APPENDIX D

1-69 Section 6 Corridor Travel Demand Model

MEMORANDUM

Date: **August 27, 2015**

Re: **I-69 Section 6 Travel Demand Model for Preliminary Alternatives Screening**

This memorandum describes the use of the I-69 Section 6 Corridor Travel Demand Model in the screening of preliminary alternatives for I-69 Section 6. It also provides technical information regarding corridor model development and assumptions used for screening.

Overview of Corridor Model Application

Corridor model outputs were utilized to support five measures of performance associated with purpose and need evaluation of the preliminary alternatives. Performance of the alternatives was compared with the "no build" scenario, in which I-69 Section 6 is not constructed but other committed and programmed roadway projects are constructed, including the construction of I-69 Sections 1 through 5.

The performance measures and how they relate to the corridor model outputs are described below:

- Annual Crash Reduction—defined as the difference between total crashes in the four-county study area for the alternative scenarios compared to the no build scenario. The model forecasts total annual vehicle miles of travel by roadway classification (freeway or interstate, arterial, collector, etc.) within the study area. Typical crash rates per mile for each classification of roadway are applied to the total vehicle miles of travel, resulting in an estimate of total system crashes.

  This approach captures the safety benefits throughout the I-69 corridor as trips shift from lower classification roadways with higher accident rates to a freeway (I-69) with lower accident rates. Applying the corridor model in this way allows the estimates to consider not only the safety benefits within the I-69 corridor, but also throughout the network.

- Travel Time Benefits—defined as the difference in trip travel times between selected sample locations during the peak hour of travel for the alternative scenarios compared to the no build scenario. The corridor model identifies the fastest route for each trip by adding and comparing individual link travel times derived from speed and distance on each link.

  Most travel time differences occur when drivers shift from lower classification roadways to the higher speed freeway. The travel time calculation also considers trips that may experience longer travel paths in alternative scenarios. Since the corridor model adjusts travel speeds based on traffic volume levels (congestion), the use of the model for this measure accounts for delays and route changes to avoid congestion during peak periods.

- Traffic Congestion Benefits—defined as the total number of miles driven under congested conditions in alternative scenario networks compared to the no build scenario network. The corridor model identifies congested segments by comparing forecasted volumes to a level of service threshold, then totals the miles traveled on those segments.

  This approach captures the benefits of diverting traffic from existing congested routes as the capacity provided by I-69 is absorbed. It also accounts for localized increases in congestion where traffic converges to access new interchanges.

- Regional Freight Truck Travel— defined as the difference between total hours of truck travel in the four-county study area for alternative scenarios compared to the no build scenario. The corridor model identifies truck vehicle hours of travel (VHT) for the alternative scenarios and the no build scenario. A lower truck VHT indicates that an alternative is more effective for this measure because trucks spend less time traveling to their destinations.

- Regional Economic Impact—defined as additional wages earned and additional regional gross domestic product for the alternative scenarios compared to the no build scenario. The calculated benefits represent the total additional wages and gross domestic product throughout the study area over the 30-year study period. These benefits are estimated by an economic impact model called TREDIS. The TREDIS model uses travel times provided by the corridor model to forecast productivity gains for businesses and access to new customers and suppliers.

