



**MID-STATES
CORRIDOR**

APPENDIX A: TRANSPORTATION PERFORMANCE MEASURES ANALYSIS

Mid-States Corridor Tier 1 Environmental Impact Statement

Prepared for

Indiana Department of Transportation

Mid-States Corridor Regional Development Authority

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Prepared by

Mid-States Corridor Project Consultant





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1. INTRODUCTION

The following substantive changes have been made to this appendix since the Draft Environmental Impact Statement (DEIS) was published:

- During the Screening of Alternatives, preliminary Alternative R was evaluated before being removed from further consideration. Alternative R consists of upgrading US 231 from I-64 to I-69. Many comments on the DEIS requested further consideration of an upgrade of US 231 in addition to the five alternatives presented in the DEIS. In response to these comments, this FEIS further evaluates the costs, impacts and benefits of Alternative R. See **Section 2.5.1** for details about Alternative R.
- Multiple comments were received from local officials in Loogootee and Martin County about the alignment of Alternative P in Martin County, in particular in the vicinity of Loogootee. The DEIS showed Alternative P with an alignment west of Loogootee. Portions of this alignment are in Daviess County. These comments requested modifications to Alternative P to bring it through or to the east of Loogootee.

In response to these comments, three additional variations of Alternative P have been added in Martin County. All variations of Alternative P are within Section of Independent Utility (SIU) 4. See **Section 2.7** for a discussion of Tier 2 sections for all alternatives. Alternative P with these variations has been designated as Refined Alternative P (RPA P). It is evaluated separately from any alternative considered in the DEIS. A single variation of RPA P will be selected in Tier 2 studies for SIU 4. See **Section 2.5.2** for details about the variations of RPA P near Loogootee.

Performance Measures are a key metric (along with cost and impacts) to evaluate Mid-States corridor alternatives. Transportation performance measures were provided by the Mid-States Travel Demand Model and are included in this document. Economic performance measures were provided by the TREDIS software tool and are included in **Appendix B**. See **Appendix T** for full documentation of the Mid-States Travel Demand Model.

Performance Measures for the Mid-States Tier 1 EIS are documented in **Chapter 1 - Purpose and Need** and **Appendix CC – Purpose and Need Appendix**. This appendix describes and provides detailed breakdowns of the performance measure calculations for project goals 1, 2, 3, 4, and 7.

2. TRANSPORTATION PERFORMANCE MEASURES

The transportation goals for the Mid-States project are given below. Each goal has one or more performance measures, as described in the following sections.

- **Goal 1 – Increase accessibility to major business markets (core goal)**
- **Goal 2 – Provide more efficient truck/freight travel in Southern Indiana (core goal)**
- **Goal 3 – Reduce localized congestion in Dubois County**



- Goal 4 – Reduce crashes at key locations in Southern Indiana
- Goal 7 – Increase access to major intermodal centers from Southern Indiana (core goal)

Performance measures are reported for all combinations of alternative and facility type. In **Chapter 2** and **Chapter 5**, performance measures (as well as costs and impacts) are reported as a range of values for Alternatives B, C, P, M, O and RPA P (see **Figure 1**). The information in this appendix provides additional details for these performance measures. The alternatives are described in detail in **Chapter 2**. Performance measures for Alternative P and RPA P are identical for each facility type.

