

Functional Classification

Roadway	Classification	Bridge
I-75	Interstate	N/A
Harrison Avenue	Collector	MAINLINE
Western Hills Viaduct	Principal Arterial	OVERHEAD
Central Pkwy	Principal Arterial	NONE
Marshall Avenue	Local	MAINLINE
W. McKicken Avenue	Principal Arterial	NONE
Spring Grove Avenue	Minor Arterial	NONE
Hopple Street	Principal Arterial	OVERHEAD
MLK Boulevard	Principal Arterial	NONE
Bates Avenue	Collector	OVERHEAD
Monmouth Street	Local	OVERHEAD
Ramp G, IR-74	Interstate	MAINLINE
Ludlow Viaduct	Principal Arterial	OVERHEAD
Clifton Avenue	Minor Arterial	MAINLINE
W. Mitchell Avenue	Principal Arterial	MAINLINE
Vine Street	Principal Arterial	MAINLINE
Norwood Lateral (SR 562)	Other Freeway/Expy	N/A
Murray Road/Laidlaw Avenue	Collector	MAINLINE
Towne Street	Minor Arterial	MAINLINE
Seymour Avenue	Minor Arterial	OVERHEAD
Paddock Road	Principal Arterial	OVERHEAD

**JOINT TECHNICAL MEMO
EVALUATION OF POTENTIAL BENEFITS AND IMPACTS
FOR 5-LANE CONTINUITY ALTERNATIVE**

HAM-75-2.30 (PID 76257)
HAM-75-10.10 (PID 76256)

PREPARED BY: TRANSYSTEMS CORPORATION
M-E COMPANIES
ODOT DISTRICT 8

REVISED OCTOBER 25, 2005

INTRODUCTION

The Ohio Department of Transportation (ODOT) is considering safety and capacity improvements to the I-75 corridor in Hamilton County as part of the I-75 Mill Creek Expressway project (HAM-75-2.30) and the I-75 Thru the Valley project (HAM-75-10.10). These projects are currently in Steps 5 and 6, respectively, under ODOT's Project Development Process (PDP). In Step 5, the PDP focuses on development and evaluation of conceptual alternatives. Only those alternatives that are truly considered feasible - reasonable to construct - are supposed to be given more detailed evaluation in Step 6.

One of the primary goals of each project is to reduce congestion. As a part of these efforts, conceptual alternatives have been developed for the I-75 mainline and the interchanges within the project limits. For the purposes of this memo, all discussion refers to the mainline options.

Existing I-75, from its interchange with I-74 to the north, has three lanes in each direction. South of I-74, the existing route has four lanes in each direction. In addition to improving ramp terminals and merges, additional through lane capacity is needed. Both project teams are considering the "four-lane continuity" alternative, as suggested by the North South Transportation Initiative, but it is recognized that this option will not meet design standards for Level of Service (LOS), by failing to provide for LOS D for the design hour in the design year throughout the project limits.

Therefore, the team has been requested to evaluate a second additional through lane, providing five lanes in each direction, known as the "five-lane continuity" option. This memo will illustrate the benefits and consequences of this option by presenting the preliminary findings, beginning with travel demand and trip diversion for the corridor as a whole. Then, each project will be discussed separately in terms of levels of service, impacts and cost, based upon available data in each project area. The goal is to provide adequate information to conclude whether this option should be dropped from further consideration or be carried forward as feasible into Step 5 and 6 engineering.

