based vacation trips. In addition, trip rates will be tied to control totals for both short- and long-distance trips to avoid potential issues of double counting. The 2001 NHTS and 1995 American Travel Survey (ATS) long-distance components will be used where possible, and will be supplemented with AirSage data as needed in model development.

The destination choice models for both short- and long-distance components will be very similar in nature, using a multinomial logit (MNL) model structure. Both will use as a key measure of impedance, the composite utility (or logsum) across travel modes. Travel modes will be defined differently for short- and long-distance models.

Short-distance mode choice models may consider a number of modes. Analysis of the survey data will be used to identify specifically which modes will be used. The list of potential modes includes auto (drive alone, shared ride 2, and shared ride 3 or more) and transit (walk access and drive access). The long-distance model will pivot off the DRPT intercity rail travel demand model, which was last updated in 2008. The model will require some significant modifications as the current model is a 2-step model, first forecasting market size, then forecasting mode shares. Key impedance measures will include travel time, travel cost, frequency of service (for public modes), and on-time performance. Impedance measures will be specific to time periods in the day, defined by the time-of-day model. Appreciating how access and egress attributes are valued differently than attributes of common carrier modes will be important for the long-distance model.

Four time periods will be used for the statewide model: AM peak, midday, PM peak, and overnight. Four of the state's MPO models currently have time of day components, but the time period definitions vary across each as shown in Table 3-2. The Metropolitan Washington Council of Governments (MWCOG) time period definitions will be used for the statewide model using splits estimated from the NHTS add-on data.

Table 3-2: Time-of-Day Periods in Virginia MPO Models

Period	Hampton Roads	Northern Virginia	Richmond	Fredericksburg
AM Peak	06:00 – 09:00	06:00 – 09:00	06:30 – 08:30	06:00 – 09:00
Midday	09:00 – 15:00	09:00 – 15:00	08:30 – 16:00	09:00 – 15:30
PM Peak	15:00 – 18:00	15:00 – 19:00	16:00 – 18:30	15:30 – 18:00
Overnight	18:00 – 06:00	19:00 – 06:00	18:30 – 06:30	18:00 – 06:00

Highway assignment will use multi-user class, user equilibrium approach for each time period. The models will consider at least three classes of autos: drive alone, shared ride 2, and shared ride 3 or more. Trucks may be included in separate classes, or may be preloaded on the network. Conical volume-delay functions will be used to estimate the interaction between volumes and congestion levels. Transit assignment routines will also be conducted for peak and off-peak periods. The final step will be feedback loops to ensure convergence between demand and supply levels.

Freight Model Development

The freight model will be split into two components: an intrastate truck trip model and an interstate freight model. The intrastate truck trip model will use American Truck Research

Institute (ATRI) and Trimble GPS data. The GPS data must be processed to identify stops among GPS coordinate data, and land use information at those stops must be identified. The model will consist of two parts. The first part is trip generation, including trip production and attraction, which relates truck trip ends to land use characteristics in a TAZ. The second is trip distribution, which will use a gravity-type model to link origin and destination trip ends identified from trip generation step.

The interstate freight model will use TRANSEARCH database. The 2010 data for Virginia will serve as the primary source of commodity flow information to develop the model. The dataset will be based on flows that start/end in Virginia or travel through the state. The basic approach will be to determine the relationships that govern these commodity flows with respect to the corresponding industries that produce them. The modeling procedure will be similar to the 4-step approach.

Model Validation and Calibration

Model validation will focus on several validation items. These include traditional validation standards, like traffic counts, VMT, transit boardings, and matching screenline counts. They also include measures for each individual model component. Several documents will be used as references for model validation:

- VDOT Travel Demand Modeling Policies and Procedures Manual (2014)
- Travel Model Improvement Program (TMIP) Travel Model Validation and Reasonableness Checking Manual – Second Edition
- National Cooperative Highway Research Program (NCHRP) Report 08-36/Task 91, Validation and Sensitivity Considerations for Statewide Models
- Federal Highway Administration (FHWA) Quick Response Freight Manual – I and II

3.3 VDOT's Goals for the Current Peer Review

The overall goal for the peer review meeting from VDOT's perspective was for the peer review panel to assess the statewide model development work plan (as summarized in the previous section). At the time of the meeting, VDOT was just getting started with the data development phase of the work, and the peer review meeting was quite timely in that regard. They hoped the peer review would help them identify and evaluate the capabilities and limitations of statewide models and VDOT's own work plan.

In preparation for the peer review meeting, VDOT devised five key questions for which they wanted response from the peer review panel members, specifically those from other state agencies:

- What is the reason your state develops/maintains a statewide model?
- What are the policy needs addressed by your statewide model?
- What are the top five challenges in the development of your statewide model?
- What are the top five applications for your statewide model?
- What are the top five pieces of advice you would like to share with VDOT?

In addition to the five questions listed above, VDOT prepared several other questions of the peer review panel members.

