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CHAPTER 5 – ENVIRONMENTAL CONSEQUENCES

Minor editorial changes have been made to this section since the publication of the Draft Environmental Impact Statement (DEIS). References to changes in Tier 2 studies for the preferred alternative have been changed to refer to the Refined Preferred Alternative (RPA).

5.1 Introduction and Methodology

Chapter 5, Environmental Consequences describes the impacts of implementing the alternatives described in **Chapter 3, Alternatives**. Sections of this chapter review 26 individual categories of social, environmental, or economic impact. Generally, the methodology used to address each impact category is described at the beginning of each section, followed by analysis, impacts, and mitigation measures. A summary is provided at the end of each section.

This introduction compares the methodologies used to determine environmental consequences in Tier 1 with the methodologies used in this Tier 2 study to provide a context for the review of environmental consequences for I-69 Section 6.

5.1.1 Overview of Tier 1 Methodology

As described in **Section 1.2**, FHWA and INDOT determined that a two-tiered process would be used to complete the NEPA process for I-69 between Evansville and Indianapolis. The Tier 1 Record of Decision (ROD) identified the project corridor based on a review of environmental impacts in a 26-county study area. This Tier 2 study reviews project impacts in greater detail within a four-county study area. **Table 1-1** describes overall differences between Tier 1 and Tier 2 studies. This chapter describes differences in how environmental impacts are measured in Tier 1 and Tier 2.

The 26-county study area of the Tier 1 FEIS encompassed approximately one-quarter of the State of Indiana, and involved the consideration of alternatives approximately 141 to 156 miles in length. The alternatives were geographically widespread, resulting in the need to consider environmental issues across a broad area. I-69 Section 6 is approximately 26 miles long.

In the Tier 1 FEIS, five major alternatives were analyzed, with multiple "options" for connecting to Indianapolis. Including these options, there were a total of 12 alternatives considered in the EIS. These alternatives, as well as the 26-county study area, are shown in **Figure 1-1**. To analyze the environmental impacts of these alternatives, FHWA and INDOT defined each alternative in Tier 1 as a set of three overlapping bands, as described below and as shown in **Figure 5.1-1**.

- **Study Band**: a two-mile-wide band within which the environmental data gathering efforts were focused for each alternative.
- **Corridor**: generally 2,000 feet wide, but its width was narrower in some places and broader in others.

- **Working Alignment**: from 240 to 470 feet of potential highway right of way within the 2,000-foot corridor.

Figure 5.1-1: Study Band, Corridor, Working Alignment (Tier 1)

The basic tool used for estimating the environmental impacts of each alternative in Tier 1 was the geographic information system (GIS) for the project. This electronic database consisted of a series of data layers, including each of the study bands, corridors, and working alignments, as well as more than 170 layers of environmental resources and other features.

The Tier 1 GIS database was used to generate maps showing the relationship of each alternative with environmental resources and other features. Some of these maps were contained in Chapter 5, Environmental Consequences, of the Tier 1 FEIS. Others were included in Volume III, Environmental Atlas, of the Tier 1 FEIS. The GIS database was used to calculate the impacts of each alternative and the results were presented in Chapter 5 of the Tier 1 FEIS.

Generally, the direct impact calculations shown in the Tier 1 FEIS reflected the impacts within the footprint of the working alignment of each alternative. Exceptions were for alternatives that incorporated I-70 added lanes or SR 641 (Terre Haute bypass) since these were separate projects. Where alternatives had multiple variations, impacts were presented as ranges. Alternatives that followed SR 37 or US 41 reflected only the impacts outside the existing right of way of these highways.

The Tier 1 FEIS identified potential interchange locations and designs based on corridor level criteria such as roadway classification, traffic volumes, access to communities, distance between

interchanges, and the presence of sensitive resources. The same factors are considered in Tier 2, but interchange locations are revised and designs refined based on additional information, more detailed analysis, and localized public and agency input.

The Tier 1 FEIS assumed right of way needs of approximately 10 acres for each potential interchange but noted that the actual amount of land could be greater or less depending upon the interchange configuration. The Tier 1 FEIS noted that the 10-acre estimate included only the land needed for the interchange. Impacts from indirect development due to the interchange were incorporated into the cumulative impacts analysis (Section 5.26) of the Tier 1 FEIS.

5.1.2 Overview of Tier 2 Methodology

The purpose of Tier 2 studies is to consider a range of alternatives within the approved Tier 1 corridor. For I-69 Section 6, alternatives were also considered outside of the corridor where necessary to avoid significant impacts (see **Section 1.2.4**). The scope of the Tier 2 studies includes preliminary engineering, field verification of aerial photography, and delineation of resource locations and boundaries. Field surveys are also conducted to identify the presence or potential for resources. Tier 2 studies develop final alternatives within the corridor and determine mitigation measures for identified impacts.