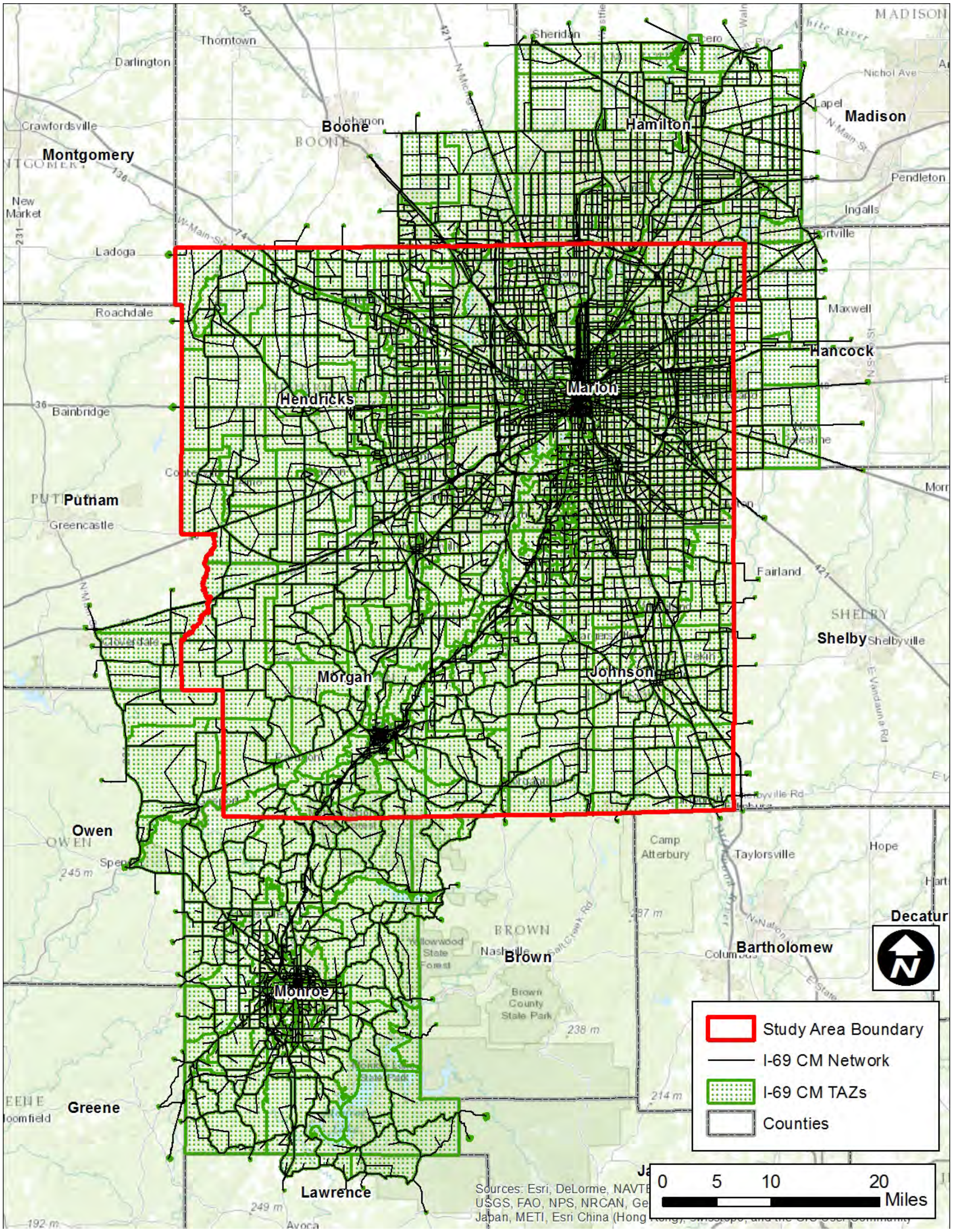
Since transportation networks are interconnected and motorists have multiple choices for most trips, changes on one segment can affect many others. Travel demand models, such as the I-69 Corridor Travel Demand Model, provide the best and sometimes the only opportunity to capture these large scale impacts. This is especially important in the evaluation of freeway proposals since their higher speeds and increased safety make them a particularly attractive choice for many trips.

Technical Description – Corridor Model and Assumptions

The I-69 Section 6 Corridor Travel Demand Model is an update of the I-69 Section 5 Corridor Travel Demand Model. In Section 6, the corridor model coverage area was expanded to include the western half of Hendricks County and enhanced to provide more fine-grained network and demographic data where needed. The corridor model presently covers 2,525 square miles utilizing a total of 2,189 traffic analysis zones (TAZs). The Section 6 study area incorporates four counties: Hendricks, Johnson, Marion and Morgan Counties. A map showing the entire model area is provided in **Figure 1**.

