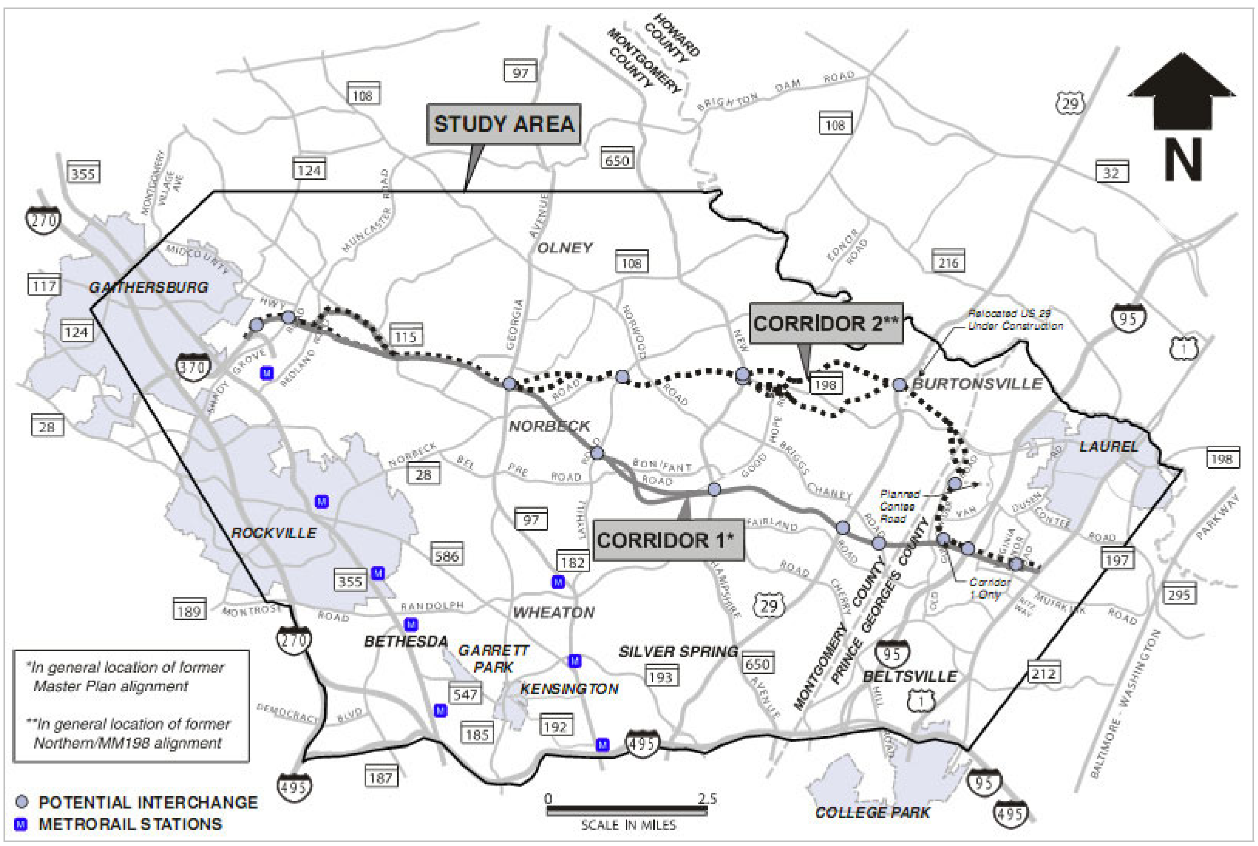
Case Study Introduction

Project Overview

The Intercounty Connector (ICC) is an 18 mile east-west limited access highway between I-270/I-370 and I-95/US 1 in Montgomery County and Prince George's County in Maryland. The ICC has been included in master plans for Montgomery County and Prince George's County for over 50 years. The National Capitol Planning Commission (NCPC) first introduced the concept of an east-west highway in the 1950s as part of a larger outer beltway around Washington, DC. The outer beltway was later dropped, but the segment between I-270 and I-95/US 1, which became known as the ICC, was retained to address a need for improved east/west mobility between those two north/south corridors. In 1972, the Montgomery County Planning Board recommended, and the Montgomery County Council approved, the alignment of a new highway east of I-270 and north of Rockville to the eastern border of Montgomery County.

