7. SUMMARY OF THE I-40 HIGH OCCUPANCY VEHICLE/CONGESTION MANAGEMENT STUDY

The I-40 High Occupancy Vehicle/Congestion Management study was conducted to investigate methods to better manage congestion on the I-40 corridor based on the projected rapid growth in the Triangle Region for the next twenty years. Several congestion management strategies were investigated for application to I-40.

High Occupancy Vehicle (HOV) facilities provide an opportunity to better manage congestion by offering an alternative for commuter traffic. HOV lanes would provide fast and reliable trip times for those individuals willing to take advantage of an additional mobility option – driving or riding in a carpool, vanpool, or transit vehicle.

In conducting the study, extensive data collection, technical analysis, and functional design were performed. All findings were presented to a technical committee and a policy committee composed of members from NCDOT and local agencies. In addition, a public involvement plan, geared toward educating and soliciting input from the general public, was implemented.

The results of the overall study are summarized in the following sections. These general conclusions are divided into four sections:

- Congestion Management Strategies,
- Phasing of HOV Facilities,
- Comparison of Initial HOV Configurations, and
- Combining Configurations.

7.1 Congestion Management Strategies

Although this study focused on HOV lanes, numerous other congestion management techniques could be applied to help reduce future congestion on I-40. These strategies include, but are not limited to:

- Traditional roadway capacity improvements,
- Express lanes,
- Transit,
- Intelligent Transportation Systems (ITS),
- Ramp metering,
- Transportation Systems Management (TSM), and
- Travel Demand Management (TDM).

7.2 Phasing of HOV Facilities

This study analyzes the feasibility of a 60-mile HOV network. The roadway sections that make up this core HOV network include:

- I-40 from NC 86 near Chapel Hill to US 1/ US 64 in Cary

- I-40 from US 1/ US 64 in Cary to US 70 near Garner
- I-540 from US 64 near Apex to Creedmoor Road in North Raleigh

The I-40 HOV/Congestion Management Study focuses on one part of this core HOV network, I-40 from NC 86 to US 1/ US 64. This section was chosen due to the high concentration of employment in the Research Triangle Park (RTP) area and the projected trip demand.

This HOV section was further segmented into five corridors for analysis, cost estimation and reporting purposes. These five corridors are labeled as follows in this report:

- **Western Corridor:** I-40 between NC 86 and NC 54
- **RTP Corridor – West:** I-40 between NC 54 and NC 147
- **RTP Corridor – East:** I-40 between NC 147 and Aviation Parkway
- **Airport Corridor:** I-40 between Aviation Parkway and Wade Avenue
- **Eastern Corridor:** I-40 between Wade Avenue and US 1/ US 64

Demand for HOV facilities varies significantly between these five corridors, depending on the peak direction of traffic flow and the overall traffic demand in GP lanes. The highest HOV demand occurs on the RTP Corridor – East and generally peaks between NC 147 and I-540, especially in the westbound direction during the morning commute hours and in the eastbound direction during the afternoon commute hours.

In the Triangle Region, the amount of HOV demand on I-40 is expected to increase in the future. The amount and rate of the increase in HOV demand will vary, however, due to differences in land use growth patterns and the planned roadway network, affecting each of the five corridor segments as shown in Table 7-1.

Table 7-1 Projected HOV Demand Comparison

Roadway Section	2005	2025
Western Corridor	Low	Moderate
RTP Corridor -- West	Moderate	High
RTP Corridor -- East	High	Very High
Airport Corridor	High	High
Eastern Corridor	Moderate	High

Based upon this analysis and other factors outlined in Section 5.3, the three eastern-most sections – i.e., the RTP Corridor East, the Airport Corridor, and the Eastern Corridor were ranked as the highest priority for implementation of HOV in the region. The analysis also shows moderate to very high HOV demand along I-540 segments in North Raleigh and I-40 segments in South Raleigh. This analysis can provide a framework for an overall implementation program of the core HOV system.

Note that these observations are not intended to serve as a recommendation of a particular phasing schedule since numerous other factors should be considered. From a pure HOV demand analysis, however, the demand for various projects does dictate a potential strategy for developing an HOV system.

