

## XIV. FINDINGS AND CONCLUSIONS

### XIV.1 FREEWAY

For both eastbound and westbound movements, the operation of the I-264 freeway corridor within the study area during peak periods is an illustration of contrasts. Vehicles along the eastern segments (east of Rosemont Road) move at or near free flow speeds, while along the western segments vehicle speeds are much lower. And the lowest speeds (and the most severely congested conditions) occur between Independence Boulevard and I-64.

However, over the next 4-5 years eastbound I-264 between I-64 and the Witchduck Road interchange will undergo a dramatic change from its current configuration, and these improvements have been included in this study as part of the No Build Alternative. Consequently, all the Build Alternatives included these improvements. Shown in **Figure XIV.1 Programmed Improvements to Eastbound I-264: I-64 to Witchduck Road**, the improvements include the following:

- Widening of the westbound I-64 off-ramp (Ramp D-7) from the twin bridges over the eastern branch of the Elizabeth River to eastbound I-264, including:
  - Relocation of the eastbound I-264 CD road to a new location immediately south of the existing CD road; and,
  - Extension of two lanes from the westbound I-64 off-ramp to eastbound I-264 mainline lanes and one lane to the relocated eastbound I-264 CD road.
- Reconfiguration of the eastbound I-264 interchange with Newtown Road, including:
  - Removal of the southbound Newtown Road to eastbound I-264 CD on-loop;
  - Reconfiguration of the eastbound I-264 CD off-loop to northbound Newtown Road to connect with the relocated eastbound I-264 CD road;
  - Installation of an on-ramp from a roundabout on Greenwich Road to the relocated eastbound I-264 CD road; and,
  - Installation of intersection improvements at the intersection of the I-264 CD ramps with Newtown Road.
- Reconfiguration of the eastbound I-264 interchange with Witchduck Road, including:
  - Removal of the eastbound I-264 off-loop to northbound Witchduck Road;
  - Closure of Greenwich Road from Witchduck Road west to just east of the rail line proposed for the Virginia Beach Light Rail Extension;
  - Widening of Greenwich Road to four lanes east of Newtown Road and the extension of Greenwich Road as a four lane facility across I-264 to intersect with Cleveland Street at Clearfield Avenue;

- Installation of an eastbound I-264 two-lane off-ramp to intersect with Witchduck Road at Grayson Road; and,
  - Installation of intersection improvements at the intersection of Witchduck Road and eastbound I-264 off-ramp/Grayson Road.
- Extension of two additional lanes on eastbound I-264 between Newtown Road and Witchduck Road.

#### XIV.1.1 West of Rosemont Road

**Figure XIV.2: I-264 Recommended 2040 Lanes** shows the recommended configuration of mainline and CD freeway lanes associated with the preferred alternatives. It should be noted that the configurations do not include ramp merge and weave lanes.

With programmed improvements to eastbound I-264 between I-64 and Witchduck Road included in the analysis, improvements in the preferred alternatives will tend to involve westbound movements between I-64 and Witchduck Road. The one exception occurs between I-64 and Newtown Road where two lanes from the relocation and widening of I-64 Ramp D-11 (eastbound I-64 to eastbound I-264 mainline lanes) is a proposed improvement (see red arrows).

From Newtown Road to Witchduck Road, the programmed improvements to the eastbound lanes are forecast to provide adequate service through 2040, and no further improvements are recommended.

