TAPPAN ZEE BRIDGE/I-287
ENVIRONMENTAL REVIEW

New York State Department of Transportation
New York State Thruway Authority
Metropolitan Transportation Authority/Metro-North Railroad

# Highway Improvements Report

DRAFT

Tappan Zee Bridge/I-287
Corridor Project

November 23, 2010

# Executive Summary

The Project Sponsors – New York State Department of Transportation (NYSDOT), the New York State Thruway Authority (NYSTA), and Metro-North Railroad (an agency of the Metropolitan Transportation Authority [MTA]) – in cooperation with the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) are preparing an Environmental Impact Statement (EIS) for the Tappan Zee Bridge/I-287 Corridor Project in Rockland and Westchester Counties, New York (NY). A key step in preparation of the EIS is the development and refinement of the EIS alternatives. The project has transit, bridge, and highway elements, and the process of defining these elements is documented in a number of studies, including this *Highway Improvements Report.*

The consideration of these highway improvement elements is consistent with the project's Project Purpose and Need as defined in the public scoping process, which states the basis for identifying and selecting solutions to effectively and efficiently address the corridor's needs while respecting the natural and human environment. Project goals and objectives were also developed to indicate how the project and its elements would address the Purpose and Need. The evaluation conducted throughout the development of the EIS – including the review of potential highway improvements completed in this report – are consistent with the Purpose and Need and the project's goals and objectives. These issues are discussed further in Chapter 1.

The HIR analyzes five potential highway improvements to determine whether they should be included in the proposed EIS build alternatives. The following is a listing of these improvements and the results of an initial analysis of their potential impacts on highway operations and safety, environmental impacts and other factors.

- **Climbing Lanes** -- providing climbing lanes in portions of the westbound and eastbound highway. The studies supported the inclusion of climbing lanes in portions of the eastbound Thruway from Interchange 12 to the crest at Interchange 11, and the westbound Thruway from approximately Interchange 11 to a point between Interchanges 14A and 14B, with the lane ending at the Spring Valley truck toll barrier approximately 1 mile west of Interchange 14A. Initial studies indicate that the new lanes would not have significant environmental impacts.

- **C/D Roads at Interchange 13** – providing collector/distributor (C/D) auxiliary lanes at Interchange 13. The studies showed that shifting the on/off ramps connecting the Thruway and the Palisades Interstate Parkway (PIP) from the Thruway mainline to the C/D roads would improve traffic operations and safety on the Thruway. Initial studies indicate that these C/D roads would not have potentially significant environmental impacts.

- **Interchange 14X** -- adding a new Interchange 14X between 14 A and 14B. Studies confirmed that adding this interchange would adversely impact Thruway operations while providing no measureable improvement to local street conditions. It would be inconsistent with the project's goals and objectives and would contradict FHWA guidelines for changes to highway access. Therefore, it has been dropped from further consideration.

- **Interchange 10 Improvements** – the proposed construction of a new Tappan Zee Bridge would require a redesign of Interchange 10, and two diamond-interchange designs – one using signalized controls and another traffic roundabouts -- have been proposed to increase local access and improve operations and safety. Studies of this improved interchange will continue at a more detailed level during the EIS process.

- **Interchange 11 Improvements –** relocation of the eastbound on-/off-ramps approximately 600 feet east to reduce conflicts with local traffic and impacts on highway operation. Traffic analyses showed that the proposed new eastbound ramps would significantly improve traffic operations and safety on local roadways and the Thruway. Initial studies indicate that the proposed change on eastbound ramps would not have potentially significant environmental impacts.

The highway improvements recommended in this report for inclusion in the EIS build alternatives will be analyzed in greater detail in the Draft EIS.

# Table of Contents

Number Title Page

## LIST OF FIGURES

Number Title Page

## LIST OF TABLES



## LIST OF PHOTOS

# LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AASHTO | American Association of State Highway and Transportation Officials |
| | |
| BODR | Bridge Options Development Report |
| BPM | Best Practice Model |
| BRT | Bus Rapid Transit |
| | |
| C/D | collector/distributor |
| CRT | Commuter Rail Transit |
| | |
| EIS | environmental impact statement |
| | |
| FHWA | Federal Highway Administration |
| FTA | Federal Transit Administration |
| | |
| HCM | Highway Capacity Manual |
| HCS | Highway Capacity Software |
| HIR | Highway Improvements Report |
| HOT | High Occupancy Toll |
| HOV | High Occupancy Vehicle |
| | |
| lb/hp | weight-to-power ratio |
| $lb/ft^2$ | weight-to-front-area ratio |
| LIE | Long Island Expressway |
| LOS | Level of Service |
| | |
| MOE | measures of effectiveness |
| mph | miles per hour |
| MTA | Metropolitan Transportation Authority |
| MVM | million vehicle miles |
| | |
| NY | New York |
| NYMTC | New York Metropolitan Transportation Council |
| NYSDEC | New York State Department of Environmental Conservation |
| NYSDOT | New York State Department of Transportation |
| NYSTA | New York State Thruway Authority |
| | |
| pc/mi/ln | passenger cars/mile/lane |
| PCE | passenger car equivalent |
| PIP | Palisades Interstate Parkway |
| | |
| TAOR | Transit Alignment Options Report |
| TSPM | truck speed profile model |
| | |
| vph | vehicles per hour |

# 1 Introduction

The Project Sponsors – New York State Department of Transportation (NYSDOT), the New York State Thruway Authority (NYSTA), and Metro-North Railroad (an agency of the Metropolitan Transportation Authority [MTA]) – in cooperation with the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) are preparing an Environmental Impact Statement (EIS) for the Tappan Zee Bridge/I-287 Corridor Project in Rockland and Westchester Counties, New York (NY).

The 30-mile corridor includes the 15-mile portion of Rockland County from Suffern to Nyack on the Hudson River, the 3-mile river crossing, and the 12-mile section of Westchester County from Tarrytown on the Hudson River to Port Chester on Long Island Sound. The corridor passes through the communities within the towns of Ramapo, Clarkstown, Orangetown, Greenburgh, White Plains, Harrison, and Rye.

One of the key steps in preparation of the EIS is the development and refinement of the EIS alternatives. As this project has transit, bridge, and highway elements, the process of defining these elements of the EIS alternatives is documented in a number of studies by the Project Sponsors:

- *Transit Alignment Options Report* (TAOR).
- *Highway Improvements Report* (HIR) (this report).
- *Bridge Options Development Report* (BODR).

This process is presented on Figure 1-1, which shows the parallel study of the transit and bridge aspects of the project, leading to the development of the EIS alternatives. Early in the process, project scoping provided a forum for the public to provide comments and feedback on the Project Purpose and Need, potential alternatives, and environmental analysis being considered in the EIS. Scoping was closed in Spring 2009.

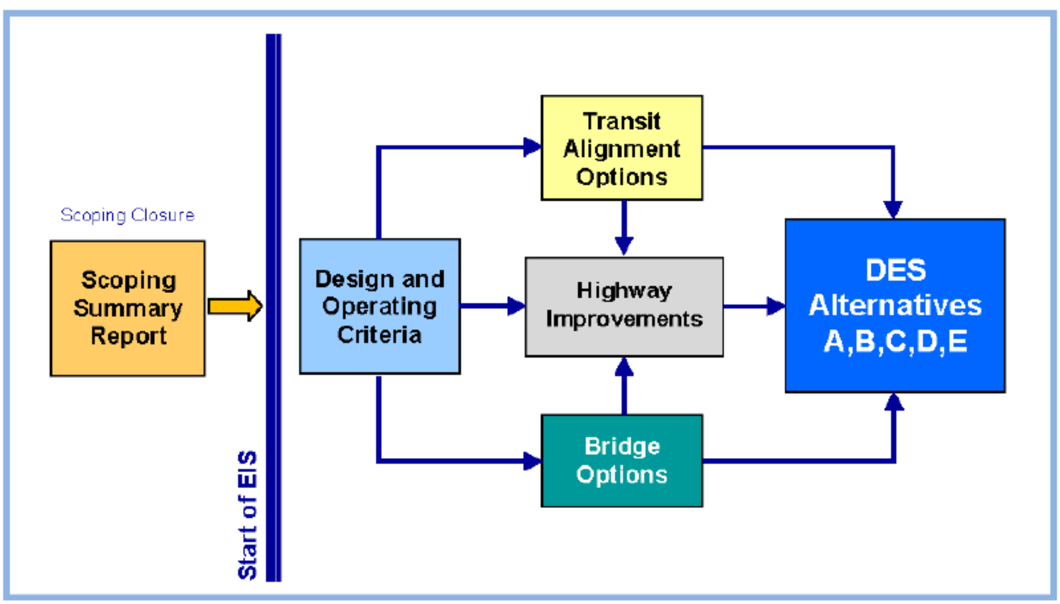



Figure 1-1 Alternatives Development Roadmap

## 1.1 Project Purpose and Need

As articulated during scoping, the Purpose and Need for the Tappan Zee Bridge/I-287 Corridor Project builds on the problems and deficiencies in the corridor, and more accurately states the basis for identifying and selecting solutions to effectively and efficiently address those needs, while respecting the natural and human environment.

Several transportation improvements, including improved mobility, transit options, and safety, are needed to meet the growing travel demands of the corridor. Travelers in the corridor experience significant delays due to congestion, as corridor facilities often operate near capacity, particularly in the vicinity of the Tappan Zee Bridge. Rockland County is one of the fastest-growing communities in the Metropolitan Region, and Westchester County is experiencing employment growth in areas around White Plains and the Platinum Mile. The Tappan Zee Bridge and the corridor provide an important link between these communities and to the overall regional transportation network. In addition to the capacity constraints of the corridor, the Tappan Zee Bridge is aging and in need of a regular and extensive maintenance program. As the region grows, travel demand will increase on this already-strained roadway network.

Based on these considerations, the Project Purpose and Need is to:

- Preserve the river crossing as a vital link in the regional and national transportation network.
- Provide a river crossing that has structural integrity, meets current design criteria and standards, and accommodates transit.
- Improve highway safety, mobility, and capacity throughout the corridor.
- Improve transit mobility and capacity throughout the corridor and travel connections to the existing north-south and east-west transit network.

Project goals and objectives were also developed to indicate how the project will address the Purpose and Need. Objectives are used to measure progress in the attainment of goals. Project alternatives developed to respond to the Purpose and Need are evaluated by how well they meet the goals (e.g., Improve Mobility) by determining their likely performance against various objectives (e.g., reduce traffic congestion, improve travel times, etc.). Evaluations conducted throughout the development of the EIS will be consistent with the Purpose and Need and the project's goals and objectives.

## 1.2 Purpose of this Report

The purpose of this Highway Improvements Report is to analyze possible highway improvements to determine whether they should be included in the proposed EIS build alternatives. More specifically, it assesses potential improvements to the Thruway within Rockland County that were identified as possible improvements during earlier project phases. The highway improvements are evaluated and screened in this HIR using a set of criteria consistent with the Purpose and Need and goals and objectives of the project. Based on this analysis, the highway improvements with the fewest impacts that best support the Purpose and Need of the project are recommended to be carried forward in the EIS as highway elements of the build alternatives, while those options with greater impacts and or lesser ability to achieve project goals and objectives are recommended to be excludedfrom further consideration in the EIS.

Following completion of the highway improvements evaluation process documented in this report, the EIS will be developed in accordance with the Revised Notice of Intent (issued February 14, 2008) using a tiered process to facilitate decision-making. The scope of analysis in each tier – Tier 2 highway and bridge and Tier 1 transit – will be appropriate to the level of detail necessary to make informed decisions regarding the alternatives, and will incorporate input received from the public and reviewing agencies. The tiering approach allows an assessment of site specific impacts, costs, and mitigation measures in a Tier 2 highway and bridge analysis, while simultaneously considering broad overall corridor issues in a Tier 1 transit analysis of general alignment and logical termini of the proposed modes. The intent of the Project Sponsors and FHWA and FTA is for the Tier 2 highway and bridge and Tier 1 transit analyses to be developed concurrently in order to maximize multimodal solutions.

The highway improvements or modifications listed below were evaluated to determine whether they warrant further consideration in the DEIS based on an initial assessment in this report of their potential impacts on transportation operations, safety, the environment and other factors. The chapter in which the assessment of each of these improvements is presented in this report is also noted:

- Providing climbing lanes in portions of the westbound and eastbound highway (analyzed in Chapter 2).
- Adding collector/distributor (C/D) auxiliary lanes at Interchange 13 (analyzed in Chapter 3).
- Adding a new Interchange 14X between 14 A and 14B (analyzed in Chapter 4).
- Improvements to Interchange 10 (analyzed in Chapter 5).
- Improvements to Interchange 11 (analyzed in Chapter 6).

The approximate locations of these possible highway improvements along the Thruway corridor in Rockland County are shown on Figure 1-2. The analyses of these improvements consider two sets of full build EIS alternatives, as defined in the TAOR. .

## 1.3 Highway Improvements Evaluation Process

Transportation analyses, primarily traffic operations and safety, will provide the key criteria for determining the optimal highway configurations, while preliminary assessments of potential environmental and cost issues will also be considered (see Table 1-1). When considering the possible impacts of these improvements, the analyses are based on the project's full build conditions (i.e., with all proposed highway, bridge and transit improvements).

**Table 1-1**

**Highway Improvement Evaluation Criteria**

| Evaluation Criteria | |
|---|---|
| **Transportation Analyses** | Traffic Operations |
| | Traffic Safety |
| **Environmental** | Displacement, Acquisitions |
| | Land Use, Parks |
| | Visual Impacts |
| | Wetlands, Ecology, Water Quality |
| | Historic/Archaeological |
| | Air/Noise Quality |
| **Costs** | Estimated Capital Costs<br>Operations & Maintenance Cost Factor |

The four build alternatives to be analyzed in the proposed project's EIS all include CRT and BRT extending across Rockland County from Suffern to the Tappan Zee Bridge. Under two alternatives, the proposed BRT service would operate in HOV/HOT lanes in the median of the highway, from east of Interchange 15 in Suffern to (and across) the Tappan Zee Bridge. The other two would locate the BRT service in a separate busway. The TAOR analyzed a variety of possible CRT and busway alignments along the Thruway corridor. Those analyses resulted in the following recommendations:

- a common CRT alignment for all four build alternatives (primarily on the south side of the highway);
- two build alternatives with HOV/HOT lanes in the median of the highway (hereafter "**Build with HOV/HOT Lane**"); and
- two build alternatives with a busway (hereafter "**Build with Busway**") primarily located on the highway's north side, except between Interchanges 11 and 10).

Therefore, Chapters 2 through 6 of the HIR report reflect a review of the five highway improvement concepts listed above and shown in Figure 1-2 under the Build with Busway and Build with HOV/HOT Lane alternatives.

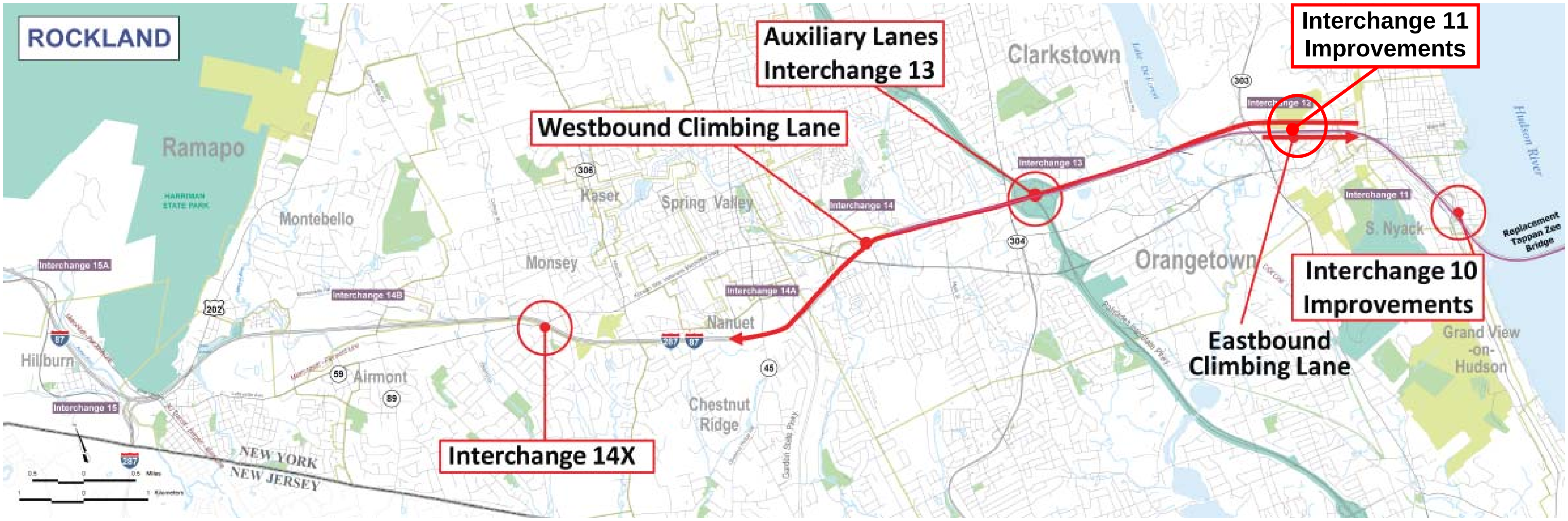



Figure 1-2 Proposed Highway Improvements in the Tappan Zee Bridge / I-287 Corridor

# 2 Climbing Lanes

A climbing lane is an auxiliary lane often provided in steep highway sections that allows slower-moving vehicles (primarily heavy trucks) to move into their own lane, thereby minimizing their interference with faster moving vehicles in the general purpose lanes. Its purpose is not to provide additional capacity, but to improve highway operations and safety characteristics. Without such lanes, slow moving trucks make other vehicles slow down or change lane, which frequently happens, for example, on uphill portions of the westbound Thruway between Interchange 10 and the Spring Valley tolls. These movements reduce the highway's effective capacity and can potentially cause an unsafe condition. Photo 2-1 shows an example of a climbing lane on a highway.


**Photo 2-1 Truck Climbing Lane (I-81, Virginia)**

The effect of heavy trucks on traffic flow is often expressed in terms of their "passenger car equivalence" (i.e., a truck is equal to a number of passenger cars). In considering the effect of trucks on traffic flow, the critical factors are the percentage of trucks in the traffic flow and the grades of the highway. On level grade the passenger car equivalent (PCE) of a truck is usually around two. When trucks are climbing on long steep grades, especially when they account for a relatively high share of a roadway's vehicles, this PCE value increases to as much as 3.5.

The section of I-287 in Rockland County from Suffern to the Tappan Zee Bridge has a number of lengthy steep sections that can adversely affect the operations of heavy trucks in the traffic stream (approximately 7 percent of average daily traffic volumes, based on 2005 Thruway toll plaza data). Because of this, the Project Sponsors are considering the addition of climbing lanes to portions of the westbound and eastbound sections of the Thruway. The potential addition of climbing lanes to various portions of the Thruway in Rockland County has been mentioned during previous stages of review. This chapter reviews the factors to be considered in assessing whether climbing lanes are warranted in a given section of highway, and presents recommendations for climbing lanes along specific portions of the Thruway in Rockland County based on those analyses.

## 2.1 Assessment Guidelines and Procedures

The relevant standards and guidelines to be met when considering separate climbing lanes are those published by the New York State Department of Transportation (NYSDOT), American Association of State Highway and Transportation Officials (AASHTO), the Federal Highway Administration (FHWA), and the Transportation Research Board (in its Highway Capacity Manual). The NYSDOT Highway Design Manual ("HDM"), as well as the AASHTO Policy on Geometric Design of Highways and Streets (2004 – "AASHTO Policy"), established the following criteria for the installation of climbing lanes in response to stated grade conditions:

- Existing grades must reduce truck speed by at least 10 miles per hour (mph). AASHTO Exhibit 3-59 (see Figure 2-1) shows the relationships among the steepness of a highway's grade (measured as the percent upgrade[1]), the length of that steep section, and the resulting speed reductions for trucks.

- The mainline must operate at Level of Service (LOS) of E or F during peak analysis periods, or truck operations in the area in question must cause at least a one-level of decrease in LOS in adjacent lanes (e.g., from D to E), as per the HDM.

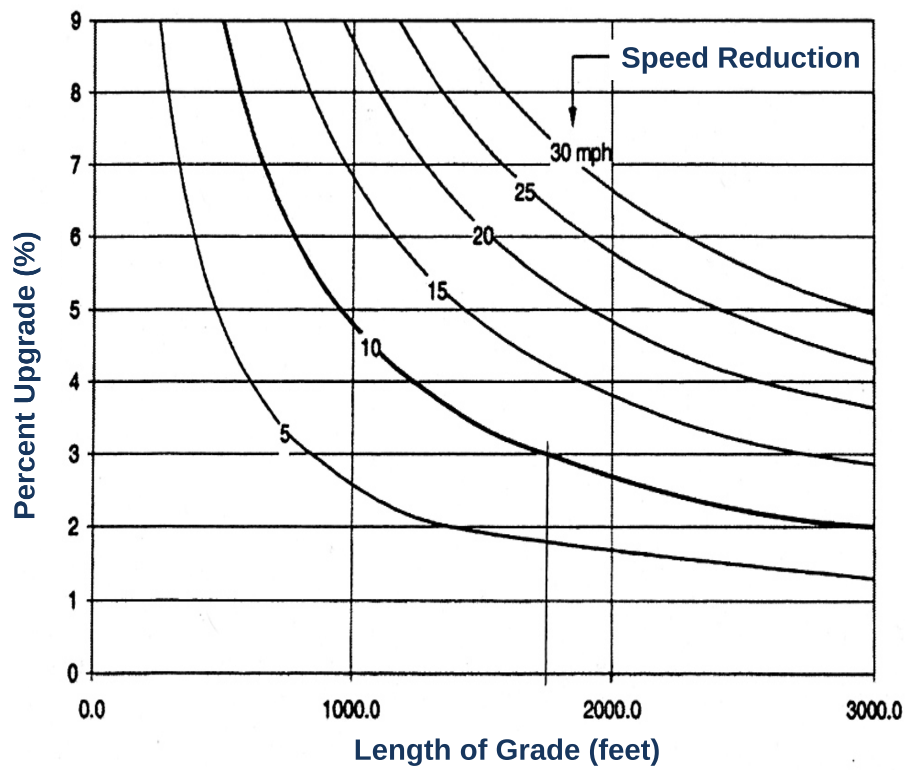



Exhibit 3-59. Critical Lengths of Grade for Design, Assumed Typical Heavy Truck of 200 lb/hp. *(AASHTO - Policy on Geometric Design of Highways and Streets - 2004)*

**Figure 2-1 Grade Length and Percent Upgrade versus Speed Reduction**

[1] Percent grade expresses in percentage terms the change in a roadway's vertical elevation per 100 feet in horizontal length (i.e., a one foot rise over a 100-foot length of roadway, that segment would have a one percent grade.

LOS levels describe the quality of highway operations on a scale from "A" to "F," based on the density of passenger car equivalents (PCE) per mile per lane; following are LOS definitions and applicable PCE/mi/ln

- A: free-flow conditions; no restrictions on maneuvering, changing lanes, etc. (<11)
- B: reasonably free flow, slight restrictions on maneuvering (>11 - ≤ 18)
- C: traffic flow still stable but freedom to maneuver noticeably restricted (>18 - ≤ 26)
- D: traffic flow more unstable, subject to disruption; maneuvering drastically restricted (>26 - < 35)
- E: highway at capacity; flow is extremely unstable, no gaps in flow for maneuvering (>35- ≤ 45)
- F: breakdown conditions; stops in vehicle flow and queuing of vehicles (>45).

The emphasis of these climbing lane standards is on safety. The AASHTO Policy indicates that:

- No matter what average speeds are on a highway, the likelihood of a vehicle becoming involved in a crash increases substantially as the vehicles' deviation from average speed increases.

- This accident probability increases significantly when a grade slows down a truck by more than 10 mph, and the accident rate with a 15-mph loss in speed is 2.4 times greater than for a 10-mph reduction.

