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## 3.0 ALTERNATIVES CONSIDERED

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This section discusses the alternatives development, refinement, and evaluation process that led to the selection of PA-2 as the Recommended Alternative for the project. A foldout map located at the back of this document (**Appendix F**) illustrates the study area, Practical Alternatives evaluated, and goals of the project.

### 3.1 Previous Studies

#### 3.1.1 1981 Project Background

The proposed US-31 freeway between Napier Avenue and I-94 is the northernmost segment of an 18.4-mile freeway corridor approved for phased implementation in a 1981 Final Environmental Impact Statement (FEIS) by the Michigan Department of Transportation (MDOT) and the Federal Highway Administration (FHWA). Details on the 1981 FEIS are discussed in **Section 1.0 Summary of the 1981 Final Environmental Impact Statement for the US-31 Freeway in Berrien County**.

#### 3.1.2 1981 FEIS Alternatives Considered

Details of the alternatives considered in the 1981 FEIS are contained in **Section 1.3 Alternatives Considered in the 1981 FEIS**. The Recommended Alternative was an 18.4-mile freeway on new location extending from Matthew Road north to the existing I-196/US-31 interchange with I-94.

#### 3.1.3 1981 FEIS Recommended Alternative (Segment A-5)

This document addresses only Segment A-5 of the 1981 FEIS Recommended Alternative, extending from Napier Avenue to the I-94/I-196/US-31 interchange in Berrien County. This interchange with I-94 was originally proposed to be completely reconstructed, including the addition of collector/distributor (C/D) roads from west of the I-94/BL-94 interchange to east of the I-94 interchange with I-196/US-31. Practical Alternative (PA-4) of this Final Supplemental Environmental Impact Statement (FSEIS) follows this same US-31 alignment, but eliminates the C/D roads along I-94.

### 3.2 History of the Alternatives Evaluation

Four preliminary Build Alternatives were developed for evaluation within the study area north of Napier Avenue. Following public comment and further analysis, these preliminary “Illustrative” Alternatives were refined and two alternatives were modified and combined to provide three “Practical” Freeway Build Alternatives (PA-2, PA-3, and PA-4). These Practical Alternatives and the prior Illustrative Alternatives were fully discussed in the Draft Supplemental Environmental Impact Statement (DSEIS) published in September 2002. The DSEIS also identified PA-2 as the Preferred Alternative.

This section compares the Build Alternatives to the No-Build and Transportation System Management (TSM) improvements. TSM improvements evaluated include the addition of turn lanes and the modification of existing freeway ramps. All alternatives were assessed as to how well they met the Purpose of and Need for the project as discussed in **Section 2.0 Purpose of**

**and Need for the Proposed Action.** The goals for the project, discussed in **Section 2.4 Project Goals**, were also used to refine and evaluate the alternatives considered.

### 3.3 No-Build Alternative Summary

The No-Build Alternative would terminate the existing US-31 freeway at Napier Avenue. One other study area improvement is proposed to take place in conjunction with the No-Build Alternative:

- Add to the existing I-94/BL-94 interchange an eastbound I-94 to westbound BL-94 loop ramp to provide this missing movement at the existing interchange. This addition will provide all movements at this interchange. This is proposed for all alternatives not requiring reconstruction of the BL-94 interchange. No additional right-of-way is proposed for this ramp.

The extension of the US-31 freeway to Napier Avenue was completed and opened to traffic in August 2003. The interchange at the Napier Avenue terminus requires northbound US-31 traffic to travel 1.9 miles west on Napier Avenue to access eastbound I-94 to I-196/US-31. Likewise, I-94 traffic accesses southbound US-31 by exiting onto eastbound Napier Avenue. Aside from the noted improvements, all other existing conditions are proposed to remain the same for the No-Build Alternative.

Traffic: Level-of-service is a measure of roadway congestion from A to F in which A represents free-flow traffic and F represents heavy congestion. For the No-Build Alternative, there are five locations on four ramps as illustrated in **Figure 2.5** that are expected to operate at level-of-service (LOS) E or F during the afternoon peak period in design year 2025. These ramps include:

- The Napier Avenue on-ramp to eastbound I-94 (LOS E and F)
- The westbound I-94 off-ramp to Napier Avenue (LOS E)
- The BL-94 off-ramp from westbound I-94 (LOS E)
- The westbound I-94 off-ramp to northbound I-196 (LOS E)

Traffic simulation showed that eastbound Napier Avenue to southbound US-31 traffic would experience delay. Traffic could be backed up as far as Yore Avenue on eastbound Napier Avenue in the pm peak hour. The Traffic Analysis Report prepared separately for this project discusses this in greater detail.

Advantages: The No-Build Alternative is the least costly of the alternatives considered; it minimizes impacts and requires no additional right-of-way. Construction of the missing eastbound I-94 to BL-94 loop ramp would take place within the existing interchange right-of-way. The No-Build Alternative would meet only the project goal of minimizing environmental impacts and reducing costs compared to the 1981 FEIS alignment.

Disadvantages: The No-Build Alternative does not meet the primary purpose for the project of providing a free flow US-31 freeway connection to I-94. It would not improve north-south vehicular travel or the movement of goods in the US-31 corridor. The No-Build Alternative would improve northbound US-31 access to BL-94 via the new BL-94 loop ramp but it would not provide a full freeway connection. This limited access improvement to the Benton Harbor area

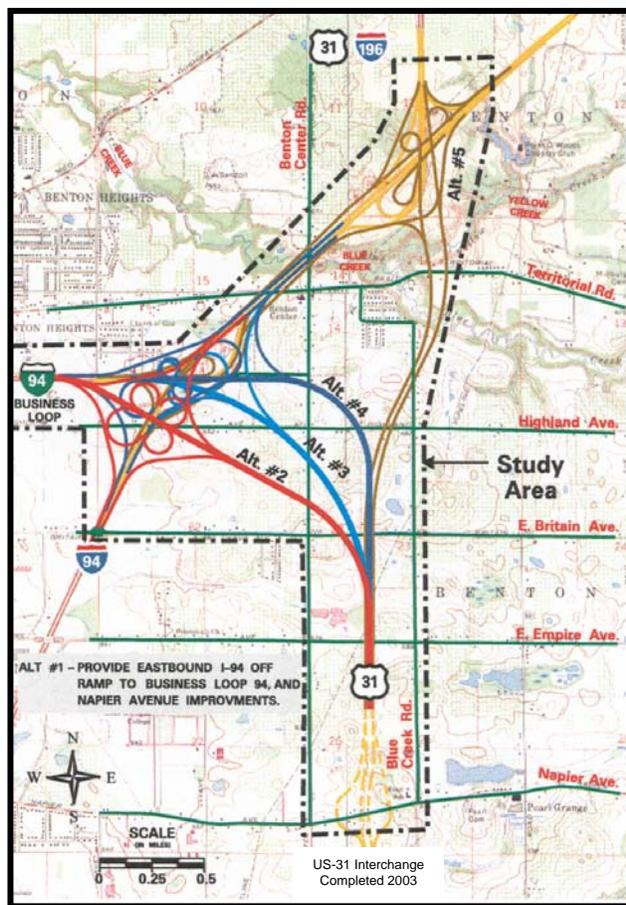
would provide only limited assistance to other economic development efforts in the region. The No-Build Alternative does not resolve any of the identified needs for the project.

The No-Build Alternative also does not meet four of the nine goals of the project (project goals are listed in **Section 2.4 Project Goals** and on the foldout map in **Appendix F**) – goals one, six, eight, and nine are not met with this alternative. This includes the project goals of improving efficient traffic movement between the current termini of US-31 at Napier Avenue and I-196, and avoiding deficiencies resulting from high traffic volumes on Napier Avenue. Comments from the two public information meetings and the subsequent public hearing indicate that the majority of the public does not support a No-Build Alternative.

### 3.4 History of the Illustrative Build Alternatives Development Process

Illustrative Build Alternatives were developed with the project goals and the Purpose of and Need for the project in mind. The approved 1981 FEIS alignment was reevaluated in the preliminary Illustrative Alternative phase; however, due to its potentially high environmental impacts and high construction cost, new alignments were also considered. **Figure 3.1** depicts the Illustrative Build Alternatives considered.

*Alignment Development:* In the Illustrative Alternatives phase, alignments were developed to extend the US-31 freeway to I-94 from the northern terminus of the US-31 freeway construction at Napier Avenue. This new connection to I-94 was to provide all movements at a freeway-to-freeway interchange with I-94. A goal of this study is to maintain or improve the level-of-service along I-94. The Illustrative Alternative alignments included a Transportation System Management (TSM) alternative (Alternative One), a western alignment that connected with I-94 and BL-94 south of the existing I-94/BL-94 interchange (Alternative Two), two western alignments that connected to I-94 at the existing I-94/BL-94 interchange (Alternatives Three and Four), and the previously approved 1981 FEIS alignment that connected to I-94 at the existing I-196/US-31 interchange with I-94 (Alternative Five).



**Figure 3.1 Illustrative Alternatives**

*Alternatives Dropped from Consideration:*

**Alternative Four:** Alternative Four was dropped from further consideration due to traffic and engineering issues. Although this alternative utilized more of the existing MDOT right-of-way than Alternatives Two and Three and connected to BL-94 at the same location as the present I-94/BL-94 interchange, the northbound (NB) US-31 to eastbound (EB) I-94 exit ramp was a reverse curve. The northern most curve on this ramp had a 60 mph design speed as desired for

this primary northbound movement, however, this required traffic exiting from NB US-31 to EB I-94 to make a tight right exit coming off a tight left curve on mainline US-31 which could prove difficult for the northbound driver. This movement also merged onto I-94 in closer proximity to the EB I-94 to NB I-196/US-31 exit ramp than any other alternative. Illustrative Alternatives Two and Three provided less potential for conflicts between NB US-31 traffic merging onto EB I-94, and for EB I-94 traffic exiting to NB I-196/US-31.