Successful implementation of a new HOV system in a region requires a carefully developed phasing plan that identifies those corridors with the highest near-term and long-term HOV traffic demand. The construction and expansion of an HOV system must be planned to maintain adequate HOV demand to minimize the risk of losing public support of HOV facilities throughout the region.

7.3 Comparison of HOV Configurations

In determining the type of configuration which may be more appropriate for the Triangle Region as well as specific sections of the HOV network, an investigation of four configurations and their impacts on measures of effectiveness were developed. These four HOV configurations are summarized below.

- **Simple** – This configuration consist of one concurrent flow HOV lane in each direction separated by a pavement stripe buffer. The demand analysis for this HOV lane configuration was calculated for I-40 from NC 86 (Mile post 266) to US 70 (Mile post 306) and I-540 from US 64 to NC 50. No HOV-only access interchanges were included.
- **Complex** – This configuration consist of one barrier-separated HOV lane in each direction and HOV-only access interchanges. An Express lane for general purpose traffic would be added to the HOV lane on I-40 between NC 147 and I-540. The demand analysis for this type of HOV lane was calculated for I-40 from NC 86 (Mile post 266) to US 70 (Mile post 306) and I-540 from US 64 to NC 50. In addition, eighteen new HOV-only access interchanges were included at or near existing interchange locations.
- **Modified Complex** – This configuration is a variation of the Complex scenario, and consist of the same barrier-separated HOV and Express lanes. It includes six HOV-only access interchanges at the following high demand locations: NC 86, NC 54, NC 147, I-540, Wade Avenue and US 1/ US 64. Note that future environmental analysis could examine additional access locations for the Modified Complex configuration.
- **Elevated** – This configuration includes two two-lane viaducts (one on each side of the I-40 freeway) from NC 86 near Chapel Hill to US 1/ US 64 in Cary. This configuration required an extra GP lane along the entire length of the viaducts due to safety and operational considerations. The configuration includes the same six access points as the Modified Complex configuration. Managed lane access at NC 147 and I-540 is provided for HOV vehicles only while the other four locations provide access to HOV and Express lane traffic. Note that the design variations made the Elevated configuration somewhat difficult to compare with other configurations based on traffic demand and operational characteristics. In addition, the geometric requirements of the viaduct limit the possibilities for providing additional HOV interchanges in the future.

Table 7-2 summarizes the number of GP, HOV and Express lanes included for each configuration by study corridor.

Table 7-2 Lane Geometrics for HOV Configurations

Corridor	Simple			Complex			Modified Complex			Elevated		
	GP	HOV	Exp	GP	HOV	Exp	GP	HOV	Exp	GP	HOV	Exp
Western Corridor	3	1	0	3	1	0	3	1	0	3	1*	1*
RTP Corridor – West	3	1	0	3	1	0	3	1	0	3	1	1
RTP Corridor – East	4	1	0	3	1*	1*	3	1	1	4	1	1
Airport Corridor	4	1	0	4	1	0	4	1	0	4	1	1
Eastern Corridor	3	1	0	3	1	0	3	1	0	3	1*	1*

Notes: Number of lanes per direction.
** HOV and Express lanes use shared two-lane freeway section.*

The overall analysis and comparison of configurations is summarized in the following sections:

- Travel Demand Modeling
- Traffic and Operations
- Environmental Screening
- Construction and Costs

7.3.1 Travel Demand Modeling

An extensive travel demand modeling effort was performed for this study applying the Triangle Regional Model (TRM). It served to develop future traffic projections for analysis of both HOV and general purpose traffic. In addition, the TRM demand model was used to evaluate the potential impact of an HOV system on overall network operation and efficiency for the entire region.

