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ALTERNATIVES ANALYSIS REPORT

July 2024

I-80 EAST WIDENING
INTERSTATE
NEVADA
80
RENO/SPARKS

Nevada Department of Transportation
I-80 East Widening NEPA

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7/3/2024

Introduction

The Nevada Department of Transportation (NDOT), in cooperation with the Federal Highway Administration (FHWA), is proposing improvements for Interstate 80 (I-80) from Vista Boulevard in Sparks, Nevada, to USA Parkway (State Route (SR) 439), located in Washoe County, Nevada, a distance of approximately 13 miles (see Figure 1). Interchanges are located at Vista Boulevard, Lockwood, Mustang, Patrick, and USA Parkway.

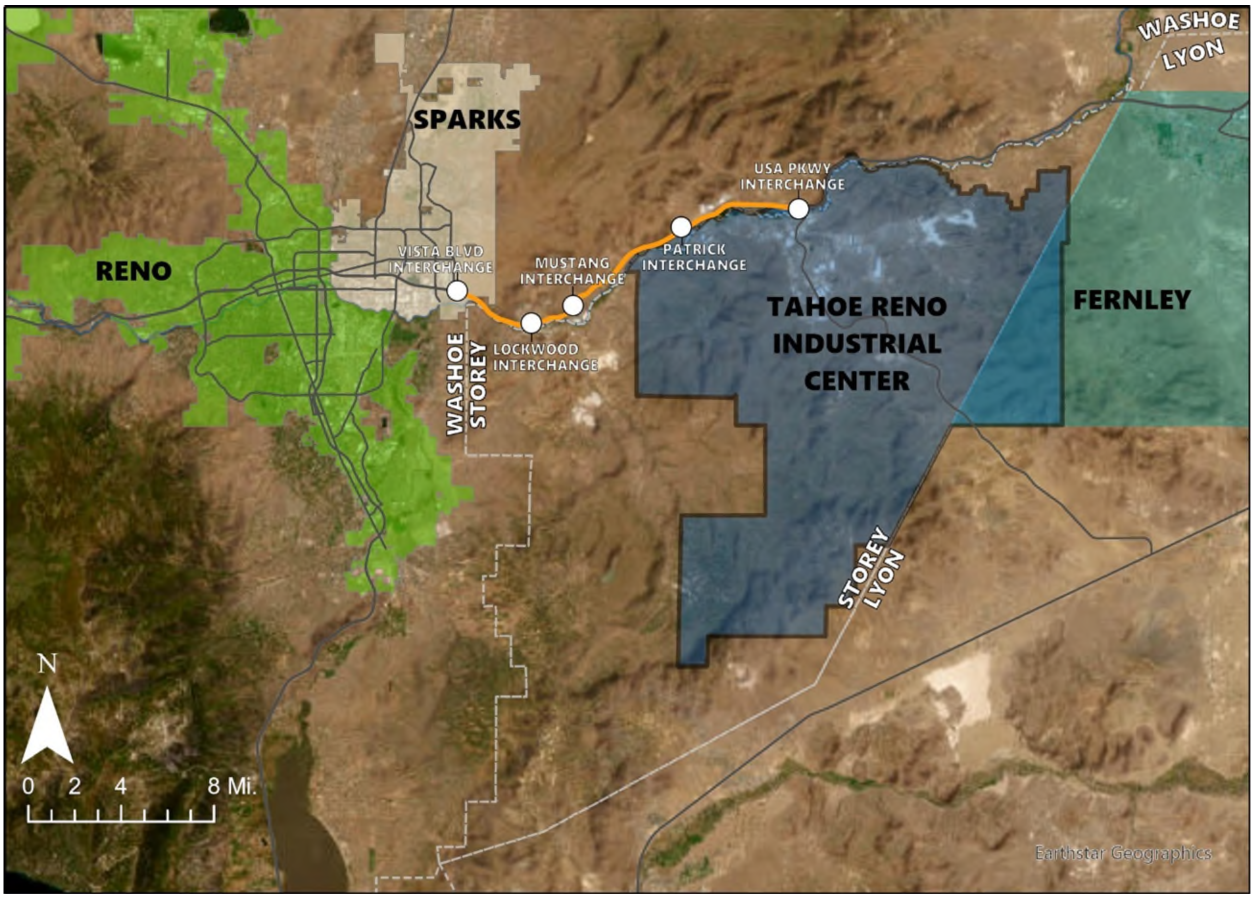


Figure 1 – Location Map

Travel demand and safety concerns have increased over the past ten years. Northern Nevada continues to see significant population increases, including major development along the I-80 corridor. Development of the Tahoe Reno Industrial Center (TRIC) is anticipated to contribute over 20,000 vehicles per day in each direction by 2050. Additionally, the western segment of the study area from Vista Boulevard to the Mustang Interchange is located in a very steep canyon, shared with the Truckee River and the Union Pacific Railroad (UPRR). There are minimal shoulders along the roadway, contributing to a degradation of safety and traffic operations. Emergency access is very problematic as there are no shoulders for emergency vehicles, and the east and westbound lanes are separated, further limiting access (see Figures 2 and 3). The lack of widened shoulders to clear crashes also results in extensive congestion during incidents, leading to secondary crashes.

NDOT is proposing to improve traffic operations by providing additional capacity to reduce travel time delays and enhance safety. The project will include additional elements such as wider shoulders, improved intersection geometries, truck parking, and wrong-way driver detection.

Figure 2 – I-80 Corridor Looking West

Figure 3 – Canyon Area Looking East

Widening the roadway through the canyon area will be very challenging, given the site constraints. Outside of the canyon area, from the Mustang Interchange to USA Parkway, widening becomes a more traditional trench and widening project, with available right-of-way for full lane width and full shoulders. Consequently, the widening alternative for the area outside the canyon is three 12-foot lanes in each direction with a 12-foot outside shoulder and a 10-foot inside shoulder.

This report presents a summary of the alternatives developed, the criteria developed to evaluate the alternatives, how the alternatives scored, and a recommendation of which alternative best meets the purpose and need of this project.

There are locations where the existing geometric alignment does not meet interstate criteria. Correcting these locations has been evaluated at a preliminary level. Some deficiencies were more easily addressed and were consequently included in all the alternatives. Other deficiencies that are more difficult to mitigate or have a high cost were not addressed within these preliminary alternatives but will be reviewed on a case-by-case basis as the design progresses. Correcting these deficiencies will have the same relative impacts for each alternative, i.e., the decisions to correct these deficiencies do not impact which alternative will be selected.

The purpose of this project phase is to perform the necessary studies, documentation, and outreach required to obtain the appropriate environmental clearances and permits by evaluating widening alternatives to select a preferred alternative on I-80 from Vista Boulevard to USA Parkway.

Purpose and Need

Why is the Project Needed?