TRAVEL DEMAND AND DIVERSION OF TRIPS

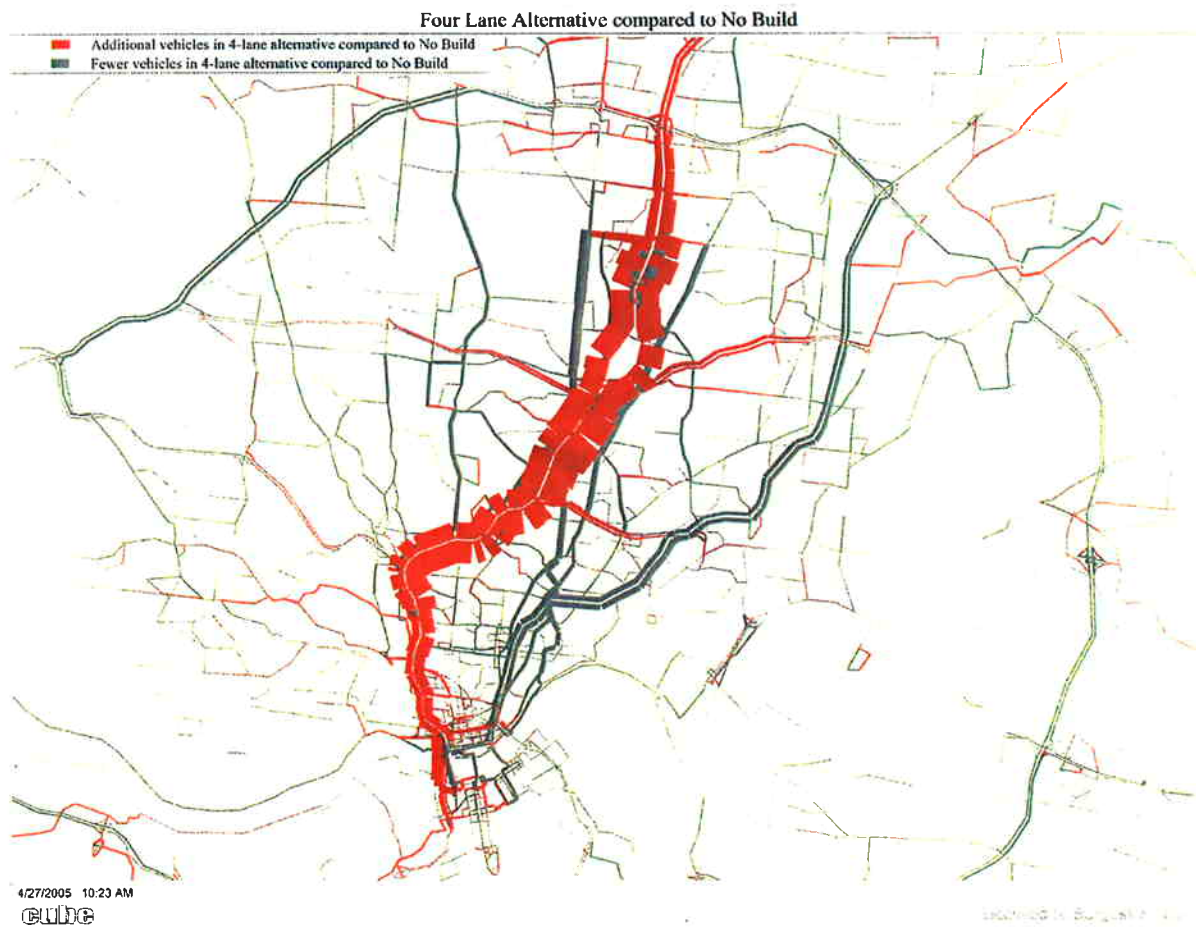
In order to coordinate the traffic projections for all of the three adjoining I-75 projects (*HAM-71-0.00 Brent Spence Bridge*, *HAM-75-2.30 Mill Creek Expressway* and the *HAM-75-10.10 Thru the Valley*), ODOT assembled a Modeling Advisory Committee (MAC). In accordance with the direction of the MAC, a 30th highest hour adjustment factor of 1.056 was developed for use on all three projects. This factor was applied to 2004 peak hour counts to determine the 30th Highest Hour for each movement. The 30th Highest Hour adjustments were validated for 2004 traffic on all three projects. A March 9, 2005 memo from Burgess & Niple, Inc. (B&N) provided the adjustment methodology for developing the 2030 30th highest hour ramp volumes using 2004 30th Highest Hour as a starting point. 2004 and 2030 Tranplan travel demand model outputs for each ramp were used, in accordance with the methodology, to calculate the growth or shrinkage to the 2030 level.

Select link analysis of the southbound exit ramp to Neumann Way in the AM peak hour was used to resolve a noted anomaly in 2030 morning traffic at this ramp. The March 9th memo also supplied the 2030 I-75 "Master Link" volume for the I-75 link between Paddock Road and State Route (SR) 126. The Master Link volumes were coordinated for all three projects by B&N and approved by the MAC. The project team used the 2030 Master Link volume and the refined ramp volumes to calculate the 2030 Refined Baseline No Build peak hour traffic volumes. Using the 2030 Refined Baseline No-Build Volumes for the AM and PM peak hours as a basis, ramp and mainline volumes were hand-adjusted for each conceptual mainline alternative.