Capacity and Access Analysis

The demand modeling effort required numerous analytical considerations that affected the trip distribution pattern for each configuration. Some of the analysis included:

- The results in this section are reported from the TRM (Triangle Regional Model, 2025 AM Peak Scenario). Therefore, delay or level of service (LOS) metrics are at the planning level and do not consider specific operational bottlenecks.
- The 2025 No-Build network is used as a baseline to compare the potential impact of

HOV facilities. The No-Build network includes all improvements funded in the NCDOT 2002-2008 Transportation Improvement Program (TIP) as well as the 2025 fiscally constrained regional transportation model. As described in Chapter 2, Interstate projects along the I-40 corridor included in the TRM are as follows:

  - I-40 widened to six lanes between the Durham Freeway and I-85 in Hillsborough,
  - I-40 widened to eight lanes between the Durham Freeway and I-540 in RTP,
  - I-540 extended as a six-lane freeway from I-40 south to US 1 in Apex, and.
  - I-40 widened to six lanes between Wade Avenue and US 1/ US 64

- In contrast to the Simple configuration, the Complex, Modified Complex and Elevated configurations add Express lane or GP lane capacity in addition to HOV capacity. For the Complex and Modified Complex configurations, this additional capacity is limited to the section of I-40 through Research Triangle Park between NC 147 and I-540. For the Elevated configuration, additional GP lane capacity is provided through the I-40 corridor study area from NC 86 to US 1/US 64. This additional capacity causes significant changes in traffic distribution patterns in the study area and attracts additional trips to the I-40 corridor from other routes and parts of the region.
- In addition to general purpose capacity, the number and type of access points directly impact the trip distribution patterns as well as the type of trips using the I-40 mainline, HOV, and Express lanes. In general, more access points would be anticipated to attract additional trips to I-40. Differences in overall capacity and access locations will provide variations, however. Table 7-3 summarizes the access points in the analysis.

Table 7-3 Number of Access Points

Comparison to No-Build Conditions	Simple	Complex	Modified Complex	Elevated
Number of Access points:				
HOV lane access points	Continuous	18	6	6
Express lane access points	N/A	2	2	4
I-40 Mainline interchanges	18	18	18	18

Demand Model Findings

Table 7-4 illustrates the network-wide and corridor-specific access impacts of the Build HOV configurations (i.e., Simple, Complex, Modified Complex & Elevated) as compared with the 2025 No-Build condition during the morning commute time. The results show no clear-cut preferences since no configuration consistently performed better for all the demand metrics considered in the study.

Table 7-4 Comparison of Demand Measures of Effectiveness (MOEs)

Comparison to No-Build Conditions	Simple	Complex	Modified Complex	Elevated
Network-wide indicators:				
Roadways operating at LOS F	-13.4%	-8.3%	-7.9%	-8.9%
Network Vehicle Miles Traveled (VMT)	+0.2%	+0.3%	+0.2%	+0.6%
Network Hours of Delay	-11.1%	-8.0%	-4.6%	-9.7%
Average Network Speed	+3.3%	+1.6%	+1.6%	+3.3%
I-40 indicators:				
VMT on I-40 (NC86 to US 1/ 64)	+15.3%	+15.3%	+14.6%	+22.3%
Average HOV volume on I-40	+65.4%	+45.5%	+35.1%	35.6%
Average People Moved on I-40	+17.5%	+16.5%	+13.4%	+20.3%
Average People Moved on I-40 through RTP (NC 55 to Aviation)	+19%	+18%	+16%	+26%

Some observations and conclusions that can be made from the results of the analysis include:

- The Simple configuration can be viewed as a marginally better solution as it shows the best performance in three out of the eight selected demand-model based indicators and ties in two indicators. The Simple configuration involves adding only HOV-capacity to the system, which causes small shifts to the traffic origin-destination pattern. As a net result, we observe higher capacity for essentially the same number of trips with similar origin-destination patterns. This results in a substantial increase in HOV volumes on I-40 and a reduction in both overall congested lane-miles and vehicle hours of delay.
- The Complex and the Modified Complex configurations show similar middle-of-the-chart type performance values in most of the demand measures. However, the Complex configuration shows a marginal edge over the Modified Complex in terms of number of people moved on I-40 and network delay reduction, since there are more frequent HOV-only access points. Specifically, the Complex configuration has eighteen HOV access interchanges as compared with six HOV access interchanges with the Modified Complex configuration.
- The Elevated configuration has the highest number of people moved on I-40 because of the additional general purpose capacity, and consequently the highest increase in VMT throughout the network and along I-40.
- In contrast to the Simple configuration, the Complex, the Modified Complex and the Elevated configurations are projected to accommodate significant Express lane traffic going through the RTP Corridor – East section of the study corridor. Express lanes provide improved operations for mainline traffic through this critical regional bottleneck.

