Berkeley-Charleston-Dorchester Council of Governments (BCDCOG)

Peer Review

June 2015

TMIP

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U.S. Department of Transportation
Federal Highway Administration

FHWA-HEP-15-041


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Berkeley-Charleston-Dorchester Council of Governments (BCDCOG)

Peer Review

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TMIP

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16. Abstract This report details the proceedings of a peer review of the Berkeley-Charleston-Dorchester Council of Governments (BCDCOG) transportation model. The peer review was intended to provide an assessment of the current model and to help guide the modeling activities BCDCOG pursues.		
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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 Berkeley-Charleston-Dorchester Council of Governments (BCDCOG).

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:

- Edward Bromage - Boston MPO
- Michael Conger – Knoxville Regional TPO
- Mei Ingram – Triangle Regional Model Service Bureau (TRMSB/ITRE/NCSU)
- Kyung-Hwa Kim (Panel Chair) - Atlanta Regional Council (ARC)
- Vidya Mysore (Peer Review Advisor) – Federal Highway Administration (FHWA)

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 BCDCOG peer review was for BCDCOG to receive feedback on their current trip-based model and guidance on the best ways to address recognized shortcomings in the model (e.g. freight and distribution issues).

The peer review panel convened for one day (2/12/15). During that time, BCDCOG presented background information and asked for guidance in specific areas of their modeling practices, and the panel discussed these items and offered a series of formal recommendations to BCDCOG.

1.4 Report Organization

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

- *Overview of the Berkeley-Charleston-Dorchester Council of Governments (BCDCOG)* – This section highlights the responsibilities of the agency as well as some key characteristics of the greater Charleston region.
- *Charleston Area Transportation Study (CHATS) Model Overview* – This section discusses BCDCOG's existing model and the agency's goals for the current peer review.
- *Peer Review Discussion* – This section details the key discussions of the peer review with BCDCOG over the course of the one day peer review meeting.

- *Peer Review 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 Berkeley-Charleston-Dorchester Council of Governments (BCDCOG)

2.1 BCDCOG Responsibilities

The Berkeley-Charleston-Dorchester Council of Governments (BCDCOG) is the federally designated MPO/TMA for the Charleston MSA in South Carolina. BCDCOG is involved in all levels of regional transportation planning and staffs the MPO's transportation planning body, known as the Charleston Area Transportation Study (CHATS). BCDCOG has a federally mandated responsibility for planning, programming, and budgeting of transportation improvements in the three county region with a population of 664,607 residents (2010 Census).

To conduct quantitative assessments of the regional transportation system, BCDCOG employs a traditional 4-step trip-based modeling framework using the TransCAD software package.

2.2 Regional Characteristics

The Charleston Area Transportation Study (CHATS) area encompasses 2,600 square miles of the tri-county region's most urbanized areas. Generally, the study area contains the Census defined Urbanized Area (UZA), and all the land expected to be urbanized within the next 20 years. It now consists of portions of all three counties in the BCD Region. The study area includes:

- Summerville & surrounding areas;
- Goose Creek and Moncks Corner
- Hanahan;
- Daniel Island;
- North Charleston;
- Charleston; and
- All land between Mt. Pleasant & Wadmalaw Island.

Figure 2-1 shows the CHATS study area in the BCDCOG region. This is the fastest growing area in South Carolina and the number of households is projected to increase from 249,569 in 2010 to over 300,000 by 2035.

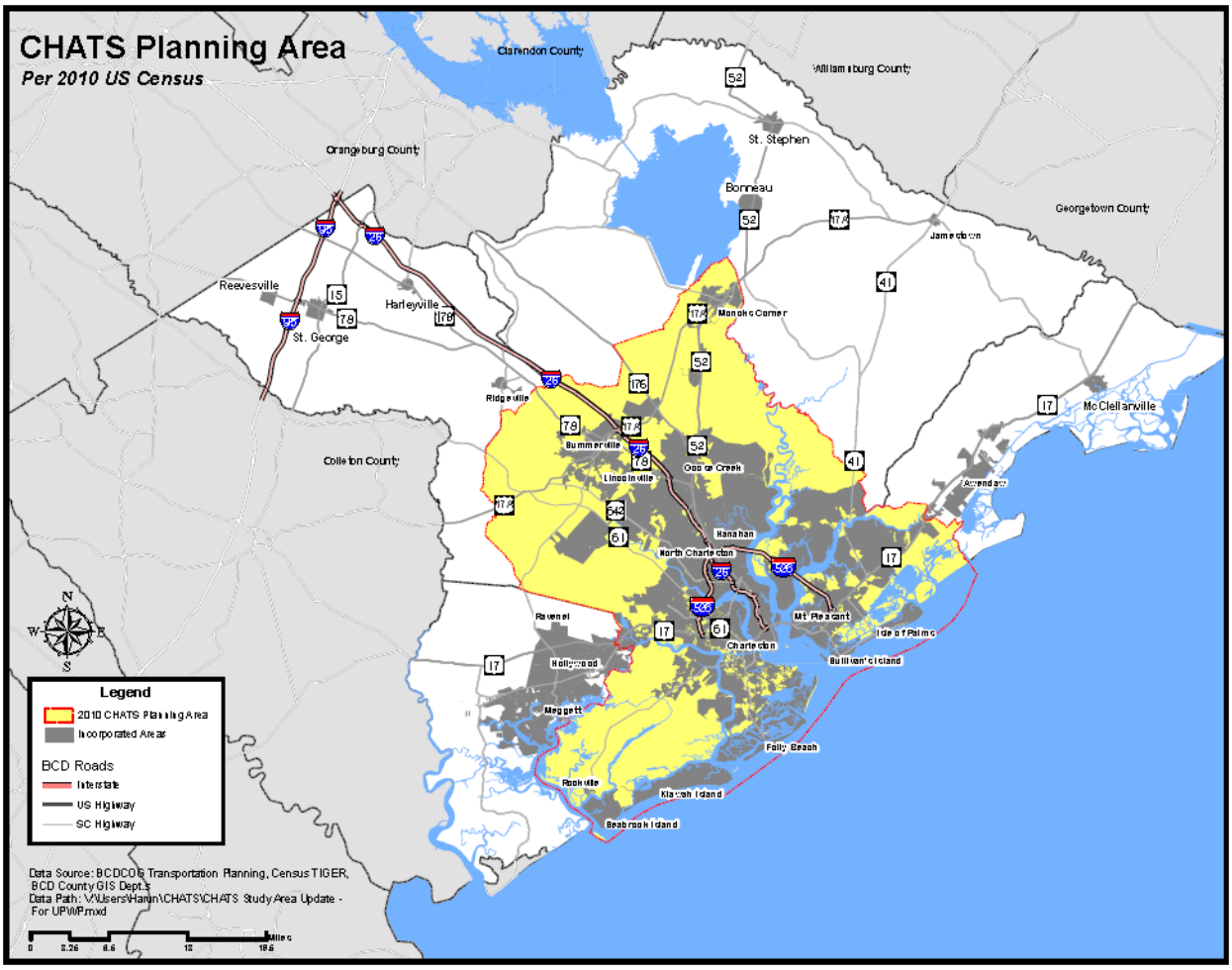

Figure 2-1: BCDCOG Geography

The region's urban core is located on the historic Charleston peninsula and the majority of traffic flows are along the I-26 corridor into downtown Charleston and along the I-526 ring. These roadways record the highest congestion in South Carolina and congestion in the Charleston area is ranked high by TTI's Urban Mobility compared to other medium-sized MPOs.