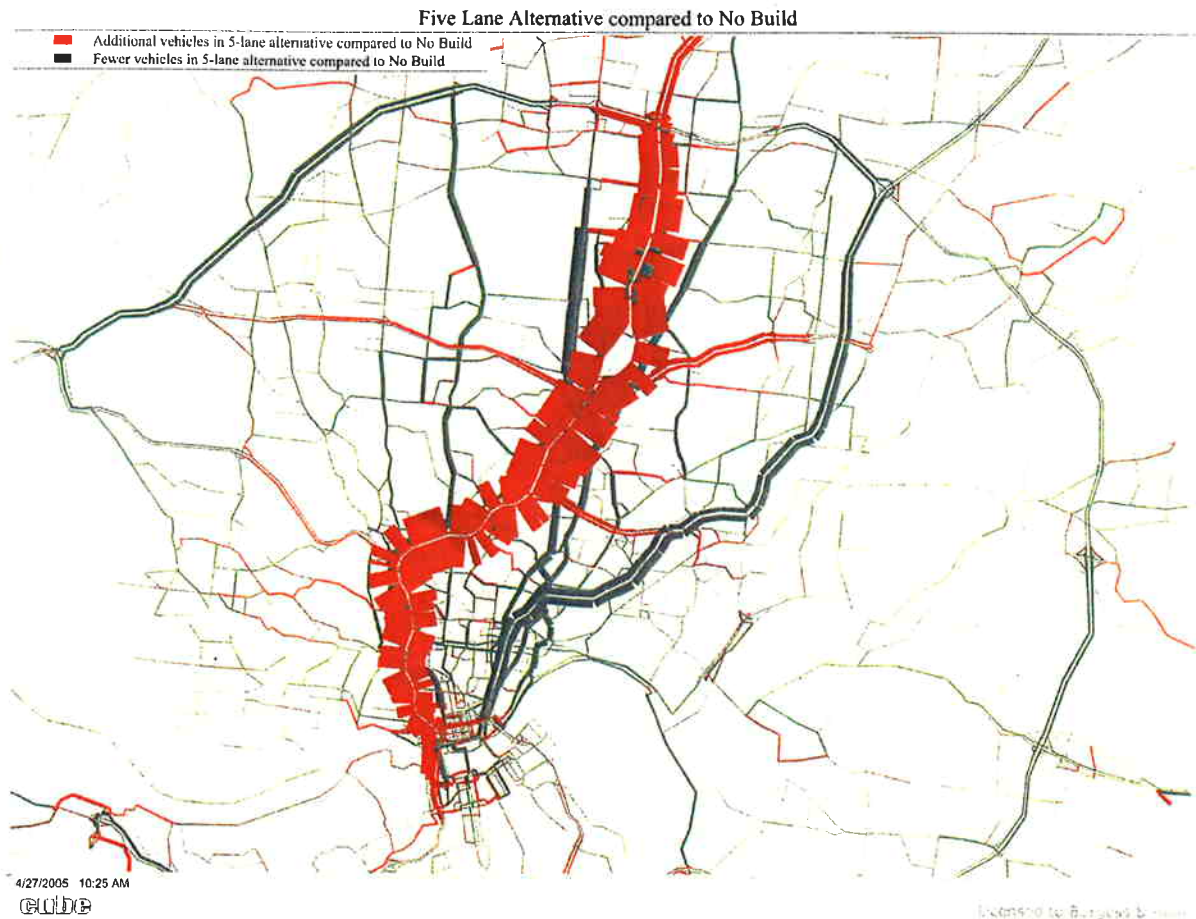
In addition to providing design year volumes for the I-75 corridor projects, B&N, under contract to TranSystems and M-E Companies, utilized the OKI travel demand model ("the model") for the purpose of estimating future traffic volumes on I-75 and surrounding routes within the corridor for the purpose of evaluating the Five-Lane Continuity Alternative. Existing counts, taken in 2004, were used to develop the current year No Build volumes. These results were used to calibrate the model and produce design year No Build volumes according to the methodology described above. Lastly, the model was coded to represent the four- and five-lane options in order to determine how much traffic would increase on I-75 in the widening scenarios due to diversion of traffic from other routes.

The results of this analysis are summarized on the following pages.