The I-80 corridor is experiencing increased travel demand and high crash rates. Minimal shoulders exacerbate crash impacts, causing significant delays and impacting first responder access. With limited area to clear the crash scene and reopen travel lanes, delays occur for emergency responders, tow trucks, and the general public, often resulting in temporary closures of both travel lanes with significant backups. These backups can result in secondary crashes due to higher-speed vehicles quickly coming up on slow-moving and stopped vehicles. Approximately 10% of the crashes in the corridor can be attributed to an earlier crash event and its associated congestion.

Congestion also occurs due to the rapid development of the TRIC, Reno-Sparks metropolitan area, City of Fernley, and overall increased freight traffic along the I-80 corridor. Major facilities attracting both employees and freight movement include the Tesla Gigafactory, Walmart Distribution Center, Switch, and James Hardie. Future development of TRIC includes Google and Blockchain campuses. The anticipated increases in traffic volumes along I-80 between Vista Boulevard and USA Parkway will push the existing corridor to exceed its current capacity, even during normal traffic conditions with no incidents or poor weather conditions.

To address these needs, NDOT is proposing the I-80 East Widening project to optimize mobility and provide safety enhancements. The purpose of the project is to provide additional capacity to reduce travel time delays and accommodate traffic associated with past and currently planned growth in the region. The project would enhance safety with wider shoulders, truck parking, and wrong-way driver detection systems. The project would provide appropriate capacity to accommodate future 2050 traffic volumes. In addition, widened shoulders would be provided to allow for quicker crash response and clearing times to reduce crash-induced congestion and the probability of secondary crashes.

Previous Studies

Many studies have been completed and several concepts have been discussed over the years. The following is a summary of concepts previously evaluated:

Expanded Public Transportation

Multimodal opportunities were also discussed and evaluated as part of the *I-80 Corridor Study*. January 2020. The Regional Transportation Commission (RTC) of Washoe County currently operates a very effective vanpool program to the TRIC area. In addition, NDOT funded the Inter-County and Regional Transit Plan, which evaluated how better public transportation could be implemented in the TRIC area. One key recommendation was the development of a Traffic Management Association (TMA), which is in the early development stages with the RTC and various counties. RTC also has future transit enhancement to the TRIC area identified in their 2050 Regional Transportation Plan, but it is currently unfunded. RTC is in the early stages of initiating a commuter rail feasibility study for TRIC.

Bike/muti-use paths were also considered. Due to the limited area available and steep topography, locating a path within the freeway corridor was problematic. A path adjacent to the freeway and path alignments above or below the freeway that would be hidden from view also raised safety and maintenance concerns.

NDOT supports the development of multimodal opportunities within the I-80 corridor; however, it was determined during the alternatives analysis that multi-modal improvements alone would not meet the purpose and need of the project and were eliminated from further consideration.

Other Corridors

Alternative corridors continue to be discussed by RTC, NDOT, and the private development community. These corridors are in the infancy of the project development process and will require extensive additional work, including initial planning and fatal flaw feasibility studies to determine potential alignment corridors, realistic costs, and potential environmental impacts. In addition, while these corridors will provide alternative routes, they will not provide a high-speed, limited-access interstate corridor comparable to I-80. As discussed in the project Purpose and Need, a major component of this project is to enhance the safety of the existing I-80 corridor. This could not be accomplished through an alternative corridor. These potential alternative corridors would most likely not remove a significant portion of freight movement or interstate travel, thus making operational improvements still a critical need along the existing I-80 corridor. Alternative corridors were dismissed as a potential alternative due to the lack of ability to meet the overall project's Purpose and Need.

High Occupancy Vehicle (HOV) Lanes

Using HOV lanes in the right environments can aid in encouraging carpooling, reducing the number of cars on the roadway. HOV lane implementation was discussed as an early potential alternative as part of the *I-80 Corridor Study,* January 2020. Through this evaluation, several key factors were identified that limited the effectiveness of an HOV lane within the I-80 Corridor, and the implementation of HOV facilities within the I-80 East corridor was dismissed from further evaluation.

HOV Master Plan – The success of an HOV program requires significant regional planning, the development of an HOV Master Plan, and the identification of regional facilities. In the late 1990s, NDOT established the Southern Nevada HOV Master Plan and has made several updates to it over the past 20 years. The Master Plan and Updates include facilities such as system-to-system direct connect ramps and service interchange direct connect ramps. In addition, these plans evaluate regional ridership and HOV lane usage/effectiveness on a regional level. Northern

Nevada does not have any type of regional HOV plan identifying how the I-80 East corridor would tie into an overall regional HOV plan.

Overall Freeway Operations – While Northern Nevada does not have an HOV Master Plan, several criteria from NDOT's Managed Lanes and Ramp Metering Manual indicate that HOV lanes would not be warranted or sufficiently utilized on I-80 East. One key element to the success of HOV lanes and encouraging carpooling is having congestion within the general purpose lanes. Ideally, HOV lanes should operate at least an average of 10 miles per hour (mph) faster than adjacent general purpose lanes to encourage usage. The proposed build alternative will provide improvements resulting in a 2050 average operating speed more than 60 mph throughout the I-80 East corridor, which will have a posted speed of 65 mph. In addition, the overall vehicle density, a key measure of effectiveness (MOE) for traffic operations, is 20 vehicles per mile per lane. For comparison, a congested freeway would have an overall density of 45 vehicles per mile plane or greater. These two factors would result in an underutilized HOV lane.

Based on this information, the development of HOV lanes as a potential alternative was eliminated from further study at this time.

Park and Ride

The project limits are largely constrained by steep topography, the Truckee River, Union Pacific Railroad facilities, and adjacent developments and private property. No feasible location has been identified that would provide a reasonable location for park and ride facilities within the proposed NEPA logical termini limits and Area of Potential Effect. Topography at the Mustang interchange is potentially accommodating to such a facility, but due to its location, it is not anticipated that such a facility would see appreciable use.

Based on this, Park and Ride facilities were not considered for further evaluation.

Diesel Idling

Additional truck parking is being evaluated near the Mustang interchange as part of the project. This will provide a location outside the urban area, specifically outside of the Verdi residential area, for truck parking during closures on I-80 in California due to snow conditions. In addition, the potential for future charging stations at these new parking areas is also being evaluated as more electric semis begin using the corridor.

Previous Evaluation

Initial Concepts and Evaluation

Numerous concepts were developed for the project. These alternatives were screened against project criteria, and the results and recommendations were documented in the *Initial Concepts and Evaluation Report, I-80 East Widening NEPA,* January 2024. Following is a summary of that report.

Screening criteria were developed to closely follow NDOT's One Nevada critical goals. The categories for this screening analysis included Safety, Preserving Infrastructure, Optimizing Mobility, Transforming Economies, Fostering Sustainability, Connecting Communities, and Cost and Risk.