Based on these research findings, AASHTO recommends that a 10-mph reduction be used to determine the "critical lengths of grade" -- i.e., how long does a highway segment of a particular grade have to be before a climbing lane is potentially warranted. These issues also affect passenger vehicles, which will attempt to merge into adjacent lanes when trucks ahead of them slow down on a grade. The differential in speeds between lanes, reduced rearward visibility, and small amount of gaps in the flow of traffic in the adjacent lane (especially under congested conditions) create a significant safety issue for passenger vehicles in both the slow lane and the faster-moving adjacent lanes.

## 2.2 Analyses of Potential Need for Climbing Lanes

A profile of the Thruway within Rockland County from the Tappan Zee Bridge to Interchange 15 in Suffern is shown on Figure 2-2. In the county, the hills of the Hudson River Valley tend to run north-south, whereas this section of the Thruway generally runs east-west. Cutting across these hills and valleys creates long sections of uphill grades, and the grades shown on Figure 2-2 reflect this. Approximately 8.3 miles of this 13.6-mile segment has grades steeper than 2 percent, while more than 4 miles are at or above 3 percent. The high point is in the Monsey area near the Route 59 overpass.

### 2.2.1 Analysis Methods

A truck speed profile model (TSPM) was developed to assess how trucks perform on upgrades, and is utilized by many transportation agencies to assess when a climbing lane may be warranted. TSPM is a spreadsheet-based model based initially on the AASHTO estimates of the impacts of grades on truck speeds that were shown in Figure 2-1. However, the AASHTO method alone cannot determine the critical length of grade that would warrant a climbing lane, as it assumes a single initial truck speed, a constant percent grade, and a single truck weight-to-power ratio (assumed to be 120 kg/kW [200 lb/hp]).

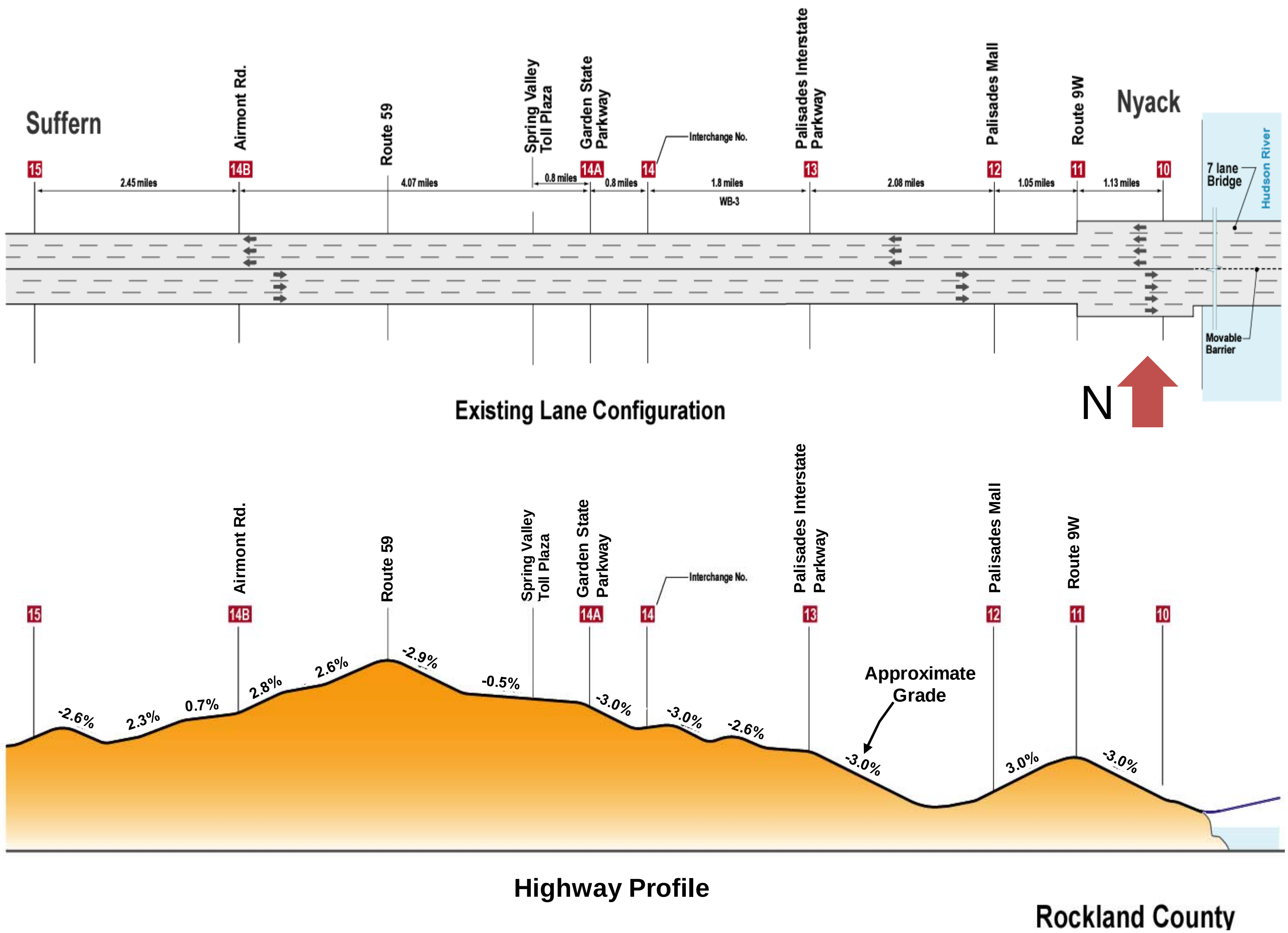



Figure 2-2: Existing Lane Configuration and Highway Profile of Thruway in Rockland County

The TSPM spreadsheet uses the actual vertical alignment of the roadway in question, and any appropriate initial truck speed value and weight-to-power ratio. The input data for the truck speed profile model include both roadway and truck characteristics.

The specific input data are:

1. Vertical profile – percent grade for specific ranges of position coordinates and elevation above sea level (ft), which is used in estimating aerodynamics; and

2. Truck Characteristics – how fast the truck would be going entering the section being analyzed (initial speed in mph), how would it operate in the absence of the grade, weight-to-power ratio (lb/hp), and weight-to-front-area ratio (lb/ft$^2$). Trucks are never assumed to travel faster than the "desired speed" (typically the speed limit).

The grades between various positions on the highway (shown in feet) are entered into the model. Curves on an interstate highway generally have little impact on truck speeds, so grades are entered into the model as continuous constant grades from one vertical transition point to the next. The initial speed of the truck, entered in mph, is the speed of the truck at coordinate zero. This speed typically represents the truck speed prior to entering the grade and should reflect the conditions in the area. The weight-to-power ratio, entered in lb/hp, represents the performance ability of the truck (the less weight per horsepower, the better a truck's performance on any grade will be). Several factors that determine the typical truck's aerodynamics are also entered (default values are typically used due to their minor effect on speed).

The analyses of this section of the Thruway used the following assumptions:

- standard AASHTO truck design vehicle for this type of analysis (200 lb/hp);

- initial truck speed of 65 mph; and

- desired speed of 65 mph. Although the speed limit on the Thruway east of 14A is 55 mph, 65 mph was used as the desired speed throughout to make the analysis more conservative and to better reflect measured speed in that area under free-flow conditions.

Figure 2-2 shows the vertical profile of the Thruway in Rockland County between the Tappan Zee Bridge and Interchange 15 and the lane configurations (number of lanes in each direction) over those sections. Figure 2-3 shows a more detailed vertical profile calculated directly from the detailed profile information for the existing Thruway. It highlights 34 inflection points where important changes in grade relevant for this analysis presently occur. Data on the horizontal and vertical locations of these points were then used as inputs to the TSPM analyses described above.

TSPM calculates speed values for each second of elapsed time after the truck enters the analysis area, including minimum and maximum computed truck speed and their difference. If the maximum speed represents the truck speed in advance of the upgrade, then the difference between the maximum and minimum speeds represents the speed reduction on the grade. If the speed reduction is 10 mph or more, a climbing lane may be warranted. This information is then plotted on a graph to show the approximate expected speed of a truck at each location to indicate how a typical heavy truck would operate over this section of roadway.

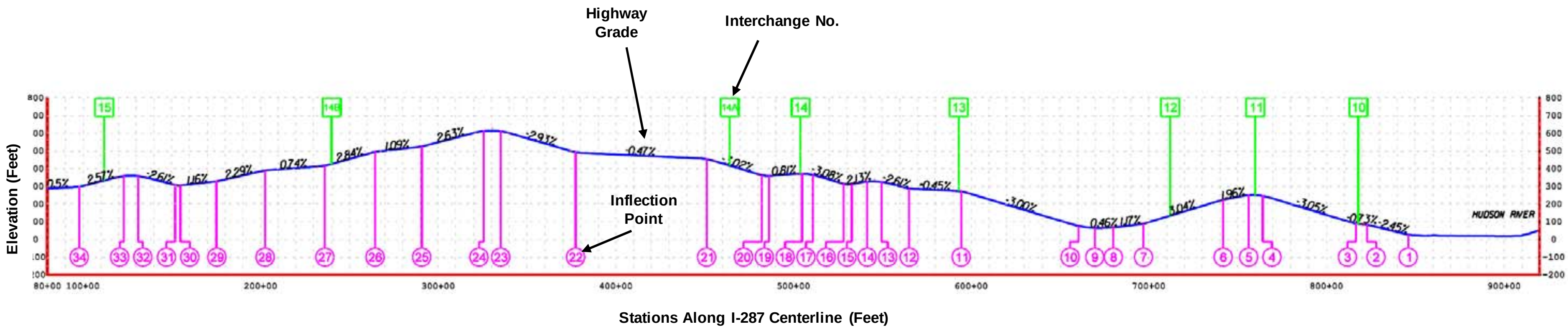



**Figure 2-3 Vertical Profile of I-287 in Rockland County (Interchange 15 to TZB) and Percentage Changes in Grade between Inflection Points**

Using the TSPM model, the speed of a truck traveling eastbound and westbound was calculated for the segment of the Thruway between the Tappan Zee Bridge and Interchange 15. The results of these calculations were then plotted for each direction of travel. Figure 2-4 presents, for the eastbound and westbound directions, the calculated truck speed profiles, highlighting those areas where trucks would operate below their desired speed levels due to grades. The plotted information in this figure is taken directly from the TSPM output, with annotations added to highlight those areas where estimated truck speeds would be 10 mph or more below a truck's desired speed level.

## 2.2.2 Eastbound and Westbound Speed Profiles

As shown in Figure 2-4, there are a number of locations where the design truck's speeds would be 10 mph or more below the desired speed due to grades along the corridor:

- **Eastbound** – speeds would generally not go below the 10-mph reduction level until Interchange 14B, and would remain below that level until past the high point in Monsey, where speeds would again increase. Truck speeds would then stay at or close to desired speeds up to the vicinity of Interchange 12, where eastbound speeds would drop and then remain below the 10 mph reduction level until the down-slope section east of Interchange 11.

- **Westbound** - trucks would have more than a 10-mph speed reduction in the section between Interchanges 10 and 11. Speeds would then increase on the downgrade past Interchange 11 and would flatten out at the desired speed level until a point west of Interchange 12 where grades would again drive truck speeds below the 10 mph reduction level. West of Interchange 13 there are various speed fluctuations reflecting the changing grades in this area, and speeds would generally be below the 10 mph reduction level until a point between Interchanges 14B and 14A (at the highpoint where Route 59 passes over the Thruway. From that point, westbound speeds would fluctuate to some extent but generally stay above the 10 mph reduction level.

The results of the TSPM model support the need for (1) two eastbound climbing lane sections, and (2) either two segments or a single continuous segment westbound. The following sections review three additional factors that are also important in considering whether climbing lanes are warranted – traffic volumes, level of service (LOS) conditions and accident rates in these areas.

## 2.2.3 Level of Service and Accident Rates

### 2.2.3.1 Peak-Hour LOS Conditions

A preliminary assessment of the No-Build condition was carried out utilizing 2035 data from the project's most recent traffic studies for the corridor. It involved use of the New York Metropolitan Transportation Council (NYMTC) Best Practice Model (BPM) to provide estimated future traffic demand and Paramics micro-simulation software to assess highway operations. These analyses, done earlier during the project's scoping process, were done for peak-direction conditions: westbound in the PM peak and eastbound in the AM peak. The estimated peak-hour volumes and LOS conditions are shown in Table 2-1.

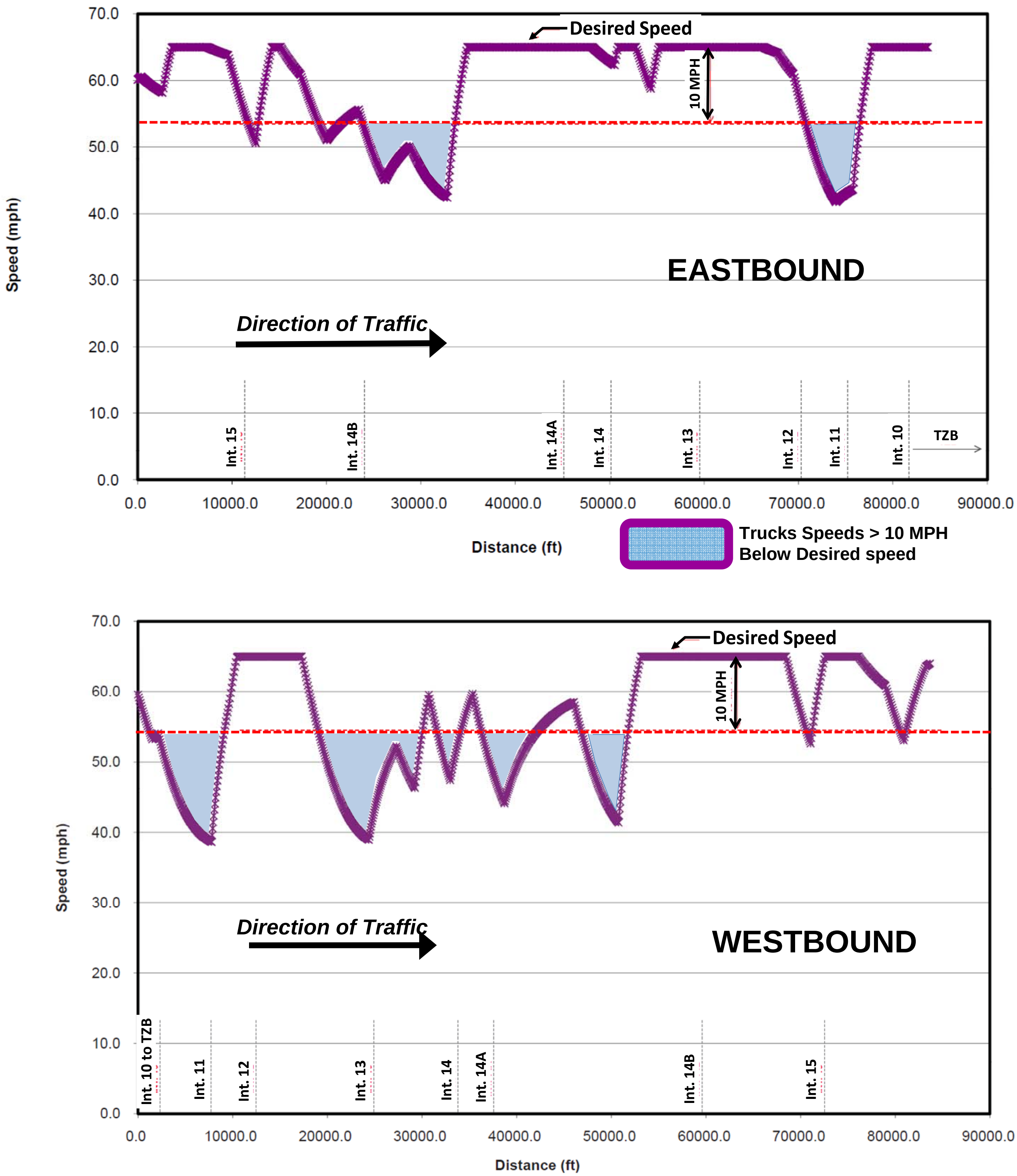



Figure 2-4 Westbound & Eastbound Speed Profile – Interchange 15 to Tappan Zee Bridge

**Table 2-1**
**2035 No-Build LOS and Volume Conditions**

| Highway Segments | Eastbound (AM peak) [1] | | Westbound (PM Peak) [1] | |
|---|---|---|---|---|
| | Volumes | LOS | Volumes | LOS |
| 15 - 14B | 2,700 | F[3] | 4,700 | C |
| 14B – 14A | 3,800 | F[3] | 5,300 | D |
| 14A – 13 | 5,400 | E | 6,900 | F |
| 13 – 12 | 5,300 | F | 6,400 | E |
| 12[2] – TZB | 6,500 | F | 7,600 | F |

[1] Highest 1-hr. volumes in approx.: 7:00-9:00am and 4:00-6:00pm periods.
[2] Average volumes on this segment.
[3] LOS "F" likely caused by downstream congestion.

These data generally reflect the typical traffic patterns in the corridor, with volumes gradually increasing in the AM peak from west (Interchange 15) to east (Tappan Zee Bridge) and east to west in the PM peak. Especially in the westbound direction in the PM peak, heavy entry/exit volumes at interchanges combined with the effect of grades can adversely affect traffic flows. Poor LOS conditions can sometimes occur when the volumes passing through an area are relatively low due to downstream congestion that spills back and affects flows in the upstream portions of the highway. The data in Table 2-1 indicate the following:

- **Eastbound** - The Level "E" or "F" criteria noted in the AASHTO Policy guidelines LOS criteria would be met in the AM peak from approximately Interchange 15 to the bridge. Note that LOS conditions in the corridor's western section are LOS "F" even though volumes there are well below those in sections further east operating at the same or somewhat better LOS levels. This is caused by the downstream congestion problem noted above.

- **Westbound** - The AASHTO criteria would be met in the westbound direction from the Tappan Zee Bridge to past Interchange 14, where volumes would decrease and LOS levels would improve.

### 2.2.3.2 Accident Rates in the Corridor

Although accident rates are not specifically used by AASHTO as criteria for climbing lanes, accident rates in the corridor were used due to the close tie between accident rates and speed differentials on highways. A review of accident records for the period from July 2004 through June 2007 indicates that the reportable accidents per million vehicle miles (MVM) between the Tappan Zee Bridge and Interchange 15 averaged 2.9 times the statewide average for similar limited access highways across the state. The number of these accidents that were specifically associated with slow moving trucks is not known. However, accidents involving only passenger vehicles may also be related to slow-truck conditions as passenger vehicles slow down, change lanes, and make other maneuvers to avoid slow-moving trucks in their lane. The poor LOS in the section is likely a contributing factor in the high accident rate. However, experience elsewhere indicates that providing climbing lanes would reduce accident rates. These issues, including accidents in specific sections of the highway and their identified causes, will be fully analyzed in the EIS. A projected overall accident reduction of 20% due to climbing lanes, for example, was recommended in *Development of Accident Reduction Factors*, Kentucky Transport Center & Commonwealth of Kentucky Transp. Cabinet (June 1996).

## 2.2.4 Summary of Transportation Analyses

The analyses performed for the portion of the Thruway in Rockland County between the Tappan Zee Bridge and Interchange 15 in Suffern identified locations where conditions related to lengthy steep grades would meet applicable guidelines for the installation of climbing lanes. These sections are:

- **Eastbound** - the analyses of truck speed profiles support the addition of two separate climbing lane sections:

  - From the vicinity of Interchange 14B to just east of the high point in Monsey at the Route 59 overpass. This section meets the speed delay (more than 10 mph drop in speed) and LOS ("E" or "F") criteria. However, the projected volumes are generally lower than in sections further to the east, and the LOS conditions reflect downstream congestion problems more than high volumes in this area. Therefore, a climbing lane in this segment may not be warranted.

  - From Interchange 12 to the crest at Interchange 11, where an eastbound climbing lane would connect to the existing fourth eastbound lane that begins at Interchange 11. Projected speed reductions, volumes and LOS conditions all support a climbing lane in this section.

  Therefore, the results of these analyses support the development of a climbing lane in the eastern segment (Interchange 12 to 11). The western portion (Interchange 14B to Monsey) would not be considered at this time and could be revisited in the future based on updated traffic analyses.

- **Westbound** - the speed reduction analyses warrant a climbing lane from approximately Interchange 11 to a point between Interchanges 14A and 14B, with the lane ending at the Spring Valley truck toll barrier approximately 1 mile west of Interchange 14A, feeding cash-paying trucks directly into the toll plaza. While there is an approximately 4,000-foot long, 3-percent grade west of the toll plaza, LOS conditions in that area (LOS "D") do not warrant a climbing lane. There is a portion of the westbound Thruway – approximately from just west of Interchange 11 to midpoint between Interchanges 12 and 13 – where the analyses show truck speeds would be near or at desired speed levels. However, with the poor LOS conditions and high volumes in that section, maintaining lane continuity by providing a continuous climbing lane to the truck toll plaza is warranted, rather than dropping the lane for this segment and then beginning it again in only 1.5 miles.

When segments of a climbing lane would pass through interchanges areas, the lengths of the on-ramp acceleration and off-ramp deceleration lanes would be extended as necessary to provide safe weaving lengths for vehicles passing through the climbing lane to enter and exit the highway. Ample signage would be posted on the highway (1) directing slow-moving trucks to use the climbing lane, except to pass, and (2) excluding trucks from the two higher-speed general purpose lanes in areas that include a climbing lane. Strict enforcement of these requirements by state police would help assure compliance and safer operations. Figure 2-5 shows the projected locations along the corridor where climbing lanes would be warranted based on the results of the analyses presented in this report. It should be noted that while climbing lanes would push proposed CRT and BRT alignments closer to the ROW edge and CRT and BRT would attract some travelers from vehicles, overall these factors would not significantly alter highway operations or the basic justification for climbing lanes, which is driven primarily by highway grades. In addition, the safety benefits of adding climbing lanes will be fully analyzed in the DEIS, along with a more detailed assessment of their impacts on traffic congestion and speeds.

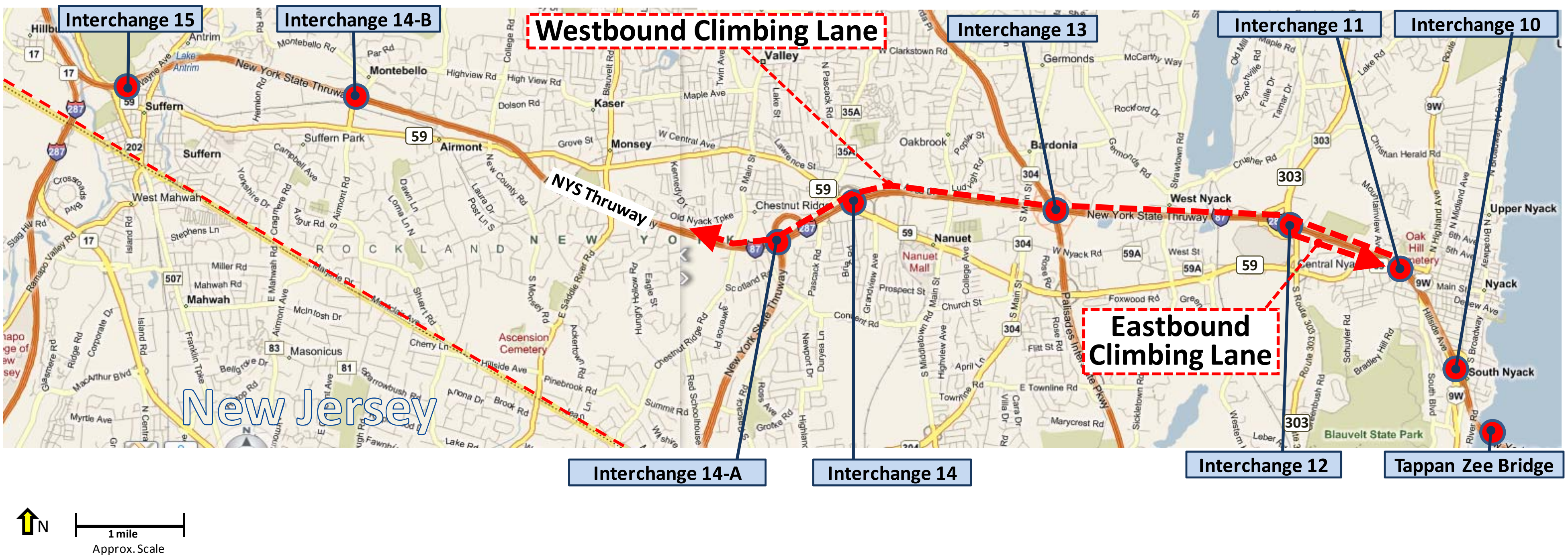



Figure 2-5 Potential Location for Eastbound and Westbound Climbing Lanes

## 2.3 Evaluation of Results

The following is an initial overall assessment of the impacts of climbing lanes in the eastbound and westbound segments where the traffic results presented in Section 2.2 above indicate they are warranted. The evaluations presented below include (1) a brief summary of the previously presented impacts of climbing lanes on transportation operations, (2) an assessment of their potential impacts on key environmental resources, and (3) an initial estimate of their potential capital construction costs and likely areas of increased operations and maintenance costs. This screening used the concept plans for these lanes that were developed as part of the TAOR analyses. The analyses presented below reflect a review of those project plans for Rockland County under the two Build scenarios defined in Chapter 1 – i.e., Build with Busway (CRT plus BRT in a Busway), and Build with HOT/HOT Lane (CRT plus BRT in HOV/HOT lanes). The overall effectiveness of climbing lanes and other planned highway improvements and any associated beneficial or adverse impacts will be analyzed in greater detail in the DEIS.

