7.0 Conceptual Alternatives – Central Viaduct Bridge

Chapter 7 details the Central Viaduct Bridge section of the Project. The chapter consists of four sections:

- 7.1 Background – This discussion reviews the section’s location within the corridor, its surrounding land uses, and its access locations. In addition, the needs for action identified during the Study are outlined.
- 7.2 Development of Conceptual Alternatives – This discussion details the development process from the Study’s Design Concept and Scope to the selection of three Central Viaduct Bridge conceptual alternatives: Widen / Rehabilitate Existing, Northern Hybrid, and Southern Hybrid Alternatives.
- 7.3 Conceptual Alternatives – This discussion describes the proposed improvements that comprise the Widen / Rehabilitate Existing, Northern Hybrid, and Southern Hybrid Alternatives, in addition to the No-Build Alternative.
- 7.4 Conceptual Alternatives Analysis and Conclusions – This discussion summarizes the detailed conceptual alternatives analysis and names the Northern and Southern Hybrid Alternatives to be carried forward into the Feasible Alternative analysis phase of the Project – Step 6.

7.1 Central Viaduct Bridge: Background

Location

The Central Viaduct Bridge section (Figure 7-1) is south of the Central Interchange section (Chapter 6) and north of the Southern Innerbelt section (Chapter 8). It consists of I-90 south of Broadway Avenue and north of the I-71/I-90/I-490 interchange. The Central Viaduct Bridge crosses the Cuyahoga River Valley with an overall structure length of 5,079 feet. It consists of eight total lanes and carries approximately 128,000 vehicles a day. It has been in continuous service since opening in 1959.

The Central Viaduct Bridge section is south and west of the City of Cleveland Central Business District (CBD). It spans the historic Cuyahoga River Valley and the Industrial Valley. Land uses under the bridge consist of commercial uses along the valley edge on sides of the river and sand and gravel storage/transshipment activities near the river. South of the Central Viaduct Bridge is the historic Tremont residential neighborhood containing a large National Register Historic District using I-90 as its western border. The Tremont neighborhood has struggled through an extended period of disinvestment and has emerged as a desirable urban residential neighborhood and destination entertainment area.

The Central Viaduct Bridge is a primary river crossing, moving Interstate traffic from the south (I-71) and west (I-90) across the Cuyahoga River to the downtown distribution system of the Central Interchange and the Innerbelt Trench. There are four other river crossings available: the SR 2 Maine Avenue Bridge, the U.S. 6/20 Veterans Memorial Detroit Superior Bridge, the SR 10 Lorain Carnegie Hope Memorial Bridge, and the I-490 bridge. Of these, only I-490 serves Interstate traffic. The Central Viaduct Bridge is intertwined with the Central Interchange, in that several of the ramps in the Central Interchange connect directly to the Central Viaduct Bridge.
The Central Viaduct Bridge, which is identified as CUY-90-152A, is comprised of three structures. The rear approach structure on the west side of the river spans over Fairfield Avenue, Abbey Avenue and University Road. The main spans (truss spans) pass over the Cuyahoga River, industrial land uses, Norfolk-Southern (NS) trestle, Harrison Street, West 4th Street, West 3rd Street, CSX tracks, and Canal Road, all of which are in the lower valley area. The forward approach structure spans over Commercial Road, the Greater Cleveland Regional Transit Authority (GCRTA) tracks, and Broadway Avenue. A detailed description of the Bridge is found in Chapter 3 of the Existing and Future Conditions Report, completed as part of the MIS for the Project.

The I-90 / Abbey Avenue / West 14th Street interchange works in tandem with the I-71 / West 14th Street interchange south of the I-71 / I-90 / I-490 interchange. The I-71 / West 14th Street interchange provides access to the Tremont and Ohio City from and to the south, while the I-90 / Abbey Avenue / West 14th Street interchange provides access to and from the north and east. The I-90 / Abbey Avenue / West 14th Street interchange has a ramp to eastbound I-90 and a ramp from westbound I-90.

**Needs**

Four needs were identified for the Innerbelt Freeway in the draft Purpose and Need statement completed in April 2003: (1) improve physical condition of existing bridge decks and roadway pavements; (2) improve operational performance; (3) improve safety; and (4) balance access.

There is a need to improve the physical condition of existing bridge decks and roadway pavements of the Central Viaduct Bridge section prior to the end of the anticipated renewal period (2017). This need is founded upon two factors: First, the Central Viaduct Bridge was constructed in 1959 and is approaching its 50th anniversary. Consequently, ODOT commissioned several studies to inspect and test the Central Viaduct Bridge. These include the following:

- Burgess & Niple, Inc. *Physical Condition Report Bridge No. CB4-90-1524 Central Viaduct Bridge, February 2001*;
- URS, *Load Rating and Fatigue Evaluation Report, June 2002*; and
- Richland Engineering Limited; BBC&M Engineering, Inc.; Robert Liang, University of Akron; Arthur Huckelbridge, Case Western Reserve University, *Preliminary West End Slope and Substructure Evaluation, April 2005*.

The deck condition survey determined that chloride ions are present in sufficient concentrations within the bridge deck of the Central Viaduct Bridge to cause the corrosion of the reinforcing steel. Corrosion of the reinforcing steel was observed in 33 percent of the samples, corrosion of the stay-in-place deck forms was observed in 30 percent, and delamination of the bridge deck was observed in 10 percent of the samples. These findings are consistent with findings on other Interstate bridge decks of similar age and construction.

Based on the performance of other Interstate bridges of similar age and construction, all of the bridge decks need to be replaced. Furthermore, the result of these studies showed that the existing structure, with structure rehabilitation and periodic maintenance, can realize at least an additional 50 years of service life.

Second, the roadway pavements had a Pavement Condition Rating (PCR) of 93-94 in 2002. A PCR of 100 represents a perfect / new roadway pavement with no observable distress, while a PCR of 0 represents roadway pavement with all distress types present at high levels of severity and extent. Based on the prediction that the PCR will fall below 75 in 2007, there is a need for rehabilitation per ODOT’s Pavement Design and Selection Process.

There is a need to improve operational performance to achieve a minimum Level of Service (LOS) of D. The ODOT standard for Interstate freeway LOS is C. Since the study area is within an urbanized area, the Northeast Ohio Areawide Coordinating Agency has established a level-of-service goal of LOS D for urbanized freeways. As such, LOS D was set as the minimum acceptable LOS for evaluation of alternatives. Alternatives that did not meet this criterion due to localized LOS failures were assumed to be correctable during detailed alternatives analysis in Step 6. Any alternative that exhibited level-of-service failures (LOS E and F) at multiple locations in the alternative was considered unacceptable.