- What types of policy analyses has your agency used the statewide model for successfully, and what types of policy questions do you feel your statewide model is not appropriate for (or other analysis methods are needed in conjunction with the model)?
- What decision processes did your agency go through and what tradeoffs were considered in determining their model structure?
- Is there any efforts made to address MAP-21 requirements in your statewide model?
- How does your statewide model interact with MPO models?
- Do you use your model in transportation project prioritization?
- What data sources did your agency use to develop the model? How often do you update the model, including survey data?
- Does your state have a statewide land use model or economic model? Have you integrated it with you statewide travel demand model?
- What techniques does your agency use in different modeling steps?
- Does your statewide model take into account special generators (passenger trips as well as truck trips)?
- Is your statewide model a time of day model?
- How does your statewide model account for different passenger travel modes?
- How does your statewide model account for different models of freight transportation?
- How does your statewide model account for toll facilities?
- How does your model account for economic impacts? What steps did your agency take to plan and design the travel demand model outputs to inform their economic analyses?
- What challenges did your agency overcome in developing your statewide model? If you had a chance to start over again, what would you do differently?
- How does your agency account for fuel use, emissions and land use?

4.0 Peer Review Discussion

The peer review discussion consisted of several parts. First, a representative from the OIPI described their goals for the statewide model as a planning partner to VDOT. Second, VDOT presented some of the specifics of the statewide modeling plan and goals from their perspective. The details of OIPI's and VDOT's goals are described in the previous section. Finally, the panel members commented on and answered many of the questions VDOT posed to the panel, as described in the previous section.

4.1 Panel Discussion of OIPI's Role

As described in the previous section, the OIPI would like the statewide model to be used in the project prioritization process. The model should be adaptable in the sense that it could be updated or modified as new approaches become available. OIPI would also like to use information from the model for the multimodal, long range plan for Virginia.

As one panel member mentioned and confirmed by VDOT and OIPI, VDOT is looking for objective measures that one could compare across projects. The legislation passed in Virginia proscribes that the same measures be used everywhere in the state. Other tools are being developed to actually prioritize projects, partly on the basis of those measures identified by the model. The panelist cautioned that there are always uncertainties in model forecasts, which necessitates a subjective layer of evaluation in addition to those objective measures. This is critical to understand that uncertainties exist in the forecasts, and to understand what actually drives the results. Another panel member warned that developing objective tools can be very difficult, and perhaps impossible. There will always be cases where certain projects or types of projects perform poorly with respect to certain metrics, and different metrics may be needed for those projects.

A couple of panelists commented that the statewide model should focus on addressing things that other tools cannot address at present. VDOT and OIPI have a myriad of tools at their disposal already, so identifying what those tools do well, but more importantly, what those tools do not do so well is important. Another panel member noted the importance of different tools being able to talk to one another in some way, or for there to be some internal consistency among the different tools that are used, so that conflicting results do not arise.

4.2 Panel Discussion of VDOT's Approach and Goals

VDOT's overall modeling plan and goals for the model were described in Chapter 3. These were presented to the peer review panel, and several specific areas of the statewide model were discussed in more detail.

Values of time (VOTs) used in the model were one key area of concern for several panelists. One panel member noted that while passenger VOTs tend to be rather stable, truck VOTs vary considerably, and the literature on truck VOTs may not be applicable everywhere. And, it will be important to determine truck VOTs, since trucks may be very sensitive to tolls. The panel member also commented that passenger VOTs should not be assumed to be equal across modes (e.g., passenger car vs. train), since, for instance, one can use time productively on a train and not while driving. Other panelists suggested that VDOT may need to make assumptions about things like VOT, and test those assumptions using the model. Then, examine the results and decide whether they make sense. If not, perhaps the assumptions should be changed. The panelists also suggested that VDOT be very transparent about these assumptions and what those assumptions mean for the model.

Another panel comment dealt with using information taken from the literature (e.g., asserted parameters), which can be very valuable. If other studies have found one answer, and VDOT's analysis suggests something contrary, then results like this should be carefully examined to determine why there is a discrepancy. Another panelist was in general agreement, adding that these discrepancies do not necessarily mean something is wrong, but they should be noted, and, if possible, should be tested and paid attention to over time.

Several panel members commented on how models should be used. One panelist worried that people tend to rely too much on their models. Sometimes other more detailed tools are needed to evaluate certain projects or project types. This may be a small scale modification to the model or adding additional information. Using the model results out of the box is a mistake, however, and the analyst should always be interpreting results and making sure they make sense.

Another panel member suggested that some scenarios that may be of interest simply are not capable of being modeled, which can happen for a variety of reasons. In such cases, it may be possible to use other tools for the analysis, but use the statewide model as a visualization tool and to get metrics that are of interest. In that sense, the model would be a post processor of sorts. One panel member's agency is doing something very similar to this. This may be what a lot of statewide models are doing. Another panelist disagreed in concept, and that typically models are run, just like an MPO model, but results and numbers are often "massaged" in certain ways to match expectations. Operationally, these ideas may be very similar, however, where the model is run, but results must still be interpreted, rather than being used without adjustment.

4.3 Panel Discussion of VDOT Questions

Questions posed to the panel are documented in Section 3.3. This section summarizes the panel members' responses to those questions. Due the number of questions posed by VDOT to the panelists and the limited time for the peer review, the questions were prioritized, and some questions were not discussed.

4.3.1 What is the reason your state develops/maintains a statewide model?

While the panel member responses to this question were often similar in some ways, there was a fair amount of disparity across panel member responses as well. Therefore, each panelist's response is detailed individually below.

One panelist remarked that their model is used to plan for accessibility, efficiency, and environmental quality. The model is used to address policy questions, such as truck corridor analyses. Future traffic conditions, congestion levels, and air quality are forecast using projected housing and employment. There are no tolls in the panelist's state so the model does not consider VOT explicitly, but will be moving in that direction in the future.