**Collector/Distributor Roads:** The option to design the alternatives with barrier separated collector/distributor roads on I-94 and/or US-31 was also evaluated and dropped from consideration during the Illustrative Alternatives phase. The addition of collector/distributor roads on I-94 would have resulted in considerable impact to the sensitive habitat within and adjoining Blue Creek, requiring:

- Substantial right-of-way and cut and fill requirements associated with steep embankments on either side of existing I-94 in the vicinity of Blue Creek.
- Lengthening of the existing 25-foot wide Blue Creek culvert under I-94 by approximately 100 feet.
- Replacement of the existing Benton Center Road bridge which crosses I-94 at a skew at Blue Creek. The skewed crossing over collector/distributor roads would have required a new structure approximately 500 feet in length.

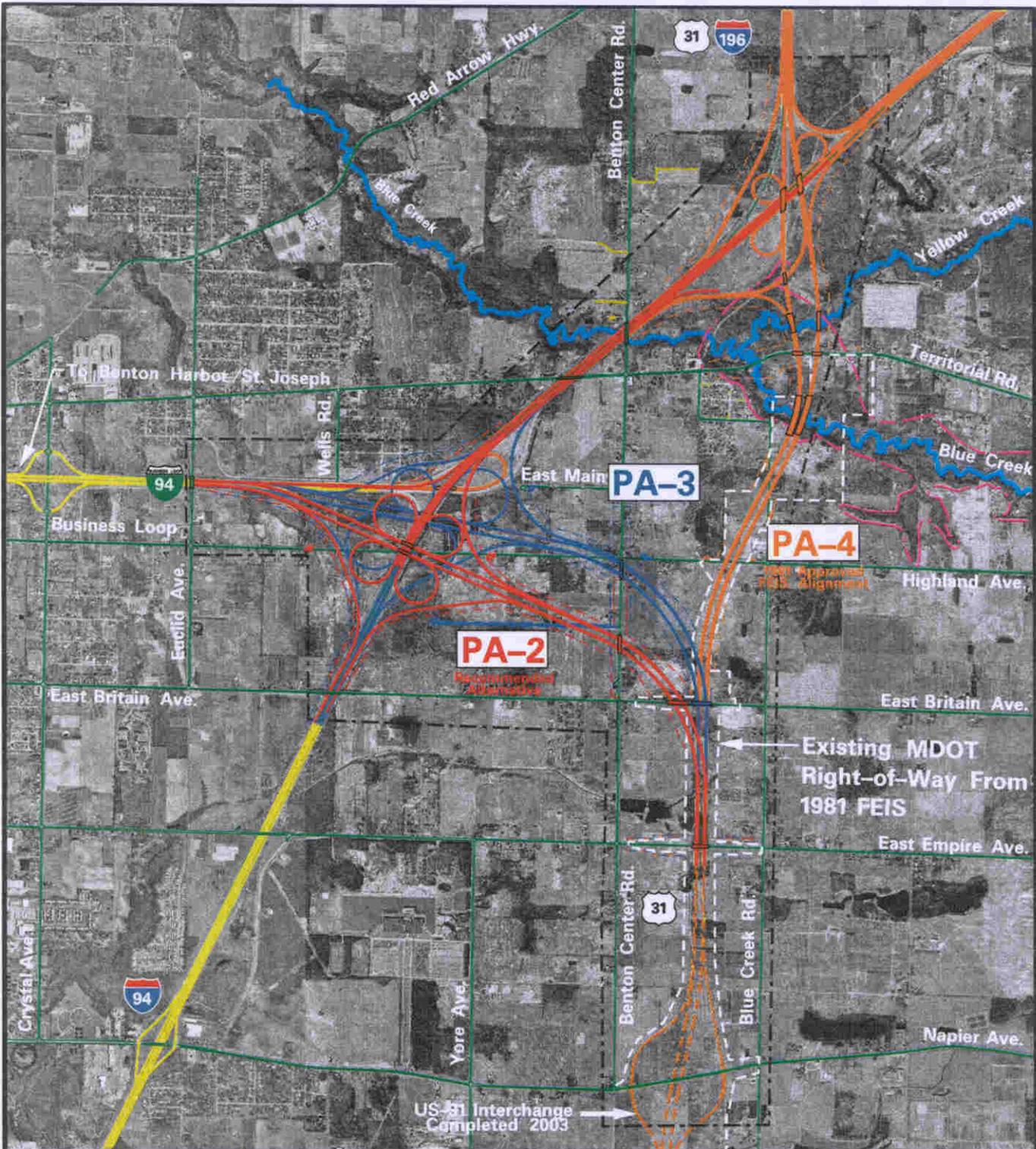
A LOS analysis indicated that collector/distributor roads were not necessary as all Build Alternatives are forecasted to function at LOS C or better on mainline US-31 and on mainline I-94 utilizing auxiliary lanes between BL-94 and I-196. Auxiliary lanes without a barrier separator are proposed on I-94 between the BL-94 and I-196 interchanges for all Practical Build Alternatives. Discussion of their operating characteristics is contained in the following sections.

### 3.5 History of the Practical Build Alternatives

The three remaining Illustrative Build Alternatives were refined and developed as Practical Alternatives based upon the planning goals and objectives, comments received from the public and regulatory agencies, and further environmental, geometric, and traffic operational analyses. Each alternative is presented in this section, including analysis of geometrics and how the alternatives compare with the project goals and objectives. **Figure 3.2** illustrates the refined Practical Freeway Build Alternatives. Recommended Alternative PA-2 and PA-3 are western alternatives connecting US-31 with I-94 at BL-94. PA-4 is the alignment approved in the 1981 FEIS. PA-4 was modified for this analysis by replacing the collector/distributor roads along I-94 with auxiliary lanes because the development and traffic forecasted for the region in the 1981 FEIS have not materialized. Future year 2025 forecasts do not warrant collector/distributor roads for any alternative and the proposed auxiliary lanes have considerably less impact.

Each Build Alternative meets the criterion of maintaining the integrity of US-31 as a freeway from the Indiana border to I-94; Practical Alternatives PA-2, PA-3, and PA-4 provide a freeway facility from Napier Avenue to I-94 where US-31 connects to I-94 with a freeway to freeway interchange. By providing a freeway connection for US-31 from Napier Avenue to I-94, traffic volumes on Napier Avenue will remain at an acceptable LOS with the existing five-lane section through the design year 2025.

Traffic analysis forecasted acceptable traffic operations and LOS for all Build Alternatives. Practical Alternatives PA-2, PA-3, and PA-4 operate at a LOS C or better for the projected 2025 traffic volumes on I-94 between Napier Avenue and BL-94; at LOS B or better on mainline



**LEGEND**

- = RECOMMENDED ALTERNATIVE PA-2
- = PA-3
- = PA-4

STUDY AREA  
 BLUE CREEK FEN AREA



**BENTON CHARTER TOWNSHIP**

**BERRIEN COUNTY, MICHIGAN**

Figure 3.2 Practical Freeway Build Alternatives

US-31; at LOS C or better on mainline I-94 between the BL-94 and I-196 interchanges; and at LOS D or better on I-94 east of I-196. LOS D is the desired minimum LOS for new construction. Commercial vehicles account for up to 30% of daily traffic volumes. An analysis of the crash history along I-94 in the study area did not find crash patterns that would indicate geometric deficiencies. Many past crashes on I-94 have involved animals or inclement weather. The Traffic Analysis Report prepared as a separate document for this study provides a more detailed discussion of traffic operations, LOS, and crash histories.

Preliminary construction cost estimates prepared for all freeway alternatives are presented in **Table 3.1**. Road and bridge construction costs include 20% for mobilization and contingencies. Miscellaneous and contingencies costs include such items as maintenance of traffic, signing, striping, drainage, utilities, mobilization, and a 3% annual inflationary cost for a base year construction estimate in 2005 dollars (**Table 3.1**). A detailed cost estimate for alternative PA-2 (the Recommended Alternative) can be found in the Engineering Report, which was prepared separately.

**Table 3.1 Build Alternatives Preliminary Cost Estimates Year 2005**

	Preliminary Costs				
	Roadway Construction	Bridge Structures	Right-of-Way	Miscellaneous/Contingencies	TOTAL Projected 2005 Cost
<b>Recommended Alternative PA-2</b>	\$31,735,000	\$12,650,000	\$7,600,000	\$28,145,000	\$80,130,000
<b>PA-3</b>	\$27,950,000	\$12,650,000	\$11,100,000	\$34,000,000	\$85,700,000
<b>PA-4</b>	\$26,950,000	\$37,500,000	\$3,500,000	\$36,050,000	\$104,000,000

### 3.5.1 Practical Alternative One (PA-1), Transportation System Management

Practical Alternative One (PA-1) includes relatively low cost infrastructure improvements to maximize the efficiency of the existing system. This is known as Transportation System Management (TSM). Like the No-Build Alternative, the US-31 freeway would terminate at Napier Avenue. Northbound and southbound US-31 traffic would continue to utilize Napier Avenue and I-94 as a link from the freeway termination to the I-94/I-196/US-31 interchange at the north end of the study area. Six TSM improvements have been recommended as a result of the traffic analysis for the No-Build Alternative (see **Figure 3.3**):

- Reconstruct the eastbound I-94 entrance ramp from Napier Avenue to add a second lane and add a second dedicated right turn lane to westbound Napier Avenue for traffic traveling east on I-94. These improvements should result in this intersection improving from a forecasted LOS E to LOS D.
- Reconstruct the southbound US-31 entrance ramp from Napier Avenue to add a second lane and add a second dedicated right turn lane to eastbound Napier Avenue for traffic traveling south on US-31. These improvements will reduce operational delay at this intersection.
- Lengthen the deceleration lane from westbound I-94 to westbound BL-94. Operations will improve from a forecasted LOS E to LOS D.
- Lengthen the deceleration lane from westbound I-94 to northbound I-196. Operations will improve from a forecasted LOS E to LOS D.

Preliminary construction cost estimates for these PA-1 improvements are under \$5 million.