### 2.3.1 Transportation

- **Traffic Operations**: In those highway sections where analyses indicate climbing lanes are warranted, ameliorating the problems of truck speed reductions greater than 10 mph below desired speed levels in often heavily congested highway sections would result in operational benefits for both the trucks using that lane and the vehicles in the adjacent general purpose lanes. The exact extent of these benefits will be established in the detailed traffic analyses to be performed for the EIS.

- **Traffic Safety**: The analyses show an overall high accident rate for the Thruway in this section of Rockland County, with climbing lanes projected to correct the unsafe conditions caused by the juxtaposition of large, slower-moving trucks next to higher-speed traffic. The more detailed accident analyses to be performed for the EIS will assess in more detail the existing accident rates in these steep grade sections and how the climbing lanes would help improve traffic safety.

### 2.3.2 Environmental

Screening assessments of the potential environmental impacts of the proposed project were completed as part of the TAOR. The following section assesses whether providinga westbound climbing lane from Interchange 11 to the Spring Valley Toll Plaza and an eastbound climbing lane from Interchange 12 to Interchange 11 would cause or exacerbate any significant environmental impacts. More detailed analyses of such impacts will be completed as part of the EIS. These studies, done for the two Build options noted above, indicate the following:

- **Displacement, Acquisitions** – Under the Build with Busway alternatives, the eastbound climbing lane would displace one additional shed (along Stony Hill Lane). The westbound climbing lane would displace five residential garden sheds (along James Drive), a garage (within Jeanne Marie Gardens), one shed belonging to the Dutch Reformed Church (along Strawtown Road), and one residence (on Amanda Lane). The area of acquisition within Mountainview Nature Park would be slightly larger (approximately 0.1 – 0.2 acres) due to the westbound climbing lane.

  Under the Build with HOV/HOT Lane alternatives, the eastbound climbing lane would displace one additional shed along Stony Hill Lane. The westbound climbing lane would displace three garden sheds (two at James Drive, one at Demarest Mill Road), and one commercial structure

(New City Diner at Interchange 13/Main Street). The area of acquisition within Mountainview Nature Park would be slightly larger (approximately 0.1 – 0.2 acres) due to the westbound climbing lane.

Overall, the project's total displacements and acquisitions would not be significantly changed by the addition of either an eastbound or westbound climbing lane in the designated highway segments.

- **Land Use, Parks** – Under both the Build with Busway and Build with HOV/HOT Lanes alternatives, the eastbound and westbound climbing lanes would have a slightly larger impact on nearby sensitive land uses (by moving project components slightly closer to them), but not to a significant extent. As noted above, the required acquisition of portions of Mountainview Nature Park (just west of Interchange 11) would be slightly greater with the westbound climbing lane.

- **Visuals** – Under the Build with Busway alternatives, eastbound and westbound climbing lanes would move the project's proposed transit elements approximately 12 feet closer to adjacent land uses, but not to the extent that would result in significantly worsened visual impacts. The CRT would remain as a new visual feature for homes located along Greenbush Road and Stony Hill Lane (just east of Interchange 12). The westbound climbing lane would move the busway somewhat closer to residences and other sensitive uses along the highway, but not to a significant extent.

  Under the Build with HOV/HOT lane alternatives, the westbound climbing lane would shift the highway elements slightly closer to adjacent land uses on the north side. This would slightly increase the visual impacts of the CRT for residences in the Greenbush Road and Stony Hill Lane area (by shifting it closer), but not to a significant extent. The vertical alignment of the CRT, unaffected by the climbing lanes, would also play a key role in defining visual impact on adjacent properties.

- **Wetlands, Ecology** – Construction of the BRT and CRT under both the Build with Busway and Build with HOV/HOT Lanes alternatives would impact wetlands (including New York State Department of Environmental Conservation [NYSDEC] – regulated wetlands) throughout the corridor. The addition of climbing lanes would result in some slight variation in the acreage of impacted wetlands under both Build options (less than 10%), but the overall wetlands and ecosystems impacts would not be significantly increased by the addition of climbing lanes.

- **Water Quality** – Impacts to water quality due to the climbing lanes are directly related to the increase in impervious surface (pavement) associated with each option; increases in impervious surface result in proportionate increases in total pollutant loads to receiving waterbodies, and the total quantity of runoff which must be managed.

  The provision of the westbound climbing lane would increase the total impervious surface of the proposed project under both the Build with Busway and Build with HOV/HOT Lanes alternatives by approximately 9.3 acres. This would represent an increase of approximately 11 percent in the estimated impervious surfaces of the proposed highway and its transit improvements within the affected drainage areas located within the Hackensack and Saddle River basins.

  Under both sets of Build alternatives, providing the eastbound climbing lane would increase the impervious surface of the proposed highway and transit improvements by 1.5 acres. This would represent an approximately 5 percent increase in the project's estimated impervious surfaces in the affected drainage areas within the Hackensack River basin. Combined, the eastbound and westbound climbing lanes would increase the proposed project's impervious surface by 12 percent within the affected drainage areas within Hackensack and Saddle River basins. These changes would not represent a significant difference in the project's overall water quality impacts.

- **Historic Resources** – the following table indicates the historic resources that the overall project would potentially impact (including all transit improvements) in the areas in which climbing lanes are being considered, and whether inclusion of the climbing lane closest to that resource in question would cause or exacerbate any significant impacts:

| Build with Busway | Build with HOV/HOT Lanes |
|---|---|
| • National Register-eligible NY & Erie RR Co. Alignment (Piermont Line) (reconstruction of Thruway bridge over railroad within railroad ROW) ***Westbound Climbing Lane would not significantly change this impact.*** | • National Register-eligible NY & Erie RR Co. Alignment (Piermont Line) (reconstruction of Thruway bridge over Piermont Line). ***Westbound Climbing lane would not significantly change this impact.*** |
| • National Register-listed Palisades Interstate Parkway (reconstruction of parkway bridge over the Thruway and parkway/Interchange 13 ramps; CRT tunnel construction beneath parkway; and acquisition of potential easement) ***Westbound Climbing Lane would not significantly change this impact.*** | • National Register-listed Palisades Interstate Parkway (reconstruction of parkway bridge over Thruway and parkway/Interchange 13 ramps; CRT tunnel construction beneath parkway; and acquisition of potential easement. ***Westbound Climbing Lane would not significantly change this impact.*** |
| • Recommended National Register-eligible Strawtown Road Historic District (strip take from contributing resources on north side of the Thruway - fee without acquisition and area of potential easement). ***Westbound Climbing Lane would not significantly change this impact.*** | • Recommended National Register-eligible Strawtown Road Historic District (area of potential easement from contributing resources on the north side of the Thruway; potential strip take and fee without acquisition from contributing resource on the south side of Thruway). ***Eastbound and Westbound Climbing Lanes would not significantly change this impact.*** |
| • Recommended National Register-eligible 62 and 64 North Greenbush Road (strip take). ***Eastbound Climbing Lane would have no significant effect on this impact.*** | |

- **Archaeological Resources** – Development of the proposed climbing lanes within the existing ROW would not impact any known archaeological resources.

- **Air and Noise Quality** – The addition of climbing lanes, by improving traffic flow along the highway, would result in a reduction in total highway-related emissions due to the increase in operating speeds, although the change in the highway's overall emissions would be relatively small. No significant changes in sound levels within properties adjacent to the highway are projected to occur due to the inclusion of climbing lanes.

## 2.4 Costs

- Capital Costs. Preliminary capital cost estimates based on the conceptual designs for the eastbound and westbound climbing lanes indicate that the additional capital costs of this proposal, in 2012 dollars, would be approximately $446 million. This estimate includes construction of the climbing lane pavement and ramp modifications, demolition, excavation/rock cutting, utility relocation and drainage. These costs also include all materials, labor and equipment costs (including location, market escalation, etc.) and mark-ups for (1) design and construction contingencies, (2) contractors general condition, insurance, overhead and profit, and (3) soft costs such as design, permitting and agency staff. This does not include the costs of additional property acquisition.

- O&M Cost Factor. Climbing lanes, through the addition of a fourth lane in the affected areas, would primarily increase pavement-related O&M costs – e.g., general pavement maintenance, pavement markings, snow clearance and de-icing, highway lighting, and added signage (fixed or VMS) related to control of the lanes' operations.

## 2.5 Summary

- Traffic analyses – specifically the assessment of those sections of the Thruway between Interchanges 10 and 15 where grades would lower heavy truck speeds beyond AASHTO guidelines – support the inclusion of climbing lanes in portions of the eastbound and westbound Thruway.

- When combined with AASHTO and NYSDOT climbing lane guidelines regarding traffic congestion and minimum traffic volume required to justify climbing lanes, the overall traffic studies indicated that climbing lanes would be warranted in the following areas:

  - **Eastbound** - From Interchange 12 to the crest at Interchange 11.

  - **Westbound** - From approximately Interchange 11 to a point between Interchanges 14A and 14B, with the lane ending at the Spring Valley truck toll barrier approximately 1 mile west of Interchange 14A

- An initial environmental assessment of the proposed addition of climbing lanes in the eastbound and westbound segments noted above did not identify any potentially significant environmental impacts associated with these improvements.

- The projected costs of the proposed climbing lanes would be approximately $446 million.

# 3 Collector/Distributor Roads at Interchange 13

This chapter reviews the general methodologies and guidelines for assessing the need for a collector/distributor (C/D) roadway within a highway interchange, and then applies those procedures to assess whether Thruway Interchange 13 in Rockland County warrants the inclusion of such a roadway within its proposed design.

Interchange 13 with the Palisades Interstate Parkway (PIP) is a full cloverleaf interchange (one "outer" and one "inner" entrance/exit ramp in each of the interchange's four quadrants). The Thruway in this area has three general purpose lanes in each direction. All the ramps are single-lane, single-directional ramps. Figure 3-1 shows the existing interchange configuration.

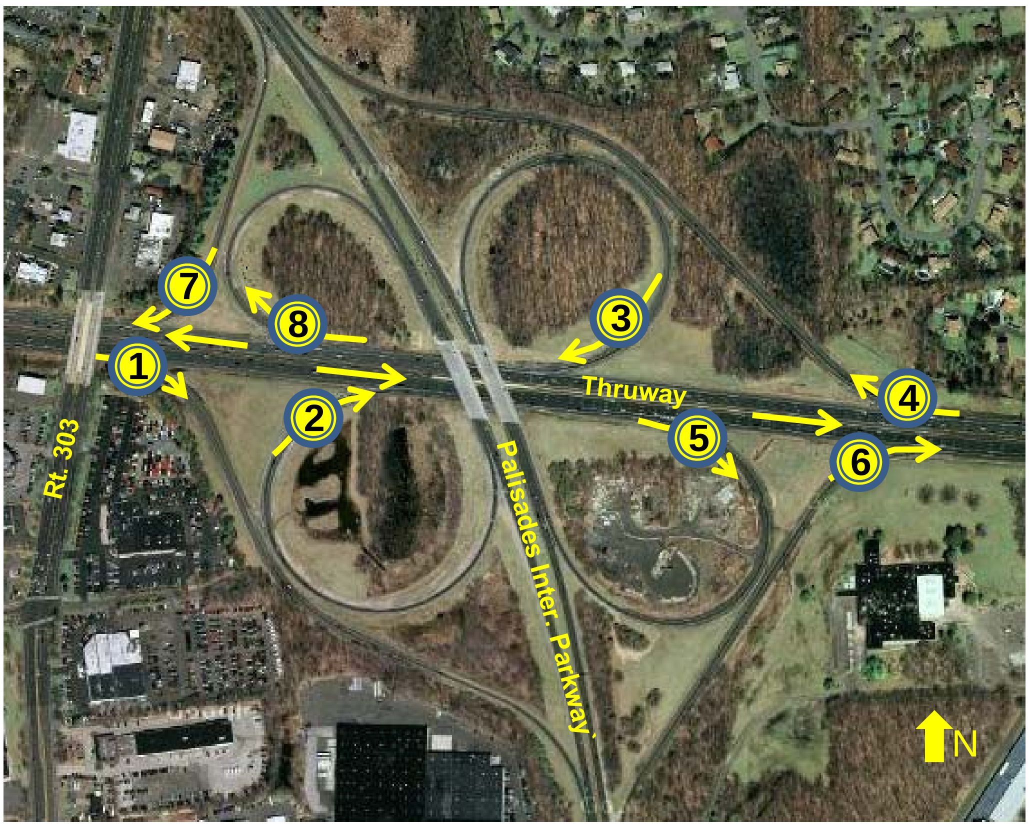



Figure 3-1 Interchange 13 (Thruway and PIP)

The potential need for collector/distributor lanes at this location is due to the high volume of vehicles transferring between the two highways and the pressure that puts on the interchange's capacity to handle those volumes, particularly at the points where so-called "weave-merge" conditions are created. Congestion in these areas affects both the flow of entering and exiting vehicles and also creates turbulence in the highway's general traffic lanes that can reduce overall highway speeds.

The numbered movements on Figure 3-1 are those locations where vehicles enter or exit the Thruway at the interchange (e.g., Movement 1 is where eastbound Thruway traffic exits to connect to the southbound PIP; Movement 3 represents vehicles leaving the northbound PIP and entering the westbound Thruway).

Traffic flow problems at interchanges can occur where vehicles are merging into a highway's traffic lanes at a point very close to where other vehicles are departing from that same highway. The area where vehicles are weaving and merging to get between on- and off-ramps and the highway lanes is called a weaving section.

Figure 3-2 shows a close-up of the weaving sections on both the eastbound and westbound Thruway at this interchange. For example, the location where vehicles from the southbound PIP merge into eastbound Thruway traffic (Movement 2 in Figure 3-1) is very close to the section where some travelers on the eastbound Thruway are shifting over to the off-ramp to the northbound PIP (Movement 5). Movements 3 and 8 have the same problem on the westbound section. Conditions in the westbound direction at this interchange are further complicated by the highway's relatively steep 3-percent grade, which is already slowing down vehicles (especially trucks).

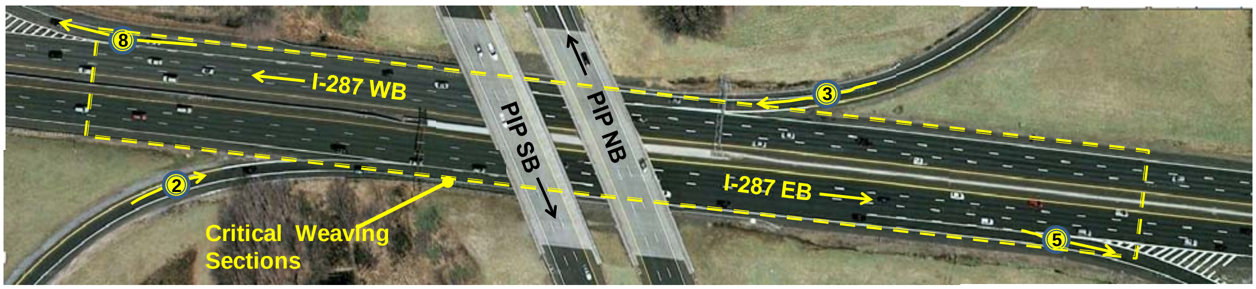



**Figure 3-2 Critical Weaving Section**

At interchanges where such weave-merge volumes are relatively high, their design often includes a C/D auxiliary roadway that effectively shifts some of the interchange's difficult weaving section from the highway's mainline traffic lanes to the C/D roadway or service road. Figure 3-3 shows an example of this type of C/D roadway at a similar interchange of the Long Island Expressway (LIE) and the Sagtikos Parkway on Long Island. The interchange includes a C/D road in both directions to better handle the movement of vehicles between the two highways. Portions of Westchester Avenue along I-287 (Cross-Westchester Expressway) also function as a C/D road.

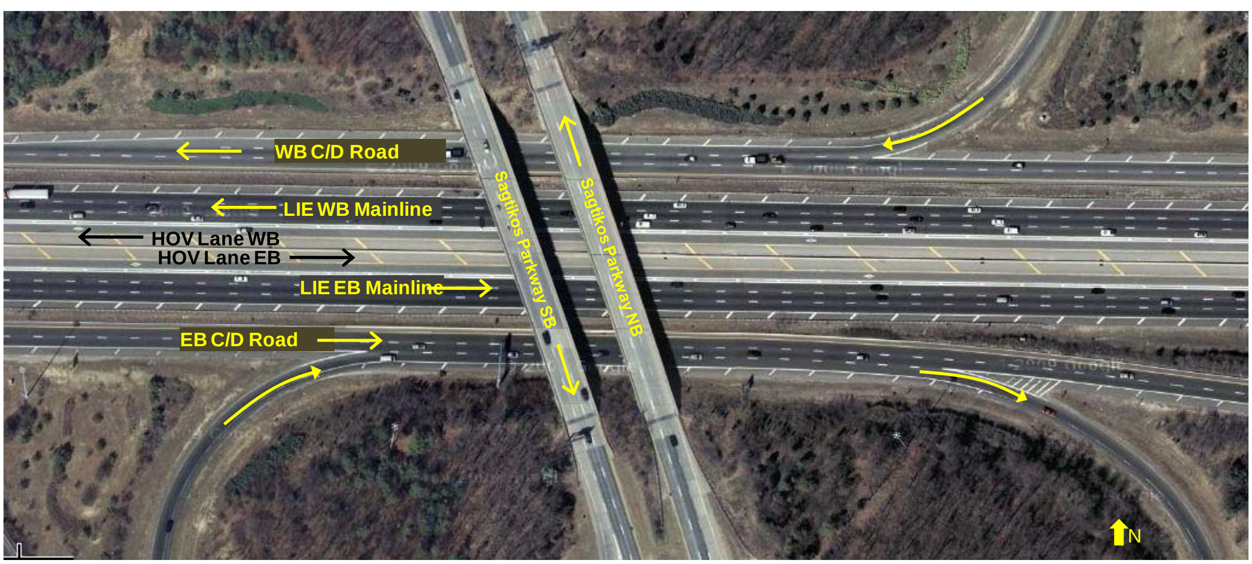



**Figure 3-3 Collector/Distributor Roadway at Interchange 53 of Long Island Expressway (I-495)**

## 3.1 Assessment Guidelines and Procedures

The NYSDOT *Highway Design Manual* (2008) indicates in Chapter 2 (January 2009) that in designing a highway interchange, the various segments should operate at a minimum Level of Service (LOS) of C in ”urban and suburban areas,” but in more “heavily developed” areas an LOS D may be more appropriate. While this area of Rockland County is not heavily developed, the volume levels on the highway are more typical of urban/suburban areas than of those in rural and moderately developed suburban areas. The LOS D criterion has, therefore, been used for these studies. This LOS criterion, which is a measure of the quality of traffic flow on a given section of highway, is based on the density of traffic, expressed in passenger cars per mile per lane (trucks are converted to “passenger car equivalents” in calculating the total volume).

Table 3-1 presents the traffic densities associated with each LOS, from A (free flow traffic) to F (breakdown conditions) for a weaving section. LOS D, the minimum congestion level for C/D roads to be considered, represents increasingly unstable traffic flow, with its higher traffic densities leaving little room to handle any disruptions (e.g., minor accidents, breakdowns, etc.). These LOS assessments use the methodologies described in the 2000 *Highway Capacity Manual (HCM)* and the associated Highway Capacity Software version 2000 (HCS 2000).

**Table 3-1**

**LOS Criteria for Highway Weaving Segments**

| Level of Service | Density (passenger cars/mile/lane) | |
|---|---|---|
| | Highway Weaving Segment | Multilane & Collector-Distributor Weaving Segment |
| A | $\leq$ 10.0 | $\leq$ 12.0 |
| B | >10.0 – 20.0 | >12.0 – 24.0 |
| C | >20.0 – 28.0 | >24.0 – 32.0 |
| D | >28.0 – 35.0 | >32.0 – 36.0 |
| E | >35.0 – 43.0 | >36.0 – 40.0 |
| F | >43.0 | >40.0 |

Source: Transportation Research Board, *Highway Capacity Manual (2000)*, Table 24.2

## 3.2 Analysis of Potential Need for C/D Roadways

To assess the potential operational benefits of providing a C/D road on both sides of Interchange 13, LOS conditions in the weekday AM and PM hours were calculated using the HCM procedures described above. The analysis compared projected LOS under no-build conditions (with the existing highway design) and build conditions (with eastbound and westbound C/D roadways) for the following key components of the interchange:

- Eastbound and westbound weaving sections (the areas highlighted on Figure 3-2).

- Entrance and exit ramps in the eastbound and westbound directions (Movements 1, 4, 6 and 7 on Figure 3-1.

- Eastbound and westbound highway segments immediately west and east of the interchange.

The build conditions also assume the westbound climbing lane, as recommended in Chapter 2 of this report, to be part of the improvements at this interchange. The no-build conditions (2035) analysis assumed a future increase in traffic volumes of approximately 25 percent over existing (2005) conditions. This growth factor was based on travel demand estimates from the study's Best Practices Model (BPM) developed during the project's scoping phase, which generated 30-year travel projections as part of the study's initial development of EIS build alternatives. All no-build and build analyses in this chapter represent conditions in 2035 with volumes estimated in this manner. No change to the existing interchange geometry was assumed under no-build conditions.

## 3.2.1 Analysis of No-Build Volumes and LOS Conditions

Figure 3-4 shows the future no-build AM and PM peak hour volumes in 2035 at Interchange 13 and the projected LOS at key locations (AM and PM peak periods for these analyses are the approximately highest 60-minute period during the 6:30 – 8:30 AM and 4:00 – 6:00 PM periods, respectively). The peak traffic direction on the Thruway mainline is eastbound during the weekday AM peak hour (6,515 vehicles per hour [vph]) and westbound during the weekday PM peak hour (6,300 vph). The highest ramp traffic volumes would be:

- In the southwest quadrant during the weekday AM peak hour (1,700 vph exiting from eastbound Thruway to southbound PIP; 1,250 vph entering the eastbound Thruway from the southbound PIP).

- In the northeast quadrant during the weekday PM peak hour (1,375 vph exiting from westbound Thruway to the northbound PIP; and 1,575 vph entering the westbound Thruway from the northbound PIP).

Figure 3-5 shows the associated no-build AM and PM peak hour weaving and non-weaving traffic volumes in the key weaving sections in the eastbound and westbound directions that were highlighted on Figure 3-2. For example, in the eastbound section in the AM peak, mainline volumes entering the weave section are 4,815 (6,515 entering the interchange area minus the 1,700 vehicles that take the exit ramp to the southbound PIP). Of those, 250 vph merge to the right and take the exit leading to the northbound PIP (Movement 5 on Figure 3-1). Of the 1,250 vph entering the merge area from the southbound PIP (Movement 2 on Figure 3-1), virtually all will continue east on the Thruway, although 65 vph would make a U-turn movement by using the ramp leading to the northbound PIP. Similar weaving traffic volumes are shown on Figure 3-5 for the westbound direction and for conditions in the PM peak. These weaving volumes were derived from the interchange volumes shown on Figure 3-4 to arrive at balanced flows.