There are no toll roads or managed lane facilities within the region. At his point, there is no plan for future toll roads or public-private-partnerships in the region, although there are toll facilities in the state and there is no explicit legislation preventing toll facilities.

Transit in the Charleston region is operated by the Charleston Area Regional Transit Authority (CARTA). CARTA offers Fixed-route, Flex Service, Express commute service, and Paratransit service throughout the Charleston Metropolitan area, including The Trolley (DASH) service in the Historic Peninsula area of the Charleston. A fixed-guideway transit project study is underway. Approximately 95% of current transit riders are captive.

Some unique aspects to the BCDCOG region include the Port of Charleston, Joint Base Charleston, a United States military facility, and several colleges, including The Citadel and College of Charleston as well as a thriving tourist industry. The Port of Charleston is the fourth busiest port on the eastern seaboard. The port operates as an intermodal facility and utilizes distribution centers in the region. Tourism is a four billion dollar industry in Charleston. Cruise

ships frequent a commercial port in the historic downtown and Charleston hosts major events such as the PGA tour.

Much of the land in the area is wetlands and not developable; therefore much of the development has few access points, and cul-de-sacs are prevalent. Figure 2-2 shows the existing and projected growth areas. These are concentrated along the I-26 and I-526 corridors.

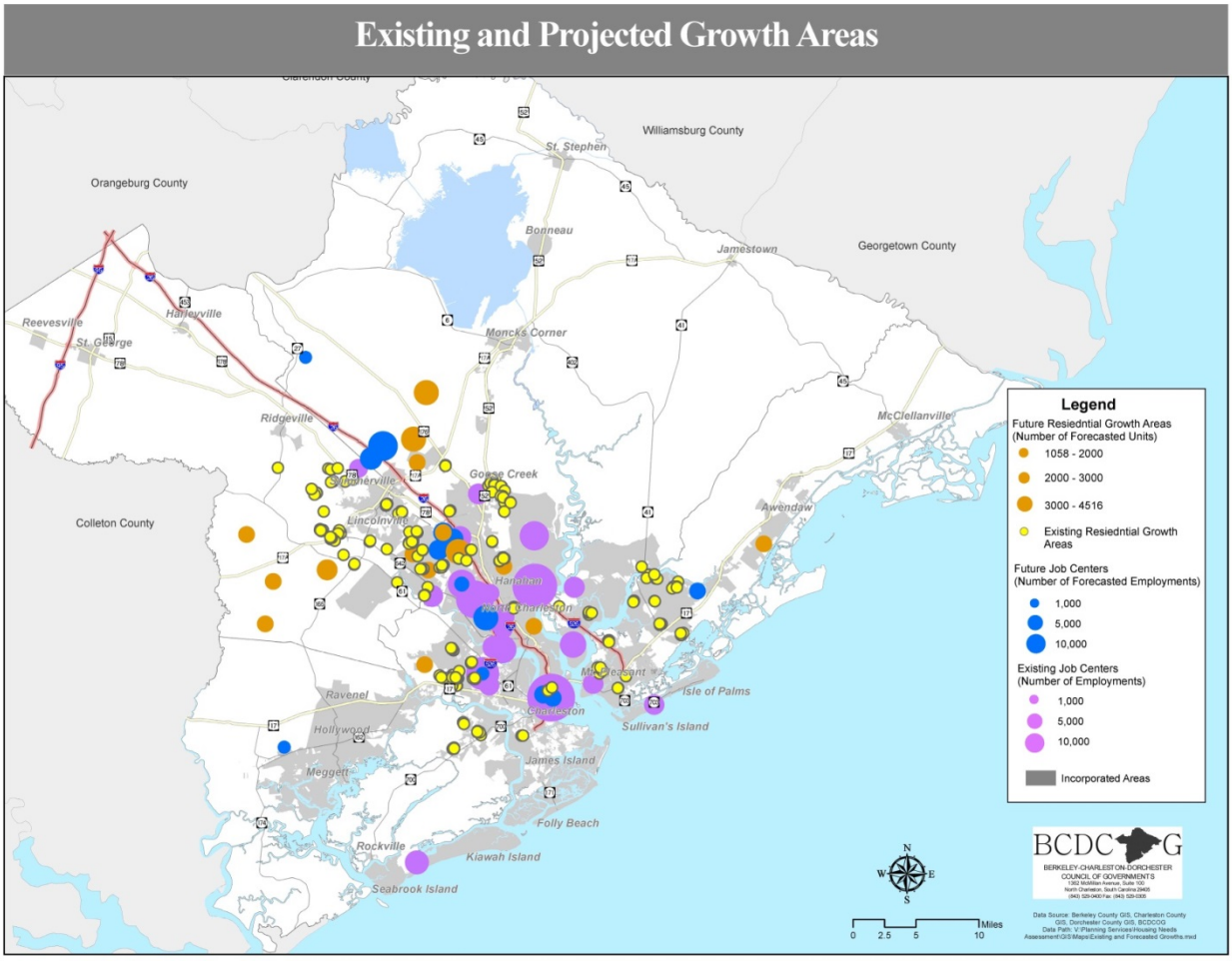

Figure 2-2: BCDCOG Existing and Projected Growth Areas

3.0 Charleston Area Transportation Study (CHATS) Model Overview

3.1 Model Background

The existing Charleston Area Transportation Study (CHATS) model platform was first developed in 2003 as a 24-hour period model with a truck trip model based on the FHWA Quick Response Freight Manual. To support the model development, a regional household and external station origin-destination survey was also completed in 2003. In 2007, this model was enhanced to include a nested logit mode-choice model, transit assignment, time-of-day factors, and a travel time feedback loop. This effort was supported by a transit on-board survey and a travel time survey of major corridors.

3.2 Current Model Status

The CHATS model is an aggregate, trip-based model implemented in TransCAD. It relies on aggregate traffic analysis zones that divide the region into small areas that form the basis for the model. Overall, the model includes 665 internal traffic analysis zones with 14 external stations.

