

Technical Memorandum: Alternatives Development and Analysis

I-95 Planning & Finance Study

To: Derrick Lewis, NCDOT Feasibility Studies Unit

From: PBS&J

Date: August 30, 2010

Subject: Results of the Consultant Team Alternatives Development and Screening Workshop, held July 26-27, 2010

1. Introduction

This memorandum documents the actions taken by the consultant team for the I-95 Planning and Finance Study during the alternatives development and evaluation workshop and recommends a Design Concept and Scope for I-95 for further development. The goal of the I-95 planning team is to recommend an alternative that addresses the purpose and need of the project, and that could have a reasonable chance of being funded. The process included developing screening criteria based on the purpose and need for the project, developing a reasonable range of conceptual alternatives, and eliminating flawed alternatives from consideration. The alternative that remains will be developed with input from the members of the project steering committee, the agency steering committee, and members of the general public.

2. Alternatives Development Process Overview

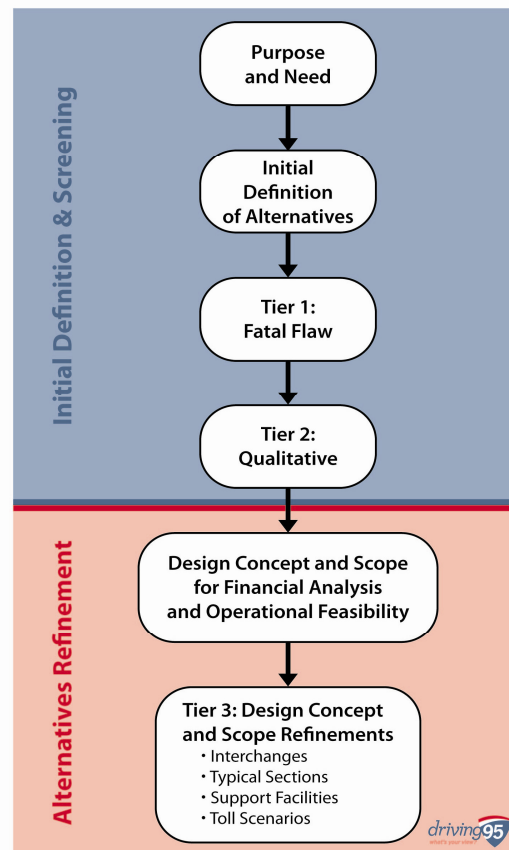
The intent of the alternatives development and evaluation process is to identify a broad range of improvement strategies for I-95 and to screen them to yield a design concept and scope that will be more thoroughly evaluated through alternatives refinement. At a two day workshop held by the study consultants, general conceptual alternatives for I-95 were developed and subjected to a Tier 1 performance screening. Those concepts that were carried forward for further evaluation were compared to each other in a Tier 2 evaluation. The results of the Tier 2 evaluation identified an alternative that will be further refined and evaluated through conceptual design, detailed traffic modeling, and environmental screening. **Figure 1** provides a schematic of the process.

Evaluation criteria were established for the Tier 1 and Tier 2 screening, prior to the development of alternatives. These criteria were developed based on the project purpose and need developed by the project consulting team, and will be reviewed by the project steering committee.

Tier 1 screening identified a range of project improvements that could meet the project purpose and need, while eliminating concepts from consideration that had a fatal flaw; that is, they were not reasonable or did not meet the purpose and need. Tier 1 screening was supported by the baseline data collected for the *I-95 Study Area Needs Assessment*

Figure 1

Alternative Development & Screening Process



(PBS&J, August 2010). During the Tier 1 screening, design concepts were evaluated qualitatively, primarily using the judgment of professionals with expertise in the applicable evaluation areas, such as roadway design, traffic, environmental resources, cost estimating, and alternative funding mechanisms.

The Tier 2 evaluation was a more detailed evaluation of the conceptual alternatives that passed the first tier of screening. During Tier 2 evaluation, alternatives were evaluated based on qualitative measures that rated them for providing operational benefits and for financing feasibility. The results of the Tier 2 evaluation led to the selection of the Design Concept and Scope to be evaluated in the detailed traffic model.

Further refinement of the Design Concept and Scope will occur after screening Tiers 1 and 2. The purpose of alternative refinement is to evaluate design options of elements within the Design Concept and Scope, separate from the screening of the various conceptual alternatives. These options will be incorporated into the Design Concept and Scope if they provide added benefit. During alternative refinement, the project team will investigate ways to improve the interchange operations, accommodate features of any special use lanes or Complete Streets guidelines, determine where and how to avoid severe environmental and local impacts, develop tolling scenarios, and determine greenway enhancements. The design options chosen will be incorporated into the Design Concept and Scope.

3. Evaluation Criteria

During the Study Area Needs Assessment, the project team collected baseline data about the physical, operational, environmental and financial condition of the I-95 corridor. This information led to the development of the project purpose and need and associated project goals and objectives, which are shown in **Figure 2**. Evaluation criteria were established for the Tier 1 and Tier 2 screening based on the project purpose and need developed by the project consulting team and reviewed by the project steering committee. Input gathered during the scoping period was used to shape the evaluation criteria.

Tier 1 and Tier 2 screening criteria were developed to screen alternatives in the following areas:

- Avoid environmental and local impacts:
- Optimize cost feasibility
- Improve traffic operations
- Maximize safety
- Minimize constructability issues.

In Tier 1, concepts were judged “good,” “fair,” or “poor” for meeting each criteria element. In Tier 2, concepts were given a rating on a scale of 1 – 10.

Figure 2

Summary of Purpose and Need

SUMMARY OF PROJECT NEED

- **Capacity Deficiencies**

Traffic flow and Levels of Service (LOS) on various sections of I-95 are projected to reach undesirable levels by the year 2030.

- **Structural Deficiencies**

Bridges - Among the 116 bridges that cross over I-95, 11 are structurally deficient and 23 are functionally obsolete. Of the 69 bridges along I-95, 6 are structurally deficient and 12 are functionally obsolete.

Pavement - Pavement conditions are 'good' but the foundation of the pavement structure is in need of reconstruction.

- **Geometric Deficiencies**

Ramp Configurations - 45 ramps of 56 interchanges have less than optimal distance for acceleration or deceleration.

Interchange Spacing - Of 56 freeway segments, 23 do not meet the minimum interchange spacing requirements.

- **Higher than Average Fatality Crash**

Fatal crashes are an issue in Robeson and Nash Counties.