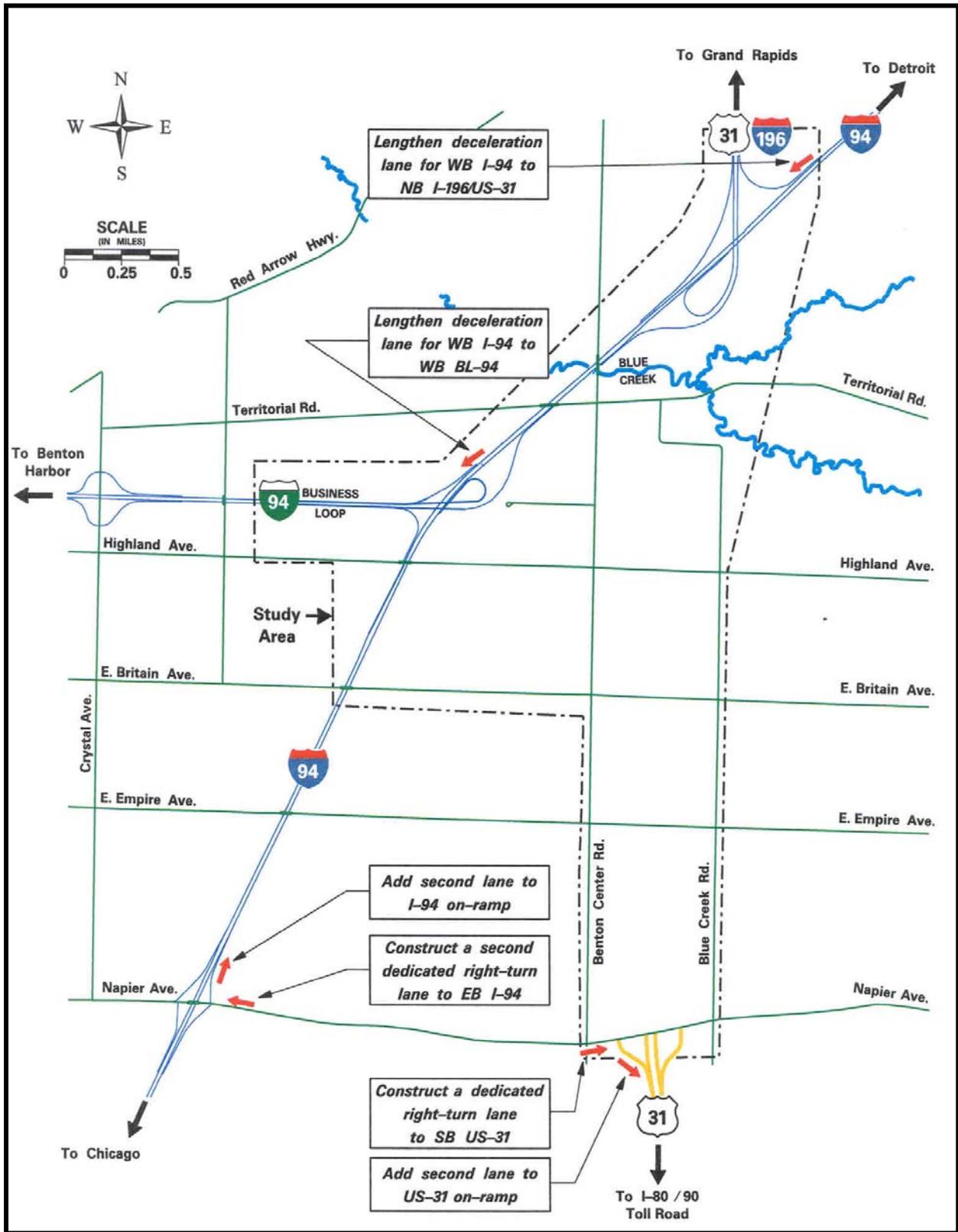


Figure 3.3 Locations of Transportation System Management Improvements

PA-1 Advantages: PA-1 has minimal adverse socio-economic and environmental impacts and the cost to construct PA-1 is substantially less than all freeway Build Alternatives. This alternative requires approximately one acre of additional right-of-way and no relocations or local road closures are necessary. PA-1 meets two purposes of the project, to minimize environmental impacts and to reduce construction costs compared to the 1981 FEIS alignment. PA-1 improves the 2025 forecasted traffic operations for Napier Avenue to LOS D for the intersections with I-94 and US-31.

PA-1 Disadvantages: PA-1 does not provide a free flow US-31 connection to the US-31 freeway north and south of the study area and a freeway linkage to I-94, therefore, it was not carried forward as the Recommended Alternative for the project. The continuity of northbound and southbound US-31 freeway traffic would be interrupted by traffic signals and forecasted congestion on Napier Avenue. PA-1 only provides minor relief of forecasted traffic congestion on Napier Avenue and does not relieve ramp deficiencies along I-94. PA-1 also does not meet project goals one, six, seven, and eight as listed on the foldout map in **Appendix F**.

### **3.5.2 Recommended Alternative PA-2**

Recommended Alternative PA-2 begins where the current construction of the US-31 freeway ends just south of East Empire Avenue. It follows the existing MDOT right-of-way north, swinging west just south of East Britain Avenue (**Figure 3.4**). This alignment continues northwest and intersects I-94 at the existing Highland Avenue Bridge over I-94. This bridge structure would be removed. US-31 continues northeast on auxiliary lanes added to existing I-94, connecting to the existing I-94 interchange with I-196/US-31. BL-94 would be realigned and continue northwest from I-94, connecting with the existing BL-94 alignment just east of Euclid Avenue.

Recommended Alternative PA-2 - Meets Purpose and Need: Recommended Alternative PA-2 meets the primary purpose of the project as it provides a free flow US-31 freeway link to I-94 and connects the US-31 freeway from south of Napier Avenue to the I-196/US-31 freeway to the north. Recommended Alternative PA-2 addresses the need for the project including reducing congestion on Napier Avenue. Recommended Alternative PA-2 completes the I-94/BL-94 interchange and connects the US-31 freeway to BL-94. Recommended Alternative PA-2 best meets the additional project purpose and need of improving local access to the Benton Harbor area from the south because it provides a direct link from US-31 to BL-94. These enhancements could assist other economic development efforts within the economically depressed Benton Harbor area by improving access for consumers and commercial vehicles to economic assets and development sites near BL-94. Recommended Alternative PA-2 also reduces environmental impacts and costs when compared to the approved 1981 FEIS alignment (PA-4).

Recommended Alternative PA-2 meets project goals one, two, three, four, seven, eight, and nine, as listed on the foldout map in **Appendix F**, as well or better than any other alternative that meets the purpose and need for the project. Recommended Alternative PA-2 also achieves goals five and six although not as well as PA-4, the original 1981 FEIS alignment.

# RECOMMENDED ALTERNATIVE PA-2



Figure 3.4 Recommended Alternative PA-2

Recommended Alternative PA-2 - Environmental Impacts: There are few social and environmental impacts associated with Recommended Alternative PA-2, and substantially fewer impacts than those of the 1981 FEIS alignment (PA-4). Recommended Alternative PA-2 has the fewest community impacts of any Build Alternative considered. There are no direct impacts to churches, neighborhoods, or community facilities with this alternative.

Recommended Alternative PA-2 requires approximately 50% fewer residential relocations than PA-3 and has no potential environmental justice issues or concerns; while PA-3 would impact the Butler-East Euclid Subdivision which has been identified as a low-income residential area. Recommended Alternative PA-2 impacts eight fewer actively farmed parcels and 10 fewer acres of unique farmland than PA-3. The overall required right-of-way for Recommended Alternative PA-2 is 403 acres.

Agency review comments from the Draft Supplemental Environmental Impact Statement (DSEIS) concurred with the selection of PA-2 as the Preferred Alternative, but requested that wetland impacts be minimized where possible. As a result, loop ramps F and G were redesigned and ramps B and C were brought in to provide a smaller footprint at the I-94/BL-94/US-31 interchange. This new configuration results in less right-of-way needs and fewer wetland impacts compared to the original PA-2 design. Recommended Alternative PA-2 impacts considerably less wetlands and has far fewer environmental impacts than PA-4, and impacts no properties on or recommended as eligible for the National Register of Historic Places.

Areas within Recommended Alternative PA-2 showed no past records or sightings of any species listed as threatened or endangered. The Eastern box turtle, a state species of special concern, was the only species identified as inhabiting the outer edges of wetlands impacted by Recommended Alternative PA-2.

The Southwest Michigan Regional Airport and the Benton Harbor Fruit Market, both located immediately northwest of the project area would benefit from the proposed construction of Recommended Alternative PA-2 through the connection to BL-94. Easier traffic movement and enhanced access to Benton Harbor would be a positive influence on existing economic conditions. Travel related costs associated with the movement of freight would also be reduced due to the increased efficiency of movement and time savings.

Recommended Alternative PA-2 – Design Advantages: Recommended Alternative PA-2 substantially reduces the cost of the freeway connection compared to the 1981 alignment (PA-4). The Recommended Alternative PA-2 alignment utilizes existing terrain in a manner that minimizes impacts to the existing Benton Center/East Britain Avenue intersection. This alternative also avoids impacts to the existing Euclid Avenue Bridge structure over BL-94. Recommended Alternative PA-2 requires only one local road closure at Highland Avenue over I-94, whereas PA-3 closes one local road and eliminates the intersection of Benton Center Road/Highland Avenue, and PA-4 requires two road closures. Recommended Alternative PA-2 does not impact any local road intersections.

Northbound US-31 traffic is allowed continuity of movement with dedicated lanes along I-94 and is never required to merge with traffic on mainline I-94. The operations of the I-94 auxiliary lanes are depicted in **Figure 3.11** at the end of this section. Southbound US-31/I-196 traffic wanting to continue south on US-31 is not required to merge with westbound I-94 since there are two dedicated entrance lanes onto westbound I-94. Eastbound I-94 traffic wanting to exit onto northbound I-196/US-31 will not be required to merge with through US-31 traffic as the right hand through lane will have an option to exit to northbound I-196/US-31.

Of the two practical western alignments considered, Recommended Alternative PA-2 allows for the greatest distance between interchanges (approximately 3300 feet from ramp gore to ramp gore). Traffic forecasts indicate the northbound US-31 to eastbound I-94 movement will be much greater in volume than the northbound US-31 to westbound BL-94 movement. As a result, Recommended Alternative PA-2 is configured to allow two lanes for the primary northbound US-31 to eastbound I-94 movement, while the northbound US-31 to westbound BL-94 movement is proposed to be constructed as a single lane exit. Recommended Alternative PA-2 thus meets the additional purpose of the project to improve the efficiency of north-south vehicular travel and goods movement.