The CHATS model network is a GIS-based network and includes both transit and highway links. Transit travel times are a function of the highway travel time based on facility type.

Like many trip-based models, the CHATS model segments trips into a number of different categories. Total trips are split into person, vehicle, and external trips, and person trips are further segmented by travel purpose. Table 3.1 shows the trip purposes used by the CHATS model.

Table 3-1: Existing CHATS Model Trip Segmentation

Trip Type	Segmentation
Person Trips	Home-based work
	Home-based school
	Home-based other
	Non-home-based
Commercial Trips	CV Auto
	Medium Truck
	Heavy Truck
External Vehicle Trips	Internal-External Auto
	Internal-External Truck
	External-External Auto
	External-External Truck

As is the case in many trip-based models, the majority of the demand model components are dedicated to modeling person trips. Households are further stratified by certain household characteristics (including household size, number of workers, and vehicle ownership) for trip

generation. The only segmentation that is used in later models is vehicle ownership, which is used by mode choice.

Special generators are used to create trips for the following purposes:

- Military;
- Hospital;
- Large Box Store Shopping;
- Airport; and
- Beach.

The trip distribution models are gravity type models and are done at the daily level. Distribution is done using a weighted highway time.

The mode choice model splits motorized trips into drive-alone, shared-ride2, shared-ride3, walk-transit, and drive-transit trips . Non-motorized trips are not segmented in the model.

Temporal factors are used to disaggregate trips by time of day. Three time of day periods are considered: AM peak (6 – 9 am), PM Peak (3 – 6 pm), and off-peak (9am-3pm and 6pm-6am). The AM peak period is factored down to hourly congestion with 50% of the volume in one hour for trip distribution and mode choice.

A truck model is included based on the Quick Response Freight Manual. This model was calibrated in 2003 and has not been updated.

The current model has a 2010 base year and 2035 forecast year. BCDCOG is beginning work to update the socio-economic forecasts to support a 2040 forecast year update for the next Long-Range Transportation Plan (LRTP).

3.3 Model Applications

The CHATS model is used primarily by BCDCOG to prepare the LRTP and all financially constrained projects are included in the model network. The model is used by consultants for specific traffic impact studies and has been included to some extent in the new statewide model.

The CHATS model outputs are used in ranking projects in the Transportation Improvement Program (TIP). Forty percent of the project score depends on the model output with 10 percentage points based on freight performance.

A recent application of the CHATS model was to produce an Environmental Impact Study for the I-526 extension.

3.4 BCDCOG's Goals for the Current Peer Review

Prior to the peer review meeting, BCDCOG identified several areas for which they wanted the peer review panel to comment and make recommendations. These items were presented as a series of questions grouped by effectiveness of the model, model framework, data/tool integration, and current model issues and were a focus during the meeting. The questions are detailed below:

Model Assessment

- Assessment of the reasonableness of current passenger/transit/freight forecasts

Model framework:

- Enhancement of the freight module to recent state-of-practice datasets/tools (near-term)
- Suggestions to include a module to forecast non-motorized modes (bike-ped) on roadways (near-term)
- Suggestions to include a module to capture tourist activities in the region
- Introduce other possible feedback loops, e.g. introduce “induced demand” in the model stream to better calculate congestion benefits of a proposed highway capacity improvement (mid-long term)
- Effectiveness of alternative trip distribution methods, e.g. destination choice instead of existing gravity model (long term)

Data/tool Integration

- How best to utilize data from the upcoming household travel survey from the NHTS program. Suggestions on the survey format and question types (near term)
- Suggestions to enhance the existing transit module with GTFS data (near term)
- How best to utilize vehicle probe-based travel speed (INRIX, TOM-TOM etc.) data (near term)
- How to improve the model to support other tools, such as microsimulation

4.0 Peer Review Discussion

The morning session of the peer review panel was spent by BCDCOG and their consultant presenting the model background and planning process. During these presentations, many topics came up which provoked discussion among peer review panel members and between panel members and BCDCOG. This section documents the key points that arose during these presentations.

The model was generally discussed in the order of execution, and this section is organized in a similar manner, beginning with the model inputs, progressing through trip generation, distribution, mode-choice, and assignment. Next, points from the discussion of the existing truck model and options to build a freight model, which was one of BCDCOG's primary areas of interest, are presented. This section concludes with the discussion notes from the model validation, user experiences, and data / tool integration questions.

4.1 Model Inputs

4.1.1 Land Use

BCDCOG has developed a socio-economic forecasting model in CommunityViz, but it is not fully integrated into the forecasting process. Instead, the modeler needs to manually translate the forecast developments into the model inputs using the spreadsheet method. There is no modeled connection between zonal accessibility and land use; instead BCDCOG uses their judgment to set growth in certain areas. An integrated land use-transportation model would consider the effects of accessibility on land use and location decisions. Several panelists commented that the connection of accessibility to land use is important because the traffic conditions have a strong impact on choices of land use and location decisions. This connection is not uncommon in most large urban area regional transportation models and is present in models of medium and small sizes as well. The panel suggested that BCDCOG rethink their model orientation so that it can demonstrate changes in the economic state of the region based on the transportation network performance, rather than only testing changes in the economic state on the transportation network.

The panel recommended that BCDCOG incorporate accessibility into their land use forecasts and integrate CommunityViz into the forecasting process.

4.1.2 Population

BCDCOG explained that their population forecast procedure first generates the entire population, then splits this population into households and group quarters, and finally generates individual households by household size. The household size decreases in forecast years to represent the aging population and reflect recent trends. A panelist emphasized that representing the aging population is a pressing need for MPOs because of the change in percentage of work-based travel, mode share, and travel time of day. Another panelist encouraged BCDCOG to consider modeling age explicitly and shared the following via email:

> Many years ago, I was brought in to help on a model where the population was declining, yet volume was growing at an annual rate of 2%. The issue was, the number of children and people without access to autos was declining. Yet, older people as a population group was growing. Also, auto registration was also growing, and growing at a rate faster than the population group growth. Thus, those who could drive, had greater access to autos, and thus the traffic growth. Basically, the area was transitioning to a retirement community.

BCDCOG explained that household income is represented by proxy through the number of workers in the household and vehicle ownership. BCDCOG acknowledged that there is some difficulty in distinguishing low-income zero-worker households from retired person zero-income households. Several panel members expressed concern that this approach is insufficient to capture the household economic situation for two major reasons. First, retired persons would not be classified as working yet may have a high amount of travel. Second, affluent households are trending towards zero-auto ownership, but this does not constrain their ability to travel.

The panel recommended that BCDCOG include age and income in forecasts to account for the growing retiree segment of the population. The panel discussion around vehicle ownership is recorded in section 1.2.