- **Funding Deficiencies**

Without additional funding, the I-95 projects in the 2009-2015 TIP cannot be completed before 2025 at the current rate that projects have been funded. Assuming an ongoing funding stream to the I-95 corridor of \$365 million every six years, it would take 65 years to address the full \$4 billion needed to improve I-95, assuming constant buying power.

SUMMARY OF PROJECT PURPOSE

- **Improve Infrastructure**

Improve Bridges - Replace functionally obsolete and structurally deficient bridges along the I-95 corridor.

Improve Pavement - Rehabilitate existing pavement and sub-pavement to provide a roadway capable of handling projected future traffic volumes.

Improve Interchange Ramp Designs - Correct functionally obsolete ramp configurations.

Improve Interchange Spacing - Correct interchange spacing to meet current FHWA requirements.

- **Improve Capacity** - Widen roadway to accommodate predicted future traffic volumes and provide a better LOS.

- **Improve Safety Along I-95 Corridor** - Improve roadway geometry, ITS, guardrail, rumble strips, etc.

- **Develop Feasible Funding Strategy** - Develop a feasible funding strategy that will allow the identified improvements to be fully implemented within a reasonable time frame.

GOALS AND OBJECTIVES

- Upgrade interstate to meet current design standards
- Provide additional capacity for predicted future traffic volumes at LOS D or better in metropolitan areas and LOS C or better in rural areas
- Identify a plan for realistic and reliable funding options that will meet the long-term funding needs of the corridor
- Utilize existing roadway right-of-way to the extent possible
- Minimize environmental impacts
- Ensure consistency with local transportation plans
- Obtain informed consent from study participants on project Purpose and Need and Alternatives to be Considered
- Incorporate USDOT complete streets specifications on overpasses where applicable
- Maintain evacuation routes

4. Alternatives Definition

Once the evaluation criteria were established, a list of feasible improvement scenarios was created to identify conceptual alternatives for I-95. This effort resulted in a wide range of potential improvement concepts being developed for consideration in Tier 1 screening. The I-95 highway is a four-lane, divided freeway in a rural environment, except for a few locations where additional lanes have been constructed. The existing problems and future needs of the corridor determined the range of initial conceptual alternatives considered.

Much of the existing infrastructure needs to be replaced or rehabilitated, some of the bridges as soon as within the next five years. There are locations along the corridor where poor traffic operations require additional lanes to keep traffic flowing at acceptable levels of service. Some of these locations require additional lanes today, while others won't require expansion until five, ten, or twenty years from now. The I-95 corridor contains a mix of travelers from out of state as well as in-state. There is a large percentage of truck traffic on the corridor as well. The initial conceptual alternatives were created to address these corridor needs. The initial conceptual alternatives are described below, and the typical sections that represent the physical layout of highway improvement concepts are included in **Attachment A**.

A. No-Build Alternative

The No-Build Alternative would include no capacity improvements to address current or future congestion, and would fund safety, maintenance, or modernization needs only to the level that can be accomplished by current funding levels, approximately \$61 million per year. This alternative would be funded by traditional funding sources, and be ineligible for other funding mechanisms such as tolling or public-private partnerships.

B. Preservation and Modernization Alternative

The Preservation and Modernization Alternative would include no capacity improvements, but would replace or rehabilitate the highway infrastructure in order to preserve the existing highway operations with a modern facility that meets current design standards, fixing or replacing inadequate infrastructure. This proposal was identified as a way to meet the infrastructure needs of the corridor, but lowering potential costs by not addressing capacity issues. This alternative would be funded by traditional funding sources; it would be ineligible for other funding mechanisms such as tolling or public-private partnerships.

C. Demand Management and System Management Measures

The Demand Management and System Management Alternative would use measures that attempt to improve traffic through means other than traditional highway expansion. System management measures include efforts to make the existing system function more efficiently as capacity increases without constructing new facilities. These measures would attempt to improve the flow of traffic through strategies such as improved signal timing at interchanges, message boards on the highway alerting travelers to delays or alternative routes, and using road sensors and cameras to notify authorities of congestion issues to improve response time. Demand management measures include efforts to reduce the number of vehicles on the highway during times of peak congestion, through telecommuting to work, varying work shift start and end times, and reducing the number of single occupied vehicles through van and car pooling. This alternative was proposed as a very low cost solution to address problems on I-95. This alternative would be funded by traditional funding sources; this alternative would be ineligible for other funding mechanisms such as tolling or public-private partnerships.

D. Multimodal Alternative (Move Freight to Rail and Passengers to Transit)

This alternative would attempt to improve operations and safety on I-95 through two similar strategies. The first would move freight traveling through the corridor on trucks to freight trains that parallel the I-95 corridor. This might be accomplished through one or more state sponsored measures. The state could encourage lower rates for freight on trains than on trucks, or pay for double tracking the existing CSX freight rail corridor that parallels I-95 and reducing train delays. The second strategy might move passengers and drivers traveling through the corridor in cars

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onto transit modes, including trains and buses. The state could provide bus service on the I-95 corridor, or could provide passenger rail service, either by adding new passenger rail service or by double tracking the existing CSX freight rail corridor reducing existing train delays. This alternative was proposed as a multimodal way to reduce construction costs and vehicle-miles traveled. This alternative would be funded by traditional funding sources; this alternative would be ineligible for other funding mechanisms such as tolling or public-private partnerships.

E. Add General Use Lanes On Existing Alignment Alternative

This alternative would reconstruct the existing alignment of I-95, adding additional lanes to I-95 to improve traffic operations and safety conditions and replace or rehabilitate substandard infrastructure. The alternative would add one or two lanes in each direction, depending on the future traffic needs for each segment between interchanges. Deficient bridges and pavement would be replaced as well. The typical section for this alternative is represented in **Attachment A** by Typical Sections 4, 5 and 6. This alternative was proposed to address all of the operational, safety, and infrastructure needs of the corridor. This alternative could be funded by traditional funding sources, as well as by other funding mechanisms such as tolling or public-private partnerships.

F. Add Special Use Lanes on Existing Alignment Alternatives

There are two types of special use lanes that could be added to I-95 to improve traffic operations on I-95, and both are represented by Typical Sections 1, 2, and 3 in **Attachment A**.