During the existing AM peak hour, congestion along eastbound I-90 through this section is caused by the weaving condition created between the I-71 / I-90 merge in the Southern Innerbelt Section and the CBD exits in the Central Interchange. Traffic in the inner two lanes from I-71, bound for the CBD, move to the outer two lanes from I-90, to exit at the Central Interchange. Through traffic in the outer two lanes from I-90 moves into the inner two lanes, for east side destinations. This is intensified by congestion on the Ontario Street and East 9th Street exit ramps, combined with the downtown intersection congestion at Ontario Street / Carnegie Avenue and East 9th Street / Carnegie Avenue. Congestion from these ramps and intersections causes backups onto I-90 in the right two lanes. The left two lanes then experience free-flow conditions into the Innerbelt Trench section. As the AM peak hour progresses, the backup extends through the Jennings Freeway merge (Chapter 8) and south to the Metro Curve. During the PM peak hour, westbound I-90 fails through this section due to the I-90 diverge in the I-71 / I-90 / I-490 interchange and the merge and weave areas of the Ontario Street, East 9th Street and East 14th Street entrance-ramps. This congestion then extends upstream.

In the future (2025), the AM and PM peak hour operational performance through the Central Viaduct Bridge section appears to improve; however, this is due to a severe congestion phenomenon. During the AM peak hour, congestion along northbound I-71 in the Southern Innerbelt is to a level where the bottleneck in the I-71 / I-90 / I-490 interchange meters traffic entering the Central Viaduct Bridge section, effectively improving operational performance. During the existing PM peak hour, congestion along westbound I-90 through the Central Interchange is to a level where it effectively limits the number of vehicles that can get through to the Central Viaduct Bridge section, which improves operational performance of the Central Viaduct Bridge section. If the bottleneck in the I-71 / I-90 / I-490 interchange and the Central Interchange were fixed, the Central Viaduct Bridge section of I-90 would then fail in both directions.

There is a need to improve safety. The Study established that there is a direct link between the system configuration, operational performance, and safety. Based on a crash analysis covering 1997 through 1999, safety problems associated with the design (design deficiencies) and operational performance of the freeway...
have been identified. The crash rate for eastbound I-90 (2.76/MVM) is 2.3 times higher than the regional freeway average of 1.2/MVM and 3.1 times higher than the statewide urban Interstate average of 0.8777/MVM. The crash rate for westbound I-90 (5.49/MVM) is 4.6 times higher than the regional freeway average and 6.3 times higher than the statewide urban Interstate average. Rear-end crashes account for 66.3 percent and 63.9 percent of crashes in the eastbound and westbound directions, respectively. These rates are approximately 2.5 times the statewide average of 26 percent.

In the eastbound direction, the elevated crash rate can be attributed primarily to the inability of drivers to safely adjust their travel speed in response to the daily recurring congestion that results from the numerous closely spaced entrance and exit ramps. In the westbound direction, the elevated rate was attributed primarily to a combination of the inability of drivers to safely enter and exit the Innerbelt Freeway from the numerous closely spaced ramps and the inability of drivers to safely adjust their travel speed in response to the daily recurring congestion that results from the numerous closely spaced entrance and exit ramps and in response to the slowing of traffic in advance of the I-71/I-90 split in the Southern Innerbelt section.

Since operational performance and safety are directly linked to the roadway configuration, improving them includes correcting the existing freeway configuration to modern standards. During the Planning Phase of the Project, the Study determined three types of design deficiencies in particular contribute to safety and operational performance problems along the Innerbelt Freeway: (1) improper reductions in the basic number of lanes (freeway); (2) inadequate acceleration, deceleration, weave or terminal spacing lengths (freeway ramps); and (3) inadequate curve radius (freeway mainline). From this list, one instance from the second type can be found in the Central Viaduct Bridge section. The exit ramp to Abbey Avenue / West 14th Street has an inadequate deceleration length.

Finally, there is a need to balance access with operational performance and safety. Per ODOT standards, average urban interchange spacing should not be less than two miles with a minimum distance between each interchange of not less than one mile. The existing interchange spacing does not meet the minimum. The approximate distance between the Abbey Avenue / West 14th Street and Broadway Avenue / Ontario Street interchanges is 4,000 feet. The I-71 / I-90 / I-490 interchange is approximately 3,800 feet south of the Abbey Avenue / West 14th Street interchange. The East 9th Street interchange is approximately 700 feet north of the Broadway Avenue / Ontario Street interchange. The current average service interchange spacing limits the potential to improve operational performance and safety.

The Tremont neighborhood of Cleveland is served by a split diamond interchange with one half located on the south end of the neighborhood by the SR 176/Jennings and I-71 merge and the other at Abhy/West 14th on the southern end of the Central Viaduct Bridge. The existing pattern of redevelopment within the Tremont and Ohio City neighborhoods has taken advantage of the access to and from the CBD that this northern half of the interchange provides. Further, inside the interchange, local roadways directly connect the Tremont and Ohio City neighborhoods. Ease of access has enabled the development of a large concentration of in-fill housing, restaurants and businesses that cater to CBD workers. Abbey Avenue provides access to the businesses and attractions (e.g. West Side Market) in Ohio City for both CBD and Tremont oriented travelers. For example, the closest grocery store for both CBD and Tremont residents is in Ohio City. Loss of connectivity to these important resources would be inconsistent with the current development patterns. Thus, in order to maintain the viability of the existing development and foster additional development, there is a need to maintain this access point.

There is a need to balance the number of access points with the demand for access while providing for mainline freeway and local street system safety and operational efficiency.

See Chapter 6 for discussion of access issues associated with the Industrial Valley on the east end of the Central Viaduct bridge.

7.2 Central Viaduct Bridge: Development of Conceptual Alternatives

Figures 3-3a, 3-3b, 3-3c and 7-2 show the progression of the Central Viaduct alternatives through the development of conceptual alternatives and the selection of the three conceptual alternatives to be analyzed. As shown, the development of Central Viaduct conceptual alternatives can be characterized by three concepts: widen/rehabilitate existing, northern alignment and southern alignment.

Once five travel lanes (10 total lanes) have been provided on the Central Viaduct, there are few operational problems to address. While alternative development for the other sections of the Project needed to focus on numerous initial iterations in order to find alternatives that had acceptable geometry and operation, this was not the case with the Central Viaduct. However, as the process for development of conceptual alternatives continued, public involvement was intensified to help refine the alternatives, with a specific focus on alignment and accessibility. Figures illustrating the development of conceptual alternatives discussed in this section are located in Appendix D of this report.

Widen/Rehabilitate Existing

At the beginning of alternative development, analysis supported the ability of the existing bridge to carry the necessary 10 travel lanes with minimal inside and outside shoulders. These analyses indicated that the bridge could not be widened further due to structural limitations. Additional width would require the construction of a parallel truss line, which would result in a longitudinal joint within the travel lanes.

Based on this, Central Viaduct 1 alternative was developed. This alternative assumed a re-decking and replacement of stringers on the existing bridge. The bridge would be widened to carry 5 lanes in each direction, with the inclusion of minimal inside and outside shoulders (4 foot). The need for 5 lanes of mainline I-90 capacity in each direction between the I-71/I-90/I-490 interchange and the Ontario Street entrance/exit ramps in the Central Interchange area had been determined during the planning study and was reconfirmed with the operational modeling of the initial alternatives developed in Step 5. Since there was an order of magnitude difference in cost between re-decking the existing structure and building a new structure, initially new bridge alignments were not considered unless for other reasons. There were some concerns raised regarding the ability of the existing structure to also carry the load of the Abbey Avenue and West 14th Street ramps, but a final determination of this would need to wait for further structural analysis.