4.1.3 Economic Forecasts

BCDCOG explained that their economic forecasts are based on data from InfoUSA. BCDCOG checks InfoUSA data against the US Bureau of Economic Analysis and large local employers. But the overall employment rates are largely driven by population data, in which there is more confidence and the projected employment growth rate is essentially constrained to match the population growth rate. A panelist pointed out that the increasing retirement population will require a different mix of employment than the historic population (e.g. retail, restaurants, health clinics) and that trip-making behavior for retirees is markedly different. This panelist explained that the new development areas, which are likely to be predominantly retirement communities, should not be assumed to have a similar mix of population and employment as existing areas.

Several panelists questioned the use of an essentially fixed relationship between employment and population. There are many factors that will influence the region's economy such as the port, large employers, and development activity. One panelist pointed out that the port is more dependent on macro economic forecasts than the local population. Another panelist noted that there have been recessions in the area during recent history so it is not necessarily reasonable to forecast direct growth. Several panelists recommended a scenario planning approach to capture the range of potential future conditions. BCDCOG has prepared four different land use scenarios for planning, although the outcome is primarily variations in the number of households because employment is balanced to households in distribution.

REMI economic forecasts had been used in the past by BCDCOG to produce economic forecasts. A panelist explained that their agency uses REMI for control totals and a similar approach could be implemented here.

The panel recommended that employment in the region not be assumed to be strictly correlated to population, but rather should follow other economic indicators. Economic forecasts should be developed with input from state and local economic forecasters and local commerce representatives. Moreover, the employment forecasts should be made through multiple scenarios and not as a single value.

4.1.4 Highway and Transit Networks

BCDCOG showed that transit drive and walk access links are included in the master network. This is convenient to ensure that changes are made in only one place but the links are virtual and can get in the way of using the network. A panelist agreed that this is a cumbersome way to formulate the network and that the virtual links should be stored separately or generated on demand.

There are no network restrictions on truck assignment although only the historic downtown is prohibited in reality. Intersection capacities, turning movements and other restrictions are not

represented in the network. Instead this is represented through capacity that varies by functional class and area type.

The panel agreed that the network should be improved to include more information about intersection delays, turning movement restrictions and special allowances. Without this type of information, many transportation system management (TSM) strategies cannot be evaluated. Furthermore, these features are necessary if the network were to be used for microsimulation.

4.2 Trip Generation

Household cross-classifications are by number of workers, household size, and vehicle ownership. Trips are generated for four purposes: Home Based Work, Home Based School, Home Based Other, and Non-Home Based.

BCDCOG employs five area type profiles (CBD, Urban, Suburban, Rural, and Beach) to disaggregate households by size, worker, and vehicle ownership. A panelist noted that the Beach communities are predominantly retirement communities and thus have their own characteristics. Retirement communities that are not on the shore, however, would not be categorized as "Beach" area type and thus would not be as well represented. Another panelist recommended that BCDCOG evaluate the seasonality of Beach community populations and potentially work with states that have similar seasonal variations, such as Florida.

BCDCOG explained that the household segments categorized vehicle ownership as a binary state (i.e., whether or not the household owns at least one vehicle). Also, vehicle ownership is not influenced by accessibility or other zonal characteristics beyond the area type. Several panelists emphasized that a vehicle sufficiency model that models the number of vehicles per worker or per driver is more appropriate to truly represent captive transit riders. Moreover, a vehicle availability model should be sensitive to the transit accessibility, particularly given the trend towards lower vehicle ownership in affluent, dense, well-connected areas.

A panelist suggested that the trip generation model include segmentation by age to capture not only the unique travel behaviors of retirees, but also the influence of children on household trip making. This panelist further recommended that BCDCOG consider a person-level trip generation model stratified by working adult, retirees, other non-working adults, and children. In this case, trip rates would be based on the household and person type nexus.

In addition to the recommendations that retirement communities and vehicle availability be better represented in the model, the panel recommended that the non-home-based trip purpose should be divided into two purposes: work and other. The non-home-based trip purpose segmentation should then be leveraged in both the distribution and mode choice models. The home-based-other trip purpose should be divided into three purposes: home-based-recreation, shop, and other.

4.2.1 Externals / Special Generators

As described in Section 3.2, the CHATS model includes special generators for multiple types of trips. Several panelists pointed out that special generators are not desirable in a model because of their insensitivity to other conditions. Special generators are effective to improve the fit of the base year model, but have poor forecasting power.

One panelist explained that they were able to eliminate special generators entirely from their model using a procedure to refine discretionary trips by industry. BCDCOG noted that this requires a higher level of survey data than is currently available. Another panelist explained that trips currently represented through special generators can be more easily incorporated when a destination choice model with the correct specification of attractiveness (right employment by

industry) and the right trip matrix balance procedure (production and attraction trips) is implemented in the model.

Another panelist discussed that the military base is unique and operates as a "black box" so this would need to be modeled using a special generator but that all other special generators should be incorporated into the model.

In regards to externals, a panelist recommended that the external trips be generated as person trips with work and non-work purpose segmentation. This approach would make the external trip mode sensitive to network conditions.

The panel recommended that BCDCOG work to eliminate all special generators from their model with the exception of military, which is infeasible to represent otherwise.

4.2.2 Tourist Activities

BCDCOG requested advice from the panel on representing visitor activity or seasonal variations as there is no current functionality in the model to do so. An ongoing study at the College of Charleston is collecting updated hotel data as well as visitor trip making and auto propensities.

The panel agreed that the lack of a visitor model is a significant shortcoming of the CHATS model. BCDCOG mentioned that the tourist peak lasts 8-10 months a year therefore a typical work day model includes some visitor travel impact. The visitor levels fluctuate over the course of the season so, in addition to the ongoing hotel survey, the panel suggested that BCDCOG conduct a visitor survey. A panelist pointed out that the non-motorized travel mode is critical to support the visitor module as many tourists do not use autos for trips in the downtown region.

A panelist cited the implementation example done in Knoxville to include travel to the Great Smoky Mountain National Park, which is not actually contained in the Knoxville TPO Planning Area but that effects of this park are evident. The Knoxville model includes a capability to adjust hotel/rental unit occupancy levels to test demand at different times of the season.

Another panelist reminded BCDCOG that the regional model is not responsible for capturing special events although regular season variation should be represented.

The panel recommended that BCDCOG collect more data on visitors in the area and implement a visitor model similar to the Knoxville model.

4.3 Trip Distribution

BCDCOG identified the current gravity model as one of the primary areas of concern in the model. The gravity model does not adequately account for the psychological barrier that bridges present and simulates too many trips between peninsulas. K-factors are necessary in the person trip distribution model to keep trips within each peninsula and manage the bridge volume in the model. The distribution model uses a time-of-day weighted highway time, not a composite highway and transit impedance factor.

