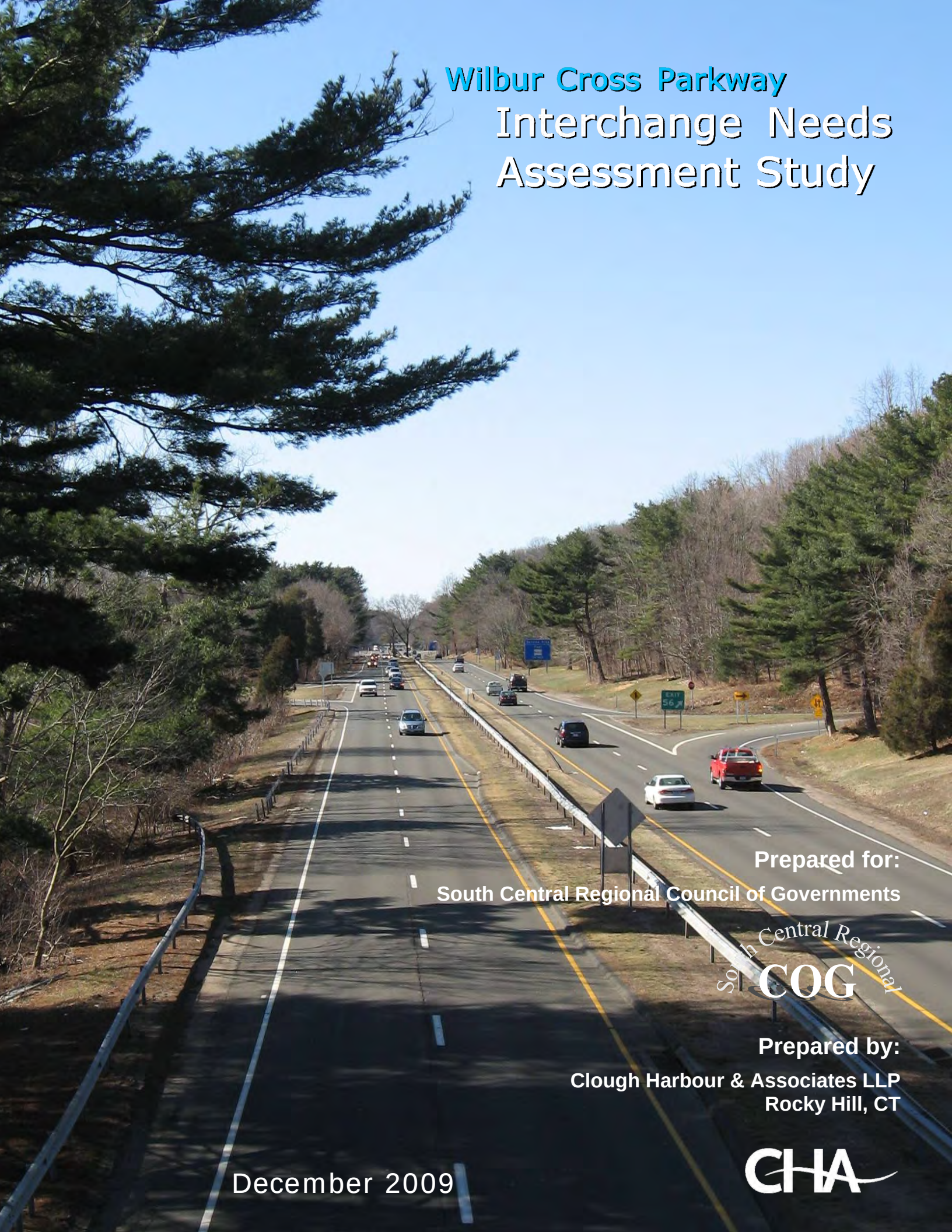

Wilbur Cross Parkway
Interchange Needs Assessment Study

Prepared for:

South Central Regional Council of Governments

South Central Regional COG

Prepared by:

Clough Harbour & Associates LLP
Rocky Hill, CT

CHA

December 2009

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Executive Summary

The purpose of the *Wilbur Cross Parkway Interchange Needs Assessment Study* is to identify and address the critical safety and operational issues at seven interchanges and two service areas on the Wilbur Cross Parkway (Route 15) between Milford and Meriden, Connecticut. This document outlines near-term, mid-term, and long-term improvement plans for each of the interchanges and service areas; provides planning-level construction cost estimates; and summarizes the potential impacts associated with each plan. The information contained in this document is intended to guide the South Central Regional Council of Governments (SCRCOG), Connecticut Department of Transportation (ConnDOT), and participating municipalities in prioritizing and programming improvement projects on the Parkway.

The near-term improvement recommendations generally consist of relatively low cost safety improvements that can be readily implemented over the next one to three years, subject to funding availability. These improvements should be considered for immediate implementation with possible priority given to those locations that have experienced the highest number or rate of accidents. The near-term improvement recommendations could be combined and advanced as one or more improvement projects.

- Total estimated construction value for near-term recommendations: $103,000.

The mid-term improvement recommendations generally consist of moderately complex safety and operational improvements that could be implemented within three to ten years depending on prioritization and funding availability. These improvements will require additional planning and design development and could involve relatively minor right-of-way and environmental impacts. The mid-term improvement recommendations could be implemented as one or more improvement projects for each interchange, or assembled with components of mid-term improvement plans from other interchanges to realize some economies-of-scale relative to construction costs.

- Total estimated construction value for mid-term recommendations: $17.2 million.

The long-term improvement recommendations consist of relatively complex and high cost safety and operational improvements that could be implemented in ten or more years depending on prioritization and funding availability. These improvements require additional planning and design development and could involve more significant right-of-way and environmental impacts as well as impacts to existing bridge structures.

- Total estimated construction value for long-term recommendations: $43.2 ~ $47.7 million (depending on which long-term plans are selected).

The key needs and deficiencies and the major components of the recommended improvement plans for each interchange and service area location are summarized below. Suggested priority levels for improvements at each location are provided in Appendix 4 (pages A4-7 to A4-9).

Interchange 55 – Milford

Summary of Key Deficiencies and Needs

Northbound:

- Off Ramp (Exit 55B): Non-standard ramp curvature and deceleration lane.
- On Ramp: Non-standard ramp curvature; no acceleration lane. Stop-controlled approach to mainline.

Southbound:

- Off Ramp: Non-standard deceleration lane.
- On Ramp: Non-standard merge with Interchange 54 southbound on ramp.

Wheelers Farms Road:

- Inadequate signing southbound between Wolf Harbor Road and Southwick Court including no merge warning sign and no lane assignment signing.

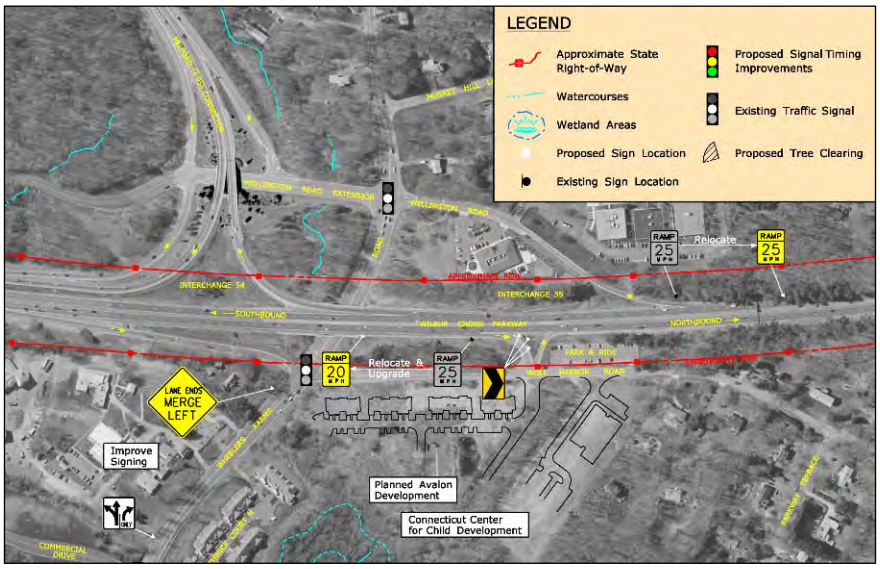
Near-term Improvement Plan $15,000

Northbound and Southbound:

- Improve signage for off ramps.

Wheelers Farms Road:

- Improve signage.
- Consider revised signal timings to optimize operations.



See Interchange 55, pages 55-1 through 55-22, for full details.

Interchange 55 – Milford (continued)

Mid-term Improvement Plan ..... $3.4 million

Northbound:

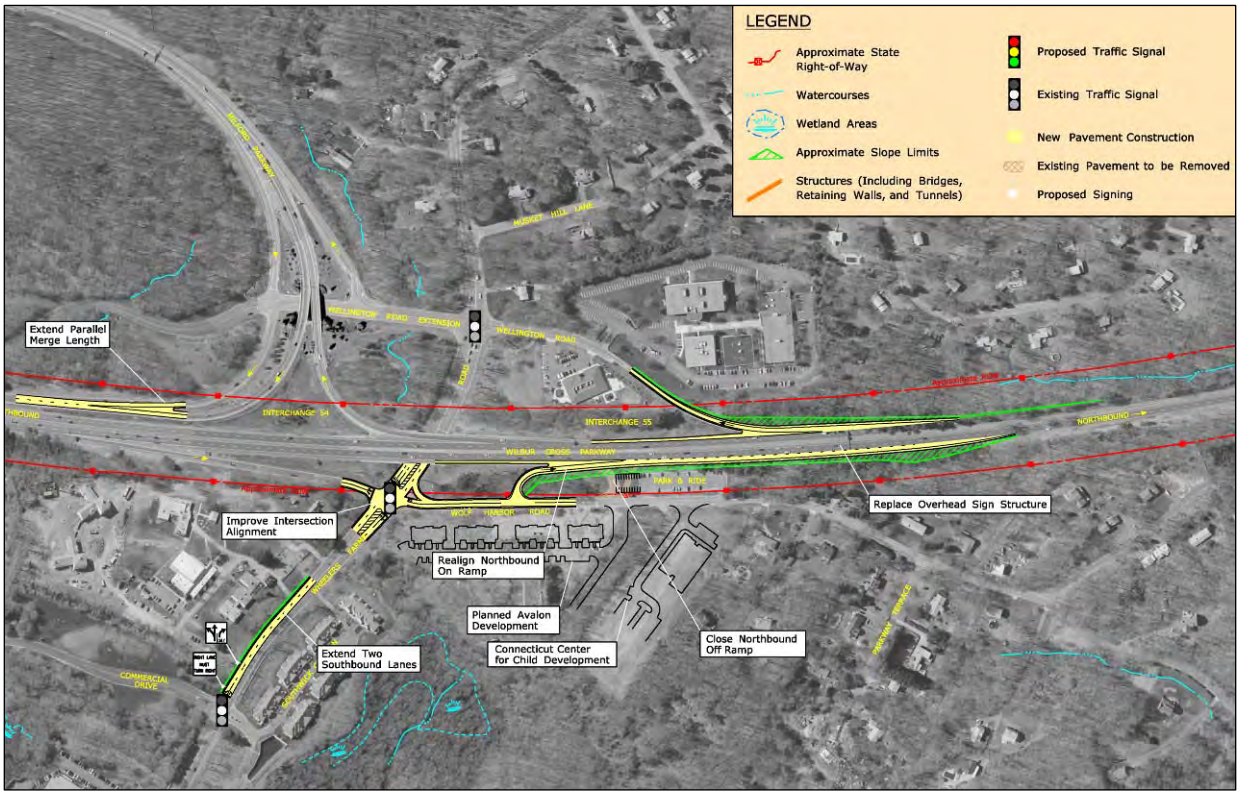
- Close off ramp (Exit 55B) to Wolf Harbor Road.
- Improve on ramp and acceleration lane.

Southbound:

- Improve off ramp and provide standard deceleration lane.
- Improve on ramp merge with Interchange 54.

Wheelers Farms Road:

- Extend two southbound lanes to intersection with commercial driveway/Southwick Court.



See Interchange 55, pages 55-1 through 55-22, for full details.

Service Areas – Orange

Summary of Key Deficiencies and Needs

Northbound:

- Insufficient physical separation between mainline and service area.
- Off Ramp: Non-standard deceleration lane.
- On Ramp: Yield-controlled approach to mainline with non-standard acceleration lane.

Southbound:

- Insufficient physical separation between mainline and service area.
- Off Ramp: Non-standard deceleration lane.
- On Ramp: Yield-controlled approach to mainline with non-standard acceleration lane.

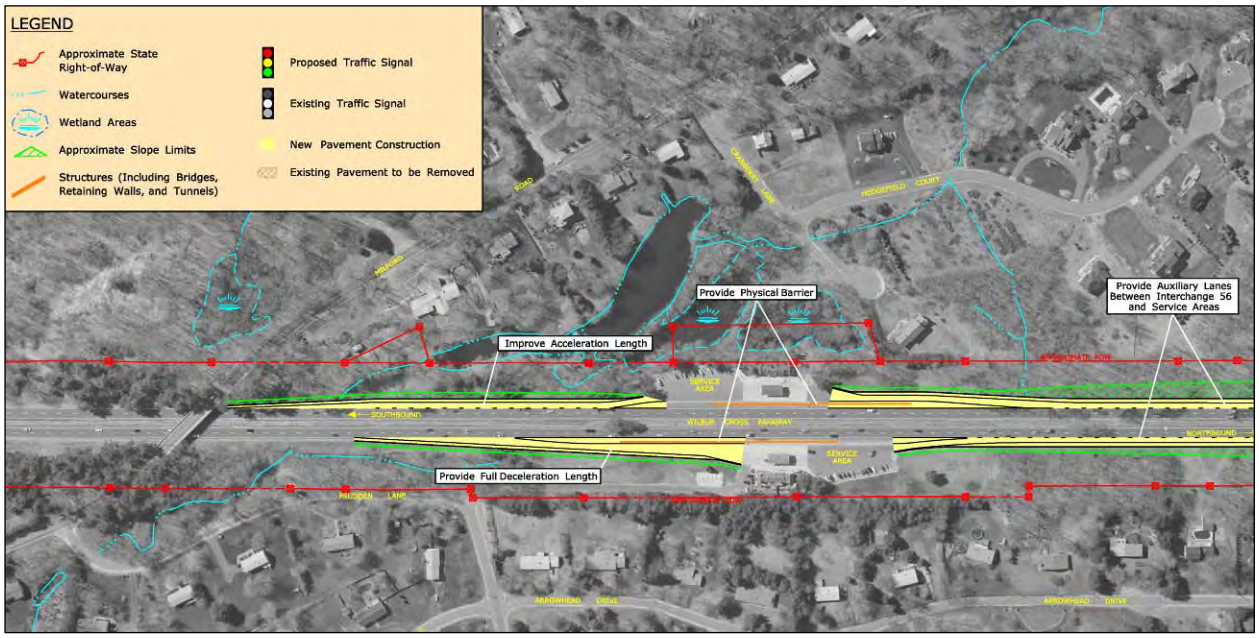
Mid-term Improvement Plan ..... $1.3 million

Northbound:

- Provide concrete barrier to improve physical separation between mainline and service area.
- Provide standard deceleration lane for off ramp.
- Improve acceleration lane for on ramp in conjunction with Interchange 56 auxiliary lane improvements.

Southbound:

- Provide concrete barrier to improve physical separation between mainline and service area.
- Provide standard deceleration lane for off ramp in conjunction with Interchange 56 auxiliary lane improvements.
- Improve acceleration lane for on ramp within constraints of Derby-Milford Road bridge.



See Orange Service Areas, pages OS-1 through OS-13, for full details.

Interchange 56 – Orange

Summary of Key Deficiencies and Needs

Overall:

- Interchange is a high accident location.

Northbound:

- Off Ramp: No deceleration lane.
- On Ramp: Non-standard ramp curvature; no acceleration lane. Stop-controlled approach to mainline. Poor visibility of existing stop sign due to sight line obstructed by trees.

Southbound:

- Off Ramp: Non-standard ramp curvature and deceleration lane.
- On Ramp: Non-standard ramp curvature; no acceleration lane. Stop-controlled approach to mainline.

Route 121:

- Intersection of northbound ramps, Route 121 and Old Grassy Hill Road is a high accident location with a high percentage of rear-end and angle collisions.

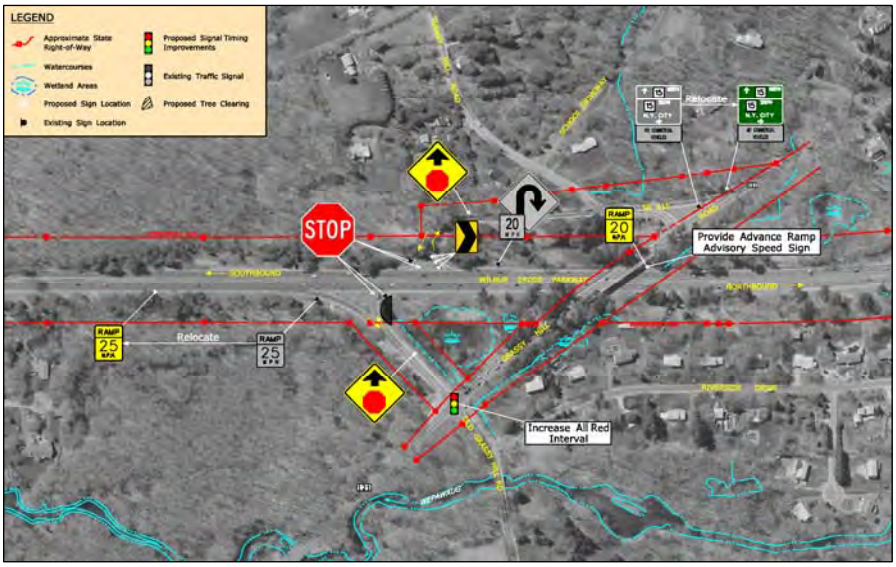
Near-term Improvement Plan $40,000

Northbound and Southbound:

- Improve signage for all ramps.
- Provide tree clearing to improve visibility of stop sign on northbound on ramp approach to mainline.

Route 121:

- Modify signal timing at northbound ramps intersection.



See Interchange 56, pages 56-1 through 56-26, for full details.

Interchange 56 – Orange (continued)

Mid-term Improvement Plan ..... $5.1 million

Northbound:

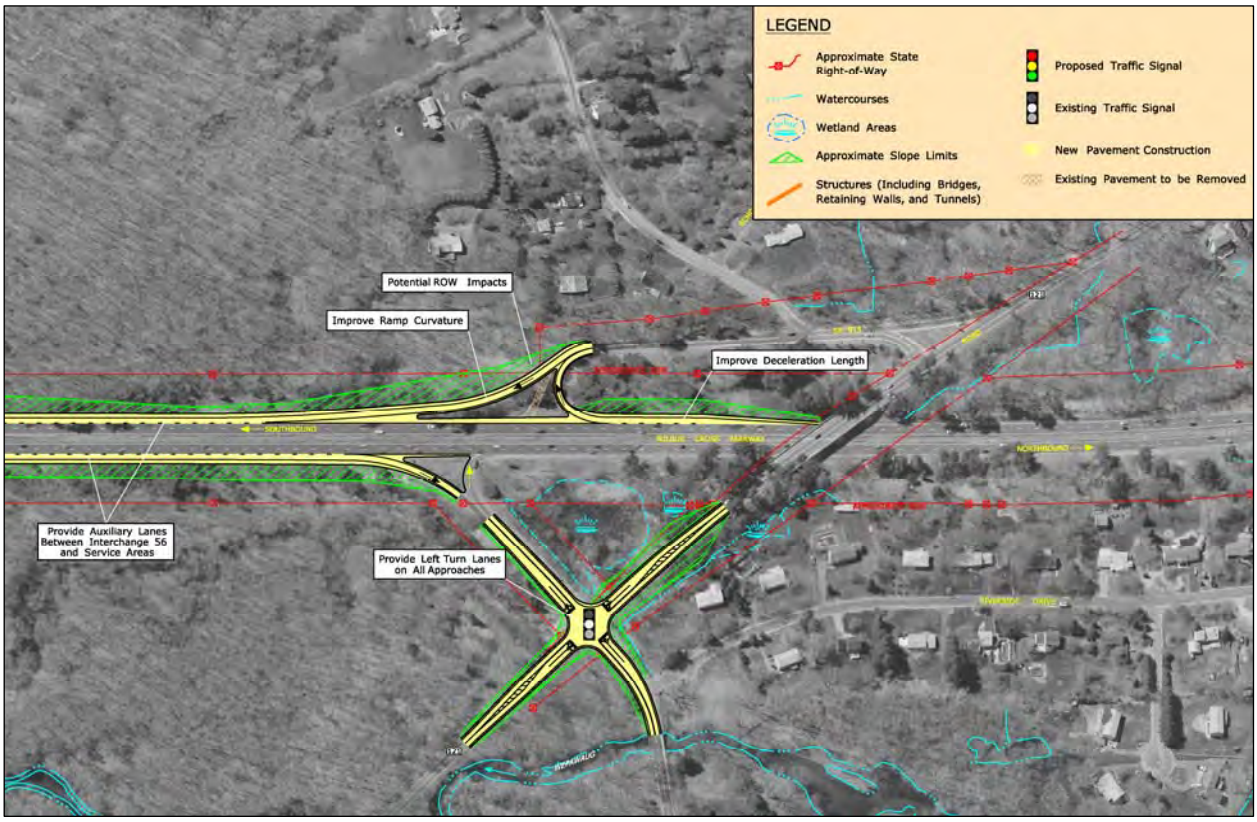
- Provide auxiliary lane from Orange Service Area to northbound off ramp.

Southbound:

- Provide auxiliary lane from on ramp to Orange Service Area.
- Improve deceleration lane for off ramp within constraints of Route 121 bridge.

Route 121:

- Provide left turn lanes on all approaches to intersection with northbound ramps.



See Interchange 56, pages 56-1 through 56-26, for full details.

Interchange 56 – Orange (continued)

Long-term Improvement Plan ..... Plan A: $3.7 million
Plan B: $6.8 million

Northbound Plan A:

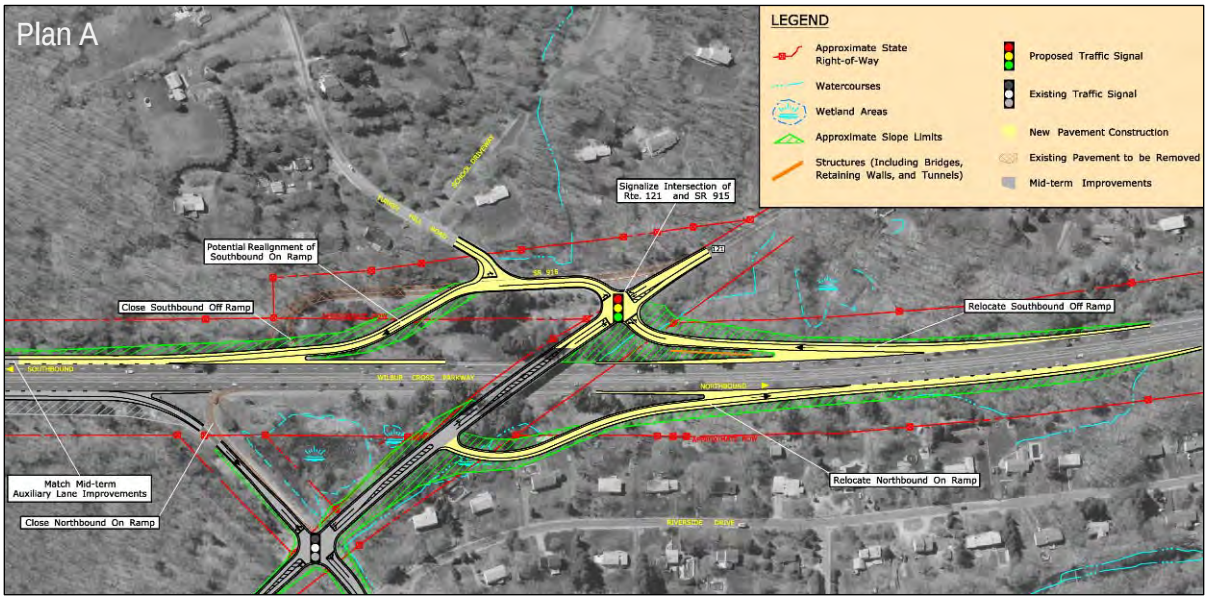
- Relocate on ramp to east side of Route 121 and provide standard acceleration lane.

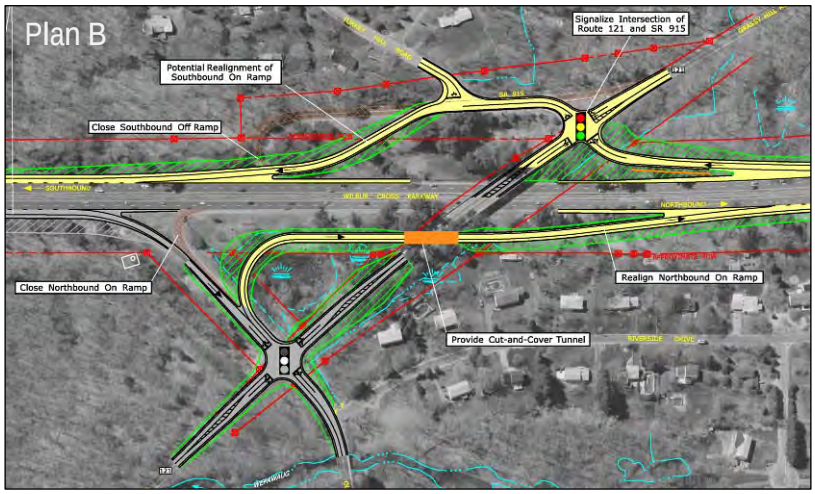
Northbound Plan B:

- Realign existing on ramp and provide cut-and-cover tunnel under Route 121 to accommodate standard acceleration lane.

Southbound:

- Relocate off ramp to east side of Route 121 and provide standard deceleration lane. Signalize new intersection of SR 915, southbound off ramp, and Route 121.





See Interchange 56, pages 56-1 through 56-26, for full details.

Interchange 60 – Hamden

Summary of Key Deficiencies and Needs

Northbound:

- Off Ramp: High percentage of rear end collisions. Queuing concerns under future traffic conditions.
- On Ramp: Non-standard acceleration lane.

Southbound:

- Off Ramp: Two pedestrian accidents in three years.
- On Ramp: Non-standard acceleration lane.

Near-term Improvement Plan $18,000

Northbound:

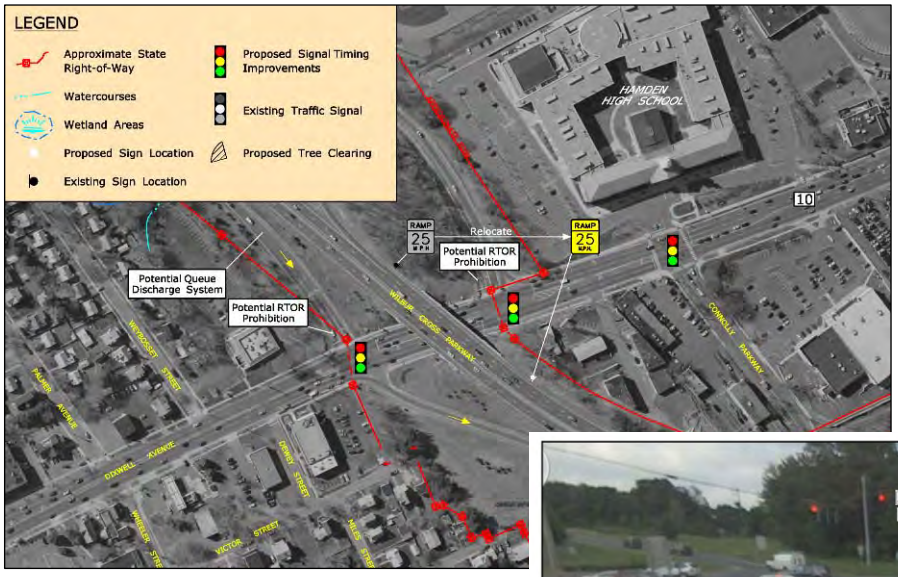
- Improve signage for off ramp including consideration of "No Turn on Red" at Route 10 intersection during peak pedestrian periods.

Southbound:

- Improve signage for off ramp including consideration of "No Turn on Red" at Route 10 intersection during peak pedestrian periods.

Route 10:

- Modify signal timings as required to optimize operations.



See Interchange 60, pages 60-1 through 60-20, for full details.

Interchange 60 – Hamden (continued)

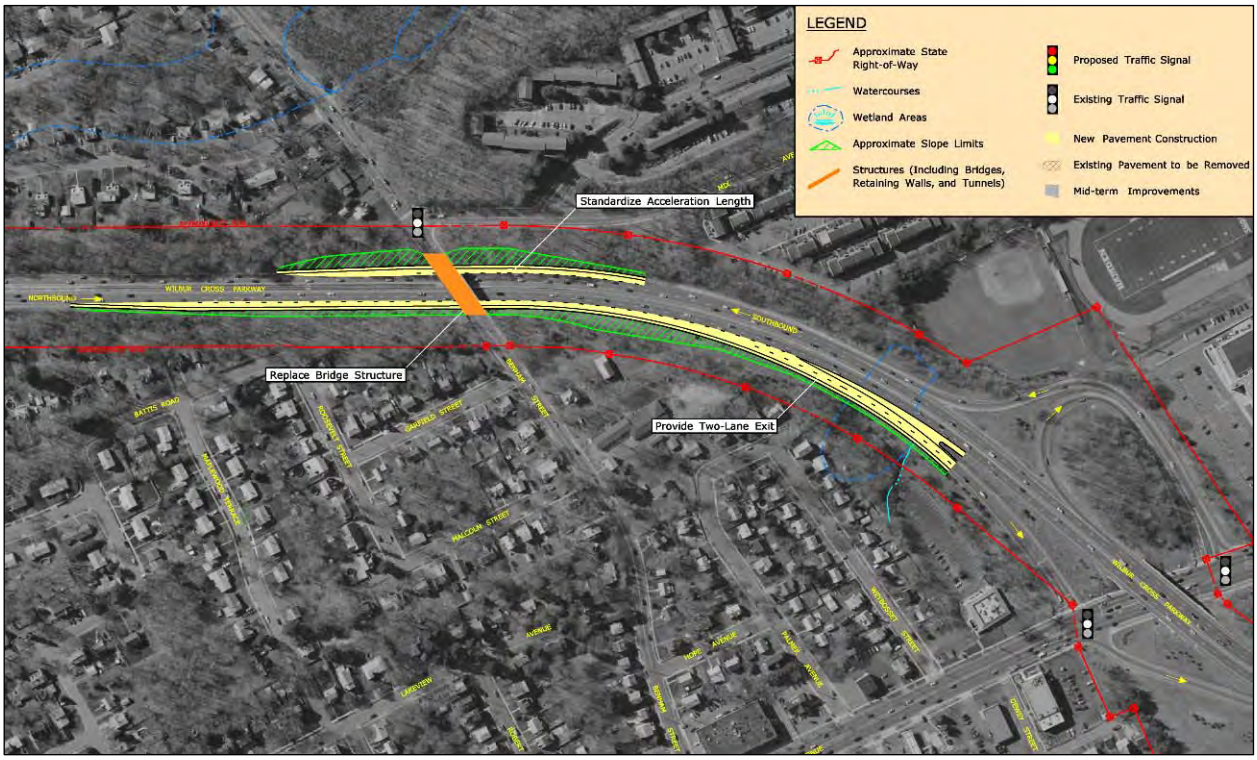
Long-term Improvement Plan ..... $2.6 million

Northbound:

- Provide two lane exit for off ramp in conjunction with future replacement of Benham Street overpass.

Southbound:

- Provide standard acceleration lane in conjunction with future replacement of Benham Street overpass.



See Interchange 60, pages 60-1 through 60-20, for full details.

Interchange 61 – Hamden

Summary of Key Deficiencies and Needs

Overall:

- Interchange is a high accident location.

Northbound:

- Off Ramp: Non-standard ramp curvature and deceleration lane.
- On Ramp: Non-standard ramp curvature; no acceleration lane. Stop-controlled approach to mainline with a high number (55) and percentage (92%) of rear-end accidents.

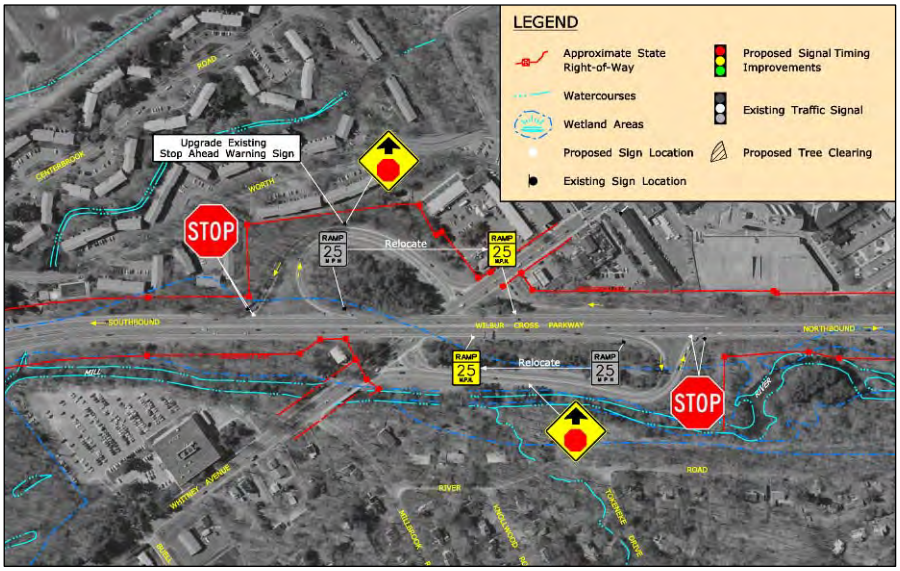
Southbound:

- Off Ramp: Non-standard ramp curvature and deceleration lane.
- On Ramp: Non-standard ramp curvature; no acceleration lane. Stop-controlled approach to mainline with a high number (291) and percentage (98%) of rear-end accidents.

Near-term Improvement Plan $5,000

Northbound and Southbound:

- Improve signage for all ramps.



See Interchange 61, pages 61-1 through 61-26, for full details.

Interchange 61 – Hamden (continued)

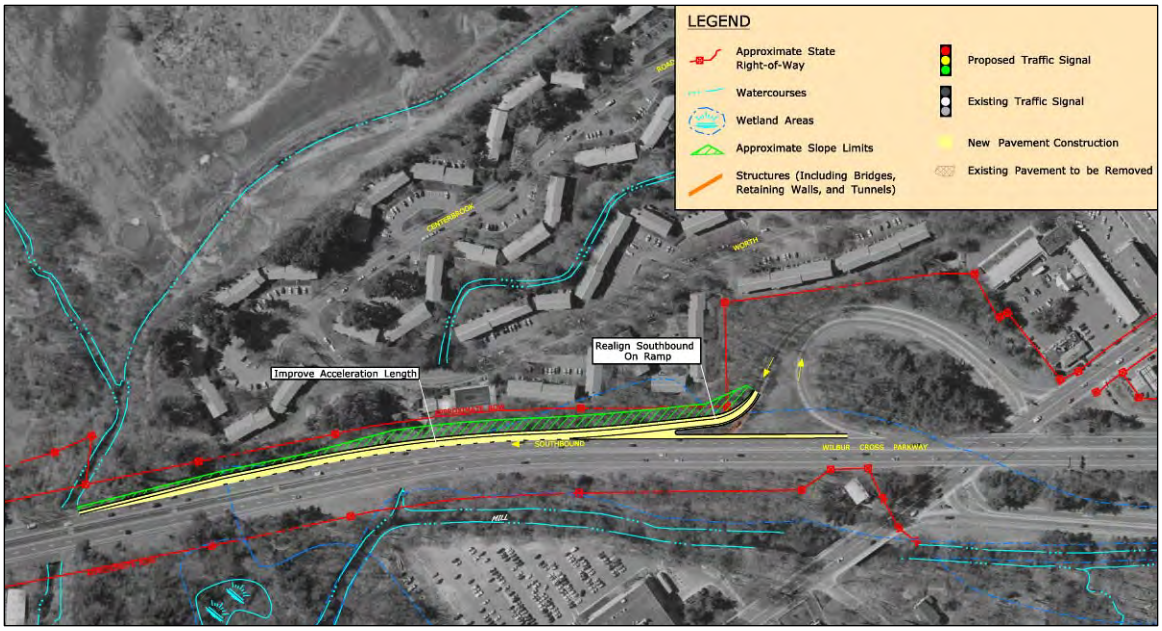
Mid-term Improvement Plan ..... $2.8 million

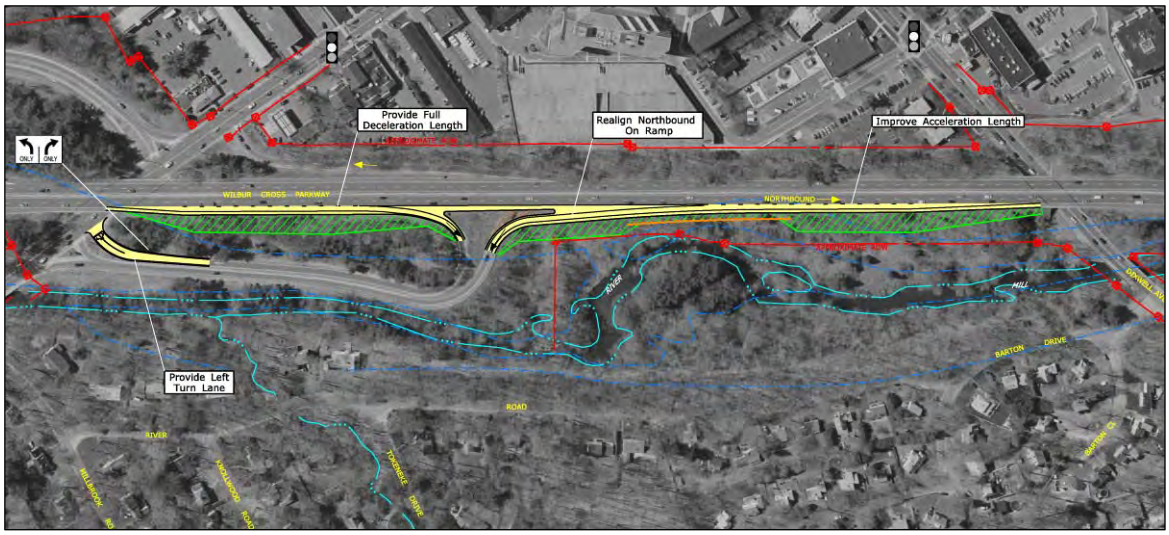
Northbound:

- Provide standard deceleration lane for off ramp. Provide separate left and right turn lanes at ramp terminus.
- Improve acceleration lane for on ramp within constraints of Route 15 bridge over Dixwell Avenue.

Southbound:

- Improve acceleration lane for on ramp within constraints of Route 15 bridge over Mill Brook.





See Interchange 61, pages 61-1 through 61-26, for full details.

Interchange 61 – Hamden (continued)

Long-term Improvement Plan ..... Plan A: $5.3 million
Plan B: $3.9 million

Northbound Plan A:

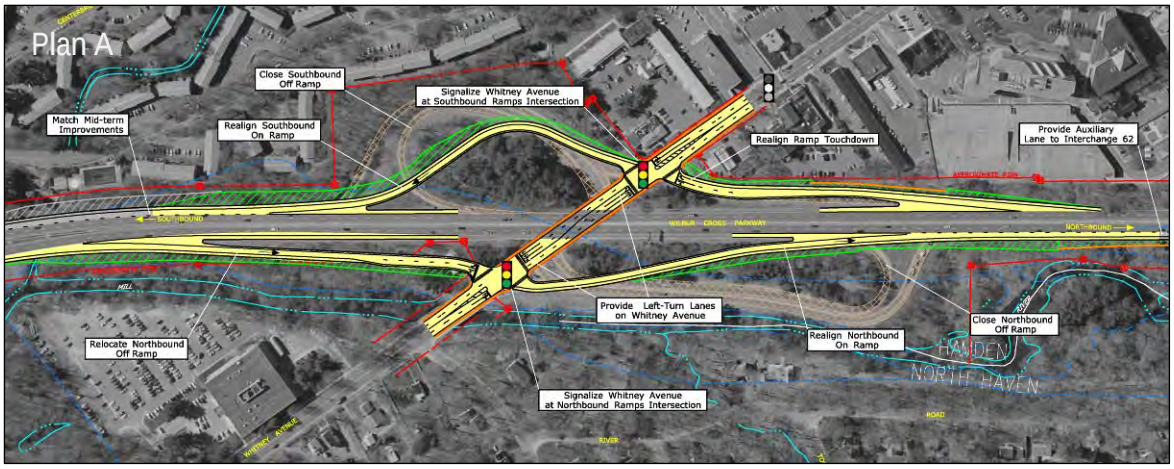
- Relocate off ramp to west side of Whitney Avenue.
- Realign on ramp and provide auxiliary lane to Interchange 62 off ramp.
- Signalize intersection of northbound ramps and Whitney Avenue.

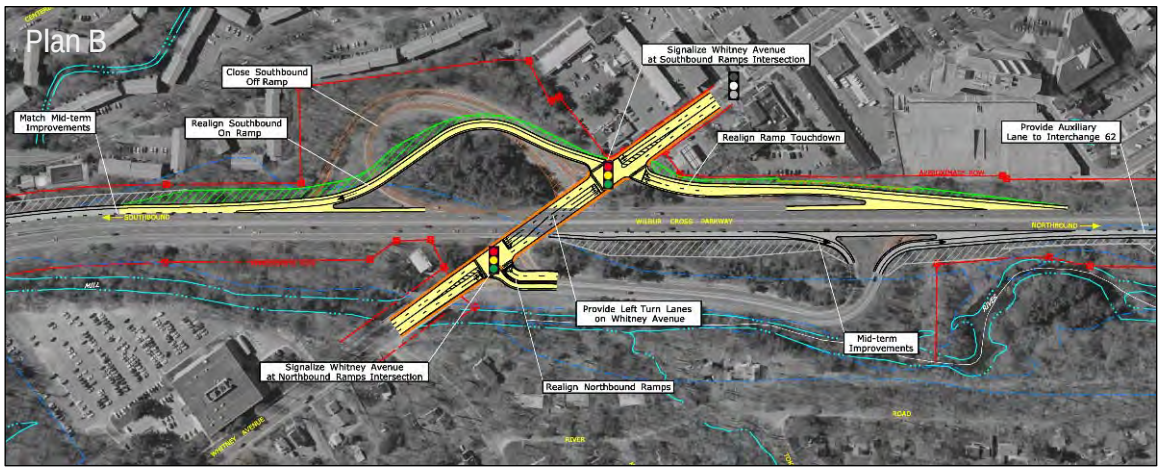
Northbound Plan B:

- Maintain off ramp in existing location; realign northbound ramps at Whitney Avenue.
- Provide auxiliary lane to Interchange 62 off ramp.
- Signalize intersection of northbound ramps and Whitney Avenue.

Southbound:

- Close off ramp (Exit 61); realign on ramp to provide standard acceleration lane.
- Improve off ramp geometry
- Signalize intersection of southbound ramps and Whitney Avenue





See Interchange 61, pages 61-1 through 61-26, for full details.

Interchange 62 – North Haven

Summary of Key Deficiencies and Needs

Overall

- Interchange is a high accident location.

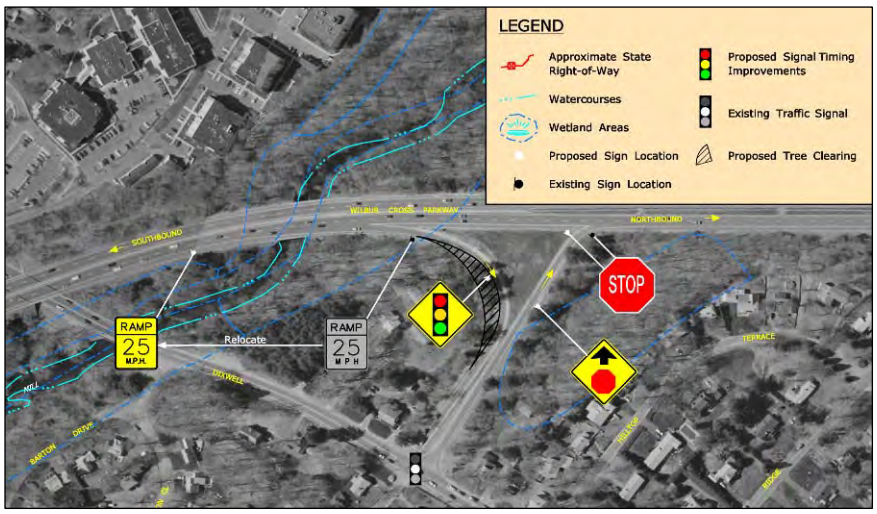
Northbound:

- Off Ramp: Non-standard deceleration lane. Limited sight lines for exiting motorists.
- On Ramp: Non-standard ramp curvature; no acceleration lane. Stop-controlled approach to mainline with a high number (53) and percentage (87%) of rear-end accidents.

Near-term Improvement Plan $13,000

Northbound:

- Improve signage for ramps.
- Provide tree clearing to improve visibility along off ramp.



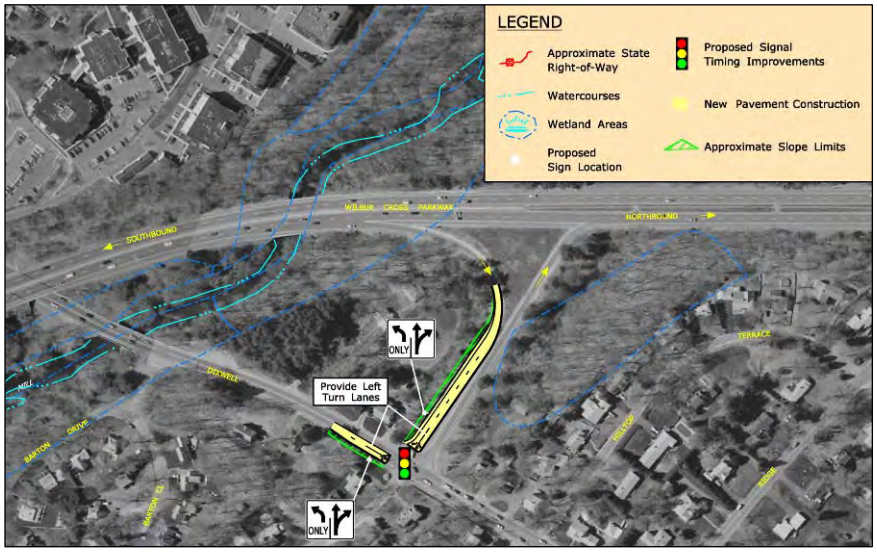
Mid-term Improvement Plan $210,000

Northbound:

- Provide left turn lane on the off ramp approach to Dixwell Avenue.

Dixwell Avenue:

- Provide eastbound left turn lane on Dixwell Avenue at northbound ramps intersection.
- Modify existing traffic signal timings at northbound ramps intersection.



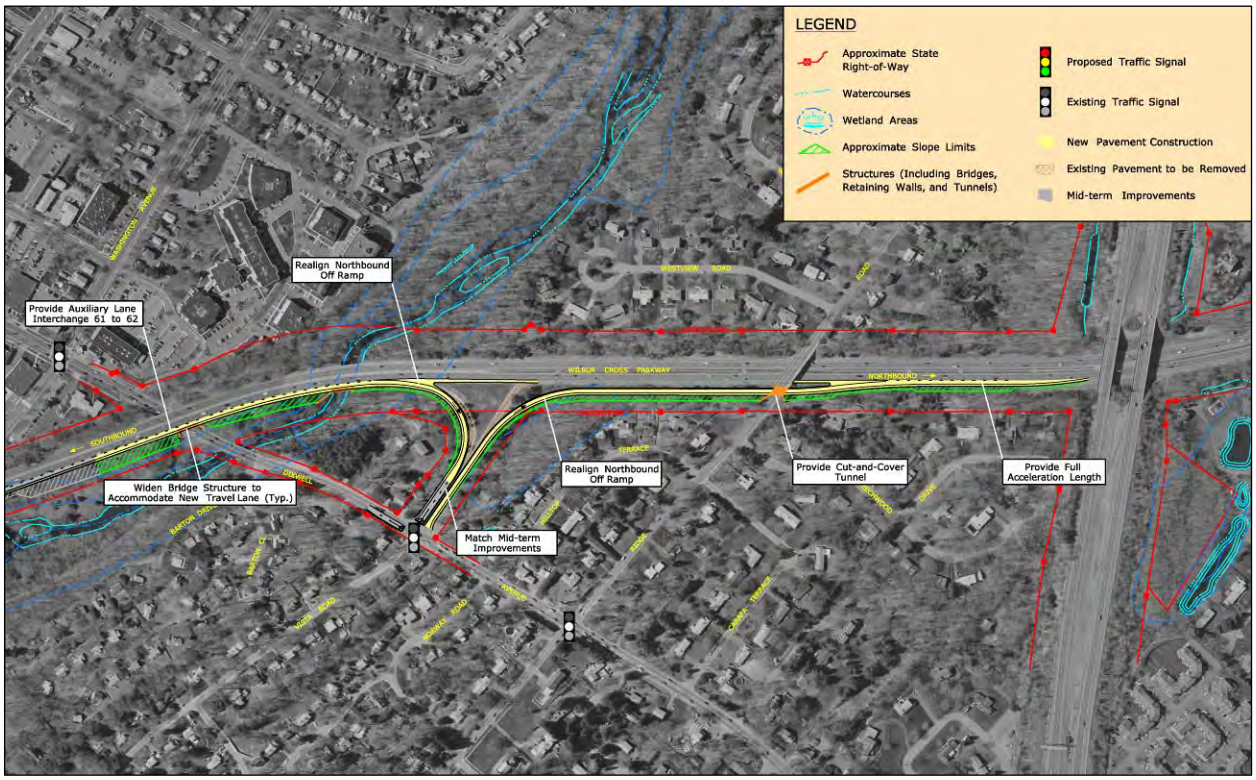
See Interchange 62, pages 62-1 through 62-19, for full details.

Interchange 62 – North Haven (continued)

Long-term Improvement Plan ..... $5.6 million

Northbound:

- Provide standard deceleration lane for off ramp.
- Provide standard acceleration lane for on ramp.



See Interchange 62, pages 62-1 through 62-19, for full details.

Interchange 63 – North Haven

Summary of Key Deficiencies and Needs

Overall:

- Interchange is a high accident location.

Northbound:

- Off Ramp: Non-standard ramp curvature and deceleration lane.
- On Ramp: Non-standard ramp curvature; no acceleration lane. Stop-controlled approach to mainline.

Southbound:

- Off Ramp: Non-standard deceleration lane.
- On Ramp: Non-standard ramp curvature; no acceleration lane. Stop-controlled approach to mainline with a high number (224) and percentage (98%) of rear-end accidents.

Intersection Operations:

- Poor operations at four locations within the interchange area including Hartford Turnpike/Route 15 southbound ramps; Route 22/Hartford Turnpike; Route 22/Route 15 northbound ramps; and Route 22/State Street.

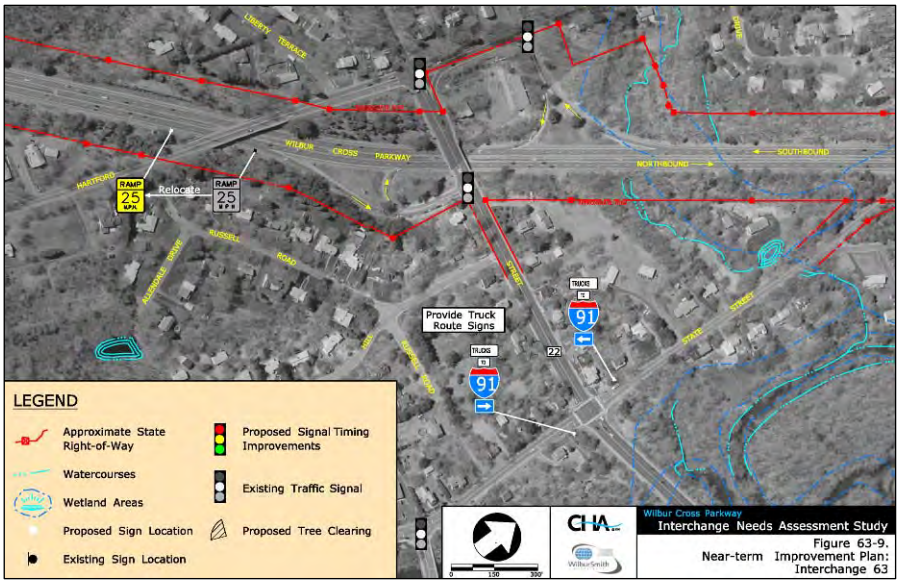
Near-term Improvement Plan $3,000

Northbound:

- Improve signage for off ramp.

Other:

- Provide truck route signs at Route 22/US 5 intersection.