At Workshop 4 held on September 16, 2004, ODOT structural engineers began to question the efficacy of rehabilitating the existing Central Viaduct with a widened deck to carry 10 lanes. Historically, there has been a problem with movement of the west end pier due to poor soil conditions. In 1996 ODOT undertook

August 11, 2006
Figure 7-2: Development of Conceptual Alternatives Flow Diagram for Central Viaduct
actions to arrest this movement. The pier has been monitored continuously for movement since that time. At this time the corrective actions seemed to be working, but ODOT raised questions regarding the impact a widened deck and additional load might have on the substructures.

At this time it was recommended that the engineering team begin to develop an alternative to the rehabilitation in the event that the existing structure could not be used. It was also decided that ODOT would commission additional geotechnical analysis at this location.

Based on structural analysis completed on the existing structure, it was discovered that the extent of widening to accommodate the Abbey/West 14th Street interchange ramps could not practically be supported by the existing structure. These ramps function as the northern ramps of a split interchange, with the southern portion of the interchange located at West 14th Street and Holmden Avenue in southern Tremont. As such, development began on an alternative which relocated this interchange further south on the I-90/I-71 alignment. Possible new interchanges were studied at Clark Avenue, Castle Avenue, Starkweather Avenue, and Kenilworth Avenue, as well as at the current location at Abbey Avenue / Fairfield Avenue / West 14th Street. Because of property impacts and stakeholder concerns voiced at a meeting with the Tremont West Development Corporation (11-10-04), alternative possibilities at Castle, Starkweather, and Kenilworth Avenues were removed from further consideration. An alternative was possible at Clark Avenue.

By relocating the Abbey/West 14th Street portion of the Tremont interchange to Clark Avenue as part of Central Viaduct 3, several things were accomplished. First, the potential for cut-through traffic along West 14th Street was all but eliminated. Second, the distance between the south and north ends of this split interchange was greatly reduced. However, at the aforementioned meeting with Tremont West CDC, other concerns with this alternative were raised. There is a school located just west of the proposed Clark Avenue interchange and strong opposition to increasing traffic in the vicinity of this school was expressed. Further, the Tremont neighborhood business have developed based on the access provided by the Abbey/West 14th Street ramps, which provide traffic coming from the CBD a convenient off-ramp to access northern Tremont and Ohio City and then an easy on-ramp for the return trip. However, moving the access to Clark Avenue was the only workable alternative developed that would allow reconstruction of the existing Central Viaduct. As such, this alternative was selected as a conceptual alternative and renamed the Widen/Rehabilitate Existing alternative.

Between Workshop 4 (September 2004) and Workshop 7 (April 2005) major efforts were undertaken to develop new Central Viaduct alternatives to address the outstanding issues of access at Abbey Avenue and West 14th Street and the potentially problematic geotechnical conditions on the west slope of the river valley. In concert with the community objections raised to the Clark Avenue interchange option, much attention was given to preserving Abbey Avenue and West 14th Street access.

To address the strong stakeholder desire to preserve access at Abbey Avenue/West 14th Street, four additional alternatives (Central Viaduct 4-7) were developed. Since it had already been determined that the existing structure could not provide access at Abbey Avenue and West 14th Street, all four new alternatives focused on new structure concepts.

Northern Alignment

The first of these new structure concepts, Central Viaduct 4, provided for a new five-lane westbound bridge with full inside and outside shoulders parallel to and north of the existing Central Viaduct. This alignment was selected to allow much of the construction of this new westbound structure to be completed off-line, dramatically reducing the impact of construction on traffic. To provide five lanes and desired inside and outside shoulders for the eastbound direction, the existing bridge will be re-decked and rehabilitated. This option allows for maintaining full existing access at Abbey Avenue and West 14th Street. This option is also superior to the Widen/Rehabilitate Existing alternative (Central Viaduct 3) as it can provide for the desired inside and outside shoulders, which that alternative could not. A further feature of this alternative is that the new westbound structure is located far enough north of the existing structure so that, in the future, when the eastbound structure would need to be replaced, right-of-way is preserved for this replacement structure. This would allow the future replacement of eastbound I-90 to be constructed off-line with minimal disruption to traffic. However, there are two possible Historic Register eligible properties along this proposed alignment—the Cold Storage building and the Broadway Mills building, which need to be evaluated further. This alternative was selected as a conceptual alternative and was renamed Northern Hybrid.

Prior to Workshop 7, the geotechnical analysis and field measurements of the west end slope revealed that, in fact, Pier 1 and the West End Pier were continuing to move. A pier stabilization project began in 1997, consisting of an ongoing program of instrumentation and measurement as well as the construction of an underground tied-back drilled shaft structure to stabilize the slope. In addition, a 6,000 ton section of superstructure was relocated to relieve built up stresses in the bridge. The drilled shaft stabilization structure did result in slowing down slope movements, but still requires periodic evaluation. After reviewing the data, ODOT engineering staff concluded that replacing the deck on the existing bridge with a 10-lane deck provided unacceptable uncertainties for the long term needs of this corridor. As such, alternatives were developed that considered a complete replacement of the Central Viaduct. Central Viaduct 6 provided for new, twin five lane structures on alignment north of the existing bridge. It was determined after analysis that additional corrective measures to the existing Central Viaduct substructures could be undertaken in a cost effective manner to arrest the pier movement and that a rehabilitation of the bridge with a new five-lane deck was a viable alternative. As such, Central Viaduct 6 was dropped from further consideration due to the ability to cost effectively rehabilitate the existing Central Viaduct. New twin spans were not deemed necessary.

Southern Alignment

During the planning phase of this project (ODOT PDP Step 3), the Cuyahoga County Planning Commission (CCPC) proposed the construction of a new signature bridge on a southern alignment parallel to the existing Central Viaduct. This proposal was put forth at the Innerbelt Scoping Committee in the Spring of 2003. It was a counter-proposal to options to widen and rehabilitate the existing bridge (Central Viaduct 1, Central Viaduct 3). This proposal became known as the CCPC proposal (CCPC 1—See Appendix D, page D-9).

The CCPC developed the concept with the intent of: providing a signature structure that would showcase the view of downtown Cleveland, recover approximately 40 acres of land in the Central Interchange area for urban redevelopment, and provide better vistas of downtown by depressing the Central Interchange.
In examination of the proposal put forth by the CCPC, an alternative that exactly corresponded with the mainline I-90 alignment shown in CCPC 1 was developed. As no ramp connections had been provided with this mainline alignment, the alternative was refined to include necessary service and system ramp connections within the Central Interchange (CCPC 2).

It was determined that the concept, as put forward, had several disadvantages:

- The configuration of such a bridge on this alignment would have a high degree of complexity and was estimated to have a much higher cost than a more conventional cable-stay bridge.
- The construction of this concept would require the closure and removal of the existing Central Viaduct for most of the duration of construction, possibly up to three years. This was contrary to the stated community goals for the project and would cause a severe congestion and maintenance of traffic problem for the community with potential adverse economic consequences.
- The concept would require trenching the entire mainline of I-90 underneath all of the streets in the Central Interchange in order to depress the freeway. Construction would require closure of access ramps to and from I-77 in the Central Interchange (shown in red on CCPC 3) throughout construction, worsening the traffic congestion situation during construction.
- The land use impacts of the southern shift of the Central Interchange would not yield the proposed 40 acres of development. In fact, only about 10 acres would be realized and this would come at the expense of three existing businesses/institutions: the Visiting Nurse Association, the Ohio Education Credit Union, and Cleveland Black Oxide.