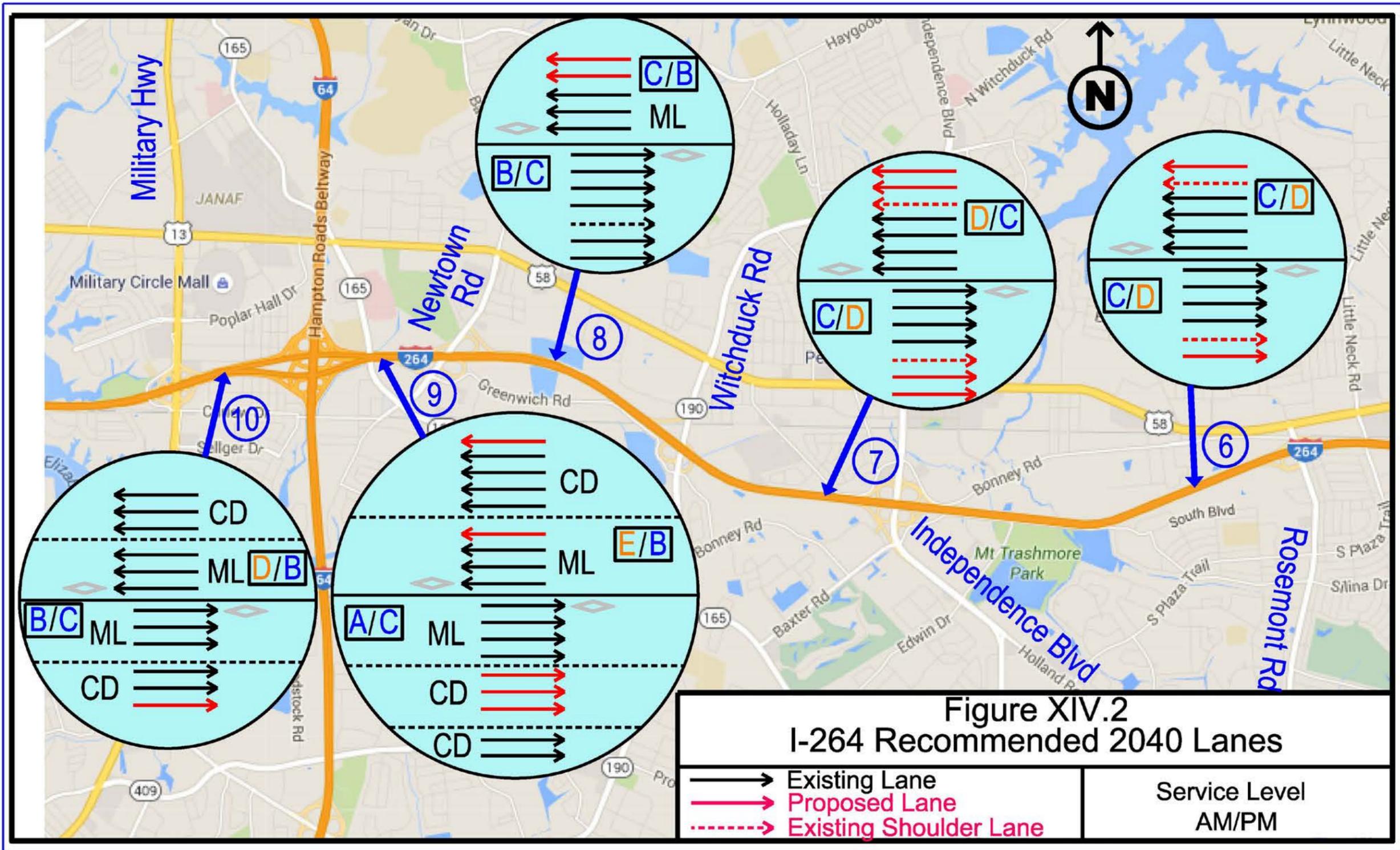
Continuing in the eastbound direction, from Witchduck Road to Independence Boulevard, two additional lanes are to be added and the existing shoulder lane is to be converted into a general purpose lane. Finally, between Independence Boulevard and Rosemont Road, one additional lane is to be added, and where HOV restrictions are in place, the shoulder lanes is to be converted to a general purpose lane.