The following assumptions were used in the LOS analysis of the individual highway elements at Interchange 13:

- Free-flow speed on mainline = 70 mph (based on measured speeds under free-flow conditions).
- Free-flow speed on C/D road = 45 mph (under build conditions, as described below).
- Free-flow speed on outer ramps = 30-40 mph.
- Percentage of trucks on the Thruway = 5 percent.

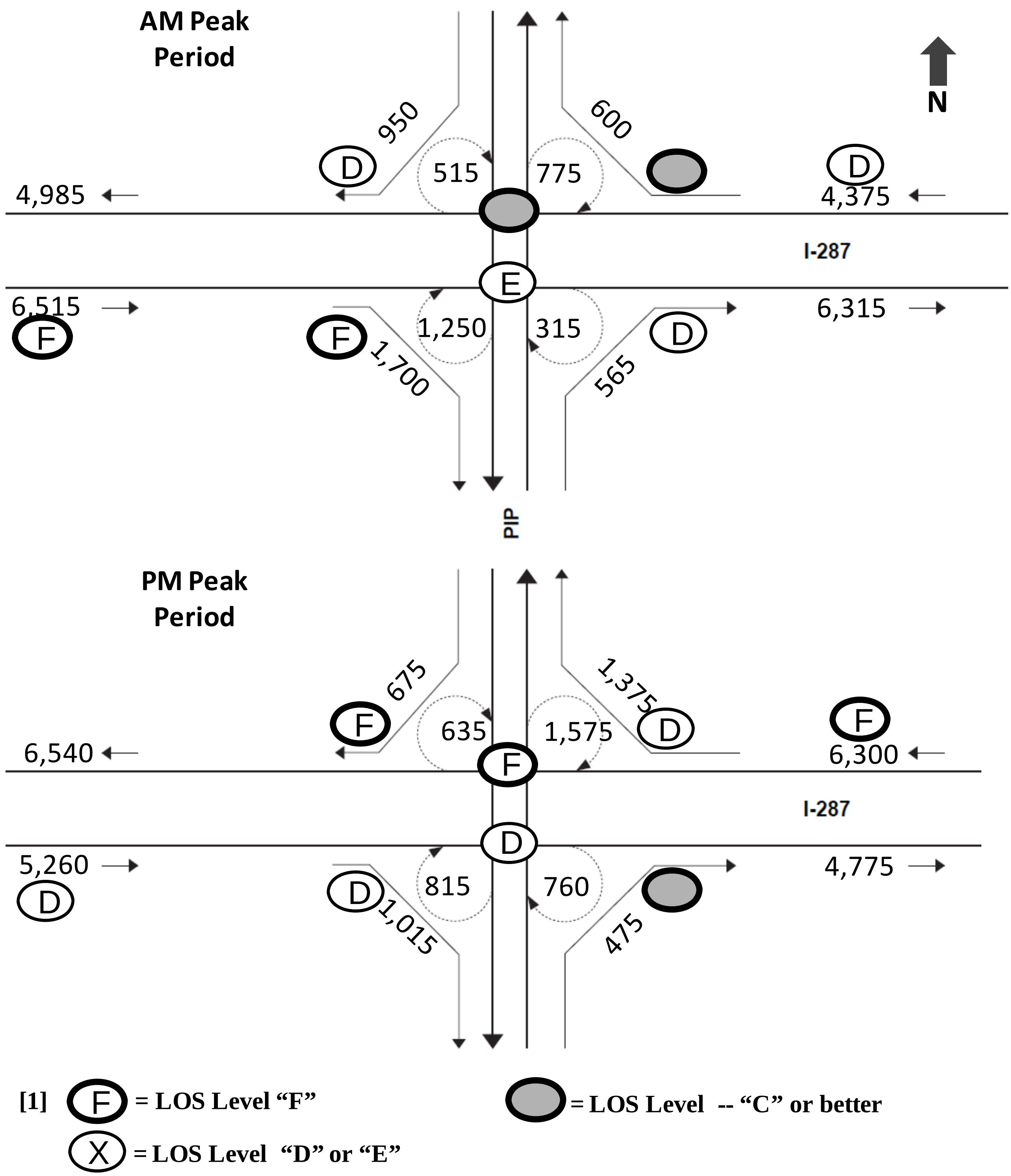



Figure 3-4 Future No-Build Volumes at Interchange 13 [1]

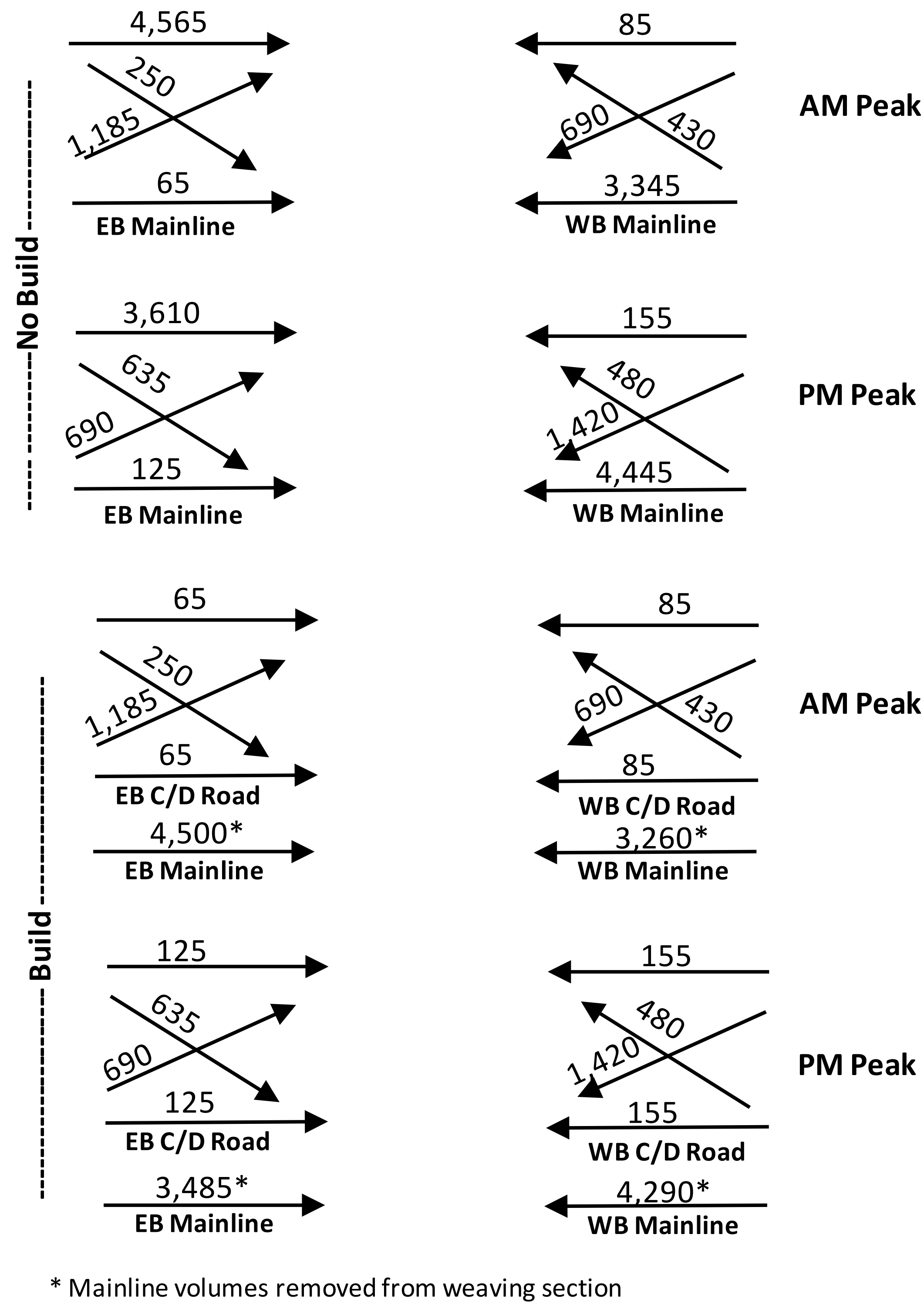



**Figure 3-5 No-Build & Build Weaving Section Volumes**

- Horizontal and vertical geometry according to TAOR plans.

Table 3-2 summarizes the no-build LOS analysis results for each of the interchange components in the eastbound and westbound directions during the weekday AM and PM peak hours. Under future no-build conditions, traffic operations on the following interchange components would deteriorate to LOS F:

- **The eastbound mainline west of Interchange 13, during the weekday AM peak hour**: this indicates the high eastbound traffic flows on the highway upstream (west) of the interchange; LOS conditions would likely be further affected by spillback from weave/merge problems at the interchange (to be analyzed in greater detail in the DEIS).

- **The eastbound mainline diverge during the weekday AM peak hour**: the ramp leading to the southbound PIP (Movement 1 on Figure 3-1) would not have sufficient capacity to handle the high volume of exiting traffic (1,700 vph).

- **The westbound mainline, east of Interchange 13, during the weekday PM peak hour**: same mainline congestion problem as in the eastbound direction, with weave/merge congestion at the interchange creating spillback problems affecting highway operations east of the interchange.

- **The westbound weaving section during the weekday PM peak hour**: these conditions reflect the over 2,100 vph getting on or off the westbound Thruway in this area, combined with high through-traffic volumes.

- **The westbound mainline merge during the weekday PM peak hour**: the high volumes in the westbound highway lanes provide insufficient openings for the volumes entering from the southbound PIP.

Although not at LOS F, the eastbound mainline weaving section would operate at LOS E during the weekday AM peak hour, reflecting the same type of weave/merge problems that create LOS F in the westbound mainline weaving section in the PM peak.

**Table 3-2**

**Level of Service Conditions: Future No-Build AM & PM Peak Hours**

| | AM Peak | | | PM Peak | | |
|---|---|---|---|---|---|---|
| | Speed | Density | LOS | Speed | Density | LOS |
| **Eastbound Mainline** | | | | | | |
| EB ML West of Int. 13 | * | * | F | 62.0 | 33.0 | D |
| EB ML Diverge | 58.5 | 37.5 | F | 60.3 | 31.1 | D |
| EB ML Weaving Section | 46.7 | 37.4 | E | 48.7 | 29.9 | D |
| EB ML Merge | 56.7 | 30.2 | D | 61.8 | 23.0 | C |
| **Westbound Mainline** | | | | | | |
| WB ML East of Int. 13 | 65.7 | 27.1 | D | * | * | F |
| WB ML Diverge | 61.4 | 25.8 | C | 59.3 | 34.4 | D |
| WB ML Weaving Section | 50.5 | 26.0 | C | 41.5 | 45.0 | F |
| WB ML Merge | 59.6 | 30.2 | D | 52.3 | 38.0 | F |

* Speed and density results are not computed by HCM for freeway segments under highly contested conditions.

### 3.2.2 Analysis of Build Volumes and LOS Conditions with C/D Roads

The assessment of the build condition (i.e., with the addition of C/D roads in both the eastbound and westbound direction) was based on the January 2010 conceptual plan for *HOV/BRT Alternative Option 1* prepared for the TAOR (see Figure 3-6). The conceptual plan shows the following geometric improvements to Interchange 13:

- One high occupancy vehicle/high occupancy toll (HOV/HOT) lane in each direction (other build alternatives without a median HOV/HOT lane are also being considered).
- A two-lane C/D road in each direction on the Thruway (such that weaving due to ramps from the PIP to the eastbound and westbound Thruway would now take place on the C/D roads, rather than on the mainline).
- A fourth westbound lane (the warranted westbound climbing lane, as discussed in Chapter 2).

The figure shows a commuter rail transit (CRT) alignment along the southern edge of the highway. CRT in Rockland County is proposed as part of all build alternatives to be considered in the EIS, as is BRT operating in either a busway or in HOV/HOT lanes.

Because the presence of an HOV/HOT lane would shift some traffic from the adjacent general traffic lanes to the HOV/HOT lanes, LOS analyses were performed for the build condition with and without the presence of the HOV/HOT lane to assess the differences in the operation of the interchange. Therefore, two build options (both with C/D roads) were analyzed, as defined in Chapter 1:

- **Build with Busway** - represents condition with C/D roads but no HOV/HOT lanes.
- **Build with HOV/HOT Lanes** - includes C/D roads and HOV/HOT lanes, and assumes approximately 1,000 vehicles per hour traveling through the interchange in the general traffic volume would shift to the HOV/HOT lanes in the peak direction.

For each direction of the Thruway, the C/D road volumes were calculated from the projected traffic volumes transferring between the mainline and the northbound and southbound PIP. The projected volumes for the Build with Busway and Build with HOV/HOT Lanes options and estimated LOS levels at key points within the interchange during the weekday AM and PM peak hours are shown on Figures 3-7 and 3-8, respectively.

The weaving and non-weaving traffic volumes projected for the no-build condition were adjusted to reflect the build condition (with the C/D road) and are shown in Figure 3-5 (previously presented in Section 3.2.1) for the weekday AM and PM peak hours. The peak hour traffic volumes for the on- and off-ramps and C/D roads are identical for the Build with Busway and Build with HOV/HOT Lanes options, as the volume of traffic heading to and from the PIP is independent of whether the HOV/HOT lane is included in the proposed project.

The projected LOS conditions under no-build and the two Build options are presented in Table 3-3 for westbound and eastbound operations in the AM and PM peak hours. Under both Build options, all highway components at Interchange 13 operate at LOS D or better in the off-peak direction (i.e., westbound in the AM peak, eastbound in the PM peak). However, in the peak directions, a variety of operational failures are projected to occur during the both peak periods, as described below.

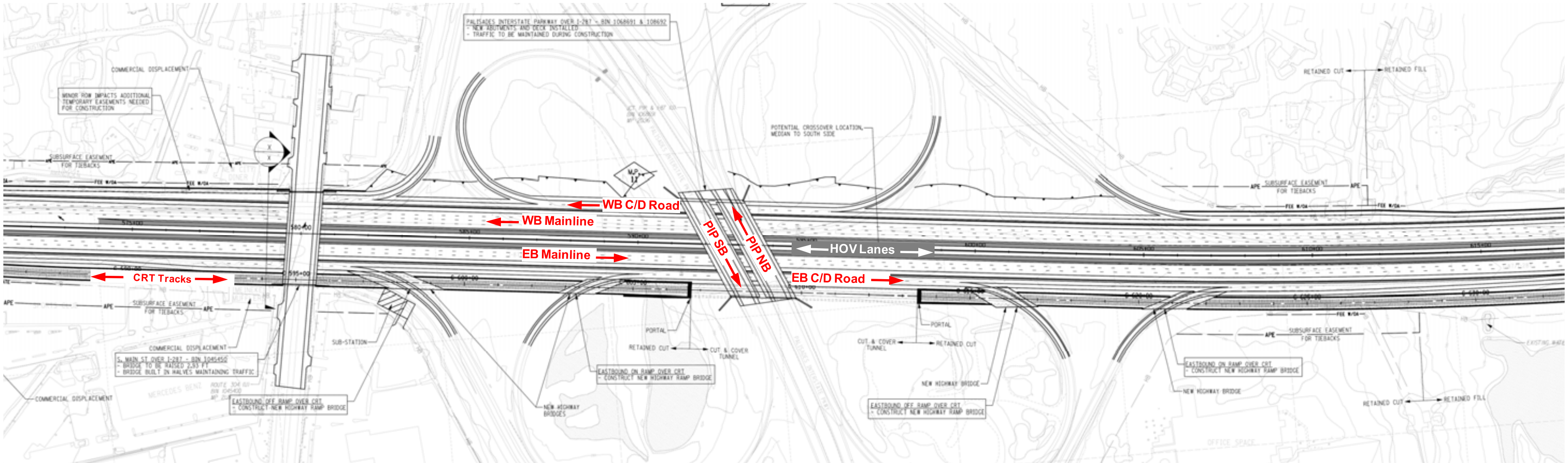



Figure 3-6 Concept Plan for C/D Roads at Interchange 13

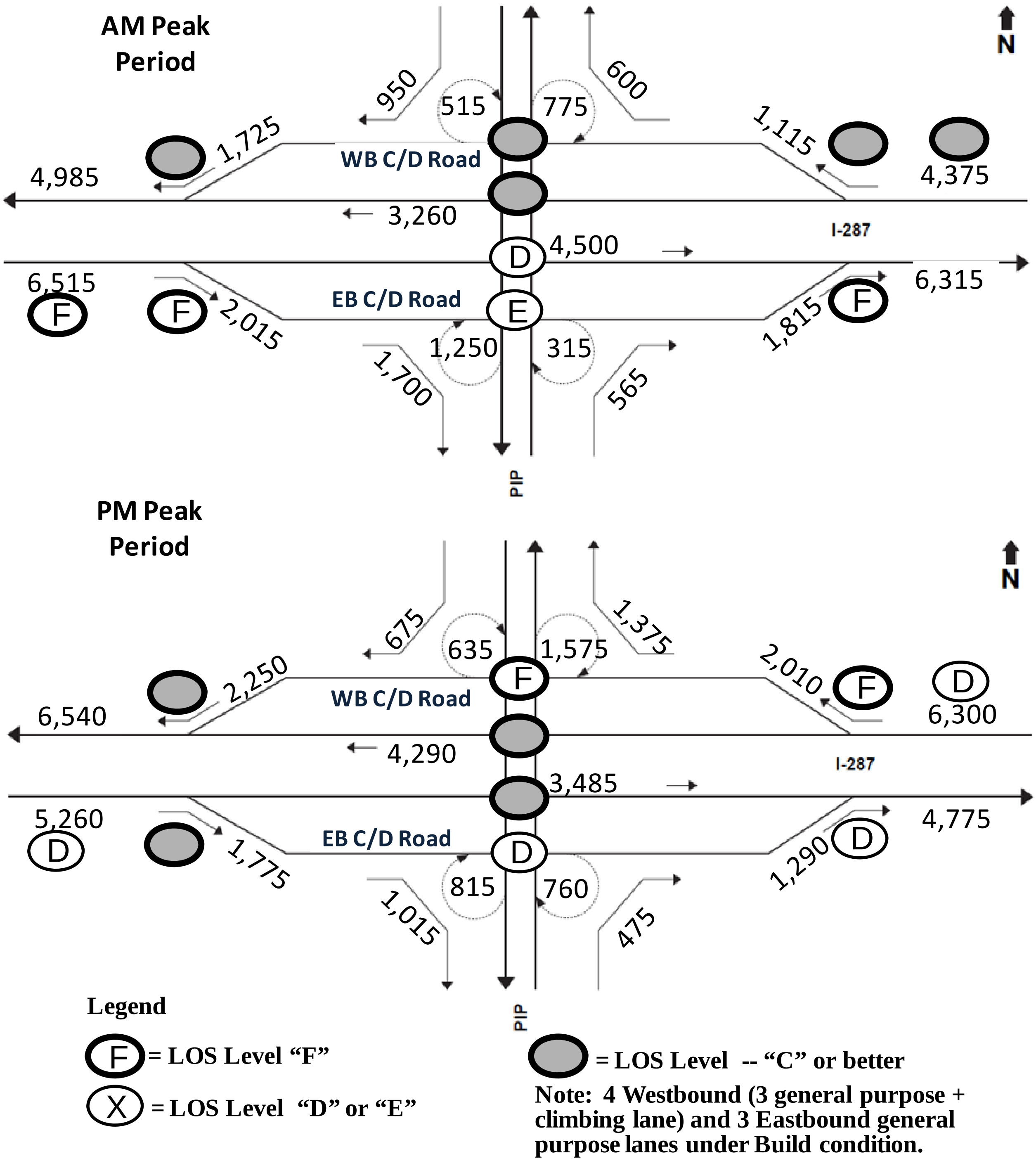
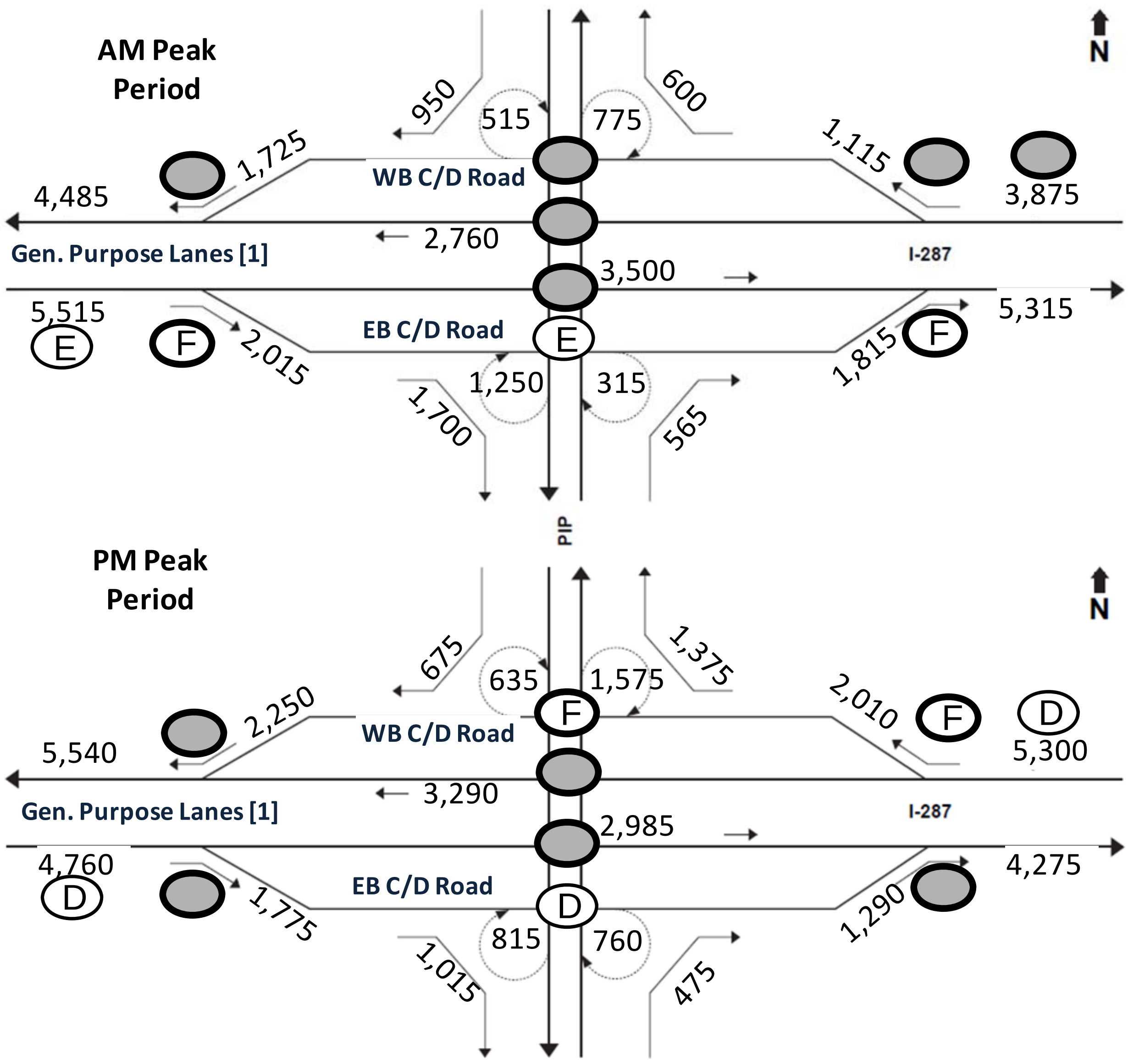



**Figure 3-7 Future Build Volumes at Interchange 13 with C/D Roads: Build with Busway (No HOV/HOT Lanes)**




[1] Volumes shown on I-287 Mainline are in the general purpose lanes and do not include those in the HOV/HOT lanes assumed under this alternative.