Initial Analysis Results

The project team scored each of the viable alternatives, and the following three concepts from the initial screening efforts were determined to satisfy the screening criteria best and were recommended for further analysis:

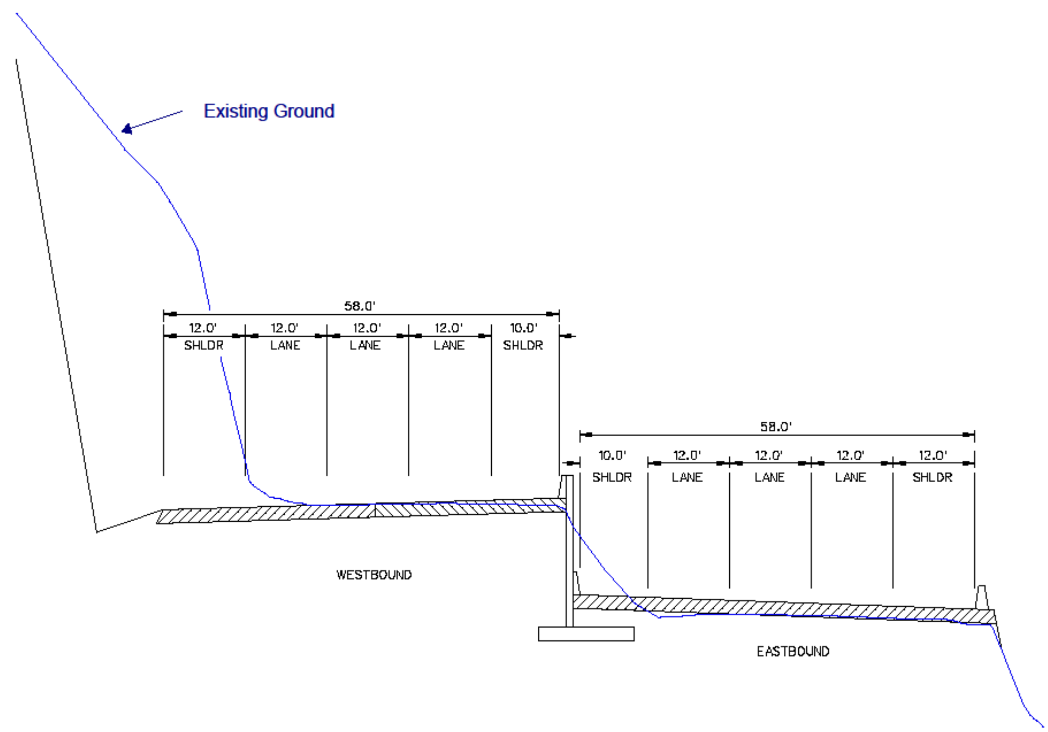
Alternative 3A – Split Profile at Existing Grade

Alternative 3A follows the existing split horizontal alignment and follows the existing profile grades.

Key elements:

- Three 12' lanes each direction
- 12' outside shoulder
- 10' inside shoulder
- Split profile at existing grade

Figure 4 - Alternative 3A Typical Section



Pros:

- Lower cost
- Better maintenance of traffic during construction
- More compatible with phased construction

Cons:

- More rock cut and retaining wall construction in uncertain rock slopes on north side

Alternative 3B – Split Profile with Westbound Grade Elevated

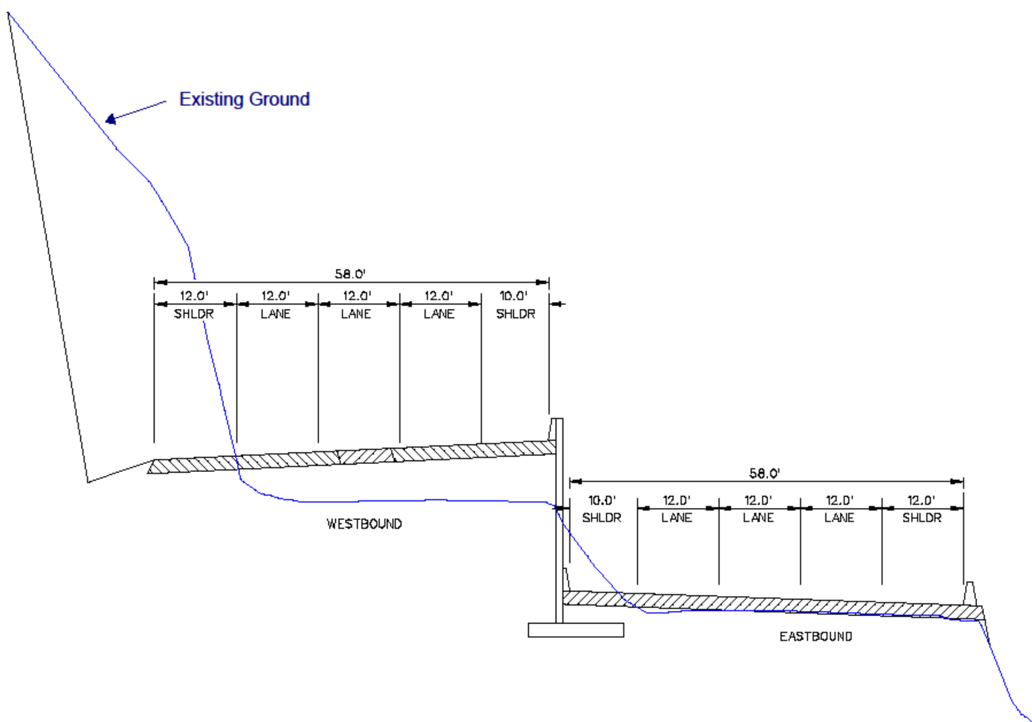
Alternative 3B follows the existing split alignment. The westbound profile is elevated to minimize the cut slopes on the north side of the roadway.

Key elements:

- Three 12' lanes each direction
- 12' outside shoulder
- 10' inside shoulder
- Split profile – eastbound at existing grade, westbound grade elevated

The retaining wall in the median is taller but expected to be more economical and have less risk of unknown geotechnical issues. However, the overall quantity of retaining wall is increased, resulting in a higher cost than Alternative 3A.