Figure 1: Map of Intercounty Connector Study Area



Maryland State Highway Administration (Maryland SHA) started the first National Environmental Policy Act (NEPA) analysis of an ICC in 1979, and published a Draft Environmental Impact Statement (DEIS) on July 8,

1983. Later in the 1980s, several Federal reviewing agencies expressed concern about the impacts on the natural environment. Additionally, Maryland SHA became concerned that much of the socioeconomic data and traffic forecasts, upon which the need and design of the ICC were based, had become outdated since preparation of the 1983 DEIS. Maryland SHA initiated a new ICC planning study in 1991 and published a new DEIS on March 3, 1997, but no final decisions were made on the study.

Maryland SHA and the other lead agencies restarted planning efforts in 2004, when the project was identified as a high priority for the state by the Governor. The project's purpose and need was based on a combination of existing and future needs. Population in the area had grown by 28% over the past two decades and was expected to continue to grow, leading to a projected 29% growth in ADT in the study area by 2030. Maryland SHA also identified a need for a connection between the two north/south corridors of I-95/US 1 and I-270 that are the most intensive employment, residential and transportation corridors in Maryland. A DEIS was published in November 2004. The FEIS was signed on January 3rd, 2006, and the Record of Decision on May 29th 2006.

A subsequent legal challenge to the project focused on a number of issues, including traffic modeling and analyses. Among the issues of contention were the measures of effectiveness used to evaluate alternatives and the choices made in the land use forecasts used in the model. While reviewing this case study, the reader should note the effort made to identify the measures of effectiveness prior to modeling of alternatives so as not to prejudice the outcome and the sensitivity analyses that were conducted to review the effect that new land use forecasts would have on the project. Based in part on the efforts in these areas, the court decided in favor of the project sponsors.

Travel Forecasting Summary

Maryland SHA used the Metropolitan Washington Council of Government (MWCOG) Transportation Planning Board (TPB) travel forecasting model as a basis for developing a travel forecasting model specifically for the ICC project. TPB is the designated Metropolitan Planning Organization (MPO) for the local government jurisdictions of the three-state Metropolitan Washington area.

Maryland SHA selected 2030 as the forecast year for the ICC study. The modeled highway facilities included the planned improvements in the Fiscal Year 2003 Constrained Long Range Plan (FY 03 CLRP) for construction through 2030. The modeled transit service included all services in the FY 03 CLRP, express bus routes on the ICC, and feeder routes to support the express service. Maryland SHA used the 2030 Round 6.3 Cooperative land use forecasts, which were the latest socioeconomic data approved by MWCOG for the Metropolitan Washington area for all alternatives.

Case Study Illustration of the Guidance

The ICC project provides good illustrations of five of the seven key considerations contained in FHWA's Guidance on the Application of Travel and Land Use Forecasting in NEPA. The MPO and project sponsors had a tight, collaborative relationship on the ICC study. This relationship resulted in the MPO adopting an update to the regional model that incorporated refinements that were made to the regional model as part of the ICC forecasting effort, ensuring consistency between the project-level and regional traffic data. Extensive effort was applied to planning the modeling effort, including defining a wide study area to prevent the need to later extend it, and preparing memoranda that proposed model runs and documented assumptions prior to conducting the model run. This case study emphasizes the following considerations from the guidance: 1. Project Conditions and the Forecasting Needs of the Study; 2. Suitability of Modeling Methods, Tools, and

Underlying Data; 4. Forecasting in the Alternatives Analysis; 5. Project Management Considerations, and 7. Documenting and Archiving Forecast Analyses.