**Legend**

F = LOS Level "F"

X = LOS Level "D" or "E"

= LOS Level -- "C" or better

**Note: 4 Westbound (3 general purpose + climbing lane) and 3 Eastbound general purpose lanes under Build condition.**

**Figure 3-8 Future Build Volumes at Interchange 13 with C/D Roads: Build with HOV/HOT Lanes**

## Table 3-3
## Level of Service Conditions: No-Build, Build with Busway (No HOV/HOT Lanes) & Build with HOT/HOV Lanes

| | No-Build | | | Build w/ Busway (No HOV/HOT) | | | Build with HOV/HOT Lane | | |
|---|---|---|---|---|---|---|---|---|---|
| **WESTBOUND** | Speed (mph) | Density (pc/mi/ln) | LOS | Speed (mph) | Density (pc/mi/ln) | LOS | Speed (mph) | Density (pc/mi/ln) | LOS |
| | **Westbound AM Peak Hour** | | | | | | | | |
| WB ML East of Int. 13 | 65.7 | 27.1 | D | 68.5 | 19.5 | C | 67.0 | 17.7 | B |
| WB ML Diverge | 61.4 | 25.8 | C | - | - | - | - | - | - |
| WB ML Weaving Section | 50.5 | 26.0 | C | - | - | - | - | - | - |
| WB ML Merge | 59.6 | 30.2 | D | - | - | - | - | - | - |
| WB ML Diverge to C/D Rd | - | - | - | 62.4 | 19.4 | B | 62.1 | 17.1 | B |
| WB Mlthrough Int. 13 with C/D Rd | - | - | - | 68.5 | 13.9 | B | 68.5 | 11.8 | B |
| WB C/D Rd Weaving Section | - | - | - | 23.7 | 30.2 | D | 23.7 | 30.2 | D |
| WB Merge from C/D Rd to ML | - | - | - | 63.5 | 22.1 | C | 68.0 | 23.8 | C |
| | **Westbound PM Peak Hour** | | | | | | | | |
| WB ML East of Int. 13 | * | * | F | 65.1 | 29.6 | D | 68 | 23.8 | C |
| WB ML Diverge | 59.3 | 34.4 | D | - | - | - | - | - | - |
| WB ML Weaving Section | 41.5 | 45.0 | F | - | - | - | - | - | - |
| WB ML Merge | 52.3 | 38.0 | F | - | - | - | - | - | - |
| WB ML Diverge to C/D Rd | - | - | - | 59.4 | 31.2 | F | 58.9 | 27.1 | F |
| WB Mlthrough Int. 13 with C/D Rd | - | - | - | 68.5 | 18.3 | C | 68.5 | 14.0 | B |
| WB C/D Rd Weaving Section | - | - | - | 20.9 | 58.7 | F | 20.9 | 58.7 | F |
| WB Merge from C/D Rd to ML | - | - | - | 62.0 | 25.9 | C | 62.9 | 23.9 | C |

* Speed and density results are not computed by HCM for freeway segments under highly congested conditions.

| | No-Build | | | Build w/ Busway (No HOV/HOT) | | | Build with HOV/HOT Lane | | |
|---|---|---|---|---|---|---|---|---|---|
| **EASTBOUND** | Speed (mph) | Density (pc/mi/ln) | LOS | Speed (mph) | Density (pc/mi/ln) | LOS | Speed (mph) | Density (pc/mi/ln) | LOS |
| | **Eastbound AM Peak Hour** | | | | | | | | |
| EB ML West of Int. 13 | * | * | F | * | * | F | 59.7 | 35.4 | E |
| EB ML Diverge | 58.5 | 37.5 | F | - | - | - | - | - | - |
| EB ML Weaving Section | 46.7 | 37.4 | E | - | - | - | - | - | - |
| EB ML Merge | 56.7 | 30.2 | D | - | - | - | - | - | - |
| EB ML Diverge to C/D Rd | - | - | - | 57.7 | 32.7 | F | 57.5 | 29.1 | F |
| EB ML through Int. 13 with C/D Rd | - | - | - | 65.9 | 26.5 | D | 67.0 | 17.7 | C |
| EB C/D Rd Weaving Section | - | - | - | 22.2 | 39.1 | E | 22.2 | 39.1 | E |
| EB Merge from C/D Rd to ML | - | - | - | 50.1 | 37.6 | F | 57.0 | 32.4 | D |
| | **Eastbound PM Peak Hour** | | | | | | | | |
| EB ML West of Int. 13 | 62.0 | 33.0 | D | 62.0 | 33.0 | D | 65.0 | 28.5 | D |
| EB ML Diverge | 60.3 | 31.1 | D | - | - | - | - | - | - |
| EB ML Weaving Section | 48.7 | 29.9 | D | - | - | - | - | - | - |
| EB ML Merge | 61.8 | 23.0 | C | - | - | - | - | - | - |
| EB ML Diverge to C/D Rd | - | - | - | 58.2 | 27.4 | C | 57.9 | 25.3 | C |
| EB ML through Int. 13 with C/D Rd | - | - | - | 67.0 | 20.2 | C | 67.0 | 17.3 | B |
| EB C/D Rd Weaving Section | - | - | - | 23.3 | 37.5 | E | 23.3 | 37.5 | E |
| EB Merge from C/D Rd to ML | - | - | - | 60.3 | 28.0 | D | 61.5 | 25.4 | C |

* Speed and density results are not computed by HCM for freeway segments under highly congested conditions.

### 3.2.3 Summary of Impact of C/D Roads on LOS Conditions

Figure 3-9 indicates the locations where operational deficiencies are projected under no-build conditions in the AM and PM peak hours (i.e., LOS conditions worse than the LOS D design criterion), while Figures 3-10 and 3-11 show the equivalent information under the two Build options.

The results of the analyses described above are based on *HCM* methodologies, which cannot fully reflect potential interactions that may occur among the individual highway components (e.g., merges, diverges, weaving sections, and mainline travel lanes). Therefore, as part of the EIS traffic analyses, Interchange 13 and other aspects of the highway will be investigated using a micro-simulation model to gain further understanding of how the interchange works and the potential interactions among these components. However, the HCM-based analysis and the close review of the volumes and turning patterns provide a strong basis for reviewing the merits of a C/D road system at this location.

The following are the conclusions from the analysis of no-build and build traffic operations at Interchange 13 in terms of the projected LOS conditions and the design options under consideration for this location:

- **Design LOS** - The analyzed section of the Thruway, while located in a moderate-density suburban setting, has sufficiently high volumes to make LOS D a reasonable minimum LOS design standard, as per NYSDOT design criteria. Design exceptions may be requested for C/D roads with weaving sections that would likely not meet the LOS D criterion, as is likely to occur at this location. It should be noted that, in general, design exceptions may be granted for weaving sections at cloverleaf interchanges.

- **Eastbound mainline (weekday AM peak hour)** - The conceptual highway designs utilized for the build conditions at this location included three travel lanes in the eastbound mainline, compared to four travel lanes (three general purpose lanes and one climbing lane) in the westbound direction. Because of the additional lane in the westbound direction, traffic densities would be lower in the westbound direction under similar traffic volume conditions. The difference in the number of basic highway lanes must be taken into consideration when reviewing and comparing LOS levels or other measures of effectiveness (MOEs) for the mainline, merges and diverges in the eastbound and westbound directions under Build conditions.

- **LOS F for Highway Merges and Diverges (weekday AM and PM peak hours)** - As per the 2000 HCM methodology, highway ramp merges and diverges can operate at LOS F when:

    - The traffic demand in the ramp exceeds the ramp's capacity, or;

    - When traffic densities from the ramp traffic and freeway volumes in lanes 1 and 2 (i.e., the lanes closest to the right shoulder) in the highway-ramp influence area exceed critical density thresholds.

  Thruway traffic heading to the northbound and southbound PIP presently uses two separate off-ramps to exit from the mainline. With the C/D road exiting vehicles headed to the PIP would now utilize a single exit ramp leading to the C/D road, with two exit ramps from the C/D roads providing access to the northbound and southbound PIP. Similarly, ramps from the PIP to the Thruway would now connect to the C/D road, with those PIP-related volumes now concentrated at a single entrance ramp from the C/D road to the Thruway. When a ramp's demand volume exceeds its capacity, LOS F would occur, even when standard acceleration/deceleration lane

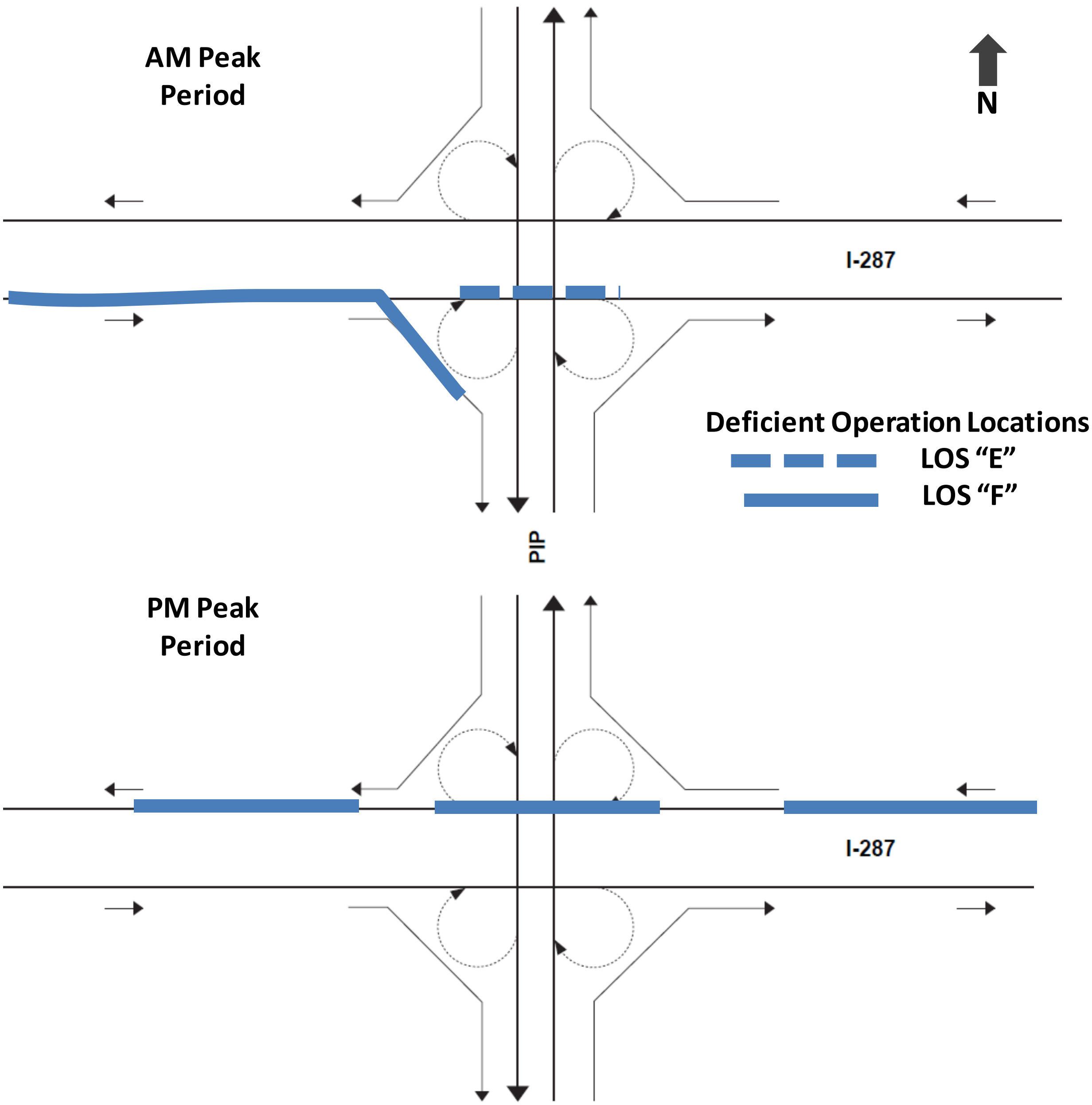



Figure 3-9 Operational Deficiency Locations: Future No-Build

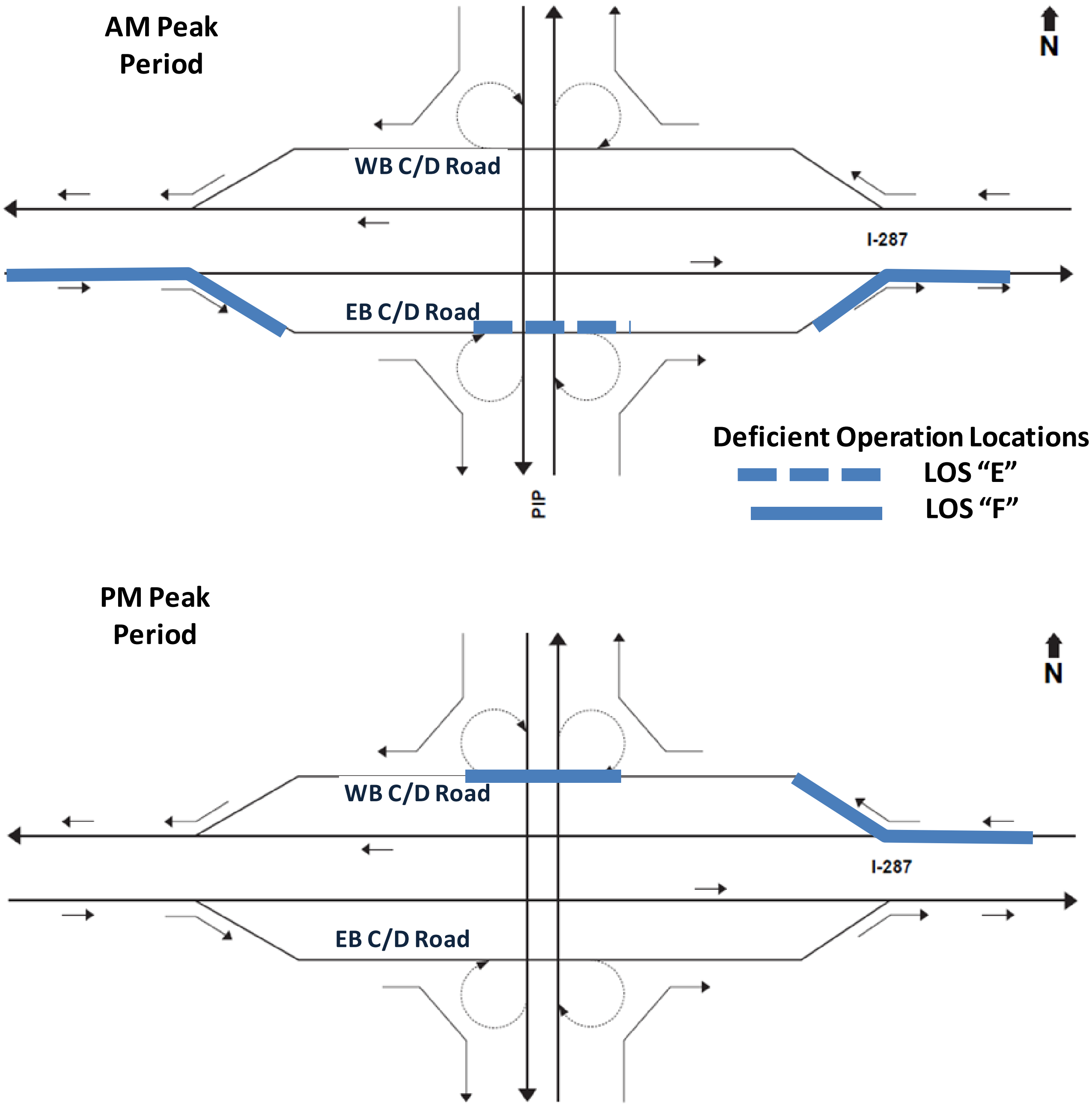



**Figure 3-10 Operational Deficiency Locations with C/D Roads: Build with Busway (No HOV/HOT Lane)**

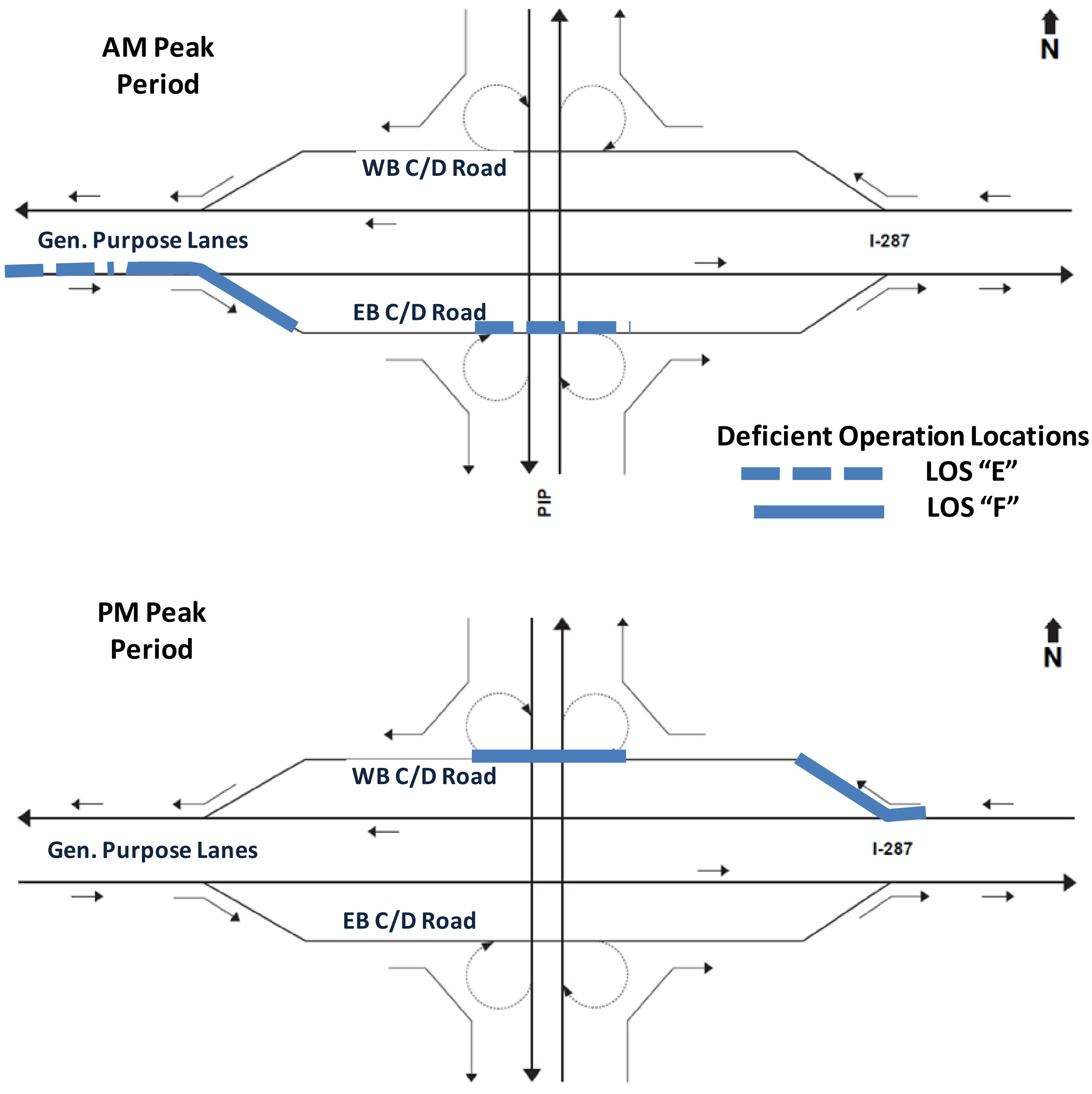



**Figure 3-11 Operational Deficiency Locations with C/D Roads: Build With HOV/HOT Lanes**

lengths are used. This problem is projected to occur during peak hours at the on- and off-ramps to the C/D roads in the peak direction (AM eastbound, PM westbound).

- **Westbound Thruway (weekday PM peak hour)** - During the weekday PM peak hour, LOS F conditions are projected for the westbound mainline diverge (due to the same demand vs. capacity issues as described above), and for the westbound weaving section on the C/D road. Traffic operations in the two-lane westbound weaving section would be more constrained than in the eastbound weaving section during the weekday AM peak hour, due to a higher overall demand (2,250 vs. 1,565 vph) and weaving intensity, and a relatively shorter weaving length (880 vs. 950 feet), in the westbound direction. The combination of these factors yields an equivalent weaving section density of approximately 55 passenger cars/mile/lane (pc/mi/ln), well above the 40 pc/mi/ln threshold for LOS F.

- **HOV/HOT Demand Volumes** - These analyses were not meant to project the exact amount of traffic that might use the HOV/HOT lanes, but rather to provide a sense of how much the shift of traffic to those lanes might impact the operation of this interchange.

In summary, the conclusions of the analyses support the inclusion of C/D roads at this location, given the high volume of movements between the Thruway and the PIP and the impact of those movements on the overall operations of the Thruway. Further, the results indicate that further consideration should be given to expanding the ramps leading to and from C/D roads from one lane to two lanes. This would apply to the eastbound diverge ramp from the eastbound mainline to the C/D road, for the merge ramp at the eastern end of the eastbound C/D road and for the westbound merge and diverge ramps. This issue will be analyzed further as part of the more detailed EIS traffic and conceptual design analyses.

### 3.2.4 Potential "Stretch Out" Concept for Interchange

A potential to increase the spacing between the four cloverleaf ramps in the center of Interchange 13 to provide more weave/merge space for vehicles traveling between the Thruway and the PIP on those ramps was analyzed in terms of its effectiveness in addressing the operational problems caused by these ramps. The results of these analyses showed that providing more space, as expected, would improve LOS conditions in this critical weave/merge area relative to the existing ramp configuration. However, by not shifting these weave/merge activities off of the mainline, as would be done under the C/D road improvement plan, this scheme would provide less overall operational and safety benefits than the C/D road plan, especially under projected higher future volumes. Therefore, this concept was dropped from further consideration.

## 3.3 Evaluation of Results

The following is an initial overall assessment of the impacts of adding C/D roads to Interchange 13. The evaluations presented below include (1) a brief summary of the previously presented impacts of C/D roads on transportation operations, (2) an assessment of their potential impacts on key environmental resources, and (3) an initial estimate of their potential capital construction costs and likely areas where operating and maintenance costs may increase. This screening used the concept plans for C/D roads that were developed as part of the TAOR analyses. The analyses presented below reflect a review of those project plans for Rockland County under the Build with Busway and Build with HOV/HOT Lanes options as defined above.

### 3.3.1 Transportation

- **Traffic Operations**: The analyses presented in Section 3.2 above confirmed that the provision of C/D roads at Interchange 13 would improve traffic operations by shifting the weave/merge conflicts associated with vehicles entering and exiting between the PIP and the Thruway from the Thruway to the C/D roads. Some of the same congestion in the critical weave sections would still occur but to a lesser extent and in a location (the C/D roads) where many fewer vehicles are impacted by the associated delays.

  The HOV/HOT lanes included in the Build with HOV/HOT option would result in somewhat greater improvements in highway operations than under the Build with Busway option, as a portion of the highway traffic would shift to the HOV/HOT lanes, reducing traffic in the regular highway lanes and associated congestion at points where traffic enters to or exits from the highway.

  LOS problems projected to occur in the one-lane sections of the off-ramps leading to the C/D roadways may warrant an expansion of these ramp sections to two lanes. This issue will be analyzed further during the EIS process.

- **Traffic Safety**: shifting much of the weave/merge movements off of the mainline, where the bulk of the traffic is located, and onto a slower-speed C/D roadway better able to handle these entering and exiting movements would be the primary traffic safety improvement in this section of the corridor.

### 3.3.2 Environmental

Preliminary assessment of the potential environmental impacts of adding C/D roadways at Interchange 13 were completed. The studies assessed whether having the C/D roadways would meaningfully change any of the areas where potentially significant impacts projected to occur if all of the project's elements – CRT, BRT, other highway improvements – were implemented. These studies, done for the two Build options as noted above, indicate the following:

- **Displacement, Acquisitions** – The Build with Busway option would displace one additional residence (Amanda Lane), five additional residential garden sheds (James Drive), and one additional garage (residential apartment complex). In addition, there would be three additional commercial displacements. There would also be one more sliver acquisition and the associated reconstruction of that portion of Amanda Lane.

  The Build with HOV/HOT Lane option would displace five additional residential garden sheds (James Drive), one additional garage/maintenance building (residential apartment complex .), and three additional commercial displacements. There would also be one more sliver acquisition and the associated reconstruction of that portion of Amanda Lane.