Another panel member noted their state had two primary needs from the statewide model. First, it is used for statewide planning for rural areas, between the states' many MPOs. Second, the model is used to examine impacts of the North American Free Trade Agreement (NAFTA). So the state's goals are varied, evaluation of small projects outside the jurisdiction of MPOs, but also planning issues dealing with how the state fits in on a broader, national and international scale. One of the key challenges of the model is linking up the local level needs with the statewide needs. The first version of the model was developed in 1998, and the state is now on version 3. The panelist noted that with each revision to the model, new uses for the model are

identified. Lastly, the panelist remarked that the state is very aware of MAP-21 (especially related to the freight advisory committee), and this will likely become a key policy driver in the future.

A third panelist noted that the need for a statewide model in their state arose in the 1990's, when a lot of new policies and mandates came into effect. The panelist's agency was being left out of important planning discussions because the tools they had were antiquated, particularly relative to what was going in the key metropolitan areas. The model was originally intended to inform MPO models and to incorporate state economy and land use (particularly in response to the new policies which were primarily focused on land use). After using the model, they found that it was very applicable for economic scenario testing. The model is often used to provide bounds on growth, in order to help decision-makers deal with uncertainty in the future. It has also been used to examine specific scenarios, like a large earthquake, and it is used to aid in advancing the state's freight plans. The panelist commented that the agency is continually looking at how the model works, what it does well, and where it can be improved, and taking action to improve it when feasible. This state typically uses other tools for project prioritization.

Another panel member agreed with the general uses the other panel members described, emphasizing that freight was a big driver in the panelist's state. In addition, the model is used to drive project planning in rural areas without MPO coverage and as a scenario testing tool to inform policy makers. Overall, the model is used to evaluate a number of policies, including MAP-21 performance measures, smart growth strategies, the state's freight implementation plan, greenhouse gas emissions, and the state's transit plan.

A topic that arose from this question was the need to model transit in statewide models. One panel member was not aware of any statewide models implemented for transit planning, mostly because the models are not robust enough to get it right. Another panelist noted that in the panelist's state, transit was included in the model, but the detail came from the MPOs and it was not a priority. For intercity and long-distance passenger modes, they were mostly used to ensure good validation of highway measures.

4.3.2 What are the top five challenges in the development of your statewide model?

Of the panel member responses to this question, common themes emerged in terms of key challenges. A number of panelists noted data challenges. Accurate socioeconomic and employment data can be difficult to obtain and surveys are typically too expensive to conduct frequently. Another key data concern is keeping all the data (especially input data) up-to-date and consistent with the state's MPO models. Dealing with rail and operations data can be challenging, particularly because it often requires extra time to clean the data. Other data items were also noted as concerns, including validation/calibration data (e.g., traffic counts) and network data,. One panelist commented that limitations with data can create limitations for the model.

Another common theme among the panelists was information technology (IT) and hardware and software issues. In one case IT issues originated as a legislative issue in the state. In several cases, obtaining the necessary hardware to run the model proved difficult, and getting the necessary space to store model run results can also be challenging.

Several panelists commented on staffing needs here as well. It is important to have in-house expertise on the statewide model, so that as issues arise, there are individuals capable of identifying sources of such issues and making modifications if necessary. Getting in-house expertise can be particularly challenging when consultants are retained to actually develop the

model, as is the case in Virginia. In addition, it was noted that matching model sophistication to staff expertise can be beneficial. Overstepping the expertise of the in-house staff can create issues.

Keeping the model up-to-date can be an important challenge. For instance, it is desirable for the statewide model to be consistent with MPO models. This goes beyond the consistency of data sources, as described above, and includes consistency between the models themselves, and in some cases, integration of the statewide model with the MPO models. It is clear that maintaining consistency across these different tools is important, but it provides a key challenge to development of the statewide model. In some cases if a good relationship is maintained between MPOs and the state agency, these issues can be mitigated to some extent. But there is also always the challenge of keeping rural areas and areas external to the state up-to-date.

Another challenge that was discussed dealt with modeling rural areas of the state, which Virginia will also have. In one case, trip rates in certain rural areas were much lower than other areas, primarily due to standard of living considerations. In this case, it has been a key challenge to account for these differences in the model in a satisfactory way.

Other challenges were also mentioned. One panel member's state went through a lot of trial and error in development, and the panelist emphasized that keeping the model design simple can be important so that the model is ultimately utilized. Another panelist remarked that there is often too little time in the schedule to do everything that is desired from a modeling perspective. The one-year schedule that VDOT has proposed seemed very short to this panelist, and suggested that VDOT will need to be highly coordinated to accomplish this (e.g., by working in parallel, etc.). A third panel member commented on the accuracy of long-distance person trip flows, noting that there is a great deal of uncertainty associated with such flows. Another panel member felt that AirSage data (which VDOT is obtaining) could be useful to inform those flows, but such data may be biased in several ways, and thus, not the whole answer.

4.3.3 What are the top five applications for your statewide model?

The panel responses to this question were, again, quite varied. Each panel member's response is detailed individually below.