7.3.2 Traffic and Operations

Using the traffic projections from the TRM demand model, a thorough analysis of traffic operations through the I-40 corridor was undertaken. This included a level of service (LOS) analysis and a micro-simulation modeling for travel time analysis.

Traffic Operations

Table 7-5 presents a summary comparison of the LOS along I-40 corridors for morning (AM) and afternoon (PM) 2025 peak period traffic conditions. The LOS is reported for the peak direction of flow and average traffic volumes on each corridor section.

The Simple configuration includes the additional HOV lane, but for all other build configurations, the HOV and Express lanes are separated from the GP lanes. As a result, the LOS designation for the Simple configuration is generally better than all other configurations.

Barrier separated HOV operations on the Complex, Modified Complex and the Elevated configurations are not presented but are expected to operate at LOS D or better for most of the segments. In general, a two-lane freeway serving a combination of Express lane and HOV traffic (i.e., the Complex configurations) would have higher capacity than two barrier separated lanes serving Express lane and HOV traffic separately (i.e., the Elevated configuration).

The mainline analysis reveals that the I-40 GP lanes will continue to experience the highest level of congestion in the RTP Corridor – East segment, regardless of the direction of travel or time of day. In other words, I-40 through the RTP area would operate at- or over-capacity conditions in both directions during peak periods, resulting in unstable flow and frequent breakdown conditions. The Airport Corridor is also projected to experience high levels of congestion, especially in the westbound direction in AM and in the eastbound direction in the PM.

Although the configurations show only minimal improvement in the operations and LOS of the GP lanes, they are projected to accommodate higher peak period traffic volumes than the No-Build scenario. In addition, the impacts of peak period spreading should be minimized with additional capacity. Finally, this analysis does not examine the potential benefits of providing the proposed scenarios on off-peak operations, either with or without HOV restrictions.

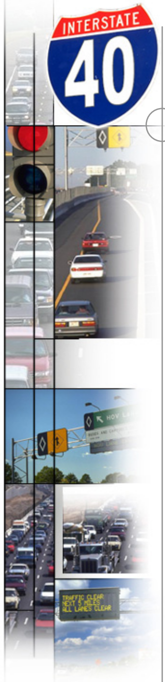


Table 7-5 2025 Traffic Operation Level of Service

AM PEAK PERIOD

Study Corridor and Direction of Peak Flow	No-Build	Simple	Complex	Modified Complex	Elevated
Western Corridor (EB)	D	C	D	D	D
RTP Corridor – West (EB)	F	E	E	E	E
RTP Corridor – East (WB)	F	F	F	F	F
Airport Corridor (WB)	F	E	E	E	E
Eastern Corridor (WB)	D	D	E	E	D

PM PEAK PERIOD

Study Corridor and Direction of Peak Flow	No-Build	Simple	Complex	Modified Complex	Elevated
Western Corridor (WB)	D	D	D	D	E
RTP Corridor – West (WB)	F	E	E	E	E
RTP Corridor – East (WB)	F	E	F	F	E
Airport Corridor (EB)	E	E	F	F	F
Eastern Corridor (EB)	D	E	D	D	D

Notes: LOS letter grades indicate a range of traffic conditions from free-flow (LOS A) to stop-and-go traffic (LOS D), to breakdown conditions (LOS F). Theoretical capacity has been exceeded when LOS E is reached.
Corridor LOS estimates reflect average traffic volumes and mask any bottlenecks.
Corridor LOS estimates are for general purpose lanes and do not include HOV/Express traffic except for the Simple configuration.