Key Consideration 1 of the Guidance: Project Conditions and Forecasting Needs

Establishment of Forecasting Analysis Requirements

The size of the study area and the measures of effectiveness were both considerations addressed at the beginning of the study, prior to any modeling efforts. The size of the study area was intended to be sufficiently large as to avoid the need to revise the model later in the project. The ICC study area extended beyond the immediate corridor eventually selected for the ICC. It included the major highways adjacent to the corridor that would likely be most affected by the ICC: I-270 from Gaithersburg, MD to I-495, I-495 from I-270 to US-1, and I-95 and US-1 from Laurel, MD to I-495.

The introduction to the forecasting methodology section of the study documentation explains that "New facilities are usually justified not only based on existing travel patterns, but also based on future patterns that result from changes in population and employment. The design year for a new facility is usually at least 20 to 30 years in the future. Year 2030 travel patterns for the ICC EIS were developed using the Metropolitan Washington Council of Governments (MWCOG) Transportation Planning Board (TPB) travel forecasting model." The region covered by MWCOG (and the TPB model) includes all of Montgomery and Prince George counties, but not Howard or Anne Arundel counties. The edge of the study area selected for the project is partially formed by the border of the MWCOG region, but was sufficiently large to allow analysis of transportation, air quality, and noise impacts in the EIS. The traffic analysis zones (the basic geographic area to and from which trips are analyzed) in the TPB model were retained and not further refined for project-level studies.

Measures of effectiveness were also defined at the beginning of the study and tied into the likely purpose and need elements of the project. The need for the ICC is described in terms of both current deficiencies in the transportation network in the study area and the long term impacts that anticipated growth in the study area will have on the transportation network. The ICC's Purpose and Need chapter states that the "this transportation project is intended… to provide cost effective transportation infrastructure to serve existing and future development patterns reflecting local land use planning objectives." The chapter introduces several project needs, including "Community Mobility and Safety" and "Movement of Goods and People to and From Economic Centers." The Purpose and Need chapter also highlights the lack of east-west highway routes, which has led to congestion and high accident rates on the local road system, and frames the need for an east-west highway to accommodate traffic generated by economic development areas so that economic growth is not hindered.

The ICC's Purpose and Need chapter discusses (in both qualitative and quantitative terms) the current and anticipated travel demand in the corridor. It describes:

- The existing and planned transportation network, including a discussion of the traffic conditions on and the shortcomings of major roads in the study area.
- The existing and future (no-action 2030) traffic volumes at six screenlines across the study area.
- The existing and future (no-action 2030) levels of service at 51 key intersections in the study area.

Key Consideration 2 of the Guidance: The Suitability of Modeling Methods, Tools, and Underlying Data

Appendix F to the *ICC Travel Analysis Technical Report* provides detailed memorandums discussing improvements to the regional travel model to support testing of highway tolls; validation of the regional travel model in the ICC corridor that led to adjustments in land use inputs, speed and capacity parameters, k-factors in the trip distribution model, and network updates; a peer review of the regional travel model by a Transportation Research Board panel; and a proposed work plan to improve the regional travel model based on the findings of the peer review.

Calibration, Validation, and Reasonableness Checking of Travel Models

The calibration and validation of Version 2.1C of MWCOG's model is described in the ICC Travel Analysis Technical Report. The Travel Analysis Technical Report describes the validation of the model for the ICC study area. The report describes a sequence of validation tests that were used to validate the ICC travel demand model. In summary, these involved reviewing the regional model's performance in the study area, which led to the observation that the regional model somewhat over-simulated travel region-wide as well as within in the ICC corridor.

Next, the project modelers applied updated land use inputs as well as model and network refinements to improve the modeling process at both the regional and corridor levels. Each change was evaluated by examining the performance of such characteristics as regional and corridor vehicle trips, vehicle miles traveled, and screenline results. Specific adjustments included:

- Land Use: The land use inputs for the project were brought up to date to include the Round 6.3 Cooperative Forecasts. Even with the refined land use inputs, however, travel to and through the ICC corridor remained substantially over-simulated in comparison to traffic counts.
- Speeds and capacities: Updates were made to speeds and capacities of different facility types, based on both the Highway Capacity Manual and data collected locally. The changes to the speeds and capacities improved the model, but there were still instances of over-simulated volumes on some freeways. To help correct this, some adjustments to free flow speeds and capacities were made to specific freeway segments in the corridor where their observed operation characteristics deviated from the values used in the model.
- Trip distribution: The ICC base runs indicated over-simulation between Montgomery County and both Frederick and Howard Counties. Additional penalties were added to the model to reduce the over-simulation.
- Network updates: A series of network updates were made to improve the simulation in the ICC corridor. Local agencies reviewed the network in their area and suggested updates to the number of lanes and routes types, and also additional facilities that should be included in the network. A manual review of mechanically assigned land use types for each zone, including comparisons with aerial photos, led to a number of corrections to facility speed and capacities (which are dependent on the density of development in the vicinity). Further corrections were made to be consistent with additional traffic counts that were made at many locations in the corridor.

Consideration of Peer Review

TPB, the region's MPO, requested the Transportation Research Board (TRB) to convene an expert panel to review Version 2.1C of their model. This version of the model was used as the basis of the ICC study model, so the peer review recommendations also helped to improve the quality of the ICC modeling effort. The TRB review panel consisted of seven members, a mix of academics and senior practicing modelers from consultants and MPOs. The panel worked under the following statement of task:

"This project will perform review of the state of the practice of travel demand modeling by the Transportation Planning Board (TPB) of the Metropolitan Washington Council of Governments. The review panel will provide guidance on:

1. The performance of the TPB's latest travel model (version 2) in forecasting regional travel;
2. The proposed process for merging the latest travel model outputs to produce mobile source emissions;
3. The TPB's proposed direction of future travel demand model upgrades;
4. Travel survey and other data needed to accomplish future model upgrades; and
5. The detail (grain) of travel analysis zones that should be developed for future upgrades."

Over a two month period, the panel met for a total of three days, with two additional teleconferences, with staff from MWCOG and other Maryland and Virginia agencies. The panel produced two reports documenting the findings of their review of each of the five elements of the statement of task. TPB provided written responses to the two letter reports and a work plan to address some of the issues raised by the panel. The FEIS includes these letter reports and responses, as well as lists of the reviewed documents. The review process did not consist of detailed work with the model files themselves, but was instead a review of summary inputs, calibration documentation, and other documents describing mode inputs, the model, and the post processing procedures used on model output.

Key Consideration 4 of the Guidance: Forecasting in the Alternatives Analysis

Overview of Transportation-related Effects and Impacts

In the ICC FEIS, Maryland SHA presented the analysis of several transportation related impacts that can be classified as direct effects, including screenline analyses comparing the build and no-build alternatives, travel times during the peak periods, average weekday traffic volumes on local roads, estimated crashes, and the level of service at 51 intersections in the study area.

In addition to these traditional travel performance measures, the study team also considered several other factors that addressed multimodal and accessibility issues. These included:

- Accessibility to jobs: Maryland SHA used the TPB model to estimate the number of jobs accessible within a 45 minute commute time from the study area for no-build and build alternatives.
- Express bus service ridership: To determine the ability of the ICC to function as a multimodal highway, the transit components of the TPB model were used to forecast ridership for the proposed express bus services that would use the ICC.

- Hours at capacity at study area intersections: In addition to the measured intersection level of service in the peak hour, Maryland SHA also estimated the length of the congested period to identify whether the length of the peak period would be reduced under some alternatives.

To measure indirect and cumulative effects, Maryland SHA conducted a secondary (indirect) and cumulative effects analysis that is included as an appendix to the FEIS and is summarized in the main body of the FEIS. The analysis considered a timeframe from 1964 to 2030. The indirect effects that Maryland SHA considered were induced changes in the pattern of land use, population density, and growth rate.

Moving from Regional Model Output to a Project Level Forecast

Post-processing for the ICC project closely followed NCHRP Report 255, *Highway Traffic Data For Urbanized Area Project Planning And Design*[1], to generate design hour turning volumes. NCHRP 255 examines the best techniques being used in urban areas to connect traffic modeling at the system level with project analyses. In particular, the report discusses post-processing techniques that are applicable to projects like the ICC.