F1. Add Managed Lanes

This alternative would add extra capacity to I-95 with one or two additional lanes in each direction that would be tolled in order to guarantee a high level of service (C or better). Only the new capacity lanes would be tolled and they would be separated from the general purpose lanes with either soft or hard barriers. While this alternative is typically used in urban environments, there are indications this type of facility could improve traffic operations in some parts of the corridor, despite the fact that I-95 has a mix of long-distance trips and high truck traffic. This alternative could be funded by traditional funding sources, as well as by other funding mechanisms such as tolling or public-private partnerships.

F2. Add Truck Lanes

This alternative would add extra capacity to I-95 with two additional lanes in each direction that would be reserved for truck use only; there would be no additional capacity added to the general use lanes. The barrier separated lanes could be on the outside or inside lanes, and would require special ramp configurations at the interchanges. This alternative was proposed as a way to address some of the safety needs of I-95. This alternative could be funded by traditional funding sources, as well as by other funding mechanisms such as tolling or public-private partnerships.

G. New Alignment Freeway

This alternative would construct a limited access freeway on new alignment, either west or east of I-95 for the entire 182 miles between South Carolina and Virginia, and leave the existing I-95 in place. The typical section for this alternative is represented in **Attachment A** by Typical Sections 4 and 5. This alternative was proposed as a way to address most of the operational, safety and infrastructure needs of the corridor, without potentially severe impacts associated with staying on the existing alignment. This alternative could be funded by traditional funding sources, as well as by other funding mechanisms such as tolling or public-private partnerships.

H. Four-lane US 301

This alternative would upgrade US Highway 301 to four lanes along its entire length, keeping local access open. Because US 301 and I-95 are co-located on the same alignment for a portion of the way, a new US 301 alignment would need to be constructed in this area. This alternative was considered under the assumption that widening of I-95 would be excessively costly and have severe adverse impacts due to widening. This alternative could be funded by traditional funding sources.

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5a. Tier 1 Alternatives Screening

Tier 1 screening evaluated a range of project improvements that could meet the project purpose and need, while eliminating conceptual alternatives from consideration that had poor ratings. Alternatives were eliminated that had fatal flaws; in other words, were not reasonable or did not meet the purpose and need. The screening also eliminated from further consideration alternatives that would have unacceptable levels of environmental or local impacts. Tier 1 screening was supported by the baseline data collected for the *I-95 Study Area Needs Assessment*.

During the Tier 1 screening, conceptual alternatives were evaluated qualitatively by the consultant team. The screening used a three level scale, rating satisfaction of evaluation criteria as Good, Fair, or Poor. The basis for the rating for each screening criterion was as follows:

- Human and Physical Environmental Impacts: Good rating has the least right of way requirements; Poor rating has the most right of way requirements.
- Cost: Good rating has a low relative total cost, and Poor rating has high relative costs.
- Operations: Good rating has an acceptable Tier of Service, and Poor rating has an unacceptable Tier of Service.
- Safety: Good rating has more potential for safer conditions, and Poor rating has less potential for safer conditions.
- Constructability: Good rating means the alternative is relatively easy to build, and Poor means the alternative is relatively more difficult to build.

The criteria that best represent purpose and need are the Operations criterion and the Safety Criterion. Accordingly, these were given a higher priority in the final overall rating.

The results of the Tier 1 screening of the I-95 alternatives are presented in **Table 1**. The No Action alternative does not meet Operations or Safety evaluation criteria but is retained for baseline comparison. In addition to the No Action alternative, the three concepts retained for Tier 2 Evaluation included the Add Lanes on Existing Alignment, Managed Lanes, and Truck Lanes alternatives.

Table 1: I-95 Conceptual Alternative Tier 1 Screening Results

Conceptual Alternative	Avoid Impacts to Human /Physical Environment	Optimize Cost	Improve Operations	Maximize Safety	Minimize Constructability Issues	Moved on to Tier 2
No-Build	Good	Good	Poor	Poor	Good	Yes
Preservation and Modernization	Good	Fair	Poor	Poor	Poor	No
Demand/System Management	Good	Good	Poor	Poor	Good	No
Multimodal (Move Passengers to Transit/Freight to Rail)	Good	Fair	Poor	Poor	Poor	No
Add Lanes on Existing Alignment	Fair	Poor	Good	Good	Fair	Yes
Add Managed Lanes	Fair	Poor	Fair	Fair	Fair	Yes
Add Truck Lanes	Fair	Poor	Fair	Fair	Fair	Yes
New Alignment Freeway	Poor	Poor	Good	Fair	Fair	No
4-lane US 301	Poor	Poor	Fair	Poor	Fair	No

The Add General Use Lanes on Existing Alignment Alternative rated the highest on the priority criteria of operations and safety, and the Freight to Rail, Passengers to Rail and Preservation Only Alternatives received the lowest ratings for these criteria. The New Alignment Freeway and Four Lane US 301 Alternatives rated Low on human and physical environmental impacts criterion. The No-Build Alternative will be moved into detailed traffic modeling; even though it does not meet purpose and need, it will provide a baseline comparison to judge the performance of the Design Concept and Scope.

5b. Alternatives Eliminated

The alternatives listed below were eliminated because they had fatal flaws; they would not meet the project purpose and need or would have extraordinary environmental or local impacts.

A. Preservation and Modernization

This alternative was eliminated because it does not meet the purpose and need of improving traffic operations and safety on I-95, even though the costs of replacing inadequate infrastructure would be very high. However, preservation needs will be considered during development of phasing and financing plans, to ensure that system preservation needs are reflected along with improvement needs.

B. Demand Management and System Management Measures

This alternative was eliminated because it does not meet the purpose and need of improving traffic operations and safety on I-95 or fixing inadequate infrastructure, even though it is a very low-cost alternative. System management strategies may improve interchange operations, but they would not improve traffic operations on the I-95 mainline. Demand management strategies would reduce the number of vehicles on I-95 by only a small percentage. This alternative would be unlikely to reduce sufficient people or freight to resolve the corridor's capacity needs.

C. Multimodal Alternative (Move Freight to Rail and Passengers to Transit)

This alternative was eliminated because it would not meet the purpose and need of improving traffic operations and safety on I-95, or fixing inadequate infrastructure. Moving freight to rail and passengers to transit would reduce the number of vehicles on I-95 by only a small percentage. This alternative would be unlikely to reduce auto or truck traffic sufficiently to resolve eliminate the need for additional highway capacity. I-95 infrastructure would still need to be modernized and expanded along I-95, and so costs would be very high for this alternative.