One panelist noted that their statewide model is used for long range planning studies, like freight plans and statewide transportation plans. However, the model is also used for other purposes. For instance, the state's highway system is deteriorating, and so the model has been used to test what happens if different levels of maintenance and preservation are pursued, including a relatively small budget with little preservation and minimal maintenance, or a higher budget to maintain current conditions. The model has been used to evaluate impacts of a major earthquake and how the state's economy and transportation services operate in the event of prior mitigation compared to no preparation in advance. In addition, the model was used to examine the economic impacts of cracking bridges requiring weight restrictions over time on the state transportation system. The impact to commodity flows and the economy ultimately led to a plan for repairing many bridges. Visible studies such as these will lead to intense scrutiny of the modeling tools and methods, which should be planned for in the model development and application program. Thus, good documentation and a peer review process are very important. It is also important to report results in the form appropriate to the tool. For example, this statewide model reports relative changes and growth rates, not quantities for which it was not designed to predict.

Another panel member's agency uses the statewide model a lot for freight applications. For instance, that state's ports group uses the model extensively, and they have used the model for

port-to-airport studies and to crosscheck freight commodity flow studies, usually conducted at the MPO level. The model has also been used to answer questions regarding commuter rail, interregional analyses, and corridor studies.

Like the agencies above, a third panel member's agency uses the model for corridor studies and for the state transportation plan. This agency also uses the model for a lot of scenario analysis, including evaluation of smart growth strategies, managed lanes (e.g., tolling and HOV), and accessibility studies. This model includes a time-of-day component, which they use to get efficiency measures from the model. In addition, this state recently started to integrate the model with SHRP 2 – C11 products for estimating economic benefits.

Another panelist's agency is using their statewide model for a variety of applications. One model application that has proven very beneficial for the state is in providing external flows to the MPO models. They have also used the model a great deal for estimating diversions to new roads, and diversions resulting from road closures or work zones, which is captured well by the model. The model is used to obtain point-to-point travel times and provides estimates of ADT, though it does not capture congestion so well, since the model does not have a time-of-day component. The panelist suggested that one nice feature of the model is that it runs in only 10 minutes, which allows the agency to be quite responsive to requests.

4.3.4 What decision processes did your agency go through and what tradeoffs were considered in determining their model structure?

One panelist remarked that the process for statewide model development at their agency started with project justification, since there was some opposition to it. Many believed that the MPO models should be enough and that a statewide model was unnecessary. In this case, a lot of work went into the networks and freight models. Instead of worrying about freight mode choice, they focused on enhancing truck trip tables. In addition, there was a desire to make the statewide model complimentary to and consistent with the MPO models. For instance, there was a need to model intercity mode choice for intercity buses and commuter rail, but for more local modal questions, they would defer to the MPO models. The focus was on areas where the MPO models were weak, and less focus was given to areas where the MPO models were strong. In addition, the panelist believed the modular approach to model enhancements has worked well for the state.

A second panelist commented that temporal and spatial resolution is a very important consideration, and this dictates the model structure. In the panelist's case, there were only a few needs for the model, however, which may be different from VDOT. The panelist emphasized that the needs should drive the outputs of the model, and the outputs will drive the model structure. So focusing on the needs prior to setting the model structure is important.

Another panel member's agency has a statewide model users group. In the agency's last round of model updates, they obtained feedback from this user group to help inform where investments were made. They also obtained feedback and recommendations on what was possible with respect to modeling techniques and data availability. The deciding factors upon which updates were made, however, were the primary uses of the model and how much time was available for the updates. The agency for the most part abandoned attempts for operational and economic analysis, but focused on the best possible integration with MPO models in the state.

In another case, the statewide model started getting overly complex and taking too much time to develop. That panelist noted that a lot of the models were simplified (e.g., with look up tables) in order to get the model up and running. For instance, look up tables replaced models in some

instances. In addition, freight commodity flows were replaced with truck flows, using modal hubs to identify reasonable trip ends. Two truck types are modeled, including service-related and freight long-distance. These simplifications have resulted in huge gains in model run times, from over two hours to just 15 minutes, which has been very useful to the agency. The panelist mentioned that a time-of-day component was explored, but ultimately it did not work well and was abandoned.

One panel member remarked that model development at their agency began by having a stakeholder meeting with peer reviewers, which helped to get everyone on the same page (including MPOs and other partners) with respect to needs and expectations for the model. This collaboration was important and helped them avoid "dueling" models and identified common objectives. The initial statewide model was in one complete software package, which suffered from the "black box" syndrome. This made improving features of the model very difficult, as well as understanding the internal assumptions and subtle details within the model. This experience led to following a modular approach for the next generation of the model. Resources are focused on specific areas of model performance for upgrades and enhancements. In hindsight, we believe the best approach to developing new models is to keep the design as simple a possible to meet the needs of the agency. Once it is used in practice, improvements can be prioritized to meet the analytical goals of the agency.

4.4 Time-of-Day Model Component

VDOT was particularly interested in getting panel feedback on the importance of time-of-day modeling component. The panel had a brief discussion related to time-of-day modeling, which is described in this section.

The primary reason VDOT would like to have a time-of-day model component is that they are particularly interested in the congestion on the I-95 and I-81 corridors, and in managed lane policies. One panelist remarked that, at least for the I-95 corridor, the MPO model may be better equipped to answer questions there, since it is mostly contained within a single MPO.

In general, the panel agreed that incorporating a time-of-day component was a good idea, but they differed some in what they believed was necessary. One panel member questioned whether VDOT planned on asking the model how peak spreading actually occurs, or if they planned on extrapolating existing time-of-day data. If the latter, then a model may not be necessary, or a very simple model may suffice. Other panel members suggested starting with something fairly simple during initial model development, then being able to add more sophistication later on as VDOT better understand how the simpler model is working. In fact, something simple may be all that is needed. One panelist made the comment using multihour peak periods can cause issues for model assignment because multi-hour capacity measures do not work well for traffic assignment. The panelist suggested using a peak hour, rather than multi-hour peak periods. In the off-peak periods, it is less critical that capacity measures are multi-hour, since there is less congestion in off-peak periods.