The TPB model produced average weekday daily traffic across the coarse network the model contained. The ICC and adjacent arterial and interstate facilities were incorporated in the model for the post processing effort. The NCHRP 255 procedures for smoothing link volumes and determining average daily turning volumes were applied using a series of Excel worksheets that were developed as tools for this process. An iterative process was used to define cutlines that bisected groups of parallel routes.

Once the cutlines were identified, the Excel worksheet tool was used to refine link volumes. The tool corrected for differences between base year model assignments and base year ground counts, then it redistributed vehicles across the cutline. The Excel tool not only assisted directly in the analytical effort, but also provided file documentation of the effort.

Version 2.1C of MWCOG's model incorporates highway pricing to a limited capacity; since it was important to test tolling on the ICC, it was necessary to improve the model's sensitivity to highway tolls. To address the potential redistribution of traffic based on a tolling scheme, the capacity of the ICC was adjusted. Two model runs were completed for each toll alternative considered, a no-toll run and a toll run. The ratio of the no-toll and toll volumes was then applied to the link capacity, which in turn was used in the redistribution of traffic along the cutlines. Appendix F to the ICC Travel Analysis Technical Report provides further detail about the updates made to the model related to tolling.

For more detail about the post processing effort, see Section II of the ICC Travel Analysis Technical Report.

Addressing Land Development or Redistribution Effects

Maryland SHA performed the ICC alternatives analysis using the 2030 socioeconomic forecasts adopted by MWCOG when the DEIS was started, known as Cooperative Forecast Round 6.3. The same data was used for the analysis of build and no-build alternatives. In November, 2004, after the DEIS was published, MWCOG adopted updated forecasts referred to as Round 6.4A, which utilized input from the Expert Land Use Panel (ELUP) that had been convened to assess land use impacts of the ICC. The ELUP estimated households and jobs within smaller geographies of the study area (known as traffic analysis districts) for the year 2030 for the build and no-build alternatives. These allocations considered land use and zoning to identify areas of

[1] http://pubsindex.trb.org/view.aspx?type=MO&id=188432

potential development, as well as potential impacts to resources and transportation facilities that would result from the potential development.

The traffic forecasts produced with the Round 6.4A land use forecasts assume increased growth in the ICC Study Area and showed that there would be more development, and more traffic, if the ICC is built than if the ICC is not built. County planners for Prince George's County, where growth was shown in Round 6.4A forecasts, determined that the growth was not necessarily a direct result of the ICC, but rather influenced by "larger demographic and economic" factors (page IV-387 of the FEIS).

A sensitivity analysis was completed following the DEIS to assess the effect of different development assumptions on traffic forecasts and determine the effect that using the latest forecast would have on the analysis of the alternatives. As would be expected from the inputs used in the creation of Round 6.4A forecasts, the newer land use forecasts showed growth in the eastern portion of the study area that would occur with the ICC, but the ICC was shown to have the capacity to accommodate the related increase in traffic volumes.

For additional information, see Chapter IV, Section J, of Volume I of the FEIS.

Key Consideration 5 of the Guidance: Project Management Considerations

Potential for Reevaluating Analysis

Version 2.1C of MWCOG's travel demand model was used as the basis for the ICC model, which was then validated with an extensive set of traffic counts at 44 cutlines, resulting in matches for 40 of the 44. The counts themselves were validated by analyzing several years of data to identify anomalies. The peer review panel convened for the project was used to assess the data and process.

Following the circulation of the DEIS, MWCOG updated their model to version 2.1D. Stakeholders questioned whether better results would be obtained for the ICC study by adopting the 2.1D model. A sensitivity test was performed using the same cutlines as were used to validate the ICC model. The test found that Version 2.1D did not provide acceptable results on 14 of the 44 cutlines. For the cutlines where Version 2.1D did provide acceptable results, the ICC model still presented better validation in most cases. Considering that Version 2.1C validated better than Version 2.1D, the project sponsors determined that the ICC model was better suited than Version 2.1 D for use in the ICC FEIS.