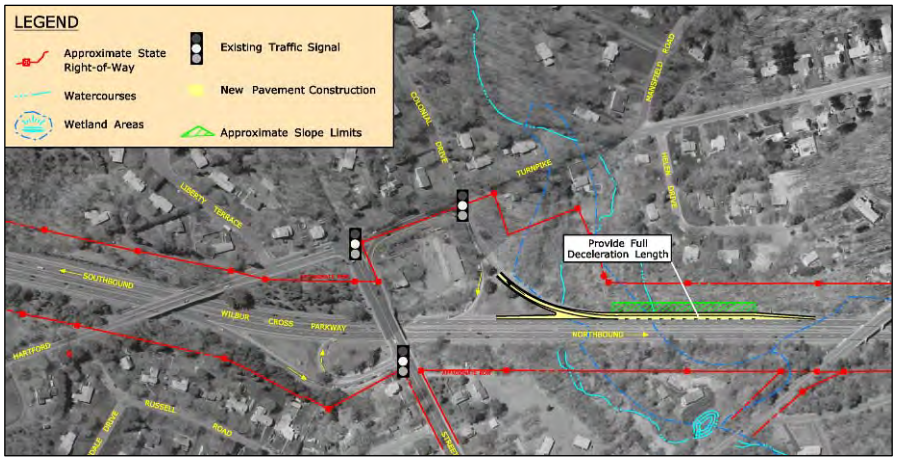
See Interchange 63, pages 63-1 through 63-23, for full details.

Interchange 63 – North Haven (continued)

Mid-term Improvement Plan $380,000

Southbound:

- Provide standard deceleration lane for off ramp.



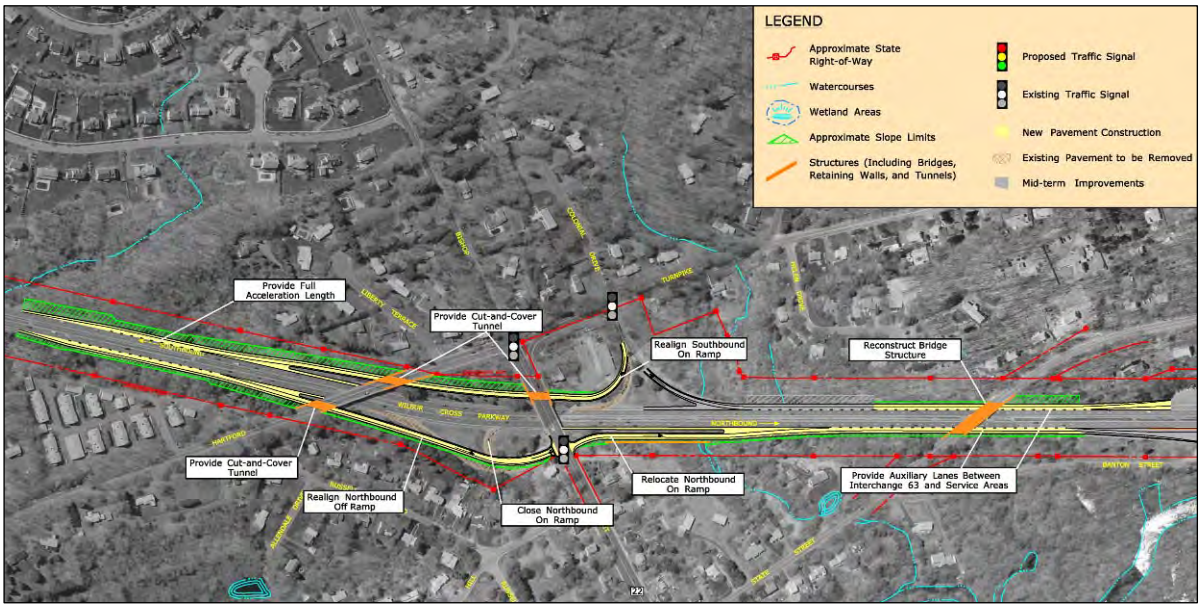
Long-term Improvement Plan ..... $26 million

Northbound:

- Provide standard deceleration lane via cut-and-cover tunnel under Hartford Turnpike.
- Relocate on ramp to north side of Route 22 and provide acceleration lane improvements.
- Provide auxiliary lane to North Haven Service Area off ramp.

Southbound:

- Provide standard acceleration length via two cut-and-cover tunnels under Route 22 and Hartford Turnpike.
- Provide auxiliary lane from North Haven Service Area on ramp.



See Interchange 63, pages 63-1 through 63-23, for full details.

Service Areas – North Haven

Summary of Key Deficiencies and Needs

Northbound:

- Insufficient physical separation between mainline and service area.
- Off Ramp: Non-standard deceleration lane.
- On Ramp: Yield-controlled approach to mainline with non-standard acceleration lane.

Southbound:

- Insufficient physical separation between mainline and service area.
- Off Ramp: Non-standard deceleration lane.
- On Ramp: Yield-controlled approach to mainline with non-standard acceleration lane.

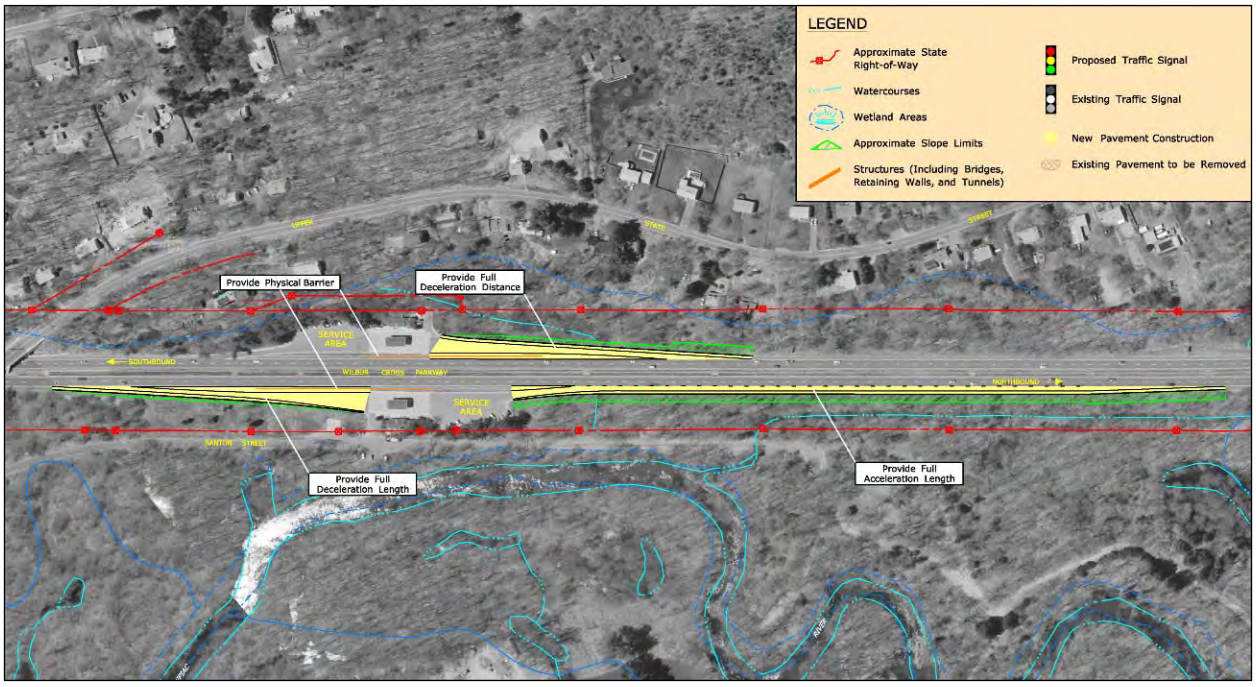
Mid-term Improvement Plan ..... $1.8 million

Northbound:

- Provide concrete barrier to improve physical separation between mainline service area.
- Provide standard deceleration lane for off ramp.
- Provide standard acceleration lane for on ramp.

Southbound:

- Provide concrete barrier to improve physical separation between mainline and service area.
- Provide standard deceleration lane for off ramp.



See North Haven Service Areas, pages NS-1 through NS-13, for full details.

DOT Maintenance Exit – North Haven

Summary of Key Deficiencies and Needs

Northbound:

- Off Ramp: Non-standard ramp curvature and deceleration lane.
- On Ramp: Non-standard ramp curvature and acceleration lane. Stop-controlled approach to mainline.

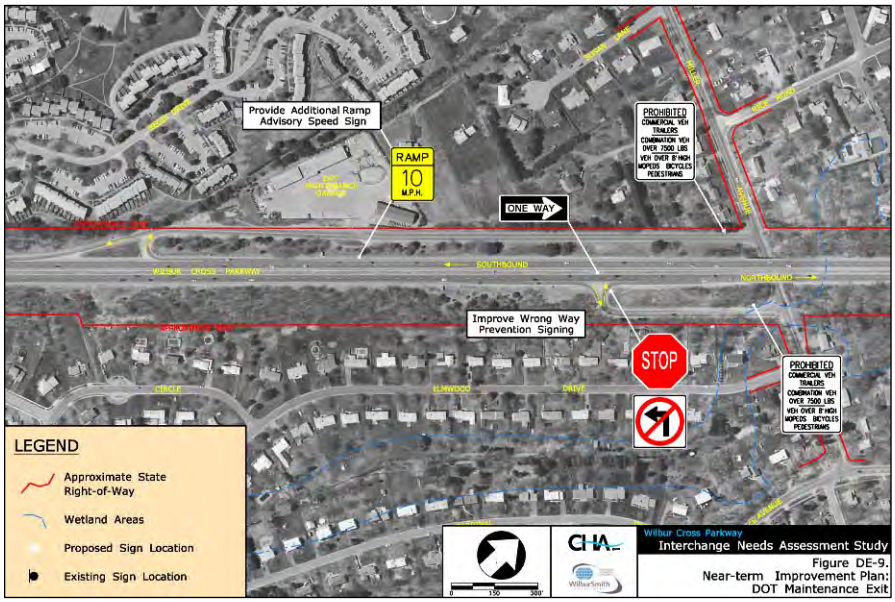
Southbound:

- Off Ramp: Non-standard ramp curvature and deceleration lane.
- On Ramp: Non-standard acceleration lane.

Near-term Improvement Plan $9,000

Northbound and Southbound:

- Improve signage for ramps.



See DOT Maintenance Exit, pages DE-1 through DE-21, for full details.

DOT Maintenance Exit – North Haven (continued)

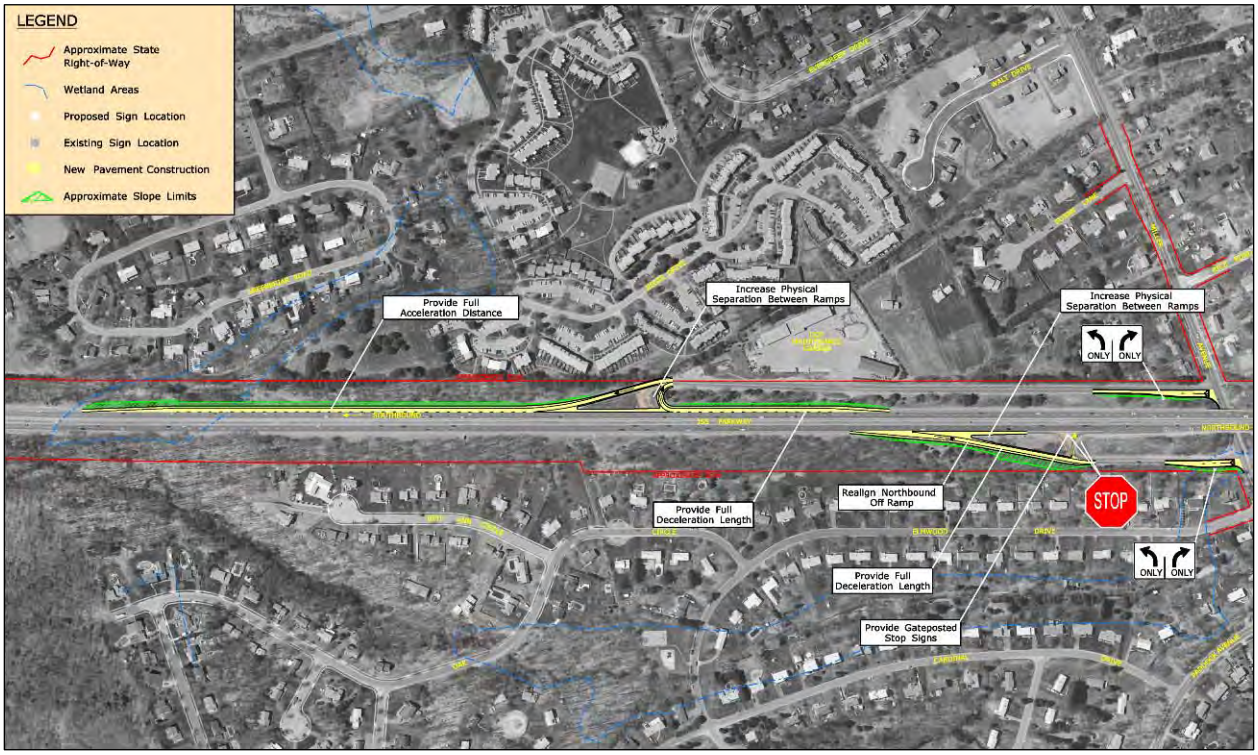
Mid-term Improvement Plan ..... $2.2 million

Northbound:

- Realign/relocate off ramp to provide physical separation between off ramp and on ramp.
- Modify curvature of on ramp and improve signage.
- Provide separate left and right turn lanes at off ramp approach to Miller Avenue.

Southbound:

- Improve physical separation between off ramp and on ramp.
- Provide separate left and right turn lanes at off ramp approach to Miller Avenue.
- Provide standard on ramp acceleration lane.



See DOT Maintenance Exit, pages DE-1 through DE-21, for full details.

DOT Maintenance Exit – North Haven (continued)

Long-term Improvement Plan ..... $1.4 million

Northbound:

- Relocate on ramp to north side of Miller Avenue to eliminate non-standard ramp curvature and improve acceleration length.

See DOT Maintenance Exit, pages DE-1 through DE-21, for full details.

Introduction

The South Central Regional Council of Governments (SCRCOG) commissioned the *Wilbur Cross Parkway Interchange Needs Assessment Study* under their Fiscal Year 2009 Unified Planning Work Program to evaluate and address traffic safety and operational issues at seven interchanges and two service areas on the Wilbur Cross Parkway (Route 15) between Milford and Meriden, Connecticut. This document summarizes the existing and future transportation conditions; identifies key deficiencies; and outlines a plan for near, mid, and long-term improvement recommendations at each of the study interchanges and service areas.

Background

The Wilbur Cross Parkway is a four-lane, controlled-access divided highway which extends approximately 29 miles from the Housatonic River at the Stratford/Milford city line to US Route 5 in Meriden. As a parkway, commercial vehicles and trucks are prohibited from accessing the route.

The Wilbur Cross Parkway was planned and designed in the late 1930s as an extension of the Merritt Parkway in Fairfield County and opened in stages between 1941 and 1949. The original roadway and its interchanges were designed for the traffic speeds and volumes of the time and not for the high speed, high volume commuter traffic the Parkway currently services. Only a few locations in the corridor have been significantly improved over the years to meet current design standards. The generally antiquated design features of the Parkway – such as sharp ramp curves, lack of acceleration and deceleration lanes, and stop-controlled on ramps – coupled with modern day traffic demands, have created safety and operational issues throughout the corridor and at its interchanges.

Study Purpose

The purpose of this study is to identify, evaluate, and comprehensively address safety and operational issues at the Wilbur Cross Parkway interchanges and service areas. The primary focus of the study effort is on safety and addressing existing conditions and deficiencies that have led to historically high numbers of accidents. Additionally, the focus is on addressing existing conditions and deficiencies that have not necessarily contributed to high accident rates, but have the potential to lead to serious accidents in the future as traffic demands on the corridor continue to rise. It should be noted that although this study identifies mainline areas that are currently, or are expected to be over capacity in the future, it does not evaluate considerations for additional travel lanes on the Parkway to increase capacity.

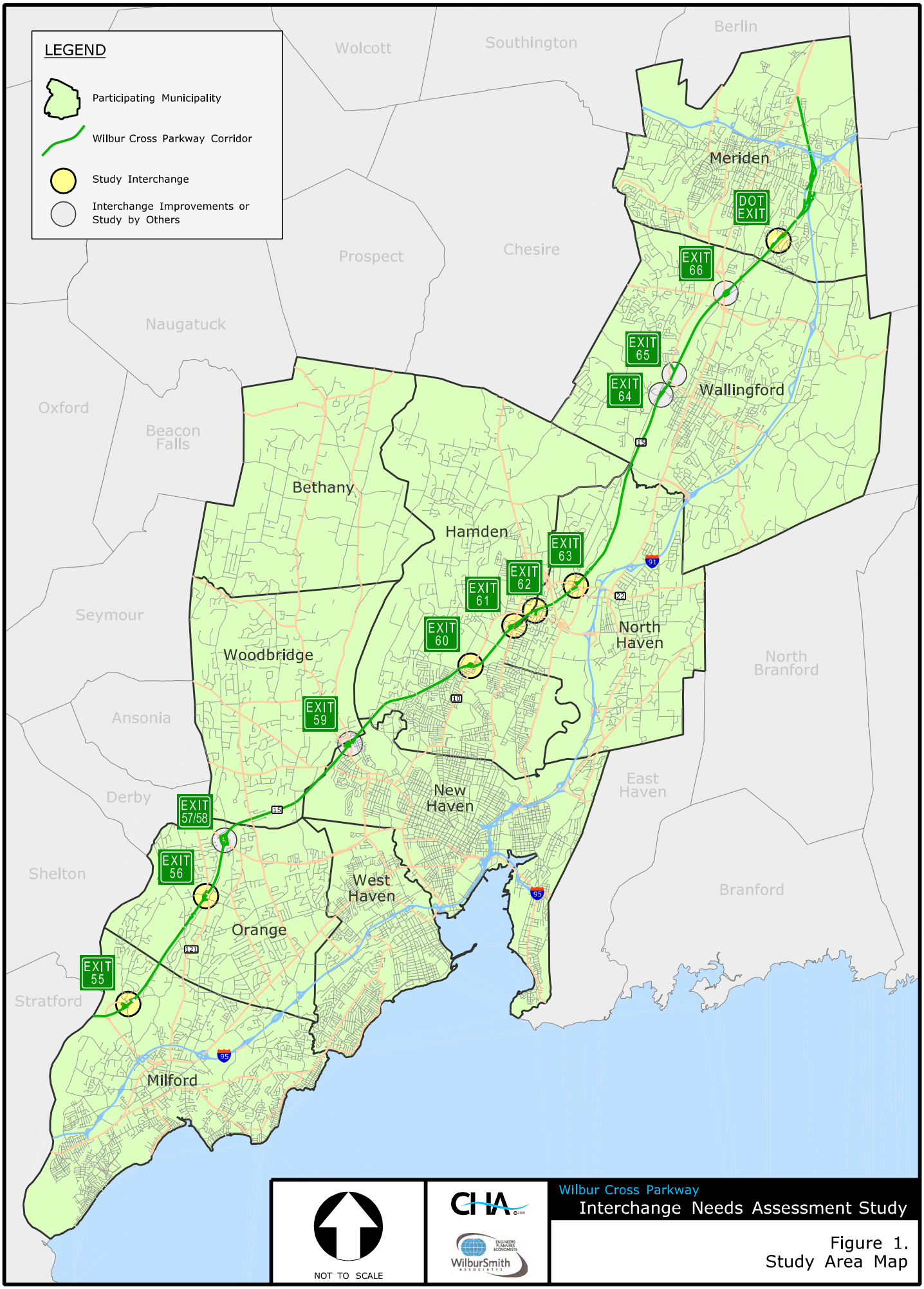
Study Area

The Wilbur Cross Parkway study area, as shown in Figure 1, includes the following interchanges and service areas:

- Milford: **Interchange 55** – Wheelers Farms Road/Wolf Harbor Road
- Orange: **Service Areas** – Northbound/Southbound
  Interchange 56 – Route 121 (Grassy Hill Road)
- Hamden: **Interchange 60** – Route 10 (Dixwell Avenue)
  Interchange 61 – Whitney Avenue
- North Haven: **Interchange 62** – Dixwell Avenue
  Interchange 63 – Route 22 (Bishop Street)
  Service Areas – Northbound/Southbound
- Meriden: **ConnDOT Maintenance Facility Exit** – Miller Avenue

The remaining interchanges in the Wilbur Cross Parkway corridor have recently been, or are currently being studied or improved by others and are not included in the study area. These interchanges include:

- **Interchange 57/58, Orange:** The Connecticut Department of Transportation's (ConnDOT) Division of Traffic Safety is currently evaluating safety and operational issues at this interchange. ConnDOT has been working closely with the Town of Orange in developing and reviewing numerous improvement concepts for this interchange.
- **Interchange 59, New Haven and Woodbridge:** ConnDOT recently selected a consultant to study existing high accident locations at this interchange. The study began in Spring 2009 and is anticipated to be completed in 18 to 24 months.
- **Interchange 64/65, Wallingford:** ConnDOT's Division of State Design is currently developing design plans for improvements to the northbound ramps at this interchange. Final Design Plans are tentatively scheduled for completion in September 2011. Advertising date is tentatively scheduled for November 2011.
- **Interchange 66, Wallingford:** SCRCOG completed a study of this interchange under their Fiscal Year 2007 Unified Planning Work Program that included detailed recommendations for reconfiguring the interchange to address safety and operational issues. No actions have been taken since completion of the study in 2007 to program the recommendations. The study is on file at SCRCOG.


LEGEND
Participating Municipality
Wilbur Cross Parkway Corridor
Study Interchange
Interchange Improvements or Study by Others
Wolcott
Southington
Berlin
Meriden
Prospect
Chesire
Naugatuck
Oxford
Beacon Falls
Wallingford
Bethany
Hamden
Seymour
Woodbridge
North Haven
North Branford
Ansonia
Derby
New Haven
East Haven
Shelton
West Haven
Branford
Orange
Stratford
Milford
DOT EXIT
EXIT 66
EXIT 65
EXIT 64
EXIT 63
EXIT 62
EXIT 61
EXIT 60
EXIT 59
EXIT 57/58
EXIT 56
EXIT 55
NOT TO SCALE
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 1.
Study Area Map

Study Participants

A key component of the Wilbur Cross Parkway study was active involvement of the study participants (municipal officials/representatives, ConnDOT and SCRCOG staff, consultant design staff, and local stakeholders/citizens) throughout the study process. The study team maintained close coordination with the municipalities, ConnDOT, and general public through a number of outreach mechanisms intended to solicit input on existing conditions and concerns; review the technical findings of the study; and develop and refine a set of preferred improvement concepts contained in this document. These outreach mechanisms included:

- Work session with ConnDOT to gather information on previous or on-going efforts in the study corridor
- Work sessions with participating municipalities to gather input on existing conditions and concerns
- Work sessions with participating municipalities to review technical findings and solicit input
- Public information meetings to present and discuss preliminary study findings and solicit public input
- Design workshop with ConnDOT design staff to review preliminary improvement concepts
- Work sessions with participating municipalities to review and discuss preliminary improvement concepts
- Public information meetings to present and discuss refined improvement concepts
- Posting of public meeting materials and preliminary improvement concepts on SCRCOG website for public review and comment

A record of the specific dates and locations of the work sessions and public meetings is provided in the appendix.

Report Format

The seven study interchanges and two service areas each have a section in this report that contains a needs and deficiencies assessment and recommended improvement plan that is specific to that interchange or service area. General information relative to the needs assessment for all interchanges and service areas – such as design standards used, sources of traffic data, and source of accident data – is provided in the *Needs Assessment Overview*. Additionally, general information relative to the improvement plans – such as definitions of near, mid, and long-term improvements, and methodologies for approximating impacts and estimating construction costs – is provided in the *Improvement Plan Overview.*

Needs Assessment Overview

The study team investigated the transportation conditions at each of the study interchanges to identify the needs and deficiencies of each interchange with respect to existing roadway geometry, existing and future traffic operations, and safety. This section provides an overview of how the study team approached the technical investigation and assessment of each of these transportation conditions. The detailed results of the needs assessment for each interchange are presented separately in subsequent sections of this report.

Roadway Geometry

In general, the procedure for identifying the geometric deficiencies of a roadway facility (such as a limited access highway, interchange ramp, secondary roadway, etc.) consists of comparing the existing characteristics of the facility to minimum design standards that are specific to the functional classification and design speed of that facility. For this study, the critical geometric characteristics are those that are closely related to vehicular safety on the Wilbur Cross Parkway and its interchanges. These critical geometric characteristics include deceleration lane lengths; acceleration lane lengths; and ramp curvatures and speeds. The study team obtained the minimum design standards from ConnDOT's *Highway Design Manual 2003 Edition* (HDM) assuming the following conditions apply:

- Functional classification of the Wilbur Cross Parkway is *Urban Freeway.*
- Wilbur Cross Parkway design speed is 70 mph.
- Minimum ramp design speed is 35 mph.

The minimum design standards for the mainline and interchange ramps are shown in Table 1. These standards were approved by ConnDOT for this study.

The study team determined existing acceleration lane lengths, deceleration lane lengths, and ramp curvatures from aerial orthophotographs of the study area provided by ConnDOT. The existing ramp curvatures were used to approximate ramp design speeds assuming a superelevation rate of 6%. These ramp design speeds were then used to determine the required acceleration or deceleration lane length associated with each on and off ramp. Those locations where existing acceleration and deceleration lane lengths were less than the required lengths were identified as deficient. In addition, any existing ramp design speed that is less than 35 mph was identified as deficient.

Table 1. Design Standards

Design Element	Design Standard
Mainline	
Design Speed	70 mph
Interchange Ramps	
Design Speed	35 mph
Radius (for 35 mph) • for 35 mph	385'
Deceleration Lane • 70 mph to 35 mph	490'
Acceleration Lane • 35 mph to 70 mph	1230'

The study team notes that mainline lane and shoulder widths were also checked against current design standards. Mainline travel lane widths throughout the Wilbur Cross Parkway corridor vary between 11 feet and 12 feet, which are slightly less than the standard minimum width of 12 feet for an urban freeway roadway classification. Additionally, both the left and right shoulder widths are less than the standard minimum of 4 feet and 10 feet, respectively, in many areas. Because mainline improvements are not a focus of this study and its recommendations, deficient travel lane and shoulder widths are not discussed as a separate issue for each interchange. Recognizing that narrow shoulders in a high-speed, high-volume corridor are a potential safety concern, the study team has incorporated standard mainline shoulder widths where possible into the interchange improvement recommendations.

Traffic Conditions

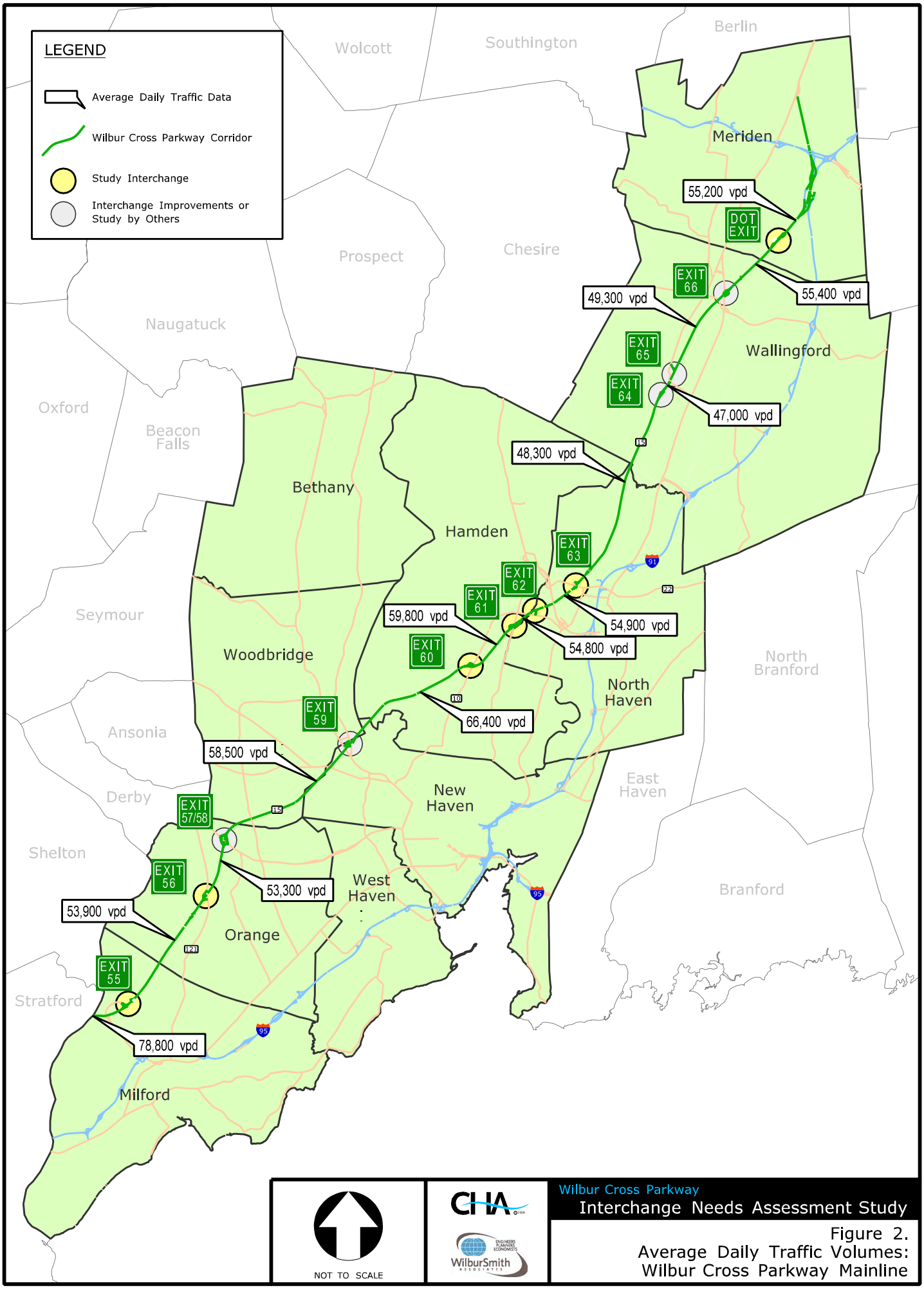
Just as non-standard geometric features can contribute to unsafe driving conditions, high traffic volumes, congestion, and delays can create and exacerbate unsafe conditions. Therefore, it is important to understand the relationship between traffic conditions and safety at each of the interchanges so that critical issues can be adequately addressed by the study recommendations.

The traffic conditions assessment for this study involved quantifying traffic along the corridor and at the study interchanges, and evaluating traffic operations under existing and future traffic conditions. This section presents some basic information relative to the existing and future traffic data the study team compiled and developed for this study. This section also presents the metrics for quantifying traffic capacity and operations for mainline segments, ramp/mainline junctions, and secondary roadway intersections. Detailed traffic data and the results of the traffic analysis are presented for each interchange in subsequent sections of this report.

Existing Traffic Data

The existing traffic data compiled for this study included:

- **Average Daily Traffic (ADT) Volumes**: ConnDOT maintains a database of ADT volumes for State roadways that was referenced for this study. The database is updated approximately every three years as new automatic traffic recorder (ATR) data is collected. ConnDOT most recently collected ATR data along the Wilbur Cross Parkway in 2006. Figure 2 illustrates the mainline, total two-way ADT volumes along the Wilbur Cross Parkway in the study area. As shown in the figure, total two-way ADT volumes range between 47,000 vehicles per day (vpd) and 78,800 vpd, with the highest volumes occurring south of Interchange 54, and between Interchange 59 and Interchange 60.
- **Ramp and Mainline Volumes:** ConnDOT developed 2008 peak hour volumes for each of the mainline segments and ramps in the interchange study areas based on current 24-hour count data, continuous count station data, and SCRCOG turning movement counts.
- **Service Area Volumes:** The study team obtained ATR counts on the service area ramps in Orange and North Haven for a 72-hour period that included Friday, Saturday, and Sunday counts.


LEGEND
Average Daily Traffic Data
Wilbur Cross Parkway Corridor
Study Interchange
Interchange Improvements or Study by Others
Wolcott
Southington
Berlin
Meriden
Prospect
Chesire
Naugatuck
Wallingford
Oxford
Beacon Falls
Bethany
Hamden
Seymour
Woodbridge
North Haven
North Branford
Ansonia
Derby
New Haven
East Haven
Shelton
West Haven
Branford
Orange
Stratford
Milford
55,200 vpd
DOT EXIT
49,300 vpd
EXIT 66
55,400 vpd
EXIT 65
EXIT 64
47,000 vpd
48,300 vpd
EXIT 63
EXIT 62
EXIT 61
59,800 vpd
54,900 vpd
54,800 vpd
EXIT 60
66,400 vpd
EXIT 59
58,500 vpd
EXIT 57/58
53,300 vpd
EXIT 56
53,900 vpd
EXIT 55
78,800 vpd
NOT TO SCALE
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 2.
Average Daily Traffic Volumes:
Wilbur Cross Parkway Mainline

- **Intersection Volumes:** SCRCOG obtained manual turning movement counts at the interchange ramp intersections with secondary roadways and at several other major secondary roadway intersections at each of the study interchanges. These counts were obtained on various occasions in 2007 and 2008 during the weekday morning (AM) peak period (7 to 9 am) and weekday afternoon (PM) peak period (4 to 6 pm) to capture the influence of commuter traffic demand. SCRCOG obtained AM and PM counts at all of the study interchanges. Additionally, SCRCOG obtained Saturday peak period (11 am to 1 pm) counts at Interchange 60 to capture the influence of strong commercial and retail traffic demand along Route 10 in that area.

The study team worked with ConnDOT's traffic forecasting unit to develop a traffic volume diagram for each interchange that represents the existing (2008) weekday peak hour traffic volumes for the mainline segments, interchange ramps, and intersections. The study team used these peak hour volumes as the basis for the existing traffic operations analysis completed for each interchange.

Future Traffic Data

The study team also worked with ConnDOT's traffic forecasting unit to develop future peak hour traffic forecasts for each interchange study area that represent anticipated traffic volumes in 2030 – the planning year for this study. The forecasts were developed using ConnDOT's Statewide travel demand model which estimates regional background traffic growth based on anticipated changes in land use and demographics. The forecasts were also adjusted to incorporate local development information provided by the participating municipalities. The study team used these peak hour forecasts as the basis for the future traffic operations analysis completed for each interchange.

Table 2 summarizes the projected traffic growth between 2008 and 2030 for the AM and PM peak hours at each study interchange. As shown in the table, overall growth is expected to range between 16% and 26% with the highest growth occurring at Interchange 55 and Interchange 56 in Milford and Orange, and the lowest growth occurring at Interchange 63 and the DOT Maintenance Exit in North Haven and Meriden, respectively. The corresponding average annual growth rates range between 0.7% and 1.1%.

Table 2. Projected Traffic Growth Summary

Direction	AM Peak Hour Growth		PM Peak Hour Growth	
	Total (2008 – 2030)	Average Annual Rate	Total (2008 – 2030)	Average Annual Rate
Interchange 55	25.2%	1.0%	25.9%	1.1%
Interchange 56	25.0%	1.0%	24.4%	1.0%
Interchange 60	21.5%	0.9%	21.6%	0.9%
Interchange 61	22.6%	0.9%	22.2%	0.9%
Interchange 62	22.9%	0.9%	23.3%	1.0%
Interchange 63	19.2%	0.8%	18.9%	0.8%
DOT Maintenance Exit	18.6%	0.8%	15.6%	0.7%

Traffic Operations

The study team analyzed the traffic operations in the Wilbur Cross Parkway study corridor for the existing and future traffic conditions to identify locations that are currently experiencing, or will likely experience, unacceptable traffic operations. Analyses were performed for northbound and southbound mainline segments, ramp junctions (merges and diverges), and key intersections in each interchange area. Highway Capacity Software (HCS) was used to complete the mainline and ramp analyses; SYNCHRO software was used to complete the intersection analyses.

The results of the traffic operations analyses are expressed as Levels of Service (LOS). LOS is a qualitative measure of driver satisfaction that takes into consideration travel speed and time, traffic flow interruption, freedom of maneuverability, driver comfort and convenience, and delay. LOS values range from A to F with LOS A representing the best operational conditions.

For mainline segments and ramp junctions, LOS is based on maximum vehicle density on the roadway measured in passenger cars per mile per lane (pc/mi/ln). LOS A describes a free-flow condition with generally low volumes and high maneuverability. LOS F describes a force-flow condition with volumes that exceed the theoretical capacity of the roadway.

For signalized intersections, LOS is based on the computed average delay at the intersection measured in seconds per vehicle (sec/veh). For unsignalized intersections, LOS is based on the computed delay for each minor movement also measured in sec/veh. LOS A describes a condition with little or no delay. LOS F describes a condition with long delays and vehicle queues.

LOS D or better represents an acceptable degree of congestion for mainline segments, ramp junctions, and intersections. LOS E and F represent unacceptable degrees of congestion. Locations operating at LOS E and F are highlighted in this report to indicate locations where traffic capacity and operational issues exist, or could exist under future traffic conditions.

Accidents and Safety

For this study, it is particularly important to understand how the accident history at each interchange relates to deficient geometric conditions and traffic operations. Generally, higher traffic volumes will amplify unsafe conditions by resulting in greater numbers of accidents as more motorists are exposed to these unsafe conditions. Additionally, higher volumes create more opportunities for vehicular conflicts, particularly where motorists are entering and exiting the Wilbur Cross Parkway. Traffic congestion and delays can exacerbate many of the safety concerns by contributing to driver frustration and impatience.

The study team obtained accident data from ConnDOT's *Traffic Accident Viewing System* (TAVS) for the three-year period beginning January 1, 2005 and ending December 31, 2007. Accident data for each interchange was analyzed to identify trends in the locations and types of accidents that have occurred within each interchange. The study team also relied upon input received from representatives of the participating municipalities and citizens who attended the public information meetings to understand the unique safety issues and concerns at each interchange.

Improvement Plan Overview

The study team developed a set of recommended improvement plans for each interchange and service area in the Wilbur Cross Parkway study area. The improvement plans consist of near, mid, and long-term improvement recommendations and include other design and implementation considerations, and summaries of constraints, impacts, and estimated construction costs. This section generally defines the terminology of near, mid, and long-term recommendations and presents the assumptions and methodologies used to determine potential impacts and develop planning-level construction cost estimates. The detailed improvement plans for each interchange are presented separately in subsequent sections of this report.

Near, Mid, and Long-term Definitions

For the purposes of this study, the improvement recommendations are grouped together as near, mid, and long-term improvements based on assumed implementation periods for the improvements. The actual implementation period for each improvement will depend on a number of variables including project complexity, funding availability, and project prioritization.

Near-term:

- Implementation period of 1 to 3 years.
- Includes low cost improvements such as signing and striping improvements, existing signal timing modifications, tree clearing, etc.

Mid-term:

- Implementation period of 3 to 10 years.
- Includes acceleration and deceleration lane improvements, new turn lanes, new traffic signals, and minor ramp modifications that can be implemented with little or no impacts to rights-of-way, environmental resources, or existing bridge structures.
- Includes interim improvements intended to improve high priority locations.

Long-term:

- Implementation period greater than 10 years.
- Includes higher-cost improvements that could significantly impact existing bridge structures, rights-of-way, or environmental resources.

Detailed figures illustrating the near, mid, and long-term improvement plans for each interchange are presented separately in subsequent sections of this report.

Assessment of Impacts

The study team completed a cursory review and assessment of the potential impacts to existing rights-of-way and environmental resources that could be associated with the improvement recommendations at each interchange and service area. The limits of potential impact were assumed to be located approximately 10 feet beyond the slope/grading limits for the improvements. The study team approximated the slope limits for the improvements using contour data obtained from available topographic maps provided by ConnDOT and available municipal GIS data.

Right-of-way (ROW) impacts were quantified using approximate ROW lines obtained from ConnDOT ROW maps and property lines obtained from municipal GIS databases. The number of properties impacted refers to the number of properties from which a ROW taking would likely be required to accommodate the improvement recommendation.

Wetland and waterbody impacts were approximated from wetland soils information that was obtained from available topographic maps provided by ConnDOT and available municipal GIS data.

A detailed summary of the potential impacts associated with the improvement plans for each interchange are presented separately in subsequent sections of this report.

Cost Estimating Methodology

The study team developed planning-level construction cost estimates in accordance with Connecticut Department of Transportation's guidelines for preliminary cost estimating dated January 2009. Because the cost estimates are highly variable based on many unknown field conditions – conditions that would ultimately be determined through survey and preliminary design – the cost estimates presented in this study are intended to provide an indication of the approximate funding level that would be required for construction.

The construction cost estimates assume the following conditions:

- All roadway widening to accommodate acceleration lane, deceleration lane, and turn lane improvements would be accomplished by providing a new, full-depth, bituminous concrete pavement structure beyond the limits of the existing pavement surface.
- All new ramps would be constructed with a full-depth, bituminous concrete pavement structure.
- Costs for all new or widened bridge structures would be based on the approximate area of the new bridge deck.
- Additional cost allowances for right-of-way acquisitions, utility relocations, environmental mitigation, and engineering are not included in the cost estimates.

The full-depth, bituminous concrete pavement structure used as the basis for estimating was provided by ConnDOT.

For planning purposes, the mid-term cost estimates are represented in 2009 dollars and 2014 dollars to illustrate the effect of compounding inflation over an assumed implementation period of five years. The long-term cost estimates are represented in 2009 dollars and 2024 dollars to illustrate the effect of compounding inflation over an assumed implementation period of 15 years. The estimated costs in future-year dollars were determined using an annual inflation rate of 6% in accordance with ConnDOT's cost estimating guidelines.

A detailed summary of the planning-level construction cost estimates associated with the improvement plans for each interchange are presented separately in subsequent sections of this report.

Interchange 55

In Brief

Location: City of Milford
- Adjacent to Interchange 54
- 2.2 miles south of Orange Service Area
- 3.0 miles south of Interchange 56

Access to: Wheelers Farms Road
Wolf Harbor Road

Interchange 55 of the Wilbur Cross Parkway is located in the City of Milford and provides access to Wheelers Farms Road and Wolf Harbor Road. The interchange primarily serves residential land use and some commercial uses in the immediate interchange area. Wheelers Farms Road also provides access to downtown Milford and southbound I-95 to the south. A park-and-ride lot is located off Wolf Harbor Road immediately north of the northbound ramps.

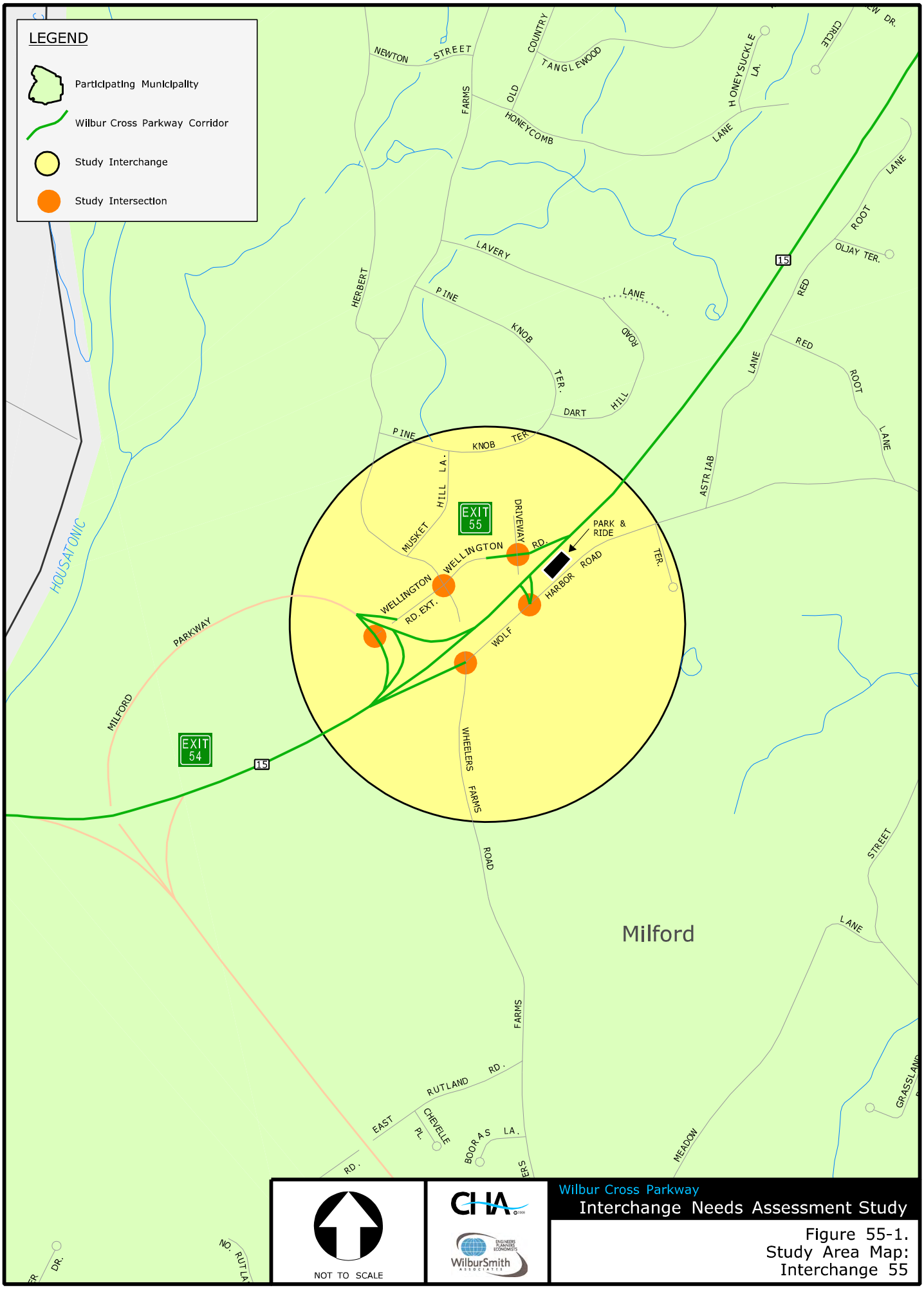
The interchange was originally constructed in the early 1940s with limited geometric improvements made to the ramps since that time. Northbound access includes an *exit only* northbound off ramp that begins as a continuation of the on ramp from Interchange 54. The ramp terminates at Wheelers Farms Road (Exit 55A) creating a four-legged signalized intersection with Wolf Harbor Road. Northbound access also includes northbound ramps that terminate at Wolf Harbor Road (Exit 55B) in an unsignalized T-intersection. The off ramp is a taper-type exit; the on ramp is located adjacent to the off ramp in a button-hook configuration and is characterized by a stop-controlled approach to the Parkway.

The southbound off ramp diverges from the mainline in a taper-type exit; the ramp technically terminates at the Kindercare driveway, but continues ahead as two-lane Wellington Road. The southbound on ramp is provided from Wellington Road Extension and merges with the on ramp from the Milford Parkway before continuing as an auxiliary lane over the Sikorsky Bridge and terminating as an *exit only* lane at Interchange 53.

The Parkway in the interchange area consists of two travel lanes in the northbound and southbound directions separated by a narrow raised median and metal beam guide railing. The typical lane and shoulder configuration includes 11 ft to 12 ft wide lanes, 2 ft to 4 ft wide left shoulders, and 2 ft to 10 ft wide right shoulders.

The study area, as shown in Figure 55-1, includes the interchange ramps, the junctions of these ramps with the Wilbur Cross Parkway, and the following intersections:

- Northbound off ramp at Wheelers Farms Road (signalized)
- Northbound ramps at Wolf Harbor Road (unsignalized)
- Southbound off ramp at Wellington Road and Drives (unsignalized)
- Southbound on ramp at Wellington Road Extension (unsignalized)
- Wheelers Farms Road at Wellington Road and Wellington Road Extension (signalized)


LEGEND
Participating Municipality
Wilbur Cross Parkway Corridor
Study Interchange
Study Intersection
EXIT 55
EXIT 54
PARK & RIDE
WELLINGTON RD.
WELLINGTON RD. EXT.
HARBOR ROAD
WOLF
DRIVEWAY
HILL LA.
MUSKET
PINE KNOB TER.
DART HILL ROAD
LAVERY LANE
HERBERT
NEWTON STREET
OLD FARMS
COUNTRY TANGLEWOOD
HONEYCOMB LANE
HONEYSUCKLE LA.
CIRCLE
DR.
ROOT
OLJAY TER.
RED
ASTRIAB
TER.
HOUSATONIC
PARKWAY
MILFORD
WHEELERS FARMS ROAD
RUTLAND RD. EAST
CHEVELLE PL.
BOORAS LA.
MEADOW
GRASSLAND
STREET
LANE
15
Milford
NOT TO SCALE
CHA
WilburSmith ASSOCIATES
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 55-1.
Study Area Map:
Interchange 55

Needs and Deficiencies Assessment

Roadway Geometry

For this study, the critical geometric characteristics of the Wilbur Cross Parkway and its interchanges are those that are closely related to vehicular safety. These critical geometric characteristics include deceleration lane lengths; acceleration lane lengths; and ramp curvatures and speeds. The study team determined the existing geometric characteristics of Interchange 55 and compared them to the minimum design standards obtained from ConnDOT's *Highway Design Manual 2003 Edition* (HDM).

The results of the existing geometric conditions assessment are summarized in Table 55-1 and illustrated in Figure 55-2. Non-standard conditions, or deficiencies, are noted in bold red text in the table and figure.

Table 55-1. Existing Geometric Conditions Summary: Interchange 55

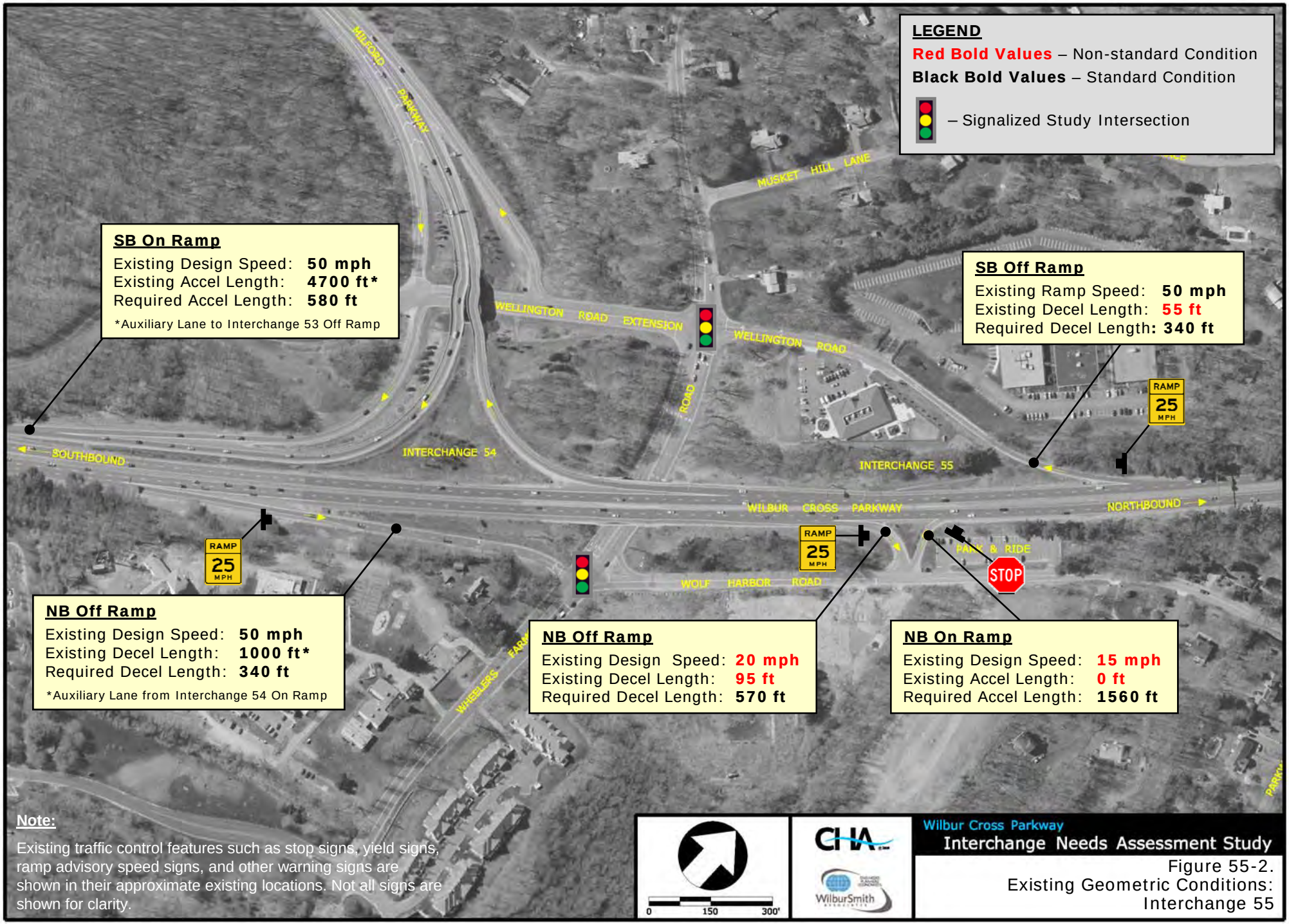
Location	Ramp		Acceleration/Deceleration Lanes		Other Notes
	Curve Radius	Design Speed	Existing Length	Required Length	
Northbound					
Off Ramp A	1000 ft	50 mph	1000 ft[1]	340 ft	**1050 ft from Int. 54**
Off Ramp B	**90 ft**	**20 mph**	**95 ft**	570 ft	-
On Ramp	**70 ft**	**15 mph**	**0 ft**	1560 ft	Stop Condition
Southbound					
Off Ramp	960 ft	50 mph	**55 ft**	340 ft	-
On Ramp	1470 ft	50 mph	4700 ft [2]	580 ft	Merge with Int. 54

[1]Deceleration for the northbound off ramp (Exit 55A) is accommodated in the auxiliary lane between the Interchange 54 northbound on ramp and Interchange 55 off ramp.