D. New Alignment Freeway

This alternative was eliminated because it would have unacceptable impacts to the human and physical environment, and would not fix inadequate infrastructure on I-95. Also, there would be a significant amount of traffic remaining on I-95. The costs to build this alternative would be very high. This alternative would only be selected as a last resort, revisited only if further evaluation reveals that the Add Lanes on Existing Alignment alternative won't work.

E. Four-lane US 301

This alternative was eliminated because it would have unacceptable impacts to the human and physical environment, requiring substantial amounts of additional right of way, placing increased amounts of traffic on inherently less-safe roads, increasing traffic through the developed areas along us 301, and would not fix inadequate infrastructure on I-95. Also, there would be a significant amount of traffic remaining on I-95. Due to lack of access control, this alternative could not provide a comparable level of safety or travel speed and times as improvements to I-95. The costs to build this alternative would be very high.

6. Tier 2 Alternatives Screening

The Tier 2 evaluation was conducted for I-95 conceptual alternatives that passed the Tier 1 screening. Three conceptual alternatives were carried forward from the Tier 1 screening for additional evaluation:

- Add General-use Lanes on Existing Alignment Alternative
- Add Managed Lanes Alternative

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- Add Truck Lanes Alternative

(The No-Build Alternative was passed on to Tier 2 screening only to be used as a baseline for future analysis.)

The Tier 2 qualitative analysis is documented in the *Tier 2 Alternatives Screening White Paper* (see **Attachment B**) and describes the required improvements for the remaining conceptual alternatives. It describes the advantages and disadvantages relative to mobility, community and financial goals for each alternative, and recommends whether each alternative should be considered further. The results of the Tier 2 evaluation of the three remaining I-95 alternatives are presented **Table 2** below.

Table 2: Tier 2 Alternative Screening Results

Alternative	Avoid Impacts to Human /Physical Environment	Optimize Cost	Improve Operations	Maximize Safety	Minimize Construct-ability Issues	Ability to Generate Revenue	Total
No-Build	9	9	1	1	10	1	31
Add Lanes on Existing Alignment	6	6	8	8	5	9	39
Add Managed Lanes	4	1	6	6	5	3	25
Add Truck Lanes	4	1	3	6	5	9	28

Rating scale: Good: 7-10, Fair: 4-6; Poor, 1-3.

The concepts of each of the three alternatives were reviewed to better understand the operational benefits and financing requirements of the alternatives, and to provide information for a qualitative assessment in the Tier 2 evaluation. The three concepts were then rated and compared to determine how well each concept met the evaluation criteria, as well as one additional criterion related to financial feasibility.

A. Add Managed Lanes

Adding Managed Lanes provides an improvement alternative that would toll the additional capacity required to provide the needed Level of Service (LOS) within the I-95 Corridor. Preliminary traffic projections indicate that there are portions of the I-95 corridor that will have LOS D during peak hours beginning in 2010.

The managed lanes would be open 24 hours a day and would most likely charge a variable toll that would be adjusted by time of day and the volume within the managed lanes. Access to and from the managed lanes would be restricted to designated access points that would improve flow within the managed lanes. Dedicated managed lane interchanges are not assumed due to high cost and a predicted low volume of vehicles within the managed lanes.

Managed lane users would exit the managed lanes at the designated access points and need to weave across the general use lanes to exit at interchanges. The designated access points would be designed to provide the necessary weaving distances in advance of the interchanges. Managed lanes would always provide a higher level of service than the general use lanes. As the congestion grows, the travel time savings would grow and the managed lanes would be used more. The toll would be adjusted to ensure that a desirable LOS is maintained.

The level of traffic that would use the managed lanes would vary greatly by the section of the I-95 corridor. There are areas of the corridor that the existing 4 lane section will be adequate well into the future, providing an acceptable LOS C. For managed lanes to be successful there must be appreciable time savings between the managed lanes and the general use lanes. This would require LOS E and F for extended periods of time. It is expected that the peak hours would not last an appreciable amount of time. Therefore, the managed lanes would not be expected to be utilized except for the one or two highest hours of any given day.

Add Managed Lane Advantages

1. Would provide desired LOS throughout the corridor.

Add Managed Lane Disadvantages

1. Higher cost than Add General Use Lanes on Existing Alignment alternative due to additional lanes and shoulders.
2. Higher impacts to the community and environment because of the wider typical section.
3. Highest amount of right of way required (same as Add Truck Lanes alternative).

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4. Very low revenue potential that may not cover operating costs.
5. Potential to construct a great deal of capacity that would be under-utilized.

B. Add Truck Lanes

The Add Truck Lanes alternative would add truck only lanes within the I-95 Corridor. This alternative would add two additional lanes in each direction to the corridor that would be exclusive to trucks only. The alternative would require two lanes to allow trucks the ability to pass slower moving vehicles.

The truck lanes would be open 24 hours a day. The truck lanes as well as the general use lanes would be tolled because there has been much negative feedback from the trucking industry on projects that propose to be toll trucks but not passenger cars. The Truck Lanes alternative would improve operations, primarily because with two truck lanes, an excellent LOS would be maintained for the trucks. The LOS in the general use lanes would degrade.

Access to and from the truck lanes would be restricted to designated access points that would improve traffic flow within the truck lanes and the general use lanes. Trucks would exit the truck lanes at the designated access points and need to weave across the general use lanes to exit at interchanges. The designated access points would be designed to provide the necessary weaving distances in advance of the interchanges.

The Add Truck Lanes alternative would be expected to carry the same amount of traffic as the Add General Use Lanes on Existing Alignment alternative, and so additional improvements to the general use lanes would also be required. Because this alternative assumes that both the truck lanes and the general use lanes would be tolled, the total revenue that would be collected in this alternative should be equivalent to the revenue collected in the Add General Use Lanes on Existing Alignment alternative.

Add Truck Lane Advantages

1. Would provide desired LOS in truck only lanes
2. Separation of trucks and passenger vehicles may have a perception of increased safety. Trucks would need to cross the general use lanes to access the truck only lanes. There would need to be an assessment of safety issues relative to weaving between trucks and passenger vehicles as trucks enter and exit the truck only lanes.
3. Provides a high level of revenue potential due to the assumption that all vehicles would be tolled. This is the same level as the Add General Use Lanes on Existing Alignment alternative.