The graphic below illustrates the changes in traffic volumes for the four-lane alternative compared to the No Build case. The increases in volumes on I-75 are shown in red. The green bands represent routes where traffic volumes are reduced. The thickness of the band in each area represents the magnitude of increase or decrease in volume. This graphic indicates that trips are diverted primarily from the local arterial system, with modest increases on the Ronald Reagan and the Norwood Lateral, which feed into I-75. There is some diversion shown from I-71, particularly south of the Norwood Lateral.

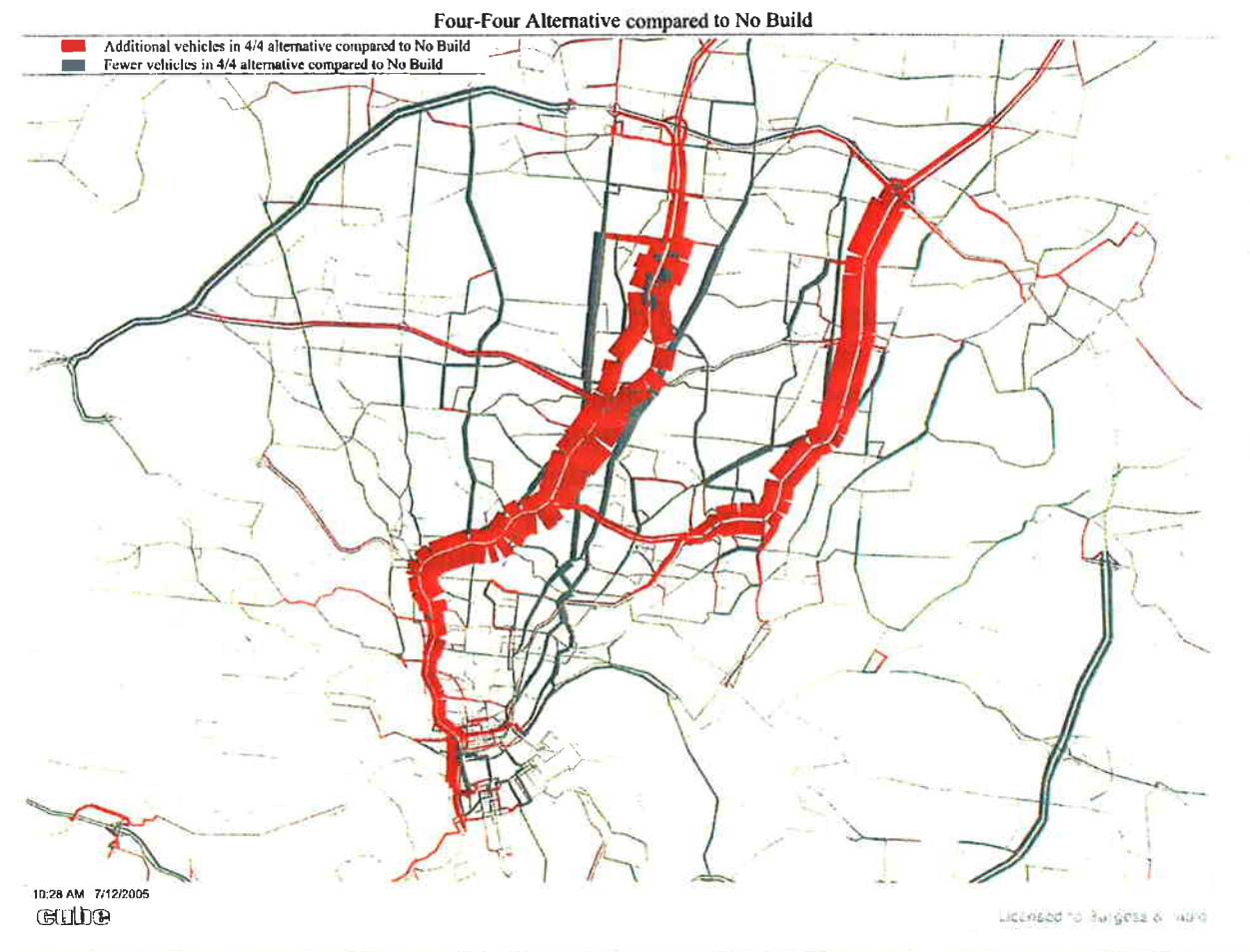


The graphic below illustrates the results for the five-lane alternative compared to the No Build case. Again, the thickness of the band in each area represents the magnitude of increase or decrease in volume. This graphic indicates approximately the same magnitude of trips diverted from the local arterial system, but shows greater diversions from I-71 and I-275. This results in additional increases on the Ronald Reagan and the Norwood Lateral. Comparing these results side-by-side indicates that traffic was drawn to I-75 from alternative routes, including I-71, in both build scenarios, but much more so and from a greater distance in the five-lane option.