  Overall, for both Build options, the displacement/acquisition impacts of including C/D roadways in this area would be measurable but not significantly different than those that would occur due to the overall project without these additional lanes.

- **Land Use, Parks** – The Build with Busway option would displace one additional residence on Amanda Lane and James Drive, a small number of sheds and a garage, and a local diner and two other commercial properties. The amount of parkland acquisition and disruption associated with the PIP would be slightly increased by this plan. Overall, the impacts to land use and parks would be similar under the Build with HOV/HOT Lane option. For both Build options, the impacts of including C/D roadways would be measurable but not significantly different than those that would occur due to the overall project without these additional lanes.

- **Visuals** – The two Build options would potentially result in a slightly greater visual change to the PIP ramps at Interchange 13, although the inclusion of C/D roadway is unlikely to cause or exacerbate any significant visual impacts.

- **Wetlands, Ecology** – The construction of the BRT and CRT alignments associated with both the Build options would impact wetlands (including NYSDEC–regulated wetlands) throughout the corridor. Although there may be some minor differences between the two Build options in terms of the acreage of wetlands potential impacted by the inclusion of C/D roads at this location, these differences are unlikely to cause or substantially exacerbate any significant impacts to wetlands.

- **Water Quality** – Impacts to water quality due to C/D roads being analyzed are directly related to the increase in impervious surface associated with each option; increases in impervious surface result in proportionate increases in total pollutant loads to receiving waterbodies, and the total quantity of runoff which must be managed. The provision of C/D roads would increase the total impervious surface by 3.9 acres in the Build with Busway option and 3.6 acres in the Build with HOV/HOT Lanes option. This would represent an increase of approximately 24 percent and 22 percent in the estimated impervious surfaces of the proposed highway and its transit improvements within the affected drainage areas located within the Hackensack River basin. These changes would not represent a significant difference in the project's overall water quality impacts.

- **Historic Resources** – The inclusion of C/D roads at Interchange 13 under the two Build options would slightly alter the projected impacts of the overall project on the National Register-listed Palisades Interstate Parkway. The parkway would be impacted by reconstruction of the parkway bridge over I-287, the interchange ramps, CRT tunnel construction beneath the parkway, and the associated acquisition of potential easements. The C/D roadways would potentially increase the overall extent of acquisitions and easements but overall would not significantly change the potential impacts on historic resources in this area.

- **Archaeological Resources** – The inclusion of C/D roads at Thruway Interchange 13 in Rockland County would not impact any known archaeological resources.

- **Air and Noise Quality** – The inclusion of C/D roadways, by improving traffic flow along the highway, would result in a reduction in total highway-related emissions due to the increase in operating speeds. It would shift a portion of the highway's traffic somewhat closer to the properties to the north and south of the highway, but would not significantly alter pollutant or sound levels in those areas.

## 3.3.3 Costs

- Preliminary capital cost estimates based on the conceptual designs for the C/D roads at Interchange 13 indicate that the additional capital costs of these improvements, in 2012 dollars, would be approximately $55 million. This estimate includes costs for construction of the eastbound and westbound C/D road and ramps, new ramp bridges over the CRT cut and widening of the PIP and South Main Street bridges. These costs also include all materials, labor and equipment costs (including location, market escalation, etc.) and mark-ups for (1) design and construction contingencies, (2) contractors general condition, insurance, overhead and profit, and (3) soft costs such as design, permitting and agency staff. This does not include the costs of additional property acquisition.

- **O&M Cost Factor**. C/D roads, through the addition of a new roadway in the affected areas, would primarily increase pavement-related O&M costs – e.g., general pavement maintenance, pavement markings, snow clearance and de-icing, additional highway lighting, and added signage (fixed or VMS) related to control of the lanes' operations.

## 3.4 Summary

- Traffic analyses showed that shifting the on/off ramps connecting the Thruway and the PIP from the mainline to the C/D roads would improve traffic operations and safety on the Thruway.
- The single-lane on- and off-ramps connecting the C/D roads to the Thruway would be heavily congested due to high projected volumes. Increasing these ramps to two lanes would likely improve these conditions substantially. During the DEIS process, the potential effectiveness of increasing one or more of these ramps to two lanes will be fully analyzed.
- An initial environmental assessment of the proposed addition of C/D roads at this location did not identify any potentially significant environmental impacts associated with these improvements.
- The projected costs of the proposed C/D roads would be approximately $55 million.

# 4 Interchange 14X

Rockland County Planning officials have expressed an interest in creating an additional interchange along the Thruway between Interchange 14B (Airmont Road) and Interchanges 14A (Garden State Parkway) and 14 (Grandview Avenue – Rt. 59). The goal of this concept would be to provide more convenient highway access for Monsey area residents and businesses, making it easier to use the Thruway for east-west travel rather than the often-congested NYS Route 59 (Korean War Veterans Memorial Highway – “Rt. 59”). The suggested location is at the point where Rt. 59 presently crosses over the Thruway approximately 1.65 miles east of Interchange 14B and approximately 3.6 miles and 4.0 miles from Interchanges 14A and 14, respectively. Figure 4-1 shows the location of Interchange 14X and its relation to the nearest interchanges to the east and west, while Figure 4-2 shows the existing conditions at the location of this interchange.

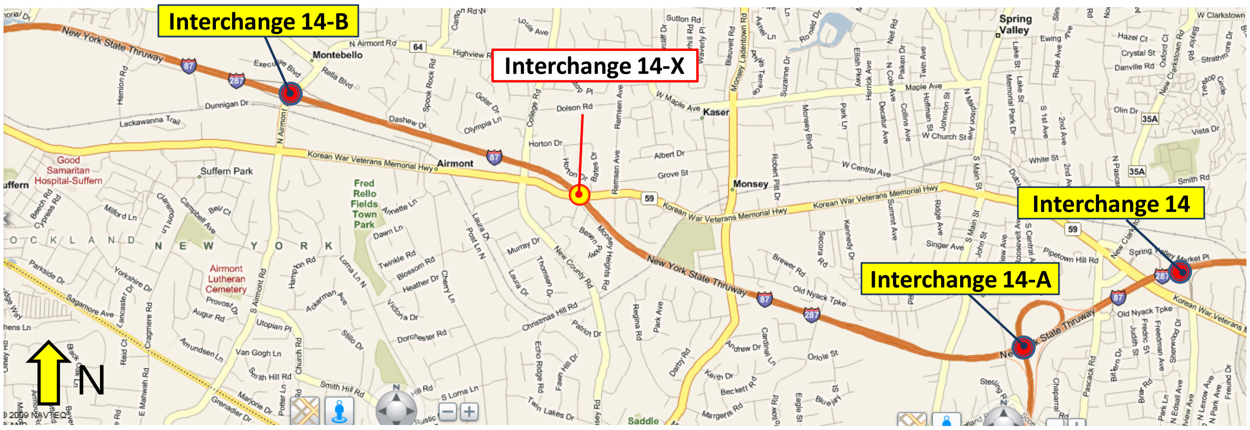



Figure 4-1 Location of Interchange 14X – Rockland County


Figure 4-2 Existing Conditions at Location of Interchange 14X

Land uses fronting onto this section of Rt. 59 are primarily commercial, while the areas located to the north and south of Rt. 59 in this area are more residential in character. As shown in Figure 4-3, the Thruway is in a cut section in this area, with the difference in elevation effectively blocking views of the highway from the surrounding neighborhoods.

**Figure 4-3 View of Route 59 Viaduct over Thruway**

## 4.1 Assessment Guidelines and Procedures

Interchange spacing is a key aspect of highway design, with consequences ranging from highway operations and safety to local mobility and capital and operating costs. Among standards to determining optimal spacing for interchanges, the *Access Management Manual* (Transportation Research Board, 2003) recommends an approximately 3-mile spacing between interchanges in urban areas on highways under high-speed, high-volume urban/suburban conditions for optimum highway operations and safety, and approximately 6 miles in rural areas. While the spacing of existing interchanges along the Thruway (e.g., between Int. 10 and 11 and 14 and 14A) may be less than these design guidelines, the intent of these guidelines is to avoid creating any additional closely-spaced interchanges. AASHTO's *A Policy on Geometric Design of Highways and Streets* recommends a minimum of 1 mile in urban areas and 2 miles in rural areas. Most importantly, for Interstate highways, FHWA's latest guidelines for "Access to the Interstate System"(August 2009), mandates that any such proposed change meet the following requirements:

1. *The need being addressed by the request cannot be adequately satisfied by existing interchanges to the Interstate, and/or local roads and streets in the corridor can neither provide the desired access, nor can they be reasonably improved (such as access control along surface streets, improving traffic control, modifying ramp terminals and intersections, adding turn bays or lengthening storage) to satisfactorily accommodate the design-year traffic demands (23 CFR 625.2(a)).*

2. *The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit, and HOV facilities),*

*geometric design, and alternative improvements to the Interstate without the proposed change(s) in access (23 CFR 625.2(a)).*

3. *An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis shall, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (23 CFR 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, shall be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)).*

   *Requests for a proposed change in access must include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request must also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).*

4. *The proposed access connects to a public road only and will provide for all traffic movements. Less than "full interchanges" may be considered on a case-by-case basis for applications requiring special access for managed lanes (e.g., transit, HOVs, HOT lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)).*

5. *The proposal considers and is consistent with local and regional land use and transportation plans. Prior to receiving final approval, all requests for new or revised access must be included in an adopted Metropolitan Transportation Plan, in the adopted Statewide or Metropolitan Transportation Improvement Program (STIP or TIP), and the Congestion Management Process within transportation management areas, as appropriate, and as specified in 23 CFR part 450, and the transportation conformity requirements of 40 CFR parts 51 and 93.*

6. *In corridors where the potential exists for future multiple interchange additions, a comprehensive corridor or network study must accompany all requests for new or revised access with recommendations that address all of the proposed and desired access changes within the context of a longer-range system or network plan (23 U.S.C. 109(d), 23 CFR 625.2(a), 655.603(d), and 771.111).*

7. *When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements (23 CFR 625.2(a) and 655.603(d)). The request must describe the commitments agreed upon to assure adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point (23 CFR 625.2(a) and 655.603(d)).*

8. *The proposal can be expected to be included as an alternative in the required environmental evaluation, review and processing. The proposal should include supporting information and current status of the environmental processing (23 CFR 771.111).*

In conformance with earlier versions of these guidelines, NYSDOT has developed related procedures in the Appendix 8 of its Project Development Manual, *Interstate and Other Freeway Access Control Modifications* (January 2002), and related requirements included in its *Policy and Standards for the Design of Entrances to State Highways* (November 2003). Of the eight elements of the FHWA policy, the most important from a technical analysis perspective are #1 through #3. These three focus on whether other measures – e.g., adjustments to existing interchanges and nearby local roadways – that might meet these same needs have been fully investigated. Further, they stress that any proposed highway access changes must not have an operational or safety impact on the interstate highway. The following sections of this chapter present the results of such an assessment regarding the possible addition of an Interchange 14X.

## 4.2 Analysis of Potential Impact of Interchange 14X

### 4.2.1 Analyses of Interchange 14X Traffic Impacts

An analysis of the impact of the Interchange 14X proposal of highway and local roadway operations was performed using the corridor-wide 2035 No Build Paramics simulation network developed during the project's scoping process, from Suffern to the Tappan Zee Bridge. The projected growth in traffic on the various elements of the highway and local arterial network was based on input from the BPM 2035 forecasts developed at that time. All known highway improvement projects relevant to the Paramics model simulation were incorporated into the 2035 network, and the analyses once again were done for 2035 conditions with and without Interchange 14X for both AM and PM peak hours.

A key change in the network that was implemented in 2008 was the improvements to the westbound off-ramp at Interchange 14B. Figure 4-4 shows an aerial of Interchange 14B while Figure 4-5 shows the improved conditions on the westbound off-ramp at that location. These improvements increased the traffic capacity of the westbound off-ramp and of its intersection with Airmont Road. Widening much of this ramp from two to three lanes provided additional storage capacity for queued vehicles, reducing the potential for vehicles queued up on this ramp during peak periods to spill back onto the Thruway. A second left-turn lane from southbound Airmont Road to the eastbound Thruway on-ramp was also added at this time. In the traffic simulations discussed below, the basic signal phasing that presently exists at Interchange 14B were maintained but signal timing was adjusted to reflect the substantially different volumes that are projected to occur at this location in 25 years.

The traffic simulations of the inclusion of a new Interchange 14X indicate that substantial additional volumes would get on and off at both 14B and 14X in both peak periods. This would result in an increase in highway volumes between these interchanges in westbound and eastbound directions in both the AM and PM peak periods as well as changes in on- and off-ramp volumes at Interchange 14B. In general, the greater use of this segment of the Thruway would be coupled with a reduction in traffic on some segments of Rt. 59. However, in the same way that some drivers on Rt. 59 and other local roadways would shift to the Thruway under this plan to take advantage of the highway's higher speeds, other drivers might shift to Rt. 59 as volumes shifted to the Thruway improved operations on that roadway.

#### 4.2.1.1 Impacts on Traffic Volumes

Figure 4-6 shows the projected 2035 volumes on the Thruway and Rt. 59 in the AM peak hour from Interchange 14B on the west to Interchange 14 on the east both with and without Interchange 14X, while Figure 4-7 provides the same information for the PM peak.

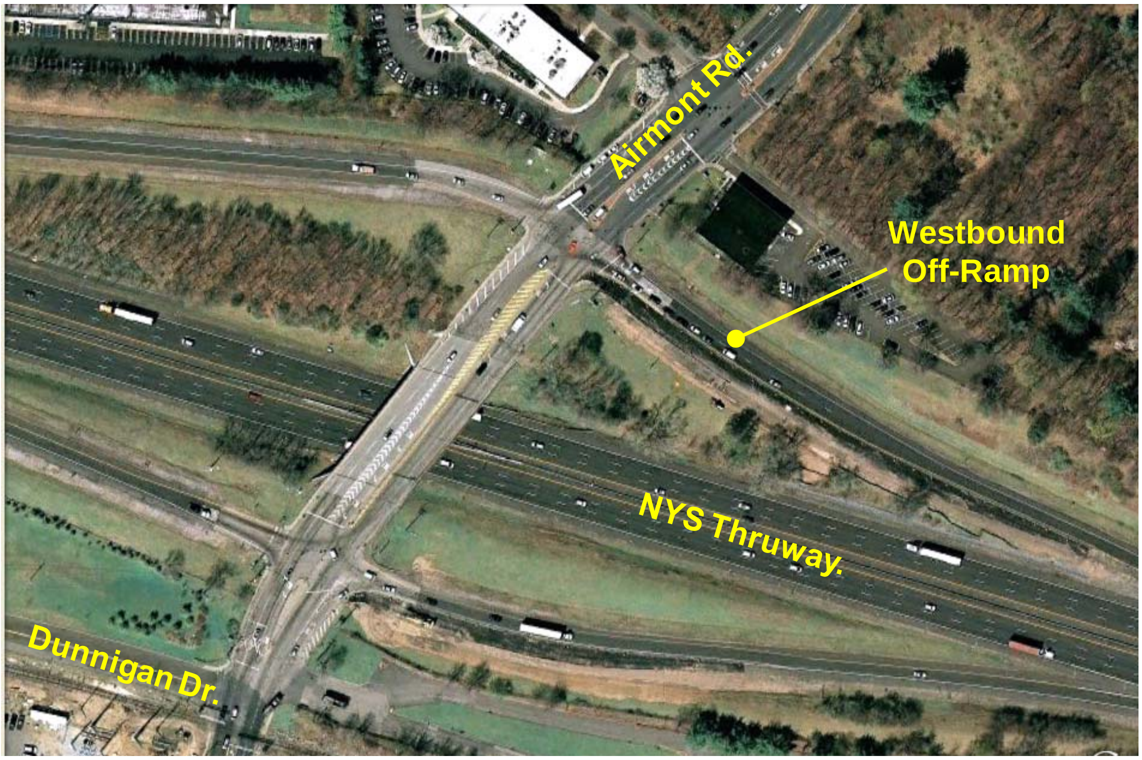



Figure 4-4 Interchange 14B Aerial

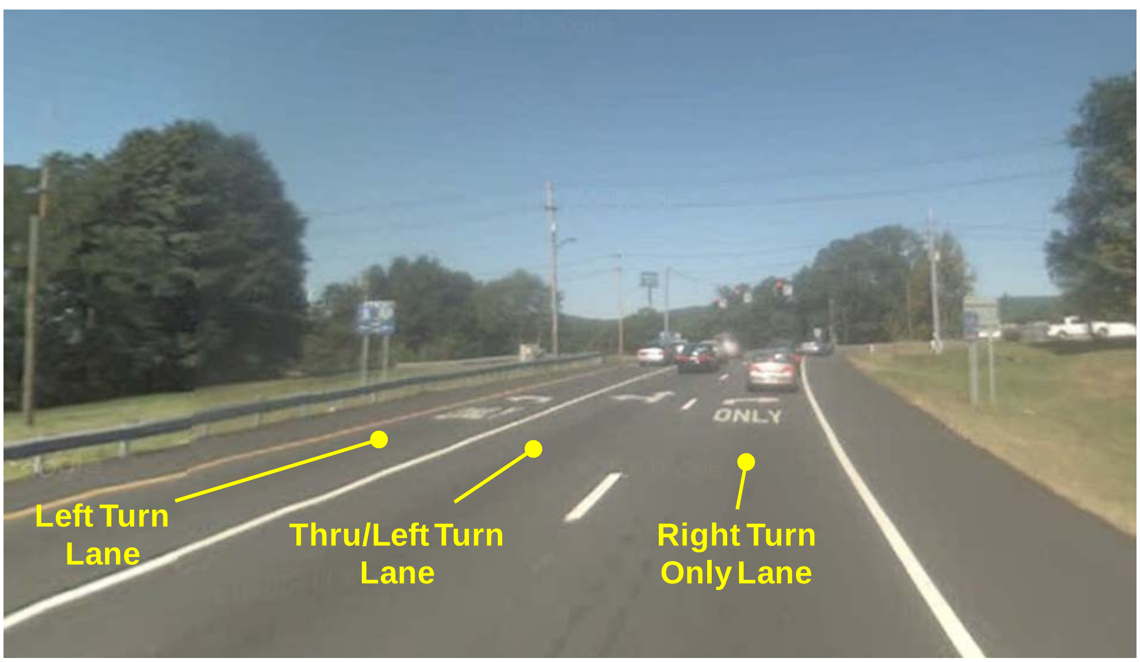
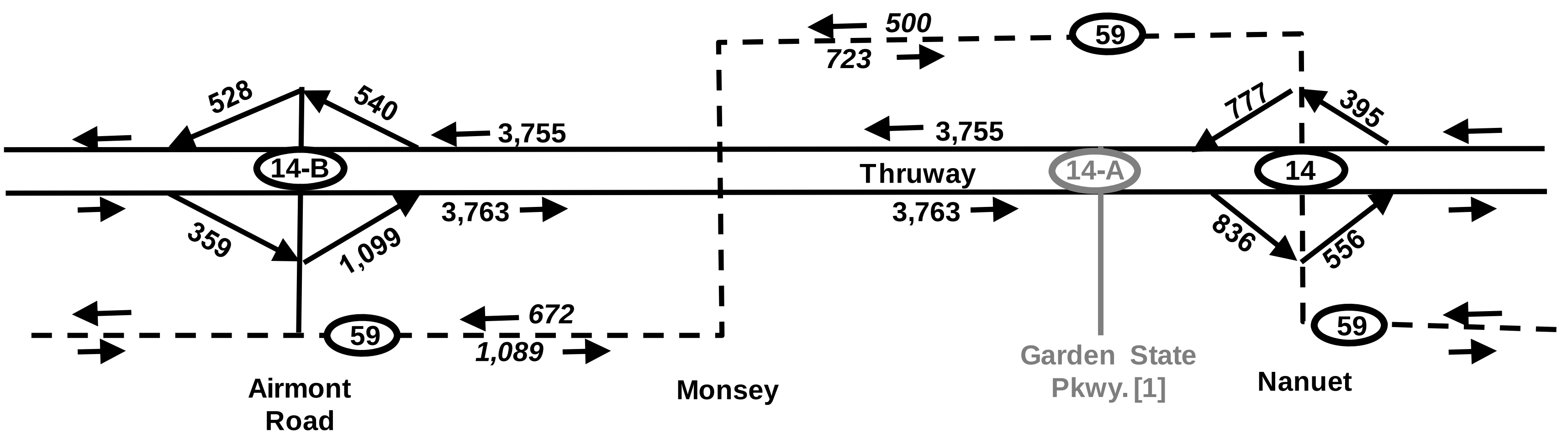
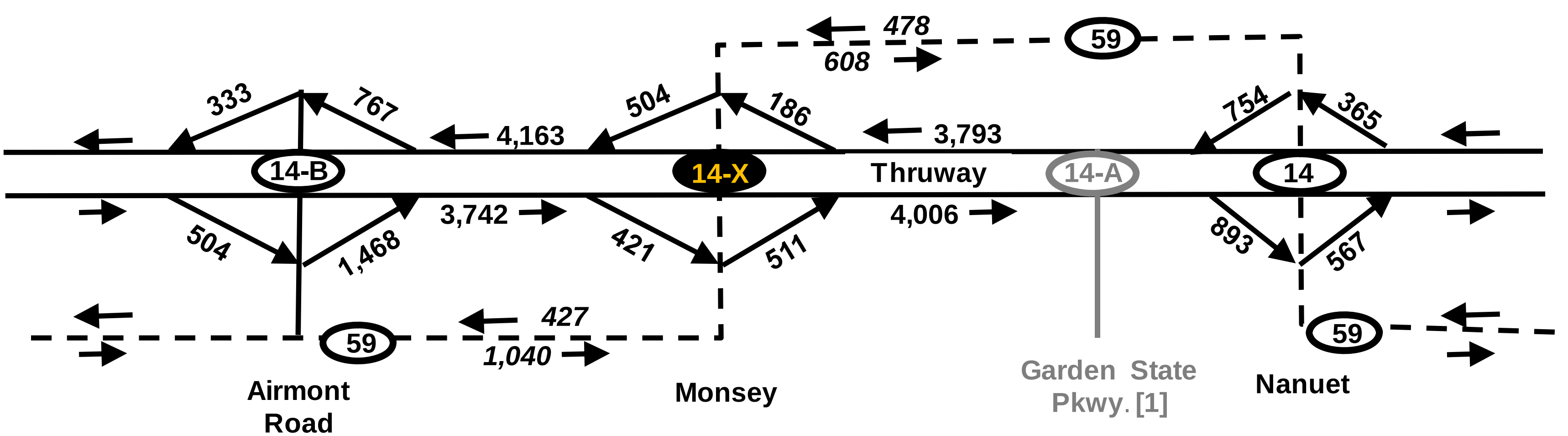