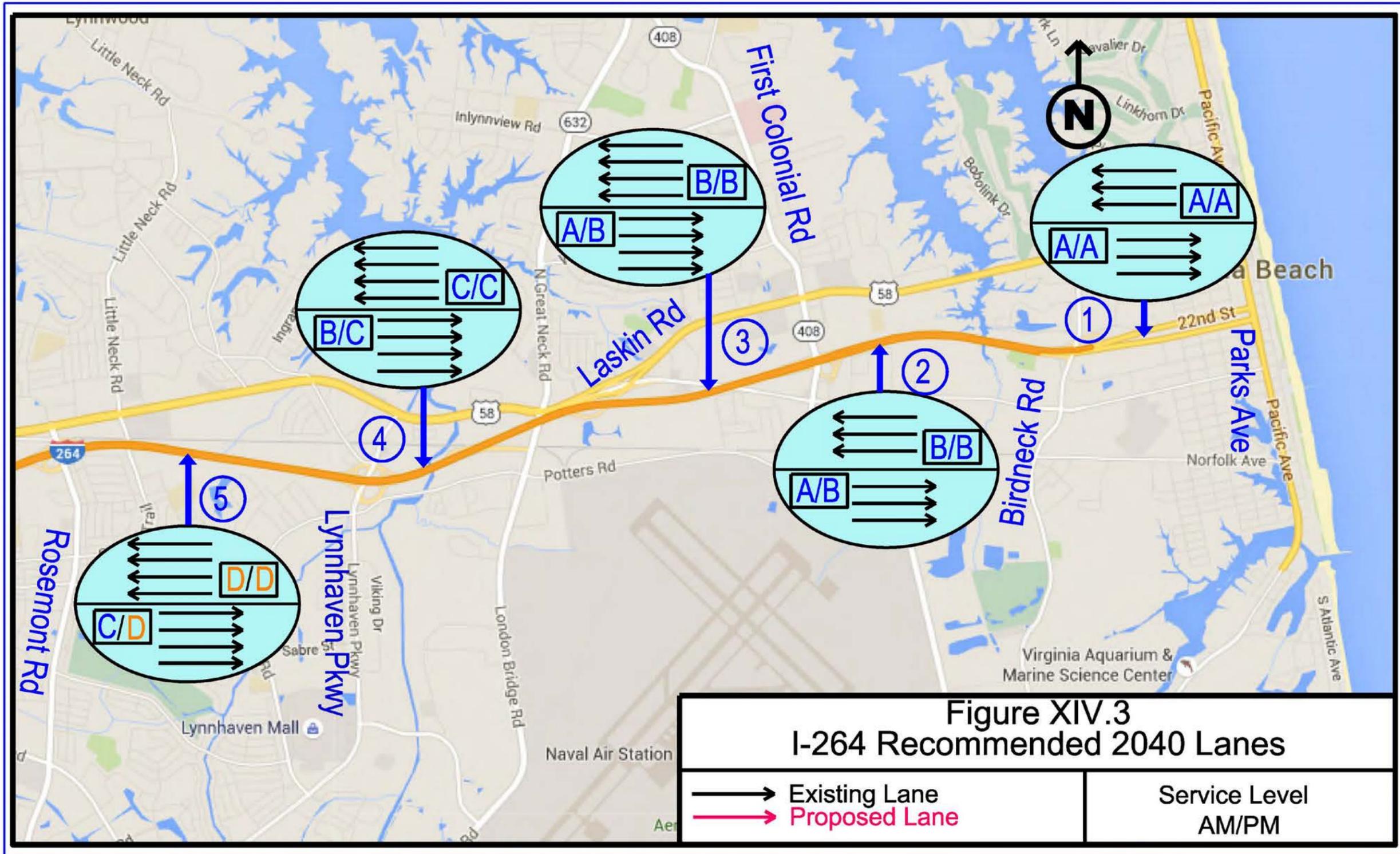
Turning to the westbound direction, from Rosemont Road to Witchduck Road, the recommended pavement sections mirror those recommended in the eastbound direction. On westbound I-264 west of Witchduck Road, two lanes are recommended to be added to the existing freeway section and a third lane is to be added from the widening from one lane to two lanes of the on-ramp to westbound I-264. These three added lanes transition to the CD section approaching Newtown Road and beyond to I-64 with two lanes recommended to be added to the mainline and one lane to the CD system pavement sections.

#### XIV.1.2 East of Rosemont Road

**Figure XIV.3: I-264 Recommended 2040 Lanes** shows the recommended configuration of freeway lanes associated with the preferred alternatives east of Rosemont Road. Confirming recommendations provided in Section II, no widening of the freeway pavement section is recommended between Rosemont Road and the end of I-264 at Parks Avenue.