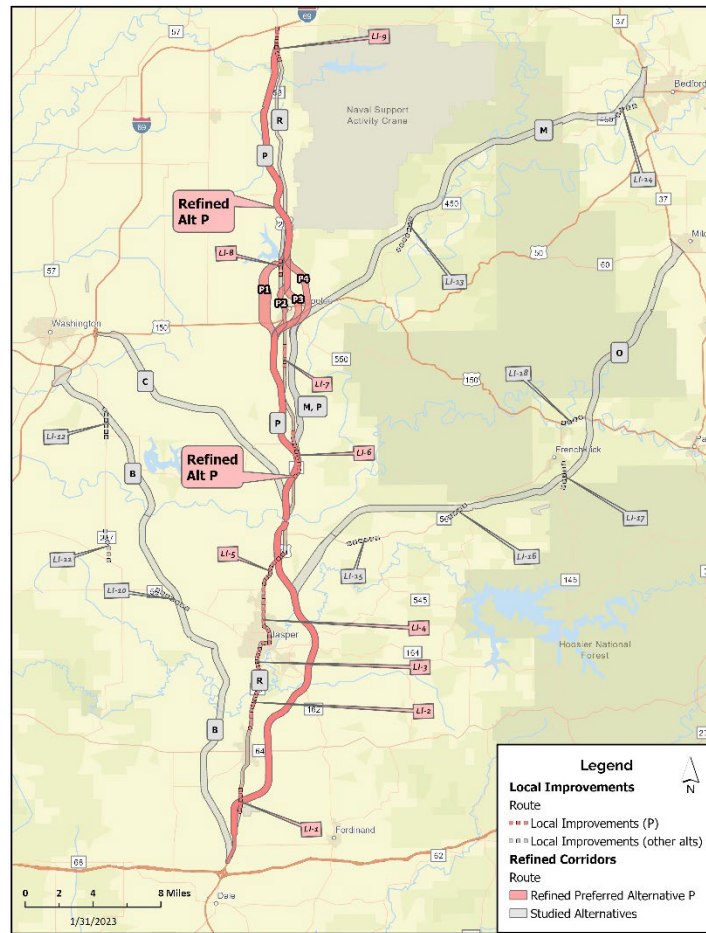


Figure 1: DEIS Alternatives

Goal 1 – Increase Accessibility to Major Business Markets (Core Goal)

Jasper is the largest population and employment center within the 12-county Study Area. It is home to a number of industries and manufacturers doing business in broad regional and national markets. A core goal of the study is to increase its accessibility to major business markets. Lower travel time from Jasper (and other business centers described in following sections) to major economic centers would increase accessibility for businesses within the Study Area. Several performance measures assess reduction in



travel time from Jasper, Crane, Bedford and French Lick, as well as increases in accessibility along the entire US 231 corridor in the Study Area. An additional performance measure assesses increases in labor force access to five major employment centers. These are described in the following text.

Improved Access to Jasper¹

Travel times between Jasper and Indianapolis, Chicago and Louisville for the horizon year 2045 for No-Build and Build Alternatives were estimated using the Mid-States Travel Demand Model (TDM). Travel time for the PM peak period (4PM to 7PM) was estimated by skimming assigned highway networks to obtain travel times between Jasper and Indianapolis, Chicago and Louisville. Network skimming is a tool used with travel model assignments for obtaining impedances (e.g., travel time, cost) between origins and destinations, which includes collecting attribute data for links in the model. Full details of the Mid-States Travel Demand Model and associated post processors are included in **Appendix T**. **Table A-1** shows travel times and differences in travel times from the No-Build alternative for the Mid-States alternatives.

Origin-Destination	2045 No-Build Travel Time (Min)	Changes in Travel Time (Min) Reduction (-ve) and Increase (+ve)										
		B2	B3	C2E	C3E	M2E	M3E	P/RPA2	P/RPA3	O2E	O3E	R
Jasper - Indianapolis	143	-1	-1	-1	-1	-2	-1	-5	-2	0	0	-1
Jasper - Chicago	272	-2	-1	-2	-1	-2	-2	-5	-2	0	0	-1
Jasper - Louisville	103	-2	-2	0	-1	-3	-2	-3	-2	-3	-3	0

Table A-1: Travel Time Savings from Jasper

Travel Time Improvements Between Interstate 64 and 69

Interstate Highways 64 and 69 are the two major freeways within the 12-County Study Area. This performance measure identifies travel time savings between these two major freeways along US 231. This measure is based upon feedback received during multiple interviews with economic development officials who identified issues with slow speeds, congestion, and travel time predictability along US 231. Please refer to **Section 1.4.2.2** in **Chapter 1 – Purpose and Need** for specifics. This measure assesses the ability of all alternatives to improve travel time in this corridor.

Table A-2 shows the travel time between Interstate Highways 64 and 69 for the No-Build alternative and the differences in travel times from the No-Build alternatives for the Mid-States alternatives. This measures the increase in accessibility along the US 231 corridor through the Study Area.

¹ See **Section ES.8 – Glossary** for explanation of alternative naming conventions. Table header designation “-ve” refers to improvements/reductions in travel time. Designation “+ve” refers to worsening/increases in travel time.