[2]Southbound on ramp merges with Interchange 54 southbound on ramp and continues ahead as an auxiliary lane to the Interchange 53 off ramp. Acceleration for the on ramp is accommodated in the auxiliary lane.

As shown in Table 55-1, the following geometric conditions are deficient:

- **Northbound Off Ramp (Exit 55A):** Ramp spacing between Interchange 54 northbound on ramp and off ramp is non-standard. Weaving operations occur in the auxiliary lane.
- **Northbound Off Ramp and Deceleration Lane (Exit 55B):** Ramp curvature and 20 mph design speed are non-standard. Limited deceleration lane exists to accommodate deceleration from mainline to ramp speeds. Most deceleration must occur on the mainline creating unsafe conditions for through and exiting traffic.
- **Northbound On Ramp and Acceleration Lane:** Ramp curvature and 15 mph design speed are non-standard. Stop-controlled approach requires motorists to perceive gaps in traffic flow sufficient to accommodate merging operations and acceleration to mainline speeds. No acceleration lane exists to accommodate acceleration prior to merging.
- **Southbound Deceleration Lane:** Limited deceleration lane exists to accommodate deceleration from mainline to ramp speeds. Most deceleration must occur on the mainline creating unsafe conditions for through and exiting traffic.



Note:

Existing traffic control features such as stop signs, yield signs, ramp advisory speed signs, and other warning signs are shown in their approximate existing locations. Not all signs are shown for clarity.

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 55-2.
Existing Geometric Conditions:
Interchange 55

Traffic Conditions

The study team compiled traffic data for Interchange 55 that included average daily traffic (ADT) volumes, existing (2008) weekday peak hour traffic volumes, and estimated future (2030) weekday peak hour traffic volumes. This data was used as the basis for assessing traffic conditions on the mainline Wilbur Cross Parkway (WCP), at the interchange ramp junctions, and at key secondary roadway intersections. Figure 55-3 illustrates the most recent (2006) ADT volumes that were collected by ConnDOT at Interchange 55.

Figure 55-3. 2006 Average Daily Traffic Volumes (in vehicles per day, vpd): Interchange 55

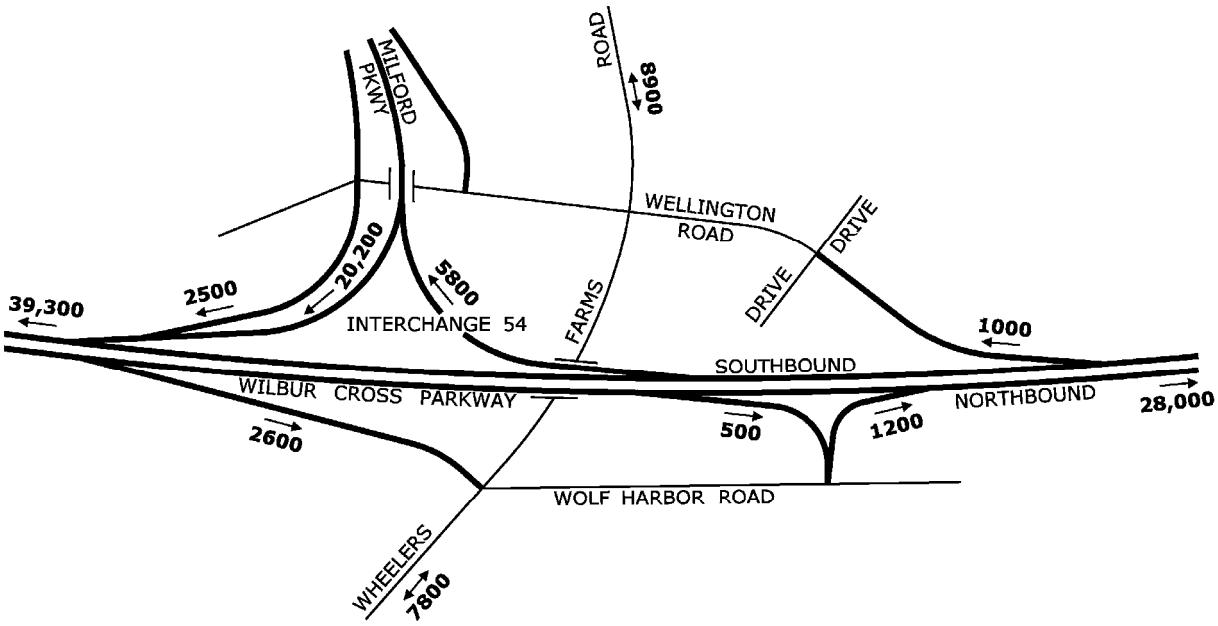
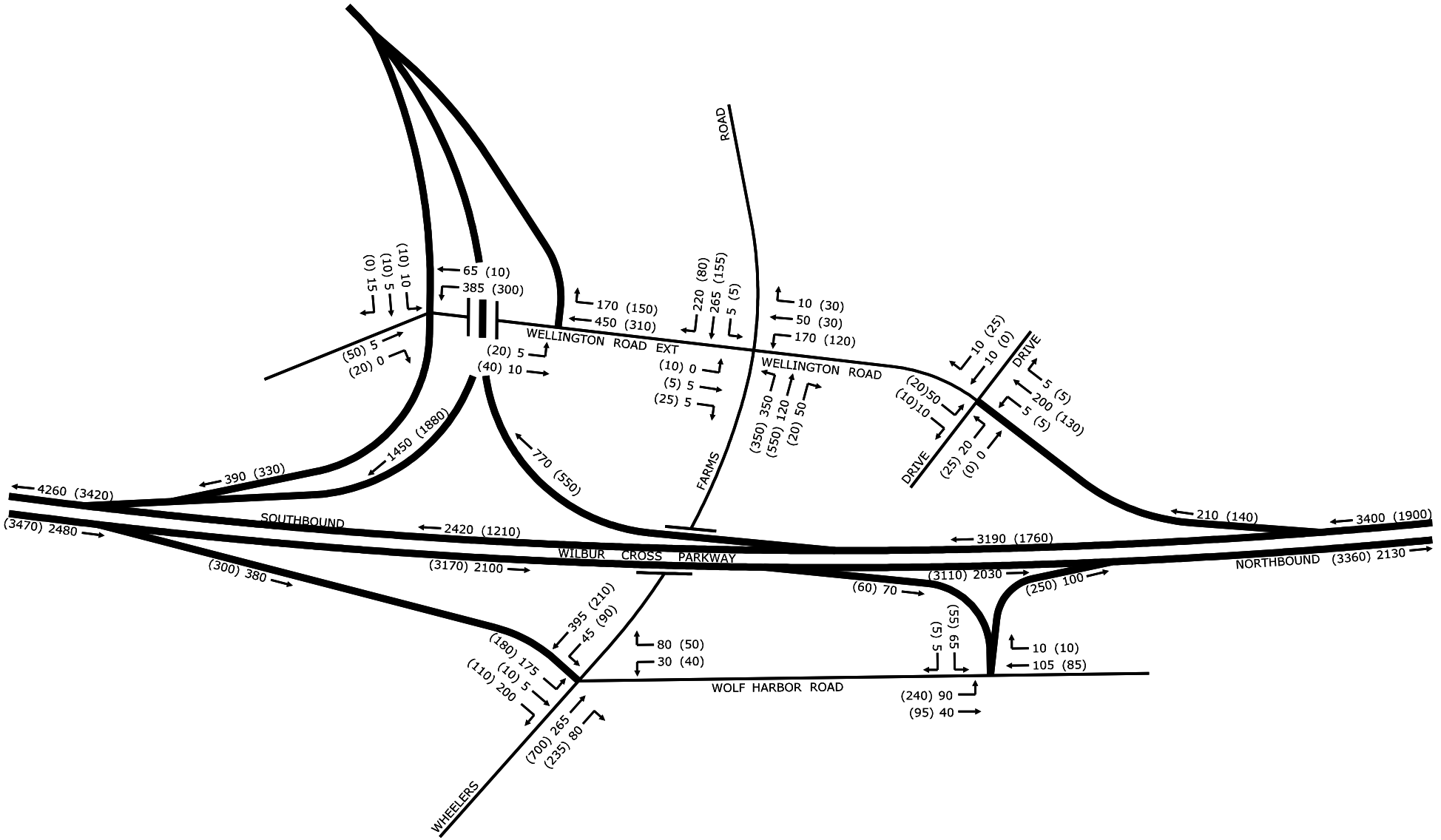


Figure 55-4 presents the 2008 weekday peak hour traffic volumes for the morning (AM) and afternoon (PM) peak commuting periods. The study team worked with ConnDOT's traffic forecasting unit to develop these volumes from intersection turning movement counts obtained by SCRCOG and available traffic data for Interchange 55 provided by ConnDOT.

Figure 55-5 presents the estimated 2030 weekday peak hour traffic volumes that were developed by ConnDOT's traffic forecasting unit. These volumes reflect an increase in traffic at Interchange 55 that is primarily a function of regional background traffic growth and includes some additional growth for planned developments in the interchange area. These developments include a new 27,000 sf school for Connecticut School for Child Development on Wolf Harbor Road and plans for 370 new residential units in two developments on Wheelers Farms Road.

The notable traffic conditions presented in Figures 55-3, 55-4, and 55-5 include:

- Highest daily ramp volumes occur on the southbound on ramp
- Lowest daily ramp volumes occur on the northbound off ramp (Exit 55B)
- Approximately 62% of WCP traffic is traveling southbound in the morning
- Approximately 64% of WCP traffic is traveling northbound in the afternoon
- Overall traffic growth by 2030 is estimated to be approximately 25%, or 1% annually

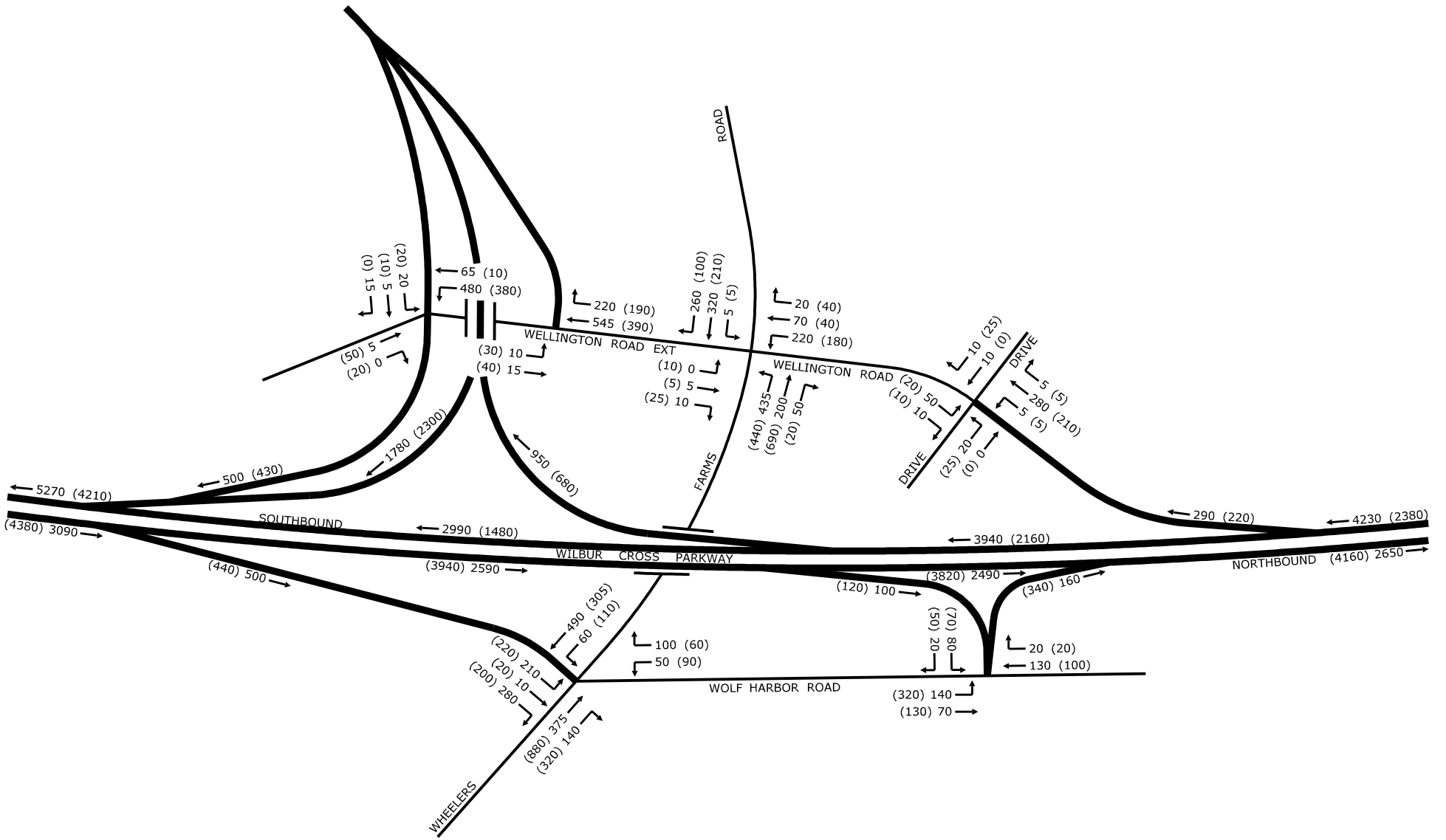


LEGEND
(PM) AM

NOT TO SCALE

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 55-4.
Existing (2008) Peak Hour Volumes:
Interchange 55


WELLINGTON ROAD EXT
WELLINGTON ROAD
ROAD
FARMS
DRIVE
DRIVE
SOUTHBOUND
WILBUR CROSS PARKWAY
NORTHBOUND
WOLF HARBOR ROAD
WHEELERS
5270 (4210)
(4380) 3090
(440) 500
500 (430)
1780 (2300)
950 (680)
2990 (1480)
(3940) 2590
3940 (2160)
290 (220)
4230 (2380)
(4160) 2650
(3820) 2490
(120) 100
(340) 160
65 (10)
480 (380)
220 (190)
545 (390)
260 (100)
320 (210)
5 (5)
20 (40)
70 (40)
220 (180)
(0) 15
(10) 5
(20) 20
(50) 5
(20) 0
(30) 10
(40) 15
(10) 0
(5) 5
(25) 10
(440) 435
(690) 200
(20) 50
10 (25)
10 (0)
(20) 50
(10) 10
5 (5)
280 (210)
5 (5)
(25) 20
(0) 0
490 (305)
60 (110)
(220) 210
(20) 10
(200) 280
(880) 375
(320) 140
100 (60)
50 (90)
(50) 20
(70) 80
20 (20)
130 (100)
(320) 140
(130) 70
LEGEND
(PM) AM
NOT TO SCALE
CHA
WilburSmith
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 55-5.
Future (2030) Peak Hour Volumes:
Interchange 55

Traffic Operations

The study team analyzed the operations of the mainline segments, ramp junctions, and intersections in the Interchange 55 study area. The analyses were conducted for the weekday AM and PM peak hours under the 2008 and estimated 2030 traffic conditions. The results of the analyses, which are reported as Levels of Service (LOS), are presented below in tabular form and illustrated in Figures 55-6 and 55-7.

As described in the *Needs Assessment Overview* section, LOS D or better represents an acceptable degree of congestion for mainline segments, ramp junctions, and intersections. LOS E and F, which are indicated in red in the tables and figures, represent unacceptable degrees of congestion. Locations operating at LOS E and F are highlighted in this report to indicate locations where traffic capacity and operational issues exist, or could exist under future traffic conditions.

Mainline

Table 55-2. Mainline Operations Summary: Interchange 55

Segment	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
Northbound				
South of Interchange 55A Off Ramp	C (19.7)	C (24.7)	D (29.2)	E (43.9)
Between Interchange 55A Off & 55B Ramps	B (16.7)	C (20.5)	C (25.8)	E (35.5)
Between Interchange 55B Ramps	B (16.1)	C (19.8)	C (25.2)	D (34.1)
North of Interchange 55	B (16.9)	C (20.7)	D (27.9)	E (40.1)
Southbound				
North of Interchange 55	D (28.3)	E (42.0)	B (15.1)	C (18.6)
Between Interchange 55 Off & 54 Off Ramp	D (26.0)	E (36.2)	B (14.0)	B (17.1)
Between Interchange 54 Off & 54/55 On Ramps	C (19.2)	C (24.0)	A (9.6)	B (11.7)
South of Interchange 54/55 On Ramp[2]	C (22.7)	D (29.5)	C (18.1)	C (22.3)

[1] Mainline density is reported in passenger cars per mile per lane (pc/mi/ln).
[2] Analysis includes additional capacity provided by auxiliary lane between Interchange 54/55 and Interchange 53.

The mainline analysis shows that all mainline segments currently operate at LOS D or better during both the AM and PM peak hours. The lower levels of service in the southbound direction in the AM and in the northbound direction in the PM correspond to the predominant direction of travel during the respective peak hours. Mainline operations deteriorate under 2030 traffic conditions resulting in congested conditions upstream of the interchange in the southbound direction in the AM (LOS E), and upstream and downstream of the interchange in the northbound direction in the PM (LOS E).

The study team also analyzed the operations in the auxiliary lane between the northbound on ramp at Interchange 54 and the off ramp at Interchange 55A. Traffic entering the WCP from the Interchange 54 on ramp must cross paths with traffic exiting the WCP to the Interchange 55A off ramp creating a weave condition. The results of the weave operations analysis are shown in Table 55-3.

Table 55-3. Weave Operations Summary: Interchange 55

Location	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
NB Interchange 54 On Ramp to 55A Off Ramp	B (22.4)	C (29.7)	E (39.7)	F (52.6)

[1] Weave density is reported in passenger cars per mile per lane (pc/mi/ln).

The weave analysis shows that the auxiliary lane operates at LOS E during the PM peak hour when northbound traffic volumes are highest. The level of service will deteriorate under 2030 traffic conditions to LOS F.

Ramp Junctions

Table 55-4. Ramp Merge/Diverge Operations Summary: Interchange 55

Location	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
Northbound				
Off Ramp to Wheelers Farm Road (55A)	B (19.0)	C (24.5)	D (28.4)	F (43.7)
Off Ramp to Wolf Harbor Road (55B)	C (23.5)	D (28.1)	D (33.7)	E (40.7)
On Ramp from Wolf Harbor Road (55B)	C (23.9)	D (28.1)	D (34.5)	F (41.1)
Southbound				
Off Ramp to Wellington Road	D (34.8)	E (42.5)	C (20.4)	C (24.6)
On Ramp from Wellington Road Extension	N/A[2]	N/A[2]	N/A[2]	N/A[2]

[1] Ramp junction density is reported in passenger cars per mile per lane (pc/mi/ln).
[2] Merge analysis does not apply to this location because the southbound on ramp continues ahead as a 4700 ft auxiliary lane between Interchange 54/55 on ramp and Interchange 53 off ramp.

The ramp analysis shows that the northbound and southbound ramps generally operate at LOS D or better during the AM and PM peak hours. Levels of service deteriorate under 2030 traffic conditions resulting in congested conditions (LOS E and F) at the northbound ramp junctions in the PM peak hour and southbound off ramp in the AM peak hour.

Intersections

The study team analyzed traffic operations at the following intersections:

- **Northbound Off Ramp at Wheelers Farms Road:** Signalized, skewed, four-legged intersection with Wolf Harbor Road. Wheelers Farms Road is oriented in a north-south direction; ramp and Wolf Harbor Road are oriented in an east-west direction. The northbound and southbound approaches on Wheelers Farms Road consist of two travel lanes in each direction; southbound approach includes a left turn lane. The northbound off ramp approach consists of a shared left-through lane and a right turn lane. The Wolf Harbor Road approach splits near the intersection to provide a channelized, right turn slip lane to northbound Wheelers Farms Road.

- **Northbound Ramps at Wolf Harbor Road:** Unsignalized, all-way stop-controlled T-intersection. Wolf Harbor Road is oriented in an east-west direction; ramps are oriented in a north-south direction. The eastbound and westbound approaches on Wolf Harbor Road consist of one travel lane in each direction. The northbound off ramp approach consists of a shared left-right lane.

- **Southbound Off Ramp at Wellington Road and Drives:** Unsignalized, four-legged intersection. Off ramp and Wellington Road are oriented in an east-west direction; drives are oriented in a north-south direction. Westbound ramp approach consists of a single through lane with no stop control. Eastbound Wellington Road approach consists of a single lane with no stop control that terminates at the drives. Drives are assumed to be stop controlled, though are not signed as such.

- **Southbound On ramp at Wellington Road Extension:** Unsignalized, all-way stop-controlled, four-legged intersection. Wellington Road Extension is oriented in an east-west direction; southbound ramp is oriented in a north-south direction. The eastbound and westbound approaches on Wellington Road Extension consist of two travel lanes in each direction. Southbound ramp approach from the Milford Parkway consists of a single left-through-right lane.

- **Wheelers Farms Road at Wellington Road and Wellington Road Extension**: Signalized, four-legged intersection. Wheelers Farms Road is oriented in a north-south direction; Wellington Road and Wellington Road Extension are oriented in an east-west direction. The northbound approach on Wheelers Farms Road consists of two left turn lanes and a shared through-right lane; the southbound approach consists of a left-through lane and a through-right lane. The westbound approach on Wellington Road consists of a left turn lane and a through-right lane. The eastbound approach on Wellington Road Extension consists of a left-through lane and a right turn lane.

Results of the intersection analysis are presented in Table 55-5.

Table 55-5. Intersection Operations Summary: Interchange 55

Intersection / Approach	AM LOS (Delay[1])		PM LOS (Delay[1])	
	2008	2030	2008	2030
NB Off Ramp (55A) at Wheelers Farms Road (Signalized)				
Eastbound – NB Off Ramp	C (21.9)	C (20.7)	C (26.9)	C (25.6)
Westbound – Wolf Harbor Road	A (8.0)	A (6.9)	A (8.7)	A (7.2)
Northbound – Wheelers Farms Road	A (7.2)	A (8.8)	B (11.2)	B (14.7)
Southbound – Wheelers Farms Road	A (5.1)	A (6.6)	A (4.2)	A (8.6)
Overall	**B (11.4)**	**B (12.2)**	**B (13.2)**	**B (16.0)**
Wheelers Farms Road at Wellington Road and Wellington Road Extension (Signalized)				
Northbound – Wheelers Farms Road	C (22.8)	C (21.7)	B (19.8)	B (19.2)
Southbound – Wheelers Farms Road	A (7.4)	A (9.1)	A (8.8)	B (10.8)
Eastbound – Wellington Road Extension	B (16.9)	B (11.3)	B (14.0)	B (12.8)
Westbound – Wellington Road	D (35.7)	C (35.0)	C (31.5)	C (32.0)
Overall	**B (19.1)**	**B (19.2)**	**B (19.2)**	**B (19.3)**
SB Off Ramp at Wellington Road and Drives (Unsignalized)				
Northbound – Commercial Drive	B (11.7)	B (12.5)	B (10.4)	B (10.8)
Southbound – Commercial Drive	B (10.7)	B (11.2)	A (9.1)	A (9.4)
NB Ramps at Wolf Harbor Road (Unsignalized)				
Southbound – NB Off Ramp	A (8.2)	A (8.6)	A (8.6)	A (9.3)
Eastbound – Wolf Harbor Road	A (8.3)	A (8.8)	B (10.8)	B (13.3)
Westbound – Wolf Harbor Road	A (7.9)	A (8.4)	A (8.1)	A (8.6)
SB Ramps at Wellington Road Extension (Unsignalized)				
Southbound – SB On Ramp	A (8.1)	A (8.5)	A (8.2)	A (8.5)
Eastbound – Wellington Road Extension	A (6.8)	A (6.9)	A (6.7)	A (6.8)
Westbound – Wellington Road Extension	B (14.3)	C (19.4)	B (11.3)	B (13.4)

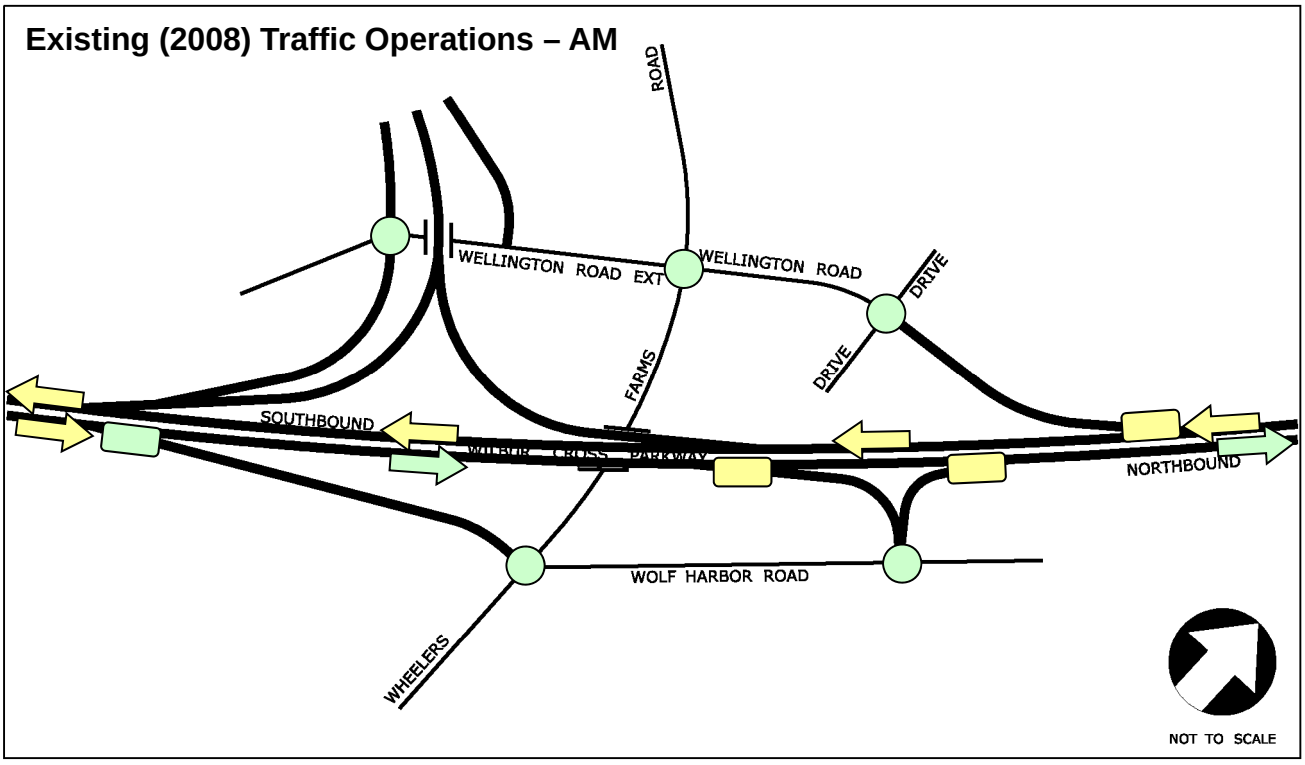
[1] Delays are reported in seconds.

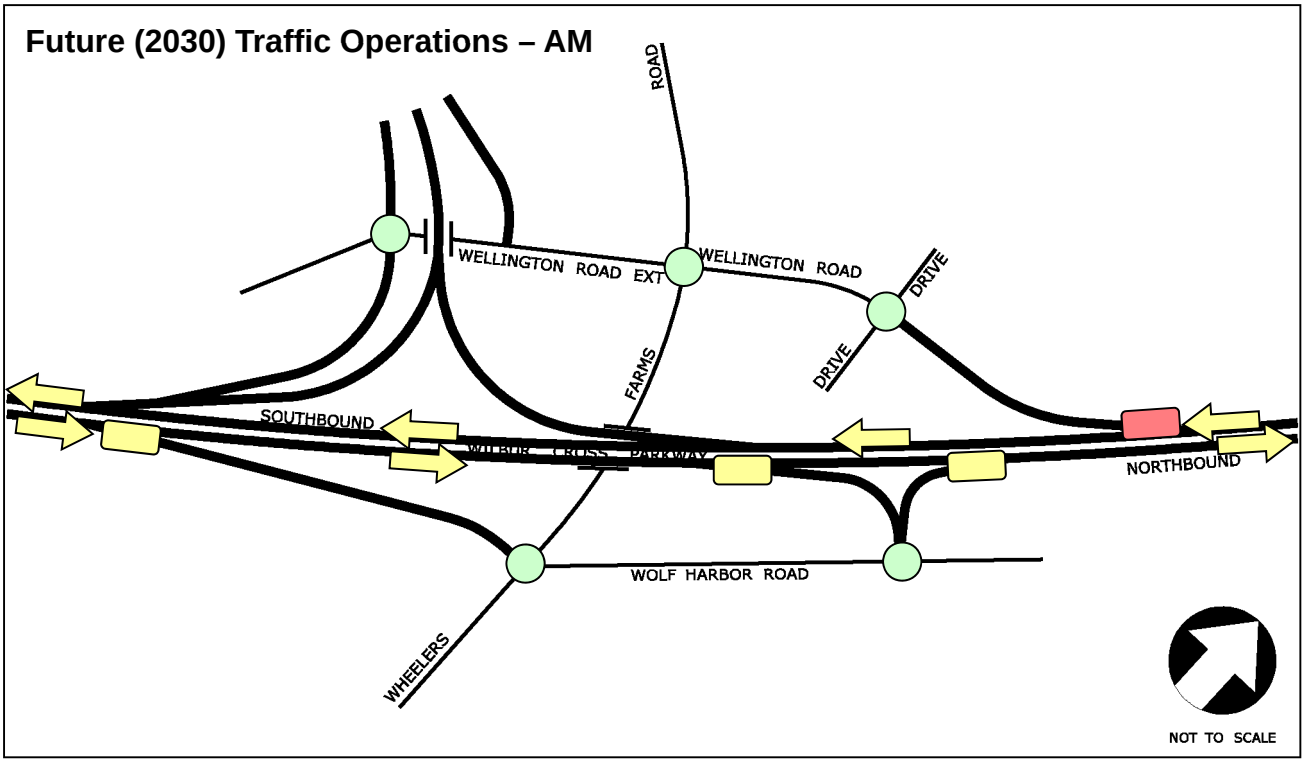
The intersection analysis shows that the five study intersections currently operate at LOS B or better during both the AM and PM peak hours. Levels of service will generally deteriorate slightly under 2030 traffic conditions due to increasing volumes and delay, but will remain LOS B or better.

Although the intersection analysis does not indicate operational issues based on LOS, public input received at the March 23, 2009 public meeting in Milford indicated that traffic queues at the northbound on ramp cause delays at the eastbound stop-controlled approach on Wolf Harbor Road during the PM peak hour. Because the majority of vehicles are turning left to the Parkway, through vehicles on Wolf Harbor Road will bypass these vehicles on the right creating a de-facto through lane. No other queuing issues were identified through analysis of the other intersections.

Additionally, the City noted several recent public complaints regarding long signal phases and delays at the signalized intersections along Wheelers Farms Road in the interchange area.

Figures 55-6 and 55-7 summarize the results of the traffic operations analyses for the AM and PM peak hour traffic conditions, respectively.



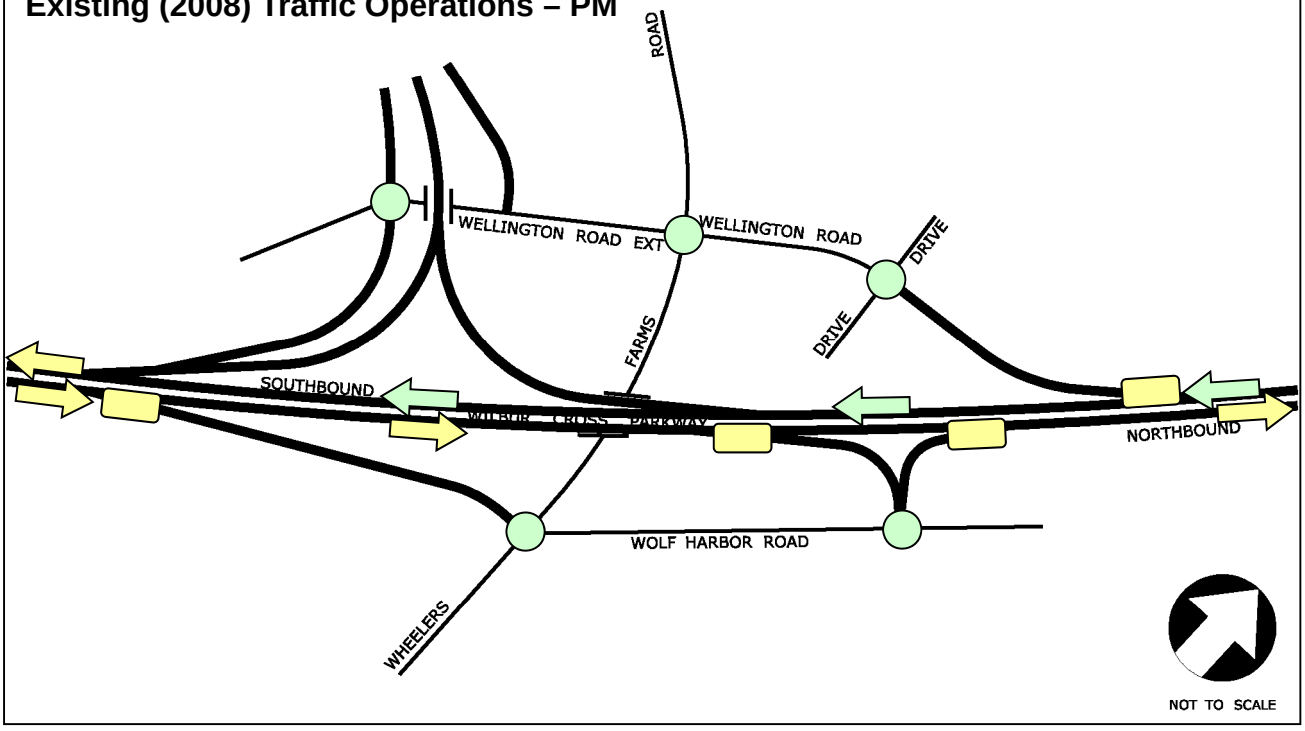


LOS	Intersection	Mainline	Merge/Diverge
A-B			
C-D			
E-F			

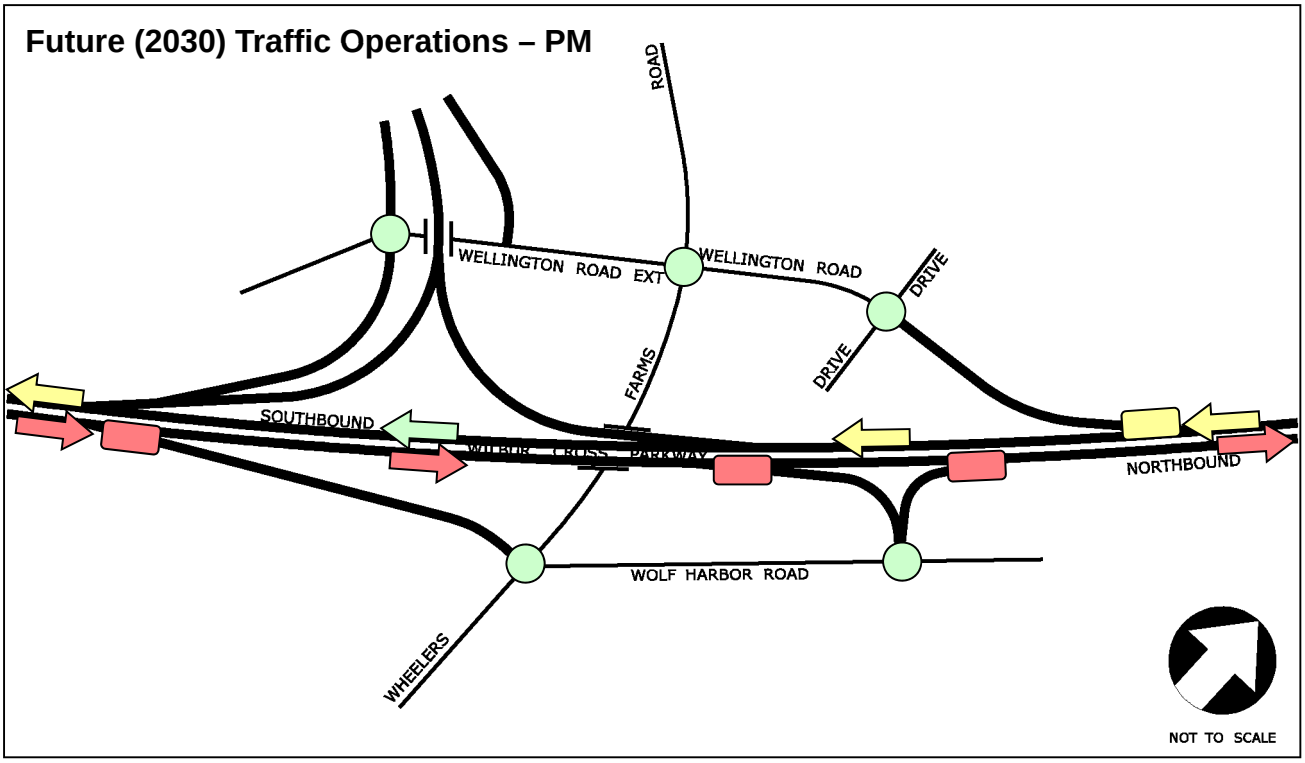
Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 55-6.
AM Traffic Operations Summary:
Interchange 55

Existing (2008) Traffic Operations – PM



Future (2030) Traffic Operations – PM



LOS	Intersection	Mainline	Merge/Diverge
A-B			
C-D			
E-F			

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 55-7.
PM Traffic Operations Summary:
Interchange 55

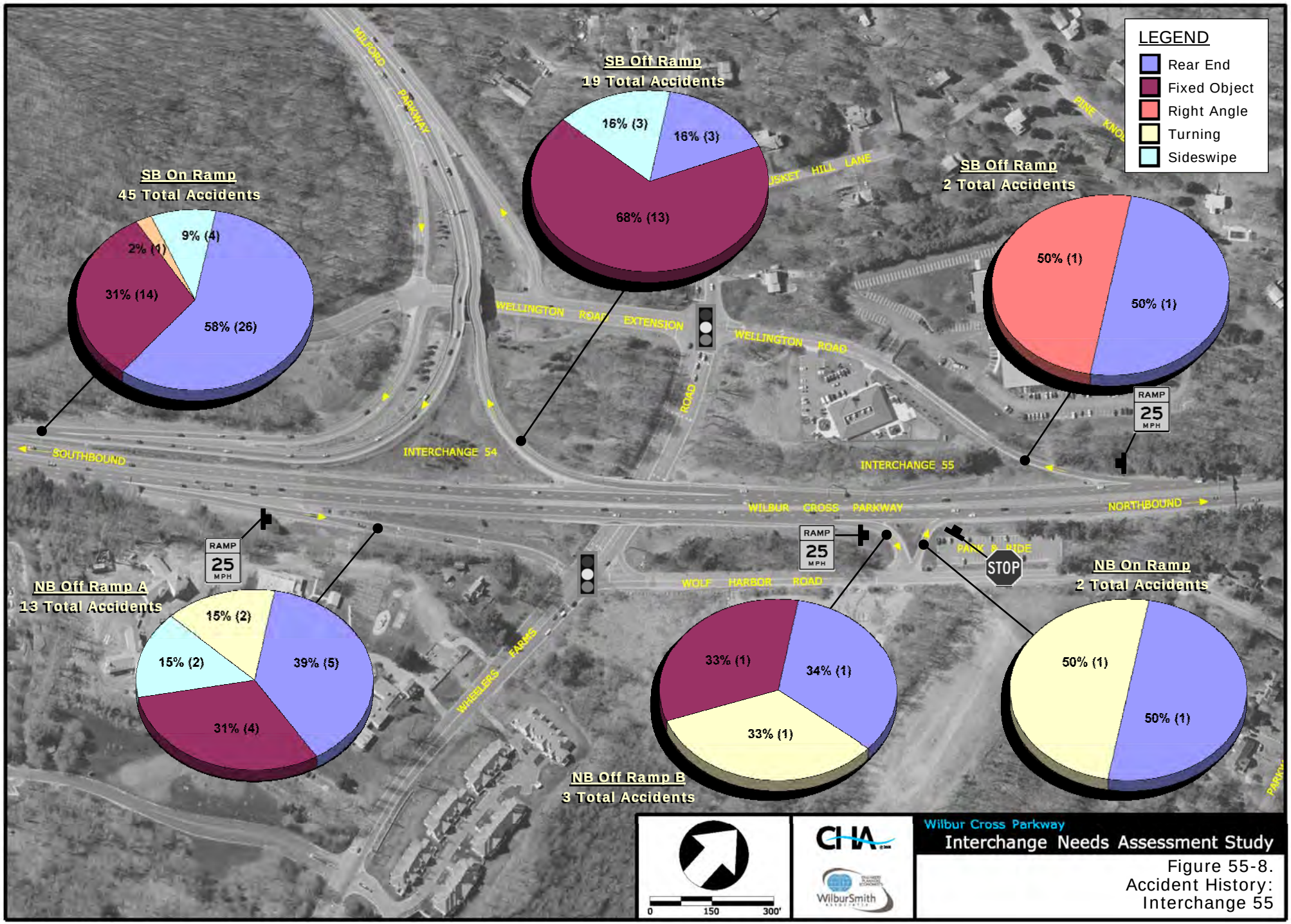
Accidents and Safety

The study team obtained accident data from ConnDOT's *Traffic Accident Viewing System* (TAVS) for the three-year period beginning January 1, 2005 and ending December 31, 2007. The data shows that 121 accidents occurred at Interchange 55 during this period, slightly more than half of which were rear end accidents. Table 55-6 summarizes the types of collisions that occurred at various locations in the interchange area. Figure 55-8 illustrates the accident trends that have developed over the last few years at each of the interchange ramps.

Table 55-6. Accident History: Interchange 55

Location	Collisions by Type						
	Rear End	Fixed Object	Side Swipe	Right Angle	Left Turn	Other	Total
Northbound							
Off Ramp (55A)	5	4	2	-	2	-	**13**
Between Off Ramps	-	2	-	-	-	1	**3**
Off Ramp (55B)	1	1	-	-	1	-	**3**
On Ramp	1	-	-	-	1	-	**2**
Southbound							
Off Ramp (55)	1	-	-	1	-	-	**2**
Between Off Ramps	3	1	1	-	-	-	**5**
Off Ramp (54)	3	13	3	-	-	-	**19**
Between Off and On Ramps	22	5	2	-	-	-	**29**
On Ramp	26	14	4	-	-	1	**45**
Total Number	**62**	**40**	**12**	**1**	**4**	**2**	**121**
Percentage	**51%**	**33%**	**10%**	**1%**	**3%**	**2%**	**100%**

As shown in Table 55-6, the southbound on ramp experienced the highest number of accidents – 37% of the total number of accidents at Interchange 55. The majority of accidents on this ramp were rear-end collisions, which the study team believes is not consistent with the existing ramp configuration that continues ahead as an auxiliary lane to Interchange 53. Further investigation of the accident data indicated that more than 75% of the accidents on the southbound on ramp occurred during construction of the Sikorsky Bridge, which was completed late in 2006. The study team believes that construction delays that resulted in peak hour congestion and backups at the bridge were a significant factor in the accident history at this location. The relatively high number of rear-end accidents on the mainline between the southbound off ramp for Interchange 54 and the southbound on ramp also suggests that bridge construction and construction-related traffic delays were a factor in the number of accidents in this area over the analysis period.


LEGEND
Rear End
Fixed Object
Right Angle
Turning
Sideswipe
SB On Ramp
45 Total Accidents
9% (4)
2% (1)
31% (14)
58% (26)
SB Off Ramp
19 Total Accidents
16% (3)
16% (3)
68% (13)
SB Off Ramp
2 Total Accidents
50% (1)
50% (1)
NB Off Ramp A
13 Total Accidents
15% (2)
15% (2)
39% (5)
31% (4)
NB Off Ramp B
3 Total Accidents
33% (1)
34% (1)
33% (1)
NB On Ramp
2 Total Accidents
50% (1)
50% (1)
MILFORD PARKWAY
WELLINGTON ROAD EXTENSION
WELLINGTON ROAD
INTERCHANGE 54
INTERCHANGE 55
SOUTHBOUND
NORTHBOUND
WILBUR CROSS PARKWAY
WOLF HARBOR ROAD
WHEELERS FARMS
RAMP 25 MPH
PARK & RIDE
STOP
0 150 300'
CHA
WilburSmith
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 55-8.
Accident History:
Interchange 55

Other notable accident trends illustrated in Table 55-6 and Figure 55-8 include:

- Only one rear end collision occurred over the three year analysis period at the stop condition on the northbound on ramp. The study team notes that similar stop-controlled on-ramp approaches at the other study interchanges have experienced considerably higher numbers of accidents. The study team believes that the low number of accidents at this location is a result of a combination of factors including relatively low traffic volumes (1200 vpd); good visibility of the stop condition and of stopped vehicles for motorists approaching the ramp from Wolf Harbor Road; and possibly slower northbound traffic speeds during construction of the Sikorsky Bridge that facilitated better merging conditions at the on ramp.
- Relatively few collisions occurred at the northbound (Exit 55B) and southbound off ramps suggesting that the non-standard deceleration lanes and non-standard ramp speeds and curvature are not contributing to an excessively high number of reported accidents at these locations. It is possible that more accidents have occurred at these locations, but have gone unreported.

In addition to the safety issues that the study team has identified through analysis of the recent accident data, input received from the City and from the public indicated several other safety concerns at Interchange 55. These include:

- Unsafe merging operations at the junction of the southbound on ramp from Wellington Road Extension and the southbound on ramp from the Milford Parkway. It was noted that the high traffic volume from the Milford Parkway (20,200 vpd) and the higher speed of this traffic relative to traffic from Wellington Road Extension contribute to unsafe conditions at this merge. The study team notes that the merge area of approximately 250 ft is less than the standard merge length of 630 ft.

Southbound On Ramp: Looking south at merge with on ramp from Milford Parkway.

- Unsafe exit to the southbound off ramp resulting from poor visibility of the exit location and poor exit signage, and the need to decelerate in high speed mainline traffic due to the lack of a deceleration lane at this location.
- Unsafe southbound merge along Wheelers Farms Road due to the lack of a merge warning sign where two southbound travel lanes merge to one just south of the Wolf Harbor Road intersection. Widening just south of the merge location for a right turn lane to Southwick Court contributes to safety issues for southbound vehicles that must merge with through traffic only to diverge again if making a right turn.

Recommended Improvement Plan

The study team worked with the City of Milford, ConnDOT, SCRCOG, and other stakeholders to develop and refine a set of near-term and mid-term improvement plans to address the identified deficiencies and needs at Interchange 55. The recommended improvement plans are detailed and illustrated below along with discussion regarding other design and implementation considerations. Also included are summaries of constraints, impacts, and estimated construction costs.

Near-term Improvement Plan (Figure 55-9)

Northbound:

- Replace existing 25 mph ramp advisory speed sign for off ramp (Exit 55B) with 20 mph sign; relocate sign slightly south to improve visibility of sign and to provide motorists a greater advance warning of ramp speed condition.
- Provide chevrons along left side of off ramp (Exit 55B) to improve delineation and visibility of non-standard ramp curvature.

Southbound:

- Relocate existing ramp advisory speed sign for off ramp to improve visibility of sign for approaching motorists.

Near, Mid, and Long-term Definitions

Near-term:
- Implementation period of 1 to 3 years.
- Includes low cost improvements such as signing and striping improvements, existing signal timing modifications, tree clearing, etc.

Mid-term:
- Implementation period of 3 to 10 years.
- Includes acceleration and deceleration lane improvements, new turn lanes, new traffic signals, and minor ramp modifications that could be implemented with little or no impacts to rights-of-way, environmental features, or existing bridge structures.

Long-term:
- Implementation period greater than 10 years.
- Includes higher-cost improvements that could significantly impact existing bridge structures, rights-of-way, or environmental features.

Wheelers Farms Road:

- Provide merge warning sign for southbound lane drop located south of Wolf Harbor Road intersection where no merge warning sign currently exists.
- Provide regulatory lane control sign at beginning of southbound right turn lane to commercial driveway (opposite Southwick Court) to indicate right-turn only lane.
- Consider revised signal timings at Wheelers Farms Road intersections to optimize operations and address identified timing issues.

Mid-term Improvement Plan (Figure 55-10)

Northbound:

- Close northbound off ramp to Wolf Harbor Road (Exit 55B). Closing this ramp will require all motorists to exit via the northbound off ramp to Wheelers Farms Road (Exit 55A).

- Relocate northbound on ramp westerly along Wolf Harbor Road providing standard acceleration length and eliminating the existing stop condition at the mainline/ramp junction. Relocating the ramp westerly will provide adequate space to accommodate the typical ramp approach geometry while not impacting the existing park and ride lot and while minimizing downstream grading impacts associated with the acceleration lane. Eliminate stop controls on Wolf Harbor Road at existing on ramp intersection.
- Improve the alignment of the northbound off ramp (Exit 55A) approach and Wolf Harbor Road approach to the Wheelers Farms Road intersection to better accommodate the increased through-vehicle volume from the northbound off ramp to Wolf Harbor Road that will result from the closing of the northbound off ramp to Wolf Harbor Road (Exit 55B).

Southbound:

- Provide standard deceleration length for southbound off ramp.
- Improve merge area at southbound on ramp merge with ramp from Milford Parkway (Interchange 54). The improvement will provide a longer merging area to improve merging operations, but will not provide a standard merge length due to the physical constraints in this area (see Constraints, Limitations and Impacts below for additional details).

Wheelers Farms Road:

- Extend southbound two-lane section on Wheelers Farms Road to the signalized intersection with the commercial drive/Southwick Court where the right lane would become a right turn only lane. This improvement will eliminate the need for right-turning traffic to the commercial drive to merge with through traffic only to diverge again at the intersection, as is currently required.

Other Considerations

- The study team notes that closure of the northbound off ramp to Wolf Harbor Road (Exit 55B) would require all motorists to exit via the northbound off ramp to Wheelers Farms Road. The operations at the northbound off ramp and Wheelers Farms Road intersection would deteriorate slightly due to the change in traffic pattern, but would remain LOS B in both AM and PM Peak Hours under 2030 traffic. The weave operations between the existing Interchange 54 on ramp and Interchange 55 off ramp to Wheelers Farms Road will deteriorate from LOS C to LOS E during the AM Peak Hour, and LOS E to LOS F during the PM Peak Hour under 2030 traffic. The potential implications of contributing additional traffic to this weave area will have to be weighed against the potential benefits of eliminating the existing non-standard off ramp to Wolf Harbor Road. The study team evaluated the feasibility of providing a collector-distributor (CD) road along the Wilbur Cross Parkway between the north side of the Sikorsky Bridge and the north side of Interchange 55. Although a CD road would remove the weave condition from the mainline, minimum spacing requirements between successive exit ramps could not be attained. Consequently, the study team determined that a CD road would not be feasible.

- Two new developments, currently in various stages of construction/planning on Wolf Harbor Road, should be considered during subsequent planning and design phases for the mid-term improvements to the northbound ramps:
    - Ground was broken on the Connecticut Center for Child Development in Spring 2009. The site drive will intersect Wolf Harbor Road approximately halfway between the two Park & Ride drives.
    - Avalon Bay Properties is planning an age-restricted housing development immediately west of the Connecticut Center for Child Development. The proposed site drive is located opposite the existing northbound ramps on Wolf Harbor Road. The study team notes that the northbound on ramp and acceleration lane could be improved in their existing location to remain aligned opposite the proposed drive; however, the impacts of improving the northbound on ramp aligned with the proposed site drive would be greater than those associated with relocating the ramp to the west along Wolf Harbor Road.
- Relocation of the northbound on ramp westerly along Wolf Harbor Road creates an opportunity to expand the existing park-and-ride lot.
- The geometric requirements of all intersection improvements will be further evaluated and refined through subsequent stages of planning and design.
- In general, improvements to municipally owned and maintained roadways (such as Wheelers Farms Road) will be the responsibility of the municipality.