Based on this preliminary examination of the concept, the concept was slightly revised to provide for a straighter alignment on a southern alignment and an elevated Central Interchange. This concept was included in the Innerbelt Strategic Plan and carried forward into PDP Step 5 as Central Viaduct 2.

Central Viaduct 2 included total replacement of the bridge with a new 10-lane structure. Building on the proposal made by the Cuyahoga County Planning Commission during the Study, the bridge alignment considered was south of the current bridge alignment. This replacement and re-alignment was necessary to support the greater concept being pursued—the depression of mainline I-90 in the Central Interchange area. This alternative was deemed to have serious flaws. First, the construction of this bridge would require the demolition of the existing structure leaving no I-90/I-71 access to Cleveland for at least two, and possibly three, years. Based on previous travel demand modeling done in the course of the MIS, it was known that this would result an unacceptable level of service on all alternate routes from the south and all bridges entering the city of Cleveland. During the course of the MIS, Cleveland city government and the business community all emphasized their concern about maintaining access to Cleveland throughout construction of the Project. Second, the alignment would require depressing I-90 on the east bank of the Cuyahoga River as it entered the Central Interchange. The resultant Central Interchange with a lowered grade would require the closure of numerous ramps from I-77 into the Central Business District further restricting access to the downtown during construction. While cost and complexity of construction were also discussed (this bridge alternative was estimated to be approximately $400 million more than the rehabilitation alternative), the alternative was determined to have too many disruptive impacts to be viable and was revised.

Central Viaduct 5 was developed in an attempt to improve upon Central Viaduct 2. It uses a similar concept as Central Viaduct 4, the construction of a new five-lane bridge adjacent to the existing bridge, but on the south instead of the north side. In this alternative, a new five-lane eastbound bridge with desired inside and outside shoulders would be constructed parallel to and south of the existing Central Viaduct.

The Southern Hybrid alternative provides the same lane-balance and access locations as the Northern Hybrid. In the eastbound direction, three lanes from I-71 northbound join with two lanes from I-90 eastbound to form five mainline lanes on I-90 eastbound. The West 14th Street entrance ramp enters I-90 as a merge condition, maintaining five eastbound lanes into the Central Interchange. In the westbound direction within the Central Interchange, the entrance ramp from East 18th Street enters I-90 as a merge condition, continuing four westbound lanes on I-90. Then, the entrance ramp from East 9th Street enters I-90 as an add-lane, giving I-90 four lanes. The entrance ramp from Ontario Street enters I-90 as an add-lane, pushing five westbound lanes across the Central Viaduct Bridge. The diverge to West 14th Street/Abbey Avenue is a standard high-speed diverge, continuing five lanes westbound to the I-71/I-90/I-490 interchange.

In the Southern Hybrid alternative, the new eastbound structure pulls away from the existing alignment with a 4-degree deflection angle. This angle was set to minimize the span length over the river while still missing the Greek Orthodox Church and staying off of the existing main span. This deflection angle creates 50' of separation between the two structures on the west edge of the river. This separation increases to 80' on the east edge of the river, and reaches a maximum separation of 125' in the Cuyahoga River Valley. Once in the Central Interchange, the new structure is within 40' south of the existing approach structure to the viaduct. The Southern Hybrid alignment for the Central Viaduct Bridge has implications on the design of the Central Interchange as well, which are described in Chapter 6.

This alternative was selected as a conceptual alternative, renamed Southern Hybrid, for further consideration to provide a comparison with the Northern Hybrid option.

Based on the same geotechnical analysis that resulted in the development of Central Viaduct 6, a southern alignment was developed for the complete replacement of the Central Viaduct. Central Viaduct 7 provided for new, twin five lane structures on alignment south of the existing bridge. It was determined after analysis that additional corrective measures to the existing Central Viaduct substructures could be undertaken in a cost effective manner to arrest the pier movement and that a rehabilitation of the bridge with a new five lane deck was a viable alternative. As such, Central Viaduct 7 was dropped from further consideration due to the ability to cost effectively rehabilitate the existing Central Viaduct. New twin spans were not deemed necessary.

### 7.3 Central Viaduct Bridge: Conceptual Alternatives

In addition to the No-Build Alternative, several conceptual alternatives were selected for analysis: Widen / Rehabilitate Existing Alternative (Central Viaduct 3), Northern Hybrid Alternative (Central Viaduct 4); and Southern Hybrid Alternative (Central Viaduct 5). The Central Viaduct Bridge conceptual alternatives can connect to any of the Southern Innerbelt conceptual alternatives. However, if an operationally failing alternative were selected (such as the No Build), there would be operational failures in adjacent sections.
These operational failures would result in queuing into adjacent sections that would eliminate benefits intended by the major investments proposed for adjacent sections.

Not all Central Viaduct Bridge conceptual alternatives are compatible with all of the Central Interchange conceptual alternatives. The conceptual alternatives in both of these sections must be able to accommodate the adjacent section’s number of mainline lanes and mainline alignment. For example, the Central Viaduct Bridge Southern Hybrid Alternative utilizes a southern mainline alignment; therefore, the Central Interchange conceptual alternative also needs a southern mainline alignment. Of the conceptual alternatives developed, only the Southern Alternative in the Central Interchange utilizes a southern mainline alignment. See Table 7-1 for Central Interchange / Central Viaduct Bridge conceptual alternatives compatibility.

<table>
<thead>
<tr>
<th>Central Viaduct Bridge</th>
<th>No-Build</th>
<th>Dedicated I-77</th>
<th>Shared I-77</th>
<th>Indirect I-77</th>
<th>Dual Intersections</th>
<th>Southern</th>
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No-Build Alternative

The Central Viaduct Bridge No-Build Alternative (Figure 7-3) serves as the baseline alternative. Because this section of the Innerbelt was built in the late 1950s, the bridges and roadway pavements are in need of reconstruction. Under the No-Build Alternative, the Central Viaduct Bridge will be re-decked. Ramp and connecting roadway pavements will undergo reconstruction, including bridge deck replacement. This work only addresses the physical condition of the facility and does not address operational performance, safety, and access. Capacity is not increased and changes will not be made to lane widths, shoulder widths, bridge widths, structural capacity, horizontal / vertical alignments, grades, stopping sight distance, pavement cross slopes, super-elevation, or horizontal / vertical clearance. See Figure 7-8a for the geometric layout of the No-Build Alternative.

Widen / Rehabilitate Existing Alternative

The Widen / Rehabilitate Existing Alternative (Figure 7-4) addresses the physical condition needs by re-decking and rehabilitating the existing structure. This alternative then addresses operational performance by constructing a wider replacement bridge deck to carry five lanes of traffic in each direction. The improved operational performance will also address safety since congestion will be mitigated. Additionally, the left and right side lateral clearances (shoulders) will be widened to the minimally acceptable width of four feet. The structure is not capable of supporting the preferable deck with ten total lanes and desired 12-ft shoulders.