During a conference call held with the panel prior to the peer review meeting, a panelist suggested a tri-proportional gravity model. This type of model is in use at the Boston MPO and has proven capable of representing the deterrence of travel bridging geographic barriers, such as rivers and bays.

During the meeting at least two panelists recommended implementing a destination choice model. One panelist had estimated a destination choice model for an area with similar bridge crossings and even state crossings with different sales taxes. Furthermore, the destination choice model can use composite logsum formulations from the mode choice so that the trip distribution is sensitive to both auto and transit accessibilities. A panelist suggested that

BCDCOG could transfer the model from an area such as Portland, OR and recalibrate to fit their trip length distribution. Another panelist also proposed conducting destination choice at the person, rather than household level. Given that BCDCOG is already using CommunityViz, the person-level forecasts would not be overly difficult to produce.

Panel members agreed that it would not be a difficult upgrade to improve the distribution model and that this should be moved from a long-term to a short-term project. The panel concluded that a destination choice model which can include travelers' characteristics, transportation system characteristics (incl. impedance), and destination zone attributes should be implemented.

4.4 Mode Choice

BCDCOG explained that the previous mode split function included a share for non-motorized modes, but that the current mode choice model does not. Several panelists raised concerns about this because the trip generation rate was estimated using all household trips including non-motorized trips. Therefore, the trips processed in the mode choice model are for all modes while the current mode choice model is constructed to only produce motorized trips. BCDCOG estimates that at most 5% of trips are non-motorized and that many of these would be intrazonal. Yet, a panelist pointed out that this is a higher share than transit riders and that the historic downtown has a higher concentration of non-motorized travel. BCDCOG agreed that the motorized trips are being overstated in the model, particularly for short distances. BCDCOG explained that there have been some studies into the quality of non-motorized trails and byways, but that the data is dated. A panelist suggested that a sketch planning tool could be a good first step to developing an integrated non-motorized model. Another panelist explained that a non-motorized split could be implemented prior to the motorized mode choice model or, alternatively, the current mode choice model structure could be extended to include non-motorized modes, which would be more difficult.

A panelist recommended that the region set a mode shift goal and track a mode share metric as part of the model results. BCDCOG had identified a mode share goal in the previous LRTP and is doing a fixed rail study now, but has not yet included mode share in the model metrics.

BCDCOG explained that there is a fixed operating cost parameter in the auto mode utilities, but that parking cost data is not available. Two panelists pointed out that the only socio-economic input to mode choice is vehicle availability, which is insufficient particularly because vehicle availability is not well incorporated in the model.

Transit ridership in the area has doubled over the last 10 years and it is unclear if the model is representing current transit ridership accurately. A panelist pointed out that transit ridership can be strongly driven by college students, but that the college trips are not segmented in the model. BCDCOG noted that a majority of transit routes serves the corridor into the College of Charleston. The panel suggested that segmenting Home-Based College trips may be necessary to more accurately represent the strong connection between transit ridership and college trips.

The panel recommended that non-motorized trips be explicitly handled within the CHATS model, either by extending the mode choice model to incorporate non-motorized alternatives or adding a non-motorized mode split model prior to the current motorized mode choice model. The model output must show that non-motorized travel is accounted for in the modeling process, although the non-motorized travel may not be assigned. In general, the motorized mode choice model should include more socio-economic variables across all alternatives.

4.5 Assignment

The CHATS model uses a standard BPR curve with parameters from NCHRP Report 365 (page 95, table 48). Minor adjustments have been made based on observed congestion. There is no plan to update these curves as BCDCOG's understanding of congestion is due to bottlenecks and weaving and not capacity constraints.

A panelist suggested that BCDCOG evaluate the traffic levels during the midday time period and consider separating the midday period from night, which are currently assigned together, to capture the midday rush.

The model has not been validated using speed data, and so adjustments to the BPR curve could not be made with confidence.

The panel recommended that BCDCOG revisit the BPR curves on their major corridors once speed data is available.

4.6 Model Validation

BCDCOG validates the model according to daily traffic count data, segmented by facility type, examines the overall model RMSE, and compares the county-level VMT to estimates from the South Carolina Department of Transportation (SCDOT). The 2003 household survey results are used to validate trip-length distributions and district-district flows.

A panelist pointed out that the count data is in AADT format, but the model is producing AWDT. Another panelist seconded this and explained that they observed other instances in the model documentation that indicated issues with the model input data that need to be corrected.

A panel member commented that the current validation process is insufficient and that more attention needs to be paid to each component in the model process and not only the end assignment results. Another panel member agreed and stressed that speeds need to be included in the validation metrics. There is a lot more variation in speed than volume in a model, particularly when links are near capacity.

Currently there is no speed data used in model validation, but BCDCOG will have access to INRIX data through their membership in the I-95 corridor coalition. The data received will be in 5 minute intervals on the I-26 and I-526 corridors. A panelist familiar with using type of data from INRIX, NAVTEQ and HERE cautioned BCDCOG that the data is free but extracting useful information can be time consuming and requires a dedicated analyst with a strong skill set.

4.7 Freight Model

BCDCOG highlighted that the existing truck model has not been updated since 2003 due to a lack of more recent classified counts, that the Quick Response Freight Manual (QRFM) distribution requires K-factors to meet the observed traffic, and that distribution centers are not being properly modeled. BCDCOG is most concerned that freight activity related to the Port of Charleston is not well represented. It has been difficult for BCDCOG to get data from the port, and the information they are using is limited to vehicle counts at the access points. An updated freight model has been identified in the UPWP.

A panelist explained that there are other ways to gather information about port operations and freight activity in the region. This panelist confirmed with the SCDOT representative that they have funded MPO access to TRANSEARCH data at the county level, which can be very useful because the entire port is within Charleston County. The panelist recommended that BCDCOG obtain a copy of the 5 year plan from the port to determine what types of commodities will be handled over the near future. This will indicate the types of warehouses and distribution centers

that will be constructed in the region. The panelist also recommended that BCDCOG obtain a copy of the bill of lading information to understand the types of commodities that are currently coming into the port. The growth of Berkeley and Dorchester counties, where the warehouses and distribution centers are expected to be located, could be very different depending on the types of commodities coming into the port. Another panelist pointed out that the port-based trips would be traveling out of the region, therefore the existing QRFM-based truck model component should remain in the model.

4.7.1 Urban goods movement

The existing BCDCOG model is a truck model and not a true freight model in that it does not account for goods movements or commodity flows. A panelist explained that freight movements are driven by costs, not distances. A discussion developed around the different types of urban goods movements and how varied the delivery frequency can be based on the type of product and technology. The panel agreed that complexities of freight travel imply that they do not necessarily need to be integrated into the model. Moreover, when freight forecasts of more than 10 years are included in the model they need to be treated as highly speculative and should be done with a scenario planning approach.