Travel Time Savings and Delay Comparisons

Table 7-6 presents part of the results of micro-simulation modeling, which estimated travel times along GP lanes and the HOV facility and investigated the effects of specific traffic bottlenecks. The analysis shows that the majority of travel time savings on the corridor occurs within the RTP section of I-40. This primarily results from a critical bottleneck at the I-540 interchange that results in excessive delays for GP lane traffic.

Table 7-6 2025 Travel Time Advantage of HOV Lanes over GP lanes for RTP Commuters (Minutes)

	Simple	Complex	Modified Complex	Elevated
AM Peak Period				
1. EB I-40 from NC 86(Chapel Hill) to Aviation Pkwy (RTP)	2.1	8.6	6.2	6.9
2. WB I-40 from US 1/US 64 (Cary) to NC 147 (RTP)	3.1	5.2	5.2	7.1
PM Peak Period				
1. WB I-40 from Aviation Pkwy (RTP) to NC 86 (Chapel Hill)	1.1	0.7	0.6	1.2
2. EB I-40 from NC 147 (RTP) to US 1/US 64 (Cary)	13.6*	9.9*	8.6*	10.8*

**Time savings are primarily due to the bottleneck west of Aviation Pkwy and at the I-540 interchange in the GP lanes.*

Using the CORSIM micro-simulation tool, the total delays encountered by all vehicles, both in the GP and the HOV lanes, was estimated. Since this delay comparison is based on microsimulation analysis, it factors in delays due to traffic bottlenecks, weaving movements, and flow breakdowns along the I-40 corridor. The comparison is focused on the delay in the I-40 corridor between NC 86 to US 1/US 64, exclusively. It does not examine changes in regional delay that may occur on adjacent roads or access points to the network.

Delay for each HOV configuration was compared on a percentage basis with the 2025 No-Build condition.

Figure 7-1 summarizes the projected delay per unit vehicle miles traveled (VMT) for each HOV configuration. Figure 7-2 summarizes projected changes in total vehicle hours of delay for each HOV configuration. In examining the figures, a positive percentage change indicates that the HOV configuration is expected to increase delays as compared to the No-Build condition. In contrast, a negative change shows a reduction in vehicle hours of delay with the proposed configuration and indicates improved operations.