**XIV.1.3 Recommendations**

In considering recommended improvements to the I-264 freeway, it is worthwhile to repeat that the close spacing of interchanges along most of the freeway – and most particularly along the heavily traveled western segments – does not accommodate independent freeway segment analysis (See Section II).

Beyond the limitations of the ability to analyze short freeway segments (4,000 feet or less in length) the practicality of developing projects for widening short segments is limited because costs for contractor mobilization and maintenance of traffic would be excessive. The more projects pursued to improve an existing freeway, the more transition area work will be required to move from the newly improved segment to the adjacent unimproved segment. The transition area improvements likely will require reconstruction as the adjacent unimproved area is eventually widened.

Clearly, improving a freeway corridor using a piecemeal approach of small improvement projects is disproportionately more costly than implementing fewer, longer and more expensive improvement projects. Recognizing the limitations on programming projects for the widening freeway segments, this study has recommended improvements to only one stand-alone freeway segment - between the Independence Boulevard and Rosemont Road. Consequently, all other recommended freeway pavement section improvements from Independence Boulevard west to I-64 have been included in the respective interchange preferred alternative.

Based on the findings of the analysis of forecasted operations (including the operations analysis detailed in the sections on the Rosemont Road and Independence Boulevard interchanges presented later in this report) the widening of I-264 between Rosemont Road and Independence Boulevard is recommended as the Preferred Alternative.

**The widening of I-264 between Rosemont Road and Independence Boulevard is recommended as the Preferred Alternative. The cost estimate is \$276.8 Million.**

**XIV.2 INTERCHANGES**

In conducting the analysis of nine interchanges along the I-264 corridor, the continuing theme of capacity deficiencies and congestion in the west and adequate service in the east has become increasingly evident. With the exception of the Military Highway interchange, the level of geometric deficiencies and operational congestion along the corridor peaks at the I-64 interchange and gradually diminishes as one moves eastward. Upon reaching Laskin Road and continuing to the freeway end at Parks Avenue, no interchange improvements are needed to address existing or forecasted operational deficiencies.

Improvements have been recommended for the First Colonial Road interchange, but they are related to geometric deficiencies and the planned widening of First Colonial Road to a six-lane arterial facility, and not to existing or forecasted deficiencies due to capacity issues.

In considering the cost of improvements to the interchanges, it is also worthwhile to reiterate that costs include replacement of bridges. Not only are the structures old, they do not meet current guidelines for clearance, and full replacement will be required to address these geometric deficiencies.

**XIV.2.1 Military Highway**

Neither existing nor forecasted traffic operations of the individual interchange ramps exhibit deficiencies. Unless current priorities change, funds for major improvements to this interchange are unlikely to be programmed by the year 2040.

The development of the Preferred Alternative considered that the City of Norfolk is evaluating an extension of transit service alternative from the LRT to the Naval Station, and one alternative route may potentially use the LRT station at Curlew Drive as a transfer point.

To provide for addressing the major geometric deficiencies in the interchange – the weave movements – and to provide future transit service alternatives analysis with flexibility for accessing the LRT station on Curlew Drive, the recommended Preferred Alternative for the Military Highway Interchange is the Partial Cloverleaf as previously shown in **Figure III.6**. The estimated cost is \$152.6 Million.

**XIV.2.2 I-64**

As Virginia’s busiest crossroads outside of Northern Virginia, the I-64/I-264 interchange operates with prolonged periods of congestion affecting several movements in both the AM and PM peak periods. Considering the higher traffic volumes forecasted by 2040, the deficiencies will continue to worsen. The only improvement anticipated is the widening of the westbound I-64 to eastbound I-264 (Ramp D-7). Congested movements observed and analyzed include:

- Eastbound I-64 (from Northampton Boulevard) to Eastbound I-264
- Westbound I-264 mainline lanes to eastbound I-64 (toward Indian River Road)

- Westbound I-264 CD to westbound I-64 (toward Northampton Boulevard)
- Westbound I-64 through movement
- Eastbound I-264 CD to eastbound I-64 (toward Indian River Road)

In addition to congestion for these specific movements, operations are compromised by vehicle queues extending from the adjacent Newtown Road interchange along the eastbound CD road.