To build a freight model, however, a larger geographical context is necessary. The representative from SCDOT expressed interest and support to a larger freight model. A panelist explained that the statewide freight model flows could serve as an input to the local model and that there are methods to disaggregate to a zonal level. The group also noted that South Carolina includes two Class 1 railroads and that the statewide intermodal plan created a freight committee. Panelists recommended that this committee be included in any freight model formulations.

Several panelists agreed that BCDCOG needs to more closely identify the specific need for a freight model in their region, beyond the presence of the port and large employers. By balancing employment inputs to population, BCDCOG is undermining the influence commercial forces have on the model anyway. A panelist noted that a freight model is not necessary to build a freight plan for the region. A freight plan could be based on a data-driven process leveraging the TRANSEARCH data already available from SCDOT.

The panel recommended strongly that BCDCOG not pursue a tour-based freight model to integrate into their regional travel demand model, but that they should be tactical depending on the identified need for freight information to the degree that a "freight model" need not even be constructed. That is to say that the urban goods component does not need to be fully integrated into the regional travel demand model; instead, it could operate as a data-driven exogenous component that provides inputs to the travel demand model. The panel also recommended that BCDCOG include SCDOT and the port authority in future efforts to build a freight forecasting component.

4.8 Model Users

BCDCOG are the primary users of the CHATS model. There are 27 municipalities represented in the model area, and some municipalities have requested access to the model for land-use studies although not for transportation-related analysis. The model is also used by consultants for traffic impact studies and their feedback has been neutral with only minor network errors found.

SCDOT has incorporated the CHATS model into the recently completed statewide model. The statewide model assembled the regional MPO networks and conducts a geographically constrained distribution of HBW, HBO, and NHB trip purposes. The geographic constraint

assures that the statewide model volumes are consistent with the MPO network externals. Most important, a freight network is currently being coded into the statewide model. Once complete, this information will be available to the MPOs.

SCDOT reported that their evaluation of the CHATS model forecasts is that the model under predicts volume on the arterials compared to the growth trend based on count data. However, the forecast year model network only includes Existing and Committed projects, which implies that the arterials may be at capacity and would see a continued growth in volume if capacity were increased. A panelist suggested that an improved traffic count forecast could be developed using local knowledge and land-use growth patterns to determine if the model is actually under-predicting.

A panel member asked if there are any tolled or public-private-partnership projects in the planning horizon. BCDCOG explained that there are tolled facilities in South Carolina, but none in the planning region nor any in the planned projects, however, there is concern at the state level as with almost every state with how to fund transportation projects. The panelist explained that Public-Private-Partnership (PPP) projects require a higher level of rigor in the model and that a better handling of household income, for example, would be necessary.

The model has been developed with a series of custom interfaces to select different build scenarios.

A panel member recommended that BCDCOG develop their future models with a more generic TransCAD interface. This will make the model easier for the average TransCAD user to understand, which will help in hiring new modelers and encouraging other users. Also, maintaining a generic format will make the model easier to upgrade to future versions of TransCAD.

4.9 Data / Tool Integration

4.9.1 NHTS recommendation

BCDCOG is opting for 1,250 supplemental NHTS samples, 1,000 of which will be within the CHATS model area. In response to BCDCOG's question about the upcoming NHTS add-on, a panel member recommended that BCDCOG specify that only weekdays be sampled. Otherwise, the survey will distribute equally across all days and BCDCOG may only be interested in the weekday travel. Panel members also recommended that any additional questions focus on the areas of interest for BCDCOG, such as to support a new destination choice model. The panel recommended against transit questions because area ridership is very low. Transit-specific data should be collected through an on-board survey.

4.9.2 Use of vehicle probe data

Two panelists pointed out that in order to make use of vehicle probe data to generate speeds for model validation BCDCOG needs to add capacity to process the data in-house by hiring an analyst with data mining experience. Moreover, this additional analyst would need to have an active peer group to learn and consult with on data applications. The panel recommends that BCDCOG look to SCDOT for leadership on using this type of data as well as DOTs and MPOs from neighboring states.

4.9.3 Supporting micro/meso simulation from model outputs

A panel member noted that it is easier to implement TransModeler from a TransCAD regional model starting point as opposed to other micro/mesosimulation packages, but only relatively so. Micro/meso models require detailed information on turning lanes and signal timing, which is not currently included in the existing CHATS model network.

5.0 Peer Review Panel Recommendations

This section summarizes the recommendations of the panel.

5.1 Model Assessment

Throughout the morning presentation, the panel was struck by several significant issues with the current BCDCOG model. These are all detailed in Section 4.0 and are listed here for completeness:

- **Land use projections**: Employment forecasts should be sensitive to presence of retirees and their greater demands for certain employment sectors such as medical, retail and restaurants. Also, land use should be sensitive to the transportation accessibilities.
- **Employment forecasts**: Employment in the region should not be assumed to be strictly correlated to population, but rather should follow other economic indicators, and the lack of earning level per worker or household income representation in the model should be remedied. Moreover, the employment forecasts should be made through multiple scenarios and not as a single value.
- **Retiree households**: The growth of retirees is one of the most substantial changes expected in the region, and the model should distinguish these households from other zero-worker households because they have different trip rates, travel patterns, modes, and trip times of day. Due to Charleston's characteristics, retiree households need to be understood in depth.
- **Auto-availability**: It is insufficient to only use the existence of an auto in the household; instead vehicle availability measures should be used to actually represent captive transit users.
- **Restrictive trip purposes**: The non-home-based trip purpose should be divided into two purposes: work and other. The home-based-other purpose should be divided into three purposes: home-based-recreation, shop, and other.
- **Special Generators**: Besides the military base, panel members recommends that BCDCOG remove all special generators and incorporate those trip types into the model.
- **Visitor model**: Without a visitor model the region is missing a large number of trips based on the size of the tourist industry. The panel agreed that the implementation done in Knoxville to include travel to the Great Smoky Mountain National Park is a good model for BCDCOG as it includes controls based on occupancy level to test demand at different times of the season.
- **Distribution model**: Panel members agreed with BCDCOG that it is not desirable to use K-factors to capture the deterrence for trips to use leave the peninsula. Panel members believe that the issues with trip distributions, including crossing bridges, can be addressed with a destination choice model and that this can be solved with a relatively simple model enhancement.
- **Freight:** BCDCOG needs to do more to account for port activity and urban goods movements. Moreover, BCDCOG needs to understand the need for each model component, particularly freight, by engaging model users and regional economy drivers.