Figure 7-1 Comparison of Unit Delay

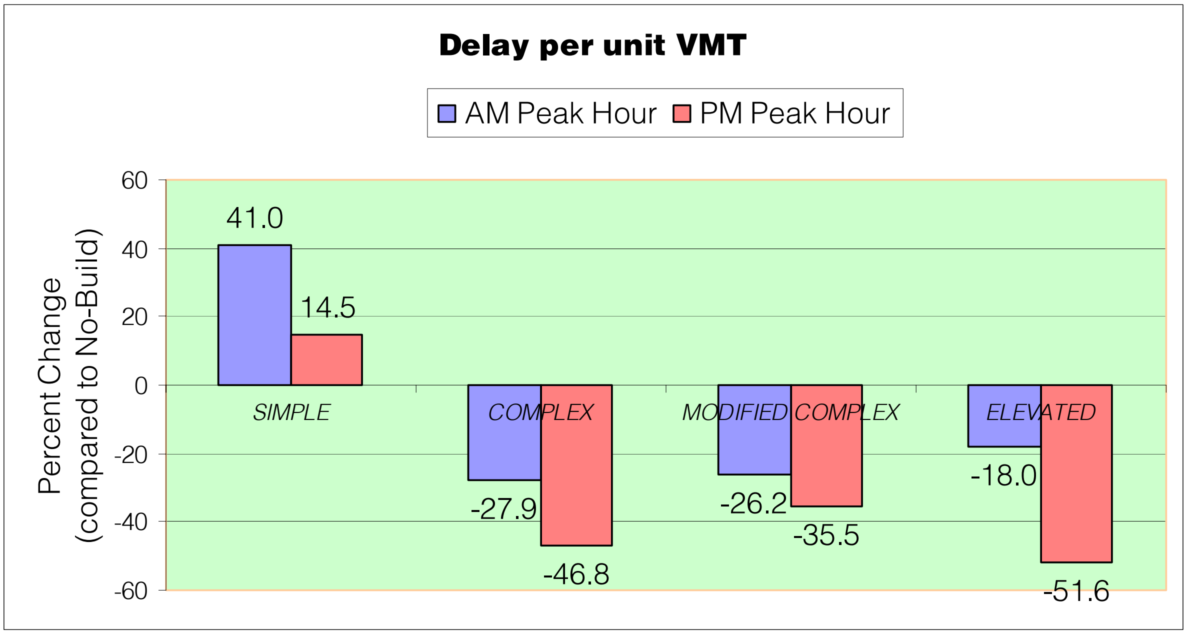
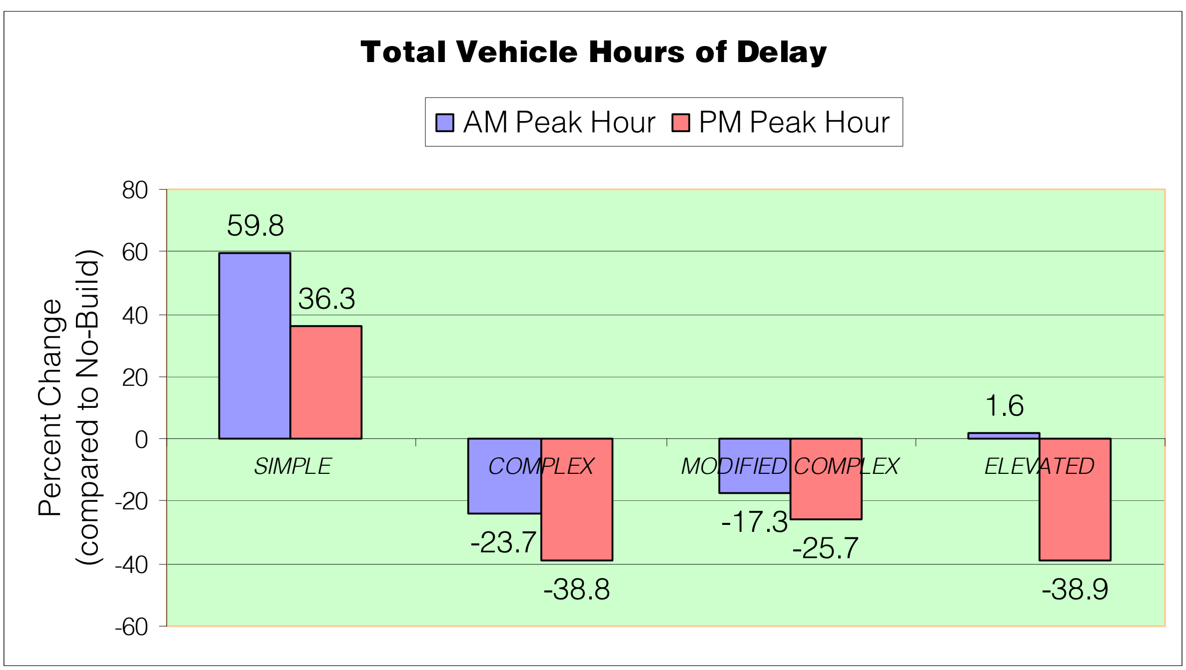


Figure 7-2 Comparison of Total Corridor Delay



The two figures indicate the following:

- The Simple configuration shows significant weakness in reducing peak period travel delays. The Simple configuration is projected to make delay longer than the No-Build condition because of additional delay that results from weaving operations between the general purpose traffic and the HOV traffic near interchange locations.
- The Complex and the Modified Complex configurations show the best performance in reducing delay during the AM peak period, either on the basis of per unit VMT or total delay. These two configurations also show consistent results in reducing PM peak period delay. They provide an additional Express lane (resulting in additional general purpose lane capacity) on I-40 between NC 147 and I-540.
- The Elevated configuration shows the best performance in reducing delay in the PM peak period but is less consistent in reducing AM delay. Note that additional general purpose traffic capacity is provided through the entire corridor with this configuration.