Origin-Destination	2045 No-Build Travel Time (Min)	Changes in Travel Time (Min) Reduction (-ve) and Increase (+ve)										
		B2	B3	C2E	C3E	M2E	M3E	P/RPA2	P/RPA3	O2E	O3E	R
Interstate 64 - Interstate 69	68	-8	-6	-6	-5	-12	-7	-15	-9	-8	-6	-1

Table A-2: Travel Time Savings between Interstate Highways 64 and 69

Improved Access to Crane

Naval Support Activity (NSA) in Crane, Martin County employs more than 3,000 people. This performance measure identifies travel time savings between NSA Crane and Jasper, Rockport and Louisville. Travel time estimates for the horizon year 2045 for No-Build and Build Alternatives were estimated using the TDM. Travel time for the PM peak period (4PM to 7PM) was estimated by skimming the assigned highway network to obtain travel time between NSA Crane and Jasper Rockport and Louisville. **Table A-3** shows travel times and differences in travel times from the No-Build alternative for the Mid-States alternatives.

Origin-Destination	2045 No-Build Travel Time (Min)	Changes in Travel Time (Min) Reduction (-ve) and Increase (+ve)										
		B2	B3	C2E	C3E	M2E	M3E	P/RPA2	P/RPA3	O2E	O3E	R
NSA Crane - Jasper	48	-1	-1	-1	-1	-2	-1	-5	-3	-1	-2	-1
NSA Crane - Rockport	90	-8	-6	-6	-5	-12	-9	-15	-8	-8	-6	-1
NSA Crane - Louisville	131	0	0	0	0	0	0	-1	0	0	0	0

Table A-3: Travel Time Savings from NSA Crane

Improved Access to Bedford

Bedford is an important population and employment center within the Study Area. This performance measure identifies travel time savings between Bedford and Rockport and Louisville. Travel time estimates for the horizon year 2045 for No-Build and Build Alternatives were estimated using the TDM. Travel time for the PM peak period was estimated by skimming the assigned highway network to obtain travel time between Bedford and Rockport and Louisville. **Table A-4** shows travel times and differences in travel times from the No-Build alternative for the Mid-States alternatives.

Origin-Destination	2045 No-Build Travel Time (Min)	Changes in Travel Time (Min) Reduction (-ve) and Increase (+ve)										
		B2	B3	C2E	C3E	M2E	M3E	P/RPA2	P/RPA3	O2E	O3E	R
Bedford - Louisville	88	0	0	0	0	0	0	0	0	0	0	0
Bedford - Rockport	114	0	0	-4	-3	-10	-9	-5	-4	-3	-1	0

Table A-4: Travel Time Savings from Bedford



Improved Access to French Lick

French Lick is an important tourist and employment center within the Study Area. This performance measure identifies travel time savings between French Lick and Indianapolis, Rockport and Louisville. Travel time estimates for the horizon year 2045 for No-Build and Build Alternatives were estimated using the TDM. Travel time for the PM peak period was estimated by skimming the assigned highway network to obtain travel time between French Lick and Indianapolis, Rockport and Louisville. **Table A-5** shows travel times and differences in travel times from the No-Build alternative for the Mid-States alternatives.

Origin-Destination	2045 No-Build Travel Time (Min)	Changes in Travel Time (Min) Reduction (-ve) and Increase (+ve)										
		B2	B3	C2E	C3E	M2E	M3E	P/RPA2	P/RPA3	O2E	O3E	R
French Lick - Indianapolis	136	0	0	0	0	0	0	0	0	-2	-1	0
French Lick - Louisville	77	0	0	0	0	0	0	0	0	0	0	0
French Lick - Rockport	73	0	0	-3	-3	-4	-4	-4	-3	-6	-5	0

Table A-5: Travel Time Savings from French Lick

Improved Access to Major Employment Centers

Improved accessibility to major business markets is one of the core goals of this project. Total population within a specified travel time of major employment centers in the Study Area was estimated for No-Build and 11 alternatives using a PM peak period assignment of the TDM for the 2045 horizon year. These major employment centers include Jasper, Crane, Washington, French Lick and Bedford. Traffic Analysis Zones (TAZs) are a major component of the TDM. TAZs contain important socioeconomic information including total population, total households and total employment. Using TransCAD’s travel time band feature, total population within 30-minute travel time during PM peak period was estimated from each of the major employment centers. **Table A-6** shows total population and increase in population within 30-minute travel time within the major employment centers for No-Build and each of the 10 Mid-States alternatives.