Add Truck Lane Disadvantages

1. Higher cost than Add General Use Lanes on Existing Alignment alternative due to additional facilities that would be required.
2. Higher impacts to the community and environment because of the wider typical section.
3. Highest amount of right of way required (same as Managed lane alternative).
4. Additional capacity is required to the general use lanes to maintain acceptable LOS (additional costs).

C. Add General Use Lanes on Existing Alignment

The Add General Use Lanes on Existing Alignment is an alternative that would reconstruct the existing travel lanes of I-95 in North Carolina and provide additional capacity by providing additional lanes as needed throughout the corridor. The existing corridor is primarily four lanes wide (two in each direction). The Add General Use Lanes on Existing Alignment alternative would provide a minimum of six total travel lanes and would provide eight travel lanes where needed to meet minimum LOS requirements. The existing lanes are to be reconstructed due to their substandard condition.

The Add General Use Lanes on Existing Alignment alternative would provide sufficient lanes to operate at the desired LOS. This alternative assumes that trucks and passenger vehicles would not be limited to specific lanes

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within the corridor; however, trucks could be required to use the two right lanes within either a six or eight lane typical section. Trucks and passenger cars would be allowed to enter and exit the alignment at any interchange.

The Add General Use Lanes on Existing Alignment alternative would be tolled. The Add General Lanes on Existing Alignment alternative would generate the highest level of revenue due to all vehicles within the corridor being tolled. This revenue level is expected to be equal to the revenue collected in the Add Truck Lanes alternative.

Add General Use Lanes on Existing Alignment Alternative advantages

1. Would provide desired LOS.
2. Lowest cost of the Tier 2 alternatives.
3. Lowest impact on the environment and communities due to fewer lanes required.
4. Lowest amount of right of way required.
5. Would provide a high level of safety.
6. This alternative would be the least complex to collect the toll revenue because there would be fewer tolling points required.

Add General Use Lanes on Existing Alignment Alternatives Disadvantages

1. While it is the lowest cost of the three alternatives in Tier 2, it is still expensive.

D. Tier 2 Conclusions

Managed lanes are typically constructed within heavily urbanized areas with a great deal of congestion. They are typically constructed to manage congestion and provide a significant travel time savings compared to general use lanes. The I-95 traffic profile is mostly rural and has a great deal of recreational use and peaking characteristics atypical of urban traffic. The Add Managed Lanes alternative is recommended to be eliminated from further consideration.

Truck lanes are typically constructed within high traffic volume facilities that have hourly volumes approaching 2,000 trucks per hour and LOS of E or F. Neither of these applies to the existing I-95 corridor. With the Add General Use Lanes on Existing Alignment alternative, acceptable LOS can be maintained at a much lower cost with fewer impacts to the environment and communities. The Add Truck Lanes alternative is recommended to be eliminated from further consideration.

The Add General Use Lanes on Existing Alignment alternative would provide the desired LOS, provide enhanced safety, would have the least impacts to the environment and communities of the build alternatives. Add General Use Lanes on Existing Alignment alternative is recommended to be retained as the Design Concept and Scope for the project.

7. Alternative Refinement

After the alternative screening process, further steps will be taken to refine the design elements of the Design Concept and Scope alternative remaining after Tier 2 screening. The alternative that remains after screening will be reviewed to include other improvement options whose design and efficacy would be evaluated by the consultant team. These additional design options include interchange design improvements, bypasses at selected locations to avoid severe community impacts, feasible tolling scenarios, greenway enhancements, and a corridor infrastructure preservation plan. The results of the refinement process will be reviewed with NCDOT. The issues to be addressed in each category are:

- Typical sections
- Interchange modification
 - Change of the form of the interchange, if required to address operational requirements
 - Typical spread diamond type
 - Service road application with the goal that no service roads lead into ramps.

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- Interchange consolidation for closely spaced interchanges, in order to avoid closing any interchanges, including the following options
 - Split diamond, with on and off ramps split between two or more interchanges
 - Collector/distributor road along the freeway with common merge points onto the highway
 - Braided ramps, where on ramps and off ramps are built on structure to avoid unsafe weaves
- Bypass needs
 - Where needed to avoid severe impacts to community resources that would be affected by widening within limited areas
 - Process would need to be created to determine the location, impacts and cost of any bypasses
 - Results of analysis that show where bypasses are viable options
- Tolling Scenarios - Determining what types of tolling systems maximize revenue and traffic operations
- Greenway enhancements – Measures to ensure the I-95 corridor promotes pedestrian and bicycle trails will be considered, along with whether these types of enhancements occur only at crossings of I-95, or should be included along the length of the corridor.

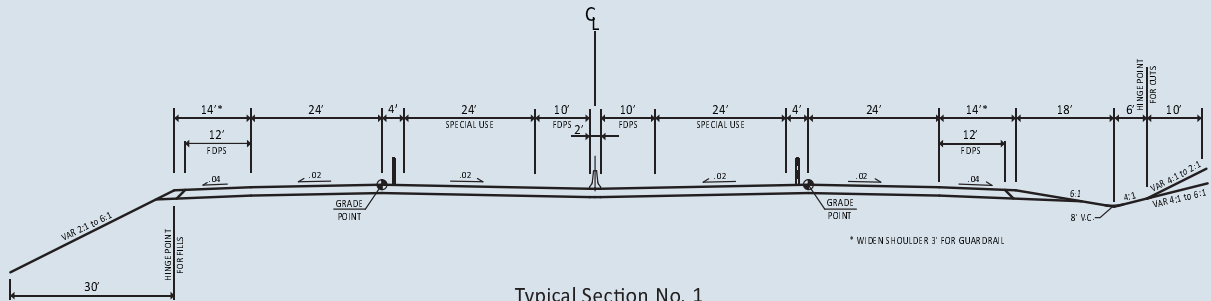
Attachment A: Typical Sections for the Conceptual Alternatives Evaluated.