An evaluation of the traffic operations analysis indicates that the Complex configuration shows the best performance in handling future projected traffic conditions during both AM and PM peak periods. The Modified Complex configuration also shows good operational performance. While the Elevated configuration works the best during PM peak condition, it fails to adequately handle the projected AM peak period demand. The Simple Configuration shows poor operational performance overall as would be expected since it does not include the provision for additional general purpose capacity in the RTP East Corridor section and the high HOV demand creates weaving-related bottlenecks on the GP lanes.

7.3.3 Environmental Screening

An environmental screening was conducted for two of the four build configurations, the Simple and the Complex, based on research of existing information. This environmental screening did not include any field data collection. The intention of the environmental screening at this juncture was to determine if there are any significant fatal flaws. If this project moves forward, a more detailed environmental assessment of configurations will more accurately account for specific environmental impacts. At this level of analysis, no fatal flaws were identified for any of the configurations.

Table 7-7 provides a comparison of potential environmental impacts of the Simple and Complex HOV configurations.

Table 7-7 Environmental Impact Comparison

Resource	Simple Configuration	Complex Configuration
Stream Crossings	40 crossings	53 crossings
Wetlands	8 potential encroachments	12 potential encroachments
Protected/Public Lands	No encroachments	No encroachments
Threatened & Endangered Species	No known impacts	No known impacts; encroachment in one Significant Natural Heritage Area
Archaeological Sites	47 sites within one-half mile	54 sites within one-half mile
Historic Sites	10 sites with some designation within one mile	10 sites with some designation within one mile
Community Impacts	No property encroachments	Up to 19 property encroachments

The Complex Configuration and the Modified Complex configuration have identical footprints and estimated right-of-ways. Therefore, environmental screening was not performed for the Modified Complex Configuration specifically. However, the Modified Complex configuration has fewer interchanges than the Complex configuration, and so it can be assumed that it would have a reduced impact on environmental resources than the Complex configuration.

Environmental screening was also not performed for the Elevated configuration. At the time that the work was scoped for the Elevated configuration analysis, NCDOT anticipated that the elevated structure could be fit entirely within the median of the existing roadway, and that the impact on the environment would be negligible. As the analysis progressed it became apparent that going to the outside of the existing roadway was necessary. This resulted in expanding the required right of way. Without an environmental screening exercise it is not possible to determine the magnitude of possible impacts. Since the right of way is wider than that for the Complex Configuration it can be assumed that the impacts would be somewhat greater.

7.3.4 Construction and Costs

A conceptual roadway design for I-40 between NC 86 near Chapel Hill and US 1/US 64 was developed and is shown in Appendix A. They include the Simple, Complex, Modified Complex and Elevated HOV configuration as well as a design for a standard widening of I-40 between Wade Avenue and US 1/ US 64.

Based upon this analysis, comparisons between the four configurations were developed. Table 7-8 examines the basic width for each typical section, excluding cut/fill slopes and right of way offsets. In general, the Simple configuration requires the narrowest typical section, the Complex and Modified Complex configuration have the same width, and the elevated section has the greatest width.

Table 7-8 Typical Section Comparison

Typical Section Width*	Simple	Complex	Modified Complex	Elevated
Western Corridor	170’	210’	210’	199’
RTP Corridor -- West	170’	210’	210’	255’
RTP Corridor -- East	194’	234’	234’	283’
Airport Corridor	194’	234’	234’	283’
Eastern Corridor	186’	226’	226’	247’

**Excluding construction easements, right of way offsets, and cut/fill slopes*

Table 7-9 examines the impact of widening I-40 to provide for HOV facilities on bridge structures through the corridor. The Simple configuration requires approximately half the bridge replacements/new bridges as the Complex alternative because it has both a narrower typical section and no HOV-exclusive interchanges in the Simple configuration. The Modified Complex, as analyzed, has fewer HOV-only interchanges (6) than the Complex configuration (18) resulting in fewer bridges. The Elevated configuration requires two two-lane structures on each side of the existing I-40. In addition, structures will be required for six HOV interchanges.