These improvements result in the loss of the existing access at the Abbey Avenue / West 14th Street partial diamond interchange. This interchange is the northern access point of the Tremont neighborhood. By widening the existing Central Viaduct Bridge, the rehabilitated structure is unable to carry these interchange ramps. The existing Abbey Avenue / West 14th Street would be relocated to Clark Avenue, where a new interchange is proposed (Figure 7-5). The Clark Avenue Interchange Alternative would be a partial diamond interchange, serving the same directions of Interstate travel as the I-90 / Abbey Avenue / West 14th Street interchange. This alternative utilizes the existing mainline alignment and structure; therefore, refer to the No-Build Alternative geometric layout (Figure 7-8a) for the Widen / Rehabilitate Existing Alternative mainline alignment information.

Northern Hybrid Alternative

The Central Viaduct Bridge Northern Hybrid Alternative (Figure 7-6) is the first of two alternatives that supplement the existing structure on a new alignment. The basic concept for addressing the physical condition, safety, operational performance, and access for the Northern and Southern Hybrid Alternatives is the same: replace the existing bridge deck with a new bridge deck to carry five lanes of traffic and desired outside shoulders (lateral clearances), construct a new bridge parallel to the existing Central Viaduct Bridge to carry the opposing five lanes of traffic, and constructing a new partial interchange at Abbey Avenue / West 14th Street to maintain the existing access point. This builds on the concept for the Widen / Rehabilitate Existing Alternative by not only addressing the need to improve the section’s physical condition and operational performance (and congestion-related safety issues), but also enhances safety through the construction of desired shoulders and maintains the existing access points.

What separates the Northern and Southern Hybrid Alternatives is which side the new structure will be built with respect to the existing Central Viaduct Bridge. The Northern Hybrid Alternative constructs the new bridge north (downstream) of the existing bridge. It would be configured to carry westbound traffic and the existing bridge would carry eastbound traffic. See Figure 7-9a for the geometric layout of the Northern Hybrid Alternative.

Southern Hybrid Alternative

The Central Viaduct Bridge Southern Hybrid Alternative (Figure 7-7) is the second of two alternatives that supplement the existing structure on a new alignment. The basic concept for the Northern and Southern Hybrid Alternatives is the same.

The Southern Hybrid Alternative proposes the new bridge south of the existing bridge. It would be configured to carry eastbound traffic and the existing bridge would carry westbound traffic. See Figure 7-10a for the geometric layout of the Southern Hybrid Alternative.

7.4 Central Viaduct Bridge: Conceptual Alternatives Analysis and Conclusions

The Conceptual Alternatives were evaluated and compared on how well they addressed the seven performance measures (Section 3.2.3.2). The following text and Table 7-2 summarizes and compares the Conceptual Alternatives analysis of the Central Viaduct Bridge section.
Physical Condition
The No-Build, Widen / Rehabilitate, Northern Hybrid, and Southern Hybrid Alternatives address the need to improve the physical condition of the existing bridge decks and roadway pavements of the Central Viaduct Bridge section. The alternatives differ in how it is addressed. The No-Build Alternative only replaces the existing bridge decks, rehabilitates the existing structures, and reconstructs the existing roadway pavements. In addition, the Widen / Rehabilitate Existing Alternative would construct a new interchange at Clark Avenue, involving completely new construction of pavements, bridge work, and roadside features at that location. The Northern and Southern Hybrid Alternatives include similar rehabilitated elements as the No-Build and Widen / Rehabilitate Existing Alternatives, but also involve construction of a new structure adjacent to the existing Central Viaduct Bridge. The Northern and Southern Hybrid Alternative also include the new construction and rehabilitation of the Abbey Avenue interchange.

Safety
The No-Build Alternative does not address the need to improve safety, while the three build alternatives do. All three build alternatives improve the geometric configuration of the section. The remaining deficiencies are the result of retaining the existing Central Viaduct Bridge and maintaining access to Abbey Avenue.

Found in all alternatives is a vertical curve with insufficient stopping sight distance along on the existing structure. Since the Widen / Rehabilitate Existing Alternative does not provide access to Abbey Avenue / West 14th Street, the deficiencies noted with maintaining the existing access point are not found in the alternative. The Northern and Southern Hybrid Alternative maintain this existing access point; therefore, both have deficiencies at this location. Since the Southern Hybrid Alternative utilizes much of the existing interchange configuration, it retains two of the existing deficiencies, bringing the total to three for the alternative. The existing interchange is reconfigured to accommodate the new bridge alignment of the Northern Hybrid Alternative; therefore, all but one deficiency is eliminated and the one is the result of maintaining westbound I-90 access to Abbey Avenue. An improvement found in the Northern and Southern Hybrid Alternatives is desired outside breakdown shoulders. This is not provided in the No-Build and Widen / Rehabilitate Existing Alternatives.

Regarding weaving sections, the Northern and Southern Hybrid Alternatives have one and two each, respectively. The Widen / Rehabilitate Existing Alternative does not have weaving sections because of the elimination of the Abbey Avenue / West 14th Street interchange. None of the weaves were found to be operationally deficient when they were modeled. See Figures 7-8a through 7-10c for geometric deficiency and weaving section information of the No-Build, Widen / Rehabilitate Existing, Northern Hybrid, and Southern Hybrid Alternatives.

Operational Performance
The No-Build Alternative does not address the need to improve the operational performance, whereas the build alternatives do. The operational performance of all parts of the Northern and Southern Hybrid Alternatives is acceptable during the AM and PM peak hours. The Widen / Rehabilitate Existing Alternative improves operational performance over the No-Build Alternative, but continues to show an unacceptable LOS E for westbound I-90 in the PM peak hour because of the location of the Clark Avenue Interchange. By relocating the north Tremont access south along I-71 to Clark Avenue, approximately 500 additional vehicles travel southbound on I-71 past the gore with I-90/I-490. This results in approximately 5,800 vehicles utilizing the mainline, 3 lane segment of southbound I-71 south of the I-90/I-490 gore. This increase in vehicles is sufficient to reduce the LOS of this segment to LOS F, which, in turn, impacts the upstream links. To resolve the capacity deficiency, an additional lane would need to stretch from the E. 18th Street on-ramp, which would enter westbound I-90 in an add-lane condition, to the Jennings Freeway on I-71, where this lane would drop. This would require the widened Central Viaduct Bridge to be six lanes westbound, for a total of eleven lanes, which is not structurally feasible without the construction of a parallel truss line, which would result in a longitudinal joint within the travel lanes.

Accessibility
The safety and operational performance improvements of the build alternatives, in concert with the physical capability of the existing Central Viaduct Bridge, affects accessibility through this section. Although all alternatives maintain one access point to Tremont serving traffic to eastbound I-90 and from westbound I-90, the location of the access point changes. The Northern and Southern Hybrid Alternatives maintain this access at the existing location of Abbey Avenue / West 14th Street, in northern Tremont. Since under the Widen / Rehabilitate Existing Alternative the existing structure cannot handle the widening for an additional lane and ramps, the access point is relocated to Clark Avenue. By relocating access to Clark Avenue, which is approximately one mile away, the function of the existing Abbey Avenue/West 14th Street ramps is not preserved. By moving this access location the Widen / Rehabilitate Existing Alternative fails to meet the project goals for adequate access to the neighborhoods, determined by traffic operations, proximity and consistency with land uses.