- **Non-Motorized travel**: The share of non-motorized travel in the region is too large to ignore. Also, these trips are included in trip generation rates, and so the trips need to be explicitly accounted for in the model. The consideration of non-motorized trips could be implemented through a non-motorized mode split applied prior to mode choice or by extending the mode choice model to include non-motorized alternatives.
- **Employ available data sets**: BCDCOG should leverage existing data from SCDOT to do freight analysis and add speed validation to the existing model, but note that doing so would require additional in-house resources to process the data.
- **Validation data**: The current validation process is inadequate and needs to pay more attention to each component in the model process and not only the end assignment results. Also, mode share and speed should be included in the validation metrics.

These issues led the panel to conclude unanimously that the current model does not meet the state of the practice and that it is not a sound structure from which to build a state of the practice model. Before BCDCOG should attempt to implement the types of improvements they have specified or other sophisticated tools, the model fundamentals need to be structurally sound. Therefore, the panel recommends that BCDCOG continue to maintain their current model to support LRTP and other active planning requests, but that all new development be directed toward building an entirely new model structure. A panel member concluded that the model is not ready for Travel Demand Management (TDM) type analysis nor the upcoming performance-based analysis required by MAP-21.

Panel members encouraged BCDCOG to leverage what they can from existing models. This was reinforced by a panel member who cautioned BCDCOG against building a highly specialized model that is not well founded or justified by the state of the practice. This could leave the agency in an indefensible situation if the model results are challenged.

If a wholesale model development approach is not feasible, BCDCOG could do an incremental approach by reworking each step of the current model. Improvements to the model should be prioritized by the degree of improvement, the resources required, and the time frame. The destination choice model is an example model enhancement that would provide great improvement with a lower level of effort and within a shorter time frame. However, similar to a house reconstruction, it will be significantly more expensive, complex, and time-consuming to improve the model in an incremental way as opposed to starting with a clean slate.

5.2 Model Vision

The panel noted that BCDCOG lacks a clear vision for the CHATS model, and thus it is difficult to formulate a set of guidelines for what the model should include. The panel acknowledges that the model vision should be spearheaded by SCDOT but that leadership at this level could be stronger. The panel recommends that a master model vision be developed to guide future model development. The annual modeling budget should be more specifically allocated and BCDCOG could have their consultants present a menu of items so that they can plan the development process.

The panel was excited by the opportunities present in an area such as BCDCOG, which is a vibrant urban area with large projected growth and active economy. With the proper fundamentals, the panel envisions that this planning group could eventually build a Dynamic

Traffic Assignment (DTA) model. The panel concluded that a lifestyle trip-based model would be sufficient for this region and that a tour-based model is not necessary.

5.3 Model Support

Having a state of the practice model requires more than a particular structure and specific model parameters. It also has to do with the perceived usefulness of the model, adoption of the model as a planning tool, and users interested in the outputs. The lack of an active model user group demonstrated to the panel that this model is not well accepted. Several panel members called for greater outreach to decision-makers and other potential model users to understand what they would value in the model.

The panel recognized that there are limited resources even at the state level and recommends that the BCDCOG look to other states for examples and guidance. A panel member encouraged BCDCOG to meet with the Florida modeling team to understand the Florida model process as a representation of how they could operate.

The panel emphasized that BCDCOG and their consultants had done an extraordinary job at maintaining a model with limited resources and support. The panel strongly recommends that BCDCOG increase the internal modeling team substantially in order to build and maintain a state of the practice model. At least one full time senior modeler with substantial prior experience should be hired. This modeler or preferably a second hire would also require strong analytical skills to be able to consume the new data sources being made available.

Appendix A List of Peer Review Panel Participants

This section lists all individuals who attended the meetings, including panel members, BCDCOG staff, and peer review support staff.

A.1 Peer Review Panel Members

Panel Member	Affiliation
Edward Bromage	Boston MPO
Michael Conger	Knoxville Regional TPO
Mei Ingram	Triangle Regional Model Service Bureau
Kyung-Hwa Kim (Panel Chair)	Atlanta Regional Council (ARC)
Vidya Mysore (Peer Review Advisor)	Federal Highway Administration (FHWA)

A.2 BCDCOG Staff, Model Users, Consultants

Name	Affiliation
Harun Rashid	Berkeley-Charleston-Dorchester Council of Governments (BCDCOG)
Dan Frazier	Berkeley-Charleston-Dorchester Council of Governments (BCDCOG)
Craig Gresham	Clearbox Forecast Group
Alice Bresher	Dorchester County
Andrea Pietras	Charleston County
Jeff Burns	Charleston Area Regional Transportation Authority (CARTA)
Jessica Hekter	Federal Highway Administration (FHWA)
Michael Dennis	South Carolina DOT (SCDOT)
Paul Roberts	Channel the Beacon (CTB)
Wes Fleming	Berkeley County School District
William Werrell	Joint Base Charleston (JB CHS)
Bryan Webb	Davis and Floyd
Jeff Ingham	Thomas and Hutton
Jonathan Avner	CDM Smith
Stuart Day	Stantec

A.3 TMIP Peer Review Support Staff

Name	Affiliation
Sarah Sun	Federal Highway Administration (FHWA)
Martin Milkovits	Cambridge Systematics

Appendix B Peer Review Panel Meeting Agenda

February 12, 2015

8:30 – 9:00:	Welcome, introduction of attendees and panel members, brief panel process overview (panel chair - Kyung-Hwa Kim)
9:00 -10:00:	BCDCOG Planning and Model Summary, Issues, and Expectations (COG – Dan Frazier, Harun Rashid, Craig Gresham)
10:00-10:15:	Break
10:15-11:15:	BCDCOG Planning and Model Summary, Issues, and Expectations (COG – Dan Frazier, Harun Rashid, Craig Gresham)
11:15-11:45:	Feedback from CHATS model users (local model users, moderated by panel chair)
11:45-12:00:	Break/Lunch ready
12:00-1:30:	Lunch and continuing Panel discussion Q&A (moderated by panel chair)
1:30-1:45:	Break
1:45-3:00:	Expert panel executive session
3:00-3:15:	Break
3:15-4:15:	Expert panel recommendation and open panel discussion (moderated by panel chair)
4:15 -5:00:	Conclusive comments and adjournment (panel chair)

Appendix C Peer Review Panel Biographies

C.1 Edward Bromage, Boston MPO

Edward (Ed) J. Bromage is the Manager of Travel Model Development for the Boston MPO and has over 37 years of transportation planning experience. He is regarded as an expert in the TransCAD software system where he has estimated/programmed numerous gravity distribution models, destination choice models, and tour based models. Ed is also proficient with the TransModeler micro-simulator software and was the modeling technical lead on the I-15 Integrated Corridor Management (ICM) project in San Diego, California.