Figure 5 - Alternative 3B Typical Section



Pros:

- More predictable wall construction

Cons:

- More overall retaining wall to maintain
- Higher cost (more overall retaining wall)
- More difficult maintenance of traffic during construction
- Less compatible with phased construction

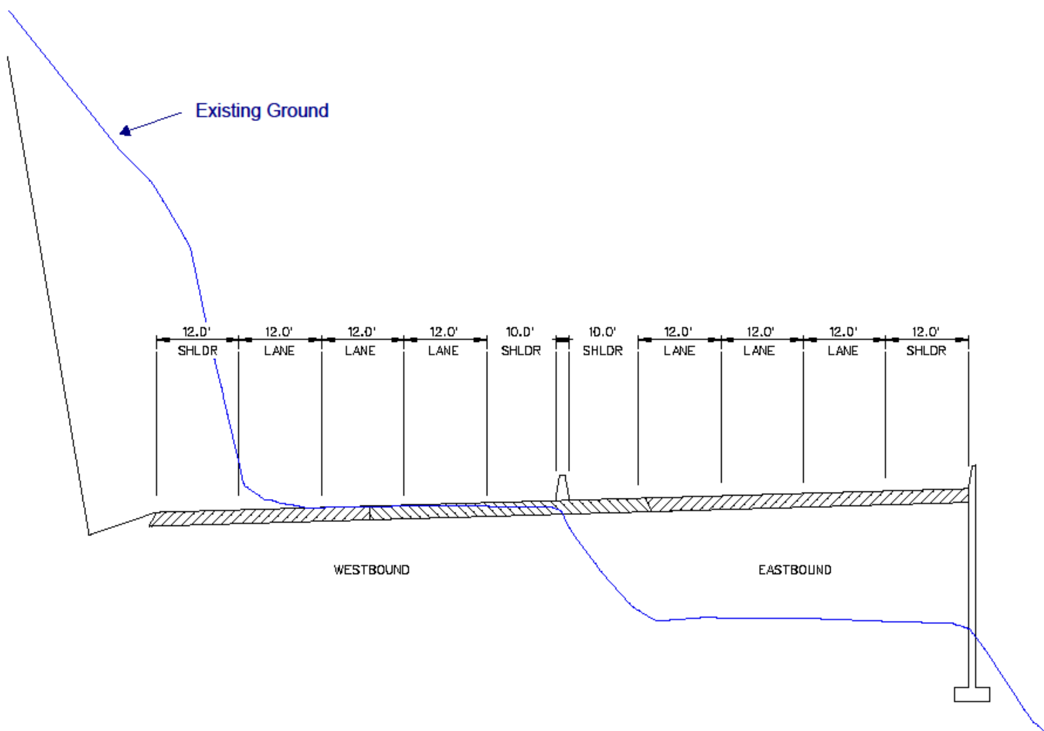
Alternative 5 – Common Crown

Alternative 5 elevates the eastbound lanes to the existing westbound lane profile and shares a common crown.

Key elements:

- Three 12′ lanes each direction
- 12′ outside shoulder
- 10′ inside shoulder
- Common crown (matching westbound profile)

Figure 6 - Alternative 5 Typical Section



Pros:

- Possibly better emergency access (eastbound and westbound are still separated by a barrier rail)

Cons:

- Difficult access to maintain downslope retaining wall
- Higher cost
- More difficult maintenance of traffic during construction
- More difficult construction close to the Truckee River
- Less compatible with phased construction

Alternative Analysis

Roadway Alternatives

The three most viable alternatives vetted through the *Initial Concepts and Evaluation Report* have been further refined and evaluated.

Roadway Alternative Evaluation Criteria

Like the *Initial Concepts and Evaluation Report*, evaluation criteria were developed to compare the viable alternatives.

- **Safety:** Consideration was given to items such as wider (safer) shoulders, improved sight distance, improved interchange geometrics, emergency service access, etc. The overall safety evaluation considered the crash rates and severity, applicable Crash Modification Factors (CMFs), and the suitability of implementing Incident Management Technology.
- **Roadway:** This category considers the roadway's design and whether it is compliant with all design criteria and policies. Alternatives that do not require design exceptions and resolve existing roadway deficiencies were considered more favorable.
- **Traffic Operations:** Alternatives were evaluated on their ability to optimize the mobility of the corridor, i.e., overall travel delay reduction throughout the design year.
- **Structures:** The existing I-80 facility includes concrete pavement and bridges that have not yet reached their useful life. Concepts that can further utilize these assets were scored higher.
- **Drainage:** Alternatives that include more efficient drainage systems (fewer structures and compatible onsite and offsite facilities) were considered preferable.
- **Geotechnical:** All the alternatives include significant cuts into the existing canyon slopes. Those alternatives with fewer cuts will have less risk of unknown rock competency (potential rockfall) and construction difficulties and were scored higher.
- **Environmental:** The alternatives that rank higher in this category will have less impact on the environment during construction and in the future. Avoiding environmentally sensitive areas such as the Truckee River and other cultural resource areas is imperative. Alternatives that minimize or avoid impacts on significant environmental resources, including cultural and biological, are considered superior.
- **Right-of-way:** Alternatives that require less right-of-way fee acquisition and fewer temporary and permanent easements were scored higher.
- **Utility Impacts:** Higher scores were given to alternatives that will have less impact on existing utilities and utility access.
- **Maintenance of Traffic**: The ability to provide traffic capacity during construction was evaluated, and the alternatives with the highest performance expected were scored higher.
- **Operations and Maintenance:** Higher scoring was given to concepts that lend themselves to prohibit future maintenance for items such as access to drainage features and toe of slope/retaining walls, rockfall areas, high retaining walls, multi-use paths, winter maintenance, etc.

- **Project Phasing:** As funding sources may be limited or become available sooner, constructing the project in phases may be necessary. Those alternatives that are reasonably divided into phases are considered preferable.
- **Cost and Cost Risk:** Alternatives with lower costs and that utilize simple construction methods with more reliable pricing were scored higher.

The scoring categories of Safety and Traffic Operations were given additional weight, consistent with the project purpose and need. The remaining criteria categories were generally weighted evenly.

Interchange Alternatives

Concepts for interchange improvements have also been developed.