Table 7-9 Bridge Requirements Comparison

Reconstruct & Provide New Bridges	Simple	Complex	Modified Complex	Elevated
Western Corridor	5	5	5	CNES
RTP Corridor -- West	16	21	19	CNES
RTP Corridor – East	6	26	21	CNES
Airport Corridor	2	5	4	CNES
Eastern Corridor	4	9	5	CNES
TOTAL	**33**	**66**	**54**	CNES

Notes: *Some of the bridge reconstruction activities in Simple will entail only changing the bent slopes to retaining walls.*
CNES = Construct New Elevated Structures with minimal impact to existing general purpose traffic by adding bridges outside the existing travel lanes.

Table 7-10 provides preliminary construction cost estimates for the four HOV configurations analyzed in this study. These figures do not include right-of-way costs. As would be expected, the Simple configuration is the least expensive with the Elevated structure having the greatest cost. The Modified Complex is less expensive than the Complex as a result of having fewer HOV-exclusive interchanges.

Table 7-10 Cost Estimates Comparison (in millions)

	2002				2025			
	Simple	Complex	Modified Complex	Elevated	Simple	Complex	Modified Complex	Elevated
Western Corridor	29	79	77	232	54	146	142	428
RTP Corridor -- West	68	127	81	465	126	234	150	858
RTP Corridor – East	59	293	225	617	109	541	415	1,139
Airport Corridor	27	53	52	323	50	98	96	596
Eastern Corridor	54	97	84	324	100	179	155	598
TOTAL	**$237**	**$649**	**$519**	**$1,961**	**$439**	**$1,198**	**$958**	**$ 3,619**

In comparing Tables 7-8, 7-9, and 7-10, it should be noted that the section with the widest typical section, the highest bridge requirements, and the highest cost is the RTP Corridor – East between NC 147 and I-540. This section also carries the highest traffic volumes in the entire region and is a daily bottleneck on the I-40 corridor today and into the future.

7.4 Combining Configurations

The analysis in this study focuses on several issues and measures of effectiveness for each of the four configurations. These four configurations represented different concepts in providing HOV mobility and accessibility. Although these four configurations were applied uniformly throughout the study corridor, it is possible that a combination of these configurations could be applied in different sections of the HOV network producing a "hybrid" configuration. This would allow a regional solution that best addresses the unique requirements of each segment of I-40. Of course, any specific "hybrid" configuration would require more detailed analysis as part of a NEPA process to determine a preferred alternative.

On I-40 through the RTP, a configuration that addresses both local and through movement congestion would be required. The area is a major employment center destination attracting thousands of commuters, thereby generating daily traffic congestion. Not only does this congestion affect those commuters destined to RTP, it affects both commuters and Interstate trips passing through RTP to other destinations.

An example of a hybrid combination concept would be combining a higher capacity alternative, such as the Elevated configuration, through the high demand RTP East Corridor with a less expensive alternative configuration in adjacent corridors. For the Airport corridor, the Modified Complex configuration may be desirable due to the wide section of GP lanes and major interchange splits that complicate highway flow. In contrast, the Simple configuration may be most applicable in the Western, RTP West, and Eastern corridors that have lower HOV demand as well as a planned typical section of six GP lanes.

In addition to varying the specific configurations under study, potential hybrid configurations could examine the potential of adding additional access points. An example would be to utilize the Modified Complex configuration and add a few local access HOV service interchanges at high demand locations. Potential opportunities that were identified as part of the demand analysis include Harrison Avenue, Alston Avenue, and possibly Trinity Road. In addition, an HOV interchange serving the Research Triangle Park could provide an HOV bypass for commuter trips.

By varying cross sections, access locations, and phasing plans, various "hybrid" configurations can be tested in the NEPA process. Analyzing "hybrid" configurations offers the potential for minimizing costs for construction on lower demand corridors. As a result, there may be opportunities for accelerated implementation of HOV facilities on a project level basis while ultimately allowing for development of a regional system.