All three Build Alternatives included an additional lane on I-64 in each direction to the adjacent interchange would be needed to provide adequate freeway service levels.

The recommended preferred alternative, Modified Conventional, maintains three of the four existing loop ramps while providing for 3 new directional ramps. This configuration eliminates two of the four existing weave segments. While the HCS analysis results show several forecasted deficient movements, the CORSIM analysis results indicate all movements are forecast to operate at adequate levels.

By retaining 3 of the 4 loop ramps, the interchange configuration of this alternative would provide for flexibility in:

1. Developing maintenance of traffic plans with the sequence of construction during construction, and
2. Providing additional options for re-routing traffic in response to incidents after completion of construction.

Based on the added flexibility and lower future maintenance costs provided by the Modified Conventional Alternative (shown in **Figures IV.6 and IV.7**), it is recommended as the Preferred Alternative. The cost estimate is \$466.9 million.

#### XIV.2.3 Newtown Road

Physically close to and operationally similar to the neighboring I-64 interchange, the Newtown Road interchange exhibits congestion and accompanying high crash rates that are indicative of insufficient capacity. These conditions are forecasted to worsen with higher volumes.

The eastbound deficiencies will be addressed with the programmed improvements I-264 between I-64 and Witchduck Road. However, no improvements have been programmed for deficient westbound conditions.

The preferred alternative addresses westbound capacity deficiencies by eliminating the southbound Newtown Road on-ramp and re-routing all traffic destined for westbound I-264 to the on-loop in the northeast quadrant. The preferred alternative also splits the westbound off-ramp to redistribute its traffic to two signals (Stoney Point and Center Drive) thereby improving operations on Newtown Road.

Based on the results of the CORSIM analysis, the recommended alternative, the Modified Folded Diamond (shown in **Figure V.5**) is forecast to provide adequate service on all westbound oriented interchange movements. The estimated cost is \$229.6 million.

#### XIV.2.4 Witchduck Road

In addition to the enhancements associated with the programmed improvements to eastbound I-264 from I-64 (Ramp D-7) to Witchduck Road, the analysis of Witchduck Road also includes the programmed improvement for widening Witchduck Road from four to six lanes beginning at the intersection with the westbound I-264 off-ramp north to Virginia Beach Boulevard. The widening project (UPC 55202) is schedule to begin construction in 2016.

To address capacity deficiencies, one improvement alternative was developed and analyzed (See **Figure VI.4**). It consists of widening westbound I-264 to seven lanes through the interchange. It also provides two additional freeway lanes on eastbound I-264, which will ultimately be extended to the Independence Boulevard interchange.

The westbound I-264 ramps to and from Witchduck Road remain on their current location, but the on-ramp is widened to two lanes. With the recommended improvements, all year 2040 forecasted interchange and intersection movements will operate with adequate services levels.

With an estimate cost of \$361.5 million, the highest cost element for this improvement is associated with replacement and widening of the I-264 bridge over Witchduck Road. In addition to being widened, the replacement structure must be raised to provide for adequate vehicle clearance for vehicles moving under the freeway. Moreover, to match the increased bridge deck elevation, approaching freeway lanes will need to be raised, further adding to the project cost.

#### XIV.2.5 Independence Boulevard

The Independence Boulevard interchange presents an array of existing and forecasted geometric and operational deficiencies, including:

- Insufficient capacity on the mainline freeway;
- Inadequate weave movements on freeway;
- Congested arterial intersections adjacent to ramp junctions; and,
- Inadequate merge capacity on freeway.

The most severe freeway congestion occurs in the AM peak period, where heavy westbound volumes on the freeway conflict with congested weave and merge movements heading toward Witchduck Road. Eastbound congestion is most severe in the PM peak period with heavy congestion with the diverge movement to southbound Independence Boulevard and with the freeway weave movement. Finally, congestion on northbound Independence Boulevard spilling back from the Bonney Road/Euclid Road intersection often blocks traffic the westbound off-ramp and in the weave area on northbound Independence Boulevard.