Ed has been the project manager on countless small urban area model development/update projects, he was the technical lead to develop the 13 State Appalachian Regional Model which evaluated the economic impacts of Congressional transportation spending throughout the region, and he has been the technical lead on the transportation planning components of numerous Environmental Impact Statements. In 1989 he authored the Massachusetts State environmental guidelines for transportation site impact analysis.

Ed holds a Bachelor of Science degree in Civil Engineering from Worcester Polytechnic Institute.

C.2 Michael Conger, Knoxville Regional TPO

Michael (Mike) D. Conger, P.E. is currently a Senior Transportation Engineer with the Knoxville Regional TPO, which is housed within the Knoxville/Knox County Metropolitan Planning Commission. He has been employed with TPO/MPC for 16 years since completing graduate school courses at the University of Tennessee. During his career Mike has spent time reviewing site plans and traffic impact studies for proposed developments in Knox County and has since transitioned into more of an emphasis on developing regional long-range transportation plans. Mike is also responsible for operating and maintaining the regional travel demand forecasting model and performing air quality modeling to ensure the Knoxville Region maintains eligibility for federal transportation funding as an air quality nonattainment area.

Mike received his BS and MS degrees in Civil Engineering from U.T. Knoxville. He is a registered Professional Engineer in the State of Tennessee and has been an active member of professional organizations including serving as President of the Tennessee Model Users Group (TNMUG) and the 2015 President of the Tennessee Section Institute of Transportation Engineers (TSITE).

C.3 Mei Ingram, Triangle Regional Model Service Bureau

Mei Z. Ingram is a senior research associate at the Triangle Regional Model Service Bureau, Institute for Transportation Research and Education, located at the North Carolina State University, Raleigh, North Carolina. Her key role is to develop and maintain the Triangle Regional Model and provide technical support to the stakeholders and other users.

Prior to her current position, Mei worked for two years at NCDOT and eight years with the Parsons Transportation Group/Barton-Aschman. She has 20 years of experience in multimodal regional traffic demand model development and application for various urban sizes, travel behavior related survey design/analysis, air quality conformity study, regional economic development and socio-economic data forecast, and highway safety.

Mei holds an MS in Economics from the University of North Carolina at Chapel Hill as well as an MA in Urban Studies from the University of Maryland at College Park and a BS in Physics from Beijing Normal University.

C.4 Kyung-Hwa Kim, Atlanta Regional Commission

Kyung-Hwa Kim is the Performance Analysis and Monitoring Manager at Atlanta Regional Commission (ARC), Atlanta Georgia. Prior to joining ARC 6 years ago, she worked at Metro in Portland, Oregon as a modeler for 20 years. Her 20 years at Metro covered everything from simple survey analysis to complicated activity model development and transit studies.

At ARC, Kyung-Hwa manages Air Quality, Equitable Target Area, Health Impact, Clean Air, Congestion Management Planning, Safety, Performance measures, and Project Prioritization.

Kyung-Hwa holds a Master's degree in Urban Planning from Portland State University and a Bachelor's degree in Psychology from Portland State University. She also studied in Korean Ethnomusicology from Seoul National University before she immigrated to United States from Korea.

C.5 Vidya Mysore, Federal Highway Administration

Vidya Mysore is a Freight Analysis and Modeling specialist with the FHWA Resource Center Planning and Freight team. With over 24 years of experience, both in public and private sectors, he provides direct technical support and training for federal, state and local agencies on the development and applications for freight transportation short and long range plans, and project level planning, operations and management.

After joining FHWA in July 2013, Vidya led and implemented SHRP2 C20 product – Advancing local freight data and behavior-based modeling improvement. In addition, Vidya provides technical support to state DOTs and MPOs around the country on various FHWA's Freight programs such as Freight Analysis Framework (FAF), Freight Performance Measures (FPM) and Freight Modeling Improvement Program (FMIP).

Vidya also played a principal role at FDOT in the advancement of statewide project development and prioritization planning program, Strategic Intermodal Systems (SIS) performance-based policy and planning applications, travel forecasting to support development and oversight for managed/toll corridor feasibility projects, inter-regional future corridors and freight planning projects, for the state of Florida.

Vidya holds an MS in transportation engineering from the Ohio State University, Masters in Urban and Regional Planning from Mysore University and Bachelors in Civil Engineering from Bangalore University, India.

Appendix D Documentation Provided to Panel Members by BCDCOG

a. ***TransCAD version 6 model files:***
   1. Model scripts in GISDK
   2. All model input files – TransCAD geographic files of TAZs and networks, input parameter files
   3. Model outputs from 2010 base and 2035 E+C scenario
   4. Model run instructions

b. ***BCDCOG TransCAD Model Documentation 2005*** (PDF file): comprehensive description of BCDCOG's model setup in TransCAD. Prior to this, BCDCOG model platform was in TRANPLAN. At this stage, model framework was based on a traditional 4-step process without a mode-split module and time-of-day capability

c. ***CHATS User Guide*** (PDF file): describes the next major model enhancement to include a mode split module and time-of-day analyses. A technical report from this process was also submitted (title: **CHATS Model Technical Report**)

d. ***2010 Forecasting Methodology*** (word file): BCDCOG utilizes a hands-on land use allocation model to derive TAZ-level household and employment forecasts, which form the basis of model socio-economic data inputs. This document describes the process in detail

e. ***DATA DICTIONARY NEW NETWORK*** (EXCEL spreadsheet): Detail field description of the highway network geographic database. This includes all fields after mode split module was implemented

f. ***BCDCOG Model Stream*** (word file) : sequence of GISDK scripts

g. ***Running the BCDCOG Model – Individual Steps*** (word file) : instruction set to run transit skims manually from TransCAD interface

h. ***BCDCOG TransCAD Model User's Guide*** (word file) : An updated set of instructions to run the model (update from the 2005 file in item #b) to cover –
   1. New utilities in the interface - to report transit ridership forecast by each fixed route, to create socio-economic data input with CommunityVIZ
   2. Detailed step-by-step instruction to update TAZs and network geographies
   3. Tips on model trouble-shooting
   4. Guidelines to post-process link level forecasts where necessary (separate word file titled "*BCDCOG Model Output Guidelines*")

i. ***BCDCOG_2012_Update_Letter*** (PDF file): With Census 2010 data release, model base year socio-economic data input was updated from 2008 to 2010. As of the date of this document (03/30/15), this is latest set of SEData TAZs for the model – Base Year (2010), Interim Year (2015), Horizon Year (2035). Model was calibrated with this new set of base year data, with some changes in model parameters. This PDF memo lists all these updates. A technical addendum lists a more detail description on the input parameters (separate PDF file titled "*BCDCOG_2012_Model_Change"*)

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