Enhanced Communication between NEPA Study Team and Forecasting Practitioners

Communication between the NEPA and travel demand forecasting disciplines was facilitated in part through bi-weekly meetings. The meetings included representatives from all disciplines, and an open discussion was encouraged. The regular communication schedule and the multi-disciplinary approach facilitated better understanding of the relationships among the various resource and engineering topics.

Additionally, the travel demand forecasting lead was heavily involved in the development of the goals and objectives for the project, the crafting of the purpose and need, and the identification of the measures of effectiveness. This integration of the traffic discipline into the NEPA documentation minimized the potential for the data and performance of the alternatives to be misinterpreted.

Key Consideration 7 of the Guidance: Documenting and Archiving Forecast Analyses

Documenting Forecast Analyses

The travel demand forecasting effort for the ICC project was documented in a series of technical memoranda and eventually compiled into a Travel Analysis Technical Report. The report identified the methodologies used, the results obtained, and was made available online. Importantly, while the multi-volume report contained substantial documentation in its main body, additional details were included in a series of appendices, further documenting the assumptions made and the results of specific analyses such as screenline refinements, HCS link analyses, and even the base records obtained from the MPO.

During the preparation of the FEIS and ROD, the Travel Analysis Technical Report was updated to incorporate results of sensitivity tests performed and the responses to stakeholder comments on the modeling process. The updated report was also made available online.

Significant to the documentation process was the timeliness of the effort. Technical reports and memoranda were prepared as the model was being refined, documenting the data sources and the rationale for the refinements that were made. Prior to each model run, and technical memo was circulated to other project team members to obtain concurrence on the model run approach.

Additional Background and Sources

FEIS and ROD

volume1_complete.pdf - Volume 1 presents a summary of the FEIS, the project's Purpose and Need, a description of the affected environment, alternatives considered, environmental consequences, possible impacts and potential mitigation for the two build alternatives (Corridor 1 and Corridor 2), including the Final 4(f) Evaluation, environmental stewardship opportunities, the preferred alternative, a summary of agency coordination and public involvement activities, a list of preparers, a distribution list, and references.

The Federal Highway Administration (FHWA), the Maryland Department of Transportation (Maryland SHA), the Maryland State Highway Administration (MSHA), and the Maryland Transportation Authority (MdTA) (collectively the lead agencies) signed the ICC's Final Environmental Impact Statement (FEIS) on January 3,2006. The FHWA signed the ICC's Record of Decision on May 29, 2006.

Documents available online at: *http://www.iccproject.com/feis-download.php*, *http://www.iccproject.com/record-of-decision.php?language=eng*

Technical Reports

The FEIS presents information summarized from other technical documents:

- scea.pdf - Intercounty Connector Secondary & Cumulative Effects Analysis Technical Memorandum (59 MB)
- setr.pdf - Intercounty Connector Socioeconomic and Land Use Technical Report (110 MB)
- TAVolume1.pdf - Intercounty Connector Travel Analysis Technical Report Volume 1 (8 MB)
- TAVolume2.pdf - Intercounty Connector Travel Analysis Technical Report Volume 2 (5 MB)
- TAAppendixA.pdf Appendix A - Screenline Refinements (6 MB)
- TAAppendixB.pdf Appendix B - ADTs and Peak Hour Turn Volumes (2 MB)
- TAAppendixC.pdf Appendix C - Critical Lanes Volume Analysis (22 MB)
- TAAppendixD.pdf Appendix D - HCS Link Analysis (4 MB)
- TAAppendixF.pdf Appendix F - MWCOG/TPB Documents (5 MB)
- TAAppendixG.pdf Appendix G - Summary of Intersection Geometric Improvements (49 MB)
- TAAppendixH.pdf Appendix H - Addendum (22 MB)

New Reports and Addendums to the Existing Technical Documents

- TAReport.pdf - Intercounty Connector Addendum to the Travel Analysis Technical Report (November 22 2005) (48 MB)

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