Constraints, Limitations and Impacts

- The existing Route 15 bridge structure over Wheelers Farms Road limits the opportunity to provide a standard deceleration lane for the northbound off ramp (Exit 55B) without modifying the existing bridge.
- There is insufficient space between Wolf Harbor Road and Route 15 to accommodate a ramp curve that would provide the standard ramp design speed of 35 mph. The mid-term improvement for the northbound on ramp provides a 20 mph design speed with acceleration lane length to allow vehicles to reach the mainline design speed of 70 mph.
- The existing bike path on the north side of Route 15 limits the opportunity to provide additional merge improvements for the southbound on ramp and Interchange 54 southbound on ramp without impacting the bike path.
- An overhead sign structure will be impacted by widening for both the southbound off ramp deceleration lane and the northbound on ramp acceleration lane.
- **Potential Environmental Impacts:** No significant wetland or surface water impacts are anticipated with the mid-term plan; however, there are several drainage ditches that could be impacted within the low area located adjacent to the recommended northbound on ramp improvement. Impacts to existing drainage patterns and outfall locations could require mitigation.

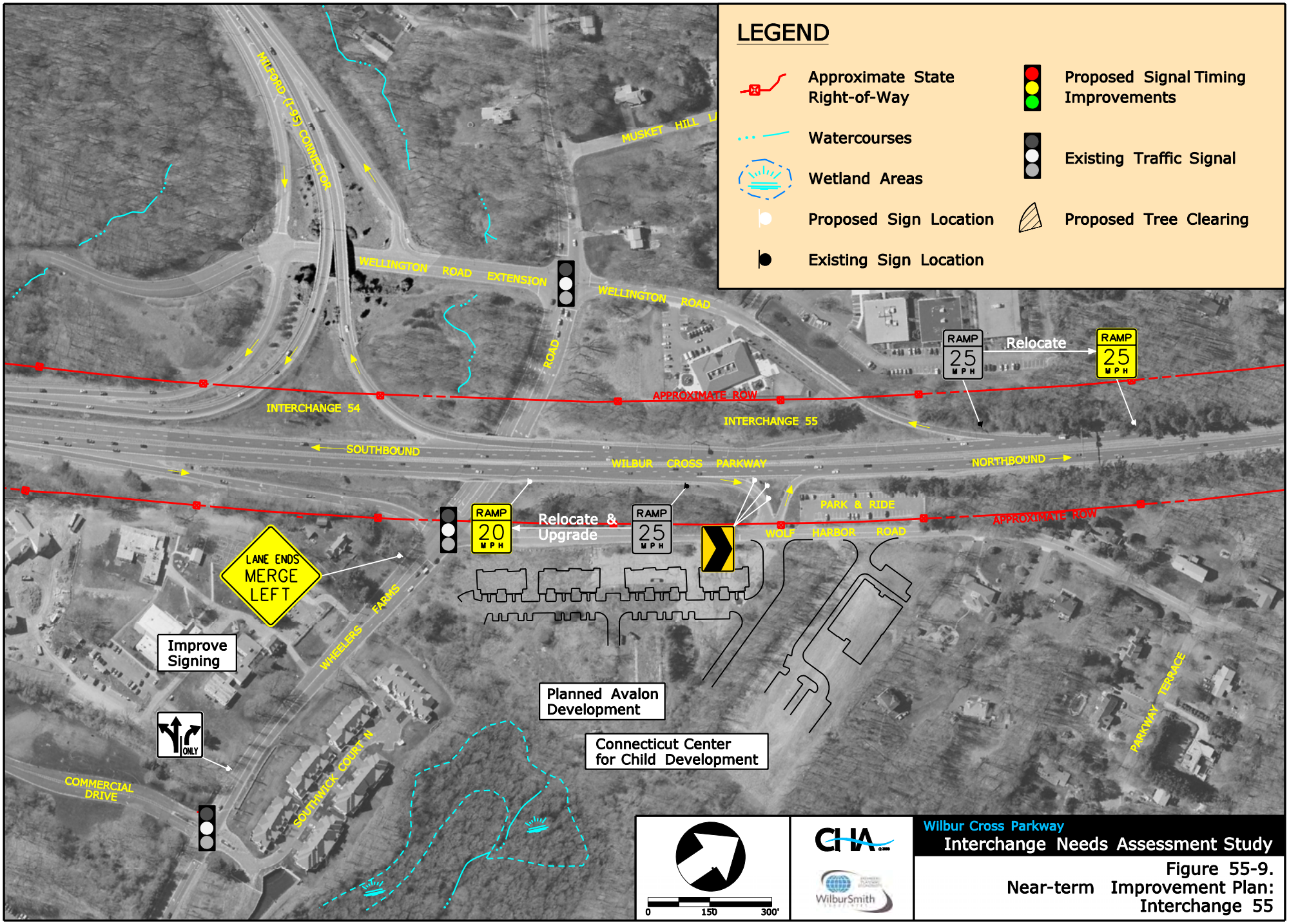
- **Potential Right-of-Way (ROW) Impacts:**
  - Mid-term southbound deceleration lane improvement could require approximately 0.004 acre (175 sf) of ROW from one parcel located near the ramp exit location.
  - Mid-term Wheelers Farms Road widening to provide two southbound lanes could require approximately 0.08 acre (3425 sf) of ROW from one parcel located along the west of Wheelers Farms Road.
  - Total potential ROW impact: 0.084 acre (3600 sf) from two parcels.

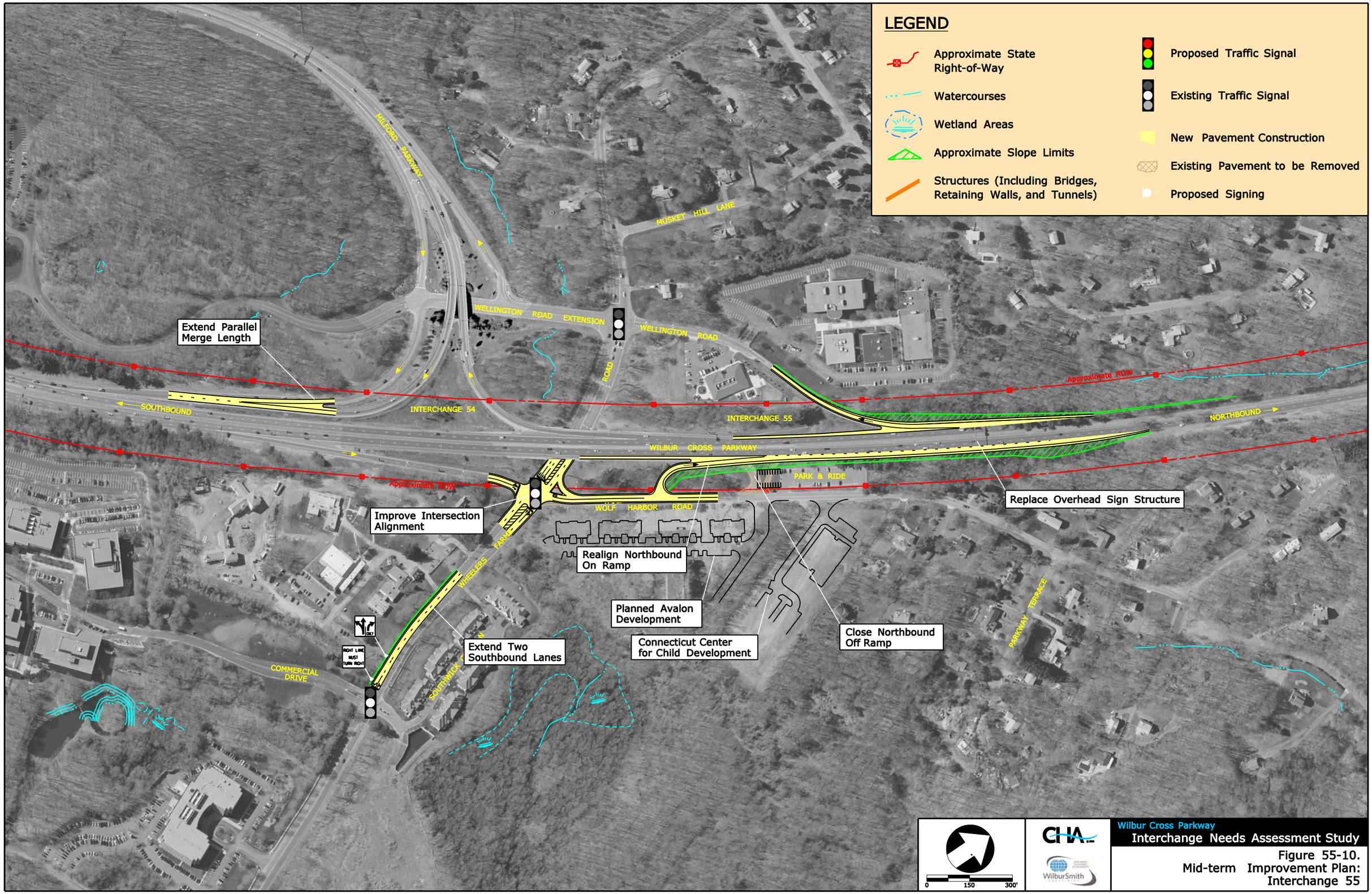
Estimated Construction Costs

The study team developed planning-level construction cost estimates for the near and mid-term improvement plans at Interchange 55 in accordance with ConnDOT's guidelines for preliminary cost estimating dated January 2009. The planning-level costs shown in Table 55-7 are based on estimates of major construction items and do not include allowances for engineering or any potential right-of-way acquisitions, utility relocations, or environmental mitigation.

Table 55-7. Planning-level Construction Cost Estimates: Interchange 55

Improvement	Planning-level Costs	
	(2009 $)	Mid-term (2014 $)
Near-term Improvement Plan		
• All signage improvements; signal timing modifications	$ 15,000	-
Mid-term Improvement Plan		
• NB ramps; Wheelers Farms Road/NB ramps intersection	$ 2.4 million	$ 3.0 million
• SB off ramp deceleration lane improvements	$ 900,000	$ 1.2 million
• SB on ramp merge improvements	$ 30,000	$ 40,000
• Wheelers Farms Road improvements	$ 110,000	$ 150,000


LEGEND
Approximate State Right-of-Way
Watercourses
Wetland Areas
Proposed Sign Location
Existing Sign Location
Proposed Signal Timing Improvements
Existing Traffic Signal
Proposed Tree Clearing
MILFORD (I-95) CONNECTOR
MUSKET HILL
WELLINGTON ROAD EXTENSION
WELLINGTON ROAD
ROAD
RAMP 25 MPH
Relocate
RAMP 25 MPH
APPROXIMATE ROW
INTERCHANGE 54
INTERCHANGE 55
SOUTHBOUND
WILBUR CROSS PARKWAY
NORTHBOUND
RAMP 20 MPH
Relocate & Upgrade
RAMP 25 MPH
PARK & RIDE
WOLF HARBOR ROAD
APPROXIMATE ROW
LANE ENDS MERGE LEFT
Improve Signing
WHEELERS FARMS
ONLY
COMMERCIAL DRIVE
SOUTHWICK COURT N
Planned Avalon Development
Connecticut Center for Child Development
PARKWAY TERRACE
0
150
300'
CHA
WilburSmith
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 55-9.
Near-term Improvement Plan:
Interchange 55


LEGEND
Approximate State Right-of-Way
Watercourses
Wetland Areas
Approximate Slope Limits
Structures (Including Bridges, Retaining Walls, and Tunnels)
Proposed Traffic Signal
Existing Traffic Signal
New Pavement Construction
Existing Pavement to be Removed
Proposed Signing
MILFORD PARKWAY
MUSKET HILL LANE
WELLINGTON ROAD EXTENSION
WELLINGTON ROAD
ROAD
Extend Parallel Merge Length
SOUTHBOUND
INTERCHANGE 54
INTERCHANGE 55
Approximate ROW
NORTHBOUND
WILBUR CROSS PARKWAY
PARK & RIDE
Approximate ROW
WOLF HARBOR ROAD
Improve Intersection Alignment
FARM
WHEELERS
Realign Northbound On Ramp
Planned Avalon Development
Connecticut Center for Child Development
Close Northbound Off Ramp
Replace Overhead Sign Structure
PARKWAY TERRACE
ONLY
RIGHT LANE MUST TURN RIGHT
Extend Two Southbound Lanes
SOUTHWICK
COMMERCIAL DRIVE
0
150
300'
CHA
WilburSmith
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 55-10.
Mid-term Improvement Plan:
Interchange 55

Orange Service Areas

In Brief

Location: Town of Orange

- 2.2 miles north of Interchange 55
- 0.4 mile south of Interchange 56

The northbound and southbound Service Areas in Orange are located approximately 0.4 mile south of Interchange 56 (refer to Figure 56-1 under Interchange 56 for location map). The Service Areas each contain gas pumps, a convenience mart, and restrooms that are only accessible to the public from the Wilbur Cross Parkway.

The configurations of the on ramps and off ramps are similar for both Service Areas. The off ramps diverge from the mainline in taper-type exits and immediately widen significantly on the approach to the gas pumps. The on ramps each consist of a short section of ramp that extends from the parking area and meets the mainline in a yield-controlled tapered merge.

The Parkway travel lanes are separated from each Service Area by a 6 ft wide shoulder and a 10 ft wide curbed and paved island that extends along the length of the Service Area between the off and on ramps.

Needs and Deficiencies Assessment

Roadway Geometry

For this study, the critical geometric characteristics of the Wilbur Cross Parkway and its interchanges and Service Areas are those that are closely related to vehicular safety. These critical geometric characteristics include deceleration lane lengths; acceleration lane lengths; and ramp curvatures and speeds. The study team determined the existing geometric characteristics of Service Area ramps and compared them to the minimum design standards obtained from ConnDOT's *Highway Design Manual 2003 Edition* (HDM).

Because of the unique nature of the Service Area sites that include gas pumps located downstream of the off ramps, the study team assumed that a stop condition located 50 ft upstream of the gas pumps, rather than ramp curvature, would control the required deceleration length at the Service Areas.

The results of the existing geometric conditions assessment are summarized in Table OS-1 and illustrated in Figure OS-1. Non-standard conditions, or deficiencies, are noted in bold red text in the table and figure.

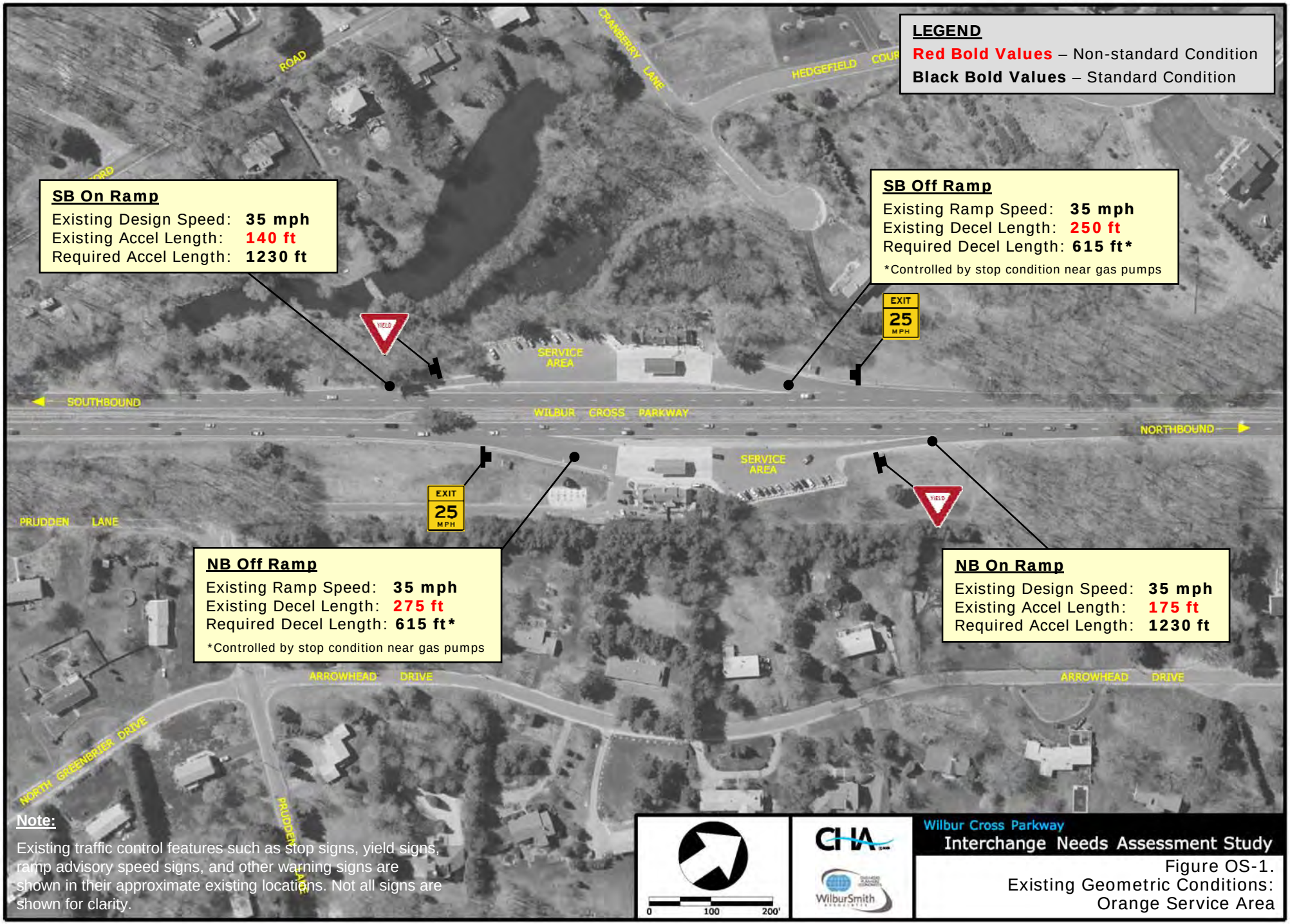
Table OS-1. Existing Geometric Conditions Summary: Orange Service Areas

Location	Ramp		Acceleration/Deceleration Lanes		Other Notes
	Curve Radius	Design Speed	Existing Length	Required Length	
Northbound					
Off Ramp	>385 ft	35 mph	**275 ft**	615 ft	Stop Condition[1]
On Ramp	>385 ft	35 mph	**175 ft**	1230 ft	Yield Control
Southbound					
Off Ramp	>385 ft	35 mph	**250 ft**	615 ft	Stop Condition[1]
On Ramp	> 385 ft	35 mph	**140 ft**	1230 ft	Yield Control

[1] A stop condition located 50 ft upstream of the gas pumps was assumed to be the controlling factor in determining the required deceleration length.

As shown in Table OS-1, the following geometric conditions are deficient:

- **Northbound Deceleration Lane:** Limited deceleration lane exists to accommodate deceleration from mainline speed to stop condition near gas pumps. Most deceleration must occur on the mainline creating unsafe conditions for through and exiting traffic.
- **Northbound Acceleration Lane:** Yield-controlled approach requires motorists to perceive gaps in traffic flow sufficient to accommodate merging and acceleration to mainline speeds. Limited acceleration lane exists to accommodate acceleration prior to merging.
- **Southbound Deceleration Lane:** Limited deceleration lane exists to accommodate deceleration from mainline speed to stop condition near gas pumps. Most deceleration must occur on the mainline creating unsafe conditions for through and exiting traffic.
- **Southbound Acceleration Lane:** Yield-controlled approach requires motorists to perceive gaps in traffic flow sufficient to accommodate merging and acceleration to mainline speeds. Limited acceleration lane exists to accommodate acceleration prior to merging.



Note:

Existing traffic control features such as stop signs, yield signs, ramp advisory speed signs, and other warning signs are shown in their approximate existing locations. Not all signs are shown for clarity.

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure OS-1.
Existing Geometric Conditions:
Orange Service Area

Traffic Conditions

The study team collected automatic traffic recorder (ATR) counts on the Service Area ramps for a 72-hour period that included a Friday, Saturday, and Sunday in December 2008. The count data was used as the basis for assessing traffic conditions at the Service Area ramp junctions.

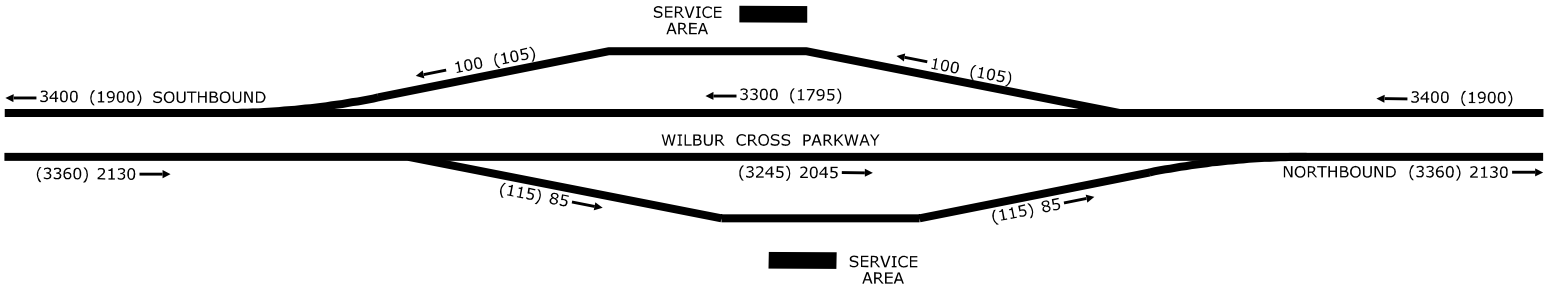
Figure OS-2 presents the existing (2008) weekday peak hour traffic volumes for the morning (AM) and afternoon (PM) peak commuting periods that the study team developed from the 72-hour ATR counts. Although the actual entering and exiting traffic volumes varied slightly during any given hour, it was assumed for analysis purposes that the on ramp volume would equal the off ramp volume so that the volume on the mainline would be constant upstream and downstream of the Service Areas.

Figure OS-3 presents the estimated future (2030) weekday peak hour traffic volumes that were developed by the study team assuming that traffic growth on the Service Area ramps would be similar to the projected growth on the adjacent mainline segment. The 2030 volumes reflect an approximate 24% increase in traffic at the Service Areas.

Traffic Operations

The study team analyzed the operations of the mainline segments and ramp junctions at the Service Areas. The analyses were conducted for the weekday AM and PM peak hours under the 2008 and estimated 2030 traffic conditions. The results of the analyses, which are reported as Levels of Service (LOS), are presented in Tables OS-2 and OS-3 and illustrated in Figures OS-4 and OS-5.

As described in the *Needs Assessment Overview* section, LOS D or better represents an acceptable degree of congestion for mainline segments, ramp junctions, and intersections. LOS E and F, which are indicated in red in the tables and figures, represent unacceptable degrees of congestion. Locations operating at LOS E and F are highlighted in this report to indicate locations where traffic capacity and operational issues exist, or could exist under future traffic conditions.



LEGEND

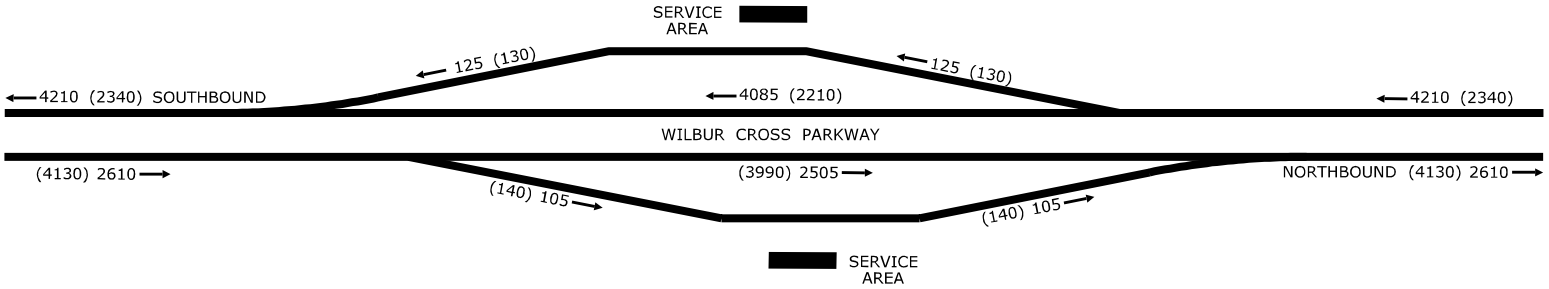
(PM) AM →

NOT TO SCALE

Wilbur Cross Parkway

Interchange Needs Assessment Study

Figure OS-2.
Existing (2008) Peak Hour Volumes:
Orange Service Areas



LEGEND

(PM) AM →

NOT TO SCALE

Wilbur Cross Parkway

Interchange Needs Assessment Study

Figure OS-3.
Future (2030) Peak Hour Volumes:
Orange Service Areas

Mainline

Table OS-2. Mainline Operations Summary: Orange Service Areas

Direction	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
Northbound				
South of Service Area	B (16.9)	C (20.7)	D (27.9)	E (40.1)
North of Service Area	B (16.9)	C (20.7)	D (27.9)	E (40.1)
Southbound				
North of Service Area	D (28.3)	E (42.0)	B (15.1)	C (18.6)
South of Service Area	D (28.3)	E (42.0)	B (15.1)	C (18.6)

[1] Mainline density is reported in passenger cars per mile per lane (pc/mi/ln).

The mainline analysis shows that the mainline segments adjacent to the Service Areas currently operate at LOS D and better during both the AM and PM peak hours. Levels of service deteriorate under 2030 traffic conditions resulting in LOS E in the southbound direction during the AM peak hour and northbound direction during the PM peak hour. It should be noted that the levels of service are the same north and south of the Service Areas during any given peak hour because the mainline volumes north and south of the Service Areas are the same.

Ramp Junctions

Table OS-3. Ramp Merge/Diverge Operations Summary: Orange Service Areas

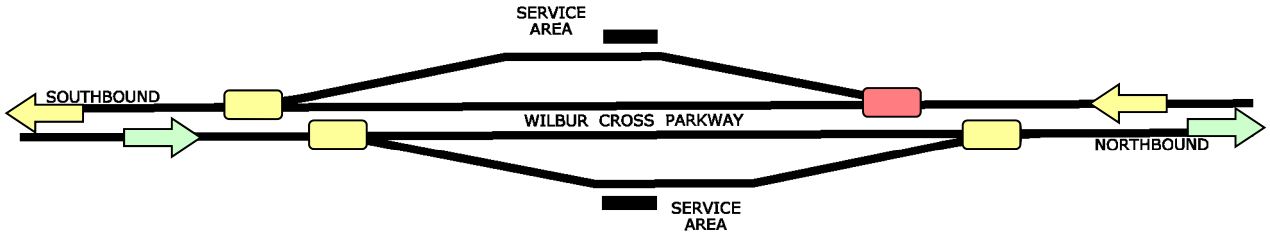
Direction	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
Northbound				
Off Ramp to Service Area	C (24.6)	D (29.2)	E (36.4)	E (43.7)
On Ramp from Service Area	C (23.9)	D (28.0)	D (34.5)	E (41.2)
Southbound				
Off Ramp to Service Area	E (36.7)	E (44.5)	C (22.4)	C (26.6)
On Ramp from Service Area	D (34.9)	E (41.9)	C (21.9)	C (25.7)

[1] Ramp junction density is reported in passenger cars per mile per lane (pc/mi/ln).

The ramp analysis shows that the northbound and southbound ramps generally operate at LOS D and better during the 2008 AM and PM peak hours with the exception of the southbound off ramp during the AM peak hour and northbound off ramp during the PM peak hour. Traffic densities are higher under 2030 traffic conditions resulting in lower levels of service and LOS E at the southbound ramps during the AM peak hour and northbound ramps during the PM peak hour.

Figures OS-4 and OS-5 summarize the results of the traffic operations analyses for the AM and PM peak hour traffic conditions, respectively.

Existing (2008) Traffic Operations – AM



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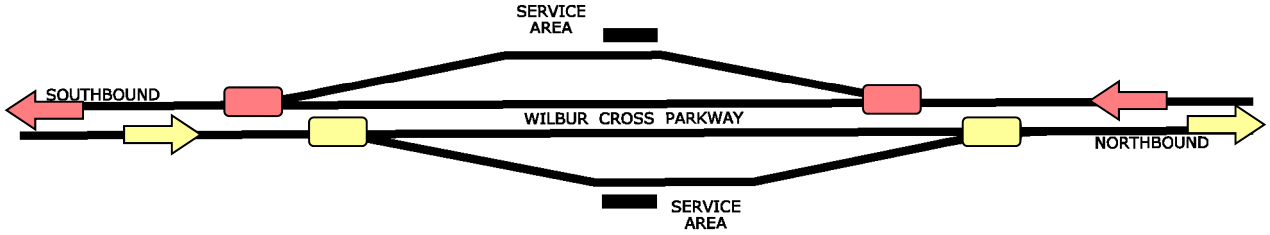
Future (2030) Traffic Operations – AM



NOT TO SCALE

LOS	Mainline	Merge/Diverge
A-B		
C-D		
E-F		

Wilbur Cross Parkway
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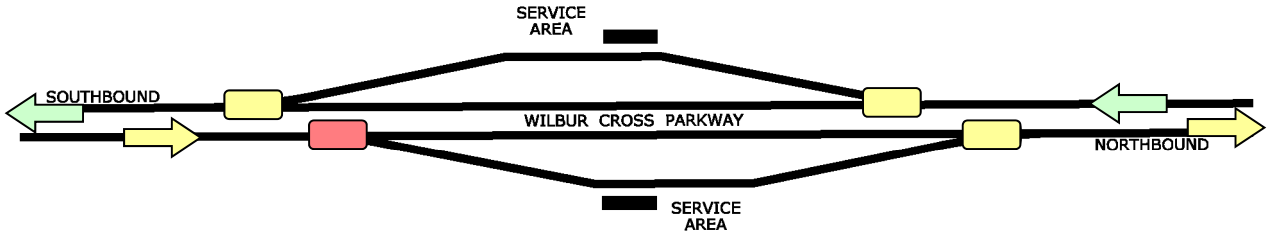
Figure OS-4.
AM Traffic Operations Summary:
Orange Service Areas

Existing (2008) Traffic Operations – PM



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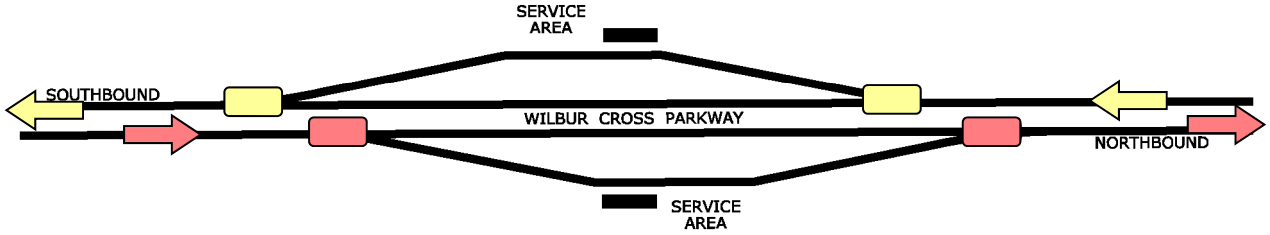
Future (2030) Traffic Operations – PM



NOT TO SCALE

LOS	Mainline	Merge/Diverge
A-B		
C-D		
E-F		

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure OS-5.
PM Traffic Operations Summary:
Orange Service Areas

Accidents and Safety

The study team obtained accident data from ConnDOT's *Traffic Accident Viewing System* (TAVS) for the three-year period beginning January 1, 2005 and ending December 31, 2007. The data shows that 10 accidents occurred on the Parkway at the Orange Service Areas during this period. Table OS-4 summarizes the accident history for the Service Areas.

Table OS-4. Accident History: Orange Service Areas

Location	Collisions by Type					
	Rear End	Fixed Object	Side Swipe	Ped.	Other	Total
Northbound						
Within Rest Area	-	-	1	1	-	**2**
Between Off and On Ramps	-	2	1	-	-	**3**
Southbound						
Within Rest Area	-	-	-	-	1	**1**
Between Off and On Ramps	1	2	-	-	-	**3**
On Ramp	1	-	-	-	-	**1**
Total Number	**2**	**4**	**2**	**1**	**1**	**10**
Percentage	**20%**	**40%**	**20%**	**10%**	**10%**	**100%**

As shown in Table OS-4, the majority of accidents occurred on the mainline between the ramps and predominantly involved fixed object collisions in the median. These collisions are likely attributable to the narrow left shoulder and bituminous curbing that is in close proximity to the high speed travel lane in both the northbound and southbound directions through the area. Despite the non-standard geometry of the deceleration and acceleration lanes, only one accident – a rear-end collision at the southbound on ramp – could be directly related to the geometric deficiencies of the ramp. The study team believes that the generally low accident history at the Service Areas could be due to a combination of factors including:

- Relatively low traffic volumes accessing the Service Areas during peak commuter periods thus limiting the number of potential vehicle conflicts.
- Generally level, open terrain in the vicinity of the Service Areas that provide unobstructed sight lines for motorists.

The study team notes that the lack of any substantial physical separation between the mainline traffic and the gas pumps is a potential safety issue. An errant mainline vehicle could relatively easily traverse or vault over the narrow curbed island at a high travel speed and collide with a gas pump, pedestrian, or other vehicle in the Service Area. The gas pumps are located just beyond the 30-ft mainline clear zone, but fueling vehicles and associated pedestrian activity do occur within the clear zone.

Recommended Improvement Plan

The study team worked with the Town of Orange, ConnDOT, SCRCOG, and other stakeholders to develop a mid-term improvement plan to address the identified deficiencies and needs at the Orange Service Areas. The recommended improvement plan is detailed and illustrated below along with discussion regarding other design and implementation considerations. Also included are summaries of constraints, impacts, and estimated construction costs.

Mid-term Improvement Plan (Figure OS-6)

- Improve the physical separation between mainline Route 15 and the service areas by replacing the existing curbed island with concrete barrier and impact attenuator. The purpose of the barrier is to better protect the existing gas pumps and pedestrian activity within the service area from potential errant vehicles off the mainline.
- Provide standard deceleration length for the northbound off ramp in conjunction with barrier improvements.
- Provide northbound on ramp/acceleration lane and southbound off ramp/deceleration lane improvements in conjunction with mid-term auxiliary lane improvements at Interchange 56 (see Interchange 56 Mid-term Improvement Plan).
- Improve southbound on ramp acceleration lane within the constraints imposed by the Derby-Milford Road bridge structure over Route 15.

Near, Mid, and Long-term Definitions

Near-term:
- Implementation period of 1 to 3 years.
- Includes low cost improvements such as signing and striping improvements, existing signal timing modifications, tree clearing, etc.

Mid-term:
- Implementation period of 3 to 10 years.
- Includes acceleration and deceleration lane improvements, new turn lanes, new traffic signals, and minor ramp modifications that could be implemented with little or no impacts to rights-of-way, environmental features, or existing bridge structures.

Long-term:
- Implementation period greater than 10 years.
- Includes higher-cost improvements that could significantly impact existing bridge structures, rights-of-way, or environmental features.

Other Considerations

- The Connecticut Department of Transportation's Project Development Unit recently conducted an independent study of Interchange 56 that included several improvement concepts other than those developed for this study. One of the concepts developed by ConnDOT considered combining improvements at Interchange 56 with a relocated southbound service area to provide for a standard southbound acceleration lane for the service area on ramp without impacting the Derby-Milford Road bride structure. The recommendations of this study should continue to be coordinated with ConnDOT's work at this service area.

Constraints, Limitations and Impacts

- The Derby-Milford Road bridge structure over Route 15 has a sufficiency rating of 78, which indicates that the bridge is in good condition and will not likely require major reconstruction for some time. When the bridge is replaced, the southbound acceleration lane should be extended to the standard length. The estimated construction cost for replacing the bridge is approximately $2.6 million (2009 $).
- A variable message sign structure is located near the southbound on ramp and could be impacted by the improvements.
- No significant right-of-way or wetland impacts are anticipated with the improvement plans at the Orange Service Areas.

Estimated Construction Costs

The study team developed planning-level construction cost estimates for the mid-term improvement plans at the Orange Service Areas in accordance with ConnDOT's guidelines for preliminary cost estimating dated January 2009. The planning-level costs shown in Table OS-5 are based on estimates of major construction items and do not include allowances for engineering or any potential right-of-way acquisitions, utility relocations, or environmental mitigation..

Table OS-5. Planning-level Construction Cost Estimates: Orange Service Areas

Improvement	Planning-level Costs	
	(2009 $)	Mid-term (2014 $)
Mid-term Improvement Plan		
• Northbound deceleration lane and off ramp	$ 700,000	$ 900,000
• Southbound on ramp and acceleration lane	$ 600,000	$ 800,000

Note: Costs for northbound on ramp/acceleration lane and southbound off ramp/deceleration lane are included in the costs for the auxiliary lane improvements presented in Table 56-7 under Interchange 56.

LEGEND

- Approximate State Right-of-Way
- Watercourses
- Wetland Areas
- Approximate Slope Limits
- Structures (Including Bridges, Retaining Walls, and Tunnels)
- Proposed Traffic Signal
- Existing Traffic Signal
- New Pavement Construction
- Existing Pavement to be Removed

Improve Acceleration Length

Provide Physical Barrier

Provide Auxiliary Lanes Between Interchange 56 and Service Areas

Provide Full Deceleration Length

MILFORD ROAD

CRANBERRY LANE

HEDGEFIELD COURT

APPROXIMATE ROW

SERVICE AREA

SOUTHBOUND

WILBUR CROSS PARKWAY

NORTHBOUND

PRUDDEN LANE

ARROWHEAD DRIVE

NORTH GREENBRIER DRIVE

0 100 200'

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure OS-6.
Mid-term Improvement Plan:
Orange Service Areas

Interchange 56

Interchange 56 of the Wilbur Cross Parkway is located in the Town of Orange and provides access to Route 121, Grassy Hill Road. The interchange primarily serves residential land use in the area via local town roads that intersect Route 121. Route 121 also provides access to Route 34 (Derby Avenue) to the north; the City of Milford to the south; and Orange Town Center to the east via Old Grassy Hill Road and Route 152.

In Brief

Location: Town of Orange

- 0.4 mile north of Service Area
- 3.0 miles north of Interchange 55
- 1.4 miles south of Interchange 57/58

Access to: Route 121 (Grassy Hill Road)

The interchange was originally constructed in the early 1940s with no significant geometric improvements made to the ramps since that time.

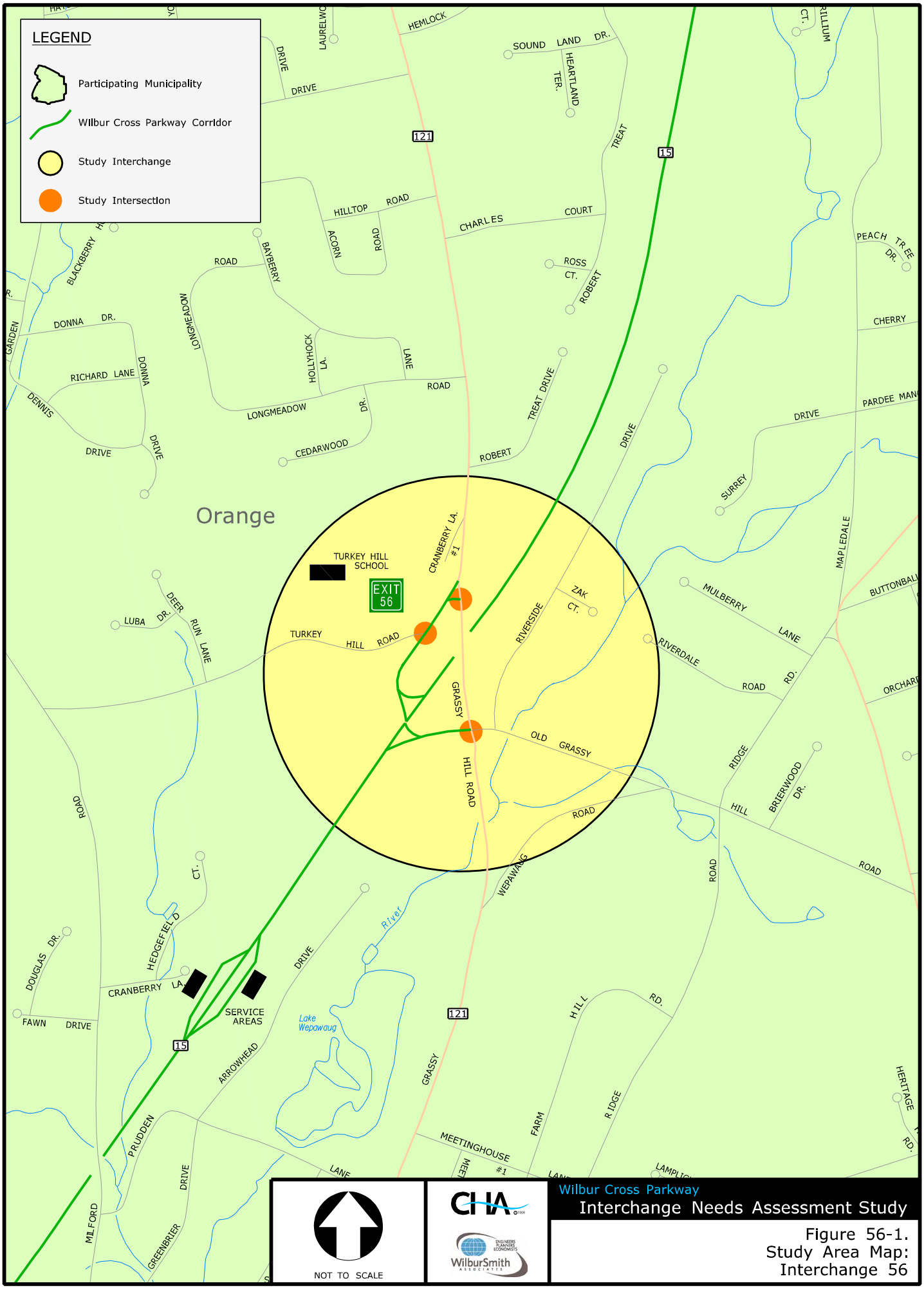
The northbound off ramp diverges from the mainline in a taper-type exit and terminates at Route 121 creating a four-legged signalized intersection with Old Grassy Hill Road. The northbound on ramp is located parallel to the off ramp and is characterized by a stop-controlled approach to the Wilbur Cross Parkway.

The southbound off ramp also diverges from the mainline in a taper-type exit and loops approximately 180 degrees before terminating at Turkey Hill Road and continuing as SR 915 to Route 121. The southbound on ramp runs parallel to the off ramp south of Turkey Hill Road and is characterized by a stop-controlled approach to the Wilbur Cross Parkway. The southbound ramps and SR 915 form a T-intersection with Turkey Hill Road, which has a stop-controlled approach to the intersection.

The Parkway in the interchange area consists of two travel lanes in the northbound and southbound directions separated by a narrow raised median and metal beam guide railing. The typical lane and shoulder configuration includes 11 ft to 12 ft wide lanes, 1 ft to 2 ft wide left shoulders, and 1 ft to 3 ft wide right shoulders.

The study area, as shown in Figure 56-1, includes the interchange ramps, the junctions of these ramps with the Wilbur Cross Parkway, and the following intersections:

- Northbound ramps at Route 121 (signalized)
- Southbound ramps at Turkey Hill Road and SR 915 (unsignalized)
- SR 915 at Route 121 (unsignalized)


LEGEND
Participating Municipality
Wilbur Cross Parkway Corridor
Study Interchange
Study Intersection
Orange
TURKEY HILL SCHOOL
EXIT 56
CRANBERRY LA. #1
TURKEY HILL ROAD
GRASSY HILL ROAD
OLD GRASSY HILL ROAD
RIVERSIDE
ZAK CT.
RIVERDALE ROAD
MULBERRY LANE
SURREY DRIVE
MAPLEDALE
PARDEE MANOR DRIVE
CHERRY
PEACH TREE DR.
ROSS CT.
ROBERT
TREAT
TREAT DRIVE
CHARLES COURT
HILLTOP ROAD
ACORN ROAD
BAYBERRY ROAD
LONGMEADOW ROAD
HOLLYHOCK LA.
LANE
DONNA DR.
RICHARD LANE
DENNIS DRIVE
CEDARWOOD DR.
SOUND LAND DR.
HEARTLAND TER.
HEMLOCK
LAURELWOOD DRIVE
BLACKBERRY
GARDEN
LUBA DR.
DEER RUN LANE
HEDGEFIELD CT.
DOUGLAS DR.
FAWN DRIVE
CRANBERRY LA.
SERVICE AREAS
ARROWHEAD DRIVE
PRUDDEN LANE
MILFORD ROAD
GREENBRIER DRIVE
WEPAWAUG River
Lake Wepawaug
MEETINGHOUSE LANE #1
FARM RIDGE HILL RD.
RIDGE HILL ROAD
BRIERWOOD DR.
HERITAGE RD.
121
15
NOT TO SCALE
CHA
WilburSmith ASSOCIATES
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 56-1.
Study Area Map:
Interchange 56

Needs and Deficiencies Assessment

Roadway Geometry

For this study, the critical geometric characteristics of the Wilbur Cross Parkway and its interchanges are those that are closely related to vehicular safety. These critical geometric characteristics include deceleration lane lengths; acceleration lane lengths; and ramp curvatures and speeds. The study team determined the existing geometric characteristics of Interchange 56 and compared them to the minimum design standards obtained from ConnDOT's *Highway Design Manual 2003 Edition* (HDM).

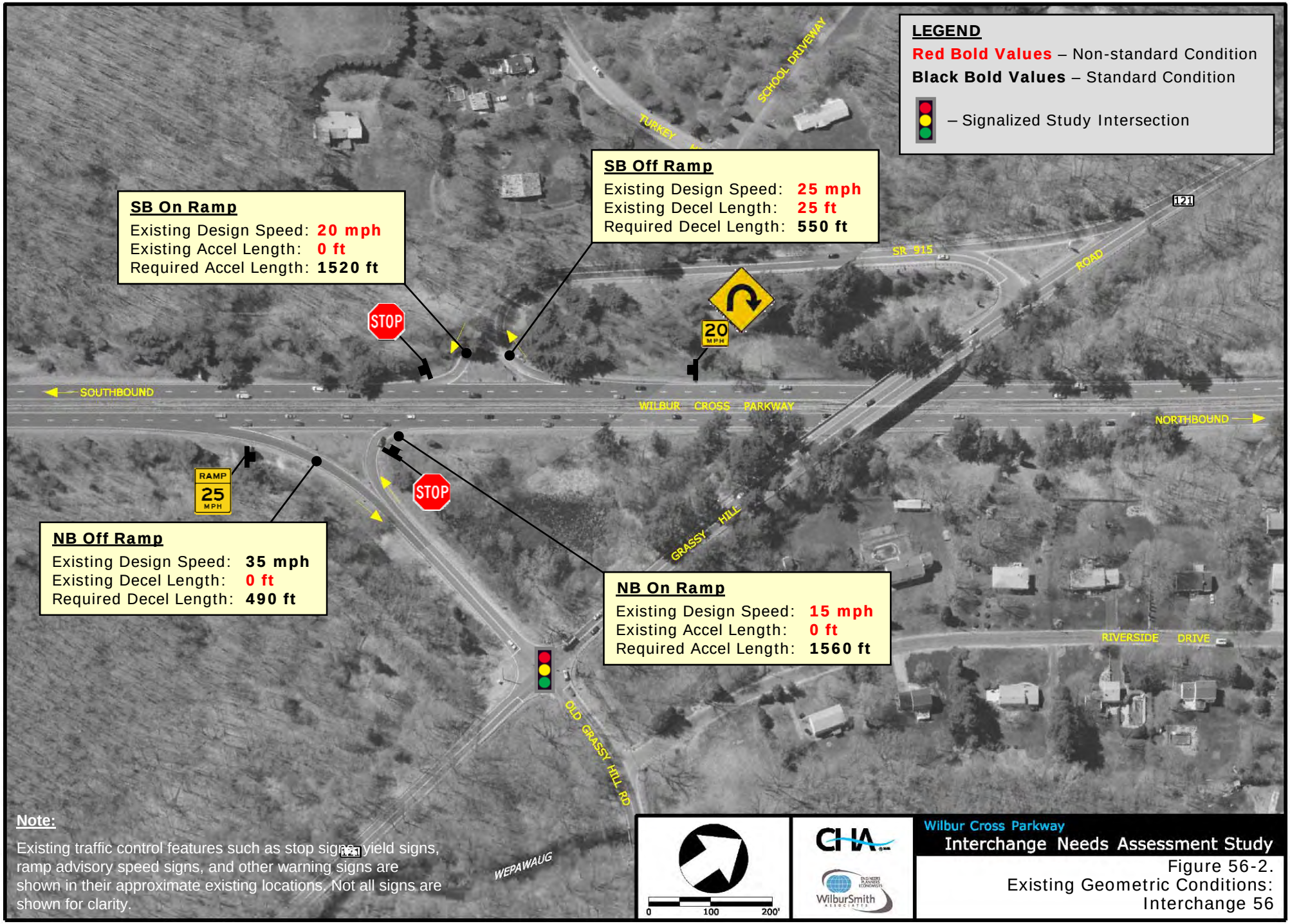
The results of the existing geometric conditions assessment are summarized in Table 56-1 and illustrated in Figure 56-2. Non-standard conditions, or deficiencies, are noted in bold red text in the table and figure.

Table 56-1. Existing Geometric Conditions Summary: Interchange 56

Location	Ramp		Acceleration/Deceleration Lanes		Other Notes
	Curve Radius	Design Speed	Existing Length	Required Length	
Northbound					
Off Ramp	460 ft	35 mph	**0 ft**	490 ft	-
On Ramp	**67 ft**	**15 mph**	**0 ft**	1560 ft	Stop Condition
Southbound					
Off Ramp	**150 ft**	**25 mph**	**25 ft**	550 ft	-
On Ramp	**80 ft**	**20 mph**	**0 ft**	1520 ft	Stop Condition

As shown in Table 56-1, the following geometric conditions are deficient:

- **Northbound Deceleration Lane:** No deceleration lane exists to accommodate deceleration from mainline to ramp speeds. All deceleration must occur on the mainline creating unsafe conditions for through and exiting traffic.
- **Northbound On Ramp and Acceleration Lane:** Ramp curvature and 15 mph design speed are non-standard. Stop-controlled approach requires motorists to perceive gaps in traffic flow sufficient to accommodate merging operations and acceleration to mainline speeds. No acceleration lane exists to accommodate acceleration prior to merging.
- **Southbound Off Ramp and Deceleration Lane:** Ramp curvature and 25 mph design speed are non-standard. Limited deceleration lane exists to accommodate deceleration from mainline to ramp speeds. Most deceleration must occur on the mainline creating unsafe conditions for through and exiting traffic.
- **Southbound On Ramp and Acceleration Lane:** Ramp curvature and 20 mph design speed are non-standard. Stop-controlled approach requires motorists to perceive gaps in traffic flow sufficient to accommodate merging and acceleration to mainline speeds. No acceleration lane exists to accommodate acceleration prior to merging.



Note:

Existing traffic control features such as stop signs, yield signs, ramp advisory speed signs, and other warning signs are shown in their approximate existing locations. Not all signs are shown for clarity.

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 56-2.
Existing Geometric Conditions:
Interchange 56

Traffic Conditions

The study team compiled traffic data for Interchange 56 that included average daily traffic (ADT) volumes, existing (2008) weekday peak hour traffic volumes, and estimated future (2030) weekday peak hour traffic volumes. This data was used as the basis for assessing traffic conditions on the mainline Wilbur Cross Parkway (WCP), at the interchange ramp junctions, and at key secondary roadway intersections. Figure 56-3 illustrates the most recent (2006) ADT volumes that were collected by ConnDOT at Interchange 56.