Attachment B: White Paper: Tier 2 Evaluation

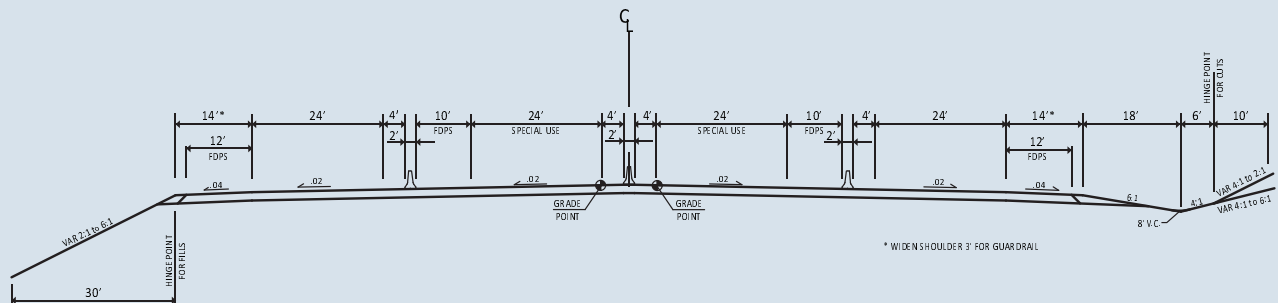
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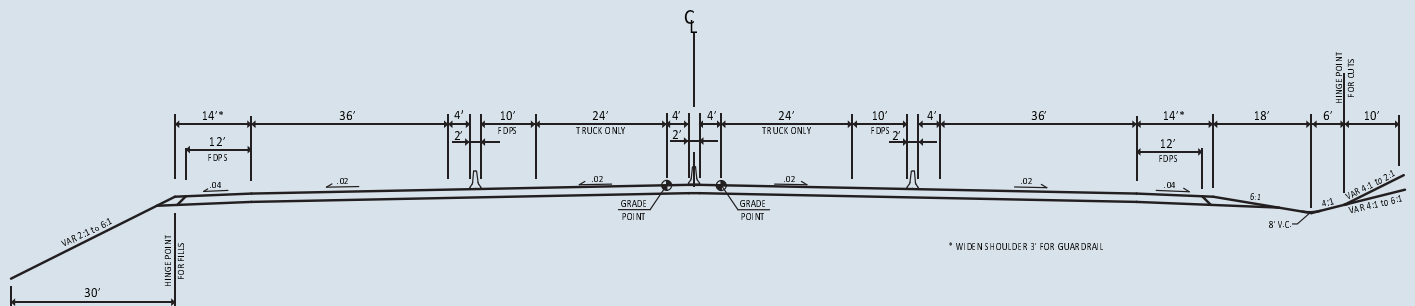
SPECIAL USE LANE TYPICAL SECTIONS



Typical Section No. 1
BUFFER or FLEXIBLE (SOFT) BARRIER SEPARATED, SPECIAL USE
MANAGED LANES TOLLED
(250' RIGHT OF WAY)

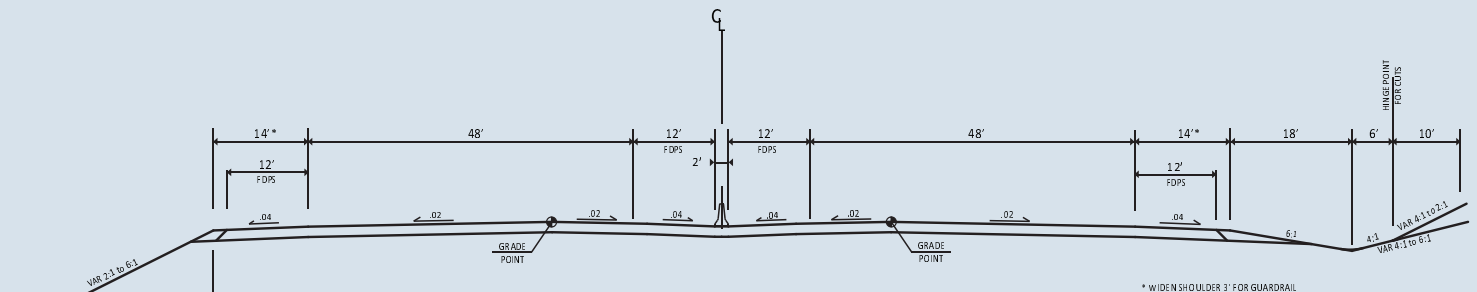
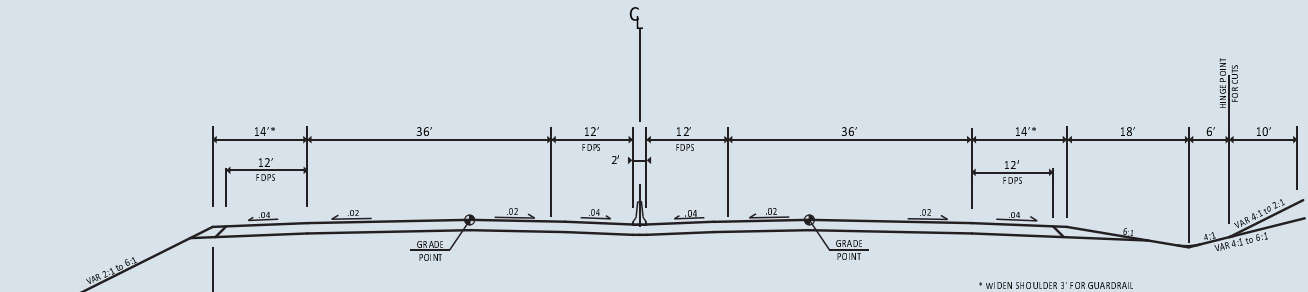
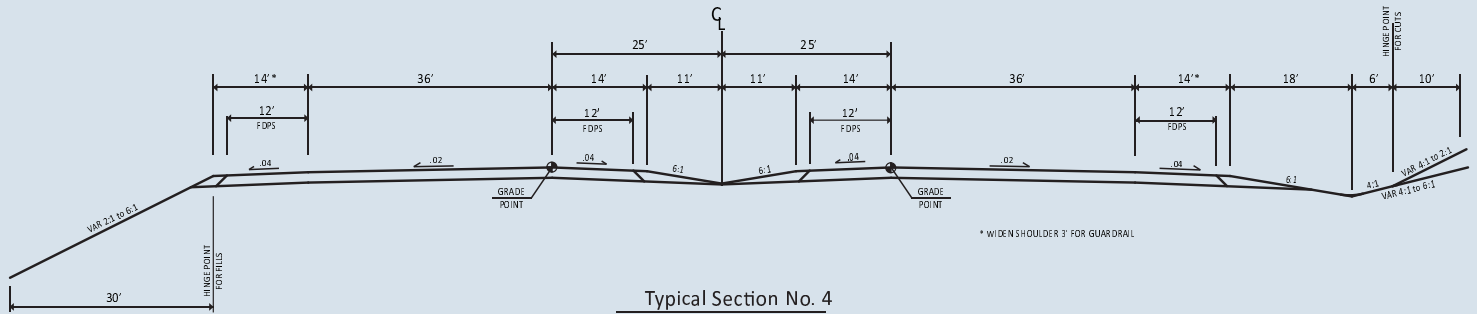