Access From	2045 No-Build Labor Access within 30-Minute Travel Time (PM Peak)	Changes in Labor Access										
		B2	B3	C2E	C3E	M2E	M3E	P/RPA2	P/RPA3	O2E	O3E	R
Jasper	77,800	4,300	2,100	2,200	1,700	7,800	7,600	8,900	8,700	8,600	8,400	100
Crane	73,500	200	300	0	0	200	100	900	500	0	0	0
Washington	88,200	13,000	12,900	2,000	2,000	200	0	400	300	0	0	0
French Lick	64,600	100	0	800	800	800	600	1,000	900	17,200	17,000	0
Bedford	95,300	100	100	0	0	2,000	1,900	600	200	1,100	900	0

Table A-6: Population Access to Major Employment Centers



Goal 2 – Provide More Efficient Truck/Freight Travel in Southern Indiana (Core Goal)

Vehicle Hours Traveled (VHT) is an important measure for evaluating highway performance. VHT is measured by multiplying travel time on each link of the highway network with the corresponding number of vehicles on that link. Reduction in VHT indicates improved highway system performance. More efficient freight travel is a core goal of the project. To assess freight efficiency changes in truck VHT for trips with one or more trip ends within the 12-County Study Area were calculated. Due to the diversion of some trips into the Study Area for the build alternatives, trips with both ends outside the Study Area were not considered in the analysis. **Table A-7** shows truck VHT for the No-Build and each of the alternatives. Negative numbers indicate decreases in truck VHT; positive numbers indicate increases in truck VHT. While most alternatives support decreases in truck VHT, three alternatives showed increases in truck VHT for one facility type.

2045 No-Build Annual Truck VHT	Annual Changes in Truck VHT: Reduction (-ve) and Increase (+ve)										
	B2	B3	C2E	C3E	M2E	M3E	P/RPA 2	P/RPA 3	O2E	O3E	R
3,565,700	-150	11,100	-34,150	-1,800	-35,900	-7,800	-36,850	-8,400	-18,250	3,000	250

Table A-7: Truck VHT Comparisons

The most direct routes connecting to I-69 with the shortest overall travel distance between I-64 near Dale and Bloomington (Alternatives M, P and RPA P) show the greatest reductions in VHT by providing the greatest reduction for long distance trips continuing to Bloomington, Indianapolis and other destination to the north. The expressway facility types (P2, RPA 2, O2, C2, etc.) provide for greater reduction in VHT due to increased speeds compared to their Super-2 counterparts (P3, RPA P, O3, C3, etc.). The increases in overall VHT identified for Alternatives B3 and O3 result from attracting trips to higher class facilities that provide greater reliability but at the cost of increased time.

Goal 3 – Reduce Localized Congestion in Dubois County

Congestion is measured by Level of Service (LOS). LOS varies from LOS A (free-flow conditions) to LOS F (frequent starting and stopping, with traffic volumes exceeding roadway capacity). LOS E or F is considered congested in urban areas, and LOS D, E or F are considered congested in rural areas. Roadway segments with higher Volume to Capacity (V/C) ratios (greater than 0.85) within the Study Area were identified for the 2017 and 2045 No-Build Alternatives. LOS values for these roadway segments were determined following the Highway Capacity Manual’s guidelines for highways (e.g., two-lane and multi-lane segments). **Table A-8** shows roads within Dubois County which were forecasted to operate under congested conditions in the 2017 and 2045 No-Build Alternatives, and LOS measures for the same roadway segments for the alternatives. It should be noted that most roads within Dubois County are forecasted to operate at adequate levels of service. These LOS estimates are based upon 2045 PM peak traffic volume assignments from the TDM.



Corridor	From	To	2045 No Build PM LOS	LOS Under Mid States Alternatives										
				B2	B3	C2E	C3E	M2E	M3E	P/RPA 2	P/RPA 3	O2E	O3E	R
US 231	47th St	300 N	F	E	E	E	E	E	E	E	E	E	E	C
	300 N	Schutter Rd	F	F	F	F	F	F	F	F	F	F	F	D
	15th St	6th St	E	E	E	D	D	C	C	C	C	C	D	D
	SR 56	Newton St	E	E	E	D	D	C	C	C	C	C	D	E

Table A-8: Roadways with Congested LOS in Dubois County for 2045 No-Build Scenario

Goal 4 – Reduce Crashes at Key Locations in Southern Indiana

Specific crash reduction is a measure best quantified based on detailed design elements beyond the Tier 1 design level.

Future detailed studies in Tier 2 will provide more detailed crash reduction performance based on additional design; however, safety evaluations were made for the local improvements for the purposes of evaluating potential reductions at this Tier.