Figure 56-3. 2006 Average Daily Traffic Volumes (in vehicles per day, vpd): Interchange 56

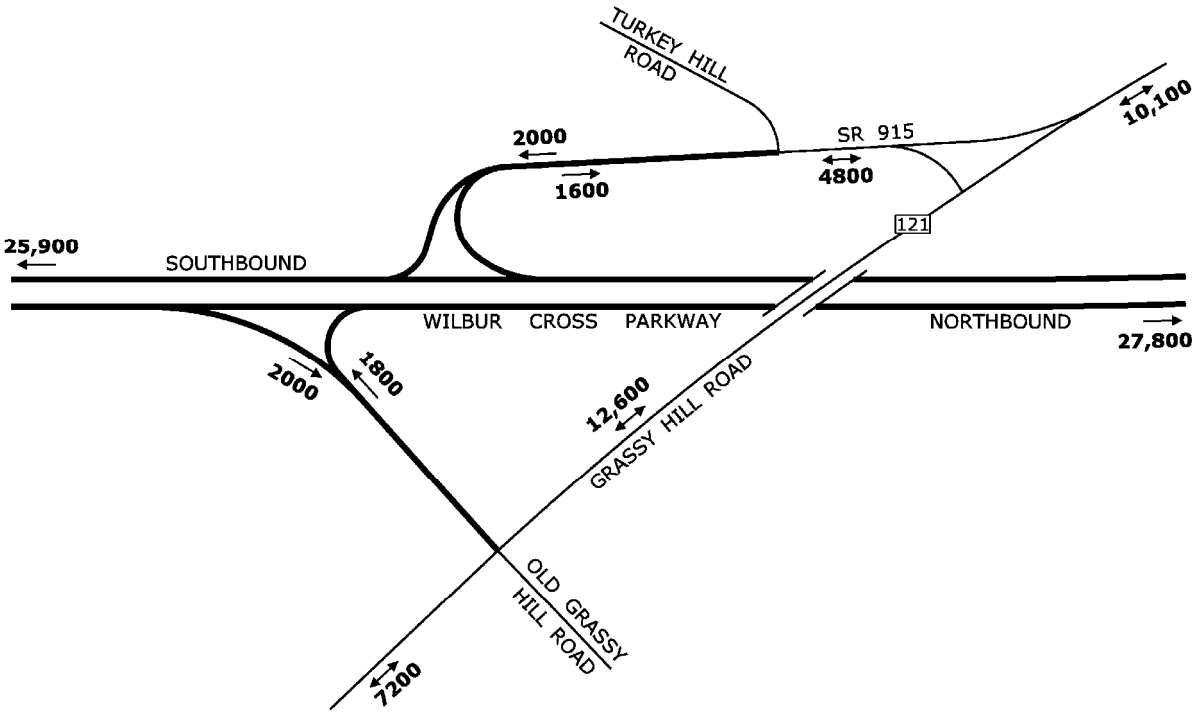
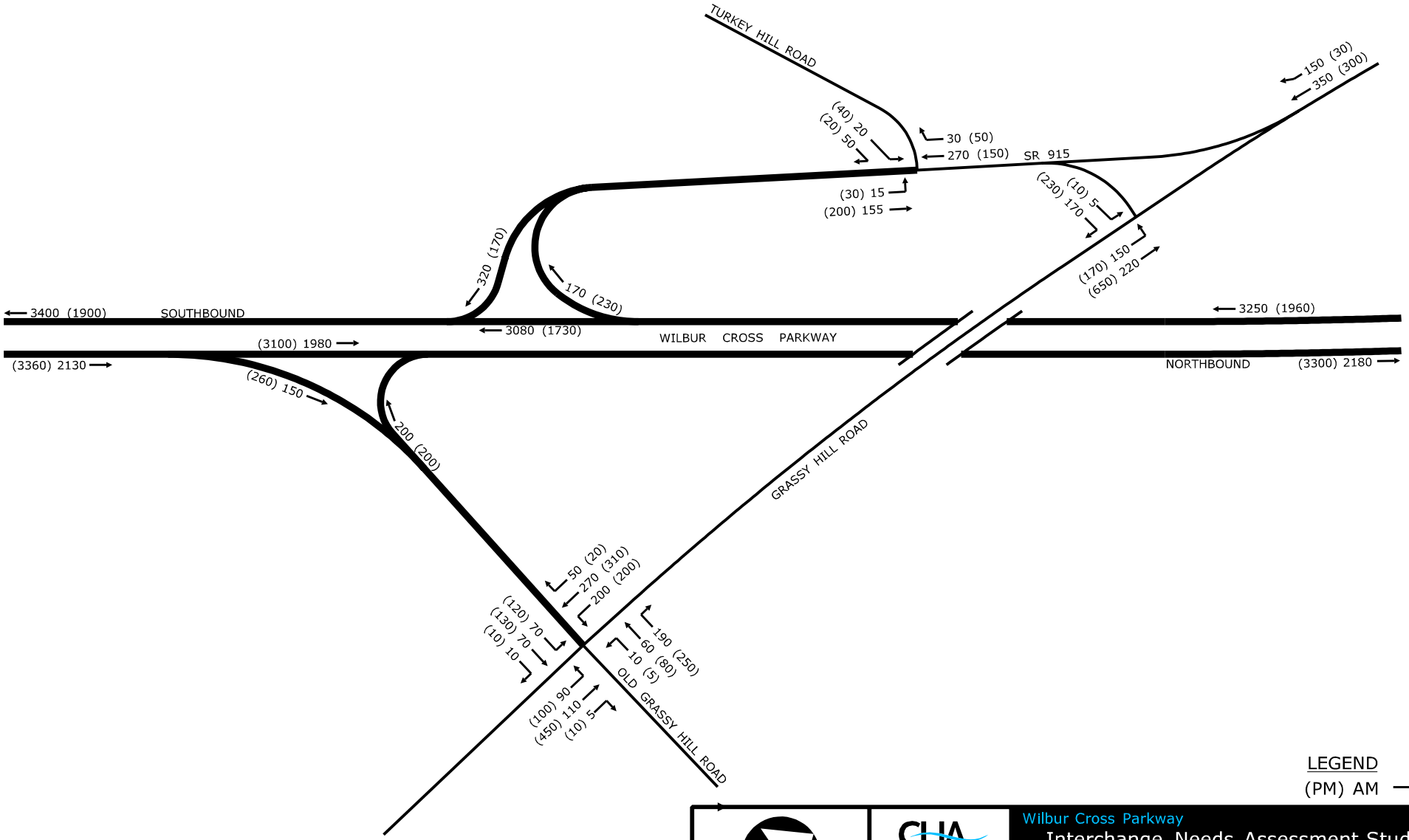


Figure 56-4 presents the 2008 weekday peak hour traffic volumes for the morning (AM) and afternoon (PM) peak commuting periods. The study team worked with ConnDOT's traffic forecasting unit to develop these volumes from intersection turning movement counts obtained by SCRCOG and available traffic data for Interchange 56 provided by ConnDOT.

Figure 56-5 presents the estimated 2030 weekday peak hour traffic volumes that were developed by ConnDOT's traffic forecasting unit. These volumes reflect an increase in traffic at Interchange 56 that is primarily a function of regional background traffic growth as no major developments in the interchange area are expected to significantly affect future traffic estimates.

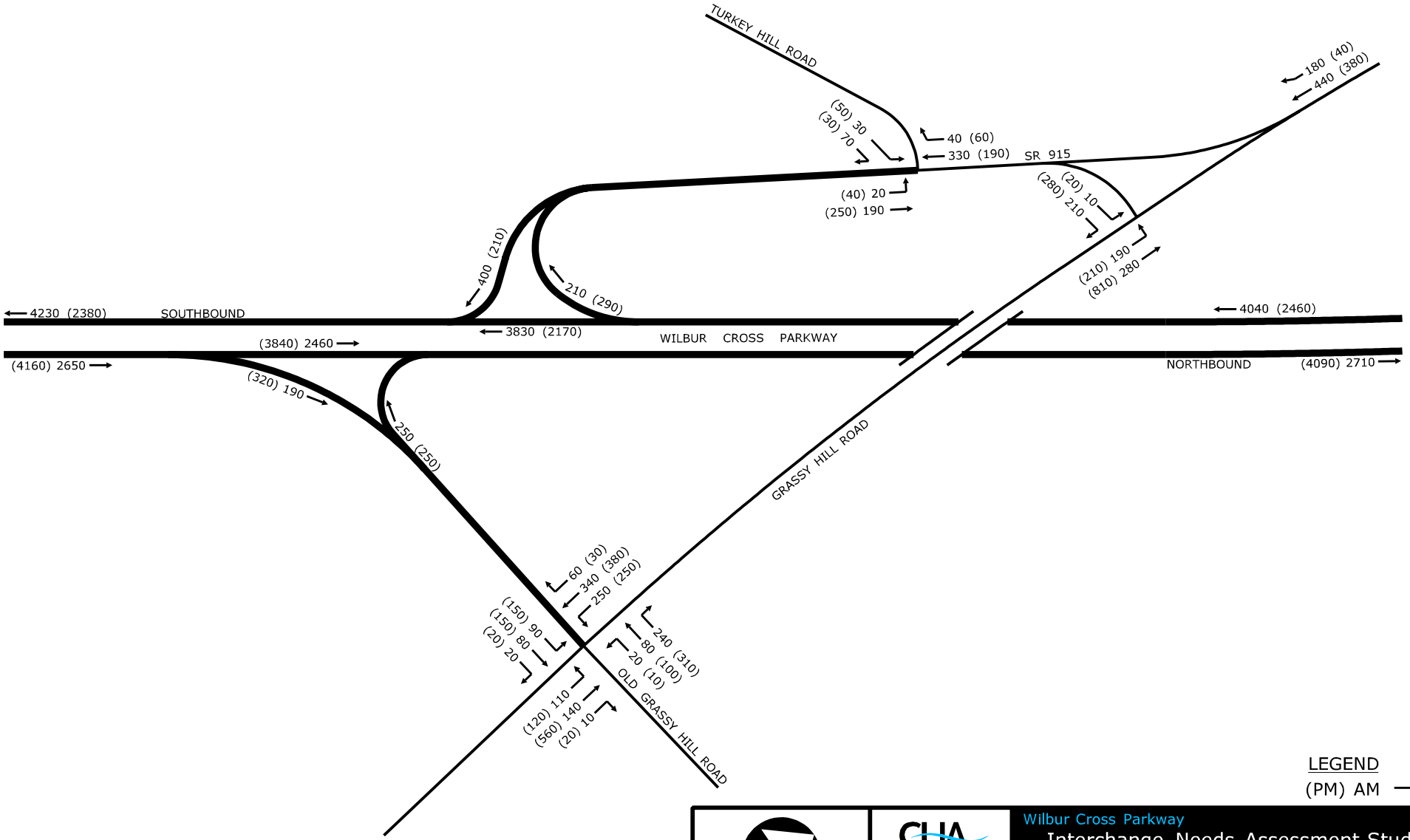
The notable traffic conditions presented in Figures 56-3, 56-4, and 56-5 include:

- Highest daily ramp volumes occur on the northbound off ramp and southbound on ramp
- Lowest daily ramp volume occurs on the southbound off ramp
- Approximately 60% of WCP traffic is traveling southbound in the morning
- Approximately 63% of WCP traffic is traveling northbound in the afternoon
- Overall traffic growth by 2030 is estimated to be approximately 25%, or 1% annually



Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 56-4.
Existing (2008) Peak Hour Volumes
Interchange 56


TURKEY HILL ROAD
(50) 30
(30) 70
40 (60)
330 (190)
SR 915
180 (40)
440 (380)
(40) 20
(250) 190
(280) 210
(20) 10
400 (210)
210 (290)
(210) 190
(810) 280
4230 (2380)
SOUTHBOUND
3830 (2170)
4040 (2460)
(3840) 2460
WILBUR CROSS PARKWAY
(4160) 2650
NORTHBOUND
(4090) 2710
(320) 190
250 (250)
GRASSY HILL ROAD
60 (30)
340 (380)
250 (250)
(150) 90
(150) 80
(20) 20
240 (310)
80 (100)
20 (10)
(120) 110
(560) 140
(20) 10
OLD GRASSY HILL ROAD
LEGEND
(PM) AM
NOT TO SCALE
CHA
WilburSmith
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 56-5.
Future (2030) Peak Hour Volumes:
Interchange 56

Traffic Operations

The study team analyzed the operations of the mainline segments, ramp junctions, and intersections in the Interchange 56 study area. The analyses were conducted for the weekday AM and PM peak hours under the 2008 and estimated 2030 traffic conditions. The results of the analyses, which are reported as Levels of Service (LOS), are presented below in tabular form and illustrated in Figures 56-6 and 56-7.

As described in the *Needs Assessment Overview* section, LOS D or better represents an acceptable degree of congestion for mainline segments, ramp junctions, and intersections. LOS E and F, which are indicated in red in the tables and figures, represent unacceptable degrees of congestion. Locations operating at LOS E and F are highlighted in this report to indicate locations where traffic capacity and operational issues exist, or could exist under future traffic conditions.

Mainline

Table 56-2. Mainline Operations Summary: Interchange 56

Direction	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
Northbound				
South of Interchange 56	B (16.9)	C (20.7)	D (27.9)	E (40.1)
Between Interchange 56 Ramps	B (15.7)	C (19.2)	C (25.1)	D (34.0)
North of Interchange 56	B (17.3)	C (21.2)	D (27.2)	E (38.6)
Southbound				
North of Interchange 56	D (26.6)	E (37.8)	B (15.6)	C (19.2)
Between Interchange 56 Ramps	C (24.9)	D (34.0)	B (13.7)	B (16.9)
South of Interchange 56	D (28.3)	E (42.0)	B (15.1)	C (18.6)

[1] Mainline density is reported in passenger cars per mile per lane (pc/mi/ln).

The mainline analysis shows that all mainline segments currently operate at LOS D or better during both the AM and PM peak hours. The lower levels of service in the southbound direction in the AM and in the northbound direction in the PM correspond to the predominant direction of travel during the respective peak hours. Levels of service deteriorate under 2030 traffic conditions resulting in LOS E in the southbound direction in the AM and LOS E in the northbound direction in the PM.

Ramp Junctions

Table 56-3. Ramp Merge/Diverge Operations Summary: Interchange 56

Direction	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
Northbound				
Off Ramp to Route 121	C (24.6)	D (29.2)	E (36.4)	E (43.7)
On Ramp from Route 121	C (24.3)	D (28.5)	D (34.0)	E (40.5)
Southbound				
Off Ramp to Route 121	E (35.1)	E (42.4)	C (22.8)	C (27.2)
On Ramp from Route 121	D (34.8)	E (41.8)	C (21.9)	C (25.6)

[1] Ramp junction density is reported in passenger cars per mile per lane (pc/mi/ln).

The ramp analysis shows that the northbound and southbound ramps generally operate at LOS C and D during the AM and PM peak hours with the exception of the northbound and southbound off ramps to Route 121, which operate at LOS E during the PM and AM peak hours, respectively. Levels of service deteriorate under 2030 traffic conditions resulting in LOS E at both northbound ramps during the PM peak hour and both southbound ramps during the AM peak hour.

Intersections

The study team analyzed traffic operations at the following intersections:

- **Northbound Ramps at Route 121:** Signalized, four-legged intersection with Old Grassy Hill Road. Route 121 is oriented in a north-south direction; northbound ramps and Old Grassy Hill Road are oriented in an east-west direction. The northbound and southbound approaches on Route 121 consist of a single travel lane in each direction. The northbound off ramp approach consists of a single lane. The westbound approach on Old Grassy Hill Road consists of a single lane.

- **Southbound Ramps at SR 915 and Turkey Hill Road:** Unsignalized, T-intersection. SR 915 and southbound ramps are oriented in a north-south direction; Turkey Hill Road, which is stop-controlled, is oriented in an east-west direction. The northbound and southbound approaches on the off ramp and SR 915 consist of single travel lanes. The eastbound approach on Turkey Hill Road is slightly skewed and consists of a single lane.

- **Route 121 at SR 915:** Unsignalized, T-intersection. Route 121 is oriented in a north-south direction; SR 915, which is stop-controlled, is oriented in an east-west direction. The northbound and southbound approaches on Route 121 consist of single travel lanes in each direction; the southbound approach includes a right slip lane to SR 915. The westbound approach to the slip lane on SR 915 from northbound Route 121 is stop-controlled. The eastbound approach on SR 915 consists of a single lane.

Results of the intersection analysis are presented in Table 56-4.

Table 56-4. Intersection Operations Summary: Interchange 56

Intersection / Approach	AM LOS (Delay[1])		PM LOS (Delay[1])	
	2008	2030	2008	2030
NB Ramps at Route 121				
Eastbound – NB Off Ramp	D (39.9)	F (>80)	E (69.2)	F (>80)
Westbound – Old Grassy Hill Road	B (17.3)	C (34.7)	B (16.9)	C (24.6)
Northbound – Route 121	D (36.4)	D (45.1)	D (35.9)	F (>80)
Southbound – Route 121	A (9.4)	B (12.1)	D (37.8)	F (>80)
Overall	**C (20.1)**	**E (57.0)**	**D (37.9)**	**F (>80)**
SB Ramps at SR 915 & Turkey Hill Road (Unsignalized)				
Eastbound – Turkey Hill Road	B (11.2)	B (12.7)	B (11.6)	B (13.0)
Route 121 at SR 915 (Unsignalized)				
Eastbound – SR 915	B (13.1)	C (17.4)	C (16.5)	F (82.5)

[1] Delays are reported in seconds.

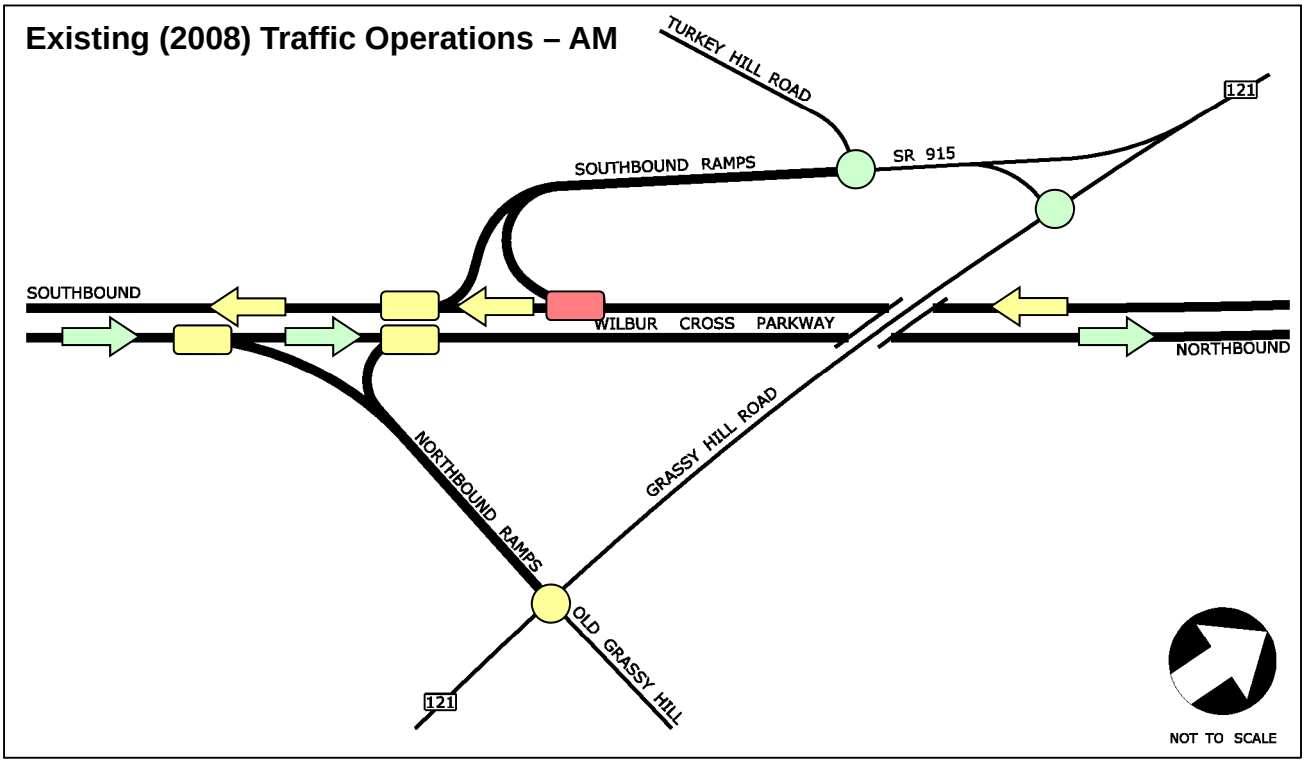
The intersection analysis shows that the three study intersections currently operate at LOS D or better during both the AM and PM peak hours. Levels of service deteriorate under 2030 traffic conditions resulting in LOS E and F during the AM and PM peak hours, respectively, at the northbound ramps intersection with Route 121. The eastbound approach of SR 915 to Route 121 also deteriorates to LOS F during the PM peak hour.

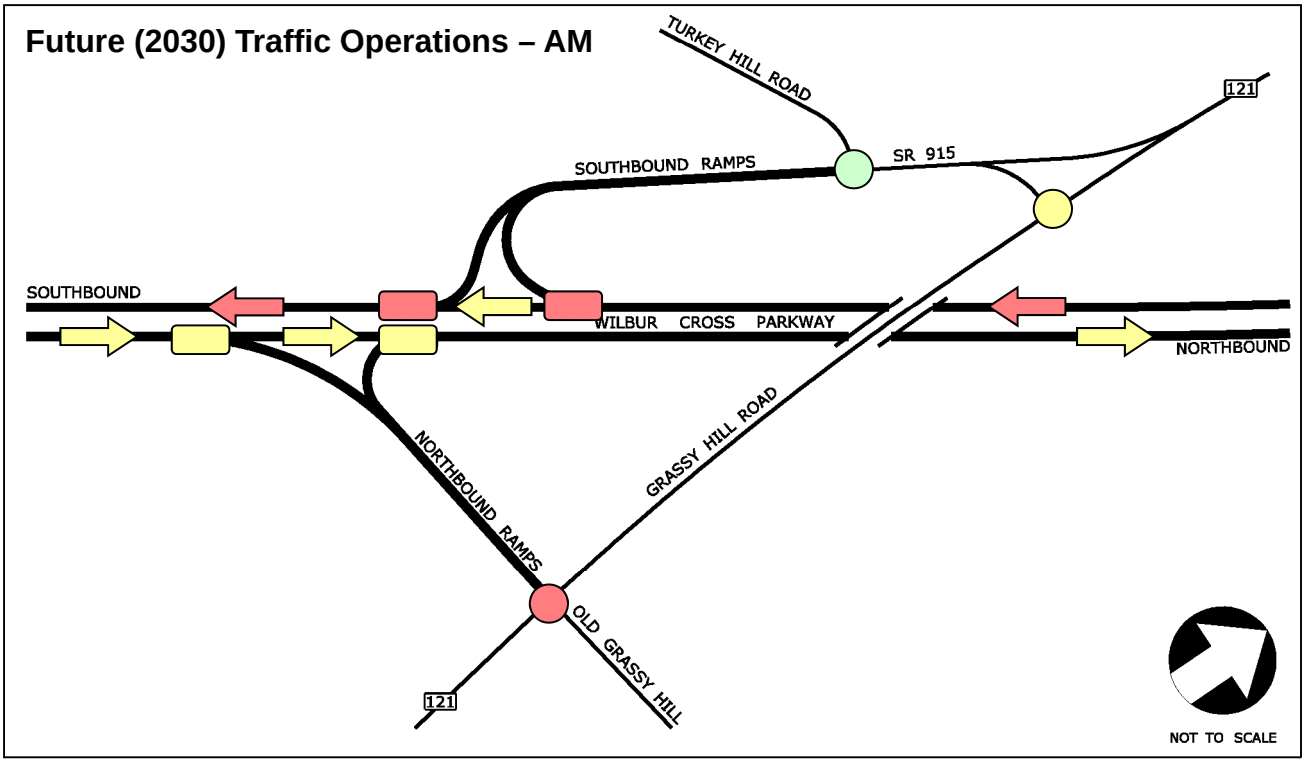
In addition to the operational issues that were identified through SYNCHRO and HCS+ software analyses, the study team has identified the following operational issues through discussions with Town of Orange representatives:

- Traffic queues on the southbound on ramp can extend from the stop sign, through the Turkey Hill Road intersection, to the intersection with Route 121. The slip right turn lane from southbound Route 121 to SR 915 is a safety concern due to the high speed nature of the turn and the unexpected condition of queuing traffic back to this intersection.

The study team notes that the traffic queue at the northbound off ramp is expected to extend to the ramp curve under 2030 traffic conditions, but is not expected to extended on to the mainline.

Figures 56-6 and 56-7 summarize the results of the traffic operations analyses for AM and PM peak hour traffic conditions, respectively.





LOS	Intersection	Mainline	Merge/Diverge
A-B			
C-D			
E-F			

Wilbur Cross Parkway
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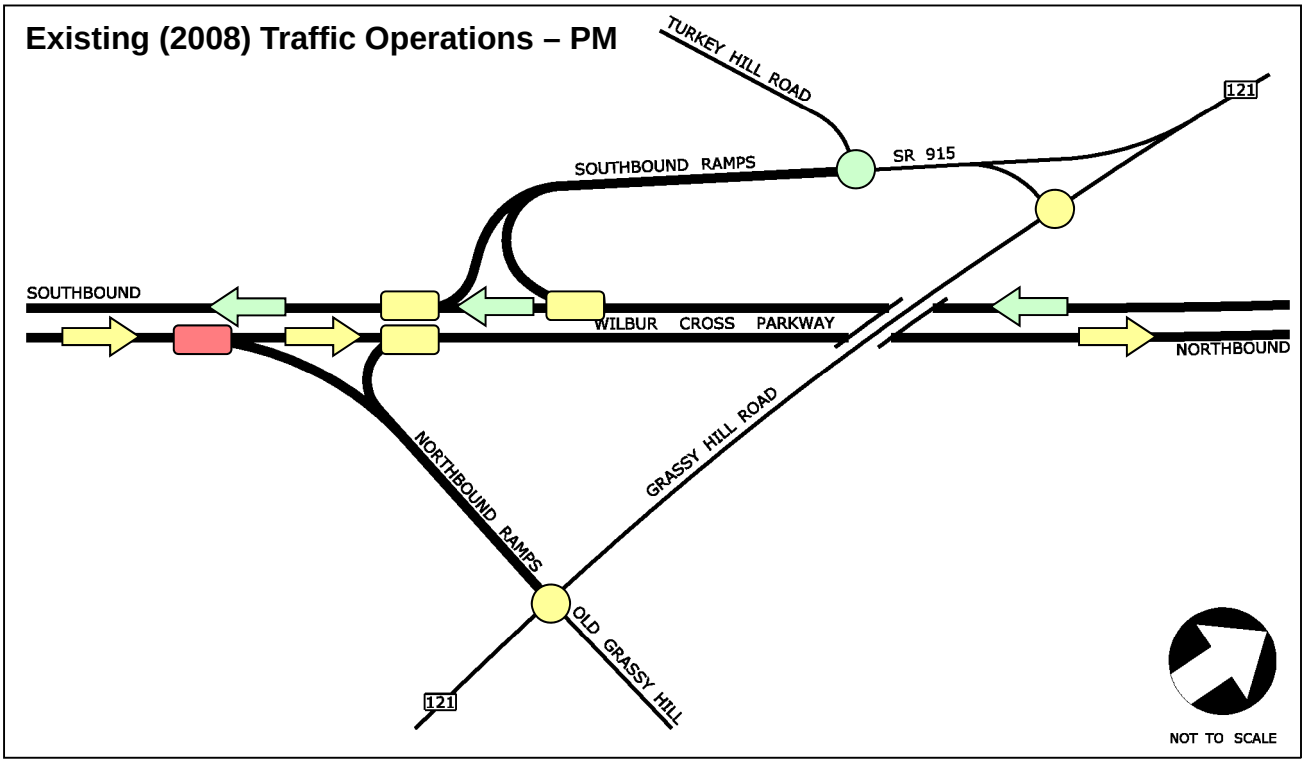
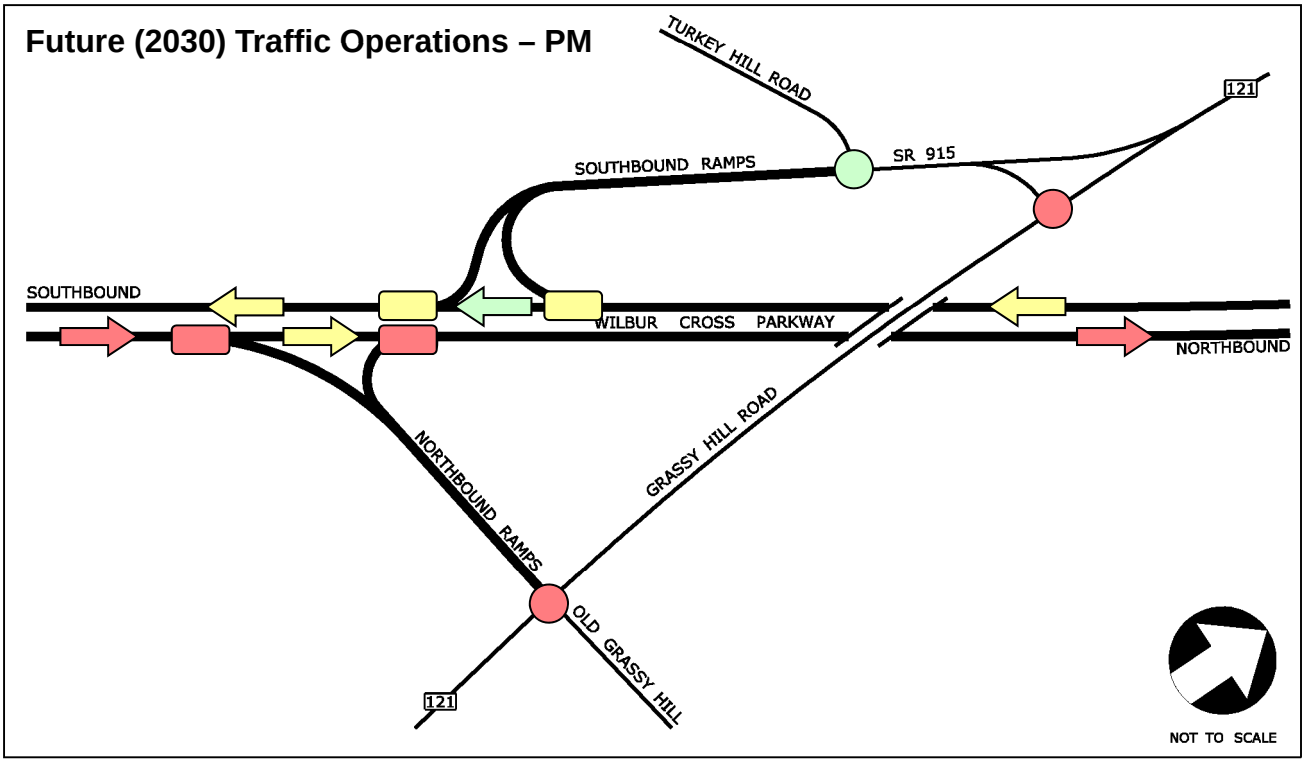
Figure 56-6.
AM Traffic Operations Summary:
Interchange 56





LOS	Intersection	Mainline	Merge/Diverge
A-B			
C-D			
E-F			

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 56-7.
PM Traffic Operations Summary:
Interchange 56

Accidents and Safety

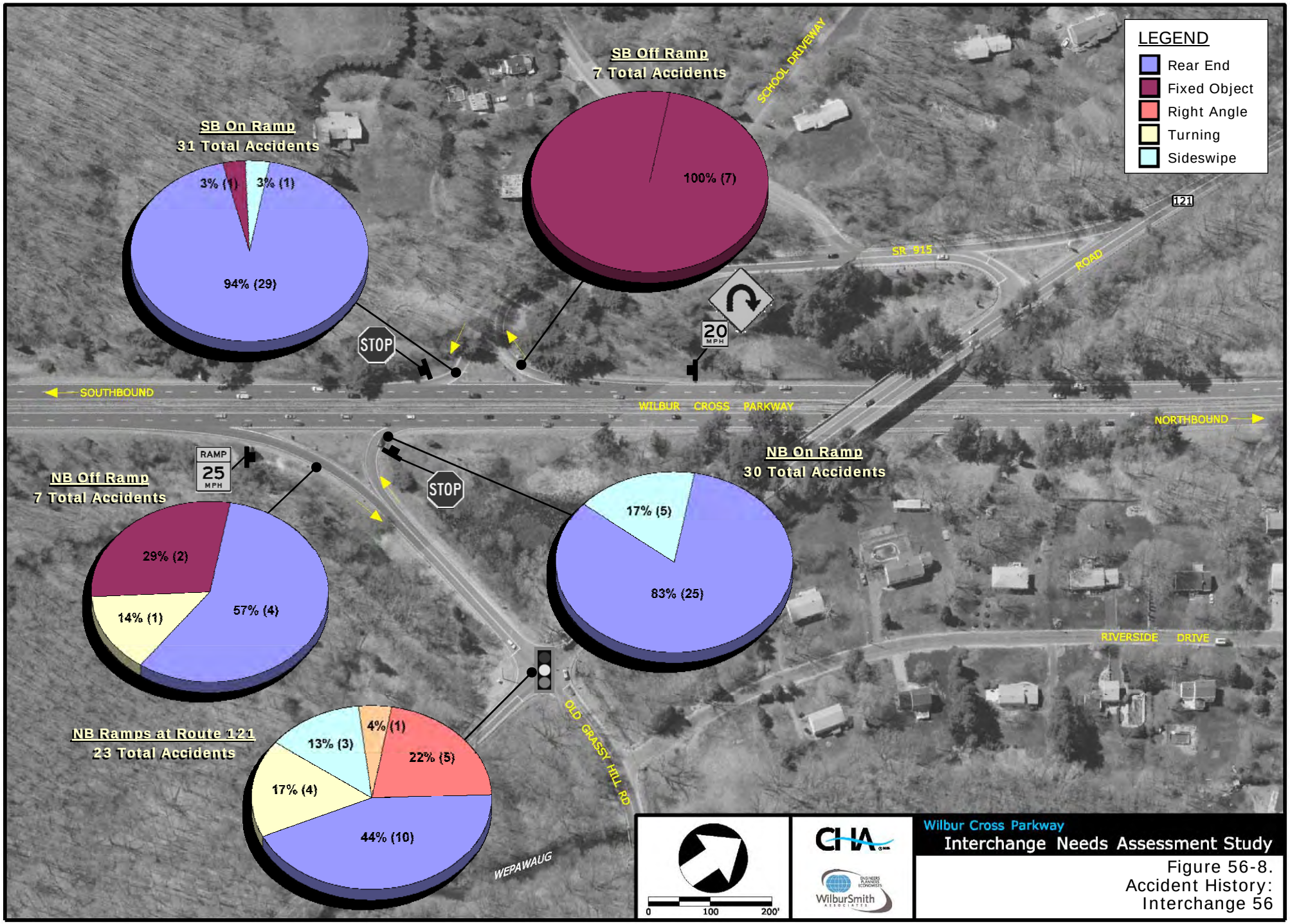
The study team obtained accident data from ConnDOT's *Traffic Accident Viewing System* (TAVS) for the three-year period beginning January 1, 2005 and ending December 31, 2007. The data shows that 99 accidents occurred in the interchange area during this period, the majority of which were rear-end accidents. Table 56-5 summarizes the types of collisions that occurred at various locations in the interchange area. Figure 56-8 illustrates the accident trends that have developed over the last few years at each of the interchange ramps.

The study team notes that Interchange 56 and the signalized intersection of Route 121/northbound ramps/Old Grassy Hill Road are considered *high accident locations*. By definition, a high accident location is one that has experienced an accident rate that is higher than expected based on accident rates for similar locations.

Table 56-5. Accident History: Interchange 56

Location	Collisions by Type						
	Rear End	Fixed Object	Side Swipe	Right Angle	Left Turn	Other	Total
Northbound							
Off Ramp	4	2	-	-	1	-	**7**
On Ramp	25	-	5	0	-	-	**30**
Southbound							
Off Ramp	-	7	-	-	-	-	**7**
Between Off and On Ramps	1	-	-	-	-	-	**1**
On Ramp	29	1	1	-	-	-	**31**
Secondary Roadway							
Route 121 at NB Ramps	10	-	3	5	4	1	**23**
Total Number	**69**	**10**	**9**	**5**	**5**	**1**	**99**
Percentage	**70%**	**10%**	**9%**	**5%**	**5%**	**1%**	**100%**

As shown in Table 56-5, the northbound and southbound on ramps experienced the highest number of collisions. The collisions at both of these on ramps were predominantly rear-end collisions, which the study team believes is a direct result of the *stop* condition and lack of acceleration lane that precedes the merge with mainline traffic. Stop conditions at the end of interchange ramps are not consistent with driver expectations for limited access facilities like the Wilbur Cross Parkway. Insufficient warning to drivers of such a condition; poor visibility of stopped vehicles by approaching drivers; and driver uncertainty and hesitation while attempting to enter a high volume and high speed corridor are all likely factors that contribute to the accident history on these ramps. In particular, the study team's field review of the northbound on ramp revealed that the visibility of the existing stop sign is obscured by roadside vegetation that obstructs sight lines from the ramp to the sign.


LEGEND
Rear End
Fixed Object
Right Angle
Turning
Sideswipe
SB On Ramp
31 Total Accidents
3% (1)
3% (1)
94% (29)
SB Off Ramp
7 Total Accidents
100% (7)
SCHOOL DRIVEWAY
SR 915
ROAD
121
STOP
20 MPH
SOUTHBOUND
WILBUR CROSS PARKWAY
NORTHBOUND
NB Off Ramp
7 Total Accidents
RAMP
25 MPH
29% (2)
14% (1)
57% (4)
STOP
NB On Ramp
30 Total Accidents
17% (5)
83% (25)
RIVERSIDE DRIVE
NB Ramps at Route 121
23 Total Accidents
4% (1)
13% (3)
22% (5)
17% (4)
44% (10)
OLD GRASSY HILL RD
WEPAWAUG
0
100
200'
CHA
WilburSmith
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 56-8.
Accident History:
Interchange 56

Other notable accident trends illustrated in Table 56-5 and Figure 56-8 include:

- 22% of accidents on Route 121 at the signalized intersection of the northbound ramps and Old Grassy Hill Road were right angle collisions. This type of accident indicates that traffic coming on and off the ramps is not clearing the intersection prior to Route 121 traffic entering the intersection, and vice versa. The traffic signal timing plan for this intersection indicates that the all-red clearance interval is 0.5 seconds, which the study team notes is probably not sufficient to clear vehicles that run the red light prior to the opposing signal turning green.
- 57% of accidents on Route 121 at the signalized intersection of the northbound ramps and Old Grassy Hill Road were either rear-end or side-swipe collisions. The lack of left turn lanes on Route 121 and limited room for vehicles to bypass left turning vehicles could be contributing to this accident history.
- 100% of accidents on the southbound off ramp are fixed object collisions. This type of accident indicates that motorists are running off the roadway in this area and colliding with guide rail, signs, trees, and other roadside objects. The study team notes that this trend is likely a function of the non-standard curvature and design speed of the off ramp, which motorists tend to misjudge and exit the roadway at speeds too high to maintain control on the curve.

In addition to the safety issues that the study team has identified through analysis of the recent accident data, input received from the Town indicated the following safety concern at Interchange 56:

- Location of large, Route 15 green guide signs located within the gore area at the SR 915/Route 121 intersection can obstruct sight lines to the north along Route 121 for motorists, particularly for bus drivers, on the SR 915 approach to the intersection. The study team notes that bus traffic is frequent at this intersection due to the school located on Turkey Hill Drive.

Recommended Improvement Plan

The study team worked with the Town of Orange, ConnDOT, SCRCOG, and other stakeholders to develop and refine a set of near-term, mid-term, and long-term improvement plans to address the identified deficiencies and needs at Interchange 56. The recommended improvement plans are detailed and illustrated below along with discussion regarding other design and implementation considerations. Also included are summaries of constraints, impacts, and estimated construction costs.

Near-term Improvement Plan (Figure 56-9)

Northbound:

- Relocate existing 25 mph ramp advisory speed sign for off ramp to improve visibility of sign and to provide motorists a greater advance warning of ramp speed condition.
- Provide stop ahead warning sign along on ramp to provide adequate advance warning of stop condition.
- Provide stop signs on the left and right sides of the on ramp at the mainline junction to improve the visibility of the stop condition.
- Clear existing trees on the right side of the on ramp to improve visibility of stop signs.

Near, Mid, and Long-term Definitions

Near-term:

- Implementation period of 1 to 3 years.
- Includes low cost improvements such as signing and striping improvements, existing signal timing modifications, tree clearing, etc.

Mid-term:

- Implementation period of 3 to 10 years.
- Includes acceleration and deceleration lane improvements, new turn lanes, new traffic signals, and minor ramp modifications that could be implemented with little or no impacts to rights-of-way, environmental features, or existing bridge structures.

Long-term:

- Implementation period greater than 10 years.
- Includes higher-cost improvements that could significantly impact existing bridge structures, rights-of-way, or environmental features.

Southbound:

- Provide 20 mph ramp advisory speed sign for off ramp on north side of Route 121 overpass to maximize visibility of sign and to provide motorists a greater advance warning of ramp speed condition.
- Provide stop ahead warning sign along on ramp to provide adequate advance warning of stop condition.
- Provide stop signs on the left and right sides of the on ramp at the mainline junction to improve the visibility of the stop condition.

Route 121

- Increase all-red interval at intersection of northbound ramps, Route 121 & Old Grassy Hill Road to address the relatively high occurrence of right angle collisions at this intersection.
- Relocate Route 15 guide sign from gore area at SR 915/Route 121 intersection to the north on Route 121, adjacent to channelized right turn lane to SR 915 to improve sight lines from the SR 915 approach to Route 121. Clear existing trees to provide adequate visibility of relocated sign.

Mid-term Improvement Plan (Figure 56-10)

Northbound:

- Provide auxiliary lane between the on ramp for Orange Service Area and the off ramp for Interchange 56 due to the proximity of these ramps. The study team notes that deceleration lane improvements to the northbound off ramp could be implemented as an interim improvement prior to providing a full northbound auxiliary lane at this location. However, given the need for acceleration lane improvements to the northbound on ramp from the Orange Service Area (see *Orange Service Areas* section) and the existence of no significant constraints to providing the auxiliary lane, the study team recommends completing the full auxiliary lane with no interim improvement to the Interchange 56 off ramp.
- The study team notes that due to the proximity of the Route 121 bridge structure over the Parkway, it is not feasible in the mid-term to remove the existing stop condition from the northbound on ramp by providing an acceleration lane. Only a limited northbound acceleration lane could be provided between the existing ramp and the bridge; the study team believes that the acceleration length that could be provided in this area would be insufficient to warrant removal of the stop condition. Furthermore, the study team believes that unless the stop condition can be removed in favor of an adequate acceleration lane, there would likely not be a substantial reduction in the number of rear-end accidents at this location.

Southbound:

- Provide auxiliary lane between on ramp for Interchange 56 and off ramp for Orange Service Area due to the proximity of these ramps. The study team notes that acceleration lane improvements to the southbound on ramp could be implemented as an interim improvement prior to providing a full southbound auxiliary lane at this location. However, given the need for deceleration lane improvements to the southbound off ramp to the Orange Service Area (see *Orange Service Areas* section) and the existence of no significant constraints to providing the auxiliary lane, the study team recommends completing the full auxiliary lane with no interim improvement to the Interchange 56 on ramp.

- Realign on ramp to provide standard ramp curvature.
- Improve off ramp deceleration length within the constraints imposed by the existing Route 121 bridge structure. The improvement will accommodate deceleration from 45 mph to 25 mph which will reduce the amount of deceleration required in traffic on the mainline. Consider providing dynamic curve warning system to better alert motorists to non-standard ramp curvature and slow ramp speed. See appendix for dynamic curve warning system details.

Route 121

- Provide left turn lanes on all approaches to the intersection of Route 121 with the northbound ramps and Old Grassy Hill Road. Left turn lanes will improve intersection operations and will help improve safety by removing left turning vehicles from the through traffic stream. This is particularly important on Route 121 where rear-end accidents are an issue.

The study team investigated two feasible long-term improvement plans for Interchange 56 that differ in how a northbound on ramp acceleration lane would be accommodated. The study team suggests that both plans could be advanced to subsequent planning stages as viable alternatives, though initial reaction from the public received at the May 2009 public meeting in Orange showed strong opposition to Plan A, which would have more significant impacts to properties along Riverside Drive than Plan B. Additionally, the study team believes that although both plans would function adequately, Plan B would likely have greater long-term sustainability relative to traffic operations.

Long-term Improvement Plan A (Figure 56-11)

Northbound:

- Relocate on ramp to east side of Route 121 to eliminate existing stop-controlled approach to mainline and to provide diamond ramp configuration with standard acceleration length. Create a new unsignalized intersection of northbound on ramp and Route 121. Maintain signalized intersection of northbound off ramp, Route 121 and Old Grassy Hill Road, but modify signal to reflect relocation of the on ramp.

Southbound:

- Relocate off ramp to east side of Route 121 to eliminate non-standard ramp curvature and to provide diamond ramp configuration with standard deceleration length. Signalize intersection of SR 915, Route 121, and southbound off ramp.

Route 121:

- Provide southbound left turn lane at unsignalized intersection to relocated northbound on ramp. Turn lane could be provided by re-striping existing roadway and utilizing existing shoulder width; no bridge widening would be required.

- Improve intersection of SR 915 and Route 121 in conjunction with relocating southbound off ramp. Provide northbound left turn lane and southbound right turn lane to SR 915. Southbound right turn lane would eliminate existing high-speed right slip lane to SR 915. Left turn lane could be provided by re-striping existing roadway and utilizing existing shoulder width; no bridge widening would be required.

Long-term Improvement Plan B (Figure 56-12)

Northbound:

- Provide standard acceleration length for the on ramp by realigning the ramp and constructing a cut-and-cover tunnel south of the Route 121 bridge structure to convey the northbound on ramp under Route 121. Maintain signalized intersection of northbound off ramp, Route 121 and Old Grassy Hill Road.

Southbound:

- Similar to Plan A, relocate off ramp to east side of Route 121 to eliminate non-standard ramp curvature and to provide diamond ramp configuration with standard deceleration length. Signalize intersection of SR 915, Route 121, and southbound off ramp.

Route 121:

- Similar to Plan A, improve intersection of SR 915 and Route 121 in conjunction with relocating southbound off ramp. Provide northbound left turn lane and southbound right turn lane to SR 915. Southbound right turn lane would eliminate existing high-speed right slip lane to SR 915. Left turn lane could be provided by re-striping existing roadway and utilizing existing shoulder width; no bridge widening would be required.

Other Considerations

- The Route 121 bridge structure over Route 15 is a major constraint to cost-effectively improving the northbound on ramp/acceleration lane and southbound off ramp/deceleration lane. The bridge was rehabilitated in 1990 and has a sufficiency rating of 79, which indicates that the bridge is in good condition and will not likely require major reconstruction for some time. The project team evaluated an alternative improvement concept that would require reconstruction of the bridge to provide sufficient lateral clearance under the bridge to accommodate a northbound acceleration lane and a southbound deceleration lane and retain the ramps in their existing locations. Because major reconstruction/replacement of the bridge would be more expensive than Plan A or Plan B, it is recommended that this alternative only be considered if the other improvements have not yet been implemented at such time the bridge requires major reconstruction/replacement. The estimated construction cost for replacing the bridge is approximately $6.4 million (2009 $).

- The alignment of the southbound on ramp shown in long-term Plans A and B reflects a potential opportunity to relocate the ramp slightly north to maximize the length of the southbound auxiliary lane. Alternatively, the alignment of the southbound on ramp that is shown for the mid-term improvement could be retained in either long-term plan.
- The Connecticut Department of Transportation's Project Development Unit recently conducted an independent study of Interchange 56 that included several improvement concepts other than those developed for this study. One of the concepts developed by ConnDOT considered combining improvements at Interchange 56 with relocated service areas in Orange. The recommendations of this study should continue to be coordinated with ConnDOT's work at this interchange.
- The geometric requirements of all intersection improvements will be further evaluated and refined through subsequent stages of planning and design.
- The long-term realignment of the southbound on ramp will be contingent upon the relocation of the southbound off ramp and will require the removal of the mid-term improvement to the southbound deceleration lane.

Constraints, Limitations and Impacts

- Mid-term southbound deceleration lane improvements are constrained by the Route 121 bridge structure. These improvements should be considered an interim improvement to the future relocation of the southbound off ramp.
- An existing culvert along the southbound auxiliary lane could require modification due to potential grading impacts.
- Rock excavation will be required for the construction of the southbound auxiliary lane.
- Long-term ramp relocations could require that new culverts be constructed to convey the existing watercourse north of Route 121 under the two relocated ramps. The watercourse currently runs through a culvert under Route 15.
- A retaining wall could be required between Route 15 and a relocated southbound off ramp due to grade differences between the ramp and mainline.
- **Potential Environmental Impacts:** Table 56-6 summarizes the potential wetland impacts associated with the mid and long-term improvement plans.
- **Potential Right-of-Way (ROW) Impacts:** Table 56-6 summarizes the potential ROW impacts associated with the mid and long-term improvement plans.

Table 56-6. Summary of Potential Impacts: Interchange 56

Improvement	ROW		Wetland Area
	Total Area (No. Parcels)	No. Full Acquisitions	
Mid-term Improvement Plan			
• SB auxiliary lane, on ramp, and deceleration lane improvements	0.12 ac (1)	0	0
• NB auxiliary lane improvements	0	0	0
• Route 121/NB ramps intersection improvements	0	0	Minor buffer
Long Term Improvement Plans			
• NB – Plan A	1.53 ac (3)	2	0.16 ac
• NB – Plan B	0.80 ac (2)	0	1.23 ac
• SB off ramp relocation; SB on ramp realignment	0.03 ac (1)	0	0.03 ac
• Route 121/SR 915 intersection improvements	0	0	0

As shown in Table 56-6, minor ROW impacts to one parcel are anticipated with the mid-term southbound on ramp and auxiliary lane improvements. Additionally, both long-term plans will require ROW acquisitions, with long-term Plan A likely requiring the full acquisition of two properties located on Riverside Drive. The study team notes that Riverside Drive residents who attended the public information meeting held in Orange in May 2009 were generally opposed to the relocation of the northbound on ramp under Plan A citing concerns over the acquisitions and the potential impact on property values along Riverside Drive.

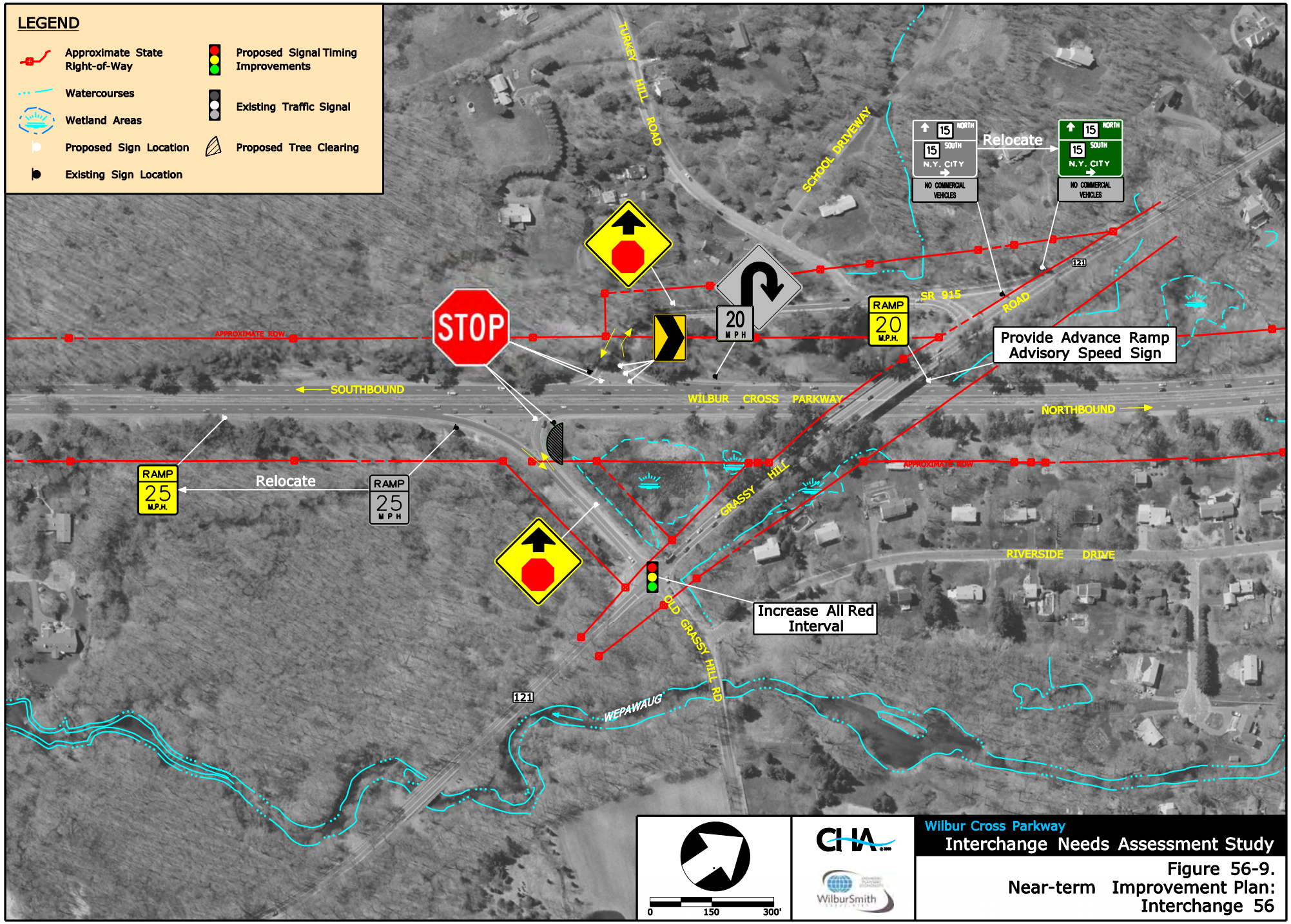
Some minor wetland buffer impacts could be associated with the mid-term improvements at the Route 121/northbound ramps intersection. Wetland impacts are anticipated with both long-term plans, though long-term Plan B would result in greater impact area. Additionally, both long-term plans would likely affect an existing watercourse/drainage ditch on the east side of Route 121 requiring new culverts to maintain existing drainage patterns in the area of the northbound on ramp and southbound off ramp improvements.