Methodologies differ in Tier 1 and Tier 2 studies, consistent with the relative scope of each analysis. Following are some of the key methodological differences between the impacts analysis of Tier 1 and Tier 2 studies:

- **Resource Impact Analysis.** The Tier 1 FEIS identified environmental resources and estimated impacts based on GIS data layers that varied in level of detail and accuracy depending on the original data source. Limited field checks were conducted in the 26-county Tier 1 study area to verify these GIS data layers. In Tier 2, resource data have been developed and/or refined with the aid of high resolution aerial photography and field reconnaissance.

  For example, Tier 1 land use/land cover data used United States Geological Survey (USGS) satellite imagery with 30-meter resolution. Tier 2 land use/land cover data uses a combination of high resolution aerial photography produced specifically for the project corridor with publicly available aerial photography with a 1-meter resolution.

- **Aerial Mapping**. Tier 1 utilized statewide mapping that was flown in 1998 with revisions flown in 1999. Mapping for Tier 2 was flown in the fall of 2015 and fall of 2016 to create digital topographic mapping and support the generation of digital terrain models (DTMs). The Tier 1 evaluation documented impacts within a 2-mile corridor and ultimately developed a preferred corridor of 2,000 feet (varying in width at select locations). The Tier 2 mapping is confined within the 2,000-foot corridor selected in Tier 1. The DTM supports the definition of project-level estimates of right of way.

- **Design of Alternatives**. Tier 1 was constrained to a two-dimensional plan view of the "potential" footprint of the corridor. Typical sections for impact analysis were established

based upon the number of lanes and the physiographic region. A standard construction length of one-half mile was used to estimate the cost for each potential overpass. For the purpose of impact calculations, it was assumed that the overpasses had no new footprint beyond the mainline typical section. These standard/typical footprints were then overlaid with environmental GIS layers to perform the impact analysis. Field verification of environmental resources was performed on a limited basis. The finished product (preferred alternative) in Tier 1 was a corridor, generally 2,000 feet wide. A geometrically defined alignment was not part of the preferred alternative.

Tier 2 uses controlled aerial mapping to define geometrics for the mainline, overpassing roadways, and local service roads. Site-specific traffic volumes are used to develop interchange configurations, and these configurations are modified as needed to avoid/minimize impacts to environmentally sensitive features. The DTM is used to generate vertical profiles and cross-sections of the various alignments using current INDOT design criteria, as described in **Section 3.5**.

Design features that lessen impacts and optimize use of existing pavement, grade, structures, and right of way are considered in Tier 2. Proposed design exceptions that might reduce cost and impact are reviewed by FHWA during the NEPA stage, although formal approval of design exceptions would occur after the Tier 2 studies are completed and final design is underway.

Potential mainline typical sections, interchange locations and types, and local service road configurations are explored as part of the Tier 2 alternative development. Typical sections for I-69 Section 6 alternatives are shown in **Figure 3-8** and **Figure 3-9**. Rights of way for the alternatives are shown in the tabbed alternative maps at the end of **Chapter 3, Alternatives**.

Additional engineering refinement was performed on Alterative C4 after it was identified as the preferred alternative in the DEIS. The resulting Refined Preferred Alternative (RPA) includes engineering changes to reduce impacts, reduce cost, and address public comments on the DEIS. The RPA is described in **Section 3.8**.

- **Local Service Roads**. Tier 1 included local service roads only at locations where an existing roadway was physically isolated from the surrounding road network. An analysis of access roads to individual properties was not performed. Tier 2 studies consider local linkages and property access in greater detail. Decisions regarding local service roads may be adjusted during final design if the determination is made that it is more cost-effective to purchase a property than to provide access to it.
- **Construction Cost Estimates**. Tier 1 studies used generalized unit costs and corridor level cost estimating methods consistent with the level of detail of the alternatives (cost per mile, per interchange, etc.). Tier 2 cost estimates are developed at a much higher level of detail and are adjusted to match the likely period of construction. See **Chapter 6, Comparison of Alternatives**.

5.1.3 Tier 1 and Tier 2 Impact Evaluation Comparison

Table 5.1-1 compares the methodologies used in Tier 1 and Tier 2 for the analysis of a range of major impact categories including the following: social, land use, farmland, economic, traffic, visual, air quality, noise, cultural resources, threatened and endangered species, water quality and floodplains, wetlands, forests, and cumulative impacts. The results of the analyses for Tier 2 are presented in the remaining sections of this chapter. Additional detail regarding the methodology used for each impact area is provided at the beginning of each section.