Recommended Alternative PA-2 construction staging will be the most efficient of all Build Alternatives. Due to the relocation of the I-94/BL-94 interchange to the south of the existing interchange, the existing ramps can remain open for a majority of the construction. All movements can remain open at the I-94/I-196/US-31 interchange during construction. Recommended Alternative PA-2 is also the freeway Build Alternative with the least project cost.

*Recommended Alternative PA-2 Disadvantages:* Disadvantages of Recommended Alternative PA-2 are minor. Southbound US-31 traffic is required to slow from a posted speed of 70 mph to 30 mph on the loop ramp transition from WB I-94 to SB US-31, which does not completely satisfy goal six for maximizing continuity of southbound US-31. Recommended Alternative PA-2 does the least of all Build Alternatives to accomplish goal five of maximizing use of the MDOT ROW originally purchased as a result of the approved 1981 FEIS alignment. Wetland impacts are 1.4 acres greater than PA-3, but 17.7 acres less than PA-4.

*Geometrics:* Recommended Alternative PA-2 utilizes a full cloverleaf interchange at I-94/BL-94/US-31 due to low forecasted traffic volumes on ramps and the rural setting of the study area. Weaving maneuvers between the loop ramps would be limited due to the proposed weaving distance between the loop ramps and the very low traffic volumes on Ramp E and Ramp H depicted in **Figure 3.5**. **Table 3.2** shows the type, number of lanes, design speed, forecast AADT, and LOS of each ramp in the proposed I-94/BL-94/US-31 interchange. Two loop ramps in the southern quadrants (ramps F and G) originally designed at 40 mph were redesigned and reduced to a 35 mph design speed. Also dropped from the original design was an interchange configuration that would allow for a future westbound I-94 flyover ramp to southbound US-31. This allowed ramps B and C to be pulled in to reduce right-of-way and wetland impacts.

Mainline I-94 is proposed to be reconstructed from Empire Avenue to east of the I-94/I-196/US-31 interchange. Auxiliary lanes are proposed between the I-94/BL-94/US-31 and I-94/I-196/US-31 interchanges as illustrated in **Figure 3.11** at the end of this section. This will allow vehicles traveling through on US-31 to stay in the auxiliary lane provided and not merge with I-94 through traffic. In order to accommodate an eight-lane section on I-94 between these interchanges without reconstructing the Benton Center Road bridge over I-94, I-94 is proposed to be reconstructed and widened into the median (**Figure 3.6**). The 8-lane reconstruction will extend from the I-94/BL-94/US-31 interchange to the I-94/I-196/US-31 interchange. EB and WB I-94 each will consist of three through travel lanes and one auxiliary lane. The EB auxiliary lane is located between the NB US-31 to EB I-94 entrance and the EB I-94 to NB I-196/US-31 exit ramp.

**Table 3.2 Recommended Alternative PA-2 Ramp Data**

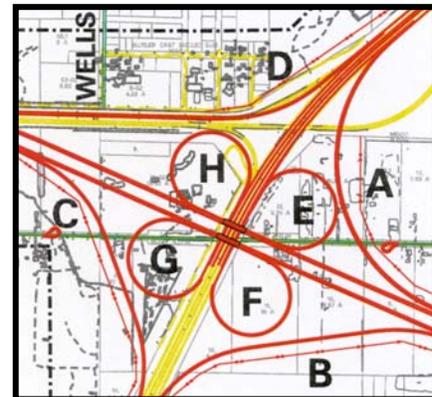
Ramp*	Description	Type	Number of Lanes	Design Speed	2025 AADT	LOS**
A	NB US-31 to EB I-94	Outer	2 tapering to 1	60 mph	5,950	A (D)
B	EB I-94 to SB US-31	Outer	1	60 mph	350	C (D)
C	EB BL-94 to WB I-94	Outer	1	60 mph	700	C (M)
D	WB I-94 to WB BL-94	Outer	1	60 mph	3,100	B (M)
E	EB I-94 to WB BL-94	Loop	1	35 mph	650	B (W)
F	EB BL-94 to EB I-94	Loop	1	35 mph	3,100	B (W)
G	WB I-94 to SB US-31	Loop	1	35 mph	5,800	C (W)
H	NB US-31 to WB I-94	Loop	1	35 mph	150	A (W)

\*See **Figure 3.5** for ramp locations

\*\*The reported LOS represents the worst-case LOS at each ramp's associated junction points. The critical junction point is shown in parenthesis, corresponding to the critical merge (M), diverge (D) or weave (W) location. This value is dependent upon the peak hour ramp volumes, the freeway volumes, and the laneage and geometry of the merge or diverge area.

The far right lane will be required to exit I-94 and the second right lane will have the option to exit. Consequently, US-31 through traffic will not have to merge with I-94 traffic and I-94 traffic will not have to merge with through US-31 traffic in order to take the NB I-196/US-31 exit. The WB I-94 auxiliary lane is located between the SB I-196 to WB I-94 entrance and the WB I-94 to WB BL-94 exit ramp. This ramp avoids southbound US-31 traffic having to merge with westbound I-94 traffic.

In conjunction with the smaller interchange configuration, foreslopes will be constructed at a rate of slope of 1 vertical on 6 horizontal (1 on 6). Sideslopes constructed at a rate of 1 on 6 provide the greatest level of safety and do not require the use of a roadside barrier. Sideslopes steeper than 1 on 6 are not desirable because backslope options are limited and consideration must be given to guardrail requirements. The American Association of State Highway and Transportation Officials (AASHTO) guidelines suggest freeways be constructed with 1 on 6 foreslopes or flatter on embankments to provide motorists with the greatest opportunity for recovery.



**Figure 3.5 Recommended Alternative PA-2 Ramps**

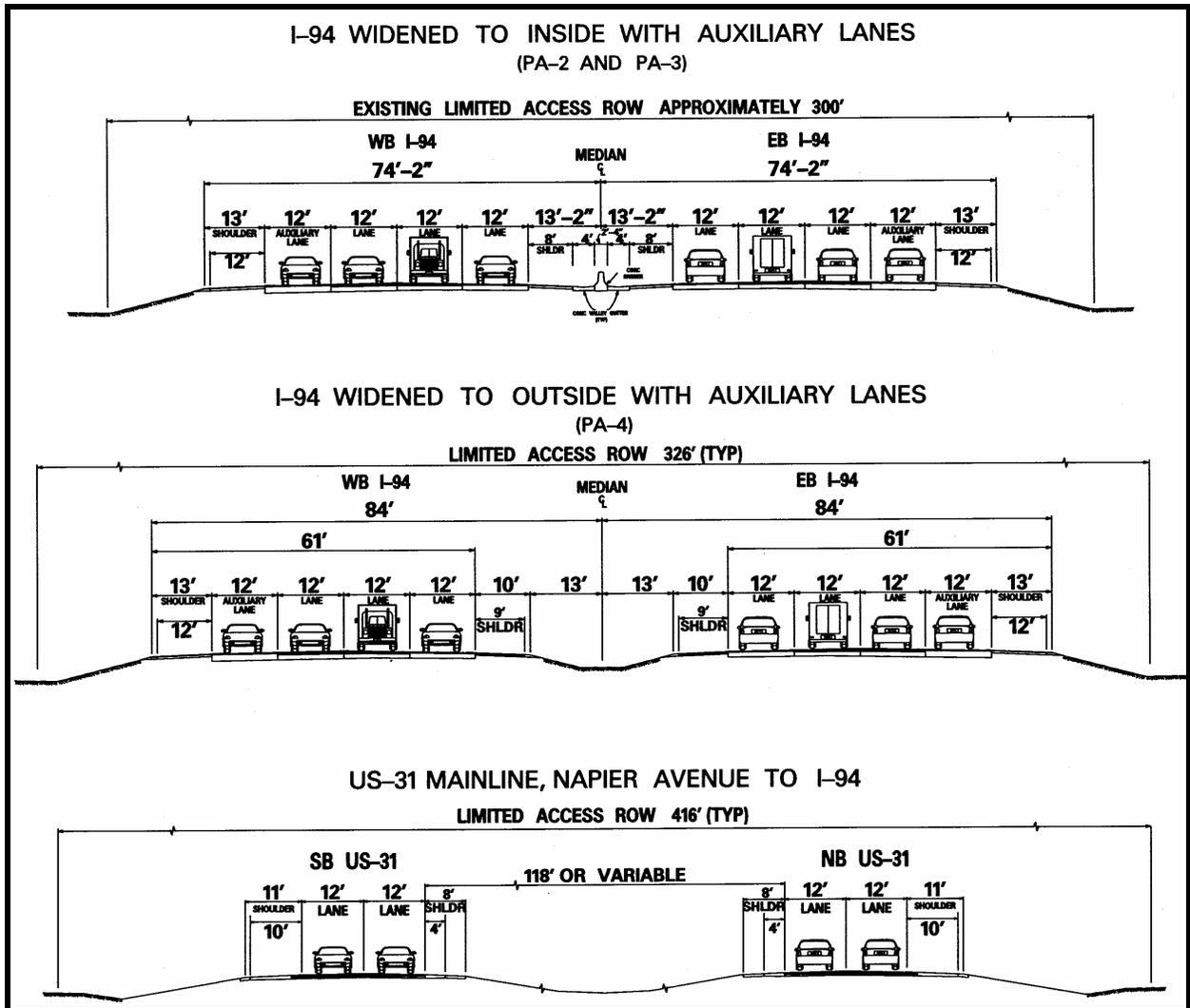


Figure 3.6 Typical Cross-Sections

*Traffic:* Table 3.3 shows the 2001 and 2025 projected Annual Average Daily Traffic (AADT) along I-94, BL-94, I-196, and US-31 associated with Recommended Alternative PA-2. Based on these traffic projections, the mainline peak hour analysis showed no LOS lower than D in 2025.

Table 3.3 Recommended Alternative PA-2 Annual Average Daily Traffic

Roadway	Segment Description	2001 AADT	Projected 2025 AADT
US-31	Napier Avenue to I-94	n/a	18,000
I-94	Napier Avenue to BL-94/US-31	54,000	62,100
I-94	BL-94/US-31 to I-196	59,000	78,300
I-94	East of I-196	36,100	48,700
BL-94	West of I-94/US-31	6,250	13,300
I-196	North of I-94	24,100	38,400

Structures: Five new bridges are proposed to be constructed with Recommended Alternative PA-2 and one existing bridge is proposed to be reconstructed. The new bridges include East Empire Avenue over US-31, East Britain Avenue over US-31, Benton Center Road over US-31, EB BL-94 over I-94 and WB BL-94 over I-94. The existing bridge requiring reconstruction is Territorial Road over I-94 (**Figure 3.4**).