The Local Improvements (see **Appendix V**) were evaluated using Highway Safety Manual (HSM) techniques for their ability to reduce crashes. These techniques were applied to Mid-States travel model forecasts of traffic volumes using these local improvements. The traffic assignments are for each alternative’s expressway facility type. Key factors in the HSM evaluation include AADT, lane width, shoulder width, driveway density and curve lengths/radii (if any).

Table A-9 provides the representative annual crash savings estimated for the Local Improvements associated with each alternative. **Appendix V** provides more information regarding these estimates.

Annual Crash Savings (Millions of Dollars)				
B	C	M	O	P and RPA P
\$5.86	\$6.40	\$7.12	\$8.66	\$8.36

Source: Highway Capacity Manual Analysis and Mid-States Corridor Regional Travel Demand Model

Table A-9: Potential Annual Crash Savings for Local Improvements

The Local Improvements are illustrative projects that will be further defined based on more specific safety needs as well as other factors during Tier 2.²

² These crash savings are only those attributable to local improvements associated with each alternative. Since Alternative R has no local improvements, it is not included in **Table A-9**.



Goal 7 – Improve Highway Connections to Existing Multi-Modal Locations from Southern Indiana (Core Goal)

Improved access to major intermodal centers is a core goal for this project. Travel time estimates for the horizon year 2045 for No-Build and 10 Build Alternatives were estimated using the TDM. These performance measures were calculated for intermodal access from Jasper and from Crane.

Intermodal Access from Jasper

Travel time skims for the PM peak period was used to obtain travel time between Jasper and the CSX Avon Rail Yard (Indianapolis), Senate Avenue Rail Yard (Indianapolis), Tell City Ohio River Port of Indiana (Ohio River at Jeffersonville), Louisville International Airport and Indianapolis International Airport.

Table A-10 shows travel times and differences in travel times from the No-Build alternative for the 10 Mid-States alternatives.

Origin-Destination	2045 No-Build Travel Time (Min)	Changes in Travel Time (Min) Reduction (-ve) and Increase (+ve)										
		B2	B3	C2E	C3E	M2E	M3E	P/RPA 2	P/RPA 3	O2E	O3E	R
Jasper - CSX Avon Yard	145	-1	-1	-1	-1	-2	-1	-5	-2	0	0	-1
Jasper - Senate Ave Yard	140	-1	0	0	0	-2	-1	-5	-2	0	0	-1
Jasper - Tell City River Port	54	0	0	0	0	-2	-2	-2	-1	-2	-2	0
Jasper - Port of Indiana	86	-1	0	0	0	-2	-1	-2	-2	-3	-2	0
Jasper - Louisville Airport	102	-1	0	0	0	-3	-2	-2	-2	-3	-2	0
Jasper - Indianapolis Airport	135	-1	-1	-1	0	-2	-1	-5	-2	0	0	-1

Table A-10: Travel Times Comparisons from Jasper to Major Rail, Water and Air Intermodal Centers

Intermodal Access from Crane

Travel time estimates for the horizon year 2045 for No-Build and 10 Build Alternatives were estimated using the TDM. Travel time skims for the PM peak period was used to obtain travel time between Crane and the CSX Avon Rail Yard (Indianapolis), Senate Avenue Rail Yard (Indianapolis), Tell City Ohio River Port the Port of Indiana (Ohio River at Jeffersonville), Louisville International Airport and Indianapolis International Airport. **Table A-11** shows travel times and differences in travel times from the No-Build alternative for the 10 Mid-States alternatives.



Origin-Destination	2045 No-Build Travel Time (Min)	Changes in Travel Time (Min) Reduction (-ve) and Increase (+ve)											
		B2	B3	C2E	C3E	M2E	M3E	P/RPA 2	P3E	O2E	O3E	R	
NSA Crane - CSX Avon Yard	102	-1	0	0	0	0	0	0	0	0	0	0	0
NSA Crane - Senate Ave Yard	97	0	0	0	0	0	0	0	0	0	0	1	0
NSA Crane - Tell City River Port	97	-1	-1	-2	-2	-8	-8	-12	-8	-4	-4	-1	
NSA Crane - Port of Indiana	120	0	0	0	0	0	0	-1	-1	0	0	0	
NSA Crane - Indianapolis Airport	91	0	1	0	0	0	0	0	0	0	0	0	
NSA Crane - Louisville Airport	130	0	0	0	0	0	0	-1	-1	0	0	0	

Table A-11: Travel Time Comparisons from NSA Crane to Major Rail, Water and Air Intermodal Centers