4.5 Network Data

Several panel members had additional thoughts on the networks VDOT is using. One panel member commented that having a master network will make things easier to maintain. Another panelist noted that starting with the HERE network (as VDOT plans) will make things more difficult in terms of compatibility with the MPO networks. Network maintenance can be a big issue with different networks. One suggestion was to perhaps let the vendor of HERE data do the maintenance, and buy new data every few years. This suggestion was seconded by

another panel member. Another panelist warned that VDOT would need to be able to add all of the necessary attributes to the network seamlessly to make this work, and developing linkages between the master network (e.g., HERE) and other data sources (e.g., HPMS) is critical.

5.0 Peer Review Panel Recommendations

In the last half of the meeting, the peer review panel took about one and one half hours in an executive session, closed to all participants of the meeting except for the panel members. The reason for this was to allow panel members to speak freely and openly among themselves while developing formal recommendations. This section details those recommendations of the panel.

5.1 Metrics

The panel recommended that VDOT get very specific (and soon) about the measures of effectiveness and performance measures that the model will generate. More specifically, the panel suggested that VDOT consider the following questions/issues:

- What will the model generate and what are VDOT's needs from the model?
- How will the model results be presented (e.g., percent shift under scenarios or actual forecasts)?
- Clearly identify the role of this model in relation to various HB 2 performance areas. What will it estimate, and how will those results be used? Evaluate whether the developed model meets those needs.
- Do not use the model for conformity analysis, but it might help as a planning tool with environmental performance indicators from post-processing.
- There is no "one model that rules them all"; the statewide model is just one tool in the toolbox.

Most importantly, the panel emphasized that VDOT always keep an eye toward their needs. Keep expectations reasonable and remember that there are things a statewide model will not be well-suited for (such as modeling intra-urban travel). Keeping these issues in mind will be useful.

5.2 Price/Tolling Sensitivity

The panel asserted that price sensitivity and tolling sensitivity are important, and they should be accommodated in the model structure. Additional specific recommendations are as follows:

- These sensitivities can be handled through asserted values of time by trip purpose. A detailed local study would be required to do anything else (other than assert the values). It would be good to store values of time in an input file so that alternatives could be adjusted and tested.
- Look to local MPOs that may have done value of time studies for guidance.
- Using a before and after study may be a good way to do the estimation of values of time. Other methods are also plausible.
- Value of time is likely to be stable for trucks. It would take a study to determine difference in response for trucks in urban and rural areas.

The panel emphasized that VDOT test different values of time once the model is up and running. It is critical to look at how value of time affects results and how different "reasonable" values of time might generate different outcomes. Value of time is one area of uncertainty in the model. The literature can offer a range of plausible values of time, but sensitivity testing will help determine where in that range VDOT should be for their state.

In addition, the panel recommended that VDOT allow for significant shifts in vehicle occupancy that could affect toll costs and price sensitivity. This should be a feature built into the model software. The panel did not think that VDOT would necessarily use it or need it, but it will be good to plan for these sorts of possibilities.

5.3 Model Structure

VDOT should pursue development of a four-step, trip-based model, which is what VDOT planned for. However, the panel recommended that VDOT consider only minimal mode choice elements, rather than the more elaborate mode choice models VDOT planned. Additional specific recommendations are as follows:

- The model should be a person trip model, with simple factoring to vehicle trips.
- VDOT may consider a separate model to develop nuanced person-to-vehicle factors.
- The panel recommends deferring all transit considerations until a later phase.
- However, VDOT may want to consider intercity bus and/or rail at this stage.
- The panel recommends deferring aviation to a later phase as well (though the model may still consider airports as special generators).

The panel also suggested using a structured repeatable process for developing the required model parameters. A user guide that takes the owner through specific steps for developing model parameters from the data would be useful. Another reason for doing this is that it can be important for transparency with outsiders, and it can also be important if legal issues related to model forecasts ever arise.

5.4 Truck Model

The truck model should be a commodity-based model. In addition, the following recommendations/comments were made with respect to a truck model.

- Commodity-based models require a lot of data (e.g., FAF, TRANSEARCH).
- Keeping the model current will require an on-going effort.
- There should be a disaggregation step from counties to TAZs.
- Establishment information and LED may help disaggregate commodity data.
- The truck model should look at possible future shifts from truck to rail, or look at different growth rates in different commodity classes.
- VDOT should include FAF in truck data sources.
- VDOT should consider using ATRI and other origin-destination truck data to help disaggregate the commodity data.
- The panel suggested that there may be an opportunity to work with TRANSEARCH to develop estimates that match the state's truck counts. This has been done with success in other states. In this case, the panel recommends splitting the work into smaller pieces (e.g., three or four) and having multiple review points.

With respect to rail freight movements, the panel recommended that VDOT consider the Rail Carload Waybill sample data as an additional data source.

VDOT had proposed to use ATRI-based data for truck modeling, which is not commodity-based. One panel member remarked that ATRI data does not have any policy sensitivity in it, and a lot

of corrections would be needed to use it well. Another panel member noted that the types of policies VDOT may be interested in are mode shifts between truck and rail and shifts across commodities. These questions cannot be answered with ATRI data, but can be with commodity flow data. However, the panel noted that ATRI and other disaggregate data sources can still be useful, and, for instance, can help disaggregate commodity flows from county level to TAZ level.