As part of the I-69 Section 6 update, the model was re-calibrated to more accurately replicate travel patterns in these four counties using targets derived from a number of sources, including

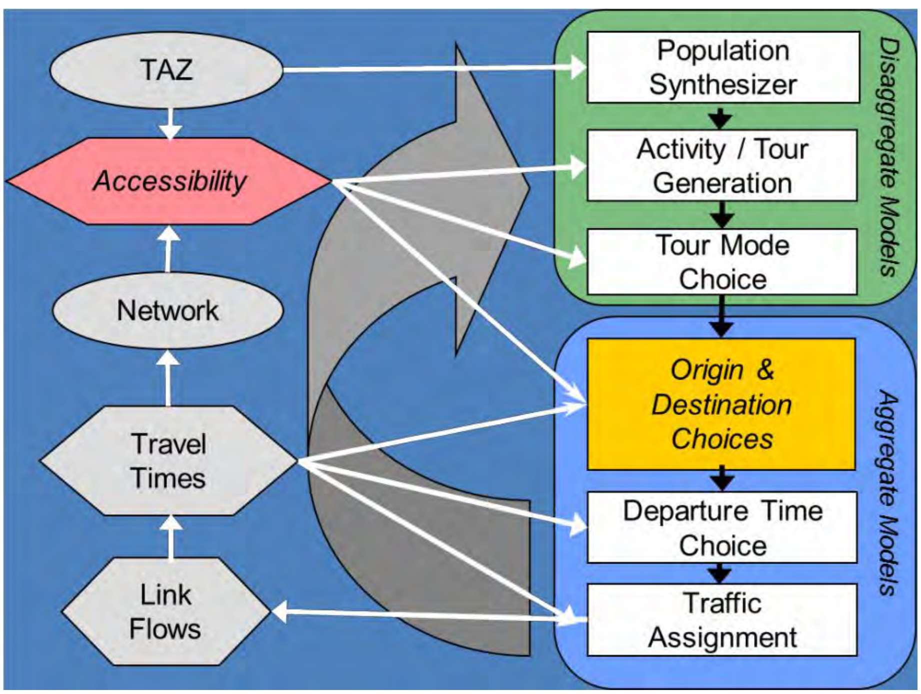
Figure 1: I-69 Corridor Travel Demand Model Area and Section 6 Study Area



the American Community Survey (ACS), National Household Travel Survey (NHTS), and the Central Indiana Travel Survey. The corridor model retains the 2010 base year used in Section 5, however the design year was updated from 2035 to 2045, recognizing that this section of I-69 would not likely be constructed until after 2020. The corridor model relies upon population and employment forecasts as inputs. Updated forecasts were developed for 2045 in coordination with INDOT and the Indianapolis MPO.

The corridor model utilizes a hybrid tour-based format. The hybrid process begins by generating a sample population of individual households for the study area. The travel patterns for each household are then forecasted based on the concept of tours (round trips beginning and ending at home). The model forecasts travel for various purposes (work, school, other), and identifies the number of stops on each tour. The dominant mode of travel (private automobile, school bus, public bus, walking, biking) is also modeled. The sequence of stops on each tour results in a set of individual trips. In the final step of the model, the trips are assigned a travel route on the roadway network so that travelers minimize their travel time and costs. This process is illustrated in **Figure 2**:

Figure 2: Hybrid Model Process



The corridor model utilizes outputs from the Indiana Statewide Travel Demand Model Version 7 (ISTDM v7) to identify the pattern of trips originating or ending outside of the four-county study area. The corridor model then determines the optimal route of these trips through the study area.

Model Assumptions

For the purposes of analysis at this stage, interim 2045 demographics were developed for the I-69 Corridor Travel Demand Model by creating a growth trend line between the 2010 census demographics and the 2035 demographic projections previously developed by INDOT and the Indianapolis MPO. This trend line was assumed to remain constant and was extrapolated from 2035 to 2045 to generate interim demographic forecasts.