Typical Section No. 2
RIGID BARRIER SEPARATED, SPECIAL USE
MANAGED LANES TOLLED
(275' RIGHT OF WAY)



Typical Section No. 3
RIGID BARRIER SEPARATED, TRUCK ONLY LANES
IF TOLLED, ALL LANES TOLLED
(300' RIGHT OF WAY)

GENERAL USE LANE TYPICAL SECTIONS



Attachment B

I-95 Corridor Planning and Finance Study

Tier 2 Alternatives Screening White Paper

1. Managed Lanes

A. Issue

Managed Lanes provide an improvement alternative that would toll the additional capacity required to provide the needed Level of Service (LOS) within the I-95 Corridor. Preliminary traffic projections indicate that there are portions of the I-95 corridor that will have LOS D during peak hours beginning in 2010. This section describes the required managed lane improvements, the advantages and disadvantages relative to mobility, community and financial goals, and provides a recommendation whether this alternative needs to be considered further.

B. Required Improvement

This alternative assumes that a managed lane typical section would be in place to provide the additional capacity once the LOS within any section of the corridor reaches LOS D. The proposed typical section would include two non-tolled general use lanes and two tolled 'managed' lanes in each direction. It is assumed that the entire corridor would be reconstructed due to the width of the existing median, the need for the 'managed' lanes to be on the inside, and the poor condition of the existing pavement. The managed lanes would be separated from the general use lanes with a physical barrier with full shoulders on each side.

C. Operations

The managed lanes would be open 24 hours a day and would most likely charge a variable toll that would be adjusted by time of day and the volume within the managed lanes. All toll collection would be electronic, either through the use of a transponder within the vehicle, video tolling accounts or tolling of vehicles through license plate identification. Access to and from the managed lanes would be restricted to designated access points that would improve flow within the managed lanes. Dedicated managed lane interchanges are not assumed due to high cost and a predicted low volume of vehicles within the managed lanes.

Managed lane users would exit the managed lanes at the designated access points and need to weave across the general use lanes to exit at interchanges. The designated access points would be designed to provide the necessary weaving distances in advance of the interchanges. The managed lanes would allow all vehicles, including trucks, to use the lanes. The managed lanes would always provide a higher level of service than the general use lanes. Once the general use lanes become congested, the managed lanes would provide a travel time savings. As the congestion grows, the travel time savings would grow and the managed lanes would be used more. The toll would be adjusted to ensure that a desirable LOS is maintained.

D. Expected Traffic and Revenue

The level of traffic that would use the managed lanes would vary greatly by the section of the I-95 corridor. There are areas of the corridor that the existing 4 lane section will be adequate well into the future, providing an acceptable LOS C. Using a 13% k factor throughout the corridor, LOS D still prevails throughout the vast majority of the corridor through 2030. For managed lanes to be successful there must be appreciable time savings between the managed lanes and the general use lanes. This would require LOS E and F for extended periods of time. With a k factor of 13% for the peak hour, it is expected that the peak hours would not last an appreciable amount of time. Therefore, the managed lanes would not be expected to be utilized except for the one or two highest hours of any given day. As traffic grows, typically the k factor decreases. Lowering of the k factor to the range of 10-12%, would extend the life of the existing four lane section greatly.

E. Managed Lane Advantages

1. Would provide desired LOS throughout the corridor.

F. Managed Lane Disadvantages

1. Higher cost than Widen on Existing Alignment with General Use Lanes alternative due to additional lanes and shoulders.
2. Higher impacts to the community and environment because of the wider typical section.
3. Highest amount of right of way required (same as Truck Lanes alternative).
4. Very low revenue potential that may not cover operating costs.
5. Potential to construct a great deal of capacity that would be under-utilized.

Conclusion

Managed Lanes are typically constructed within heavily urbanized areas with a great deal of congestion. They are typically constructed to manage congestion and provide a significant travel savings compared to general use lanes. The I-95 traffic profile is not urban and has a great deal of recreational use and peaking characteristics atypical of urban traffic. It is recommended to eliminate the Managed Lanes alternative from further consideration.

2. Truck Lanes

A. Issue

A Truck Lanes alternative would add truck only lanes within the I-95 Corridor. This section describes the required improvements, the advantages and disadvantages relative to mobility, community and financial goals, and provides a recommendation whether this alternative needs to be considered further.

B. Required Improvement

The Truck Lanes alternative would add two additional lanes in each direction to the corridor that would be exclusive to trucks only. These truck lanes would add the additional capacity within the corridor. The alternative would require two lanes to allow trucks the ability to pass slower moving vehicles. A single lane could be proposed but would require passing lanes at regular intervals.

The typical section would include two general use lanes in each direction to be used by passenger vehicles. The truck lanes are assumed to be on the inside, but could be designed on the outside. Due to the width of the existing median, the need for the truck lanes to be on the inside, and the poor condition of the existing pavement, it is assumed that the entire corridor would be reconstructed. The truck lanes would be separated from the general use lanes with a physical barrier with full shoulders on each side.

C. Operations

The truck lanes would be open 24 hours a day. The truck lanes as well as the general use lanes would be tolled because there has been much negative feedback from the trucking industry on projects that propose to toll trucks but not passenger cars. All toll collection would be electronic, either through the use of a transponder within the vehicle, video tolling accounts or tolling of vehicles through license plate identification.

Access to and from the truck lanes would be restricted to designated access points that would improve traffic flow within the truck lanes and the general use lanes. Dedicated truck only lane interchanges are not assumed due to high cost and a predicted low volume of vehicles within the truck lanes. Trucks would exit the truck lanes at the designated access points and need to weave across the general use lanes to exit at interchanges. The designated access points would be designed to provide the necessary weaving distances in advance of the interchanges.

The Truck Lanes alternative would improve operations, primarily because with two truck lanes, an excellent LOS would be maintained for the trucks. The LOS in the general use lanes would degrade. The following table shows the LOS in the general use lanes. This decrease in level of service would require additional capacity in the general use lanes between now and 2040.