So what does this mean? It could be interpreted that additional capacity is needed in the system on a regional basis, which is likely in most urban settings. In order to test the effect of providing this capacity at another location, the model was coded to reflect the four-lane alternative on I-75, but with an additional lane on I-71. In other words, the same number of additional interstate lanes as in the five-lane option, but split between two routes.

The results of this additional modeling analysis, shown below, indicate that four-lane directional capacity on both I-71 and I-75 would eliminate the attraction of traffic from I-71 to I-75. Also eliminated in this scenario is much of the east-west traffic progression between the two Interstate routes.



I-75 MILL CREEK EXPRESSWAY EVALUATION OF FOUR-LANE VERSUS FIVE-LANE

Traffic Volumes and Levels of Service

TranSystems performed capacity analyses for each segment of IR 75 between the Western Hills Viaduct and Paddock Road to evaluate four-lane and five-lane continuity alternatives for the northbound and southbound directions. Highway Capacity Software (HCS) was used to calculate level-of-service results using design year (2030) traffic volumes extracted from the OKI regional travel demand model for each alternative. As noted elsewhere, the model projected that traffic demand on IR 75 would increase as the number of travel lanes increase. Thus, higher traffic volumes were input into the capacity analyses for a five-lane section as compared to the four-lane option.

Freeway capacity was calculated per FHWA's published policy. The calculation procedure accounts for the free-flow speed, heavy vehicle percentage, location (urban versus rural), peak hour factor and the number of travel lanes. This manual procedure indicated that IR 75 would operate with a capacity of 7,886 vehicles per hour with four lanes or a capacity of 9,857 vehicles per hour with five lanes. These values were used to compute volume to capacity (v/c) ratios for each segment. The v/c ratio indicates whether the freeway segment in question can carry the traffic destined for it.

The summary table on the following page details the results of the 2030 AM and PM design hour capacity analyses. The results suggest that the v/c ratio would decrease (i.e., improve) in all segments along the IR 75 corridor with the five-lane concept as compared to the four-lane option although overall hourly traffic volumes will increase. However, failures would still occur on the IR 75 mainline in several locations even with the additional through lane in both directions.

While some freeway segments would no longer fail independently, other segments would continue to fail thus resulting in vehicular queuing within the corridor. The following locations will continue to operate at LOS F in the five-lane scenario:

- ◆ IR 75 Southbound from Paddock to Towne - AM Hour
- ◆ IR 75 Southbound from IR 74 to Hopple - AM Hour
- ◆ IR 75 Southbound from Hopple to Western Hills - AM Hour
- ◆ IR 75 Northbound from Bates to I-74 - PM Hour

It can be concluded that travel delay would decrease with the construction of a fifth lane, yet congestion related to capacity constraints would not be fully alleviated. Therefore, the four-lane continuity alternative will provide a measurable improvement in traffic operations. The five-lane continuity alternative would provide greater improvement, but not fully eliminate congestion.