Estimated Construction Costs

The study team developed planning-level construction cost estimates for the near, mid, and long-term improvement plans at Interchange 56 in accordance with ConnDOT's guidelines for preliminary cost estimating dated January 2009. The planning-level costs shown in Table 56-6 are based on estimates of major construction items and do not include allowances for engineering or any potential right-of-way acquisitions, utility relocations, or environmental mitigation.

Table 56-7. Planning-level Construction Cost Estimates: Interchange 56

Improvement	Planning-level Costs		
	(2009 $)	Mid-term (2014 $)	Long-term (2024 $)
Near-term Improvement Plan			
• All signage improvements; tree clearing; Route 121/NB ramps signal timing improvements	$ 40,000	-	-
Mid-term Improvement Plan			
• SB auxiliary lane, on ramp, and deceleration lane improvements	$ 3.1 million	$ 4.1 million	-
• NB auxiliary lane improvements	$ 1.3 million	$ 1.7 million	
• Route 121/NB ramps intersection improvements	$ 700,000	$ 900,000	-
Long Term Improvement Plans			
• NB – Plan A	$ 1.3 million	-	$ 3.1 million
• NB – Plan B	$ 4.4 million	-	$ 10.5 million
• SB off ramp relocation; SB on ramp realignment	$ 2.1 million	-	$ 5.0 million
• Route 121/SR 915 intersection improvements	$ 260,000	-	$ 630,000


LEGEND
Approximate State Right-of-Way
Watercourses
Wetland Areas
Proposed Sign Location
Existing Sign Location
Proposed Signal Timing Improvements
Existing Traffic Signal
Proposed Tree Clearing
TURKEY HILL ROAD
SCHOOL DRIVEWAY
15 NORTH
15 SOUTH
N.Y. CITY
NO COMMERCIAL VEHICLES
Relocate
15 NORTH
15 SOUTH
N.Y. CITY
NO COMMERCIAL VEHICLES
121
STOP
20 M P H
RAMP
20
M.P.H.
SR 915
ROAD
Provide Advance Ramp Advisory Speed Sign
APPROXIMATE ROW
SOUTHBOUND
WILBUR CROSS PARKWAY
NORTHBOUND
RAMP
25
M.P.H.
Relocate
RAMP
25
M P H
GRASSY HILL
APPROXIMATE ROW
RIVERSIDE DRIVE
Increase All Red Interval
OLD GRASSY HILL RD
121
WEPAWAUG
0
150
300'
CHA
WilburSmith
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 56-9.
Near-term Improvement Plan:
Interchange 56

LEGEND

- Approximate State Right-of-Way
- Watercourses
- Wetland Areas
- Approximate Slope Limits
- Structures (Including Bridges, Retaining Walls, and Tunnels)
- Proposed Traffic Signal
- Existing Traffic Signal
- New Pavement Construction
- Existing Pavement to be Removed

Potential ROW Impacts

Improve Ramp Curvature

Improve Deceleration Length

Provide Auxiliary Lanes Between Interchange 56 and Service Areas

Provide Left Turn Lanes on All Approaches

SOUTHBOUND

WILBUR CROSS PARKWAY

NORTHBOUND

APPROXIMATE ROW

SR 915

ROAD

121

RIVERSIDE DRIVE

WEPAWAUG

0 100 200'

CHA

WilburSmith

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 56-10.
Mid-term Improvement Plan:
Interchange 56

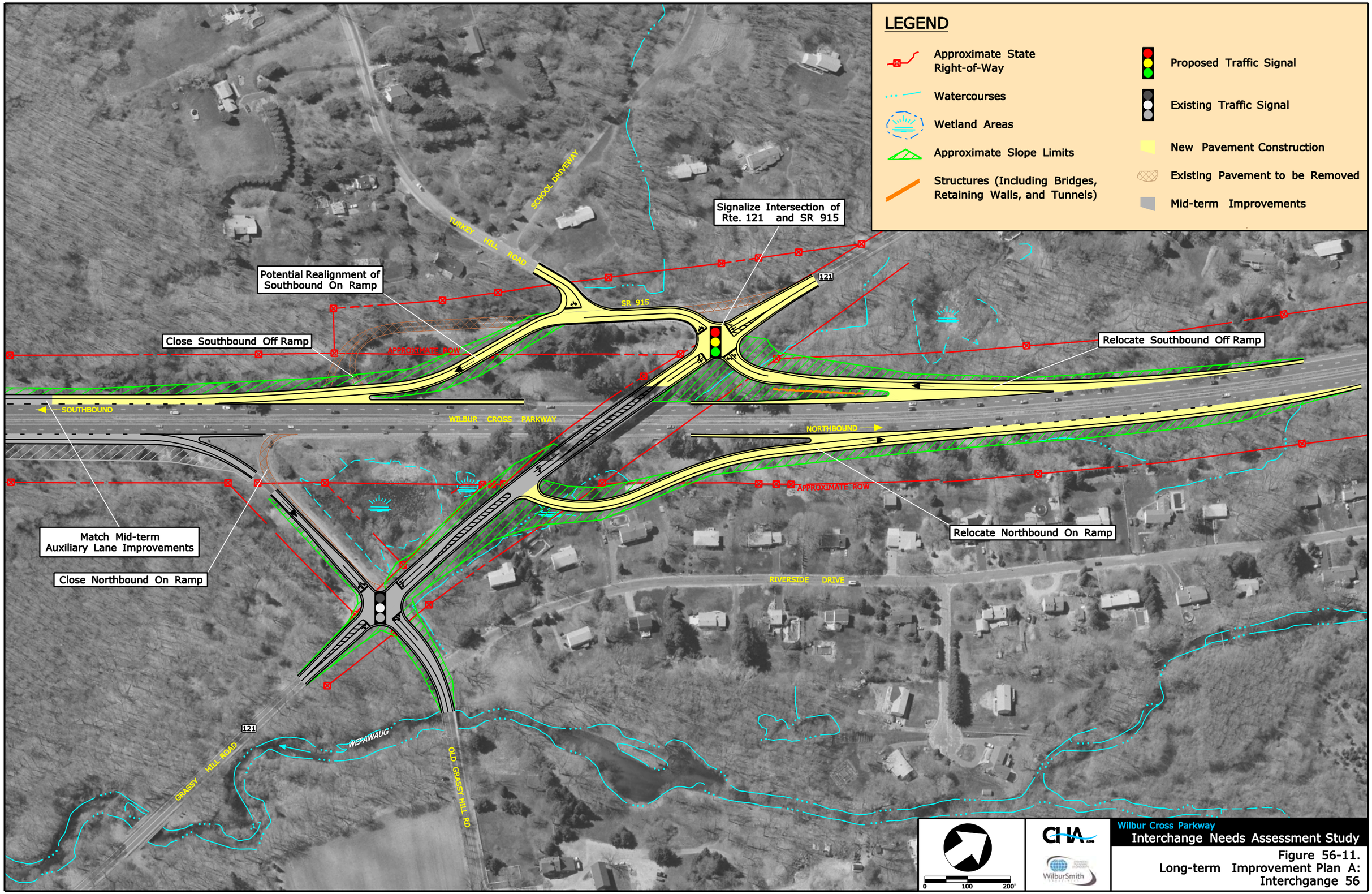

LEGEND
Approximate State Right-of-Way
Watercourses
Wetland Areas
Approximate Slope Limits
Structures (Including Bridges, Retaining Walls, and Tunnels)
Proposed Traffic Signal
Existing Traffic Signal
New Pavement Construction
Existing Pavement to be Removed
Mid-term Improvements
Signalize Intersection of Rte. 121 and SR 915
Potential Realignment of Southbound On Ramp
Close Southbound Off Ramp
Relocate Southbound Off Ramp
Match Mid-term Auxiliary Lane Improvements
Close Northbound On Ramp
Relocate Northbound On Ramp
TURKEY HILL ROAD
SCHOOL DRIVEWAY
SR 915
121
APPROXIMATE ROW
SOUTHBOUND
WILBUR CROSS PARKWAY
NORTHBOUND
RIVERSIDE DRIVE
GRASSY HILL ROAD
WEPAWAUG
OLD GRASSY HILL RD
0
100
200'
Wilbur Cross Parkway
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Figure 56-11.
Long-term Improvement Plan A:
Interchgange 56

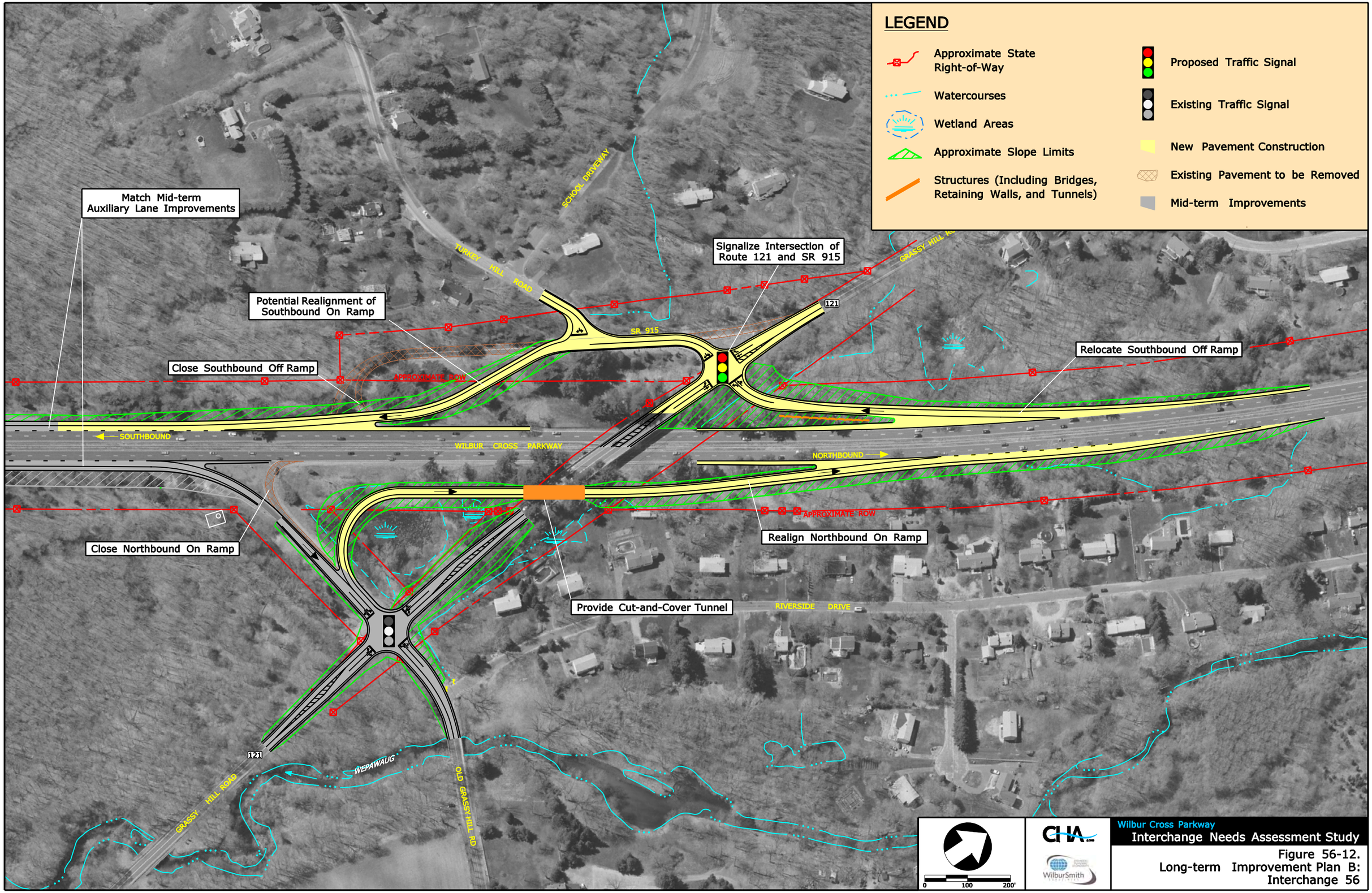
LEGEND
Approximate State Right-of-Way
Watercourses
Wetland Areas
Approximate Slope Limits
Structures (Including Bridges, Retaining Walls, and Tunnels)
Proposed Traffic Signal
Existing Traffic Signal
New Pavement Construction
Existing Pavement to be Removed
Mid-term Improvements
Match Mid-term Auxiliary Lane Improvements
Potential Realignment of Southbound On Ramp
Close Southbound Off Ramp
Signalize Intersection of Route 121 and SR 915
Relocate Southbound Off Ramp
Close Northbound On Ramp
Provide Cut-and-Cover Tunnel
Realign Northbound On Ramp
SCHOOL DRIVEWAY
TURKEY HILL ROAD
SR 915
121
APPROXIMATE ROW
SOUTHBOUND
WILBUR CROSS PARKWAY
NORTHBOUND
RIVERSIDE DRIVE
WEPAWAUG
GRASSY HILL ROAD
OLD GRASSY HILL RD
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Figure 56-12.
Long-term Improvement Plan B:
Interchange 56

Interchange 60

In Brief

Location: Town of Hamden
- 3.5 miles north of Interchange 59
- 1.4 miles south of Interchange 61

Access to: Route 10 (Dixwell Avenue)

Interchange 60 of the Wilbur Cross Parkway is located in the Town of Hamden and provides access to Route 10, Dixwell Avenue. The interchange serves commercial, residential, and institutional land uses in the immediate interchange area and along Route 10 to the north and south. Interchange 60 is also the primary access point for southbound traffic destined for New Haven and Southern Connecticut State University located approximately three miles south on Route 10.

Originally constructed in the mid to late 1940s, Interchange 60 was most recently improved in 1995 to reconfigure the northbound ramps, improve the mainline, and provide acceleration and deceleration lanes for the ramp-mainline junctions.

The current configuration consists of a northbound off ramp that diverges from the mainline in a taper-type exit and terminates at Route 10 opposite the northbound on ramp. From its intersection with Route 10, the northbound on ramp continues up a 5% grade and merges with the mainline with a parallel acceleration lane.

The southbound off ramp also diverges from the mainline in a taper-type exit and loops approximately 180 degrees before terminating at Route 10. The southbound on ramp runs parallel to the off ramp near Route 10 before curving to merge with the mainline with a parallel acceleration lane.

The Parkway in the interchange area consists of two travel lanes in the northbound and southbound directions separated by a narrow median and concrete barrier curb. The typical lane and shoulder configuration includes 11 ft wide lanes, 3 ft to 11 ft wide left shoulders, and 8 ft to 10 ft wide right shoulders.

The study area, as shown in Figure 60-1, includes the interchange ramps, the junctions of these ramps with the Wilbur Cross Parkway, and the following intersections:

- Northbound ramps at Route 10 (signalized)
- Southbound ramps at Route 10 (signalized)
- Route 10 at Connolly Parkway (signalized)

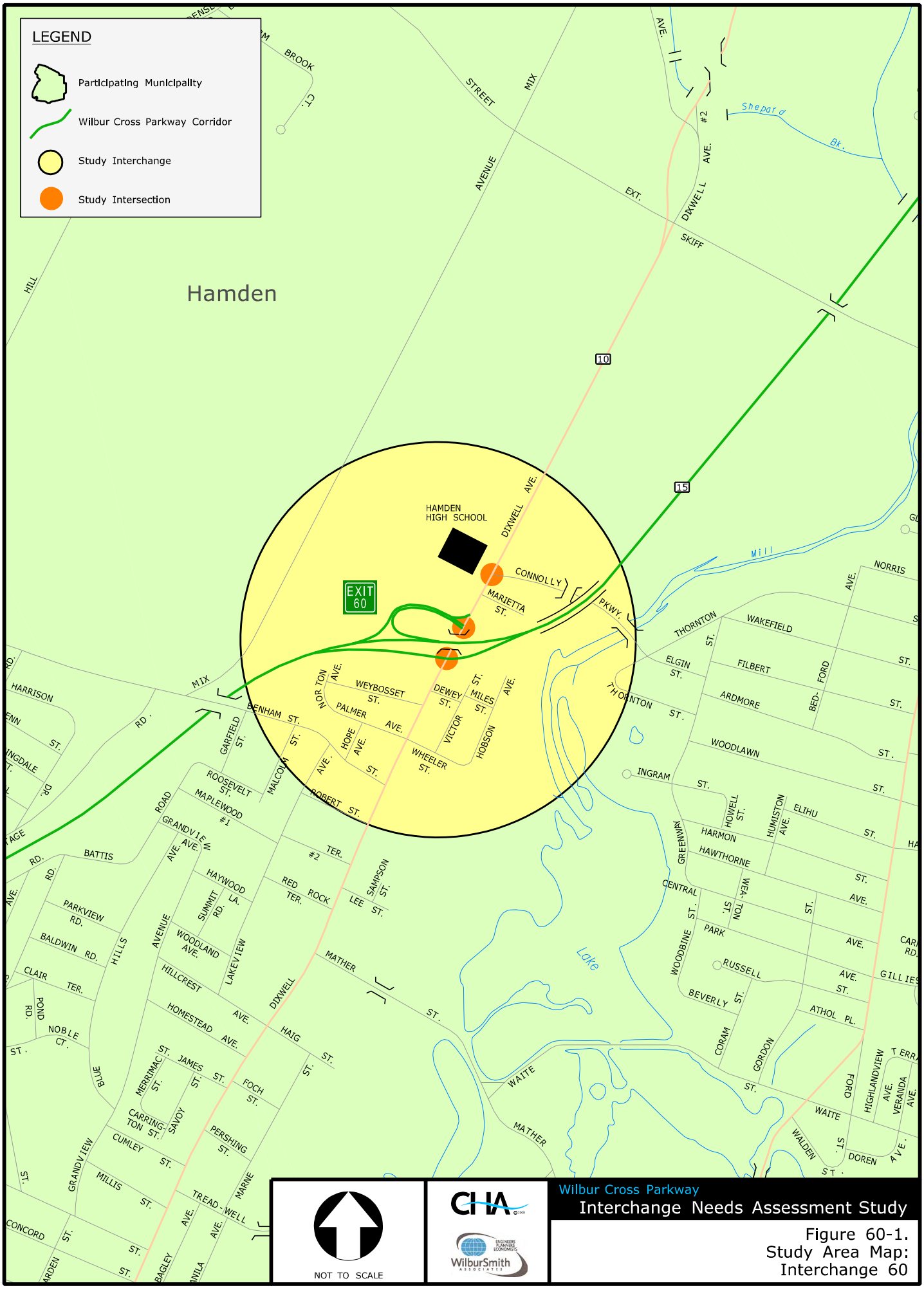
LEGEND
Participating Municipality
Wilbur Cross Parkway Corridor
Study Interchange
Study Intersection
Hamden
HAMDEN HIGH SCHOOL
EXIT 60
CONNOLLY
MARIETTA ST.
DIXWELL AVE.
PKWY.
10
15
MIX AVE.
BENHAM ST.
WEYBOSSET ST.
PALMER AVE.
WHEELER ST.
DEWEY ST.
VICTOR ST.
MILES ST.
HOBSON AVE.
NORTON AVE.
HOPE AVE.
ROBERT ST.
GARFIELD ST.
MALCOLM ST.
ROOSEVELT ST.
MAPLEWOOD #1
GRANDVIEW AVE.
HAYWOOD LA.
SUMMIT RD.
RED ROCK TER.
SAMPSON ST.
LEE ST.
WOODLAND AVE.
LAKEVIEW AVE.
HILLCREST AVE.
HOMESTEAD AVE.
MATHER ST.
HAIG ST.
JAMES ST.
FOCH ST.
MERRIMAC ST.
CARRINGTON ST.
SAVOY ST.
PERSHING ST.
CUMLEY ST.
MILLIS ST.
TREADWELL AVE.
MARNE AVE.
BAGLEY AVE.
CONCORD ST.
GRANDVIEW ST.
BLUE HILLS AVENUE
PARKVIEW RD.
BALDWIN RD.
CLAIR TER.
POND RD.
NOBLE CT.
BATTIS RD.
HARRISON RD.
THORNTON ST.
WAKEFIELD ST.
ELGIN ST.
FILBERT ST.
ARDMORE ST.
WOODLAWN ST.
INGRAM ST.
HARMON ST.
HAWTHORNE ST.
CENTRAL AVE.
PARK AVE.
RUSSELL ST.
BEVERLY ST.
ATHOL PL.
CORAM ST.
GORDON ST.
WAITE ST.
MATHER ST.
WALDEN ST.
DOREN AVE.
HIGHLANDVIEW AVE.
VERANDA AVE.
FORD ST.
NORRIS AVE.
BEDFORD ST.
HOWELL ST.
HUMISTON AVE.
ELIHU ST.
WOODBINE ST.
MEADOW ST.
GREENWAY
Lake
Mill
Shepard Bk.
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Figure 60-1.
Study Area Map:
Interchange 60

Needs and Deficiencies Assessment

Roadway Geometry

For this study, the critical geometric characteristics of the Wilbur Cross Parkway and its interchanges are those that are closely related to vehicular safety. These critical geometric characteristics include deceleration lane lengths; acceleration lane lengths; and ramp curvatures and speeds. The study team determined the existing geometric characteristics of Interchange 60 and compared them to the minimum design standards obtained from ConnDOT's *Highway Design Manual 2003 Edition* (HDM).

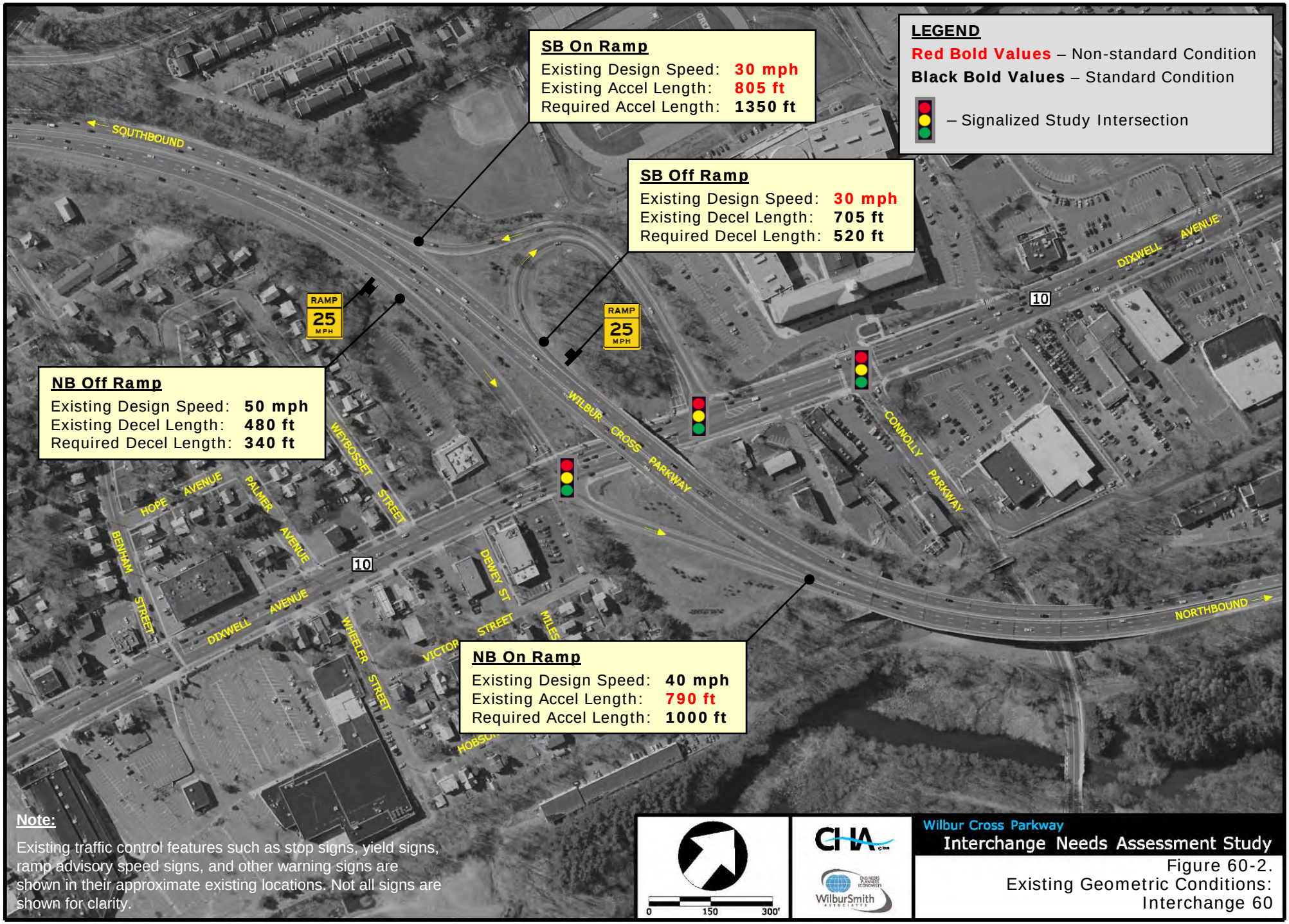
The results of the existing geometric conditions assessment are summarized in Table 60-1 and illustrated in Figure 60-2. Non-standard conditions, or deficiencies, are noted in bold red text in the table and figure.

Table 60-1. Existing Geometric Conditions Summary: Interchange 60

Location	Ramp		Acceleration/Deceleration Lanes		Other Notes
	Curve Radius	Design Speed	Existing Length	Required Length	
Northbound					
Off Ramp	1300 ft	50 mph	480 ft	340 ft	-
On Ramp	>1000 ft	40 mph	**790 ft**	1000 ft	Non-standard Taper
Southbound					
Off Ramp	**280 ft**	**30 mph**	705 ft	520 ft	-
On Ramp	**280 ft**	**30 mph**	**805 ft**	1350 ft	-

As shown in Table 60-1, the following geometric conditions are deficient:

- **Northbound Acceleration Lane:** Insufficient acceleration lane length exists to accommodate full acceleration to mainline speeds prior to merging. Acceleration lane ends in a non-standard, 230 ft long taper.
- **Southbound Off Ramp:** Ramp curvature and 30 mph design speed are non-standard, though sufficient deceleration lane length is provided to accommodate deceleration from mainline to ramp speeds.
- **Southbound On Ramp and Acceleration Lane:** Ramp curvature and 30 mph design speed are non-standard. Insufficient acceleration lane length exists to accommodate full acceleration to mainline speeds prior to merging. It is noted that the Benham Street overpass is located immediately downstream of the acceleration lane taper and poses a constraint to providing standard acceleration lane length.



Note:

Existing traffic control features such as stop signs, yield signs, ramp advisory speed signs, and other warning signs are shown in their approximate existing locations. Not all signs are shown for clarity.

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Figure 60-2.
Existing Geometric Conditions:
Interchange 60

Traffic Conditions

The study team compiled traffic data for Interchange 60 that included average daily traffic (ADT) volumes, existing (2008) weekday and Saturday peak hour traffic volumes, and estimated future (2030) weekday and Saturday peak hour traffic volumes. This data was used as the basis for assessing traffic conditions on the mainline Wilbur Cross Parkway (WCP), at the interchange ramp junctions, and at key secondary roadway intersections. Figure 60-3 illustrates the most recent (2006) ADT volumes that were collected by ConnDOT at Interchange 60.

Figure 60-3. 2006 Average Daily Traffic Volumes (in vehicles per day, vpd): Interchange 60

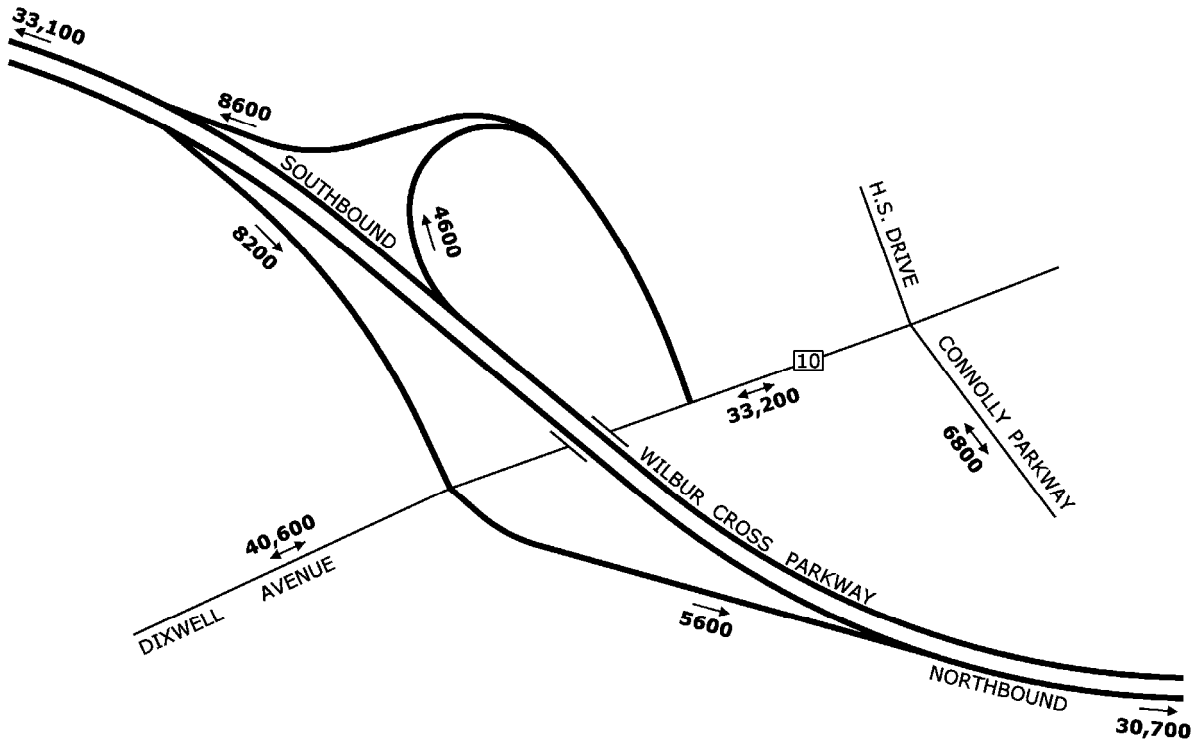

Figure 60-4 presents the 2008 weekday peak hour traffic volumes for the morning (AM) and afternoon (PM) peak commuting periods. The study team worked with ConnDOT's traffic forecasting unit to develop these volumes from intersection turning movement counts obtained by SCRCOG and available traffic data for Interchange 60 provided by ConnDOT.

Figure 60-5 presents the estimated 2030 weekday peak hour traffic volumes that were developed by ConnDOT's traffic forecasting unit. These volumes reflect an increase in traffic at Interchange 60 that is primarily a function of regional background traffic growth. It should be noted that the Town of Hamden is currently revising the Town's zoning regulations to allow greater development densities along Route 10 and Whitney Avenue. Because of the mixed-use nature of the potential infill development in these areas, the Town anticipates that the future traffic generated by these potential developments will be accounted for as a component of background traffic growth.

Saturday midday peak hour traffic volumes for 2008 and 2030 are provided in the appendix.

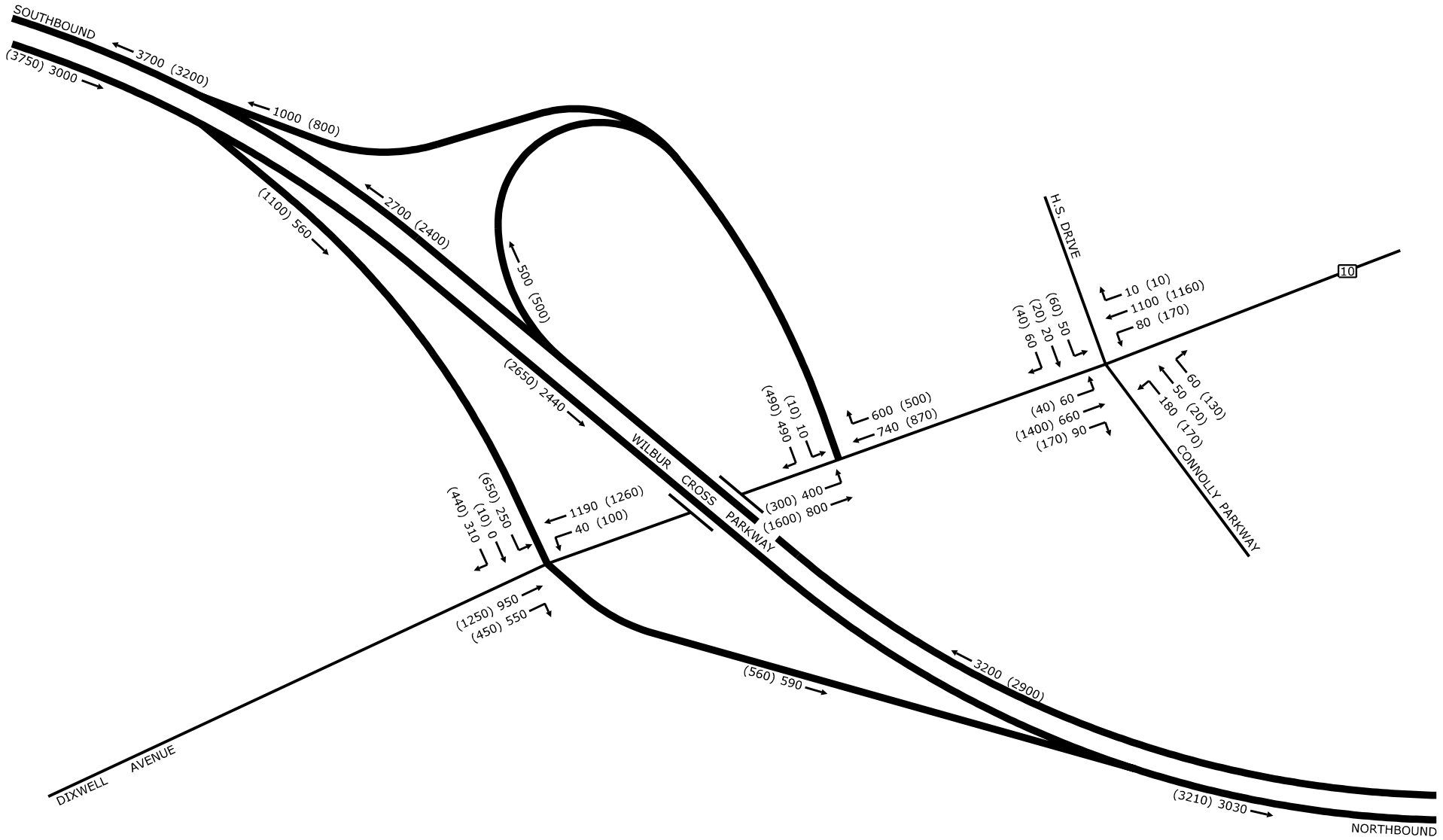

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Figure 60-4.
Existing (2008) Peak Hour Volumes:
Interchange 60

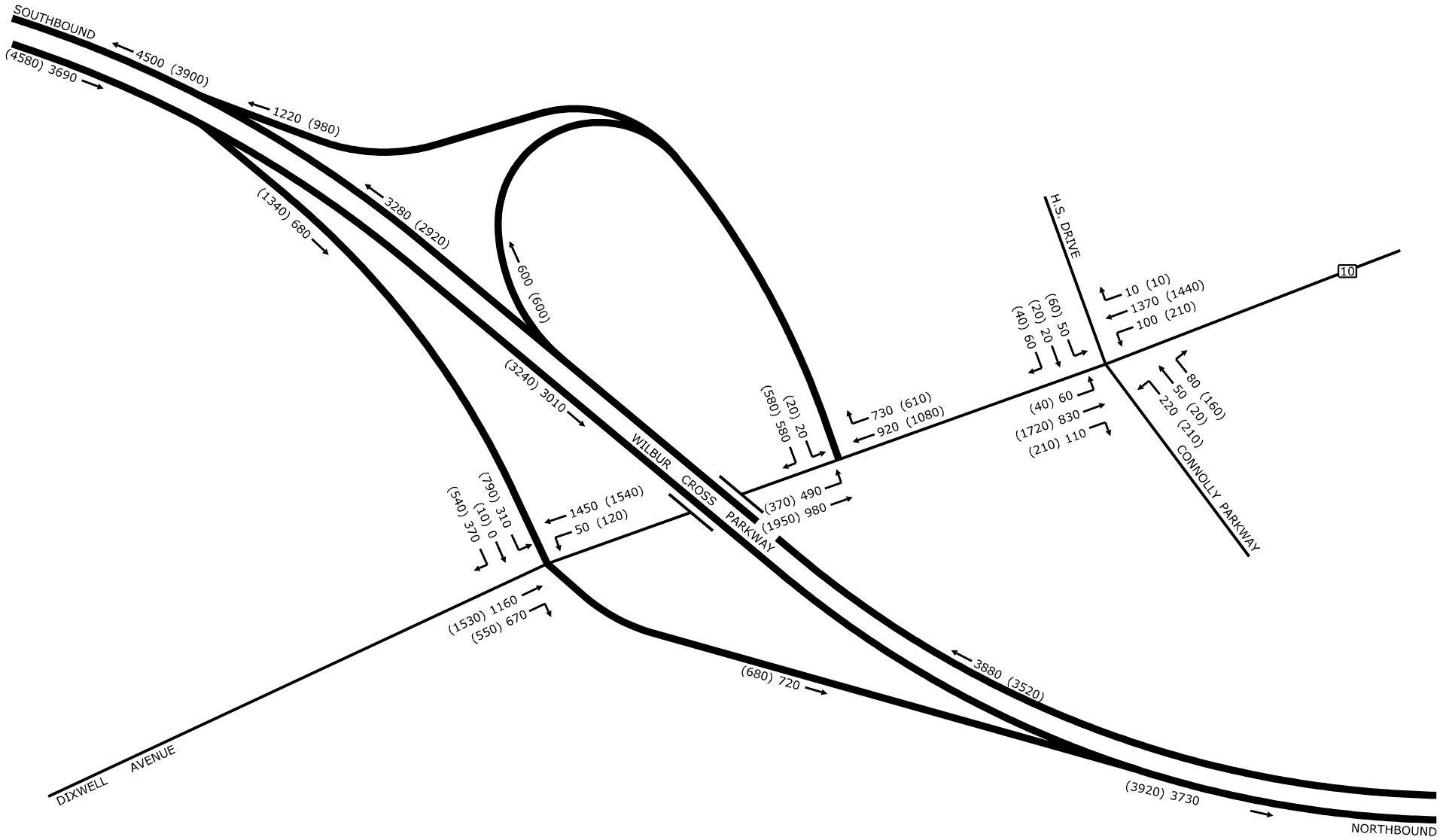

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Figure 60-5.
Future (2030) Peak Hour Volumes:
Interchange 60

The notable traffic conditions presented in Figures 60-3, 60-4, and 60-5 include:

- Highest daily ramp volumes occur on the southbound on ramp and northbound off ramp
- Lowest daily ramp volumes occur on the southbound off ramp
- Approximately 53% of WCP traffic is traveling southbound in the morning
- Approximately 53% of WCP traffic is traveling northbound in the afternoon
- Overall traffic growth by 2030 is estimated to be approximately 22%, or 0.9% annually

Traffic Operations

The study team analyzed the operations of the mainline segments, ramp junctions, and intersections in the Interchange 60 study area. The analyses were conducted for the weekday AM and PM peak hours under the 2008 and estimated 2030 traffic conditions. The results of the analyses, which are reported as Levels of Service (LOS), are presented below in tabular form and illustrated in Figures 60-6 and 60-7. The analyses were also conducted for the Saturday midday peak hour; the results of the Saturday analyses are presented in the appendix.

As described in the *Needs Assessment Overview* section, LOS D or better represents an acceptable degree of congestion for mainline segments, ramp junctions, and intersections. LOS E and F, which are indicated in red in the tables and figures, represent unacceptable degrees of congestion. Locations operating at LOS E and F are highlighted in this report to indicate locations where traffic capacity and operational issues exist, or could exist under future traffic.

Mainline

Table 60-2. Mainline Operations Summary: Interchange 60

Direction	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
Northbound				
South of Interchange 60	C (24.1)	D (32.1)	D (33.0)	F ([2])
Between Interchange 60 Ramps	C (19.4)	C (24.2)	C (21.1)	D (26.5)
North of Interchange 60	C (24.4)	D (32.7)	D (26.2)	E (35.9)
Southbound				
North of Interchange 60	D (26.1)	E (35.2)	C (23.2)	D (29.8)
Between Interchange 60 Ramps	C (21.6)	D (27.0)	C (19.0)	C (23.4)
South of Interchange 60	D (32.3)	F ([2])	D (26.1)	E (35.5)

[1] Mainline density is reported in passenger cars per hour per lane (pc/h/ln).
[2] Density results are not computed when mainline free flow speed is less than 55 mph.

The mainline analysis shows that all mainline segments currently operate at LOS C and D during both the AM and PM peak hours. The lower levels of service in the southbound direction in the AM and in the northbound direction in the PM reflect the predominant direction of travel during the respective peak hours. Mainline operations deteriorate under 2030 traffic conditions resulting in congested conditions upstream and downstream of the interchange in the southbound direction in the AM and the northbound direction in the PM. Operations are also congested downstream of the interchange in the southbound direction in the PM. LOS F indicates that the mainline segment is expected to be over capacity.

Ramp Junctions

Table 60-3. Ramp Merge/Diverge Operations Summary: Interchange 60

Direction	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
Northbound				
Off Ramp to Route 10	D (28.6)	E (35.2)	E (35.8)	F (43.7)
On Ramp from Route 10	C (26.5)	D (32.5)	D (28.1)	D (34.2)
Southbound				
Off Ramp to Route 10	D (28.5)	D (35.0)	C (25.6)	D (31.5)
On Ramp from Route 10	D (32.0)	F[2] (38.8)	C (27.8)	D (33.7)

[1] Ramp junction density is reported in passenger cars per hour per lane (pc/h/ln).
[2] LOS F in the ramp merge area is a result of the downstream mainline segment being over capacity (LOS F).

The ramp analysis shows that the northbound and southbound ramp junctions generally operate at LOS C and D during the AM and PM peak hours with the exception of the northbound off ramp to Route 10, which operates at LOS E during the PM peak hour. Levels of service are reduced under 2030 traffic conditions resulting in LOS E and F at the northbound off ramp during the AM and PM peak hours. The southbound on ramp merge is also LOS F during the AM peak hour due to the downstream mainline segment being over capacity.

Intersections

The study team analyzed traffic operations at the following intersections:

- **Northbound Ramps at Route 10:** Signalized, four-legged intersection. Northbound ramps are oriented in an east-west direction; Route 10 is oriented in a north-south direction. The eastbound approach on the northbound off ramp consists of two exclusive left turn lanes and an exclusive right turn lane. The northbound approach on Route 10 consists of two travel lanes and an exclusive right turn lane to the northbound on ramp; the southbound approach consists of two travel lanes and an exclusive left turn lane to the northbound on ramp.

- **Southbound Ramps at Route 10:** Signalized, T-intersection. Southbound ramps are oriented in an east-west direction; Route 10 is oriented in a north-south direction. The eastbound approach on the southbound off ramp consists of two exclusive left turn lanes and an exclusive right turn lane. The northbound approach on Route 10 consists of two travel lanes and an exclusive left turn lane to the southbound on ramp; the southbound approach consists of two travel lanes and an exclusive right turn lane to the southbound on ramp.

- **Route 10 at Connolly Parkway:** Signalized, four-legged intersection with Hamden High School drive. Connolly Parkway and high school drive are oriented in an east-west direction; Route 10 is oriented in a north-south direction. The westbound approach on Connolly Parkway consists of exclusive left and right turn lanes. The eastbound approach on the high school drive consists of a shared right-through lane and an exclusive left turn lane. The northbound approach on Route 10 consists of two travel lanes and an exclusive left turn lane; the southbound approach consists of three travel lanes and an exclusive left turn lane.

Results of the intersection analysis are presented in Table 60-4.

Table 60-4. Intersection Operations Summary: Interchange 60

Intersection / Approach	AM LOS (Delay[1])		PM LOS (Delay[1])	
	2008	2030	2008	2030
NB Ramps at Route 10				
Eastbound – NB Off Ramp	C (26.4)	C (29.2)	F (>80)	F (>80)
Northbound – Route 10	B (16.7)	B (14.2)	C (25.5)	E (60.6)
Southbound – Route 10	B (15.3)	B (16.5)	B (17.1)	B (20.8)
Overall	**B (18.4)**	**C (20.4)**	**D (50.8)**	**F (>80)**
SB Ramps at Route 10				
Eastbound – SB Off Ramp	B (19.9)	C (28.1)	C (23.5)	C (29.9)
Northbound – Route 10	B (19.3)	D (41.0)	E (76.9)	F (>80)
Southbound – Route 10	B (18.9)	D (41.0)	B (12.4)	B (15.8)
Overall	**B (19.2)**	**D (38.9)**	**D (46.4)**	**F (>80)**
Route 10 at Connolly Parkway				
Eastbound – High School Drive	C (25.5)	C (29.9)	D (48.0)	E (57.7)
Westbound – Connolly Parkway	E (67.1)	F (>80)	F (>80)	F (>80)
Northbound – Route 10	C (20.1)	C (24.9)	F (>80)	F (>80)
Southbound – Route 10	C (32.3)	C (34.5)	C (23.3)	C (27.8)
Overall	**C (32.0)**	**D (49.7)**	**F (>80)**	**F (>80)**

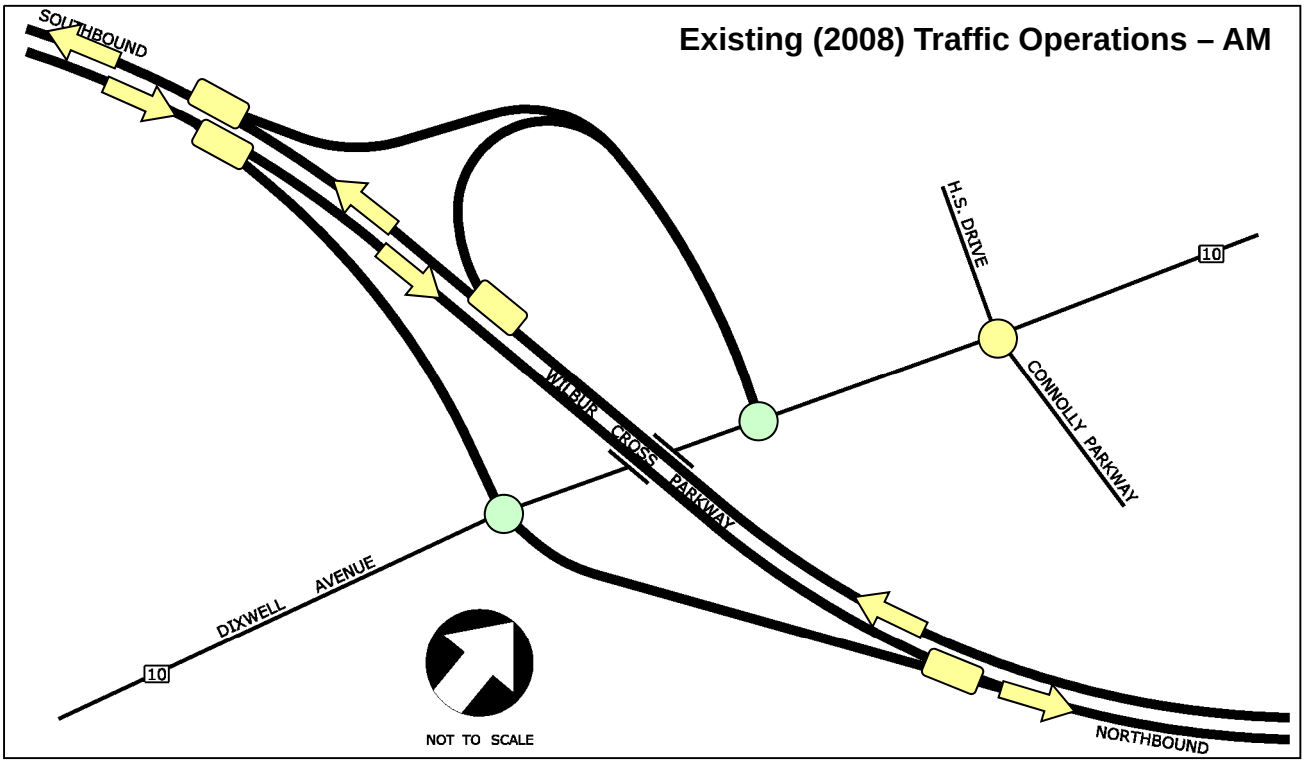
[1] Delays are reported in seconds.

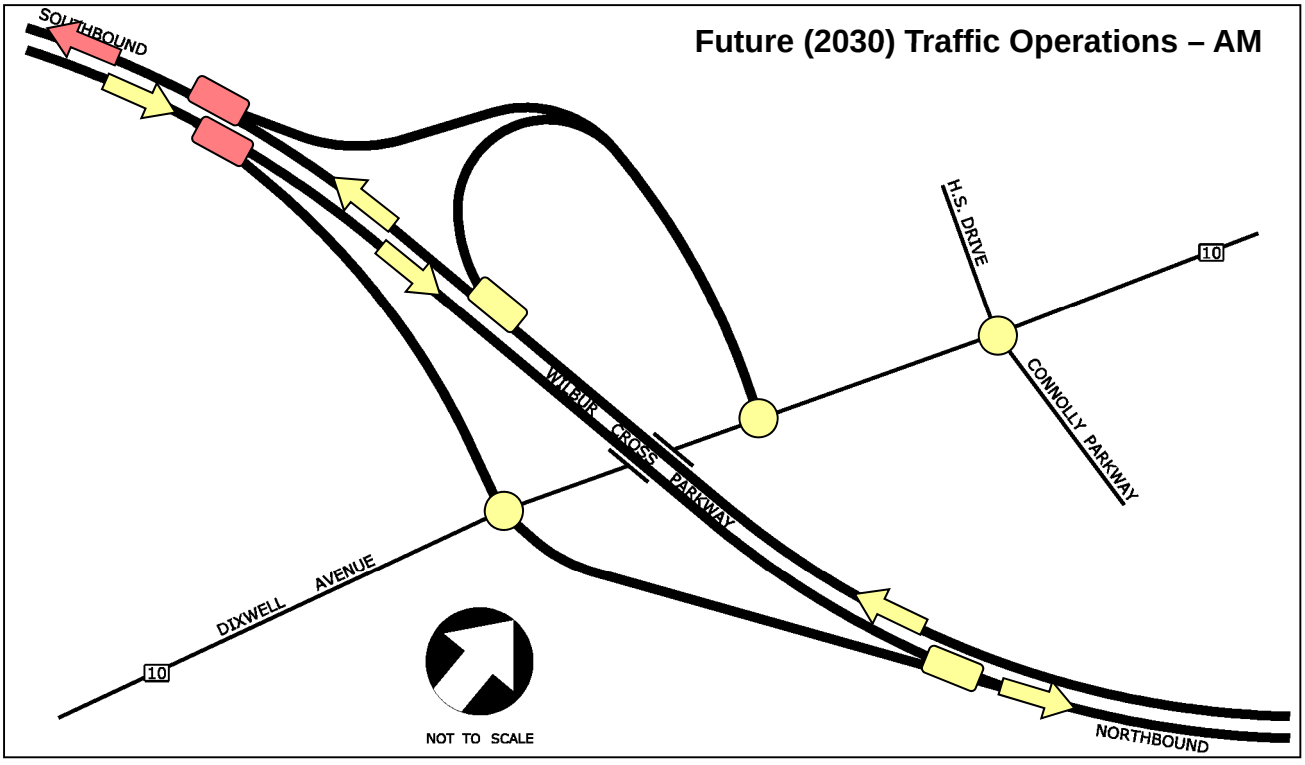
The intersection analysis shows that the three study intersections currently operate at LOS D or better during the AM and PM peak hours with the exception of Connolly Parkway which operates at LOS F during the PM peak hour. Levels of service deteriorate under 2030 traffic conditions resulting in LOS F during the PM peak hour at all three intersections.

The study team notes that the 95th percentile traffic queue on the northbound off ramp is expected to extend approximately 600 ft from the stop bar under 2030 PM peak hour traffic conditions; this will result in traffic extending just beyond the physical gore, but not extending onto the mainline. Additionally, the existing deceleration lane is long enough to accommodate deceleration from mainline speeds to a stop condition at the back of the 95th percentile queue.

However, the study team notes that local experience suggests there are currently occasions when the northbound off ramp queue extends close to the mainline travel lanes posing safety concerns.

Figures 60-6 and 60-7 summarize the results of the traffic operations analyses for the AM and PM peak hour traffic conditions, respectively.