Another panelist noted that given the short time frame VDOT is working under, there really is not enough time to develop a rail network. Unfortunately, that is really what is needed to do any sort of mode split for freight. However, it would be possible to do some types of elasticity analyses to drive the truck component of freight, making it sensitive, in some ways, to modal type issues.

The panel also recommends that VDOT consider smaller trucks in their model, which are not represented in TRANSEARCH data.

- Smaller trucks tend to be shorter, more frequent trips.
- TRANSEARCH data does not provide this.
- The panel recommends that VDOT look to the commercial vehicle survey conducted in Calgary (and possibly in Ohio) as places to start.
- In the near term, the model structure should be designed to allow for representation of these trucks in the future (including placeholder data). This will allow for a seamless transition when local data for these trucks becomes available.

5.5 Model Geography and Network

The panel made several recommendations related to the extent of the modeling geography, as detailed below:

- If not already doing so, the panel recommends that VDOT aggregate MPO TAZs so the MPO demographic data can be easily incorporated, and consistency with MPO models is achieved.
- The panel recommends a 48-state model with a minimum number of external stations for both freight and passenger travel. For external passenger interstate travel, cell phone data (such as AirSage) could be useful to generate origin-destination trip tables, but it may be expensive.
- VDOT should consider using the LEHD to study trips to/from the halo. The halo refers to areas external to the state, but where modeling geography is still relatively disaggregate. These areas are close to the state boundaries.
- VDOT should consider setting external stations farther from the state boundary, to allow for shifts in state entry points in response to network changes.

Additional recommendations were made with respect to developing networks for the model:

- The panel recommends retaining as much detail from the base HERE network as possible (e.g., freeway ramps and interchanges).
- Minor roads can be removed, like locals and minor collectors.
- Procedures should be developed for attaching auxiliary information to the network links (e.g., functional class).
- Future year networks get harder to maintain with greater detail.

5.6 Consistency with MPO Models

The panel recommended that VDOT concentrate on validation outside the major MPOs, but attempt to reproduce all traffic with consistent trip generation and trip distribution (which would not necessarily be the same as the MPO model). In addition, the panel made the following points:

- Key validation points for counts are external stations to the major MPOs.
- It may be useful to look at through corridors in urban areas (long distance corridors). In such cases, enough detail in the links and zone structure will be needed to ensure shifts in traffic remain plausible.
- As zones are enlarged, network detail can shrink (with more trips becoming "intrazonal"). There is a balance here that should be considered.
- Differences in zonal and network detail between the statewide model and MPO models deserve attention to ensure the statewide model's network links in and around major MPOs are assigned reasonable traffic volumes (which result in reasonable speeds on those links).
- The panel recommends that VDOT use as much detail as can be managed with reasonable model run times.

5.7 Time-of-Day and Traffic Assignment

The panel recommended that time-of-day modeling should ideally be done in one-hour increments, with suitable disaggregation of trip tables. For instance, VDOT could develop a 24-hour demand table, factor to single hours, and then assign. However, this may be beyond the scope of phase 1 model implementation. For phase 1, aggregating hourly demand to four time periods and using static assignment procedures would be reasonable.

One panel member emphasized that time-of-day is critical, and it is not possible to do any sort of air quality or congestion analysis with 24-hour assignment. There are some biases with static assignment over one-hour periods, since some biases can emerge, particularly for a statewide model with long trips that may not complete within one hour. However, 24-hour assignment loses a lot of information that the model could be generating.

The panel recommended that assignment be capacity constrained.

- It could be multi-class assignment, or it might preload trucks to the network for assignment.
- In addition, VDOT should expect to pay close attention to speeds, and ideally, junction details to support assignment.

One panelist remarked that it is not possible to model intersection delay using volume-delay functions, as VDOT proposed. The 2010 Highway Capacity Manual (HCM) has tools for estimating delay for roads with intersection delay. The panelist contends that speeds are an important output to transportation models, and that can only be reliably performed if intersections are modeled correctly. Unfortunately, coding intersections (and their delay) correctly can require a great deal of time (e.g., 30 minutes per intersection), which probably eliminates this option for VDOT at this stage, but should be considered in later phases of model development if possible.

The panel believes that dynamic traffic assignment (DTA) is an option that VDOT should consider. However, this could be added to the model at a later time. Some specific recommendations/comments related to DTA are as follows:

- Without DTA, longer trips may not match well spatially.
- DTA may not require much higher level detail than VDOT is already planning.
- DTA may have trouble dealing with trips longer than a day (but the analyst can compensate with longer assignment periods, e.g., 72 hours).
- While the panel believes DTA might ultimately prove the best option, they suggested an acceptable baseline would be static equilibrium assignment with four time periods, using multi-class assignment procedures.

5.8 Other Items

The panel made several additional recommendations on a variety of topics. These recommendations are outlined below:

- The panel encourages VDOT to develop a long-term statewide data clearinghouse. This would be a standard place where all data is stored. In this way, all modelers in the state would have an inventory of all the available data and everyone would be starting with the same datasets.
- Developing a working model (with appropriate sensitivities) in the short time frame stated by VDOT will be very challenging. The panel recommends that VDOT keep the statewide model off of the short-term critical path if possible.
- VDOT should strive to key payments to their model development contractor off specific milestones and validation standards, with a clear definition of what is acceptable.
- VDOT should sync the base year with the 2010 Census. For future years, the panel recommends pivoting from the base year.