Three Build Alternative improvements were evaluated, and it should be noted that none addressed one specific deficiency – the eastbound I-264 off-ramp merge to southbound Independence Boulevard approaching the Edwin Drive intersection. City staff indicated they would not consider improvements involving the widening of Independence Boulevard through and beyond the Edwin Drive, and consequently this movement was not analyzed and improvement alternatives were not developed.

The recommended preferred alternative, Partial Cloverleaf with Braided Directional Ramps (See **Figure VII.5**), addresses all the deficiencies involving the freeway and interchange movements. It eliminates weave movements, and provides directional ramps for all northbound Independence Boulevard movements to I-264. The estimated cost is \$465.6 million.

As with the Witchduck and Newtown Road recommended preferred alternatives, a major component of the total cost is the replacement, widening and raising of the I-264 bridge over the arterial roadway – Independence Boulevard.

#### XIV.2.6 Rosemont Road

Similar to the Independence Boulevard interchange, the Rosemont Road interchange also presents an array of existing and forecasted geometric and operational deficiencies, including:

- Insufficient capacity on the westbound mainline freeway;
- Congested arterial intersections adjacent to ramp junctions; and,
- Inadequate merge capacity on freeway.

Here also, the most severe freeway congestion occurs in the AM peak period, where heavy westbound volumes on the freeway conflict with congested merge movements heading toward Independence Boulevard. In general, the ramps and their interface with the freeway are functioning adequately, but congestion associated with the local street system is the cause of excessive delays.

Unlike Independence Boulevard, the immediate area of the Rosemont Road interchange includes several signalized intersections. The major arterial intersection of Rosemont Road with Virginia Beach Boulevard is separated by only approximately 300 feet. To the south, Sentara Way is located approximately 1,000 feet from the interchange, but two full-movement (with median crossover) unsignalized intersections are located between the eastbound off-ramp junction and Sentara Way. Finally, Bonney Road comprises the western leg of the westbound off-ramp intersection. The interchange geometry presents the greatest challenge to addressing operational deficiencies.

Two improvements have been included in the development of Build Alternatives:

1. The widening of Rosemont Road to six lanes from four lanes beginning at Virginia Beach Boulevard and extending south to Holland Road; and,

2. Extension of Sentara Way across I-264 to intersect with Bonney Road.

In addition to these improvements, each alternative provided for the closure of the intersection of Bonney Road with Rosemont Road.

The challenge for selecting the preferred alternative for this interchange was demonstrating the ability to address the severe deficiencies occurring and forecasted to occur on the local street system while minimizing impacts to adjacent properties. Although the planned widening of Rosemont Road to six lanes addresses much of the arterial's capacity deficiency, continuing with the interchange's poor configuration of local street intersections and freeway ramp junctions would offset forecasted benefits of roadway widening.

Of the three Build Alternatives analyzed, the Tight Diverging Diamond (See **Figure VIII.6**) exhibited the best combination of realized benefits and avoided impacts. Moreover, at an estimate cost of \$459.1 million, it also is estimated to be the least costly.

#### XIV.2.7 Lynnhaven Parkway

Analysis of the Lynnhaven Parkway interchange was not included in this study because previous studies had developed a preferred alternative that had been accepted by both VDOT and FHWA. The first phase of the preferred alternative improvements have been implemented with the installation of ramps to and from London Bridge Road. The preferred alternative is shown in **Figure IX.4**.

#### XIV.2.8 Laskin Road

Capacity analysis at I-264 and Laskin Road indicates no major deficiencies either currently or forecasted through the year 2040. Although geometric deficiencies have been identified, they do not result in operational deficiencies. Consequently, any major maintenance activities (such as bridge replacement) should be designed to incorporate consideration of a plan for future improvements. No improvement alternatives were developed, and the existing geometry at I-264 and Laskin Road is shown in **Figure X.4**.

#### XIV.2.9 First Colonial Road

Traffic operations at the interchange of I-264 with First Colonial Road are currently adequate even though minor geometric deficiencies have been identified. However, the widening of First Colonial Road has been included in the Hampton Roads Long Range Transportation Plan and has therefore been included in the year 2040 forecasts of this analysis. With the planned widening, the I-264 bridge over First Colonial Road will need to be replaced and widened.