Maintenance of Traffic / Constructability
ODOT District 12 has established a policy for the Permitted Lane Closure Times for all mainline sections. For I-90 across the Central Viaduct, these permitted lane closure times have been utilized to determine the minimum number of mainline lanes required for MOT. For the Central Viaduct, it was determined that 4 lanes must be maintained to adequately provide capacity during construction. A consistent concern of the community has been the impacts of construction on the viability of downtown Cleveland. Concerns were expressed over the costs of congestion and delays, but more importantly, concerns over business decisions (e.g., relocating to the suburbs) that could have long-term negative impacts. Achieving the goal of having four lanes of traffic maintained throughout the multi-year construction period is considered a goal of the Project by the community.

The Central Viaduct Bridge No-Build Alternative is the rehabilitation of the structure and replacement of the existing bridge deck. The rehabilitation will include complete replacement of the bridge deck across the mainspan of the Central Viaduct, as well as the approach spans, encompassing the mainline segments from Fairfield Avenue to Ontario Street. No widening of the existing facility will be performed during this rehabilitation. This alternative does not have off-line construction, which is the construction of the proposed roadway separate from the existing roadway, allowing traffic to utilize the existing roadway during construction of the proposed roadway. Because no-offline construction will be done, all of the improvements will need to be done as part-width construction. This includes utilizing part of the existing roadway to build part of the reconstructed roadway, while at the same time maintaining traffic on the remaining part of the existing roadway adjacent to the construction. Using this approach, only 2 lanes of traffic can be maintained, which is well below the required 4 and would result in increased congestion, reduced safety and reduced access to the Cleveland CBD.
The Widen/Rehabilitate Existing Alternative is similar to the No-build alternative regarding the portions of mainline I-90 to be rehabilitated. However, because of the widening of the bridge deck to occur under this alternative, additional width can be provided for maintenance of traffic. Utilizing part-width construction techniques and potential innovative contracting techniques like drop-in deck panel section, three lanes could be maintained, which is less than the minimum 4 lanes required. As with the No-Build alternative, this inadequate provision of maintained lanes will result in increased congestion, reduced safety and reduced access to the Cleveland CBD.

In the Northern Hybrid Alternative, the westbound I-90 lanes are built off-line to the north of the existing Central Viaduct Bridge as a separate structure over the Cuyahoga River. The entire structure from the city’s approach to Ontario Street is built off-line and independent of the existing Central Viaduct and approach span structures. Doing this allows the westbound lanes to be built without disturbing traffic. Once the new structure is built, the westbound traffic can be shifted to the new viaduct structure. Then the existing Central Viaduct Bridge structure, carrying only the eastbound I-90 lanes, can be re-decked using part-width construction techniques while still maintaining four lanes on the existing eight-lane bridge. This alternative meets the required number of lanes for MOT, while minimizing disturbance to the existing traffic during construction.

As with the Northern Hybrid alternative, half of the Southern Hybrid Alternative alignment is built off-line. In this case, the eastbound I-90 lanes are built as a separate structure on the south side of the existing Central Viaduct Bridge. Doing this allows the eastbound lanes to be built without disturbing traffic. Once the new structure is built, the eastbound traffic can be shifted to the new viaduct structure. Then the existing Central Viaduct Bridge structure, carrying only the westbound I-90 lanes, can be re-decked using part-width construction techniques while still maintaining four lanes on the existing eight-lane bridge. This alternative meets the required number of lanes for MOT, while minimizing disturbance to the existing traffic during construction.

It is worth noting that future maintenance of traffic opportunities also are substantially different among the three build alternatives. When the existing structure requires replacement, the Widen/Rehabilitate Existing option would provide no alternative for maintaining traffic. Having a new parallel structure in the Northern Hybrid and Southern Hybrid alternatives would provide maintenance of traffic opportunities on the new structure during replacement of the existing. The Northern Hybrid has the additional advantage of the potential for being constructed substantially north of the existing structure, allowing for construction in between when the existing structure is replaced.

Environment
Since the No-Build Alternative is a basic rehabilitation of the existing facility, no significant environmental impacts are expected. The Widen / Rehabilitate Existing Alternative is similar to the No-Build Alternative, but would require shifting of the existing interchange from Abbey Avenue / West 14th Street to Clark Avenue. The existing Abbey Avenue/West 14th Street location is important due to existing development patterns in Tremont. The Tremont community considers the relocation of the Abbey Avenue/West 14th Street to have negative impacts. These included increased traffic in front of schools on Clark Avenue, concerns for pedestrians and children, and traffic back-ups on local streets in the middle of the neighborhood. The No-Build, Northern and Southern Hybrid Alternatives retain the access at the existing location.

The Northern Hybrid and Southern Hybrid Alternatives have similar commercial property impacts. The Northern Hybrid has a greater number of residential relocations. The Northern and Southern Hybrid Alternatives have similar concerns over contaminated sites with eight and six sites, respectively, proposed for detailed studies.

The Northern Hybrid and Southern Hybrid Alternatives differ in their impacts on historic properties and adjacent communities. In the Northern Hybrid Alternative, no currently designated historic sites are impacted; however, this option would necessitate the acquisition of two potential sites, namely the Broadway Mill Building and the Cold Storage Building. Neither property is currently known to be eligible for the National Register of Historic Places (NRHP); however, both properties were recommended within the Phase I History/Architecture investigations for further work to determine their eligibility.

The Southern Hybrid would require purchase of property within the Tremont National Register Historic District. The new alignment would be 33-feet away from two 8-unit row houses that are contributing elements to the District, compared to 205-feet away for the existing condition. Furthermore, the Southern Hybrid would move the main bridge closer to the Greek Orthodox Church, reducing the distance by more than half compared to the existing condition, from 120-feet to 58-feet. In addition, the W. 14th Street ramp to I-90 EB would be within 20-feet of the church, compared to 44-feet in the existing condition and the Northern Hybrid option.

In order to obtain the 20-feet of clearance, the northbound connector road from Fairfield Avenue to Abbey Avenue would have to be relocated in the Southern Hybrid option. This relocated connection would need to be constructed underneath the approach span to the Central Viaduct between the interstate on- and off-ramps. (See Figure 7-10a.) During Step 6, the viability of this relocation will be evaluated in consideration of the structural foundation requirements of the new and rehabilitated bridge structures.

Cost
The No-Build Alternative only addresses the need to improve physical condition with a total cost of $75 million. The cost of the Widen / Rehabilitate Existing Alternative is $175 million, including the Clark Avenue Interchange ($10 million). The total cost of the Northern Hybrid Alternative is estimated to range between the $295 and $410 million, depending on the new structure type. The total cost of the Southern Hybrid Alternative is estimated to range between $235 and $380 million, depending on the new structure type. The costs for the Northern and Southern Hybrid Alternatives include the cost of the Abbey Avenue / West 14th Street interchange. These costs do not include future maintenance or any ongoing programs that would be required to manage slope instability. It should be noted for the Widen/Rehabilitate Existing Alternative that if attempts were made to resolve capacity deficiencies and to provide the desired shoulder widths, cost would increase beyond current estimates.