Local Access: Highland Avenue is the only local road interrupted by Recommended Alternative PA-2. East of I-94, Highland Avenue will be closed with a cul-de-sac approximately 1400 feet east of I-94 and to the west it will be closed with a cul-de-sac approximately 1500 feet west of I-94.

Utilities: Recommended Alternative PA-2 crosses a 10-inch oil pipeline (Marathon) between Britain and Empire Avenues. It also crosses ANR 30 inch and 22 inch pipelines near East Empire Avenue. The alignment also crosses a six-inch Michigan Gas Utility (MGU) line that runs along Benton Center Road and an eight-inch MGU line that runs along Highland Avenue. Fiber optic cable runs along the north side of I-94 and will be impacted by the construction of Ramps D and H. Detailed descriptions of utility locations are included in a separate Engineering Report available from MDOT.

Drainage: The project area is located in the Paw Paw River sub-watershed for both surface and groundwater. Water outlets into the St. Joseph River Basin. According to the US Geological Survey Water-Supply Paper 2437, page 18, the area receives approximately 14.2 inches of recharge per year. This is one of the highest recharge rates in the St. Joseph River Basin, which has recharge rates ranging from 4.5 inches to 14.5 inches per year.

Recommended Alternative PA-2 crosses Blue Creek and two county drains, the Wright and Woodley Drain north of East Empire Avenue, and the Carmichael and Closson Drain on existing BL-94 east of Euclid Avenue. It would not result in new crossings of Blue or Yellow Creeks and would have no direct impacts on either crossing.

Recommended Alternative PA-2 would require the reconstruction of the existing Carmichael and Closson Drain culvert located within the 100-year floodplain. This Carmichael and Closson Drain on BL-94 is an existing 84-inch corrugated metal pipe and has a contributing drainage area totaling less than two square miles. Recommended Alternative PA-2 will require the BL-94 alignment to be shifted slightly west, necessitating the relocation of the existing 84-inch culvert. The new BL-94 profile would allow for a ditch outlet at approximately the same location as the existing Carmichael and Closson culvert. As part of a Drainage Study during the design phase, the capacity of this culvert will be analyzed to verify that the proposed culvert crossing will not increase the existing backwater elevation by more than 0.01 foot. While the relocated BL-94 roadway and culvert will be within the 100-year floodplain, the associated fill material will be mitigated by removing the old roadway bed and culvert, resulting in zero net fill in the floodplain.

Open ditching is proposed along I-94 and US-31. The proposed open ditch design would improve upon the existing ditch system which consists of very narrow ditch bottoms and steep backslopes. It is anticipated that storm water velocities within the proposed ditch system along I-94 may require permanent ditch bottom stabilization to minimize soil erosion and sedimentation. Methods to reduce ditch flows and velocities will be explored during the design phase and may include concepts such as utilizing the I-94/I-196 and I-94/BL-94/US-31 interchange infields for short-term detention areas. These areas may also be used for discharge rate monitoring.

To facilitate I-94 auxiliary lanes between BL-94 and I-196, widening of I-94 to the median side is proposed. This widening would require the median to be reconstructed with a concrete median barrier and enclosed drainage. **Figure 5.7** of **Section 5.13.1** illustrates the proposed enclosed drainage scheme along I-94. The enclosed drainage system would be designed to accept I-94 pavement drainage from roughly the beginning of the EB I-94 auxiliary lane to the SB I-196 to EB I-94 entrance ramp which are the high-points of the vertical design. This system would handle all runoff from crown-point to crown-point of eastbound and westbound I-94. The existing eastbound and westbound I-94 ditches east of Blue Creek and the eastbound ditch west of Blue Creek drain directly into Blue Creek through outlets. The proposed enclosed median storm sewer would discharge to the new ditch system a minimum of 300 feet east and west of Blue Creek to assure adequate filtration of sediments. These discharges would be regulated to ensure that the level of discharge into Blue Creek is not significantly increased and the backwater elevation is not impacted by more than 0.01 foot upstream of the existing Blue Creek structure. The existing Blue Creek structure will not be replaced or extended as part of the I-94 improvements.

The US-31 drainage system south of I-94 is proposed to be a series of open ditches. The proposed vertical alignment places the US-31 high-point between Britain Avenue and Benton Center Road. The flow pattern south of this high-point would follow the existing flow pattern south to an existing wetland complex that ultimately drains into the Wright and Woodley Drain. The flow pattern north of this high-point would follow the existing drainage course north and west. Much of US-31 is proposed to be constructed in a fill section without ditches but requiring equalizing culverts to accommodate existing overland flow patterns.

The Recommended Alternative PA-2 crossing of the Wright and Woodley Drain will be on new alignment where the existing drain begins as a small field tile discharging into a wetland complex. This crossing will also be analyzed and sized in the Drainage Study performed as a part of the design phase. This drain crossing has a contributing drainage area totaling less than two square miles.

*Preliminary Costs:* The preliminary construction cost estimate for Recommended Alternative PA-2, including 20% for mobilization and contingencies is approximately \$65 million (2005 dollars). The additional cost of preliminary engineering and right-of-way is approximately \$6.5 million for 2004 and \$5 million for 2005. The total estimated project costs are \$80.1 million (2005 dollars) which includes \$3.6 million for early preliminary engineering already completed.

### **3.5.3 Practical Alternative Three (PA-3), Western Alternative**

Practical Alternative Three (PA-3) follows the existing MDOT right-of-way north and swings west just north of East Britain Avenue (**Figure 3.8**). It continues northwest and intersects I-94 just south of the existing I-94/BL-94 interchange. US-31 continues northeast on auxiliary lanes added to existing I-94, tying into the existing I-94/I-196/US-31 interchange. Realigned BL-94 would continue northwest from I-94 and connect with the existing BL-94 alignment just east of Euclid Avenue.

*PA-3 Advantages - Meets Purpose and Need:* PA-3 meets the primary purpose of the project by providing a free flow freeway link to I-94 and connecting the existing US-31 freeway north and south of the study area. PA-3 is less costly than PA-4 and approximately \$5 million more than Recommended Alternative PA-2. Thus, PA-3 also meets the additional purpose of reducing costs compared to the 1981 FEIS alignment, although not as well as Recommended Alternative PA-2, PA-1, or the No-Build Alternative. PA-3 also meets the project purpose of reducing environmental impacts compared to the 1981 FEIS. PA-3 utilizes slightly more of the

existing MDOT right-of-way originally purchased for the approved 1981 FEIS alignment than does Recommended Alternative PA-2.

Like Recommended Alternative PA-2, PA-3 improves access to BL-94 and thus may assist other economic development efforts in the Benton Harbor area. PA-3 also answers the need for the project of relieving projected traffic congestion that would occur along Napier Avenue under a No-Build condition.

PA-3 Disadvantages: PA-3 does not address goal six for maximizing continuity of southbound US-31 as well as PA-4. PA-3 does not meet project goals two and three as well as Recommended Alternative PA-2. PA-3 has the most residential impacts of any Practical Alternative including impacts to the Butler-East Euclid Subdivision which has been identified as a low-income residential area. The Calvary Lighthouse Church located in the northwest quadrant of the I-94/BL-94/US-31 interchange would be relocated as well. PA-3 would also impact eight more actively farmed parcels and 10 more acres of unique farmland than Recommended Alternative PA-2. PA-3 costs approximately \$5.5 million (2005 dollars) more than Recommended Alternative PA-2.

Highland Avenue would lose access to Benton Center Road, re-routing traffic to Territorial Road or East Britain Avenue. PA-3 does not allow as much distance for US-31 traffic to merge with I-94 through traffic as does Recommended Alternative PA-2 and overall geometrics are less desirable than those of Recommended Alternative PA-2.

Construction staging for PA-3 would be much less efficient than for Recommended Alternative PA-2 due to the location of the PA-3 US-31/I-94 connection that is in approximately the same location as the existing I-94/BL-94 interchange. To maintain the existing BL-94/I-94 access, complex detours or temporary ramps would be required to maintain traffic during the construction of ramps A, D, E and H (**Figure 3.7**) of the proposed US-31 interchange with I-94/BL-94; resulting in increased costs and/or user delays.

Due to all of the above discussed disadvantages of PA-3 when compared to PA-2, PA-3 was not selected as the Recommended Alternative.

Geometrics: A full cloverleaf interchange (**Figure 3.7**) was proposed for the PA-3 interchange at BL-94 with I-94 due to low forecasted traffic volumes on ramps and the rural setting of the study area. The weaving maneuvers between the loop ramps would be limited due to very low traffic volumes on Ramps E and H. **Table 3.4** shows the type, number of lanes, design speed, forecasted AADT, and LOS of each ramp in the proposed I-94/BL-94/US-31 interchange.

**Table 3.4 PA-3 Ramp Data**

Ramp*	Description	Type	Number of Lanes	Design Speed	2025 AADT	LOS**
<b>A</b>	NB US-31 to EB I-94	Outer	1	60 mph	5,950	A (D)
<b>B</b>	EB I-94 to SB US-31	Outer	1	60 mph	350	C (D)
<b>C</b>	EB BL-94 to WB I-94	Outer	1	70 mph	700	C (M)
<b>D</b>	WB I-94 to WB BL-94	Outer	1	60 mph	3,100	B (M)
<b>E</b>	EB I-94 to WB BL-94	Loop	1	40 mph	650	B (W)
<b>F</b>	EB BL-94 to EB I-94	Loop	1	35 mph	3,100	B (W)
<b>G</b>	WB I-94 to SB US-31	Loop	1	40 mph	5,800	C (W)
<b>H</b>	NB US-31 to WB I-94	Loop	1	35 mph	150	A (W)

\* See **Figure 3.8** for ramp locations  
 \*\* The reported LOS represents the worst-case LOS at each ramp's associated junction points. The critical junction point is shown in parenthesis, corresponding to the critical merge (M), diverge (D) or weave (W) location. This value is dependent upon the peak hour ramp volumes, the freeway volumes, and the laneage and geometry of the merge or diverge area.