LOS	Intersection	Mainline	Merge/Diverge
A-B			
C-D			
E-F			

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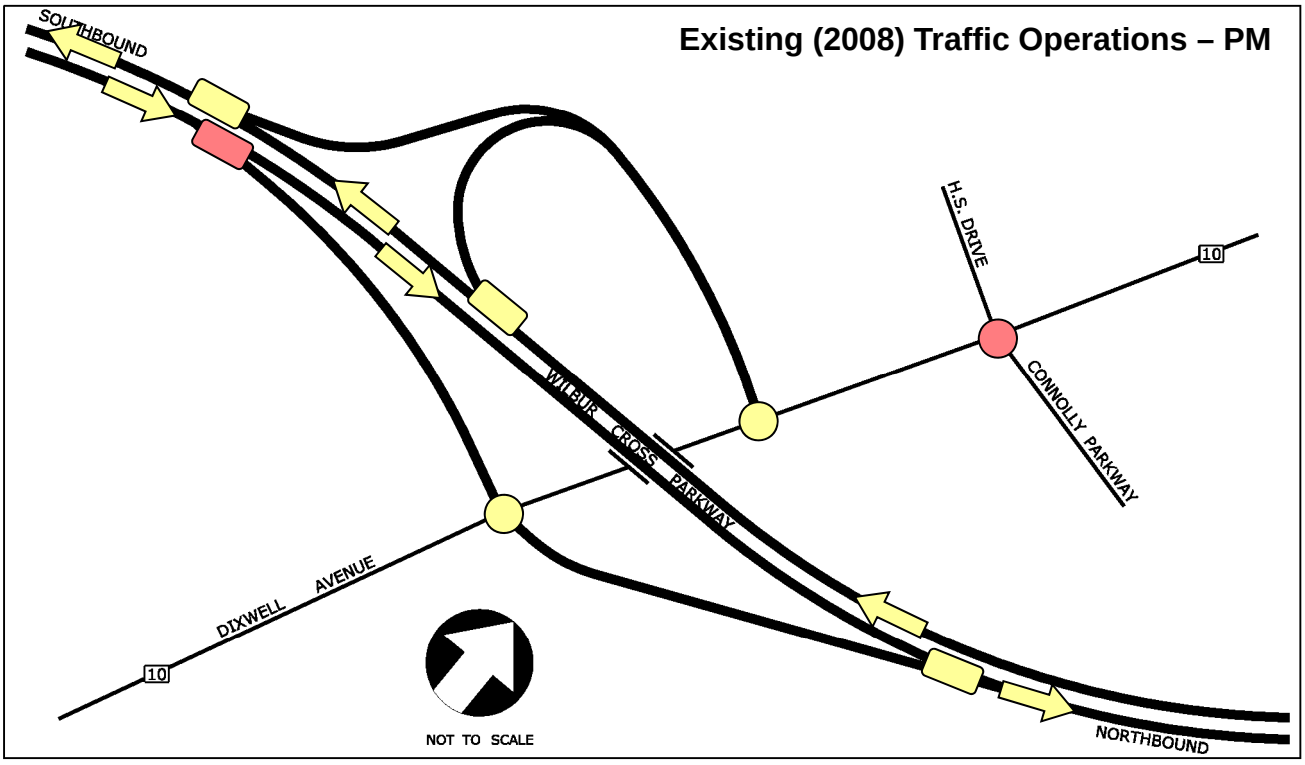
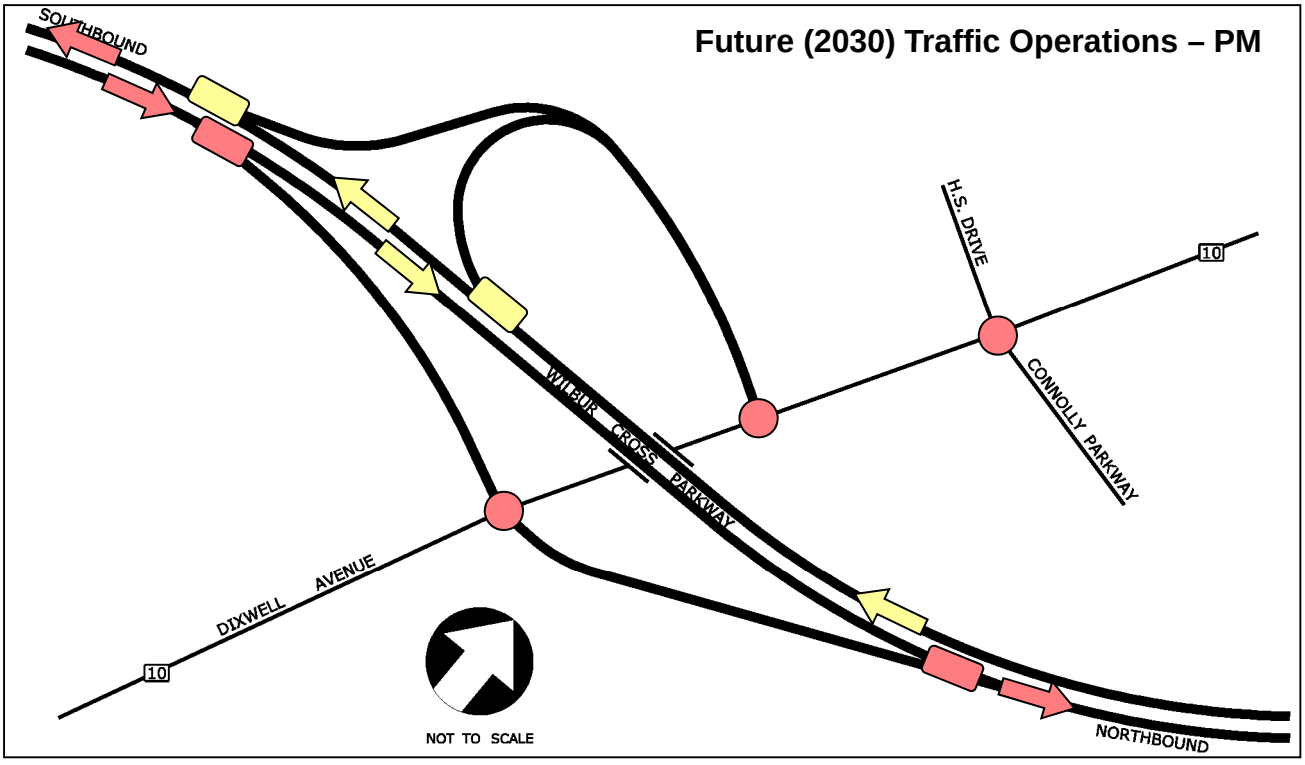
Figure 60-6.
AM Traffic Operations Summary:
Interchange 60





LOS	Intersection	Mainline	Merge/Diverge
A-B			
C-D			
E-F			

Wilbur Cross Parkway
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Figure 60-7.
PM Traffic Operations Summary:
Interchange 60

Accidents and Safety

The study team obtained accident data from ConnDOT's *Traffic Accident Viewing System* (TAVS) for the three-year period beginning January 1, 2005 and ending December 31, 2007. The data shows that 117 accidents occurred in the interchange area during this period, 43% of which occurred on Route 10 between the intersections of the northbound and southbound ramps. Table 60-5 summarizes the types of collisions that occurred at various locations in the interchange area. Figure 60-8 illustrates the accident trends that have developed over the last few years.

Table 60-5. Accident History: Interchange 60

Location	Collisions by Type						
	Rear End	Fixed Object	Side Swipe	Right Angle	Left Turn	Other	Total
Northbound							
Off Ramp	15	5	-	-	1	1	**22**
Between Off and On Ramps	2	13	3	-	-	-	**18**
On Ramp	-	2	1	-	-	-	**3**
Southbound							
Off Ramp	7	1	-	-	2	2*	**12**
Between Off and On Ramps	-	1	-	-	-	-	**1**
On Ramp	5	1	3	-	-	2	**11**
Secondary Roadway							
Rte 10 between NB & SB Ramps	34	-	5	6	5	-	**50**
Total Number	**63**	**23**	**12**	**6**	**8**	**5**	**117**
Percentage	**54%**	**20%**	**10%**	**5%**	**7%**	**4%**	**100%**

*Both accidents involved pedestrians at the intersection of the northbound off ramp and Route 10.

As shown in Table 60-5, the northbound off ramp experienced the highest number of collisions, 68% of which were rear-end collisions. Although the northbound off ramp was reconfigured in 1995 to improve the ramp geometry and provide sufficient deceleration length for the ramp design speed, the study team believes that the number and frequency of rear-end collisions at this location results from a combination of factors including: high volumes; a downgrade to the intersection that requires longer stopping distances; long vehicle queues; aggressive driving behavior; and driver impatience.

In general, the relatively low number of accidents at the on ramps is attributable to the 1995 improvements that provided acceleration lanes. Prior to these improvements, the layout and geometry of the Interchange 60 ramps were similar to the layout and geometry of the ramps at Interchange 61 where the accident frequency was much higher over the same three year period.

The study team notes that two vehicle-pedestrian collisions occurred at the terminus of the southbound off ramp. Both accidents were caused by right-turning vehicles. Pedestrian activity in the area is particularly high due to Hamden High School located immediately north of the interchange on Route 10. The Town of Hamden identified pedestrian safety as a key consideration of any improvements at the interchange.

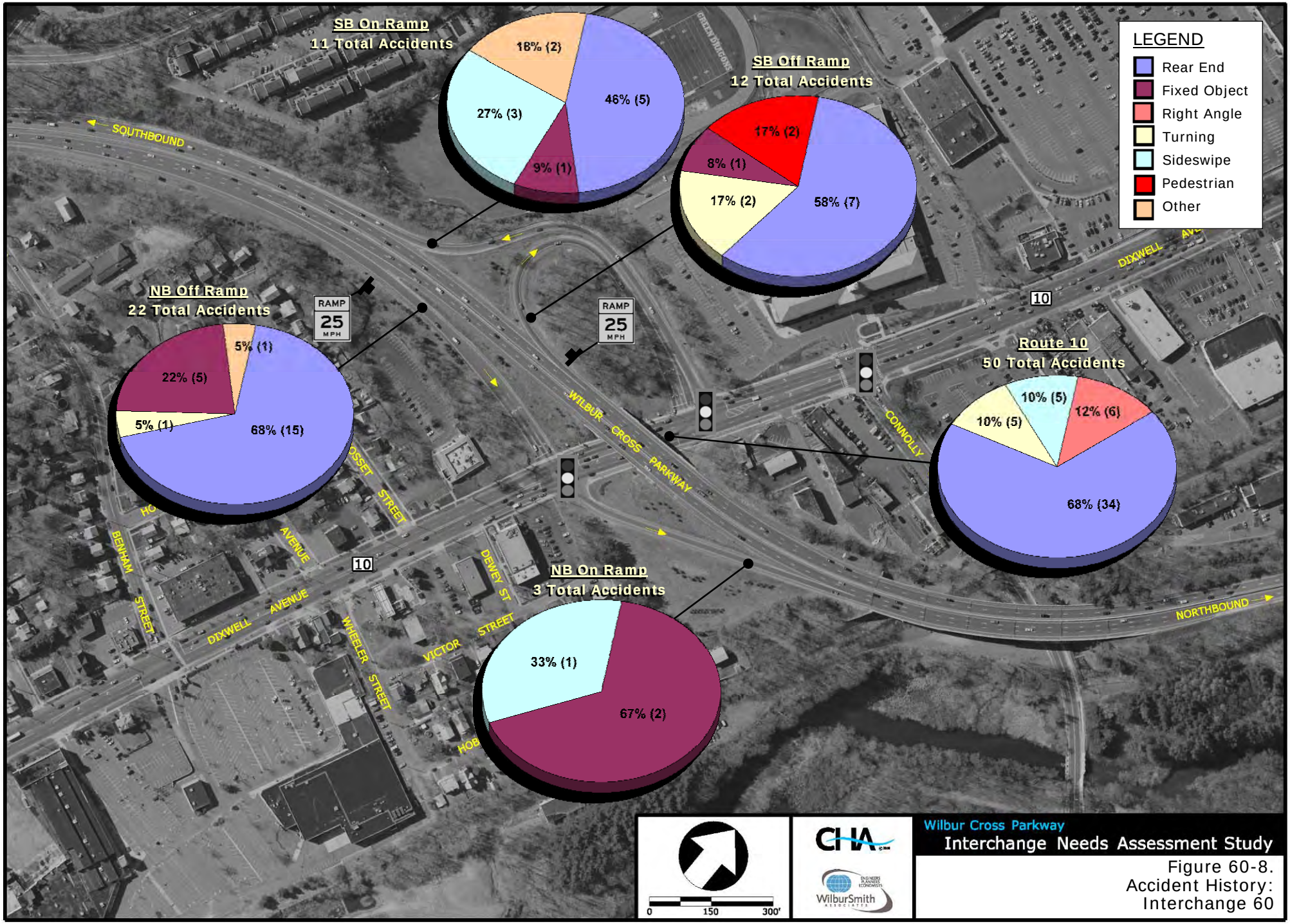
SB On Ramp
11 Total Accidents
18% (2)
27% (3)
46% (5)
9% (1)
SB Off Ramp
12 Total Accidents
17% (2)
8% (1)
17% (2)
58% (7)
NB Off Ramp
22 Total Accidents
5% (1)
22% (5)
5% (1)
68% (15)
Route 10
50 Total Accidents
10% (5)
12% (6)
10% (5)
68% (34)
NB On Ramp
3 Total Accidents
33% (1)
67% (2)
LEGEND
Rear End
Fixed Object
Right Angle
Turning
Sideswipe
Pedestrian
Other
RAMP
25
MPH
SOUTHBOUND
NORTHBOUND
WILBUR CROSS PARKWAY
CONNOLLY
DIXWELL AVENUE
DOSSET STREET
DEWEY ST
VICTOR STREET
WHEELER STREET
BENHAM STREET
10
0
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Figure 60-8.
Accident History:
Interchange 60

Recommended Improvement Plan

The study team worked with the Town of Hamden, ConnDOT, SCRCOG, and other stakeholders to develop and refine a set of near-term and long-term improvement plans to address the identified deficiencies and needs at Interchange 60. The recommended improvement plans are detailed and illustrated below along with discussion regarding other design and implementation considerations. Also included are summaries of constraints, impacts, and estimated construction costs.

Near-term Improvement Plan (Figure 60-9)

Near, Mid, and Long-term Definitions

Near-term:
- Implementation period of 1 to 3 years.
- Includes low cost improvements such as signing and striping improvements, existing signal timing modifications, tree clearing, etc.

Mid-term:
- Implementation period of 3 to 10 years.
- Includes acceleration and deceleration lane improvements, new turn lanes, new traffic signals, and minor ramp modifications that could be implemented with little or no impacts to rights-of-way, environmental features, or existing bridge structures.

Long-term:
- Implementation period greater than 10 years.
- Includes higher-cost improvements that could significantly impact existing bridge structures, rights-of-way, or environmental features.

Northbound:

- Consider part-time prohibition of right-turn-on-red (RTOR) from off ramp to improve pedestrian safety. Prohibition could restrict RTOR only during peak pedestrian periods and/or during school hours when pedestrian activity is highest so that the effect on vehicular capacity is minimized. The part-time prohibition could be indicated by a new "No Turn on Red (NTOR)" sign mounted adjacent to the signal head with time of day restrictions mounted on a supplemental sign. An alternative method for indicating the RTOR prohibition could include installing an electronic NTOR sign that is illuminated only during certain times of the day or that is activated by a pedestrian push button located at the intersection. See appendix for additional details.

Southbound:

- Similar to the northbound off ramp, consider part-time prohibition of right-turn-on-red (RTOR) from off ramp to improve pedestrian safety.
- Relocate existing 25 mph ramp advisory sign for off ramp to improve visibility of sign for exiting motorists.

Route 10:

- Consider revised signal timings at Route 10 intersections with northbound ramps, southbound ramps, and Connolly Parkway to optimize operations. In particular, signal timing modifications at the intersection of the northbound ramps and Route 10 should be considered to minimize traffic queues on the northbound off ramp during peak hours.

Long-term Improvement Plan (Figure 60-10)

Northbound:

- Provide a two lane exit for the off ramp as required to accommodate future traffic demands. Traffic conditions should be monitored for the potential need for a two lane exit at this location.

Southbound:

- Provide standard acceleration length for the southbound on ramp.

Other Considerations

- Consider providing queue-discharge system on northbound off ramp to detect and discharge traffic queues that encroach on the mainline. A queue discharge system could consist of a sensor (such as a loop detector) located on the off ramp that detects when vehicle queues extend beyond a set point on the ramp. When activated, the sensor communicates with the traffic signal controller and initiates a signal change and green phase for the off ramp that allows vehicles to move off the ramp before queuing back on the mainline.
- Implementation of the long-term improvements would require replacement of the Benham Street bridge structure over Route 15. Because the bridge is currently in good condition, the study team anticipates that provisions for a two lane exit would be incorporated into the next programmed reconstruction/replacement of the bridge. The cost for southbound acceleration lane and northbound deceleration lane improvements would be included in the future bridge project and are therefore not included in the construction cost estimate detailed below.

Constraints, Limitations and Impacts

- Rock excavation would be required to accommodate widening for any northbound off ramp and southbound on ramp/acceleration lane improvements.
- No significant right-of-way or wetland impacts are anticipated with the near or long-term improvement plans at Interchange 60.

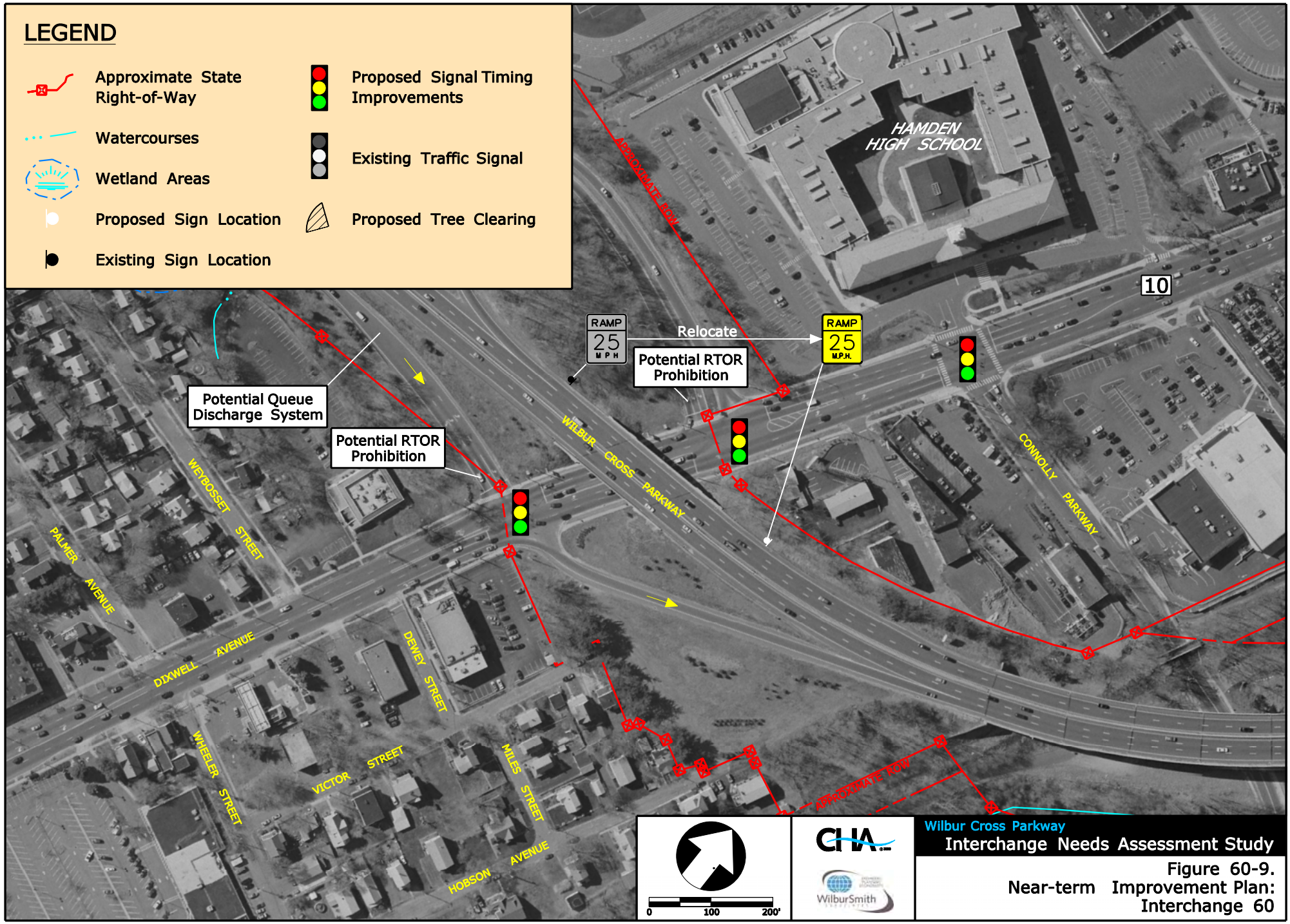
Estimated Construction Costs

The study team developed planning-level construction cost estimates for the near, mid, and long-term improvement plans at Interchange 60 in accordance with ConnDOT's guidelines for preliminary cost estimating dated January 2009. The planning-level costs shown in Table 60-6 are based on estimates of major construction items and do not include allowances for engineering or any potential right-of-way acquisitions, utility relocations, or environmental mitigation.

Table 60-6. Planning-level Construction Cost Estimates: Interchange 60

Improvement	Planning-level Costs	
	(2009 $)	Long-term (2024 $)
Near-term Improvement Plan		
• All signage improvements; signal timing modifications	$ 18,000	-
Long-term Improvement Plan		
• NB off ramp improvements	$ 1.9 million	$ 4.6 million
• SB acceleration lane improvements	$ 700,000	$ 1.7 million

Note: Costs shown for long-term plan do not include cost of replacing the Benham Street bridge structure; see other considerations for more detail.


LEGEND
Approximate State Right-of-Way
Watercourses
Wetland Areas
Proposed Sign Location
Existing Sign Location
Proposed Signal Timing Improvements
Existing Traffic Signal
Proposed Tree Clearing
HAMDEN HIGH SCHOOL
APPROXIMATE ROW
10
RAMP 25 M P H
Relocate
RAMP 25 M.P.H.
Potential RTOR Prohibition
Potential Queue Discharge System
Potential RTOR Prohibition
WILBUR CROSS PARKWAY
CONNOLLY PARKWAY
WEYBOSSET STREET
PALMER AVENUE
DIXWELL AVENUE
DEWEY STREET
WHEELER STREET
VICTOR STREET
MILES STREET
HOBSON AVENUE
APPROXIMATE ROW
0
100
200'
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Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 60-9.
Near-term Improvement Plan:
Interchange 60


LEGEND
Approximate State Right-of-Way
Watercourses
Wetland Areas
Approximate Slope Limits
Structures (Including Bridges, Retaining Walls, and Tunnels)
Proposed Traffic Signal
Existing Traffic Signal
New Pavement Construction
Existing Pavement to be Removed
Mid-term Improvements
Standardize Acceleration Length
Replace Bridge Structure
Provide Two-Lane Exit
APPROXIMATE ROW
WILBUR CROSS PARKWAY
NORTHBOUND
SOUTHBOUND
BATTIS ROAD
MAPLEWOOD TERRACE
ROOSEVELT STREET
GARFIELD STREET
BENHAM STREET
MALCOLM STREET
AVENUE
LAKEVIEW
ROBERT STREET
HOPE AVENUE
PALMER AVENUE
WEYBOSSET STREET
DEWEY STREET
DIXWELL AVENUE
HANDEN
0 100 200'
CHA
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Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 60-10.
Long-term Improvement Plan:
Interchange 60

Interchange 61

In Brief

Location: Town of Hamden
- 1.4 miles north of Interchange 60
- 0.6 mile south of Interchange 62

Access to: Whitney Avenue

Interchange 61 of the Wilbur Cross Parkway is located in the Town of Hamden and provides access to Whitney Avenue. The interchange serves commercial and residential land uses in the interchange area and is the primary access to the Hamden town center located north of the interchange. For the purposes of this study, the Interchange 62 southbound off ramp to northbound Whitney Avenue is considered part of Interchange 61 and is presented in this section.

The interchange was originally constructed in the late 1940s and no major geometric improvements have been made to the ramps since that time.

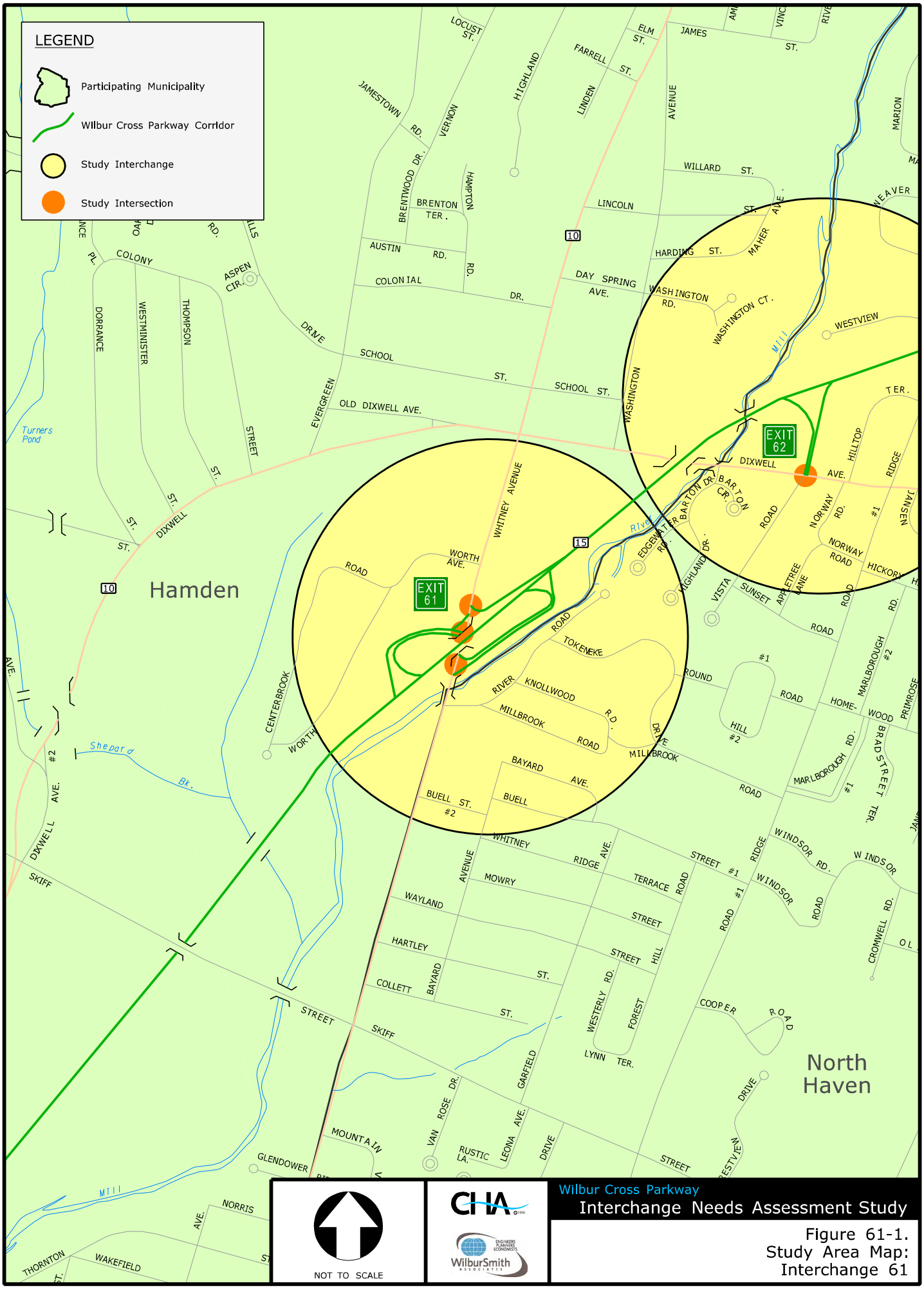
The northbound off ramp diverges from the mainline in a taper-type exit and loops approximately 180 degrees before terminating on the east side of Whitney Avenue in a stop-controlled T-intersection. The northbound on ramp is located parallel to the off ramp and is characterized by a stop-controlled approach to the Parkway.

The southbound off ramp (Exit 61) also diverges from the mainline in a taper-type exit and loops approximately 180 degrees before terminating on the west side of Whitney Avenue in a stop-controlled intersection. Access from the ramp is limited to southbound Whitney Avenue. The southbound on ramp is located parallel to the off ramp and is characterized by a stop-controlled approach to the Parkway. The southbound off ramp (Exit 62) also diverges from the mainline in a taper-type exit and terminates on the east side of Whitney Avenue in a stop-controlled intersection that is slightly offset from the southbound ramps on the west side of Whitney Avenue. Access from the ramp is limited to northbound Whitney Avenue.

The Parkway in the interchange area consists of two travel lanes in the northbound and southbound directions separated by concrete barrier curb in most areas with a narrow median with metal beam guide rail. The typical lane and shoulder configuration includes 11 ft wide lanes, 4 ft wide left shoulders, and 8 ft to 12 ft wide right shoulders.

The study area, shown in Figure 61-1, includes the interchange ramps, the junctions of these ramps with the Wilbur Cross Parkway, and the following intersections:

- Northbound ramps at Whitney Avenue (unsignalized)
- Southbound ramps at Whitney Avenue (Exit 61) (unsignalized)
- Southbound off ramp at Whitney Avenue (Exit 62) (unsignalized)


LEGEND
Participating Municipality
Wilbur Cross Parkway Corridor
Study Interchange
Study Intersection
EXIT 61
EXIT 62
Hamden
North Haven
NOT TO SCALE
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 61-1.
Study Area Map:
Interchange 61

Needs and Deficiencies Assessment

Roadway Geometry

For this study, the critical geometric characteristics of the Wilbur Cross Parkway and its interchanges are those that are closely related to vehicular safety. These critical geometric characteristics include deceleration lane lengths; acceleration lane lengths; and ramp curvatures and speeds. The study team determined the existing geometric characteristics of Interchange 61 and compared them to the minimum design standards obtained from ConnDOT's *Highway Design Manual 2003 Edition* (HDM).

The results of the existing geometric conditions assessment are summarized in Table 61-1 and illustrated in Figure 61-2. Non-standard conditions, or deficiencies, are noted in bold red text.

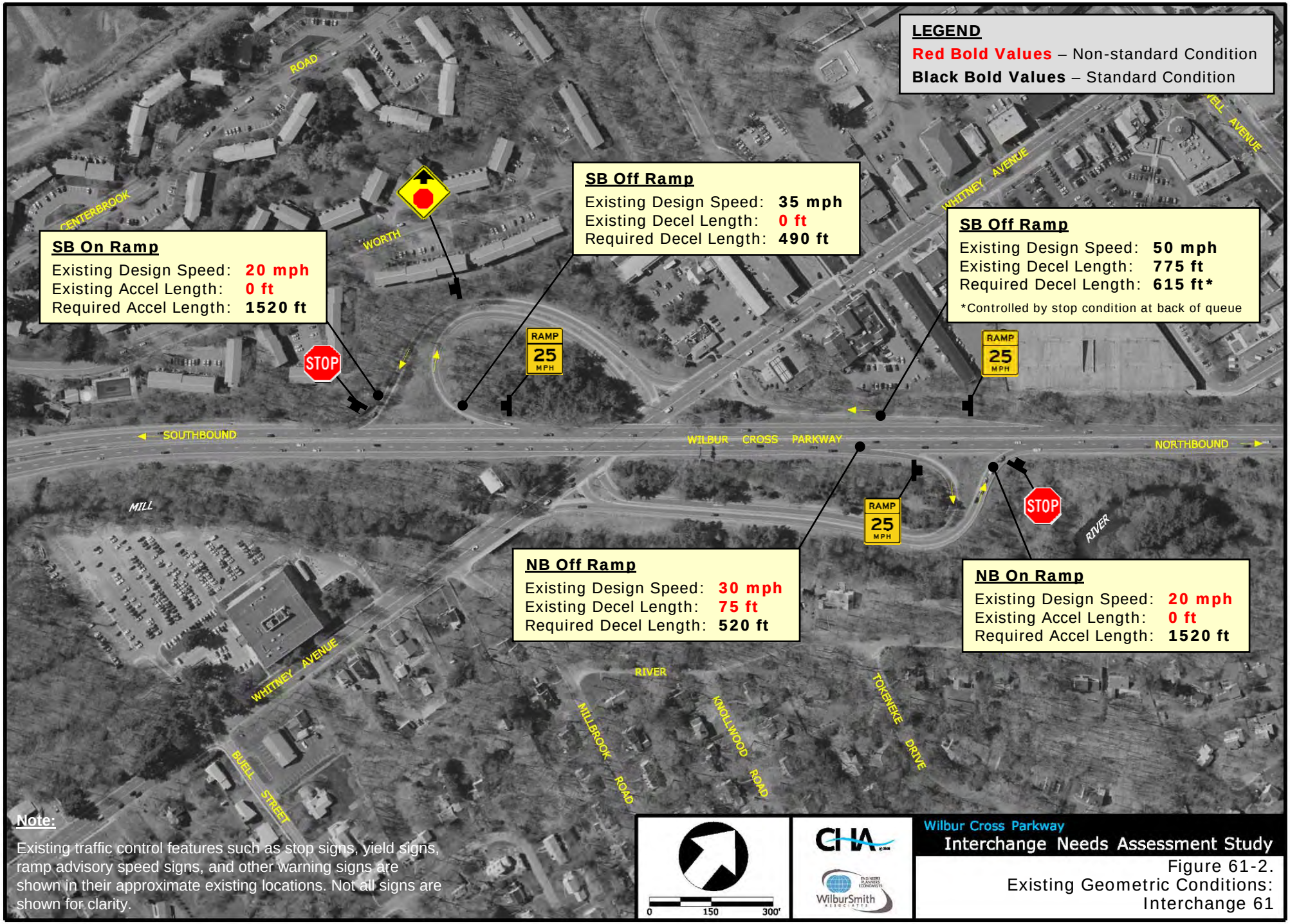
Table 61-1. Existing Geometric Conditions Summary: Interchange 61

Location	Ramp		Acceleration/Deceleration Lanes		Other Notes
	Curve Radius	Design Speed	Existing Length	Required Length	
Northbound					
Off Ramp	**330 ft**	**30 mph**	**75 ft**	520 ft	-
On Ramp	**120 ft**	**20 mph**	**0 ft**	1520 ft	Stop Controlled
Southbound					
Off Ramp 62	>1000 ft	50 mph	775 ft	615 ft	Stop Condition[1]
Off Ramp 61	420 ft	35 mph	**0 ft**	490 ft	-
On Ramp	**130 ft**	**20 mph**	**0 ft**	1520 ft	Stop Controlled

[1] A stop condition located at the back of the 95th percentile queue for the existing afternoon (PM) traffic condition was assumed to be the controlling factor in determining the required deceleration length.

As shown in Table 61-1, the following geometric conditions are deficient:

- **Northbound Off Ramp and Deceleration Lane:** Ramp curvature and 30 mph design speed are non-standard. Limited deceleration lane exists to accommodate deceleration from mainline to ramp speeds. Most deceleration must occur on the mainline creating unsafe conditions for through and exiting traffic.
- **Northbound On Ramp and Acceleration Lane:** Ramp curvature and 20 mph design speed are non-standard. Stop-controlled approach requires motorists to perceive gaps in traffic flow sufficient to accommodate merging and acceleration to mainline speeds. No acceleration lane exists to accommodate acceleration prior to merging.
- **Southbound Deceleration Lane (Exit 61):** No deceleration lane exists to accommodate deceleration from mainline to ramp speeds. Deceleration must occur on the mainline creating unsafe conditions for through and exiting traffic.
- **Southbound On Ramp and Acceleration Lane:** Ramp curvature and 20 mph design speed are non-standard. Stop-controlled approach requires motorists to perceive gaps in traffic flow sufficient to accommodate merging and acceleration to mainline speeds. No acceleration lane exists to accommodate acceleration prior to merging.



Note:

Existing traffic control features such as stop signs, yield signs, ramp advisory speed signs, and other warning signs are shown in their approximate existing locations. Not all signs are shown for clarity.

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 61-2.
Existing Geometric Conditions:
Interchange 61

Traffic Conditions

The study team compiled traffic data for Interchange 61 that included average daily traffic (ADT) volumes, existing (2008) weekday peak hour traffic volumes, and estimated future (2030) weekday peak hour traffic volumes. This data was used as the basis for assessing traffic conditions on the mainline Wilbur Cross Parkway (WCP), at the interchange ramp junctions, and at key secondary roadway intersections. Figure 61-3 illustrates the most recent (2006) ADT volumes that were obtained by ConnDOT at Interchange 61.

Figure 61-3. 2006 Average Daily Traffic Volumes (in vehicles per day, vpd): Interchange 61

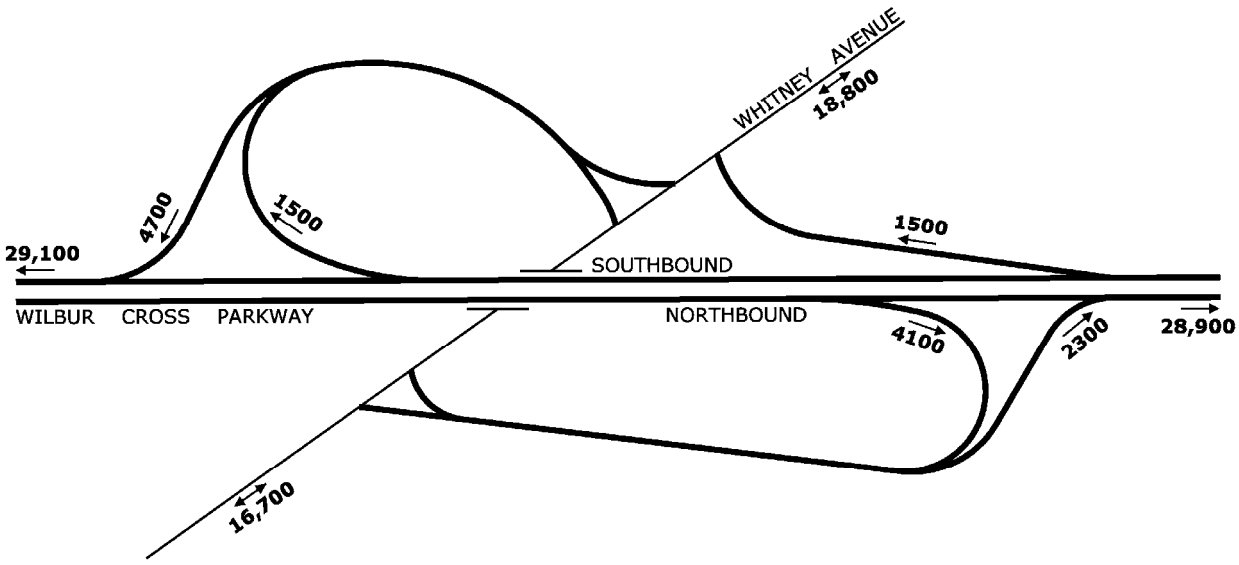
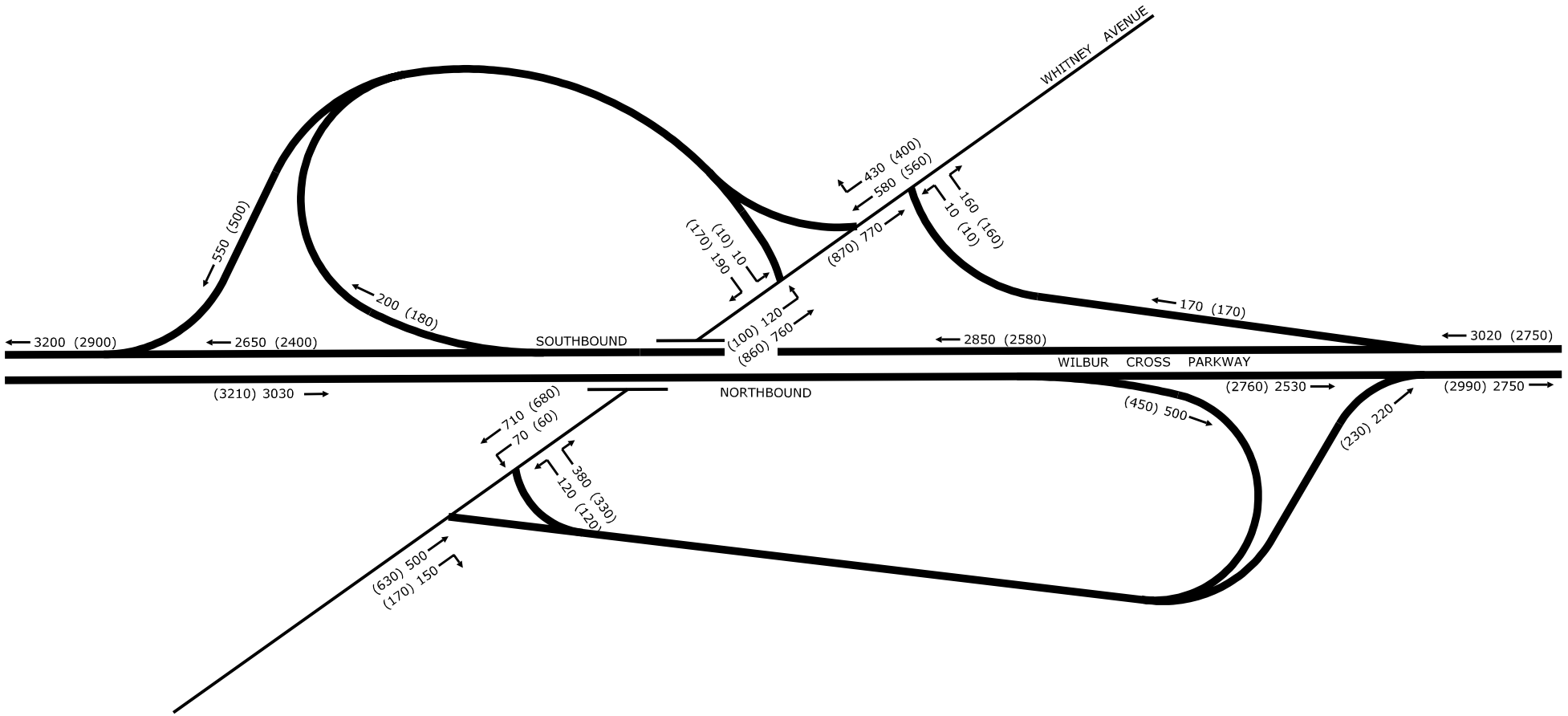


Figure 61-4 presents the 2008 weekday peak hour traffic volumes for the morning (AM) and afternoon (PM) peak commuting periods. The study team worked with ConnDOT's traffic forecasting unit to develop these volumes from intersection turning movement counts obtained by SCRCOG and available traffic data for Interchange 61 provided by ConnDOT.

Figure 61-5 presents the estimated 2030 weekday peak hour traffic volumes that were developed by ConnDOT's traffic forecasting unit. These volumes reflect an increase in traffic at Interchange 61 that is primarily a function of regional background traffic growth as no major developments in the interchange area are expected to significantly affect future traffic estimates.
.

The notable traffic conditions presented in Figures 61-3, 61-4, and 61-5 include:

- Highest daily ramp volumes occur on the southbound on ramp
- Lowest daily ramp volumes occur on the two southbound off ramps
- Approximately 52% of WCP traffic is traveling southbound in the morning
- Approximately 52% of WCP traffic is traveling northbound in the afternoon
- Overall traffic growth by 2030 is estimated to be approximately 22%, or 0.9% annually


WHITNEY AVENUE
550 (500)
200 (180)
(170) 190
(10) 10
430 (400)
580 (560)
(870) 770
160 (160)
10 (10)
3200 (2900)
2650 (2400)
SOUTHBOUND
(100) 120
(860) 760
170 (170)
2850 (2580)
3020 (2750)
WILBUR CROSS PARKWAY
(3210) 3030
NORTHBOUND
(2760) 2530
(2990) 2750
(450) 500
(230) 220
710 (680)
70 (60)
380 (330)
120 (120)
(630) 500
(170) 150
LEGEND
(PM) AM
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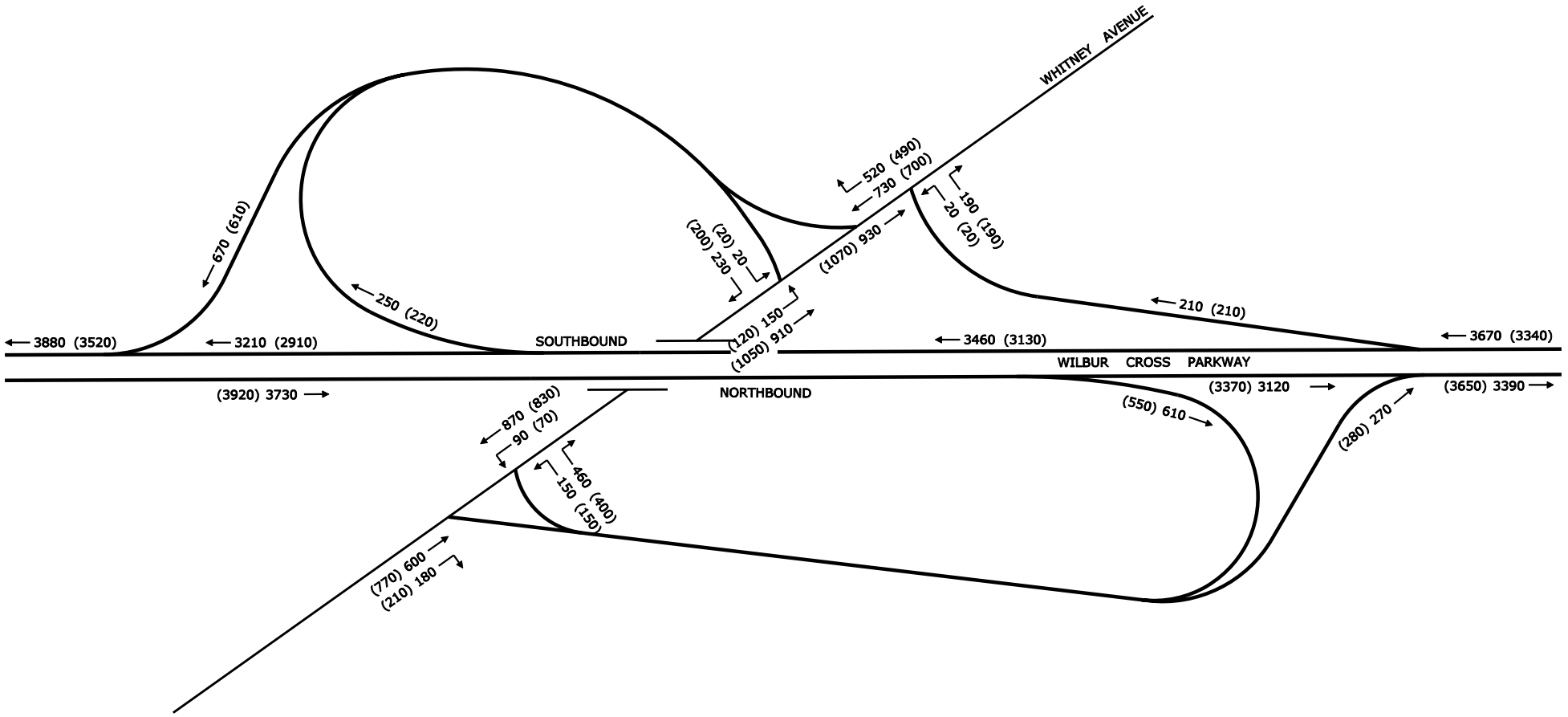
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 61-4.
Existing (2008) Peak Hour Volumes
Interchange 61



LEGEND

(PM) AM →

NOT TO SCALE

Wilbur Cross Parkway

Interchange Needs Assessment Study

Figure 61-5.
Future (2030) Peak Hour Volumes
Interchange 61

Traffic Operations

The study team analyzed the operations of the mainline segments, ramp junctions, and intersections in the Interchange 61 study area. The analyses were conducted for the weekday AM and PM peak hours under the 2008 and estimated 2030 traffic conditions. The results of the analyses, which are reported as Levels of Service (LOS), are presented below in tabular form and illustrated in Figures 61-6 and 61-7.

As described in the *Needs Assessment Overview* section, LOS D or better represents an acceptable degree of congestion for mainline segments, ramp junctions, and intersections. LOS E and F, which are indicated in red in the tables and figures, represent unacceptable degrees of congestion. Locations operating at LOS E and F are highlighted in this report to indicate locations where traffic capacity and operational issues exist, or could exist under future traffic conditions.

Mainline

Table 61-2. Mainline Operations Summary: Interchange 61

Segment	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
Northbound				
South of Interchange 61	C (24.4)	D (32.7)	D (26.2)	E (35.9)
Between Interchange 61 Ramps	C (20.1)	C (25.3)	C (22.0)	D (28.0)
North of Interchange 61	C (21.9)	D (28.2)	C (24.0)	D (31.5)
Southbound				
North of Interchange 62 Off Ramp	C (24.3)	D (31.8)	C (21.9)	D (27.6)
Between Interchange 62 Off &61 Off Ramps	C (22.8)	D (29.0)	C (20.5)	C (25.4)
Between Interchange 61 Ramps	C (21.1)	D (26.2)	C (19.0)	C (23.3)
South of Interchange 61	D (26.1)	E (35.2)	C (23.2)	D (29.8)

[1] Mainline density is reported in passenger cars per mile per lane (pc/mi/ln).

The mainline analysis shows that all mainline segments currently operate at LOS C and D during both the AM and PM peak hours. The lower levels of service in the southbound direction in the AM and in the northbound direction in the PM reflect the predominant direction of travel during the respective peak hours. Mainline operations deteriorate under 2030 traffic conditions resulting in congested conditions upstream of the interchange in the northbound direction in the PM (LOS E), and downstream of the interchange in the southbound direction in the AM (LOS E).

Ramp Junctions

Table 61-3. Ramp Merge/Diverge Operations Summary: Interchange 61

Location	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
Northbound				
Off Ramp to Whitney Avenue	D (32.5)	E (39.2)	D (34.3)	E (41.0)
On Ramp from Whitney Avenue	D (29.2)	D (34.7)	D (31.3)	E (37.0)
Southbound				
Off Ramp to NB Whitney Avenue (Exit 62)	D (33.1)	E (39.3)	D (30.5)	E (36.2)
Off Ramp to SB Whitney Avenue	D (31.5)	E (37.3)	D (28.9)	D (34.2)
On Ramp from Whitney Avenue	D (32.9)	E (38.8)	D (30.4)	E (35.7)

[1] Ramp junction density is reported in passenger cars per mile per lane (pc/mi/ln).

The ramp analysis shows that the northbound and southbound ramp junctions operate at LOS D during the AM and PM peak hours. Levels of service are reduced under 2030 traffic conditions resulting in generally congested conditions (LOS E) for all merging and diverging operations during the AM and PM peak hours with the exception of the northbound on ramp merge in the AM and the southbound off ramp diverge in the PM.

Intersections

The study team analyzed traffic operations at the following intersections:

- **Northbound Ramps at Whitney Avenue:** Unsignalized, stop-controlled T-intersection. Whitney Avenue is oriented in a north-south direction; ramps are oriented in an east-west direction on the east side of Whitney Avenue. The northbound and southbound approaches on Whitney Avenue consist of two travel lanes in each direction. The northbound off ramp approach consists of a shared left-right lane. The northbound on ramp approach is multi-legged with channelized slip lanes from Whitney Avenue.

- **Southbound Ramps at Whitney Avenue (Exit 61):** Unsignalized, stop-controlled T-intersection. Whitney Avenue is oriented in a north-south direction; ramps are oriented in an east-west direction on west side of Whitney Avenue. The northbound and southbound approaches on Whitney Avenue consist of two travel lanes in each direction. The southbound off ramp approach consists of a shared left-right lane. The southbound on ramp approach is multi-legged with channelized slip lanes from Whitney Avenue.

- **Southbound Off Ramp at Whitney Avenue (Exit 62):** Unsignalized, stop-controlled T-intersection to northbound Whitney Avenue. Whitney Avenue consists of two travel lanes in each direction and is oriented in a north-south direction; ramp is oriented in an east-west direction on east side of Whitney Avenue. The southbound off ramp includes a single lane approach.

Results of the intersection analysis are presented in Table 61-4.