A couple of panel members offered some concluding remarks. One panelist suggested that developing a longer range plan for model development can be important (e.g., 3 and 5 years). In addition, it is important to keep in mind that there is a suite of models that can be used for analyses. The statewide model need not be capable of doing all analyses on its own.

Another panel member commented that the biggest issue will be development of person trip tables (which is an issue everywhere, and not just for statewide models). The panelist fears that even after VDOT goes through the process of destination choice and mode choice model development, the accuracy of the resulting trip tables may be quite poor. While a couple of other panel members believe that AirSage data could be a fresh source of origin-destination data that could be useful to verify model results, a different panelist does not think AirSage data is all that accurate either, and has encountered multiple agencies using origin-destination matrix estimation on AirSage data in order to validate the model.

6.0 Post-Meeting Comments

During preparation of this report, panelists were given an opportunity to comment on an early draft. At that time, several additional comments were made by panel members. Those comments are documented in this section. Many of the comments were related to the plan for updating the model, as outlined in Section 3.2 of this report.

Data Development

As documented in Section 3.2, VDOT plans on developing the TAZ structure to be consistent with TAZ structures of the state's regional models as well as Census boundaries. One panel member emphasized that the TAZ boundaries should nest or coincide with geographic boundaries in the Census, the previous statewide model, and regional models. Section 3.2 also highlights VDOT's plan to use the HERE network for developing the highway network and Freight Analysis Framework (FAF) network for out-of-state network development. In contradiction to this plan, one of the panelists suggested that the HERE network would be suitable for the out-of-state network only, but something more granular may be needed for in-state network development. Regarding socioeconomic data needs, it was unclear to one panel member what economic variables would be used, but suggested that the socioeconomic data include income. In addition, the panel member encouraged that spatial variables be used to distinguish travel patterns differences between rural and urban areas.

Passenger Model Development

Section 3.2 details that VDOT plans on using the long-distance component of the American Travel Survey (ATS) from 1995. One panelist remarked that this data was quite old, predating the relatively quick rise in travel costs over the past two decades and changes to the nation's economy during that time. A better (more recent) data source would be desirable in that sense. Another panel member remarked on the different time-of-day periods used by Virginia's key MPO models (as shown in Table 3-2), noting that the Richmond MPO and Fredericksburg MPO both use periods, in part, defined on half-hours (e.g., the ending time of the PM peak period in Richmond is 6:30 pm). The panelist worried that VDOT would need half-hour counts in those regions or else it would be difficult to calibrate and validate the model.

Model Validation and Calibration

One panelist encouraged that VDOT review travel times and speeds from the model during the validation process, comparing to observed travel times and speeds from other data sources.

VDOT's Questions to the Panelists

Even though the panel members had a chance to respond to each of VDOT's questions during the meeting, one panelist left something out of the original response. In response to what the top challenges of statewide modeling are, one panelist commented that model results are often viewed in a vacuum, but it is important not to attempt to extract too much from model results or overstep the level of precision of the model. Uncertainty exists in the model.

Appendix A List of Peer Review Panel Participants

This section lists all individuals who attended the meetings, including panel members, VDOT and planning partner staff, consultants to VDOT, and peer review support staff.

A.1 Peer Review Panel Members

Panel Member	Affiliation
Alan Horowitz	University of Wisconsin-Milwaukee
Becky Knudson	Oregon Department of Transportation (ODOT)
Subrat Mahapatra	Maryland State Highway Administration (MDSHA)
Jeremy Raw	Federal Highway Administration (FHWA)
Janie Temple	Texas Department of Transportation (TxDOT)
Scott Thomson	Kentucky Transportation Cabinet (KYTC)
Ken Cervenka (Peer Review Advisor)	Federal Transit Administration (FTA)

A.2 VDOT Staff

Name	Affiliation
Ju-Yin Chen	Virginia Department of Transportation (VDOT)
Tammy Davis	Federal Highway Administration (FHWA), Virginia Division
Shan Di	Virginia Department of Transportation (VDOT)
Jaesup Lee	Virginia Department of Transportation (VDOT)
Kelli Nash	Virginia Office of Intermodal Planning and Investment (OIPI)
John Simkins	Federal Highway Administration (FHWA), Virginia Division
Rick Tambellini	Virginia Department of Transportation (VDOT)
Peng Xiao	Virginia Department of Transportation (VDOT)

A.3 Agency Consultants

Name	Affiliation
Jay Evans	Cambridge Systematics

Feng Liu	Cambridge Systematics

A.4 TMIP Peer Review Support Staff

Name	Affiliation
Jason Lemp	Cambridge Systematics

Appendix B Peer Review Panel Meeting Agenda

November 3, 2014

08:00 Welcome & Introduction
08:15 Virginia Office of Intermodal Planning and Investment (OIPI) presentation
08:45 VDOT introduction of the goals of the peer review
09:15 Panel questions of VDOT
09:45 Break
10:15 Panel discussion on statewide model development and application experience
12:00 Lunch
13:00 Panel executive session
14:45 Break
15:00 Panel presentation of recommendations to VDOT
16:00 Summary and conclusion
16:30 Adjourn

Appendix C Peer Review Panel Biographies

C.1 Alan Horowitz, University of Wisconsin-Milwaukee

Alan J. Horowitz is a transportation engineer and an urban planner. His research spans the areas of travel forecasting and traffic impacts. Since coming to the University of Wisconsin-Milwaukee in January 1979, Professor Horowitz has been continuing his research into values of time, and conducting new research about urban trip tours, land-use impact assessment, single-route ridership forecasting, trip assignment, subarea focusing, ride quality of highways, intermodal passenger transfer facilities, transportation benefits, freight planning, applications of GIS to transportation networks, hazardous materials routing, intelligent transportation systems, and travel forecasting. Dr. Horowitz is the author of the Quick Response System II travel forecasting software platform.