Lockwood Interchange

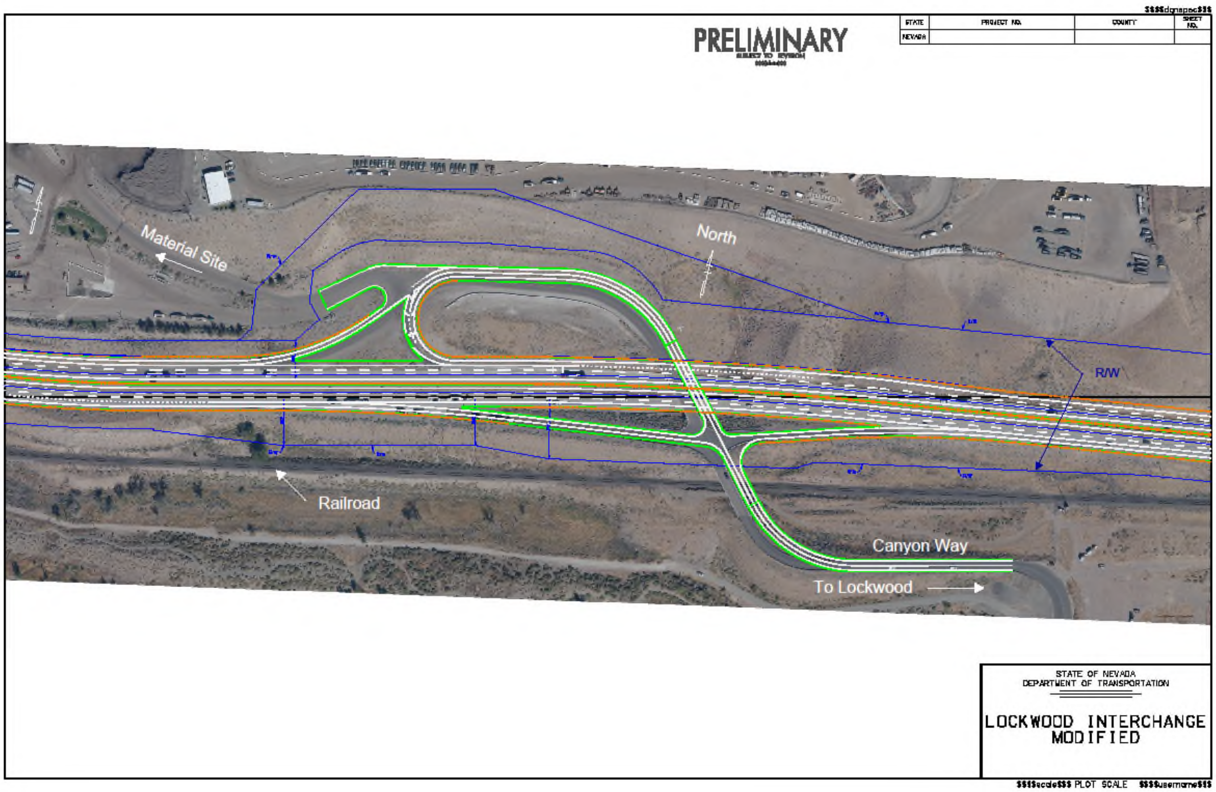
The existing interchange is a modified diamond interchange (see Figure 7). The interchange is located in an area of the canyon where there is little area available due to the steep slopes on the north side of I-80 and the close proximity of the railroad on the south side of I-80. The interchange is further constrained by an access road that ties into the westbound on-ramp and off-ramp. This road provides access to a material pit, which generates a moderate volume of truck traffic (see Figure 8).

Figure 7 - Lockwood Interchange Looking West

Alternative L1: Minor Improvements to Existing Interchange

This alternative incorporates minor improvements to the existing interchange geometry. The westbound off-ramp would be lengthened and include a separate lane and storage for vehicles accessing the material site. This storage lane would not be typical and may not meet driver expectancy. However, this interchange is not heavily used and will be primarily used by local residents and users of the material pit. Driver expectancy is not anticipated to be an issue. The westbound on-ramp has recently been lengthened and would be verified to meet current standards for proper acceleration. On the south side, a new bridge over the railroad is proposed adjacent to the existing bridge to allow the existing bridge to be used during construction. The curve would be slightly larger to allow a better design speed. This alternative would also provide enhanced ramp acceleration and deceleration areas for ramp traffic to merge into freeway traffic and decelerate outside of through freeway traffic.

Figure 8 - Lockwood Interchange Alternative L1



Pros:

- Lower cost
- Less disturbed footprint

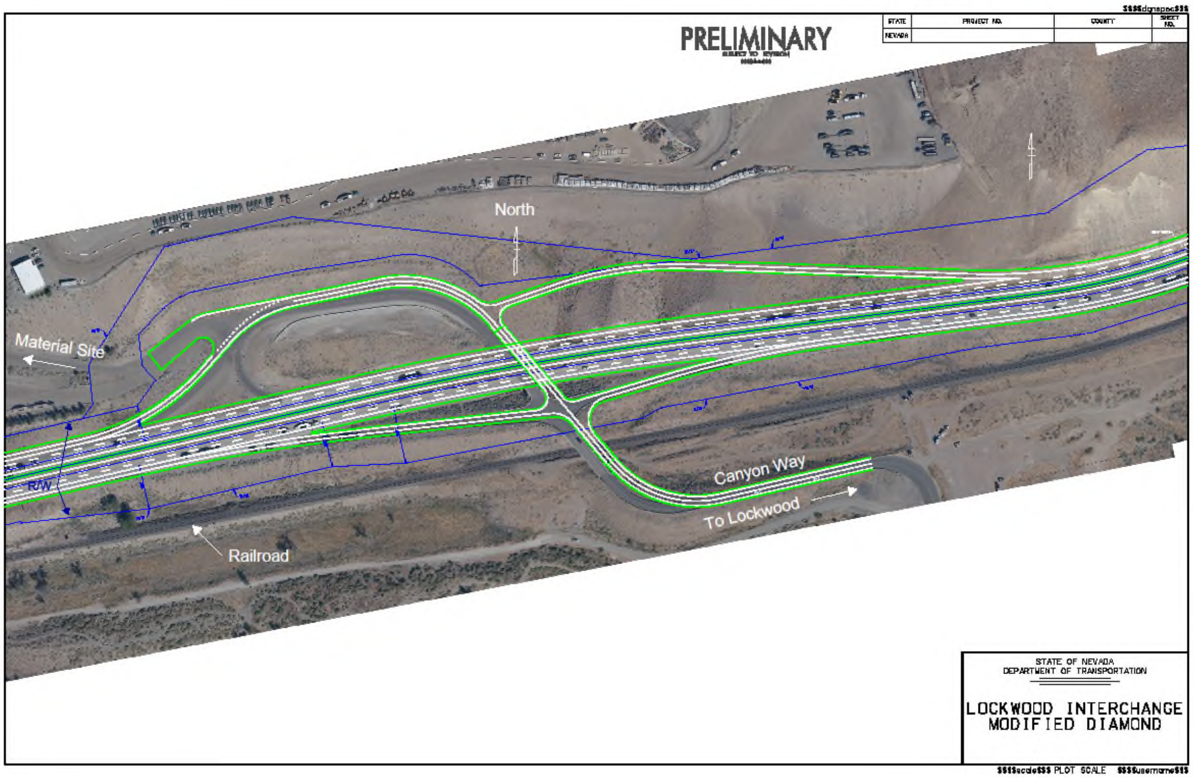
Cons:

- Unconventional (atypical) off-ramp configuration may not meet driver expectancy

Alternative L2: Add Westbound Off-Ramp

Alternative L2 adds a more typical westbound off-ramp, as shown in Figure 9. This allows the deletion of the westbound loop off-ramp and reduces the potential conflict at the material site entrance.