Freeway Segment	Alt.	Southbound						Northbound					
		AM			PM			AM			PM		
		Volume	FHWA v/c	HCS LOS	Volume	FHWA v/c	HCS LOS	Volume	FHWA v/c	HCS LOS	Volume	FHWA v/c	HCS LOS
W.H. to Hopple	Four Lane	9,597	1.22	F	7,756	0.98	E	7,698	0.98	E	9,242	1.17	F
	Five Lane	10,649	1.08	F	7,890	0.80	D	7,904	0.80	D	9,523	0.97	E
Hopple to Bates	Four Lane	10,227	1.30	F	8,459	1.07	F	7,228	0.92	E	8,931	1.13	F
	Five Lane	11,096	1.13	F	8,595	0.87	D	7,430	0.75	D	9,178	0.93	E
Bates to I-74	Four Lane	Same as Hopple to Bates						7,475	0.95	E	9,651	1.22	F
	Five Lane							7,681	0.78	D	9,905	1.00	F
I-74 Interchange	Four Lane	6,341	0.80	D	6,447	0.82	D	5,656	0.72	D	5,533	0.70	D
	Five Lane	7,038	0.71	D	6,545	0.66	C	5,850	0.59	C	5,769	0.59	C
I-74 to Mitchell	Four Lane	7,265	0.92	E	8,106	1.03	F	7,821	0.99	E	6,731	0.85	D
	Five Lane	7,945	0.81	D	8,197	0.83	D	8,042	0.82	D	6,978	0.71	D
Mitchell to SR 562	Four Lane	8,477	1.07	F	8,134	1.03	F	7,730	0.98	E	7,403	0.94	E
	Five Lane	9,035	0.92	E	8,208	0.83	D	7,910	0.80	D	7,651	0.78	D
SR562 to Towne	Four Lane	Same as Towne to Paddock						8,144	1.03	F	7,210	0.91	E
	Five Lane							8,325	0.84	D	7,469	0.76	D
Towne to Paddock	Four Lane	9,323	1.18	F	8,515	1.08	F	7,980	1.01	F	7,949	1.01	F
	Five Lane	9,876	1.00	F	8,577	0.87	D	8,187	0.83	D	8,239	0.84	D

It should be noted that the number of lanes to be provided for I-75 south of I-74 may depend, in some degree, on the plan for improvements south of this area, currently under study in the Brent Spence Bridge project (HAM-71/75-0.00). Additional capacity needs to be provided south of I-74, but may not be reasonable to provide if no additional through lanes are added south of this point. One option, currently being carried forward for consideration, provides four-lanes in each direction north of I-74 and five lanes in each direction south of this point.

Environmental and Community Impacts

TranSystems utilized the existing GIS database to estimate additional impacts to parcels, structures, parkland and environmental resources for the five-lane option. A preliminary alignment, profile and work limits were developed to approximate the proposed right-of-way for the Five-Lane Continuity alternative. These limits were compared to the Four-Lane Continuity limits to assess additional impacts of the added lane.

Property Impacts & Relocations - Existing r/w limits are not well established at this point in the process. However, based upon preliminary information, it is expected that the Five-lane Continuity option would impact approximately 12 additional acres of property. Potential building relocations would increase by 2 homes and 3 businesses. Based upon the Hamilton County Auditor's data, the current value for the 2 homes would be roughly \$ 85,000, with \$ 4.5 million for the 3 businesses.

Park Impacts - Mt. Storm Park, located within the Clifton neighborhood of Cincinnati, abuts the Mill Creek Expressway Project just north of the I-74 interchange. The park sits on 57 acres of land that rises steeply from the highway to a grassy peak which includes a parking area, two shelters and a playground. Either alternative would have similar impacts to this property.

Maple Avenue Park is a ballfield located west of the highway. It is avoided by the 4-lane option, but would experience approximately 0.04 acres of impact from the 5-lane option.

Bank Avenue Park/Landfill - Bank Avenue Park, a former St. Bernard landfill, is currently a park with ball fields located east of the existing highway just north of the Mitchell Avenue interchange. Approximately 0.25 acres would be affected by the four-lane option. The five-lane option would increase this impact to approximately 0.38 acres. This site is pending a Phase II Environmental Site Assessment to determine the limits and existing infrastructure of the closed landfill.

Mill Creek - The five-lane alternative could potentially encroach upon the channelized Mill Creek, west of the highway just north of the Mitchell Avenue interchange. The arrangement of the Mill Creek on the west and existing homes and the former St. Bernard landfill east of the highway create a "pinch point." The close proximity of the river, homes and former landfill in combination with a substandard curve make all of these resources potentially affected by the five-lane alternative.

Conceptual Cost

The current committed funding for this project for construction is \$80 million TRAC and \$31.543 million Multi-Lane, for a total current budget for construction of approximately \$111 million.

The conceptual-level cost difference between the 5-lane and 4-lane mainline alternatives is shown in the table below. Major differentiating cost drivers have been provided on separate lines. The costs for construction are based on 2005 unit prices with a 25% contingency.