Figure 4-5 Interchange 14B WB Off-Ramp Approach to Airmont Road

## AM Peak – Without Interchange 14X



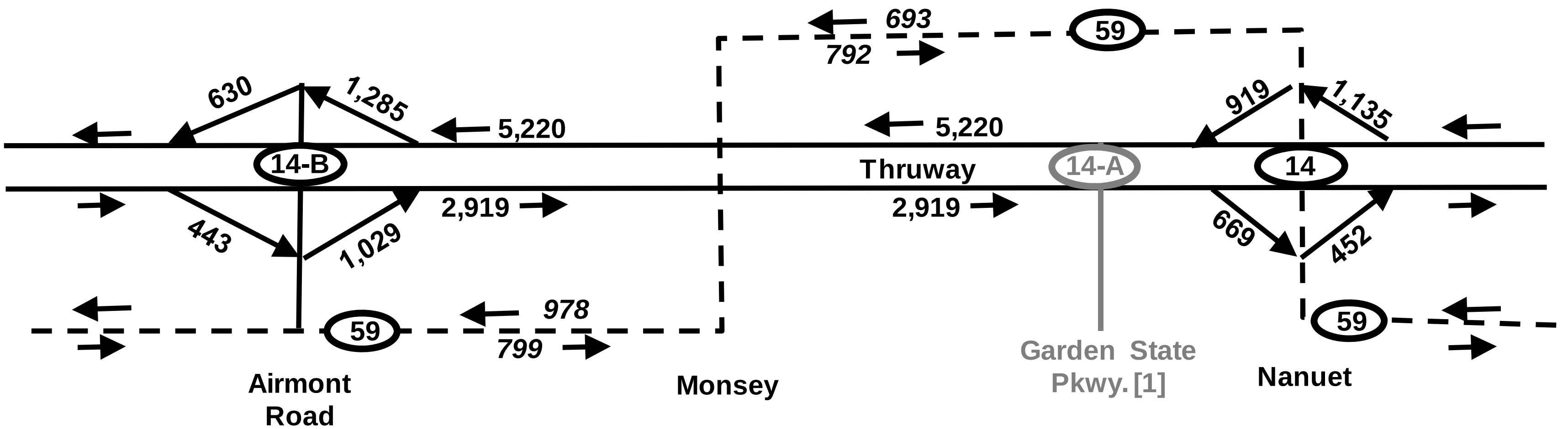

## AM Peak – With Interchange 14X



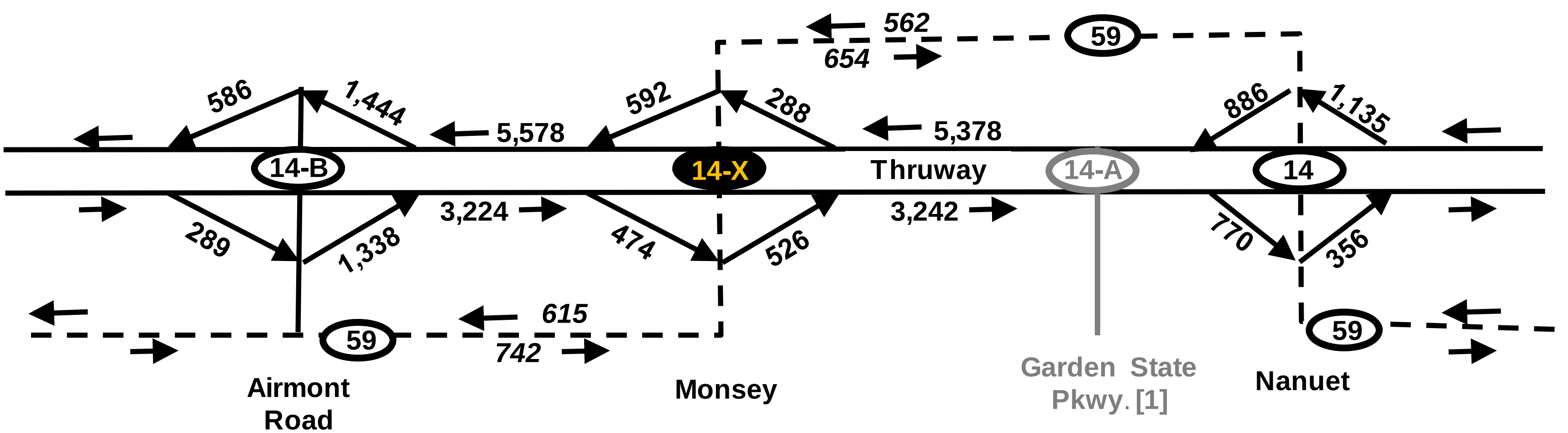

[1] Interchange 14A (Garden State Pkwy.) not shown as minimal changes are projected due to Interchange 14X

**Figure 4-6 Traffic Volumes in the AM Peak Hour With and Without Interchange 14X**

PM Peak – Without Interchange 14X




PM Peak – With Interchange 14X




[1] Interchange 14A (Garden State Pkwy.) not shown as minimal changes are projected due to Interchange 14X

Figure 4-7 Traffic Volumes in the PM Peak Hour With and Without Interchange 14X

Traffic volumes for future conditions without and with Interchange 14 X were developed using the proposed 2035 Paramics network simulation model as noted at the beginning of Section 4.2.1 above. The model assigns traffic to different parts of the highway and local roadway networks based on information on travelers' origin-destination patterns and on the changes in highway access. Changes at Interchange 14 are projected to be minimal (1% to 2% or less in peak periods) with the introduction of Interchange 14X. There would be some decreases and increases in on- and off-ramp volumes reflecting local area travelers utilizing Interchange 14X and the Thruway for certain east-west trips rather than getting on or off the highway at Interchange 14 and utilizing Rt. 59 and other roadways. However, overall these changes are not particularly significant or relevant to the merits of the Interchange 14X concept.

The following general patterns in analyzed areas west of Interchange 14A are projected to occur:

- **Interchange 14X**: volumes at 14X would be roughly the same in the two peak periods. Some volumes would reflect the corridor's eastbound AM/westbound PM peaking patterns (e.g., westbound off-ramp volumes highest in the PM), but others (eastbound on-ramp volumes approximately the same in both peak periods) would potentially not follow those patterns.

- **Interchange 14B:** the most critical changes would be the increased volumes on the already congested westbound off-ramp, in both the AM and PM peak hours. The simulation runs also confirm that the major portion of these travelers would be those getting on at Interchange 14X and get off at Interchange 14B. Similarly, volumes on the eastbound on-ramp would increase in both peak periods, also reflecting the use of the Thruway as a perceived faster route to Monsey than via Rt. 59. Volumes would also increase on approaches to other nearby intersections such as Airmont Road at Rt. 59 as traffic diverted to the 14X interchange would work its way through often-congested sections of the local network.

- **Thruway**:
  - **Interchange 14B to Interchange 14X:** the westbound and eastbound volumes on this segment of the highway primarily reflect travelers taking advantage of the Thruway as an alternative to Rt. 59, or travelers getting on the highway sooner (westbound) or off the highway later (eastbound) by using Interchange 14X. Minimal changes are shown in the eastbound direction in the AM Peak, reflecting downstream congestion on the Thruway which limits the amount of additional vehicles that the highway can actually process during that time period.

  - **Interchange 14X to Interchange 14A:** Some eastbound and westbound travelers would be utilizing the Thruway more frequently in this section of the corridor in both peak periods rather than Rt. 59 by utilizing Interchange 14X to get onto the eastbound highway sooner or to get off the westbound highway later than under present conditions.

- **Rt. 59:**
  - **Airmont Road to College Road**: Even though travelers would clearly be utilizing the Thruway as an alternative to this section of Rt. 59, the changes in the eastbound volumes on Rt. 59 in both peaks are minimal. This most likely reflects the attraction of other travelers to this roadway as capacity is freed up by the switch of some drivers to the Thruway. The volume reductions in the westbound direction on Rt. 59 are projected to be more substantial, paralleling the increased volumes on the parallel section of the westbound Thruway.

- **Interchange 14X to Interchange 14**: the reduced volume patterns reflect the often substantial shift of travelers to the parallel section of the Thruway in both directions. The largest drop is in the westbound direction in the PM peak.

### 4.2.1.2 Impacts on Traffic Operations

As noted above, the most significant changes in highway and roadway volumes due to Interchange 14X would occur west of Interchange 14A, primarily due to the changing usage patterns of the Thruway in that area due to the addition of Interchange 14X. The following discussion of traffic-related issues therefore focuses on those areas.

Figure 4-8 shows the projected LOS on the on- and off-ramps at Interchanges 14B and (under build conditions) 14X, and the projected travel times and average speeds on various sections of the Thruway and Rt. 59. Information is shown for both the AM and PM peak hours, with travel time, speeds and LOS data shown for 2035 traffic conditions without and with Interchange 14X.

LOS values were used to assess ramp-related impacts due to the direct control of ramps by signalized intersections, while average speed and travel time were used to assess impacts on the Thruway and on Rt. 59 as they provide a better sense of the overall quality of traffic flow in those areas. These results indicate the following changes in traffic operations would potentially occur:

- **Interchange 14X**: The effective capacity and associated LOS of the eastbound and westbound off-ramps at this location would be controlled by the traffic signals at the intersections with Rt. 59, while eastbound and westbound on-ramp flows would be controlled more by the capacity of the section of the Thruway receiving the new ramps' volumes. The eastbound on-ramp would operate at LOS "B" in both peaks, even though the eastbound Thruway would be heavily congested in the AM Peak. However, the projected low eastbound speeds on the Thruway in the AM peak would likely provide sufficient gaps for the on-ramp volumes to merge without delaying eastbound on-ramp ramp operations.

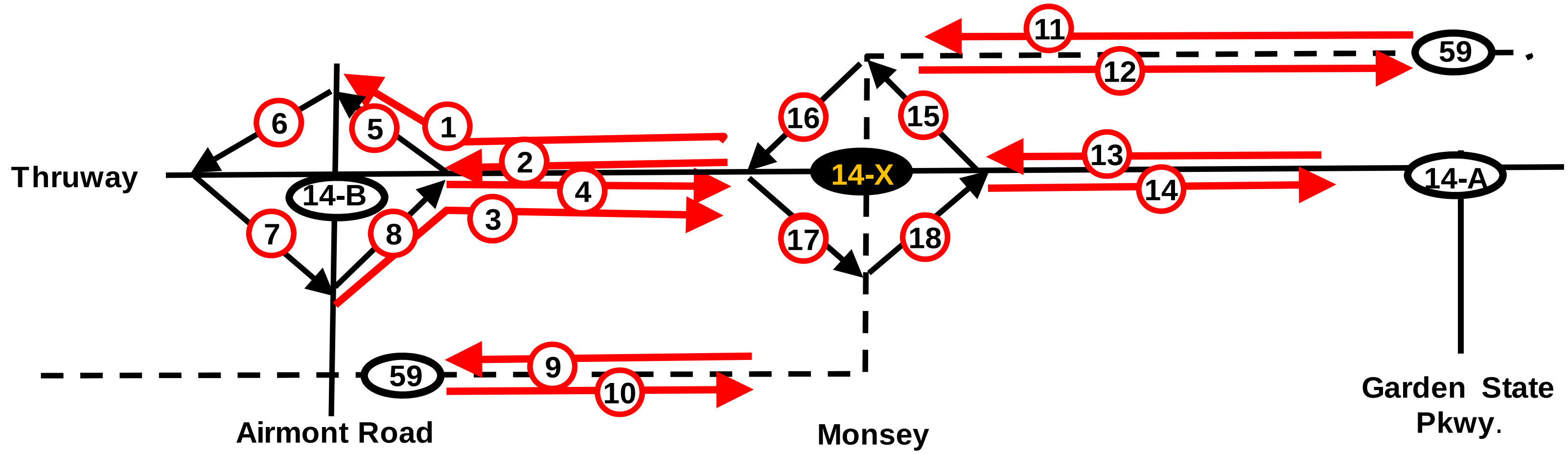
  In the westbound direction, the proximity of Interchange 14B and the turbulence caused by entering vehicles from Interchange 14X and Thruway traffic shifting to the right to exit at Interchange 14B would slow down highway operations leading up to 14B. The introduction of Interchange 14X would lower Thruway speeds in both the AM and PM peak hours, and the westbound on-ramp would operate at LOS "F."

- **Interchange 14B**: While the introduction of Interchange 14X would create a variety of changes at 14B, the most significant change would be on the westbound off-ramp due to its impact on Thruway operations, as discussed below. While the LOS impact on this ramp would be worst in the AM peak (from "D" to "F"), the impacts on highway operation would be most significant in the PM peak. With this off-ramp already operating at LOS "F," the higher volumes with Interchange 14X would create much longer delays and associated spillback onto the Thruway.

- **Thruway**: The data in Figure 4-8 demonstrates travel speeds would be the lowest in the eastbound direction in the AM peak with or without Interchange 14X, reflecting downstream congestion on the Thruway rather than conditions in this section of the highway. However, the largest impact of Interchange 14X on Thruway operations would be in the PM Peak in the already congested section between Interchanges 14X and 14B. In that section, traffic getting off at Interchange 14B would experience a speed drop from 46 to 25 mph, while traffic continuing west of Interchange 14B would be substantially slowed in this section from 57 to 29 mph.

The simulations of this section of the Thruway indicate that projected problems would be attributable to (1) the relatively high westbound off-ramp volumes at Interchange 14B, and the limits of the initial single-lane section of the off-ramp to handle those volumes; and (2) the capacity of the ramp's approach to the Airmont Road intersection.

- **Rt. 59**: The changes in average operating conditions along the approximately 1.3-mile section between Airmont and College Roads and the approximately 3.2-mile section between the Rt. 59 overpass in Monsey and Interchange 14 would be relatively modest. Minimal changes in average travel speeds are projected over these segments in both directions and in both peak hours. There would be some increased congestion at the new or expanded intersections with the Interchange 14X ramps and Rt. 59, while conditions at various other locations would likely improve.




| | | AM Peak | | | | | | PM Peak | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Travel Time (Sec) | | Speed (MPH) | | Level of Service | | Travel Time (Sec) | | Speed (MPH) | | Level of Service | |
| Analysis Locations (see Key Map Above) | | W/O 14X | With 14X | W/O 14X | With 14X | W/O 14X | With 14X | W/O 14X | With 14X | W/O 14X | With 14X | W/O 14X | With 14X |
| 1 | WB I-287: 14X to 14B Off-Ramp at Airmont Rd. | 103 | 113 | 54 | 48 | | | 177 | 241 | 35 | 20 | | |
| 2 | WB I-287 Thru-Traffic Between 14X & 14B | 54 | 57 | 66 | 64 | | | 67 | 125 | 54 | 29 | | |
| 3 | EB On-Ramp from Airmont Rd. to 14X | 484 | 475 | 15 | 15 | | | 93 | 91 | 53 | 51 | | |
| 4 | EB I-287 Thru-Traffic Between 14B & 14X | 455 | 443 | 12 | 13 | | | 73 | 72 | 70 | 70 | | |
| 5 | WB Off-Ramp - 14B | | | | | D | F | | | | | F | F |
| 6 | WB On-Ramp - 14B | | | | | B | A | | | | | D | B |
| 7 | EB Off-Ramp - 14B | | | | | A | F | | | | | F | A |
| 8 | EB On-Ramp - 14B | | | | | F | F | | | | | D | E |
| 9 | WB Route 59 : College Rd. - Airmont Rd. | 204 | 182 | 25 | 27 | | | 373 | 169 | 17 | 29 | | |
| 10 | EB Route 59 : Airmont Rd. - College Rd. | 208 | 188 | 26 | 29 | | | 175 | 170 | 28 | 29 | | |
| 11 | WB Route 59: Int. 14 to Rt. 50 Cross-Over | 403 | 404 | 28 | 28 | | | 506 | 434 | 25 | 26 | | |
| 12 | EB Route 59: Thruway Cross-Over to Int. 14 | 432 | 433 | 26 | 26 | | | 555 | 432 | 24 | 27 | | |
| 13 | WB I-287 Between 14A & 14X | 150 | 15 | 62 | 62 | | | 148 | 165 | 62 | 56 | | |
| 14 | EB I-287 Between 14X & 14A | 594 | 511 | 12 | 14 | | | 116 | 116 | 62 | 63 | | |
| 15 | WB Off-Ramp - 14X | | | | | | A | | | | | | B |
| 16 | WB On-Ramp - 14X | | | | | | F | | | | | | F |
| 17 | EB Off-Ramp - 14X | | | | | | D | | | | | | B |
| 18 | EB On-Ramp - 14X | | | | | | B | | | | | | B |

Figure 4-8 Peak Hour LOS and Travel Times and Speeds – Thruway and Route 59

## 4.3 Evaluation of Results

The conceptual designs developed for Interchange 14X were done for the two Build options noted in Chapter 1 of this report:

- Build with Busway -- Future Build with CRT and with BRT operating in a Busway (see Figure 4-9); and

- Build with HOV/HOT Lane -- Future Build with CRT and with BRT operating in HOV/HOT Lanes (see Figure 4-10).

Figure 4-9 presents the present concept design for the Build 1 option while Figure 4-10 presents the Build 2 option. A simple diamond interchange concept had previously been shown to local officials[1]. That design concept assumed that BRT would operate in a median HOV/HOT lane, with CRT located in a tunnel in this section, and no BRT station in Monsey was assumed. Under the present design, with CRT located along the south side of the highway, BRT operating either in the HOV/HOT lane or in a busway on the highway's northern side, and a Monsey BRT station proposed in this same area, the original diamond interchange concept was no longer possible. Therefore, the two design concepts noted above and presented in Figures 4-9 and 4-10 were developed.

The analyses of future transportation operations at this location showed the following:

- **Traffic Operations**: The analyses presented in Section 4.2 above confirmed that the inclusion of Interchange 14X would result in a substantial impact on Thruway operations in the westbound direction, especially in the PM peak, affecting both travelers exiting at Interchange 14B and through-traffic heading west.

- **Traffic Safety**: The projected changes in traffic volumes on the highway between Interchanges 14X and 14B (especially in the westbound direction in the PM peak) would result in more unstable traffic flow conditions on the highway and its ramps, which can increase safety problems in those sections of the highway.

These findings confirmed that the introduction of Interchange 14X would result in impacts on an interstate highway that contradict the specific FHWA guidelines for proposed changes to highway access. Further, this proposal would introduce a new interchange within approximately 1.5 miles of an existing interchange (14B), with the primary goal of diverting local traffic onto the highway. Because of these findings, this proposal is inconsistent with the overall goals and objectives of the project and has therefore been dropped from further consideration.

[1] Earlier concept was defined and analyzed in *Proposed Interchange 14X: Preliminary Findings* (March 2007).

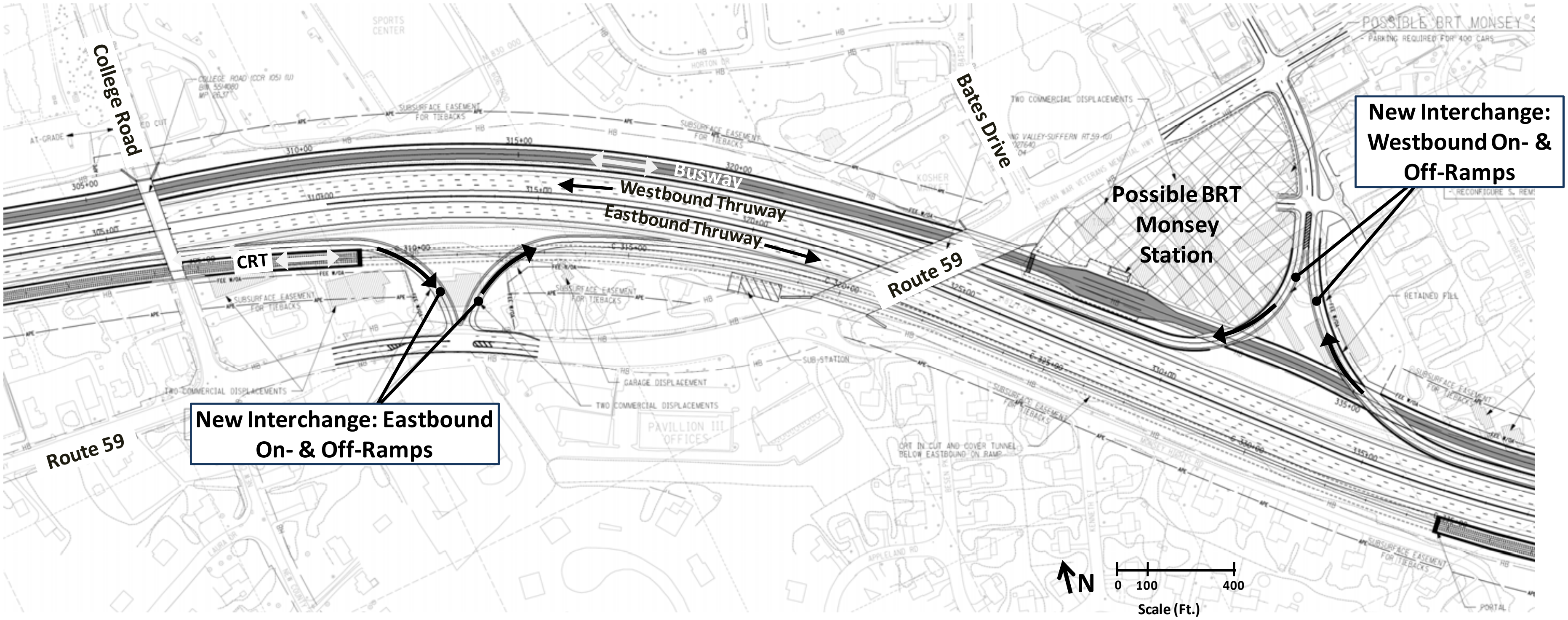



Figure 4-9 Interchange 14X with BRT in Busway

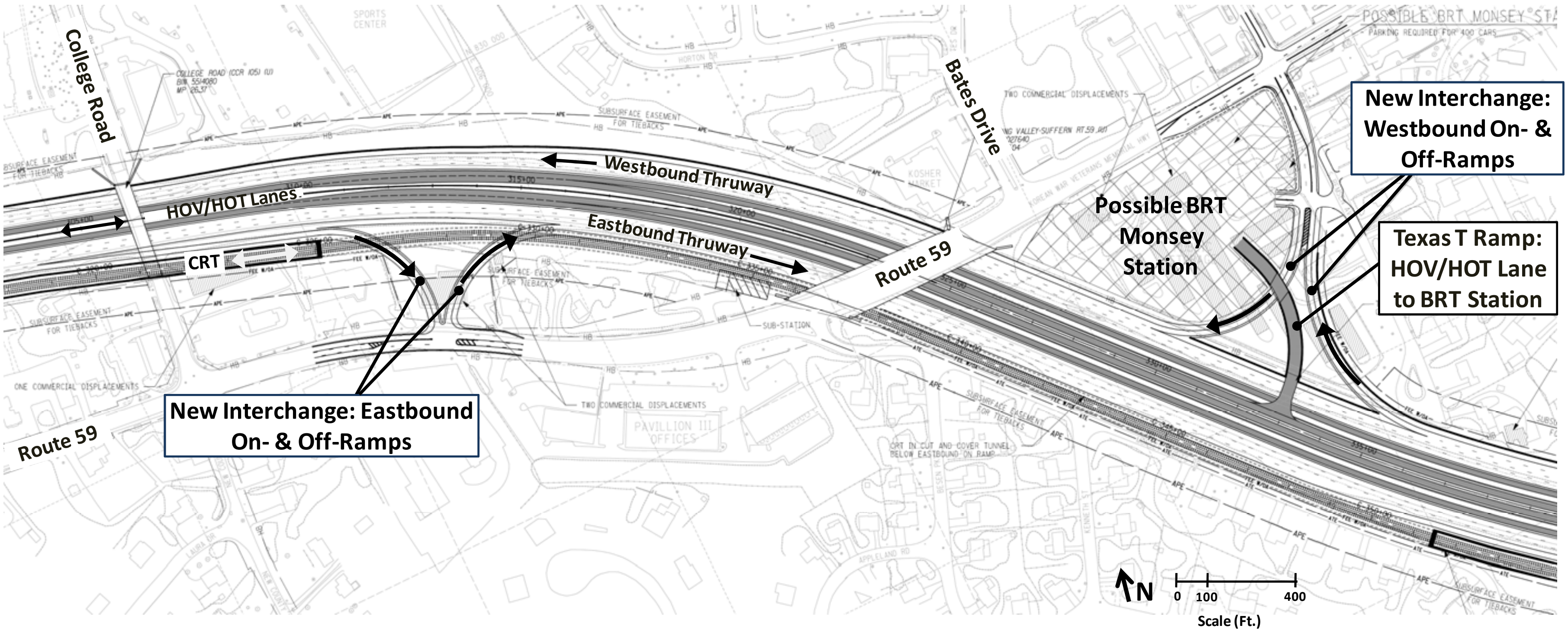



Figure 4-10 Interchange 14X with BRT in HOV/HOT Lanes

# 5 Interchange 10 Improvements

Interchange 10 is the first location where westbound travelers over the Tappan Zee Bridge can exit from the Thruway and the last location where eastbound travelers can enter the highway to cross the bridge to Westchester County. With the construction of a replacement bridge as part of the proposed project, some changes to Interchange 10 would be required to align the highway and this interchange with this new bridge. A variety of interchange design options have been developed and reviewed with local agencies and officials and the general public. These options have included the required connections between the highway and local streets and arterials, along with bicycle and pedestrian connections to the bridge and other design requirements, with careful consideration given to the revised interchange's potential impact within its surroundings.