Table 1: Truck Lanes Alternative LOS for General Use Lanes

Interchange From	Interchange To	Area Type	% Trucks	Year 2040 AADT	Year 2040 LOS	Required No. of Lanes	Year 6 Lanes Required
South Carolina State Line	SR 1003 (South Chicken Rd.) (Exit 10)	Rural	19%	44,800	C	4	Post 2040
SR 1003 (South Chicken Rd.) (Exit 10)	NC Highway 72 (Exit 17)	Rural	19%	48,600	C	4	Post 2040
NC Highway 72 (Exit 17)	US 301 (Fayetteville Rd.) (Exit 22)	Urban	16%	66,200	E	6	2031
US 301 (Fayetteville Rd.) (Exit 22)	I-95 Business (Exit 40)	Rural	15%	58,000	D	6	2033
I-95 Business (Exit 40)	I-95 Business (Exit 56)	Rural	16%	57,400	D	6	2035
I-95 Business (Exit 56) ³	I-40 (Exit 81) ³	Rural	15%	75,200	F	6	2016
I-40 (Exit 81)	US 301 (Exit 107)	Rural	15%	50,800	C	4	Post 2040
US 301 (Exit 107)	I-795/US 264 (Exit 119)	Rural	14%	41,000	C	4	Post 2040
I-795/US 264 (Exit 119)	SR 1717 (Sandy Cross Rd.) (Exit 132)	Rural	11%	52,000	D	6	2033
SR 1717 (Sandy Cross Rd.) (Exit 132)	NC 43 (Exit 141)	Urban	11%	62,000	D	4	Post 2040
NC 43 (Exit 141)	NC 125 (Exit 171)	Rural	20%	59,400	D	6	2035
NC 125 (Exit 171)	NC 46 (Exit 176)	Urban	18%	45,800	D	4	Post 2040
NC 46 (Exit 176)	Virginia State Line	Rural	9%	39,000	C	4	Post 2040

D. Expected Traffic and Revenue

The Truck Lanes alternative would be expected to carry the same amount of traffic as the Widen on Existing Alignment alternative, and so additional improvements to the general use lanes would also be required. Because this alternative assumes that both the truck lanes and the general use lanes would be tolled, the total revenue that would be collected in this alternative should be equivalent to the revenue collected in the Widen on Existing Alignment alternative.

E. Truck only Lane Advantages

1. Would provide desired LOS in truck only lanes
2. Separation of trucks and passenger vehicles may have a perception of increased safety. Trucks would need to cross the general use lanes to access the truck only lanes. There would need to be an assessment of safety issues relative to weaving between trucks and passenger vehicles as trucks enter and exit the truck only lanes.

3. Provides the highest level of revenue potential due to the assumption that all vehicles would be tolled. This is the same level as the Widen on Existing Alignment alternative.

F. Truck only Lane Disadvantages

1. Higher cost than Widen on Existing Alignment alternative due to additional facilities that would be required.
2. Higher impacts to the community and environment because of the wider typical section.
3. Highest amount of right of way required (same as Managed lane alternative).
4. Additional capacity is required to the general use lanes to maintain acceptable LOS (additional costs).

G. Conclusion

Truck lanes are typically constructed within high traffic volume facilities that have hourly volumes approaching 2,000 trucks per hour and LOS of E or F. Neither of these applies to the existing I-95 corridor. With the Widen on Existing Alignment alternative, acceptable LOS can be maintained at a much lower cost with fewer impacts to the environment and communities. It is recommended to eliminate the Truck Lanes alternative from further consideration.

3. Widen on Existing Alignment with General Use Lanes

Issue

The Widen on Existing Alignment with General Use Lanes is an alternative that would reconstruct the existing travel lanes of I-95 in North Carolina and provide additional capacity by providing additional lanes as needed throughout the corridor. This section describes the Widen on Existing Alignment alternative, the advantages and disadvantages relative to mobility, community and financial goals, and provides a recommendation whether this alternative needs to be considered further.

Required Improvement

The Widen on Existing Alignment alternative would include demolishing the existing travel lanes of I-95 and constructing new travel lanes that would provide the required LOS. The existing corridor is primarily four lanes wide (two in each direction). The Widen on Existing Alignment alternative would provide a minimum of six total travel lanes and would provide eight travel lanes where needed to meet minimum LOS requirements. The existing lanes are to be reconstructed due to their substandard condition.

The existing median width varies throughout the corridor. The new pavement would be constructed such that a minimum of two lanes of traffic in each direction would be maintained during construction. In areas where future widening may be required, provisions would be considered to reduce future construction impacts and costs. These provisions include such measures as constructing bridges and interchanges to accommodate future capacity needs.

Operations

The Widen on Existing Alignment alternative would provide sufficient lanes to operate at the desired LOS. It is assumed that the Widen on Existing Alignment alternative would be tolled. All toll collection would be electronic, either through the use of a transponder within the vehicle, video tolling accounts or tolling of vehicles through license plate identification.

This alternative assumes that trucks and passenger vehicles would not be limited to specific lanes within the corridor; however, trucks could be required to use the two right lanes within either a six or eight lane typical section. Trucks and passenger cars would be allowed to enter and exit the alignment at any interchange.

Expected Traffic and Revenue

The Widen on Existing Alignment alternative would generate the highest level of revenue due to all vehicles within the corridor being tolled. This revenue level is expected to be equal to the revenue collected in the Truck Lanes alternative.

Widen on Existing Alignment Alternative advantages

1. Would provide desired LOS.
2. Lowest cost of the Tier 2 alternatives.
3. Lowest impact on the environment and communities due to fewer lanes required.
4. Lowest amount of right of way required.
5. Would provide a high level of safety.
6. This alternative would be the least complex to collect the toll revenue because there would be fewer tolling points required.

Widen on Existing Alignment Alternatives Disadvantages

7. While it is the lowest cost of the three alternatives in Tier 2, it is still expensive.

Conclusion

The Widen on Existing Alignment alternative would provide the desired LOS, provide enhanced safety, would have the least impacts to the environment and communities of the build alternatives. It is recommended to retain the Widen on Existing Alignment alternative as the Design Concept and Scope for the project.

Table 2: Tier 2 Alternative Screening Results

Criterion	No Build	Widen on Existing Alignment	Managed Lanes	Truck Lanes
Human/Physical Environment	9	6	4	4
Cost	9	6	1	1
Operations – LOS	1	8	6	3
Safety	1	8	6	6
Constructability	10	5	5	5
Ability to Generate Revenue	1	9	3	9
Total	31	39	25	28

Rating scale: Good: 7-10, Fair: 4-6; Poor, 1-3.