Comparison of Alternatives
The Widen / Rehabilitate Existing, Northern Hybrid, and Southern Hybrid Alternatives address all of the needs: physical condition, operational performance, safety, and access. The No-Build Alternative only
addresses physical condition and does not address problems with operational performance and safety. Since build alternatives address all of the needs, the details of how well each alternative addressed these needs were necessary to make a selection.

The Widen / Rehabilitate Existing Alternative (Figure 7-4) with Clark Avenue Interchange (Figure 7-5) would allow avoidance of relocations, property impacts, and involvement with historic properties. However, this option retains the existing geotechnical conditions and concerns over the slope’s performance under the new load. This option also would not provide for desired 12-ft outside shoulders. This option would invest in one structure instead of two, but when the structure requires replacement, there would be no alternative available for maintaining traffic. This option would also not provide an adequate level of service due to the need for an additional lane westbound that cannot be provided due to structural limitations on widening of the existing bridge. This alternative would also not maintain the number of through lanes in accordance with ODOT’s Permitted Lane Closure Policy and would require relocating the Abbey Avenue/West 14th Street interchange to Clark Avenue, which is inconsistent with current development patterns in Tremont.

The Step 5 analysis results of Northern and Southern Hybrid Alternatives are similar for operational and safety performance. Both alternatives also maintain the Abbey Avenue / West 14th Street access point. In other factors, the Southern Hybrid has several disadvantages compared to the Northern Hybrid alternative. The new bridge north of the existing would have the potential for a shorter bridge span, would allow for better opportunities for future maintenance of traffic, and would have consequences within the Central Interchange (See Chapter 6). The Northern Hybrid would require the removal of two buildings that are recommended for further investigations to determine their eligibility for the National Register of Historic Places. The Southern Hybrid would require property purchase within the Tremont National Register Historic District and would move the freeway substantially closer to several buildings that are contributing elements to the district, including close proximity to the Greek Orthodox Church of Annunciation. It would also relocate the connector roadway between Fairfield Avenue and Abbey Avenue, which requires further evaluation in Step 6. Public sentiment was expressed against any alternative that would move the bridge closer to the church at the Public Involvement meeting held on June 14, 2005, the Advisory Committee meeting held on June 14, 2005 and in several smaller group meetings.

**Summary**

The Northern (Figure 7-6) and Southern (Figure 7-7) Hybrid Alternatives are selected to be carried forward into the Feasible Alternative analysis phase of the Project. The selection is based on the following:

- They improve safety by providing 12-ft outside shoulders.
- They operate identically and are operationally acceptable.
- They provide the ability to maintain four lanes of through traffic during construction.
- They provide the ability to retain the access at Abbey Avenue and West 14th Street, consistent with development patterns.

Based upon information available during Step 5, it appears that the Northern Hybrid Alternative is superior to the Southern Hybrid Alternative.

- The Southern Hybrid Alternative would result in impacts to the Tremont National Register Historic District, the relocation of the connector from Fairfield Avenue to Abbey Avenue, and reduce by more than half the distance from the freeway to the Greek Orthodox Church and several contributing structures within the District. Public comments consistently expressed concerns about effects on the church and on Tremont. In contrast, the Northern Hybrid Alternative would impact two buildings whose historic status is not yet known. Additional cultural resources and engineering studies will be conducted during Step 6 to expand upon this comparison and evaluate the viability of the relocated connector from Fairfield Avenue to Abbey Avenue.

- The Northern Hybrid has the advantage of the potential for being constructed substantially north of the existing structure, allowing for construction in between when the existing structure is eventually replaced. This opportunity does not exist for the Southern Hybrid Alternative without further increasing impacts in Tremont.

- The Northern Hybrid Alternative would require a shorter bridge span due to the width of the Cuyahoga River in this area.

- The Northern Hybrid is also less desirable within the adjacent Central Interchange section. For details, see Chapter 6.

As a result of these conclusions and the compatibility of the alternatives between the Central Interchange and Central Viaduct Bridge sections, two possible feasible alternatives are created for comparison in Step 6. The Central Interchange Dual Intersections Alternative and the Central Viaduct Bridge Northern Hybrid Alternative will be combined to become a northern alignment feasible alternative. Similarly, the Central Interchange Southern Alternative and the Central Viaduct Bridge Southern Hybrid Alternative will be combined to become a southern feasible alternative. This grouped comparison will provide a better picture of the differences between the northern and southern alignments to allow for a formal decision in Step 6.

*The Widen / Rehabilitate Existing Alternative (Figure 7-4) with Clark Avenue Interchange (Figure 7-5) is not being carried forward.* This option is not a prudent alternative for the following reasons:

- Structural limitations of widening of the existing bridge would allow for 10 lanes with only minimum shoulders. Additional width would require construction of a parallel truss line which would result in a longitudinal joint within the travel lanes. Due to uneven movement, this joint would create an unsafe, undesirable condition.

- This alternative would not provide for desired shoulders across the Central Viaduct. Public comments consistently expressed the need to provide for breakdown shoulders on the bridge.

- This option would fail to fully satisfy the Purpose and Need by not providing for an adequate Level of Service westbound. Capacity analyses indicate that westbound level of service will be LOS E. To resolve the capacity deficiency, an additional lane would need to stretch from the E. 18th Street on-ramp, which would enter westbound I-90 in an add-lane condition, to the Jennings Freeway on I-71, where this lane would drop. This would require the widened Central Viaduct Bridge to be six lanes.
westbound, for a total of eleven lanes, which is not structurally feasible without the addition of a parallel truss line.

- This option would require moving the Abbey Avenue/West 14th Street interchange. Moving this access location fails to meet the project goals for adequate access to the neighborhoods, determined by traffic operations, proximity and consistency with land uses. The nearest available location would be at Clark Avenue, approximately one mile away, and would provide access to a different portion of the neighborhood inconsistent with the current development patterns in Tremont.

- Geotechnical and structural analyses indicate uncertainty about the existing slope’s performance under the load of a widened bridge. Previous attempts to manage the movement of the slope under the existing bridge have slowed it and require periodic evaluation. ODOT is unwilling to accept this condition since all traffic would be carried across one structure, due to consequences for traffic across the valley if substantial maintenance would necessitate closure of the bridge.

- Although shown as the least expensive option, geotechnical uncertainties make the eventual cost of this alternative difficult to estimate. Moreover, if attempts were made to resolve capacity deficiencies and to provide the desired shoulder widths, cost would increase beyond current estimates.

- All investment would be made in one structure instead of two.

- When the structure requires replacement, there would be no alternative available for maintaining traffic. Having a new parallel structure would allow for this future maintenance of traffic.