Figure 9 - Lockwood Interchange Alternative L2



Pros:

- Better driver expectancy

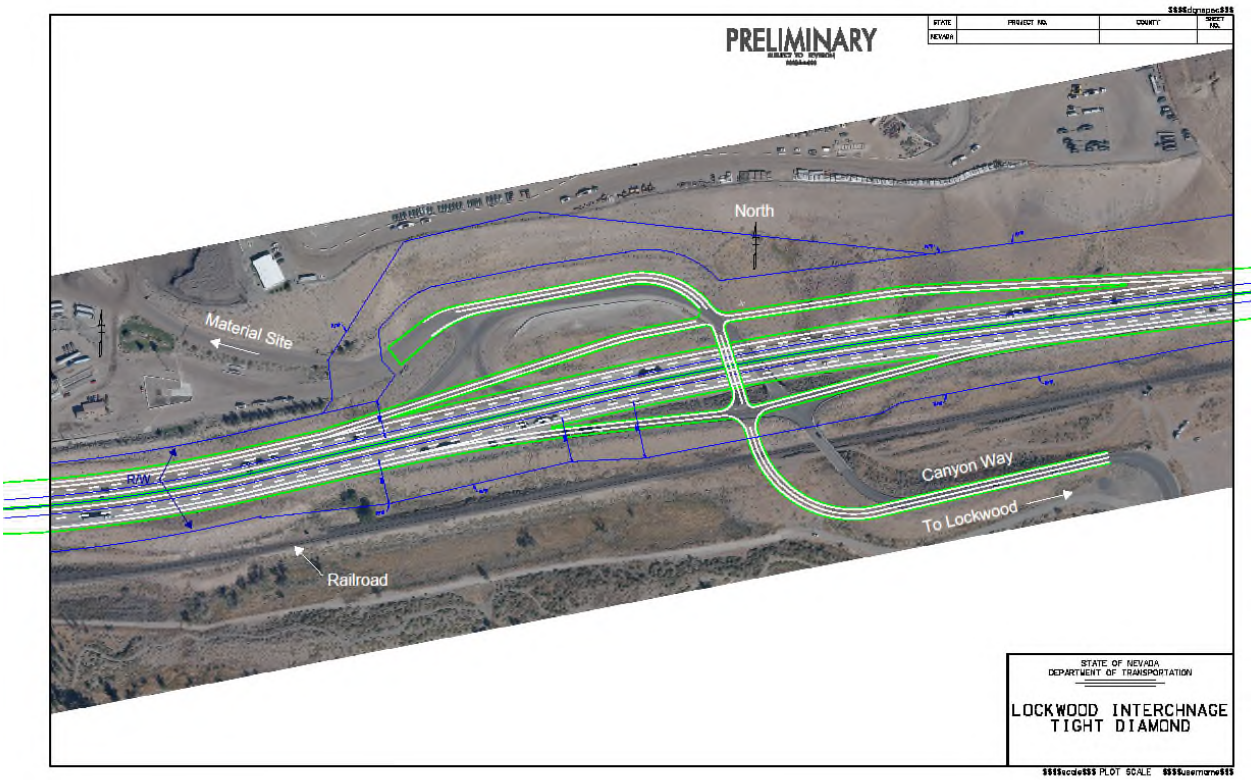
Cons:

- Higher cost
- More disturbed footprint
- Additional conflict points at westbound off-ramp left turn

Alternative L3:

Alternative L3 is similar to L2 but realigns the bridge across I-80 and the UPRR tracks (see Figure 10). This alternative reconstructs the interchange to a more typical tight diamond interchange.

Figure 10 - Lockwood Interchange Alternative L3



Pros:

- Better driver expectancy for private access to material pit

Cons:

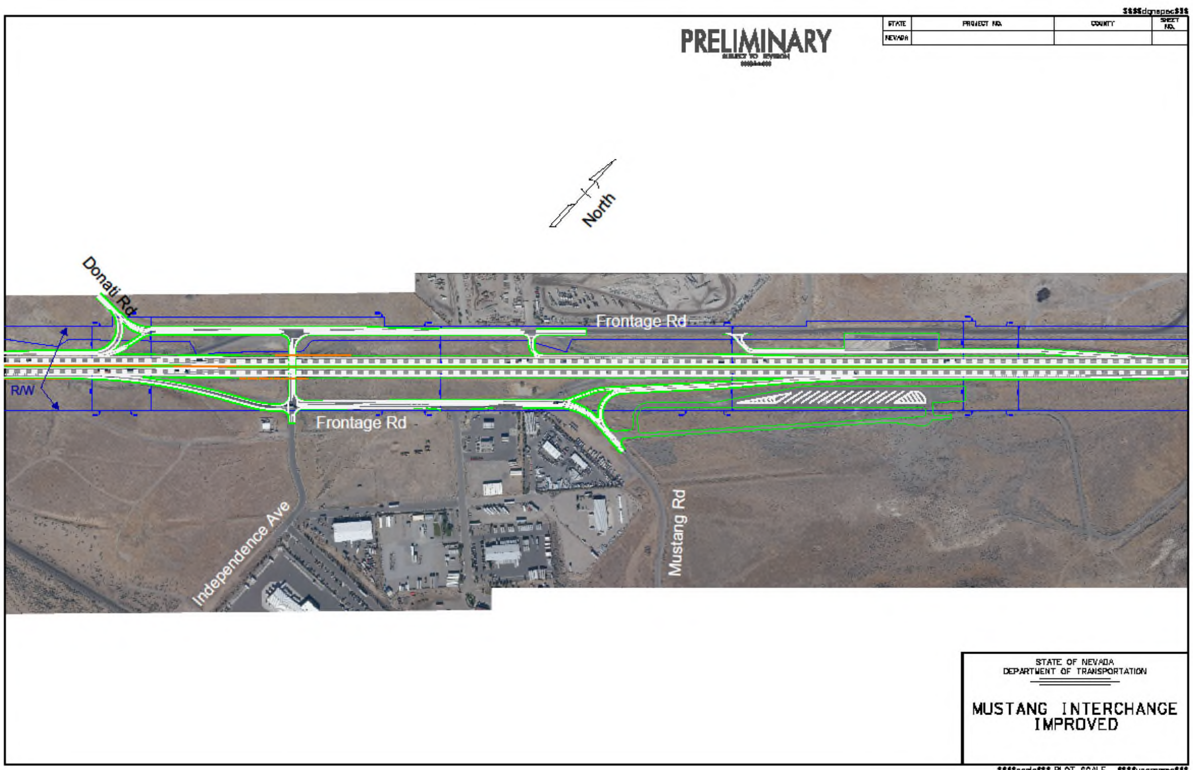
- Higher cost
- More disturbed area
- More right-of-way required

This alternative only provides minimal benefit compared to Alternative L2 but requires additional right-of-way, has a larger disturbed footprint area with additional environmental impacts, and has a higher cost. Consequently, this alternative was discarded from further evaluation.

Mustang Interchange

The Mustang Interchange is a split diamond connected with frontage roads (see Figure 11). Consideration was given to combining the ramps at a single location, essentially creating a typical diamond interchange. However, this interchange functions well in its current configuration and is anticipated to meet future traffic demands. Minor geometric improvements are proposed to address some design deficiencies and improve safety.