Figure 5-1 shows the location of this interchange in relation to the TZB and Interchange 11, and Figure 5-2 shows an aerial photo of Interchange 10. Interchange 10 includes three ramps connecting the Thruway to the local street system:

- an off-ramp from the westbound Thruway – the first exit after the bridge -- providing access to northbound and southbound Rt. 9W (Hillside Avenue) and the local street system (at Clinton Avenue and South Franklin Street).
- an on-ramp to the westbound Thruway (from Rt. 9W).
- on on-ramp to the eastbound Thruway and the Tappan Zee Bridge (from Rt. 9W and S. Broadway at Cornelison Avenue).


Figure 5-1 Location of I-287 Interchanges 10 and 11


Figure 5-2 Interchange 10

The proposed new Tappan Zee Bridge would reconnect to the Thruway in South Nyack in a manner that would require some redesign and reconstruction of Interchange 10. The additional space requirements associated with extending a new CRT alignment and BRT operations in either a busway or in HOV/HOT lanes further re-enforce the need for a comprehensive redesign and reconstruction of the interchange.

Given this requirement, a conceptual design was initiated, taking into account:

- the ability to handle future traffic demands;
- traffic operations and safety;

- improved connections between the highway and the local roadway network;
- providing bicycle and pedestrian connections (including those to and from the new bridge, and access to and use of the Esposito Trail);
- constructability; and
- design aesthetics and reducing the overall footprint of the interchange.

A wide variety of initial concepts were developed and assessed, and many of these options were discussed with local agencies and the general public to obtain their reactions to these initial designs and to understand their preferences, needs and concerns regarding this interchange. Based on this process, it appeared that a traditional diamond-type interchange that would provide access to and from the highway in both directions (the present design provides no eastbound off-ramp from the Thruway) would best meet the overall goals and objectives for a new interchange at this location.

While traffic signals have traditionally be used at such interchange locations, the use of modern-design roundabouts in such locations has increased in recent years, with NYSDOT one of the national leaders in supporting this trend. Figure 5-3 shows an example (at Exit 12 on the Northway portion of I-87 in Malta, NY) where NYSDOT chose roundabouts rather than traffic signals to handle traffic at this interchange.

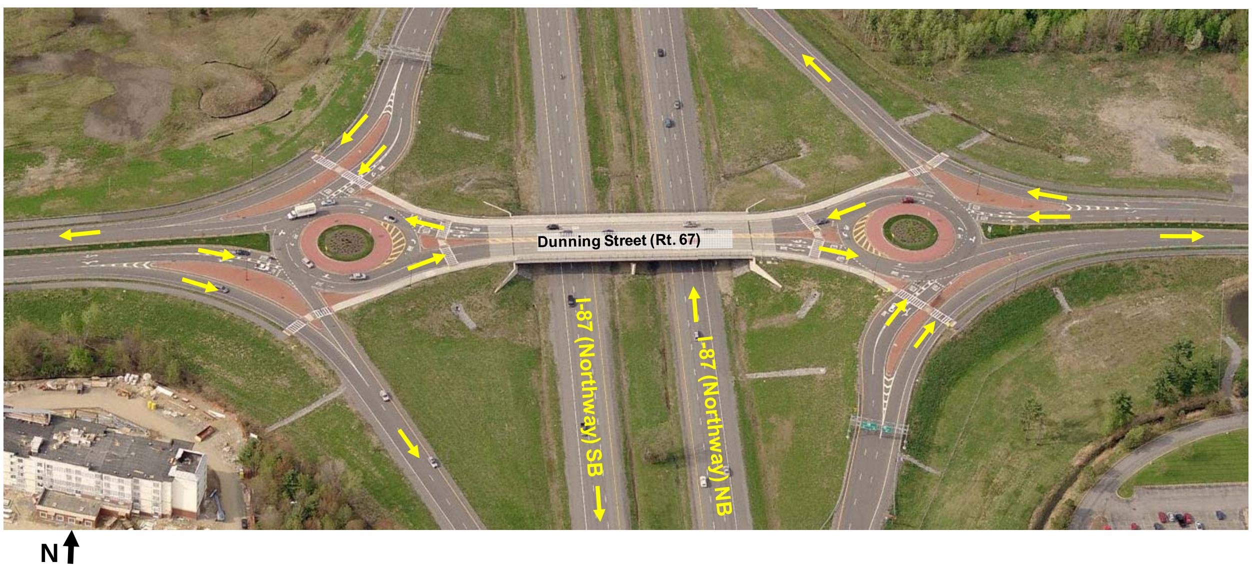



**Figure 5-3: Use of Roundabouts at Interchange 12 of I-87 (Northway)**

Figures 5-4 and 5-5 present two design concepts for a diamond interchange at this location. Both include on- and off-ramps in both directions. The primary difference is the use of roundabouts (see Figure 5-4) rather than signalized intersections (see Figure 5-5) to control conflicts among vehicles heading to and from the highway or non-highway vehicles using roadways that pass through or next to the interchange.

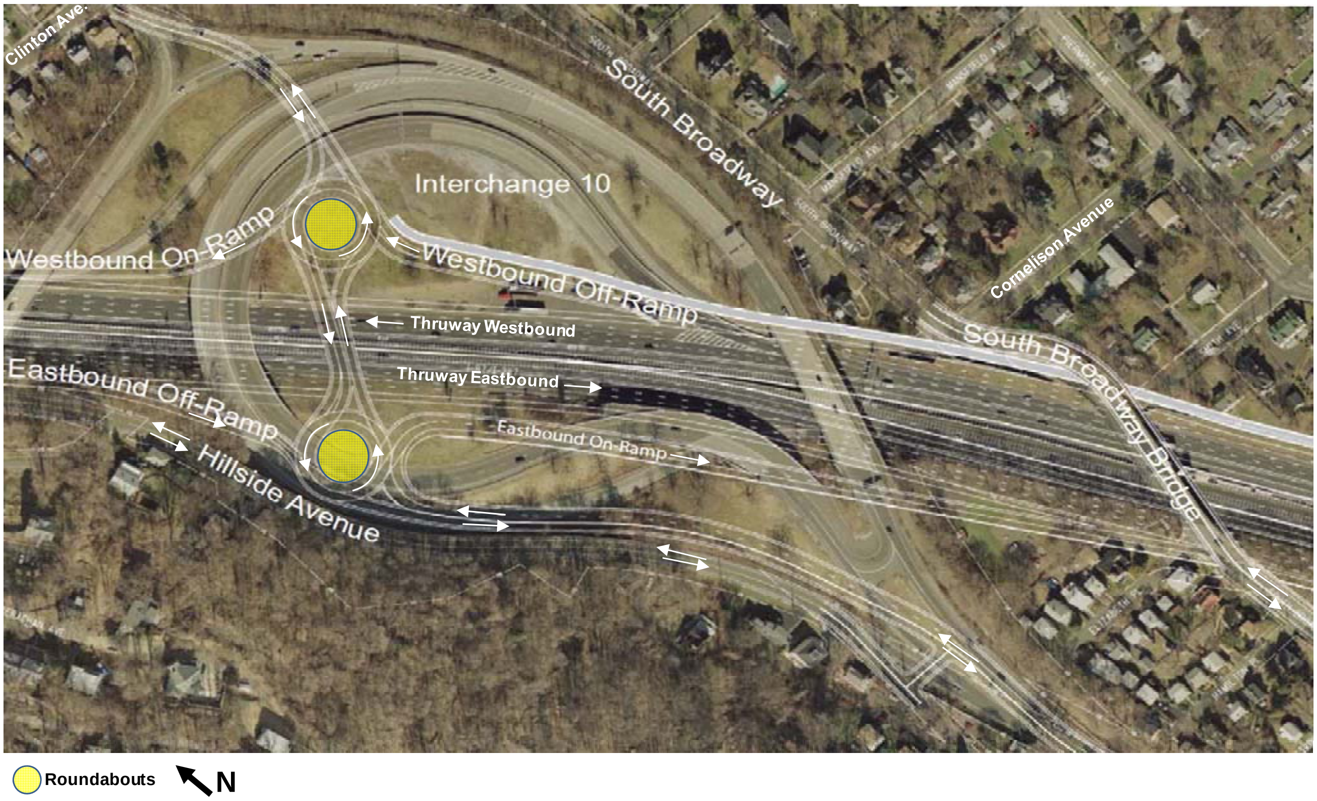



Figure 5-4: Improved Interchange 10: Diamond Interchange with Roundabout Design


Figure 5-5: Improved Interchange 10: Diamond Interchange with Signalized Intersections

Modern roundabouts (versus older traffic circles or rotaries) are designed to slow vehicles down as they enter and travel within the roundabout, resulting in dramatic reductions in the number and severity of accidents relative to similar locations using traffic signals. They also reduce overall traffic delays and vehicular emissions.[1]

The design of this interchange, including the best locations or designs to get pedestrians and bicyclists from the north to the south side of the highway (including the Esposito Trail connection) and to and from the new bridge's proposed bike/pedestrian pathways is continuing. Preliminary traffic studies indicate that the roundabout design shown in Figure 5-4 would best handle future traffic volumes while meeting the other goals and objectives noted above. The traffic and related environmental studies will continue at a more detailed level during the EIS process.

[1] For further information about roundabouts and their use in New York State and elsewhere, go to the NYSDOT website at https://www.nysdot.gov/main/roundabouts.

# 6 Improvements to Interchange 11

I-287/I-87 Interchange 11 in Nyack, NY is a separated diamond interchange, with westbound on- and off-ramps connecting to High Avenue at Polhemus Street and the eastbound ramps connecting to NY Route 59 (Rt. 59) at Mountain View Avenue. Figure 6-1 shows an aerial view of the present intersection configuration.


**Figure 6-1: Existing Interchange 11 – Rockland County**

Interchange 11 is the last eastbound exit from the Thruway prior to proceeding over the Tappan Zee Bridge. The existing intersection into which the eastbound ramps are connecting (see close-up view in Figure 6-1) has a complex, five-leg design that must handle heavy volumes heading to and from the Thruway as well as ever-increasing volumes along Rt. 59. This design requires complex signal phasing that limits the amount of green-time the major movements (EB off ramp, Rt. 59) can receive, resulting in extensive queuing and delays under peak conditions.

As discussed in Chapters 2 though 5, several highway improvements are recommended as part of the proposed project. Subsequent preliminary traffic analyses were performed to assess how well Interchange 11 and the other project interchanges within Rockland County (Interchanges 12, 14, 14A and 14B) would operate under increasing levels of traffic. Those analyses highlighted existing and future traffic problems at Interchange 11 and at several nearby intersections, and are influenced by traffic getting on and off the Thruway. These key traffic locations, as highlighted in Figure 6-1, include:

**#1: Rt. 59 @ Mountain View Avenue**, where the eastbound on- and off-ramps presently connect with Rt. 59.

**#2: Rt. 9W @ High Avenue**, through which pass substantial volumes heading to and from the westbound ramps.

**#3: Rt. 9W @ Rt. 59 (Main St.)**, the intersection of the area's two critical east-west and north-south arterials and a location of considerable congestion in peak periods.

These initial studies confirmed that the eastbound ramps pose the most significant problem to existing and future operations of both the Thruway and the local street system. A proposed improvement to this portion of Interchange 11 has therefore been identified and is assessed in the following sections.

## 6.1 Assessment Guidelines and Procedures

The primary highway design guidelines relevant to the proposed improvements to portions of Interchange 11 include (1) Chapter 10 (Grade Separation and Interchanges) of AASHTO's *A Policy on Geometric Design of Highways and Streets* (the "Green Book"); and (2) NYSDOT, *Project Development Manual*, Appendix 8 (Interstate and Other Freeway Access Control & Modifications). Changes in access to an Interstate highway also require approval from FHWA. As noted in the PDM, such changes must be based on regional traffic needs rather than local system problems, although sometimes to two are linked. Therefore, the key issue is to document how the existing interchange design adversely impacts highway operations and safety and how well the proposed improvement would address those impacts, along with their impacts on local traffic operations. To assess those problems, a Paramics traffic simulation model of this section of the corridor was utilized to assess traffic operations, with the Level of Service (LOS) conditions assessment consistent with the *Highway Capacity Manual* (HCM) 2000. Total traffic delays along the critical sections of Rt. 59 into which the existing and proposed eastbound ramps connect is also assessed, using travel time data generated by the Paramics simulation. The following section indicates the nature of the proposed improvement and the projected effectiveness in addressing these traffic problems.

## 6.2 Analysis of Potential Impact of Improved Eastbound Ramps

Given the limitations of the five-leg configuration of the existing intersection, a logical design change at this location was to shift the eastbound off-ramps away from this intersection to a new location with fewer conflicting movements. As shown Figure 6-2, the proposed new location for the eastbound ramps to connect with Rt. 59 would be at the intersection of Rt. 59 and W. Broadway Street (presently an unsignalized "T" intersection), approximately 600 feet west of the Rt. 59/Mountain View Ave. intersection.

The traffic simulation model analyses discussed below show that with future traffic growth the existing eastbound interchange design would result in spillbacks onto the eastbound Thruway, interfering with mainline traffic conditions and creating unsafe queuing conditions. Because of the severe capacity limitations of this intersection, future traffic delays would be sufficiently extensive at this location to limit travelers' ability to get to and from the Thruway. Figure 6-2 presents an initial conceptual design of the proposed new eastbound ramps at Interchange 11. The on- and off-ramps would form a fourth (north-side) leg to the existing unsignalized W. Broadway St./Rt. 59 intersection, which would now be signalized. As with the existing interchange, the off-ramp would have two lanes exiting from the highway, while the on-ramp would be a single lane. However, this intersection would have two left-turn lanes on the eastbound approach and two receiving lanes on the southern portion of the new eastbound on-ramp to handle the high volume of eastbound traffic on Rt. 59 accessing the highway at this location. In addition, the vertical alignment of Rt. 59 would be lowered near this intersection to meet roadway design standards for stopping sight distance.

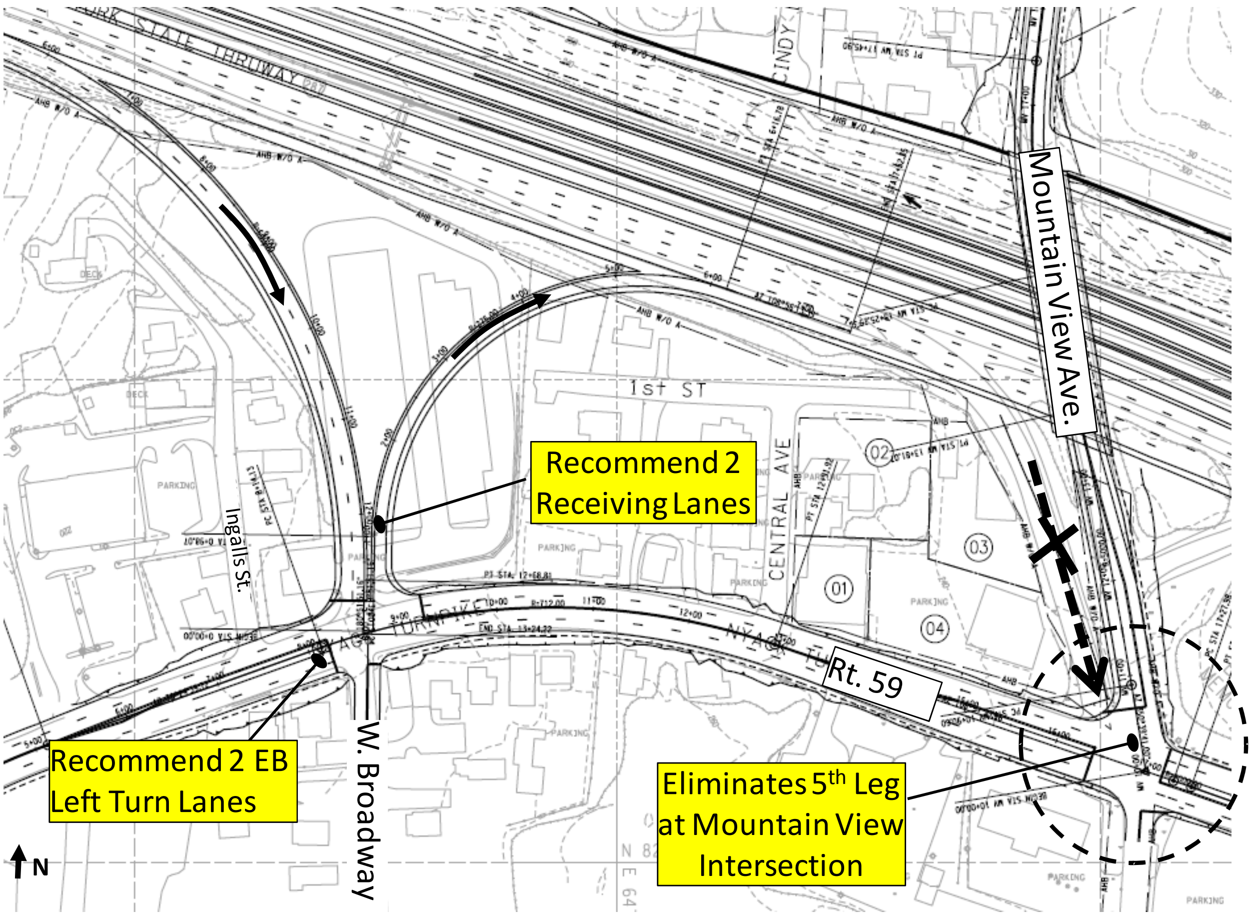



Figure 6-2: Proposed Relocated Eastbound Ramps at Interchange 11

The Paramics simulation model analysis performed for this section of the highway started with projected 2017 No-Build traffic volumes and then increasedg modeling volumes by 10% and 15% to test how well the highway and its interchange components would operate under increased pressure from the projected higher volumes in the corridor. The two analyses presented below were used to assess the quality of traffic flow in the area under existing and proposed eastbound ramp designs:

- **Level of Service (LOS)** -- at the W. Broadway St. and Mountain View Ave. intersections with Rt. 59, based on delay calculated in Paramics on the intersection approaches and LOS categories assigned to the intersection based on *Highway Capacity Manual 2000* criteria for intersections:

| Impact on Intersection Operation[1] | | | | |
|---|---|---|---|---|
| | Current Design LOS | | Proposed Design LOS | |
| | AM | PM | AM | PM |
| Mountain View Ave & Rte 59 | | | | |
| LOS | **F*** | **F*** | C | C |
| Delay (Seconds) | **181** | **252** | 25 | 30 |
| W. Broadway St & Rte 59 ** | | | | |
| LOS | N/A | N/A | D | D |
| Delay (Seconds) | N/A | N/A | 46 | 46 |

[1] Both assessments based on 2017 No-Build volumes + 15% growth factor.
* Delay values shown under the current design are well above the delay thresholds for LOS “F” operations under HCM LOS procedures.
** LOS was not calculated for the current design at this low-volume unsignalized intersection, where no congestion has been observed or shown in the traffic simulation.

- **Travel delay** -- for vehicles traveling between the W. Broadway St./Rt. 59 intersection and the Rt. 9W/Rt. 59 (Main St.) intersection (a distance of ½ mile), a segment that suffers from significant queuing and delays during peak conditions:

| Delay between W. Broadway St and 9W on Route 59 (Seconds) | | | | |
|---|---|---|---|---|
| | Current Design Delay | | Proposed Design Delay | |
| | AM | PM | AM | PM |
| Eastbound | **309** | **550** | 72 | 72 |
| Westbound | 59 | **500** | 63 | 78 |

As shown, LOS conditions at the critical Mountain View Ave. intersection would improve from breakdown-level conditions to LOS “C” while the revised W. Broadway Street intersection would operate at an acceptable peak period LOS “D”. The reductions in travel delays in the Rt. 59 corridor would be even more dramatic. The traffic simulation results showed that vehicle queues from the eastbound off-ramp would be sufficiently long to impact eastbound Thruway operations under the existing configuration, and that this queuing problem would be effectively eliminated by the proposed improvement. While designed to better handle peak traffic conditions, these improvements would also ease traffic flow and improve safety in lower-volume off-peak periods as well.

## 6.3 Evaluation of Results

The following is a brief overall assessment of the impacts of the proposed improvements at Interchange 11 in terms of the potential impacts on transportation operations and key environmental resources. This screening used the conceptual design for the new eastbound off-ramps as shown in Figure 6-2, and other improvements developed for this section of the corridor as analyzed in other chapters of this report.

## 6.3.1 Transportation

- **Traffic Operations**: The proposed improvement would result in substantially improved traffic operations along Rt. 59 from West Broadway Street and Rt. 9W, and eliminate spillback impacts on the Thruway.

  The proposed new location of the eastbound ramps at W. Broadway St. would be relatively close (approx. 110 ft) to the existing unsignalized Rt. 59/Ingalls St. intersection. This close proximity would require access to and from Ingalls Street to be restricted (right in/right out) or closed, with alternate access to and from Rt. 59 provided at an alternative location. Proposed modifications to Ingall's Street will be addressed in the EIS.

- **Traffic Safety:** Eliminating the spillback of traffic onto the Thruway would avoid the existing unsafe conditions created by queued vehicles adjacent to faster moving through-traffic and the associated traffic turbulence that those conditions create.

## 6.3.2 Environmental

Preliminary assessments of the potential environmental impacts of the proposed relocation of the eastbound ramps at Interchange 11 were performed. The studies assessed whether the proposed improvements to the intersection would result in any significant environmental impacts other than those projected to occur if all of the project's elements – CRT, BRT, and other highway improvements – were implemented. Based on these studies, which also draw on information included in the TAOR, the following indicate any new or exacerbated environmental impacts that would be caused by the proposed relocation of the eastbound ramps:

- **Displacement, Acquisitions** – The proposed improvement would displace a commercial operation on the north side of Rt. 59 at the W. Broadway Street intersection, and an existing residence at the western end of 1st Street. Some minor property strip acquisitions may be required on the north and/or south side of Rt. 59 to accommodate modifications of the roadway's horizontal and vertical alignments near the intersection and to address the impacts on access to and from Rt. 59 from Ingalls Street.

- **Land Use, Parks** – Impacts to land use character would be minimal, and there would be no impact to parks.

- **Visuals** – Minor visual impacts would occur, primarily due to changes in views from residences immediate east and west of the relocated eastbound ramps.

- **Wetlands, Ecology** – The construction of the proposed new eastbound ramps would have no significant impacts to wetlands and ecology.

- **Water Quality –** The proposed design would add additional impervious surface requiring drainage, but would also eliminate the existing ramps, with a minimal net change in impervious surface and no impacts on water quality.

- **Historic Resources** – The proposed eastbound ramps would not impact any historic resources.

- **Archaeological Resources** – The proposed eastbound ramps would not impact any known archaeological resources.

- **Air and Noise Quality** – The proposed eastbound ramps would improve traffic flow on Rt. 59 and on the eastbound Thruway, which would likely result in an overall reduction in emissions due to projected range of improvements in average travel speeds and more continuous traffic flow. The overall difference in emissions would likely not be significant, and would not change pollutant concentrations in the surrounding communities. The new ramps would likely have little or no impact on sound levels within neighborhoods close to the new ramps due to the proximity of those areas to the much higher volumes on the adjacent Thruway. These issues will be reviewed further in the EIS.

### 6.3.3 Costs

- **Capital Costs.** Development of the proposed eastbound and westbound climbing lanes, as discussed in Chapter 2, would require extensive reconstruction of portions of the existing Interchange 11, including both the eastbound ramps and the Mountain View Avenue bridge over the Thruway. As such, the relocation of the eastbound ramps would likely result in a relatively small increase in overall construction costs.

- **O&M Costs**. The proposed new eastbound ramps would have no effect on O&M costs – e.g., general pavement maintenance, pavement markings, snow clearance and de-icing, highway lighting, signage, etc. – as the ramps would be similar in pavement size and operation as the existing ramps.

## 6.4 Summary

- Traffic analyses showed that the proposed new eastbound ramps would significantly improve traffic operations on the adjacent segment of Rt. 59 and traffic and safety conditions on the eastbound Thruway.

- An initial environmental assessment of the proposed new eastbound ramps did not identify any potentially significant environmental impacts associated with these improvements.

- Minimal increases in the project's overall capital costs and no long-term impact on O&M costs are projected.

- Potential impacts associated with the proposed eastbound ramps, including those dealing with traffic operations and safety and residential or commercial displacement will be analyzed in greater detail in the DEIS.