- This option would not provide the ability to maintain the number of traffic lanes in accordance with ODOT’s Permitted Lane Closure Policy. The thresholds specified in the policy were developed based upon the number of lanes required to maintain an acceptable level of service for the traffic volumes during construction. This option would fail to provide the required number of lanes, resulting in congestion during construction more severe than that experienced in the No Build condition. Maintaining traffic during construction has consistently been expressed as a concern of the community.
Table 7-2: Alternatives Comparison

<table>
<thead>
<tr>
<th>PHYSICAL CONDITION</th>
<th>No-Build</th>
<th>Widen/ Rehabilitate</th>
<th>Northern Hybrid</th>
<th>Southern Hybrid</th>
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<td>Full-depth Replacement / New Construction</td>
<td>Full-depth Replacement / New Construction</td>
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<th>Number of Weaves</th>
<th>Design Deficiencies</th>
<th>Number of Weaves</th>
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<td>See Fig. 7-11</td>
<td>See Fig. 7-12</td>
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<td>209 (36 mph)</td>
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<tr>
<td></td>
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<td>Clark Avenue</td>
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<th>1-90 westbound / Ontario Street to I-71</th>
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<tr>
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<td>1-90 westbound / Ontario Street to I-71</td>
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Highlighted columns are conceptual alternatives that are selected to be carried forward into the Feasible Alternative analysis phase of the Project – Step 6.

*The two structures under the Northern Hybrid are potentially historic; Phase II studies are being conducted. The one District under the southern Hybrid is a National Register Historic District that is potentially impacted by that alternative.
Figure 7-7: Southern Hybrid Alternative
Figure 7-8a: No-Build Alternative Geometric Layout and Deficiencies
There are no mainline weaving sections within the Widen / Rehabilitate Existing Alternative.

**Figure 7-8c: Widen / Rehabilitate Existing Alternative Geometric Deficiencies**

<table>
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<th>Location</th>
<th>Figure 7-8a Ref. No.</th>
<th>Design Deficiency</th>
<th>Project Design Criteria</th>
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<td>I-90</td>
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<td>Stopping Sight Distance</td>
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</tr>
<tr>
<td></td>
<td>2</td>
<td>Vertical Alignment: Crest Vertical Curve</td>
<td>495' 50 mph</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Median Shoulder: 6-Lane Urban, Truck DDHV &gt; 250</td>
<td>4-5'</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Outside Shoulder: 6-Lane Urban, Truck DDHV &gt; 250</td>
<td>4-5'</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Horizontal Alignment: Lower</td>
<td>21'00'(R = 273')</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Deceleration Length</td>
<td>800'</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Ramp Terminal Spacing: Turning Roadways between I-90 and Abbey/Fairfield</td>
<td>600'</td>
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<tr>
<td></td>
<td>8</td>
<td>Taper Rate</td>
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**Totals:** 8

*Rounded up from 28 mph per ODOT L&D Sec. 104.2

**Figure 7-8a: Location and Design Manual Standards**

**Figure 7-8b: No-Build Alternative Geometric Deficiencies**

<table>
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<tr>
<th>Location</th>
<th>Figure 7-8a Ref. No.</th>
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<td>2</td>
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<td>4</td>
<td>Outside Shoulder: 6-Lane Urban, Truck DDHV &gt; 250</td>
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<td>Horizontal Alignment: Lower</td>
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<td>7</td>
<td>Ramp Terminal Spacing: Turning Roadways between I-90 and Abbey/Fairfield</td>
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**Totals:** 8

*Rounded up from 28 mph per ODOT L&D Sec. 104.2

There are no mainline weaving sections within the No-Build Alternative.
Figure 7-9a: Northern Hybrid Alternative Geometric Layout and Deficiencies
### Figure 7-9b: Northern Hybrid Alternative Geometric Deficiencies

<table>
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<tr>
<th>Location</th>
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<tr>
<td>I-90</td>
<td>1</td>
<td>Vertical Alignment: Crest Vertical Curve</td>
<td>Standards** 455' 55 mph</td>
<td>Design Speed 472 50 mph</td>
</tr>
<tr>
<td>Ramp: I-90 WB to Abbey Ave.</td>
<td>2</td>
<td>Horizontal Alignment: Lower</td>
<td>Proposed 21°00' (R = 273') 30 mph*</td>
<td>Design Speed 150' &lt; 25 mph</td>
</tr>
</tbody>
</table>

**Totals:** 2

* *Rounded up from 28 mph per ODOT L&D Sec. 104.2
**ODOT Location and Design Manual Standards

### Figure 7-9c: Northern Hybrid Alternative Weaving Sections

<table>
<thead>
<tr>
<th>Figure 7-9a Ref. No.</th>
<th>Location</th>
<th>Proposed Length</th>
<th>Operational Performance (Acceptable / Deficient)</th>
<th>Minimum Length Needed (if deficient)</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>EB I-90: From W. 14th to Ontario</td>
<td>2300'</td>
<td>Acceptable</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Total Number of Weaves:** 1

**Total Number Deficient Weaves:** 0
Figure 7-10b: Southern Hybrid Alternative Geometric Deficiencies

<table>
<thead>
<tr>
<th>Location</th>
<th>Figure 7-10a Ref. No.</th>
<th>Design Deficiency</th>
<th>Project Design Criteria Standards**</th>
<th>Design Speed</th>
<th>Deficiencies Proposed</th>
<th>Design Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-90</td>
<td>1</td>
<td>Vertical Alignment: Crest Vertical Curve</td>
<td>499'</td>
<td>55 mph</td>
<td>472'</td>
<td>60 mph</td>
</tr>
<tr>
<td>Ramp: I-90 WB to Abbey Ave.</td>
<td>2</td>
<td>Horizontal Alignment: Lower</td>
<td>21°00' (R = 273')</td>
<td>30 mph</td>
<td>R = 100'</td>
<td>&lt; 25 mph</td>
</tr>
<tr>
<td>Ramp: I-90 WB to Abbey/Fairfield</td>
<td>3</td>
<td>Ramp Terminal Spacing: Turning Roadways between I-90 and Abbey/Fairfield</td>
<td>600'</td>
<td>-</td>
<td>550'</td>
<td>-</td>
</tr>
</tbody>
</table>

**Totals:** 3

* Rounded up from 28 mph per ODOT L&D Sec. 104.2
** ODOT Location and Design Manual Standards

Figure 7-10c: Southern Hybrid Alternative Weaving Sections

<table>
<thead>
<tr>
<th>Figure 7-10a Ref. No.</th>
<th>Location</th>
<th>Proposed Length</th>
<th>Operational Performance (Acceptable / Deficient)</th>
<th>Minimum Length Needed (if deficient)</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1 EB I-90: From W. 14th to Ontario</td>
<td>2300'</td>
<td>Acceptable</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>W2 WB I-90: From Ontario to W. 14th</td>
<td>2000'</td>
<td>Acceptable</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

**Total Number of Weaves:** 2

**Total Number Deficient Weaves:** 0

August 11, 2006
Figure 7-11: No-Build Alternative Level of Service

Level of Service
- A-D
- E
- F

AM

PM
Figure 7-12: Widen / Rehabilitate Existing Alternative Level of Service
Figure 7-13: Northern Hybrid Alternative Level of Service
Figure 7-14: Southern Hybrid Alternative Level of Service