Committed and programmed roadway expansion projects were coded into the corridor model 2045 road network in accordance with the Indianapolis MPO 2014-2017 Indianapolis Regional Transportation Improvement Program (IRTIP) and Long Range Transportation Plan (LRTP), the Statewide Transportation Improvement Program (STIP), and the INDOT 5-Year construction program. These projects predominantly included widening of existing roadways but also some major new roadways, such as a Ronald Reagan Parkway extension in Hendricks County.

Additionally, the ISTDM 2035 model was utilized to create external volumes for the I-69 Corridor Model, as 2035 is the furthest horizon year available for the ISTDM. The 2035 ISTDM currently includes the I-69 Ohio River Bridge near Evansville, but this project will be removed from future model runs because it is not included in any cost-constrained transportation plan.

For alternatives screening, a single ISTDM 2035 scenario reflecting I-69 Section 6 along the SR 37 corridor was used to create a consistent externals volume matrix for each of the alternatives. This facilitated an "apples-to-apples" comparison of the preliminary alternatives.

Assumed Conditions for Testing

The five preliminary alternatives being screened are shown in **Figure 3**. Each alternative originates just south of SR 39 in Martinsville and follows the SR 37 corridor for at least 9 miles. From this point, they vary in alignment and interchange connection points with I-465. I-69 lane requirements assumed for each alternatives provide acceptable daily traffic operation with the preliminary modeling but will be analyzed in more detail during the DEIS.

The preliminary alternatives are as follows:

- **Alternative B:** Follows SR 37 for about ⅓ of its length, with ⅓ new terrain between SR 37 and I-70, and ⅓ along I-70. Adjacent land use includes commercial to the south but is largely rural in the new terrain portion with agricultural, forest and residential land uses.
- **Alternative C:** Follows SR 37 from south of SR 39 to I-465; adjacent land use includes commercial to the south and north, with agricultural, forest and scattered residential in between.
- **Alternative D:** Follows SR 37 for about ⅓ of its length, with ⅓ new terrain between SR 37 and I-70 (center section east of Alternative B), and ⅓ along I-70. Adjacent land use includes commercial to the south but is largely rural in the new terrain portion with agricultural, forest and residential land uses.

- **Alternative K3:** Follows SR 37 for about ⅔ of its length with ⅓ on new terrain west of SR 37 to I-465 at Mann Road. Adjacent land use includes commercial to the south but is largely rural in the new terrain portion with agricultural, forest and residential land uses.
- **Alternative K4:** Follows SR 37 for about ½ of its length with ½ on new terrain west of SR 37 to I-465 at Mann Road. Adjacent land use includes commercial to the south but is largely rural in the new terrain portion with agricultural, forest and residential land uses.

Additional assumptions used in the preliminary alternatives screening process include the following:

- Speed limits were assumed to be 70 mph in rural areas and 65 mph in urban/suburban areas.
- A mix of interchange types were coded at surface street access points and fully directional 'T' interchanges were coded where I-69 would tie into existing interstates (I-70 or I-465).
- Added lanes were assumed on existing interstates where preliminary model results showed a need due to the I-69 project. Additional lanes were modeled on I-465 between Mann Road and I-69 with Alternatives C, K3 and K4. For Alternatives K3 and K4, these would actually be auxiliary lanes included with the I-69 interchange.
- One added lane in each direction was assumed on I-70 between I-69 and SR 267 with Alternatives B and D. East of SR 267, existing I-70 has adequate lanes.
- No induced population or employment growth was added to the TAZ layers due to I-69.

Both the I-69 Section 6 Corridor Model and TREDIS will continue to be used to support development of the DEIS. Ongoing refinements to the corridor model will facilitate the forecast of peak hour and daily traffic volumes for the study area network. The potential for each alternative scenario to generate induced population and employment growth will be evaluated using input from an expert land use panel and data output from the TREDIS economic model. Induced growth will be incorporated into the corridor model so that the impact on traffic forecasts will be reflected in the DEIS.

Figure 3: Preliminary Alternatives