Mainline Alternative Cost Comparison¹

	4-Lane Alternative	5-Lane Alternative
Project Total⁴	\$243 Million	\$307 Million
<i>Major Cost Differentiators</i>		
- Pavement	\$51.1 Million	\$56.7 Million
- Retaining Walls	\$23.6 Million	\$35.9 Million
- Bridges	\$42.0 Million	\$66.4 Million ²
- Excavation	\$9.6 Million	\$10.9 Million
- Embankment	\$2.4 Million	\$2.8 Million
Utility Relocation		+ \$1.2 Million

NOTES:

1. All construction figures in table are shown with the 25% contingency, 3.5% inflation to 2013. The project cost includes 8% for design.
2. Cost increase includes widening at-grade bridges 24', replacing Ludlow Viaduct structure within State's ROW, and replacing the entire Paddock Road Over I-75 structure in kind.
3. Utility relocations are shown here as an increase or decrease in cost between the 4-Lane and 5-Lane alternatives. Impacts include major transmission facilities and billboards.
4. Preliminary r/w estimate for 4-lane option is still in development, so this is not included in the cost comparison above. Auditor's data suggests that additional relocations for 5-lane option would increase the cost difference by an additional \$6 million.

It is important to note that preliminary information suggests that the four-lane option will not require the replacement of the major structure known as the Ludlow Viaduct nor the recently completed Paddock Road bridge. Both of these structures would be impacted by the five-lane option.

Summary for Mill Creek Expressway

- While each segment would have an improved v/c ratio under the five-lane option, three segments in the southbound direction and one in the northbound would still fail in the design year, resulting in queues in adjacent sections.
- An additional 12 acres of right-of-way and 5 relocations will be required for the five-lane continuity alternative compared to the four-lane option.
- Additional park impacts would result from the five-lane option that are avoided by the four-lane option, including impacts to the Maple Avenue park.
- Cemetery and landfill issues would result from the five-lane option that would need to be avoided with retaining walls or mitigated
- The five-lane continuity option would be expected to have a project cost of approximately \$307 million, compared to \$243 million for the four-lane option.



Recently completed Paddock Road bridge

The construction cost of the Five-Lane Continuity Alternative would include more than just the additional pavement costs. A fifth lane would require the removal and relocation of the I-75/SR 126 bridge piers in order to accommodate the additional width. Structure replacement costs along the interstate increase as well with the additional pavement width required. The fifth lane would also require additional relocations and right of way, as discussed below. Cost associated with work to be performed along SR 126 due to the widening was included as part of this estimate.

The relocation impacts and costs were estimated based on the right-of-way being 12 feet wider than for the Four-Lane Continuity Alternative. The Five-Lane Continuity Alternative will require additional acreage and more relocations of homes and businesses, thus increasing the overall project cost. Currently, the Four-Lane Continuity Alternative would require eight acres of new right-of-way and 25 relocations. The Five-Lane Continuity Alternative would require 16 acres of new right-of-way and 51 relocations. Therefore, the Five-Lane Continuity Alternative would require an additional eight acres of new right-of-way and 26 additional relocations.

Major Impacts of Adding the 5th Lane

Adding a fifth lane results in ripple effects, particularly in the vicinity of SR 126, that represents a large portion of the increased construction cost for the Five-Lane Continuity Alternative. Following are a few key points to consider if the five-lane option were to be carried forward.

The I-75 NB ramp to SR126 WB will have a tighter radius than it does now. Any adjustment to the ramp, will impact EB SR 126, EB SR 126 ramp to NB I-75, and NB I-75 ramp to EB SR 126.

SR 126 and connection ramps to I-75 SB will need to be adjusted, including relocation of SR 126 alignment, relocation of retaining walls, and possible impacts to electrical pylons.



I-75 NB under SR126, showing proximity of bridge piers to I-75 existing edge of pavement.

Overpass structures for SR 126 will need to be replaced, their piers and abutments do not allow for five lanes plus full width shoulder.

Right of way encroaches on Forrer Road as well as the high school before the split.

Summary for Thru the Valley

The below list summarizes the main differences from the analysis of the Four-Lane Continuity and Five-Lane Continuity alternatives:

- Three of the seven northbound I-75 links will be improved by one incremental level of service, and three of the five southbound I-75 links will be improved by one incremental level of service.
- Three of the northbound I-75 links and two of the five southbound I-75 links will be at LOS E for the Five-Lane Continuity Alternative.
- An additional eight acres of right-of-way and 26 relocations will be required for the Five-Lane Continuity Alternative.
- In addition to increased right-of-way impacts, more structures would need to be relocated, and there would be additional ecological resources and history/architecture sites impacted for the Five-Lane Continuity Alternative.
- The Five-Lane Continuity Alternative would have an overall cost of \$296 million, which is \$143 million more than the Four-Lane Continuity Alternative.