Under the PA-3 Alternative mainline I-94 would be reconstructed from Empire Avenue to east of the I-94/I-196/US-31 interchange. Auxiliary lanes are proposed between the I-94/BL-94/US-31 and I-94/I-196/US-31 interchanges to prevent vehicles traveling through on US-31 from having to merge onto I-94. These auxiliary lanes are the same as those proposed for Recommended Alternative PA-2 and are shown in **Figure 3.11**. In order to accommodate a four-lane section between these interchanges without reconstructing the Benton Center Road bridge over I-94, I-94 would be reconstructed and widened into the median (**Figure 3.6**).

The 8-lane reconstruction would extend from the I-94/BL-94/US-31 interchange to the I-94/I-196/US-31 interchange. EB and WB I-94 each would consist of three through travel lanes and one auxiliary lane. The EB auxiliary lane would be located between the NB US-31 to EB I-94 entrance and the EB I-94 to NB I-196/US-31 exit ramp. The far right lane would be required to exit and the second right lane would have the option to exit. Consequently, US-31 through traffic would not have to merge with I-94 traffic and I-94 traffic would not have to merge with through US-31 traffic in order to take the NB I-196/US-31 exit. The WB I-94 auxiliary lane would be located between the SB I-196 to WB I-94 entrance and the WB I-94 to WB BL-94 exit ramp and through southbound US-31 traffic would not have to merge with westbound I-94 traffic.



**Figure 3.7 PA-3 Ramps**

PA-3 would not diminish the level-of-service (LOS) or safety along I-94 within the study area. A high speed direct ramp at the proposed I-94/BL-94/US-31 interchange and a dedicated lane along I-94 allow for a continuity of movement between US-31 south of I-94 and I-196/US-31 north of I-94. Similar to Recommended Alternative PA-2, PA-3 would improve the efficiency of north-south vehicular travel and movement of goods along US-31.



Figure 3.8 Practical Alternative 3

Traffic: **Table 3.5** depicts the 2001 and 2025 projected AADT along I-94, BL-94, I-196, and US-31 associated with PA-3.

**Table 3.5 PA-3 Annual Average Daily Traffic**

Roadway	Segment Description	2001 AADT	Projected 2025 AADT
<b>US-31</b>	Napier Avenue to I-94	n/a	18,000
<b>I-94</b>	Napier Avenue to BL-94/US-31	54,000	62,100
<b>I-94</b>	BL-94/US-31 to I-196	59,000	78,300
<b>I-94</b>	East of I-196	36,100	48,700
<b>BL-94</b>	West of I-94/US-31	6,250	13,300
<b>I-196</b>	North of I-94	24,100	38,400

Based on these traffic projections, the peak hour analysis showed LOS to be D or better for all segments of PA-3.

Structures: Five new bridges would be constructed with PA-3 and one existing bridge would be reconstructed. The new bridges include East Empire Avenue over US-31, East Britain Avenue over US-31, Benton Center Road over US-31, EB BL-94 over I-94, and WB BL-94 over I-94. The existing bridge to be reconstructed would be Territorial Road over I-94.

Local Access: Highland Avenue, East Main, and West Main are the major local roads interrupted by PA-3. East of I-94, Highland Avenue would be closed with a cul-de-sac approximately 1500 feet west of I-94 and approximately 350 feet east of Benton Center Road. This eliminates the intersection of Benton Center Road and Highland Avenue. It would be necessary to reconstruct the existing East Main cul-de-sac 100-200 feet east of its current location. West Main in the northwest quadrant of the existing I-94/BL-94 interchange would be removed east of Wells Road.

Utilities: PA-3 crosses the Marathon Oil Pipeline south of Highland Avenue and east of Benton Center Road. PA-3 crosses an ANR 30 inch and a 22 inch pipeline near East Empire Avenue. The alignment also crosses a six-inch Michigan Gas Utility (MGU) line that runs along Benton Center Road and an eight-inch MGU line that runs along Highland Avenue. The fiber optic cable running along the north side of I-94 would be impacted by the construction of Ramp D, Ramp H, and east and westbound BL-94. Detailed descriptions of utility locations are included in the Engineering Report.

Preliminary Costs: Preliminary construction cost estimates for PA-3, including 20% for mobilization and contingencies, are approximately \$74.6 million. Right-of-way costs are estimated at approximately \$11.1 million. Total estimated costs are \$85.7 million (2005 dollars) including engineering and an estimated 3% annual inflation of construction costs (see **Table 3.1**).

### 3.5.4 Practical Alternative Four (PA-4), Modified 1981 FEIS Alignment

Practical Alternative Four (PA-4) follows the same alignment as the originally approved 1981 FEIS alignment with the following exceptions (**Figure 3.9**):

- Eliminates collector/distributor roads along I-94.
- All ramps in the modified I-94/I-196/US-31 interchange and Ramp N (**Figure 3.10**) tie directly into I-94 and I-196/US-31.

- An outside auxiliary lane (fourth lane) in each direction would be added to I-94 between the I-94/I-196/US-31 and I-94/BL-94 interchanges in place of barrier separated collector/distributor roads.

These changes provide adequate operations at less cost and impact than collector/distributor roads.

*PA-4 Advantages:* As with Recommended Alternative PA-2 and PA-3, PA-4 meets the primary project purpose of a free flow freeway connection between US-31 termini north and south of the study area and linkage to I-94. PA-4 is the most favorable for continuity of the northbound and southbound movements of US-31, as vehicles are not required to reduce speed to use entrance or exit ramps to continue through on US-31/I-196. PA-4 meets the additional project purpose of improving north-south vehicular travel and movement of goods along US-31 slightly better than PA-2 and PA-3 and much better than PA-1. This north-south alignment of US-31 also facilitates using more of the existing MDOT right-of-way than the other Practical Alternatives. This alignment also supports a high level-of-service on I-94 since through US-31 traffic simply crosses I-94; however, it does not include the advantage of adding a median barrier within the existing narrow 46 foot I-94 median as do Recommended Alternative PA-2 and PA-3.

*PA-4 Disadvantages:* As PA-4 is essentially the 1981 FEIS alignment, it does not meet the project purposes of minimizing environmental impacts and reducing costs compared to the originally approved alignment. Environmental assessment of all alternatives indicates that wetland, floodplain, and threatened and endangered species impacts are much higher for PA-4 than for all other freeway Build Alternatives.

PA-4 requires 11 new bridges; this is six more structures than either PA-3 or PA-2. These bridges increase the cost and associated environmental impacts of PA-4. The PA-4 northbound and southbound crossings of Blue Creek require structures that are approximately 763 feet long by 47 feet wide. The cost of these structures accounts for over \$11 million of the PA-4 construction cost. PA-4 has the highest cost of all Practical Alternatives. The sensitivity of the Blue Creek Fen requires special provisions for construction and maintenance of these bridges, including the restriction of piers or construction activities within the fen, and special drainage requirements to avoid degradation of water quality. PA-4 also proposes to replace the existing Benton Center Road bridge and widen I-94 over sensitive habitat of Blue Creek, just downstream of the Blue Creek Fen. This would require lengthening the existing Blue Creek culvert under I-94. PA-4 also does not adequately meet project goals three, four, and eight as outlined in **Section 2.4 Project Goals**, and the **Appendix F** foldout map.

Construction staging for PA-4 would be the most difficult of all of the Build Alternatives to keep all movements open at the I-94/I-196/US-31 interchange. This interchange carries large volumes of traffic. All movements could remain open at the I-94/BL-94 interchange during construction.

The PA-4 alignment, as adapted from the 1981 FEIS, requires a left lane “high speed” merge for the I-94 eastbound movement to northbound I-196/US-31. It is likely that a detailed geometric review of this alignment would require further modifications during design.

As PA-4 does not directly connect US-31 to BL-94, it does not do as much as PA-2 and PA-3 to meet the project purpose of providing improvements that are supportive of other economic development efforts in the Benton Harbor area.



Figure 3.9 Practical Alternative 4

Due to all of the above discussed disadvantages including its failure to fully meet the Purpose of and Need for the project, PA-4 was not selected as the Recommended Alternative.

**Geometrics:** As illustrated in the 1981 FEIS, a partial cloverleaf interchange with one flyover ramp was proposed for the PA-4 interchange with I-94/I-196. **Table 3.6** shows the type, number of lanes, design speed, forecasted AADT, and LOS of each ramp in the proposed I-94/BL-94/US-31 interchange.

Auxiliary lanes are proposed for the outside of the existing six-lane section of I-94 between the I-196 and existing BL-94 interchanges with I-94 (**Figure 3.6**). While the addition of a fourth lane in each direction to the outside of existing I-94 does not require the reconstruction of I-94 or the BL-94 interchange, it would require the reconstruction of the Benton Center Bridge and the Blue Creek culvert at I-94. Adding the auxiliary lanes to the inside median of I-94 for PA-4 would necessitate the costly reconstruction of the BL-94 interchange which is included within PA-2 and PA-3, but not PA-4.

**Table 3.6 PA-4 Ramp Data**

Ramp*	Description	Type	Number of Lanes	Design Speed	2025 AADT	LOS**
<b>A</b>	WB I-94 to NB US-31/I-196	Outer	2	45 mph	2,200	A (M)
<b>B</b>	NB US-31 to EB I-94	Outer	1	65 mph	3,450	B (M)
<b>C</b>	EB I-94 to SB US-31	Outer	1	45 mph	400	A (M)
<b>D</b>	SB US-31/I-196 to WB I-94	Outer	2	65 mph	14,250	A (M)
<b>E</b>	NB US-31 to WB I-94	Loop	1	30 mph	400	A (W)
<b>F</b>	EB I-94 to NB US-31/I-196	Flyover	2	55 mph	14,350	C (M)
<b>G</b>	SB US-31/I-196 to EB I-94	Loop	1	30 mph	2,200	B (W)
<b>H</b>	WB I-94 to SB US-31	Loop	1	30 mph	3,350	B (W)
<b>N</b>	EB I-94 to WB BL-94	Loop	1	30 mph	650	B (D)

\* See **Figure 3.10** for ramp locations

\*\* The reported LOS represents the worst-case LOS at each ramp's associated junction points. The critical junction point is shown in parenthesis, corresponding to the critical merge (M), diverge (D) or weave (W) location. This value is dependent upon the peak hour ramp volumes, the freeway volumes, and the laneage and geometry of the merge or diverge area.