C.2 Becky Knudson, Oregon Department of Transportation

Becky Knudson is a senior transportation economist for the Oregon Department of Transportation. Her responsibilities range from program management to technical analysis. Becky develops and applies economic, land use and transportation forecast models for use in long range planning and policy analysis. She is the program manager for the Oregon Modeling Improvement Program, and facilitates the Oregon Modeling Steering Committee and is the program manager for the Transportation Land Use Modeling Improvement Project which conducts work on the Oregon Statewide Integrated Model (SWIM). Her primary technical duties involve analysis using the SWIM. Most recent studies using the Oregon SWIM include:

"Economic Impact Analysis related to a Major Seismic Event for the Cascadia Subduction Zone" 2013, which was presented at the 2014 TRB annual meeting.
http://www.oregon.gov/ODOT/TD/TP/docs/Statewide/TRB_Paper_14_3017_revised.pdf.

"Oregon State Highway Performance Data and Metrics Related to Freight" 2013
http://www.oregon.gov/ODOT/TD/TP/docs/Reports/FreightCorridorMetrics_RC_3.13.13.pdf.

"Oregon Freight Plan Modeling Analysis" 2010
http://www.oregon.gov/ODOT/TD/TP/docs/ofp/ofpmodelingmemo.pdf.

Becky was the project manager of the statewide Oregon Household Activity/Travel Survey 2009-2011, which collected data to be used for statewide and urban model development activity. She has a Master's degree in Economics from Oregon State University and has been with ODOT for 17 years.

C.3 Subrat Mahapatra, Maryland State Highway Administration

Subrat Mahapatra is a Transportation Engineering Manager in the Office of Planning and Preliminary Engineering at the Maryland State Highway Administration (SHA). He is the project manager for the Maryland Statewide Transportation Model program. He provides analytical and program support for various travel modeling and traffic analysis initiatives at his agency and the Maryland Department of Transportation. Mr. Mahapatra leads several mobility and reliability performance measurement efforts at SHA including the Maryland State Highway Mobility Report and Reliability Roadmap. He also oversees the SHRP2 Capacity and Reliability Products Implementation at the agency. He works closely with the MPOs, other federal and state agencies, local governments and the university research community to develop analytical engines to support coordinated transportation programs and solutions for performance based planning and data driven decision-making. He serves on multiple NCHRP and SHRP2 research

panels at the TRB. He has a Master's degree in Civil Engineering from the University of Maryland at College Park and has over 12 years of professional work experience.

C.4 Jeremy Raw, Federal Highway Administration

Jeremy Raw, P.E., works in the Federal Highway Administration Office of Planning where he conducts research, development and deployment of modeling and data analysis tools, and provides related technical assistance to Metropolitan Planning Organizations and state transportation agencies. Jeremy has worked for local, regional and state transportation agencies in North Carolina and Virginia, including the Virginia Department of Transportation from 2006 to 2010. He has built and evaluated travel models for many agencies, and has worked extensively with statewide travel models, as well as freight and toll models. Jeremy's current research includes developing suitable analytic tools to support the increasing national emphasis on performance-based planning. Jeremy has also delivered training in best practices for statewide travel models on behalf of FHWA.

C.5 Janie Temple, Texas Department of Transportation

Janie Temple is the Transportation Analysis Branch Manager for the Traffic Analysis Section of the Transportation Planning and Programming Division of the Texas Department of Transportation (TxDOT) in Austin. Janie is responsible for coordinating the development of travel demand models, providing transportation analysis for pavement and geometric design to TxDOT Districts, overseeing the development and maintenance of a statewide analysis model for freight and passenger flows, conducting travel surveys, and participating in air quality conformity reviews.

C.6 Scott Thomson, Kentucky Transportation Cabinet

Scott Thomson is the Model Team Leader for all meso and macro level Travel Demand Models for the Kentucky Transportation Cabinet (KYTC). He joined KYTC in 2004, and has over 20 years of professional experience. Scott primary responsibilities include overseeing and training modelers responsible for MPO, county, regional, and statewide models, investigating innovative data sources, and reviewing the calibration and validation of travel demand models.

C.7 Ken Cervenka, Federal Transit Administration

Ken Cervenka is a Community Planner at the FTA. Ken Cervenka has worked at the FTA since 2007. His major responsibilities include technical assistance to MPOs, transit providers, and other agencies interested in preparing transit rider "on-board" surveys and transit ridership forecasts. For forecasts submitted by project sponsors in support of New Starts and Small Starts projects, his responsibilities include a formal assessment of the plausibility of those forecasts for use in FTA's project evaluation process. Prior to joining FTA, Ken worked as the travel forecasting manager at the North Central Texas Council of Governments, the MPO for the Dallas-Fort Worth area.

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