DECISION FACTORS

In determining the decision of whether to carry forward the five-lane continuity option, several factors need to be considered: environmental and property impacts, cost and implementation schedule, and operational benefits.

The property and environmental impacts, particular to parks and neighborhoods, are greater for the five lane option. This is especially challenging where the roadway is constrained by the Mill Creek, the railroad, and the hillside. The four-lane alternative has impacts on homes, businesses and park properties, but these are increased for the five-lane option. Considered alone, this may not be that large of an issue. If the Purpose and Need requires LOS D, then these impacts would be an accepted consequence of the project. However, the community is likely to view these impacts particularly unfavorably considering the NSTI recommendation to pursue the four-lane option.

Operational benefit is provided from I-74 to the north by the four-lane continuity option compared to the No Build. (The potential for a fifth lane is needed to provide any improvement south of I-74 where it is already four lanes in each direction.) While the addition of a fifth through lane in each direction in this area does provide an additional improvement in level of service, it does not achieve the LOS D standard that is typically desired throughout the project length. If a fifth lane is going to be required due to meeting this standard for portions of the project length, then we must also consider addition of a sixth lane to achieve LOS D south of I-74 and north of Galbraith Road.

Lanes added to urban interstates quickly fill up. We know that adding lanes on I-75 will pull traffic from other routes. The more lanes that are added the more traffic that is

diverted and from farther away. The model results indicate that traffic is drawn from I-275 and I-71 in a substantial amount in the five-lane scenario, resulting in traffic increases on the lateral routes. This shows that additional capacity is needed in the system as a whole -- I-75 would not be the choice for much of this traffic if I-71 also had four lanes, for example. Since the operational benefit of additional lanes on I-75 is eroded by diversion of traffic from other routes, it begs the question of whether this additional capacity is better provided elsewhere in the system.

Lastly, the additional cost of the fifth lane needs to be considered. Adding the fifth lane in the Mill Creek Expressway area would add approximately \$64 million to the project cost, with \$143 million additional in the Through the Valley section. Since funds are not unlimited, it must be considered whether this additional lane on I-75 is the best use of these additional resources.

Level of Service is not one of the thirteen specific controlling criteria that require a design exception. That is, as a matter of policy, ODOT may choose to accept a lesser level of service in the design year on I-75, rather than be committed to five, six or even seven lanes in each direction in order to achieve LOS D. Volume/Capacity ratio is only one of a number of relevant factors and impacts to be considered in reaching a decision about the most practical, prudent and feasible use of available and anticipated resources.

Addition of a fourth lane provides a 33% increase in capacity and a calculable improvement in level of service. The associated improvements to roadway geometry, closure of access points, correction of merge and weave conditions, and elimination of design deficiencies will provide additional benefit in experienced capacity along the corridor, resulting in improved reliability of travel times which is probably more important than carrying capacity alone.

The geometric improvements and added capacity of one additional lane would have a significant impact to the safety of the motoring public. Although there is no quantitative measure to compare a one lane to two lane addition scenario from a safety perspective, we can reasonably assume that a second additional lane would have a much smaller impact compared to the improved geometrics (especially inside shoulder width) and one additional lane. The addition of two or more lanes would most likely have a much smaller rate of return in comparison to the one lane addition with geometric improvements. So, from a safety standpoint, the one lane addition with geometric improvements would provide a major long term improvement to the safety of this portion of the I75 corridor.

When considered as a dynamic network, the regional transportation system would be best served by limiting the impacts to the I-75 corridor while at the same time providing

significant improvement to the safety and operational function of the roadway by constructing a fourth lane in each direction.

It is recognized that this facility will require consideration of other strategies to manage congestion rather than providing additional lanes. Improvements to the IR-75 Corridor will incorporate transportation demand management strategies to mitigate the impact on the freeway of a build solution that accepts a reduced level of service in the design year. District Eight is implementing a system level ramp metering project on the IR-74 corridor scheduled for construction in fiscal year 2007, providing regional familiarity with the concept. Each interchange along the IR-75 corridor will be evaluated and designed to be compatible with future ramp metering. Use of ITS for travel demand management and incident response will be evaluated and enhancements incorporated that will improve the delivery of these services. The value of special purpose lanes (HOT, HOV and Busway) will be reevaluated for implementation when the freeway reaches an unacceptable level of service.