Traffic: **Table 3.7** shows the 2001 and 2025 projected AADT along I-94, BL-94, I-196, and US-31 associated with PA-4.

**Table 3.7 PA-4 Annual Average Daily Traffic**

Roadway	Segment Description	2001 AADT	Projected 2025 AADT
<b>US-31</b>	Napier Avenue to I-94	n/a	12,800
<b>I-94</b>	Napier Avenue to BL-94/US-31	54,000	61,500
<b>I-94</b>	BL-94/US-31 to I-196	59,000	67,100
<b>I-94</b>	East of I-196	36,100	48,900
<b>BL-94</b>	West of I-94/US-31	6,250	8,200
<b>I-196</b>	North of I-94	24,100	38,200

These projected AADT volumes were used for the peak hour analysis which showed LOS D or better for all segments of PA-4.

Structures: Eleven new bridges would be constructed as a result of PA-4 and two existing bridges would be reconstructed. The new bridges include East Empire Avenue over US-31, East Britain Avenue over US-31, NB US-31 over Blue Creek, SB US-31 over Blue Creek, Territorial Road over SB US-31, Territorial Road over NB US-31, NB US-31 over Yellow Creek, SB US-31 over Yellow Creek, SB US-31 over EB I-94 to the NB I-196/US-31 ramp, NB I-196/US-31 over I-94, and SB I-196/US-31 over I-94. The reconstructed bridges would be Benton Center Road over I-94 and Territorial Road over I-94.

Local Access: Highland Avenue and Blue Creek Road are local roads that would be interrupted by PA-4. East of Benton Center Road, Highland Avenue would be closed with a cul-de-sac approximately 500 feet west of US-31 and to the east of Blue Creek Road it would be closed with a cul-de-sac approximately 400 feet east of US-31. South of Territorial Road, Blue Creek Road would be closed with a cul-de-sac approximately 600 feet north of US-31 and on the south side it would be closed with a cul-de-sac approximately 600 feet south of US-31.

Utilities: PA-4 crosses the Marathon Oil Pipeline several times. Ramp A, Ramp E, Ramp F, Ramp G (**Figure 3.10**), and north and southbound US-31 all create new crossings of the pipeline. PA-4 crosses a 30 inch and a 22 inch gas pipeline near East Empire Avenue. PA-4 also crosses an eight-inch Michigan Gas Utility (MGU) line that runs along Highland Avenue, a four-inch MGU line that runs along Blue Creek Road, and a four-inch MGU line that runs along Territorial Road. The fiber optic cable running along the north side of I-94 would be impacted by the construction of the I-94/I-196/US-31 interchange.



**Figure 3.10 PA-4 Ramps**

Preliminary Costs: Preliminary construction cost estimates for PA-4, including 20% for mobilization and contingencies, are approximately \$100.5 million. Additional right-of-way costs necessary to build PA-4 are approximately \$3.5 million. With engineering costs and an

estimated 3% annual inflation of construction costs, total costs are estimated at \$104 million (2005 dollars) as depicted in **Table 3.1**.

## 3.6 Design Criteria

Detailed design criteria were developed for the three Build Alternatives presented in this study. The design criteria contained fundamental roadway and bridge design elements adhering to Michigan Department of Transportation (MDOT) and American Association of State Highway and Transportation Officials (AASHTO) guidelines. The design criteria were utilized in the development of the Build Alternatives and are detailed in a separate Engineering Report available from MDOT.

### 3.6.1 Roadway Design

The road design elements identified in the design criteria include the following:

- Traffic data for design year 2025
- Design speed
- Number of lanes
- Lane width
- Shoulder width
- Side slopes
- Pavement and shoulder cross slopes
- Horizontal and vertical alignment parameters, including:
  - minimum horizontal curve radii
  - clear zone distance
  - maximum allowable superelevation
  - K-values
  - vertical clearance
  - stopping sight distance
  - maximum and minimum percent grades

The three Build Alternatives meet or exceed the desirable design criteria values except as noted below.

Recommended Alternative PA-2: Recommended Alternative PA-2 consists of a rural cloverleaf type interchange with four outer direct ramps and four interior loop ramps. None of the ramps meets the 65 mile per hour (mph) desirable speed for the high speed direct ramps. However, the outer ramps maintain a 60 mph design speed, which is greater than the 50 mph minimum design speed suggested by AASHTO. The interior loop ramps all meet applicable design criteria values.

Practical Alternative Three (PA-3): Western alternative PA-3 is similar to Recommended Alternative PA-2. Ramp A, due to the proximity of the I-94/BL-94/US-31 interchange to the I-196/I-94 interchange, operates at a 60 mph design speed, which is greater than the desired minimum, but five miles per hour less than the desired speed for the high speed direct ramps.

Practical Alternative Four (PA-4): The 1981 FEIS Alternative PA-4 consists of a modified cloverleaf interchange with two high speed ramps, one directional ramp, and three loop ramps. Only Ramp B, northbound US-31 to eastbound I-94, and Ramp D, southbound I-196 to westbound I-94, meet the 65 mph desirable speed. Ramp A (westbound I-94 to northbound

I-196) and Ramp C (eastbound I-94 to southbound US-31), operate at a design speed of 45 mph, which is borderline for a high speed directional movement and a design exception would be required. The interior loop ramps all meet applicable design criteria values.

### 3.6.2 Bridge Design

The bridge design elements identified in the design criteria include the following:

- Design loading
- Deflection limits (LL)
- Bridge clear roadway widths
- Vertical underclearance

The preliminary structure estimates associated with the Build Alternatives are based on these design criteria values.

## 3.7 Conclusion - PA-2 is the Recommended Alternative

Analysis of the Practical Alternatives (No-Build, TSM, Recommended Alternative PA-2, and Practical Alternatives PA-3 and PA-4) included comparison between the Practical Freeway Build Alternatives as well as comparison of the freeway Build Alternatives to the No-Build and TSM Alternatives. The merit of each alternative was assessed based on the Purpose of and Need for the project as outlined in **Section 2.0 Purpose of and Need for the Proposed Action**.

### 3.7.1 Selection of Recommended Alternative PA-2

Recommended Alternative PA-2 best meets the Purpose of and Need for the project when compared to all Practical Alternatives. From an environmental, social, geometrics, safety, maintenance of traffic, construction phasing, and cost perspective, Recommended Alternative PA-2 is more desirable than PA-3 or PA-4.

Recommended Alternative PA-2 achieves the primary project purpose by providing a free flow US-31 freeway connection to I-94 and ultimately to I-196/US-31 north. Recommended Alternative PA-2 minimizes total social and environmental impacts and is the least costly as compared with the PA-3 and PA-4 freeway alternatives. Recommended Alternative PA-2 accomplishes project goals (found in **Appendix F**) one, two, three, four, seven, eight, and nine as well or better than any alternative that fully meets the Purpose of and Need for the project. The continuity of traffic flow for southbound US-31 is slightly compromised at the I-94/BL-94/US-31 interchange with a speed differential of 70 mph to 30 mph, but it is a free-flow movement. The existing MDOT right-of-way (ROW) is utilized as much as possible given the location of the relocated I-94/BL-94 interchange and Recommended Alternative PA-2 requires less costly additional ROW purchases than does PA-3.

Recommended Alternative PA-2 provides several distinct advantages over PA-3 and PA-4. The proposed cloverleaf interchange associated with Recommended Alternative PA-2 provides an additional 1,800 feet more weaving distance along I-94 than PA-3, allowing greater distance for US-31 traffic to merge with existing I-94 traffic. Recommended Alternative PA-2 does not require exit ramps to be located on horizontal curves like PA-3, and construction phasing is easier and more efficient due to the proposed interchange location being located further south of the existing I-94/BL-94 interchange.

Recommended Alternative PA-2 has fewer overall environmental impacts than PA-3 (with wetlands being the exception) and substantially fewer impacts than PA-4. Recommended Alternative PA-2 has fewer residential impacts than PA-3 and no potential environmental justice concerns. Recommended Alternative PA-2 has no direct impacts to churches, neighborhoods, or community facilities. Recommended Alternative PA-2 also impacts eight fewer actively farmed parcels and 10 fewer acres of unique farmland than PA-3.

Unlike Recommended Alternative PA-2, the No-Build and TSM (PA-1) Alternatives do not meet the project's primary purpose of providing a free flow freeway connection between US-31 termini north and south of the study area and a free flow link to I-94. They also do not adequately meet the project purposes of improving north-south vehicular movements and enhancing access to the Benton Harbor area.