Figure 11 - Mustang Interchange



Retrofitting to a typical diamond interchange was considered but would require relocating the frontage roads to perpetuate local circulation. This improvement would only minorly benefit driver expectancy at a significant construction cost and was therefore discarded as an alternative.

Patrick/Waltham Interchange

The interchange at SR 655 (Patrick area)/Waltham Way also has a split layout (see Figures 12, 13, and 14). Access for westbound I-80 includes an off-ramp that flows directly into SR 655 and an on-ramp directly from SR 655. A major private access point from SR 655 to the north is located close to where the on- and off-ramps tie into SR 655. Figure 12 is looking east at the location.

Figure 12 - Patrick Interchange Looking East

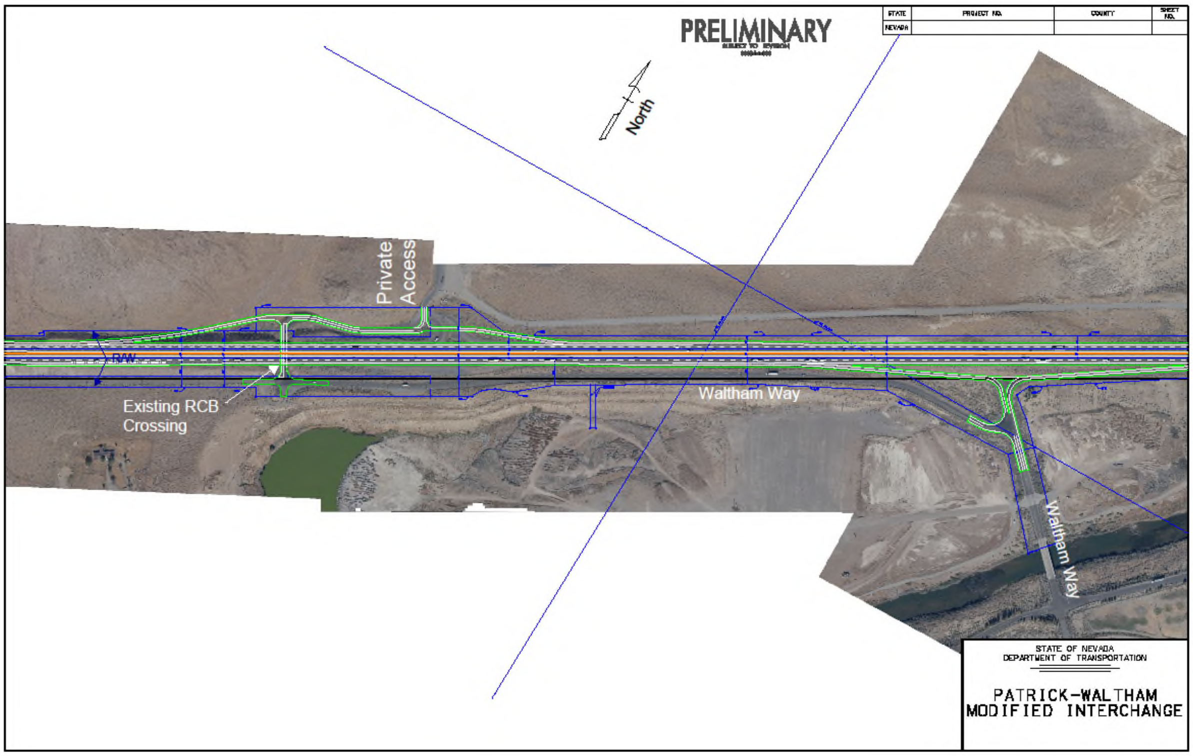
To access the south side of I-80 from the north side, vehicles must travel west on SR 655 and cross under the Interstate through a large, reinforced box culvert (RCB, see Figure 13). The height of the RCB is substandard. The on and off-ramp for eastbound I-80 are approximately 4,000 feet east of the RCB, at Waltham Way, with a typical on and off-ramp (see Figure 14).

Figure 13 - Existing RCB Vehicle Crossing at Patrick Interchange Looking East

Alternative P1: Hybrid Interchange

Alternative P1 includes improvements to bring the westbound access up to design standards and better meet driver expectancy by improving the roadway geometry and adding a westbound on-ramp with improved acceleration distance. The RCB crossing would be replaced with a bridge structure (see Figure 14).

Figure 14 - Patrick Interchange Alternative P1



Pros:

- Lower cost
- Less right-of-way
- Increased acceleration and deceleration distances
- Removal of westbound "hook" on-ramp and replace with standard on-ramp

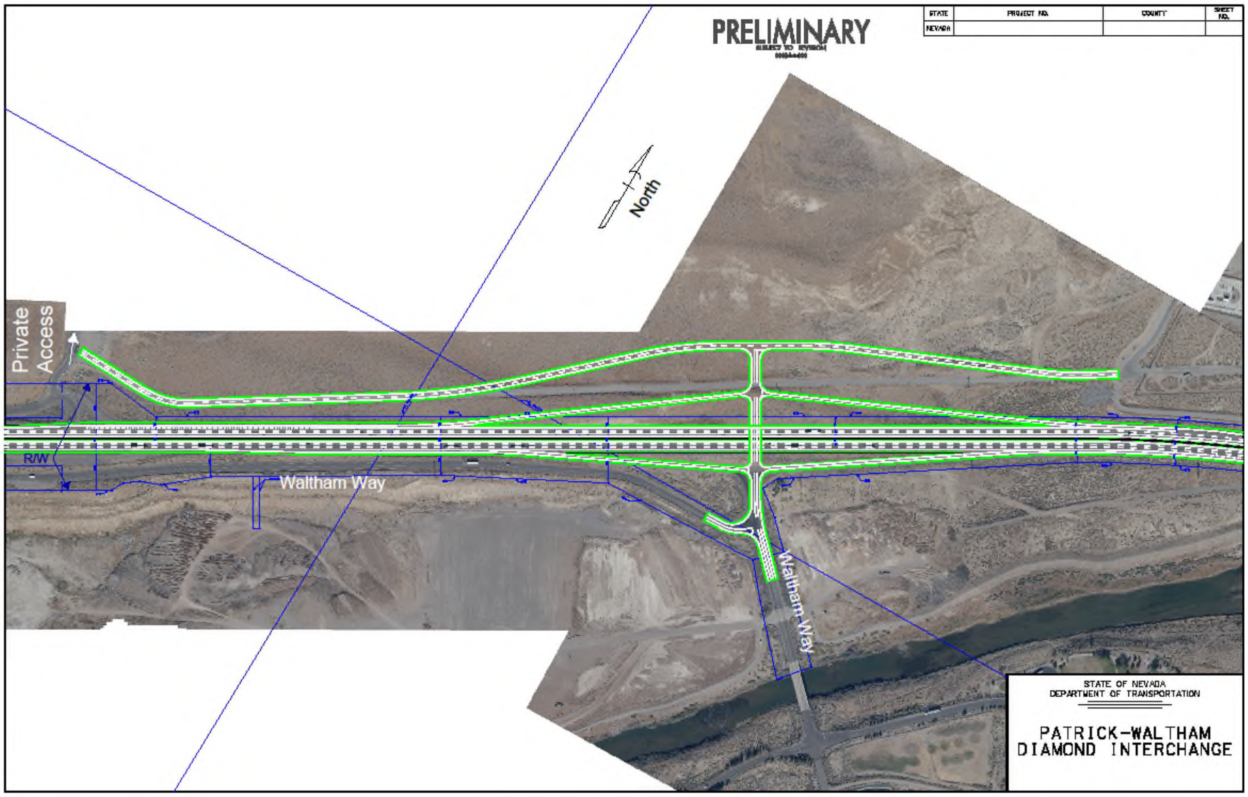
Cons:

- Lower driver expectancy

Alternative P2: New Tight Diamond Interchange

This alternative proposes combining the eastbound and westbound access points to a single new tight diamond interchange near Waltham Way (see Figure 15). The existing frontage road would be relocated north for proper intersection spacing.

Figure 15 - Patrick Interchange Alternative P2



Pros:

- Good driver expectancy
- Standards on and off-ramps
- Increased acceleration and deceleration distances

Cons:

- Higher cost
- Significant right-of-way needs
- Impacts to recently installed utilities
- Negative impacts to property owner future development plans

Interchange Alternative Evaluation Criteria

The same criteria used for the roadway alternatives were used for the interchange scoring with the following modifications:

- **Project Phasing:** Not considered.
- **Driver Expectancy:** Higher scoring was given to alternatives with common and predictable traffic movements and flow.

Like the Roadway Alternative Evaluation Criteria, the Safety and Traffic Operations criteria were given additional weight, and the remaining criteria categories were generally weighted evenly.

Planning Level Cost Estimates

As part of the alternative development process, high-level planning estimates were developed. These estimates were developed based on preliminary earthwork, paving, structures, and barrier quantities developed through Microstation/Inroads design. Additional percentage-based costs were developed for items such as drainage, MOT, signing/striping, and landscape and aesthetics. In addition, project soft costs such as design and construction engineering were also included based on NDOT's Risk Management and Risk-Based Cost Estimation Guidelines. Since final project funding is still being evaluated, the costs indicated below do not account for escalation as a construction start date has not yet been determined. Project costs also assume a single construction package.

Alternative	Description	Cost
Alternative 3A	Split Profile at Existing Grade	$507.5 Million
Alternative 3B	Split Profile with Westbound Grade Elevated	$523.9 Million
Alternative 5	Common Crown	$530.3 Million

Alternatives Analysis Results

The project team held a screening meeting on March 11th, 2024, to discuss and evaluate the alternatives developed. Attendees included representatives from FHWA, NDOT, and consultant staff. The meeting minutes are included in Appendix A.

The alternatives were screened against the criteria previously described and given a rating following the description below.

- ● Substantially Addresses Criteria
- ◉ Addresses Criteria
- ◎ Does Not Address Criteria
- ○ Conflicts with Criteria

The following tables summarize the consensus rating of the project team for the roadway alternatives and for the interchange alternatives:

Table 1 – Roadway Alternative Scoring Summary

Roadway Alternative Scoring Summary			
Criteria	**Alternative 3A** (split profile at existing grade)	**Alternative 3B** (split profile and elevated WB grade)	**Alternative 5** (common crown)
Safety	●	●	●+
Roadway	●	●	●
Traffic	●	●	●
Structures	◉	◉+	◉-
Drainage	◉	◉	◉-
Geotechnical	◉	●	◉-
Environmental	●	●	◉
Right-of-way	◉	◉	◉
Utility Impacts	◉	◉	◉
Maintenance of Traffic	●	◉	◉+
Operations and Maintenance	◉	◉	○
Phasing	●	◉	◉
Cost and Cost Risk	●	●	◉+
OVERALL	●	◉+	◉-

Table 2 - Lockwood Interchange Scoring Summary

Lockwood Interchange Scoring Summary		
Criteria	**Alternative L1** (minor modifications to existing layout)	**Alternative L2** (tight diamond)
Safety	●	⦿
Roadway	⦿	⦿
Traffic	⦿	⦿
Structures	⦿	⦿
Drainage	●	⦿+
Geotechnical	●	⦿+
Environmental	●	⦿+
Right-of-way	●	⦿+
Utility Impacts	●	●
Maintenance of Traffic	⦿+	●
Operations and Maintenance	●	⦿+
Driver Expectancy	⦿+	●
Cost and Cost Risk	●	⦿+
OVERALL	●	⦿+

Table 3 – Patrick/Waltham Interchange Scoring Summary

Patrick/Waltham Interchange Scoring Summary		
Criteria	**Alternative P/W1** (minor modifications to existing layout-hybrid)	**Alternative PW/2** (tight diamond at Waltham)
Safety	◉	●
Roadway	●	●
Traffic	◉	●
Structures	◉	●
Drainage	◉	●
Geotechnical	◉	◉
Environmental	◉	◉
Right-of-Way	◉	○
Utility Impacts	◉	○
Maintenance of Traffic	◉	●
Operations and Maintenance	◉	●
Driver Expectancy	◉	●
Cost and Cost Risk	◉	◉
OVERALL	◉	◉ –

Recommendations

Roadway Recommendation

Through the alternative development process and screening criteria meetings, the team consensus was to consider the following roadway alternative as the most favorable:

Alternative 3A – Split Profile at Existing Grade

Alternative 3A best meets the project criteria and scored the highest overall. This alternative provides a more cost-effective and user-friendly construction sequencing. In addition, the project team did note during the evaluation that raising the westbound grade could be utilized in localized areas if required due to design, environmental, and/or right-of-way constraints.

Interchange Recommendations

Similarly, the team scored the possible interchange alternatives, and the consensus was the following are the most favorable alternatives:

Lockwood Interchange

The team recommends Alternative L1 – Minor Improvements to Existing Interchange.

Mustang Interchange

The team recommends leaving the current interchange configuration essentially as it is.

Patrick/Waltham Interchange

The team recommends Alternative P1 – Hybrid Interchange.

Build Alternative

The combination of roadway Alternative 3A and interchange alternatives L1 and P1 as described above are recommended as the Build Alternative to be further evaluated in the Environmental Assessment as required by NEPA.

References:

1. *CA Group, I-80 Corridor Study,* January 2020.
2. CA Group, *Initial Concepts and Evaluation Report, I-80 East Widening NEPA,* January 2024

Appendix A

Screening Workshop Meeting Notes