In addition, the southeast quadrant of the interchange, the on-ramp to eastbound I-264 begins from a local two-way street, Wisconsin Avenue. To bring the interchange into compliance with current guidelines, the on-ramp must be a one-way facility connecting the arterial roadway (First Colonial Road) with the freeway.

The recommended preferred alternative, Single Point Urban Interchange (See **Figure XI.4**) consists of converting the First Colonial Road interchange into a single point interchange configuration. This improvement alternative removes the existing eastbound I-264 off-loop to northbound First Colonial Road and the on-ramp to eastbound I-264 from Wisconsin Avenue.

Capacity analysis results show that all of the movements associated with the interchange are forecasted to exhibit adequate service levels of C or better.

With its planned widening to six lanes, all signalized intersections on First Colonial Road in the interchange area are forecast to operate at service levels of C or better. Moreover, the recommended preferred alternative reduces the number of signalized intersections along the First Colonial Road corridor. The estimated cost of the recommended preferred alternative is \$75.2 million, with bridge improvement costs being the major cost component.

#### XIV.2.10 Birdneck Road

The Birdneck Road interchange is a partial access modified diamond interchange. Several geometric deficiencies have been identified and the more notable deficiencies include:

- No direct I-264 eastbound access
- Less than 14.5' vertical clearance over Birdneck Road
- Ramp speeds are non-compliant at 1 location

No major deficiencies are forecasted to occur. Consequently, future major maintenance projects should consider addressing the geometric deficiencies.

No improvements have been developed and the existing interchange is shown in **Figure XII.4**.

#### XIV.2.11 Parks Avenue

Parks Avenue is the eastern terminus of the I-264 freeway. The terminal points for eastbound I-264 are the signalized intersections of Parks Avenue and 21<sup>st</sup> Street, and for westbound I-264 the signalized intersection of Parks Avenue and 22<sup>nd</sup> Street.

The results of capacity analysis show that for both existing and forecasted year 2040 conditions all movements exhibit excellent service levels of A.

No improvements have been developed for these intersections (See **Figure XIII.4**).

### XIV.3 CONCLUSIONS

A summary of the preferred alternatives and their respective costs are presented in **Table 14.1**, which shows the total costs for all improvements at \$2,487.2 million.

As discussed in the Introduction to this report, the recommendations set forth in this study should not be viewed as a unified, rigid set of improvements, nor should the costs be viewed as a program in need of a comprehensive financing plan.

This analysis is a planning level evaluation, and more detailed analysis of all proposed interchange improvements (specifically, interchange modification reports and environmental documents) must be completed before design can begin. Moreover, this study does not address the relative priorities among the interchange improvements. Setting such priorities will be completed as part of the regional transportation planning and programming process.

Interchange	Preferred Alternative (Figure)	2015 Cost (\$million)
Military Highway	Partial Cloverleaf (Figure III.6)	\$ 152.6
I-64	Modified Conventional (Figures IV.6 & IV.7)	466.9
Newtown Road	Modified Folded Diamond (Figure V.5)	229.6
Witchduck Road	Folded Diamond (Figure VI.4)	361.4
Independence Boulevard	Partial Cloverleaf with Braided Directional Ramps (Figure VII.5)	465.6
Rosemont Road	Tight Diverging Diamond (Figure VIII.6)	459.1
Lynnhaven Parkway	Partial Cloverleaf with Directional Ramp (Figure IX.4)	N/A
Laskin Road	Existing Interchange Geometry (Figure X.4)	0.0
First Colonial Road	Single Point Urban Interchange (Figure XI.4)	75.2
Birdneck Road	Existing Interchange Geometry (Figure XII.4)	0.0
Parks Avenue	Existing Intersection Geometries (Figure XIII.4)	0.0
<b>Sub-Total Interchanges</b>		<b>\$2,210.4</b>
Mainline Freeway	Widening between Independence Boulevard and Rosemont Road (Figure II.1)	276.8
<b>TOTAL: ALL CORRIDOR IMPROVEMENTS</b>		<b>\$ 2,487.2</b>