Table 5.1-1: Tier 1 and Tier 2 Impact Evaluation Methodologies

Tier 1	Tier 2
Wetlands	
Identify wetlands within study bands using NWI wetland maps. Identify high value and sensitive wetlands through previous studies and resource agency coordination. Conduct field studies as needed.	Conduct field studies to identify wetlands impacted. Wetland boundaries are estimated within the corridor. Delineate wetlands impacted by the RPA. Impacts within existing SR 37 right of way are included within the overall impact totals; features within SR 37 right of way are noted as a separate subtotal.
Estimate NWI wetland impacts of working alignments.	Complete Indiana Wetland Rapid Assessment Procedure (INWRAP) analysis for wetlands impacted. Use construction limits to determine wetland impacts, per United States Army Corps of Engineers (USACE) requirements for Clean Water Act (CWA) Section 404 and state issued Isolated Wetland and CWA Section 401 permits. Impacts within proposed construction limits are included within the overall impact totals; features within SR 37 right of way are noted as a separate subtotal.
Define buffer zones around high quality and sensitive wetland complexes.	Obtain USACE and Indiana Department of Environmental Management (IDEM) approval of wetland determinations.
Cultural Resources	
Identify known sites within study bands.	Conduct full assessments of effects on individual resources.
Consult with SHPO and local historians to identify unrecorded historic sites potentially affected by working alignments (APE = two-mile-wide study band).	Resolve adverse effects, as appropriate.
Identify reported archaeological sites and High Probability Areas.	Conduct archaeological field survey in areas potentially impacted by the RPA. Impacts within the heavily disturbed areas of the existing SR 37 are not included in the archaeological field surveys.

Tier 1	Tier 2
Threatened and Endangered Species (T/E)	
Identify potential habitat and resident T/E species within study bands using Indiana Department of Natural Resources (IDNR) database and identify possible areas for wildlife impacts.	Conduct comprehensive field surveys, including sampling, trapping, and capturing.
Review the probability of occurrence for listed species in and near the corridor.	Analyze specific impacts based on the RPA.
Farmland and Agriculture	
Identify farmland, including prime farmland, within study bands.	Map farmland in and around alternatives.
Estimate farmland (including prime farmland) acres potentially affected by working alignments.	Determine total farmland (including prime) acres potentially impacted. Assess the potential annual loss in crop production using data from most recent three-year period. Determine severance of existing farm operations and creation of point row tracts using property information obtained as GIS shapefiles from the county assessor.
Coordinate with Natural Resource Conservation Service (NRCS) to develop a methodology using existing GIS data to assess farmland impacts for each alternative.	Prepare NRCS-CPA-106 in coordination with NRCS.
Land Use	
Identify major land uses or land cover within study bands (GAP analysis, e.g., forests, croplands, wetlands, quarries, residential).	Field verify land use depicted on aerial photographs.
Identify areas with comprehensive land use plans and evaluate project consistency with plans.	Update review of comprehensive land use plans and evaluate project consistency with plans. Incorporate input from Expert Land Use Panel.
Estimate range of converted acres.	Determine acres converted by alternatives. Impacts within the existing SR 37 right of way are already devoted to transportation use and are not incorporated in the acres converted.
Water Quality and Floodplains	
Identify water bodies, impaired water bodies, general floodplains, and karst within study bands.	Conduct field studies to evaluate the physical habitat available to support biological communities.
Review baseline water quality information and literature.	Conduct Qualitative Habitat Evaluation Index (QHEI) and Headwater Habitat Evaluation Index (HHEI) surveys to classify existing water quality. Conduct field studies to identify karst features.
Estimate acres of water bodies, physiographic karst areas, and general floodplains impacted by working alignments.	Determine acres of water bodies and Federal Emergency Management Agency (FEMA) floodplains impacted. Determine number of karst features impacted through identification of karst features within the corridor and areas hydrologically linked to the corridor. Implement project development in accordance with the procedural steps 1-4 of the Karst Memorandum of Understanding (MOU). Impacts within existing SR 37 right of way are included within the overall impact totals; features within SR 37 right of way are noted as a separate subtotal.