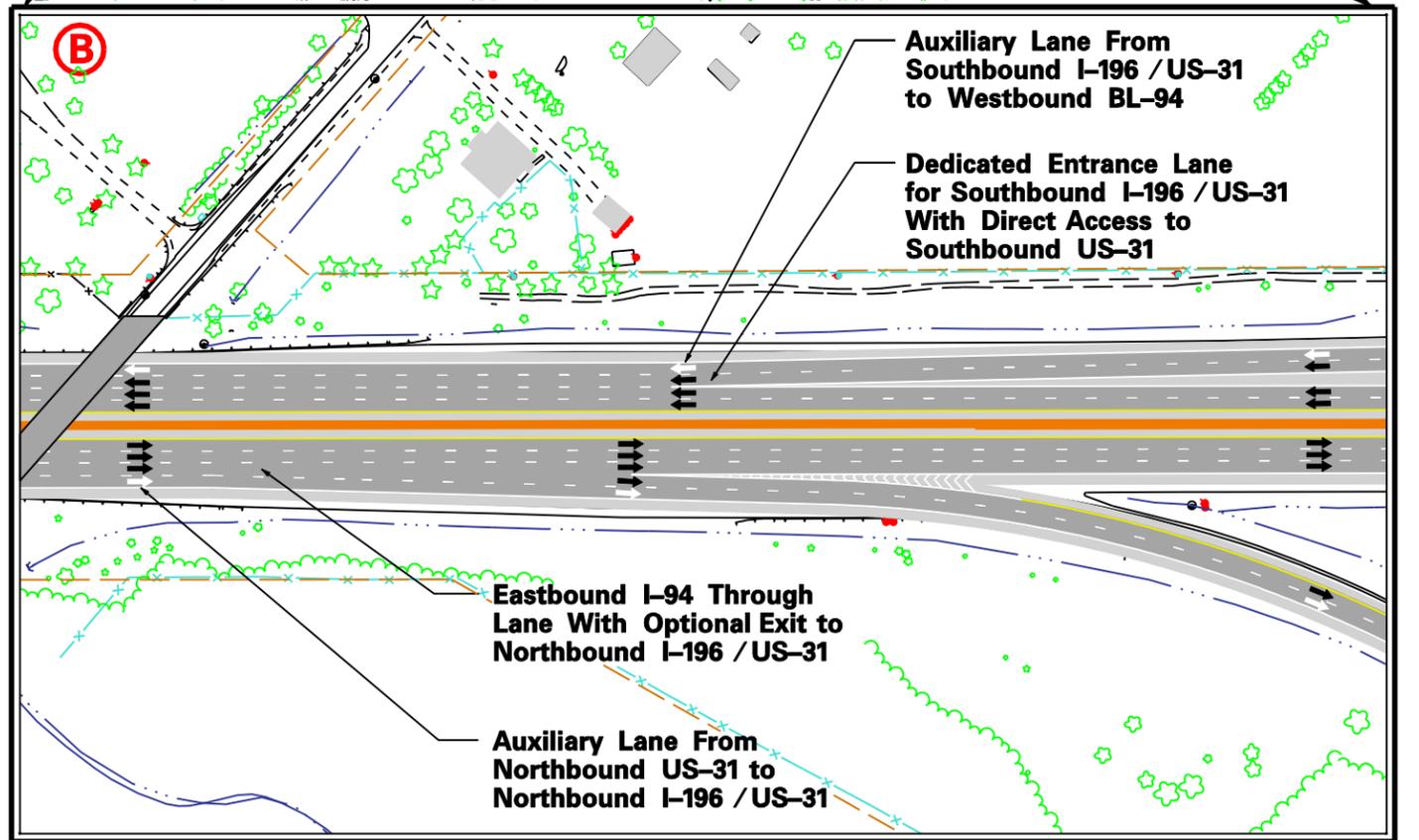
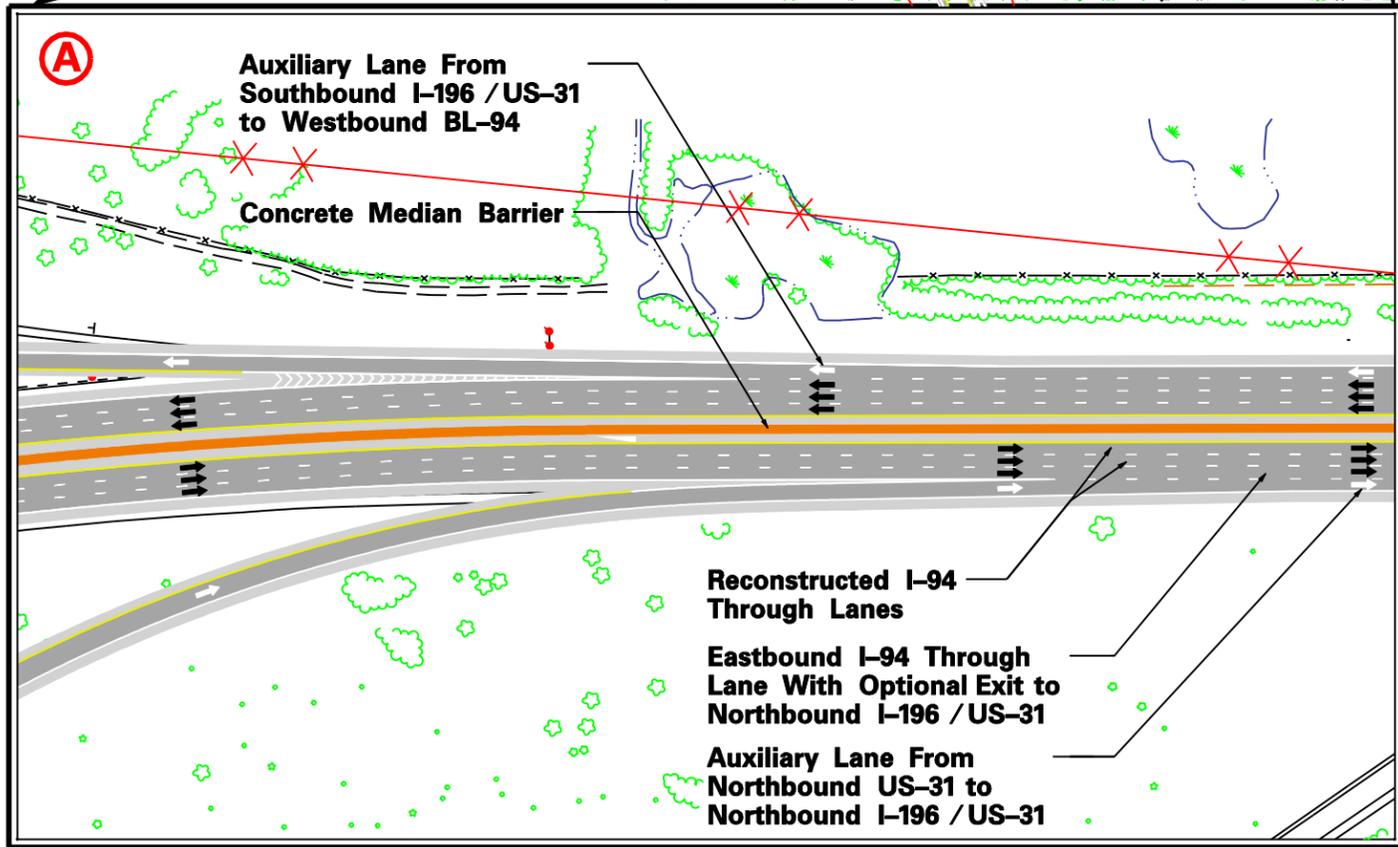
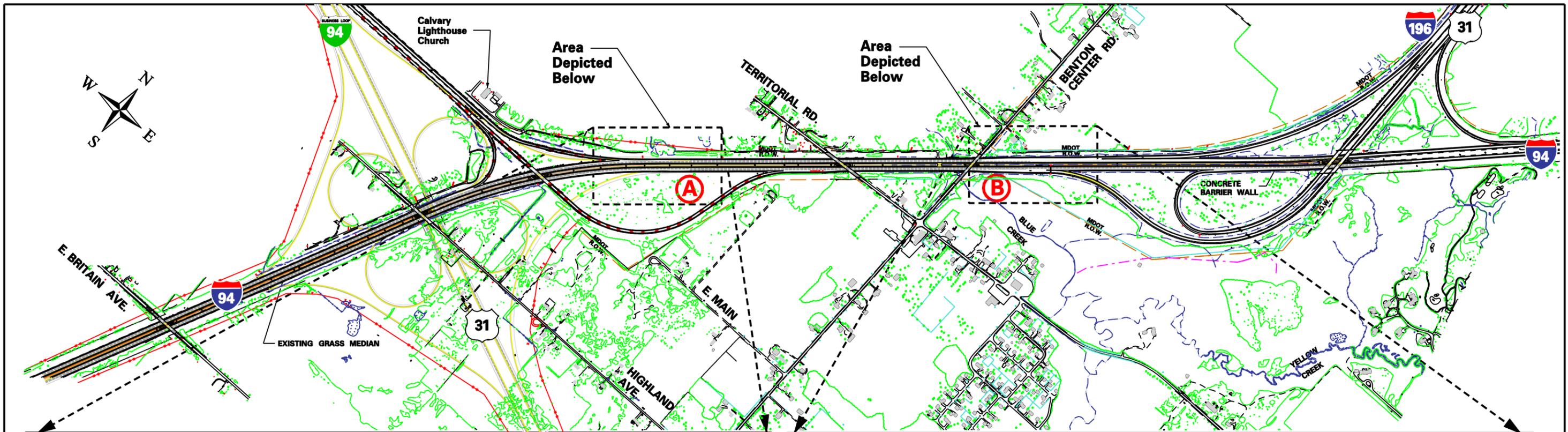
Compared to Recommended Alternative PA-2, PA-3 is much less desirable from a geometric, cost, safety, maintenance of traffic and environmental perspective. PA-3 requires the northbound US-31 exit ramp to be located on a horizontal curve, and construction phasing is more difficult and less efficient due to the location of the proposed PA-3 interchange with respect to the existing I-94/BL-94 interchange. PA-3 has more residential relocations than Recommended Alternative PA-2 and has potential environmental justice issues within the Butler-East Euclid Subdivision in the northwest quadrant of the I-94/BL-94/US-31 interchange.

PA-4 has significant impacts on the environmentally sensitive Blue Creek Fen and associated habitat for the federally endangered Mitchell's satyr butterfly. It impacts high quality wetland areas and requires lengthy bridge structures that would be costly to construct and maintain.

PA-4 far exceeds all Practical Alternatives in cost and environmental impacts and would not provide the same degree of improved BL-94 access to assist other economic development efforts as does Recommended Alternative PA-2. Thus, PA-4 does not meet the Purpose of and Need for the project as well as Recommended Alternative PA-2.

### **3.7.2 NEPA/404 Concurrence on Practical Alternatives to be Carried Forward**

As a part of the National Environmental Policy Act (NEPA) environmental clearance and Section 404 wetland permitting process, concurrence was requested from the Michigan Department of Environmental Quality, United States Army Corps of Engineers, United States Environmental Protection Agency, and United States Fish and Wildlife Service on Practical Alternatives to be Carried Forward through letters and documentation sent on November 14, 2002. Each of these agencies sent letters (**Appendix E.4**) concurring with the Practical Alternatives to be Carried Forward and were supportive of Recommended Alternative PA-2. PA-2 was identified as the Preferred Alternative within the DSEIS and in some cases agency concurrence was contingent upon the selection of PA-2 as the Recommended Alternative.



➡ = Dedicated Entrance / Exit Lane Between Interchanges

**Auxiliary Lanes for Recommended Alternative PA-2**

Figure 3.11 Auxiliary Lanes on I-94

Alternatives Considered