Tier 1	Tier 2
Air Quality	
Identify nonattainment and maintenance areas within 26-county study area.	Analyze project level air quality. Determine air quality dispersion impacts among alternates, as applicable.
Coordinate with Metropolitan Planning Organizations (MPOs) to satisfy conformity requirements.	Coordinate with MPOs and INDOT to satisfy conformity requirements.
Economic Impacts	
Identify impacts to personal income, businesses, tourism, industry, and employment for study area and for all of Indiana using Regional Economic Models, Inc. (REMI)[1] model.	Assess potential increases in personal income, total employment, and employment in key employment categories in the I-69 Section 6 study area. Evaluate additional wages earned and regional gross domestic product resulting from the I-69 Section 6 project using TREDIS.[2]
Identify regional breakdown of impacts within 26-county study area.	Consult with local and county officials to identify economic development plans.
Social Impacts	
Identify residences and communities, including minority and low-income communities, within study bands.	Identify parcels to be impacted and land owners to be relocated. Review relocations and other impacts from an environmental justice perspective for disproportionate impact on minorities and low-income populations.
Estimate range of possible relocations.	Identify relocation issues.
Adjust working alignment to minimize relocations.	Provide more precise estimates of number of relocations.
Cumulative Impacts	
Identify effects of major planned projects upon existing land use development trends in 26-county study area.	Refine assessment of impacts based on current and planned development and consultation with local and county officials.
Model effects of these projects to estimate cumulative impacts over 26-county study area.	
Identify potential mitigation measures.	Refine and confirm mitigation measures.
Estimate indirect and other impacts for Year 2025.	Estimate indirect and other impacts for Year 2045.
Noise Impacts	
Identify existing activities, land use, and levels of truck and car traffic with study bands.	Conduct field studies to determine existing noise levels for model validation. Existing noise levels include traffic from existing SR 37 and other proximate transportation facilities.
Estimate noise levels in bands radiating from working alignment using existing traffic data.	Predict noise levels resulting from alternatives and develop mitigation measures (e.g., noise barriers).

[1] *REMI is an economic forecasting and policy analysis model which evaluates the economic effects of transportation improvements.*

2 *TREDIS is a suite of tools that assess economic impacts, benefits and costs of transportation policies, plans and projects from alternative perspectives. It uses the I-69 Section 6 Corridor Model network and Freight Analysis Framework (FAF) of INDOT to evaluate the cumulative additional economic benefits over a 20-year period within the four-county study area.*

Tier 1	Tier 2
Visual Impacts	
Identify type of setting crossed by working alignment.	Refine assessment of visual impacts by considering more detailed alternatives definition. Since I-69 Section 6 involves the conversion of existing SR 37 to an interstate highway, visual impacts are compared to the views to and from the existing roadway.
Estimate views of and from working alignments to determine impacts.	
Evaluate potential for context-sensitive design elements.	Identify specific elements of working alignment appropriate for context-sensitive design. Since I-69 Section 6 involves the conversion of existing SR 37 to an interstate highway, resource impacts are compared to those impacts attributable to the existing roadway.
Traffic Impacts	
Traffic forecasts provided by Indiana Statewide Travel Demand Model (ISTDM) Version 3. Base year for ISTDM is 1998 and forecast year is 2025.	Traffic forecasts provided by more detailed corridor model, which uses as input forecasts provided by ISTDM. For both ISTDM and corridor model, base forecasts are for Year 2010 and the forecasts are Year 2045. Forecasts are developed in coordination with the Indianapolis MPO for consistency with their regional travel demand model.
Traffic forecasts based upon land use forecasts for Year 2025. Land use forecasts were extrapolated from a 1998 base year.	Traffic forecasts based on land use forecasts for Year 2045. Land use forecasts incorporated 2010 Census data, as well as input from the Expert Land Use Panel which convened in December 2015 and February 2016.
Traffic model forecasts traffic flows on state highways and limited number of major local roads.	Traffic model forecasts traffic flows on local roads throughout study corridor. Generally, traffic flows are forecasted for all roads with functional classification of major collector and higher.
Traffic forecasts suitable for evaluating performance on purpose and need throughout 26-county study area. Traffic forecasts also suitable for evaluating capacity requirements and level of service on major state highways.	Traffic forecasts suitable for evaluating performance on local purpose and need in the four-county study area. Traffic forecasts also suitable for evaluating access treatment alternatives, such as grade separations and local service roads.
Forest Impacts	
Identify forest impacts using USGS Land Cover GIS data, which is a subset of the National Land Cover Data (NLCD). The NLCD was developed by the USGS with the United States Environmental Protection Agency (USEPA) to produce a consistent, land cover data layer for the continental United States. The land cover layer is based on satellite imagery with 30-meter resolution. This data is current through 1992.	Identify forest impacts through photo interpretation of 2010 aerial photographs supplemented by field reconnaissance. Include groups of trees larger than one acre and wider than 120 feet. Forest is grouped into USDA Forest Classifications (Cherry-Ash-Yellow Poplar, Oak-Hickory, etc.) based upon field reconnaissance.
Estimate the acreage of possible forest impacts within the working alignment.	Identify acreage of forest impacts, type of forest to be impacted (USDA Forest Classifications), acreage of core forest impacts, and indirect forest impacts. Impacts within existing SR 37 right of way are included within the overall impact totals; features within SR 37 right of way are noted as a separate subtotal.