Table 61-4. Intersection Operations Summary: Interchange 61

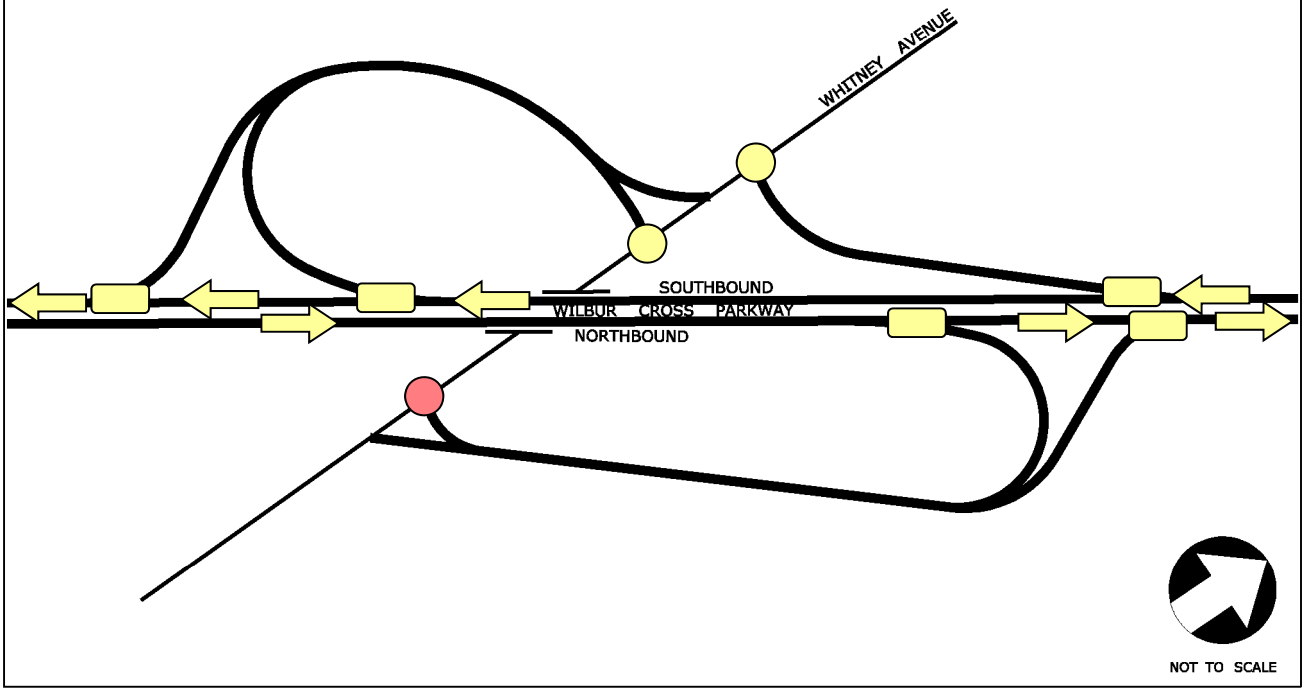
Intersection / Approach	AM LOS (Delay[1])		PM LOS (Delay[1])	
	2008	2030	2008	2030
NB Off Ramp at Whitney Avenue (Unsignalized)				
Westbound – NB Off Ramp	F (>80)	F (>80)	F (>80)	F (>80)
SB Off Ramp (Exit 61) at Whitney Avenue (Unsignalized)				
Eastbound – SB Off Ramp	C (15.5)	D (33.4)	B (14.9)	D (29.3)
SB Off Ramp (Exit 62) at Whitney Avenue (Unsignalized)				
Westbound – SB Off Ramp	C (16.8)	D (33.2)	C (18.7)	E (46.3)

[1] Delays are reported in seconds.

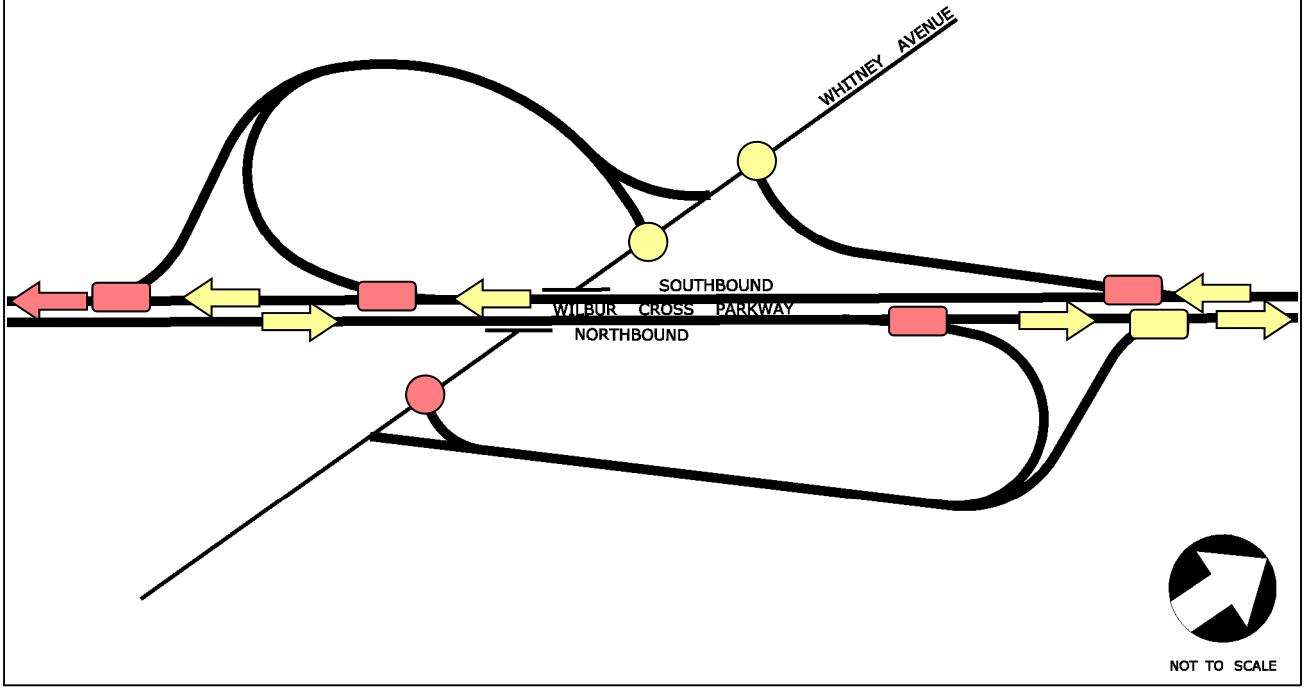
The intersection analysis shows that the northbound off ramp approach currently operates at LOS F during both the AM and PM peak hours. Traffic growth in the future will exacerbate existing delays and result in increasingly long traffic queues on the ramp. Delays at this location result in part from the volume of left turning vehicles and the single lane approach that creates delays for right turning vehicles. The southbound off ramp to northbound Whitney Avenue (Interchange 62) is also expected to operate at LOS E during the future PM peak hour. Because the ramp is intended for right turns only, the delays are predominantly the result of vehicles turning left illegally.

Figures 61-6 and 61-7 summarize the results of the traffic operations analyses for the AM and PM peak hour traffic conditions, respectively.

Existing (2008) Traffic Operations – AM



Future (2030) Traffic Operations – AM

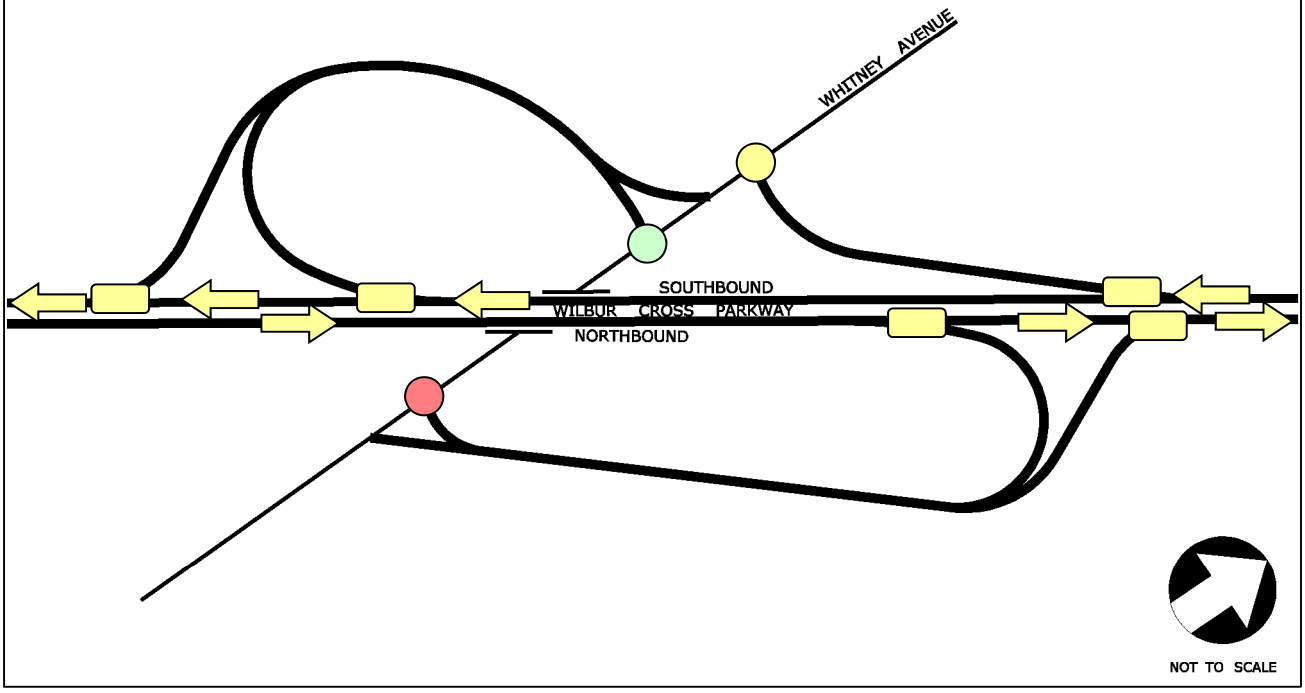


LOS	Intersection	Mainline	Merge/Diverge
A-B			
C-D			
E-F			

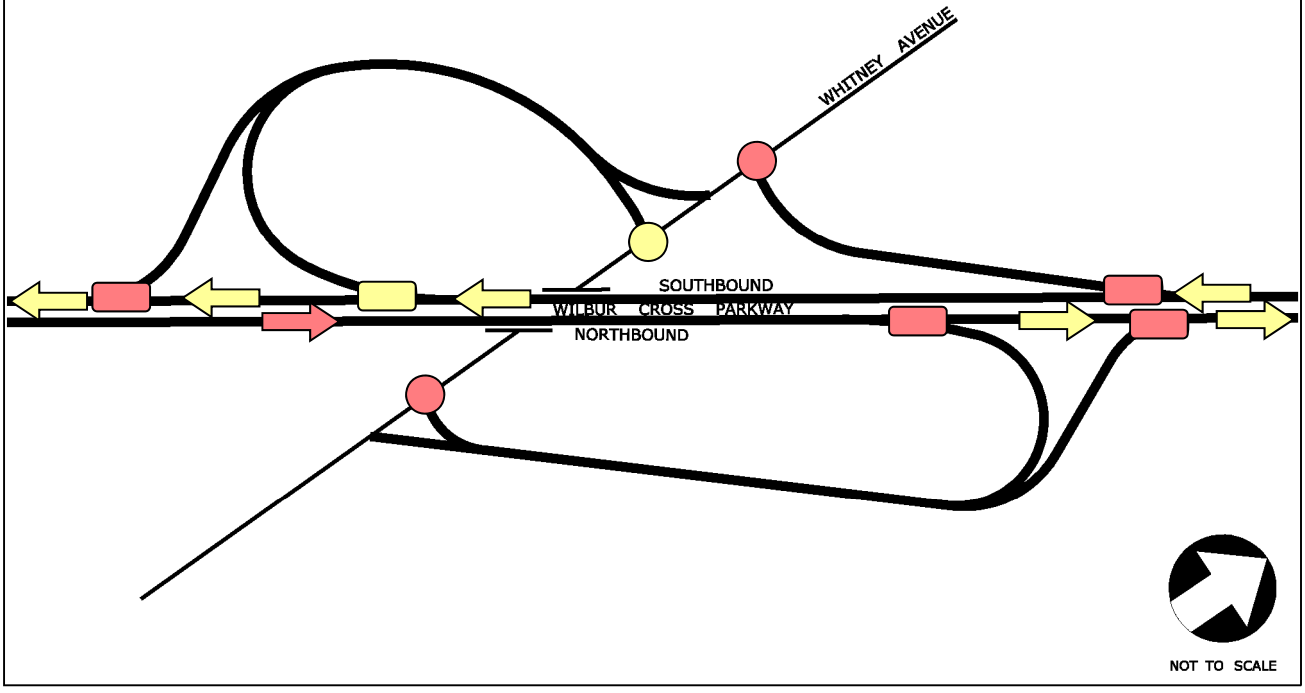
Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 61-6.
AM Traffic Operations Summary:
Interchange 61

Existing (2008) Traffic Operations – PM



Future (2030) Traffic Operations – PM



LOS	Intersection	Mainline	Merge/Diverge
A-B			
C-D			
E-F			

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 61-7.
PM Traffic Operations Summary:
Interchange 61

Accidents and Safety

The study team obtained accident data from ConnDOT's *Traffic Accident Viewing System* (TAVS) for the three-year period beginning January 1, 2005 and ending December 31, 2007. The data shows that 438 accidents occurred in the interchange area during this period, 87% of which were rear-end collisions. Table 61-5 summarizes the types of collisions that occurred at various locations in the interchange area. Figure 61-8 illustrates the accident trends that have developed over the last few years.

The study team notes that Interchange 61 is considered a *high accident location*. By definition, a high accident location is one that has experienced an accident rate that is higher than expected based on accident rates for similar locations.

Table 61-5. Accident History: Interchange 61

Location	Collisions by Type						
	Rear End	Fixed Object	Left Turn	Side Swipe	Right Angle	Other	Total
Northbound							
Off Ramp	11	2	7	1	-	1	**22**
Between Off and On Ramps	2	-	-	-	-	-	**2**
On Ramp	55	3	-	2	-	-	**60**
Southbound							
Off Ramp (Exit 62)	4	4	4	-	-	-	**12**
Between Int. 62 Off and 61 Off	2	2	-	3	-	1	**8**
Off Ramp (Exit 61)	12	1	3	-	-	-	**16**
Between Int. 61 Off and On Ramps	1	4	-	1	-	2	**8**
On Ramp	291	1	-	5	-	-	**297**
Secondary Roadway							
Whitney Ave between Ramps	4	4	1	2	1	1	**13**
Total Number	**382**	**21**	**15**	**14**	**1**	**5**	**438**
Percentage	**87%**	**5%**	**4%**	**3%**	**0%**	**1%**	**100%**

As shown in Table 61-5, the southbound on ramp experienced nearly 300 accidents, or 68% of the total number of accidents at Interchange 61. The accidents on this ramp were nearly all rear-end collisions, which the study team believes is a direct result of the *stop* condition and lack of acceleration lane that precedes the merge with mainline traffic. The stop condition and lack of acceleration lane at the northbound on ramp has led to the second highest number of accidents at this interchange, 92% of which were rear-end collisions.

Stop conditions at the end of interchange ramps are not consistent with driver expectations for limited access facilities like the Wilbur Cross Parkway. Insufficient warning to drivers of the stop condition; poor sight lines to the existing stop signs; and driver uncertainty and hesitation while attempting to enter the high volume and high speed corridor are all likely factors that contribute to the accident history on these ramps.

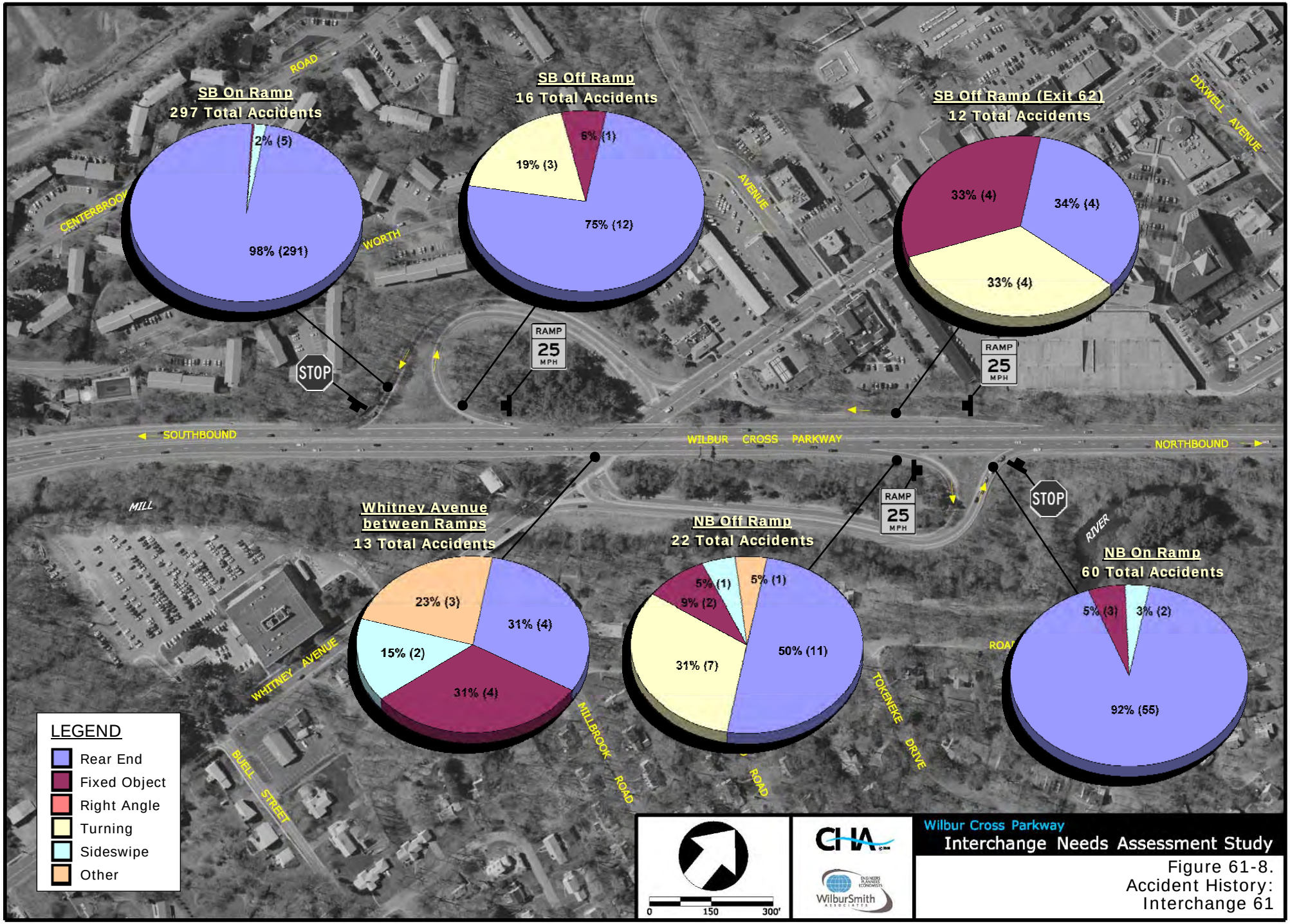

SB On Ramp
297 Total Accidents
2% (5)
98% (291)
SB Off Ramp
16 Total Accidents
6% (1)
19% (3)
75% (12)
SB Off Ramp (Exit 62)
12 Total Accidents
33% (4)
34% (4)
33% (4)
Whitney Avenue
between Ramps
13 Total Accidents
23% (3)
31% (4)
15% (2)
31% (4)
NB Off Ramp
22 Total Accidents
5% (1)
5% (1)
9% (2)
50% (11)
31% (7)
NB On Ramp
60 Total Accidents
5% (3)
3% (2)
92% (55)
RAMP
25
MPH
STOP
SOUTHBOUND
NORTHBOUND
WILBUR CROSS PARKWAY
CENTERBROOK ROAD
WORTH AVENUE
DIXWELL AVENUE
MILL RIVER
WHITNEY AVENUE
MILLBROOK ROAD
TOKENEKE DRIVE
BUELL STREET
LEGEND
Rear End
Fixed Object
Right Angle
Turning
Sideswipe
Other
0
150
300'
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Figure 61-8.
Accident History:
Interchange 61

The significantly higher number of accidents at the southbound on ramp (compared to the northbound on ramp) is likely a function of higher ramp volumes and the proximity of the ramp merge to the crest vertical curve over Whitney Avenue that limits sight distance for motorists looking northbound along the mainline from the stop location. The limited sight distance can make it difficult for drivers to perceive gaps in traffic and can cause hesitation and indecision resulting in "false starts" while attempting to enter mainline traffic. False starts can in turn cause a following driver to inadvertently rear-end the lead vehicle while moving forward, particularly if the following driver is also watching on-coming traffic for potential gaps.

Other notable accident trends illustrated in Table 61-5 and Figure 61-8 include:

- Relatively few fixed object collisions occurred at the northbound off ramp and southbound off ramp (Exit 61) suggesting that the lack of deceleration lanes and non-standard ramp speeds and curvature are not contributing to an excessively high number of reported run-off-the-road accidents. It is possible that more run-off-the-road accidents have occurred than indicated by the number of fixed object collisions in these locations due to these accidents going unreported or not resulting in a collision with a fixed object.

Recommended Improvement Plan

The study team worked with the Town of Hamden, ConnDOT, SCRCOG, and other stakeholders to develop and refine a set of near-term, mid-term, and long-term improvement plans to address the identified deficiencies and needs at Interchange 61. The recommended improvement plans are detailed and illustrated below along with discussion regarding other design and implementation considerations. Also included are summaries of constraints, impacts, and estimated construction costs.

Near-term Improvement Plan (Figure 61-9)

Northbound:

- Relocate existing 25 mph ramp advisory speed sign for off ramp to improve visibility of sign and to provide motorists a greater advance warning of ramp speed condition.
- Provide stop ahead warning sign along on ramp to provide adequate advance warning of stop condition.
- Provide stop signs on the left and right sides of the on ramp at the mainline junction to improve the visibility of the stop condition.

Southbound:

- Improve stop ahead warning sign along on ramp to standard size.
- Provide stop signs on the left and right sides of the on ramp at the mainline junction to improve the visibility of the stop condition.
- Relocate existing 25 mph ramp advisory speed sign for off ramp (Exit 61) to improve visibility of sign and to provide motorists a greater advance warning of ramp speed condition.

Near, Mid, and Long-term Definitions

Near-term:

- Implementation period of 1 to 3 years.
- Includes low cost improvements such as signing and striping improvements, existing signal timing modifications, tree clearing, etc.

Mid-term:

- Implementation period of 3 to 10 years.
- Includes acceleration and deceleration lane improvements, new turn lanes, new traffic signals, and minor ramp modifications that could be implemented with little or no impacts to rights-of-way, environmental features, or existing bridge structures.

Long-term:

- Implementation period greater than 10 years.
- Includes higher-cost improvements that could significantly impact existing bridge structures, rights-of-way, or environmental features.

Mid-term Improvement Plan (Figure 61-10)

Northbound:

- Provide standard deceleration length for off ramp. Consider providing dynamic curve warning system to better alert motorists to non-standard ramp curvature and slow ramp speed. See appendix for dynamic curve warning system details.
- Provide separate left and right turn lanes at off ramp approach to Whitney Avenue to reduce delays.
- Improve on ramp acceleration length within the constraints imposed by the Route 15 bridge structure over Dixwell Avenue. Eliminate stop control. The improved acceleration lane would allow vehicles to accelerate to approximately 45 mph before merging into mainline traffic.

Southbound:

- Improve on ramp acceleration length within the constraints imposed by the Route 15 bridge structure over Mill Brook. Eliminate stop control. The improved acceleration lane would allow vehicles to accelerate to approximately 48 mph before merging into mainline traffic.
- The study team notes that due to the proximity of the Route 15 bridge structure over Whitney Avenue, it is not feasible to improve the deceleration length for the off ramp (Exit 61) in the mid-term. Bridge widening would be required to accommodate any improvement to the deceleration lane.

The study team investigated two feasible long-term improvement plans for Interchange 61 that differ in how the northbound ramps are configured. The study team suggests that both plans could be advanced to subsequent planning stages as viable alternatives. Analyses of the build conditions show that Plan A would be less efficient relative to processing traffic through the interchange and would create more congestion than Plan B.

Long-term Improvement Plan A (Figure 61-11)

Northbound:

- Relocate off ramp to west side of Whitney Avenue to eliminate non-standard ramp curvature and to provide diamond ramp configuration with standard deceleration length. Signalize intersection of northbound ramps and Whitney Avenue. Elimination of the non-standard ramp curvature is the primary benefit of Plan A.
- Realign on ramp to improve ramp geometry. Provide auxiliary lane between Interchange 61 on ramp and Interchange 62 off ramp. Auxiliary lane improvements should match into mid-term improvements for the northbound on ramp and acceleration lane. The auxiliary lane would require widening of the Route 15 bridge structure over Dixwell Avenue.

Southbound:

- Close redundant off ramp (Exit 61) and realign on ramp to provide standard geometry and acceleration length. Improve geometry of off ramp (Exit 62) to provide adequate deceleration length to a stop condition at the back of the future 95th percentile traffic queue. Signalize intersection of southbound ramps and Whitney Avenue.

Whitney Avenue:

- Provide back-to-back left turn lanes on Whitney Avenue to maintain acceptable operations at the signalized intersections for the northbound and southbound ramps. The lateral clearance under the Route 15 bridge structure is approximately 64'-5", which could accommodate four 10 ft wide travel lanes, a 10 ft wide back-to-back left turn lane, 2 ft wide left and right shoulders, and 5 ft wide sidewalks on both sides of the roadway. The study team notes that the lane and shoulder widths would be non-standard relative to ConnDOT's current minimum standards of 11 ft lanes and 4 ft shoulders.

Long-term Improvement Plan B (Figure 61-12)

Northbound:

- Maintain off ramp in its existing location on the east side of Whitney Avenue. Realign approach of northbound ramps to Whitney Avenue to maximize distance from the southbound ramps intersection. Signalize intersection of northbound ramps and Whitney Avenue.
- Similar to Plan A, provide auxiliary lane between Interchange 61 on ramp and Interchange 62 off ramp. Auxiliary lane improvements should match into mid-term improvements for the northbound on ramp and acceleration lane. The auxiliary lane would require widening of the Route 15 bridge structure over Dixwell Avenue.

Southbound:

- Similar to Plan A, close redundant off ramp (Exit 61) and realign on ramp to provide standard geometry and acceleration length. Improve geometry of off ramp (Exit 62) to better align with on ramp. Signalize intersection of southbound ramps and Whitney Avenue.

Whitney Avenue:

- Similar to Plan A, provide back-to-back left turn lanes on Whitney Avenue to maintain acceptable operations at the signalized intersections for the northbound and southbound ramps.

Other Considerations

- The study team investigated the feasibility of relocating the northbound off ramp to the west side of Whitney Avenue given the constraints imposed by the existing switching station for United Illuminating (UI) at 2210 Whitney Avenue. Correspondence with UI revealed the switching station was de-energized, and therefore relocation could be feasible given appropriate mitigation and clean up of any environmental contaminants on the site.
- The northbound auxiliary lane is consistent with the long-term improvement plan at Interchange 62.
- The geometric requirements of all intersection improvements will be further evaluated and refined through subsequent stages of planning and design.
- Implementation of the long-term improvements at the northbound off ramp, northbound on ramp, and southbound on ramp will impact portions of the mid-term improvements at these locations.
- Provide a widened shoulder on the northbound off ramp approach to Whitney Avenue to accommodate right turn bypass as an alternative to providing separate left and right turn lanes.

Constraints, Limitations and Impacts

- The Mill River runs in close proximity to Route 15 in the interchange area. The northbound on ramp improvement would require widening adjacent to the existing steep embankment and could require construction of a retaining wall to minimize potential environmental and right-of-way impacts in this area.
- The mid-term northbound off ramp deceleration lane improvement requires the use of a 180 ft taper (less than the 250 ft taper specified by AASHTO for a parallel deceleration lane) to accommodate a standard deceleration lane within the constraints imposed by the Whitney Avenue bridge structure.
- The existing noise wall adjacent to the southbound on ramp would have to be relocated or replaced in conjunction with the mid-term ramp and acceleration lane improvements.
- The Route 15 bridge structure over Dixwell Avenue would have to be widened to provide the northbound auxiliary lane. The study team does not anticipate that full replacement of the bridge structure would be required to accommodate the auxiliary lane.
- The long-term relocation of the northbound off ramp (Plan A) would require lengthening the dual-pipe culvert that is located under Route 15 near the point of divergence of the ramp. If Plan A is pursued, replacement of the culvert should be evaluated as an alternative to lengthening culvert to address potential flooding issues expressed by the Town of Hamden.

Constraints, Limitations and Impacts (continued)

- **Potential Environmental Impacts:** Table 61-6 summarizes the potential wetland impacts associated with the mid and long-term improvement plans.
- **Potential Right-of-Way (ROW) Impacts:** Table 61-6 summarizes the potential ROW impacts associated with the mid and long-term improvement plans.

Table 61-6. Summary of Potential Impacts: Interchange 61

Improvement	ROW Area (No. Parcels)	Wetland Area
Mid-term Improvement Plan		
• SB acceleration lane improvements	0.07 ac (1)	0.67 ac
• NB acceleration and deceleration lane improvements; NB ramps/Whitney Avenue intersection improvements	0.02 ac (1)	0.67 ac
Long-term Improvement Plan		
• NB – Plan A; auxiliary lane to Interchange 62	0.67 ac (2)	1.89 ac
• NB – Plan B; auxiliary lane to Interchange 62	0 ac (0)	0 ac
• SB ramp improvements; signalization of SB ramps	0 ac (0)	0.44 ac
• Whitney Avenue improvements	0 ac (0)	0 ac

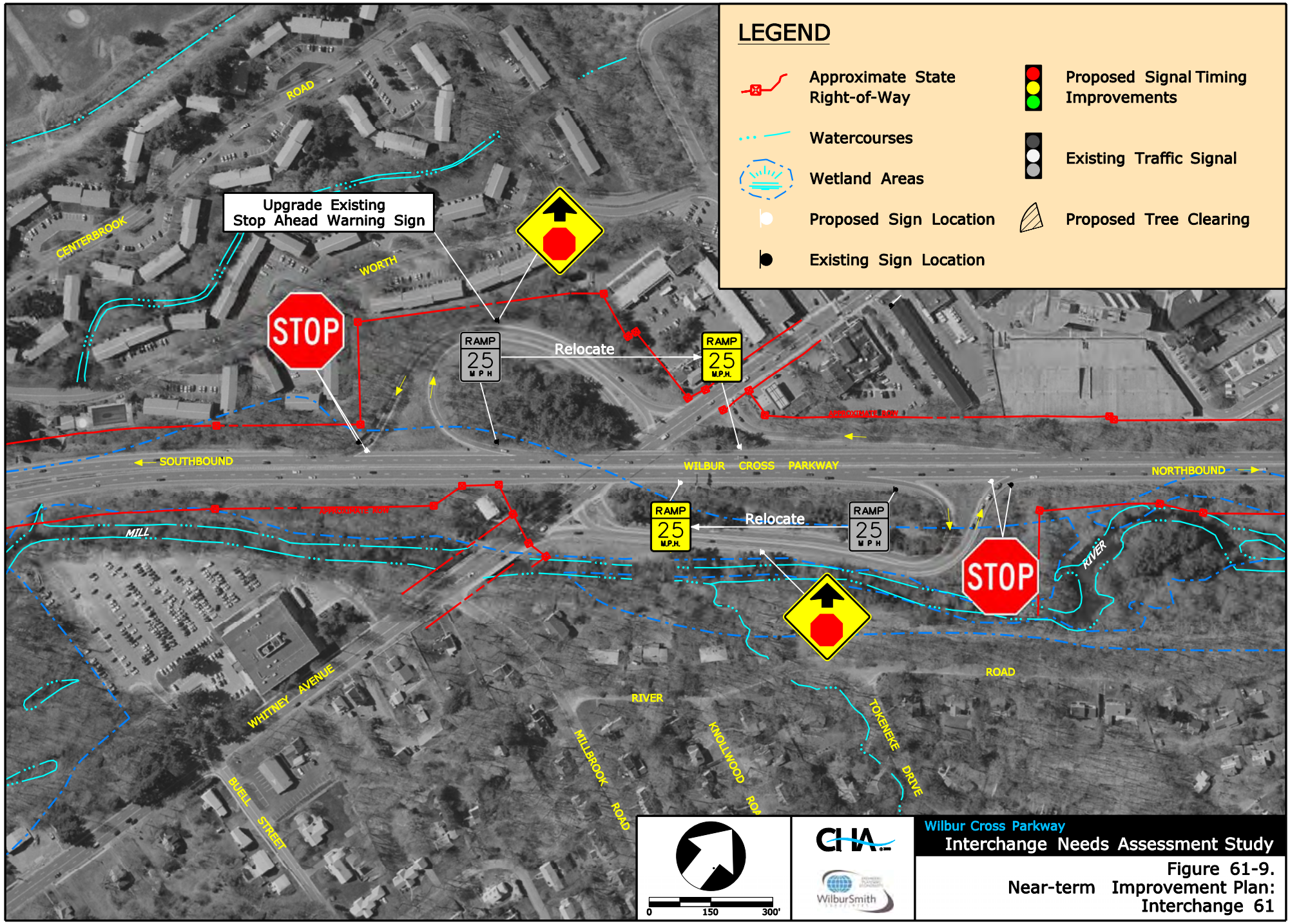
As shown in Table 61-6, minor ROW impacts to two parcels and relatively minor wetland impacts are anticipated with the mid-term improvements. Additionally, long-term Plan A would result in greater ROW and wetland impacts than Plan B.

Estimated Construction Costs

The study team developed planning-level construction cost estimates for the near, mid, and long-term improvement plans at Interchange 61 in accordance with ConnDOT's guidelines for preliminary cost estimating dated January 2009. The planning-level costs shown in Table 61-7 are based on estimates of major construction items and do not include allowances for engineering or any potential right-of-way acquisitions, utility relocations, or environmental mitigation.

Table 61-7. Planning-level Construction Cost Estimates: Interchange 61

Improvement	Planning-level Costs		
	(2009 $)	Mid-term (2014 $)	Long-term (2024 $)
Near-term Improvement Plan			
• All signage improvements	$ 5,000	-	-
Mid-term Improvement Plan			
• SB acceleration lane improvements	$ 1.2 million	$ 1.6 million	-
• NB acceleration and deceleration lane improvements; NB ramps/Whitney Avenue intersection improvements	$ 1.6 million	$ 2.1 million	-
Long-term Improvement Plan			
• NB – Plan A; auxiliary lane to Interchange 62	$ 2.9 million	-	$ 7.0 million
• NB – Plan B; auxiliary lane to Interchange 62	$ 1.5 million	-	$ 3.7 million
• SB ramp improvements; signalization of SB ramps	$ 1.7 million	-	$ 4.1 million
• Whitney Avenue improvements	$700.000	-	$ 1.7 million



Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 61-9.
Near-term Improvement Plan:
Interchange 61

LEGEND

- Approximate State Right-of-Way
- Watercourses
- Wetland Areas
- Approximate Slope Limits
- Structures (Including Bridges, Retaining Walls, and Tunnels)
- Proposed Traffic Signal
- Existing Traffic Signal
- New Pavement Construction
- Existing Pavement to be Removed

Improve Acceleration Length

Realign Southbound On Ramp

APPROXIMATE ROW

SOUTHBOUND

WILBUR CROSS PARKWAY

CENTERBROOK

WORTH

MILL

WHITNEY AVENUE

BUELL STREET

RIVER

MILLBROOK ROAD

KNOLLWOOD ROAD

0 100 200'

CHA

WilburSmith

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 61-10 (Sheet 1 of 2).
Mid-term Improvement Plan:
Interchange 61

LEGEND

- Approximate State Right-of-Way
- Watercourses
- Wetland Areas
- Approximate Slope Limits
- Structures (Including Bridges, Retaining Walls, and Tunnels)
- Proposed Traffic Signal
- Existing Traffic Signal
- New Pavement Construction
- Existing Pavement to be Removed

Provide Full Deceleration Length

Realign Northbound On Ramp

Improve Acceleration Length

Provide Left Turn Lane

WHITNEY AVENUE

AVENUE

WILBUR CROSS PARKWAY

NORTHBOUND

APPROXIMATE ROW

ONLY ONLY

RIVER

MILL

DERWELL AVENUE

BARTON DRIVE

BARTON CL

ROAD

MILLBROOK ROAD

KNOLLWOOD ROAD

TOKENEKE DRIVE

VISTA ROAD

0 100 200'

CHA

WilburSmith

Wilbur Cross Parkway

Interchange Needs Assessment Study

Figure 61-10 (Sheet 2 of 2)
Mid-term Improvement Plan:
Interchange 61

LEGEND

- Approximate State Right-of-Way
- Watercourses
- Wetland Areas
- Approximate Slope Limits
- Structures (Including Bridges, Retaining Walls, and Tunnels)
- Proposed Traffic Signal
- Existing Traffic Signal
- New Pavement Construction
- Existing Pavement to be Removed
- Mid-term Improvements

Match Mid-term Improvements

Close Southbound Off Ramp

Realign Southbound On Ramp

Signalize Whitney Avenue at Southbound Ramps Intersection

Realign Ramp Touchdown

Provide Auxiliary Lane to Interchange 62

Relocate Northbound Off Ramp

Provide Left-Turn Lanes on Whitney Avenue

Realign Northbound On Ramp

Close Northbound Off Ramp

Signalize Whitney Avenue at Northbound Ramps Intersection

CENTERBROOK ROAD

WORTH AVENUE

SOUTHBOUND

WILBUR CROSS PARKWAY

NORTHBOUND

APPROXIMATE ROW

MILL RIVER

WHITNEY AVENUE

BUELL STREET

MILLBROOK ROAD

KNOLLWOOD ROAD

TOKENEKE DRIVE

HAMDEN

NORTH HAVEN

0 100 200'

CHA

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Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 61-11.
Long-term Improvement Plan A:
Interchange 61

LEGEND

- Approximate State Right-of-Way
- Watercourses
- Wetland Areas
- Approximate Slope Limits
- Structures (Including Bridges, Retaining Walls, and Tunnels)
- Proposed Traffic Signal
- Existing Traffic Signal
- New Pavement Construction
- Existing Pavement to be Removed
- Mid-term Improvements

Match Mid-term Improvements

Close Southbound Off Ramp

Realign Southbound On Ramp

Signalize Whitney Avenue at Southbound Ramps Intersection

Realign Ramp Touchdown

Provide Auxiliary Lane to Interchange 62

Signalize Whitney Avenue at Northbound Ramps Intersection

Provide Left Turn Lanes on Whitney Avenue

Realign Northbound Ramps

Mid-term Improvements

CENTERBROOK ROAD

WORTH AVENUE

SOUTHBOUND

APPROXIMATE ROW

WILBUR CROSS PARKWAY

NORTHBOUND

MILL

RIVER

WHITNEY AVENUE

BUELL STREET

MILLBROOK ROAD

KNOLLWOOD ROAD

TOKENEKE DRIVE

0 100 200'

CHA

WilburSmith

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 61-12.
Long-term Improvement Plan B:
Interchange 61

Interchange 62

In Brief

Location: Town of North Haven
- 0.6 mile north of Interchange 61
- 1.1 miles south of Interchange 63

Access to: Dixwell Avenue

Interchange 62 of the Wilbur Cross Parkway is located in the Town of North Haven and provides access to Dixwell Avenue (SR 717). The interchange is a partial interchange that provides northbound access to primarily residential land use in North Haven and some commercial uses to the immediate west in Hamden. From Interchange 62, Dixwell Avenue provides direct access to US Route 5 and Route 40 to the east, and indirect access to I-91 via Route 40. Interchange 62 also includes southbound access to Whitney Avenue; however, for the purposes of this study, the Interchange 62 southbound off ramp to Whitney Avenue is considered part of Interchange 61 and is presented with Interchange 61.

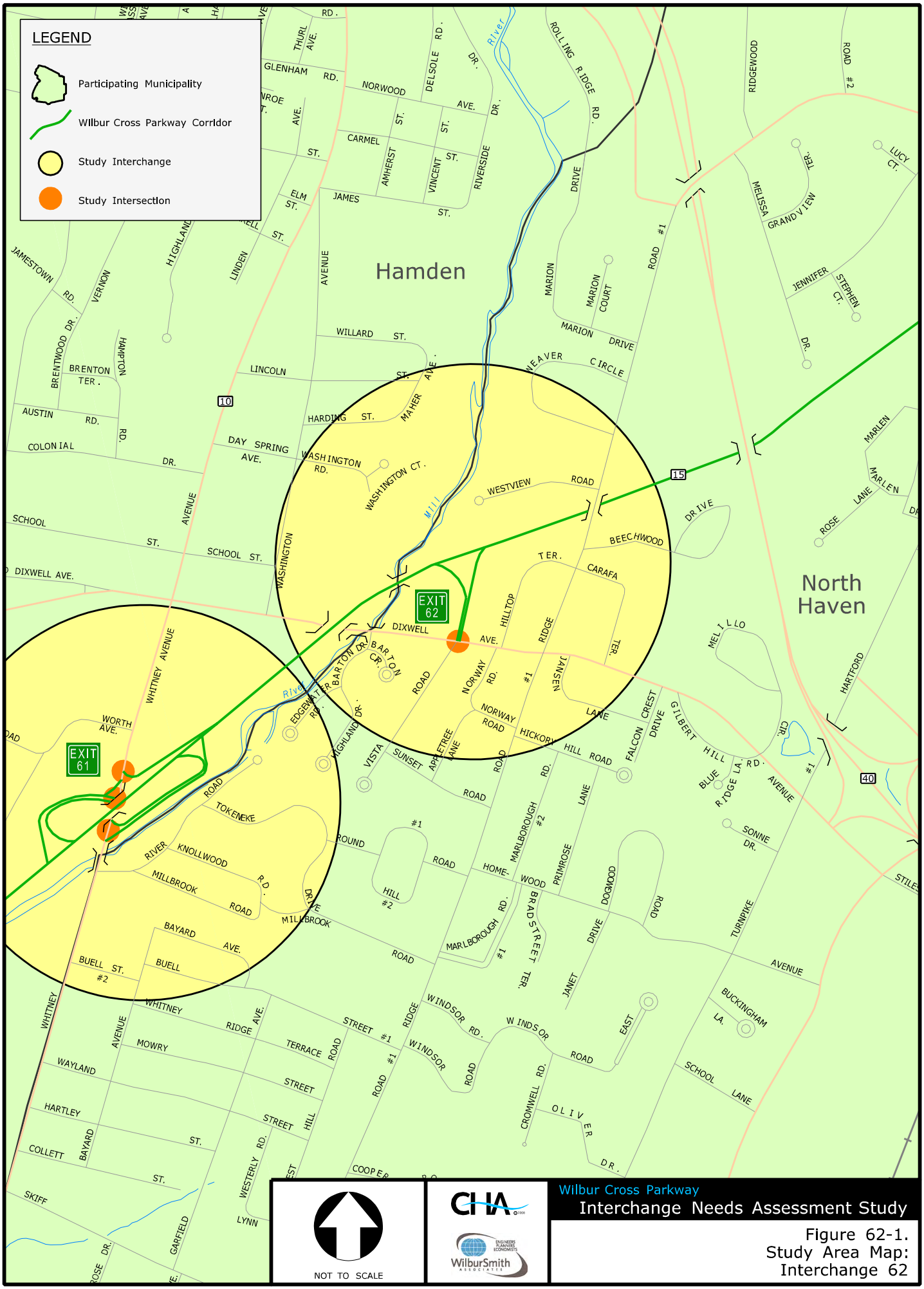
The interchange was originally constructed in the late 1940s with no significant geometric improvements made to the ramps since that time.

The northbound off ramp diverges from the mainline in a taper-type exit and terminates at Dixwell Avenue creating a four-legged signalized intersection with Vista Road. The northbound on ramp is located parallel to the off ramp and is characterized by a stop-controlled approach to the Wilbur Cross Parkway.

The Parkway in the interchange area consists of two travel lanes in the northbound and southbound directions separated by a narrow median with concrete barrier curb south of the interchange, and a narrow depressed median with metal beam guide railing north of the interchange. The typical lane and shoulder configuration includes 11 ft wide lanes, 3 ft to 4 ft wide left shoulders, and 8 ft to 10 ft wide right shoulders.

The study area, as shown in Figure 62-1, includes the interchange ramps, the junction of these ramps with the Wilbur Cross Parkway, and the following intersection:

- Northbound ramps at Dixwell Avenue (signalized)


LEGEND
Participating Municipality
Wilbur Cross Parkway Corridor
Study Interchange
Study Intersection
Hamden
North Haven
EXIT 62
EXIT 61
NOT TO SCALE
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 62-1.
Study Area Map:
Interchange 62

Needs and Deficiencies Assessment

Roadway Geometry

For this study, the critical geometric characteristics of the Wilbur Cross Parkway and its interchanges are those that are closely related to vehicular safety. These critical geometric characteristics include deceleration lane lengths; acceleration lane lengths; and ramp curvatures and speeds. The study team determined the existing geometric characteristics of Interchange 62 and compared them to the minimum design standards obtained from ConnDOT's *Highway Design Manual 2003 Edition* (HDM).

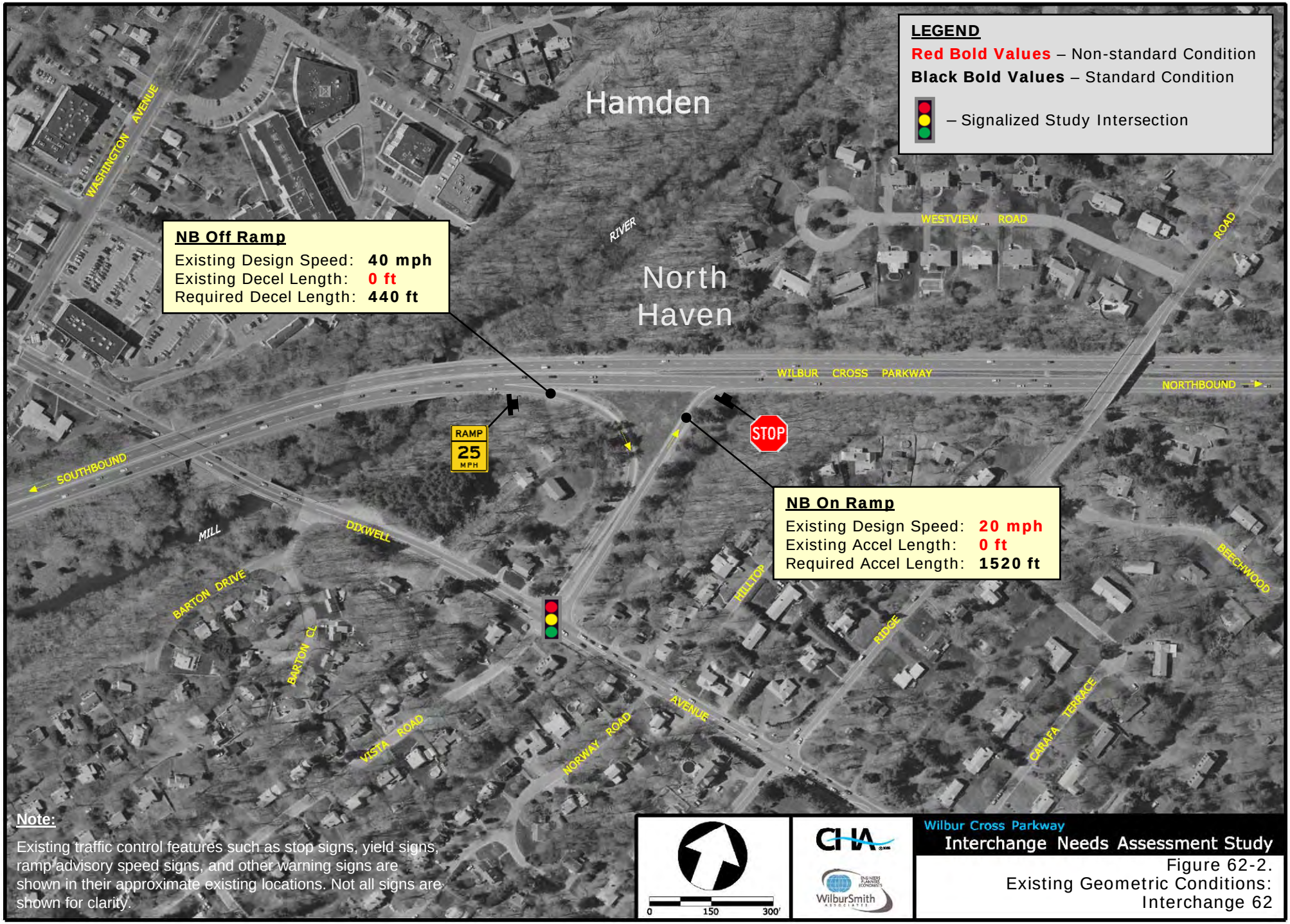
The results of the existing geometric conditions assessment are summarized in Table 62-1 and illustrated in Figure 62-2. Non-standard conditions, or deficiencies, are noted in bold red text in the table and figure.

Table 62-1. Existing Geometric Conditions Summary: Interchange 62

Location	Ramp		Acceleration/Deceleration Lanes		Other Notes
	Curve Radius	Design Speed	Existing Length	Required Length	
Northbound					
Off Ramp	590 ft	40 mph	**195 ft**	440 ft	-
On Ramp	**100 ft**	**20 mph**	**0 ft**	1520 ft	Stop Condition

As shown in Table 62-1, the following geometric conditions are deficient:

- **Northbound Deceleration Lane:** Limited deceleration lane exists to accommodate deceleration from mainline to ramp speeds. Deceleration must occur on the mainline creating unsafe conditions for through and exiting traffic.
- **Northbound On Ramp and Acceleration Lane:** Ramp curvature and 20 mph design speed are non-standard. Stop-controlled approach requires motorists to perceive gaps in traffic flow sufficient to accommodate merging operations and acceleration to mainline speeds. No acceleration lane exists to accommodate acceleration prior to merging.


LEGEND
Red Bold Values – Non-standard Condition
Black Bold Values – Standard Condition
– Signalized Study Intersection
NB Off Ramp
Existing Design Speed: 40 mph
Existing Decel Length: 0 ft
Required Decel Length: 440 ft
NB On Ramp
Existing Design Speed: 20 mph
Existing Accel Length: 0 ft
Required Accel Length: 1520 ft
Hamden
North Haven
WASHINGTON AVENUE
RIVER
WESTVIEW ROAD
WILBUR CROSS PARKWAY
NORTHBOUND
SOUTHBOUND
RAMP
25
MPH
STOP
MILL
DIXWELL
BARTON DRIVE
BARTON CL
HILLTOP
RIDGE
BEECHWOOD
VISTA ROAD
NORWAY ROAD
AVENUE
CARAFA TERRACE
0
150
300'
Note:
Existing traffic control features such as stop signs, yield signs, ramp advisory speed signs, and other warning signs are shown in their approximate existing locations. Not all signs are shown for clarity.
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 62-2.
Existing Geometric Conditions:
Interchange 62

Traffic Conditions

The study team compiled traffic data for Interchange 62 that included average daily traffic (ADT) volumes, existing (2008) weekday peak hour traffic volumes, and estimated future (2030) weekday peak hour traffic volumes. This data was used as the basis for assessing traffic conditions on the mainline Wilbur Cross Parkway (WCP), at the interchange ramp junctions, and at the northbound ramps intersection with Dixwell Avenue. Figure 62-3 illustrates the most recent (2006) ADT volumes that were obtained by ConnDOT at Interchange 62.

Figure 62-3. 2006 Average Daily Traffic Volumes (in vehicles per day, vpd): Interchange 62

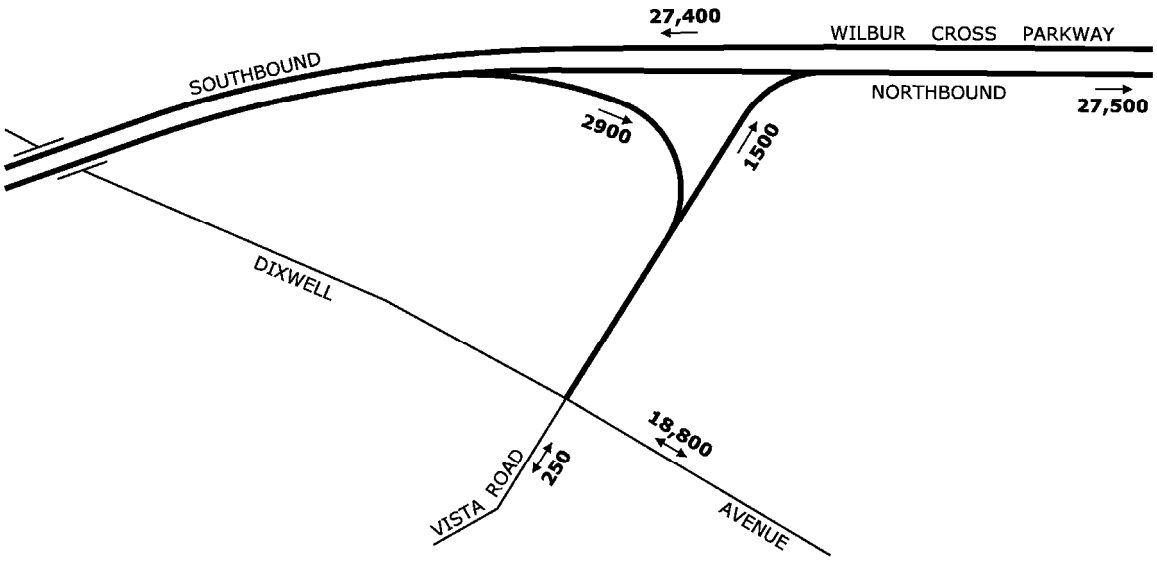
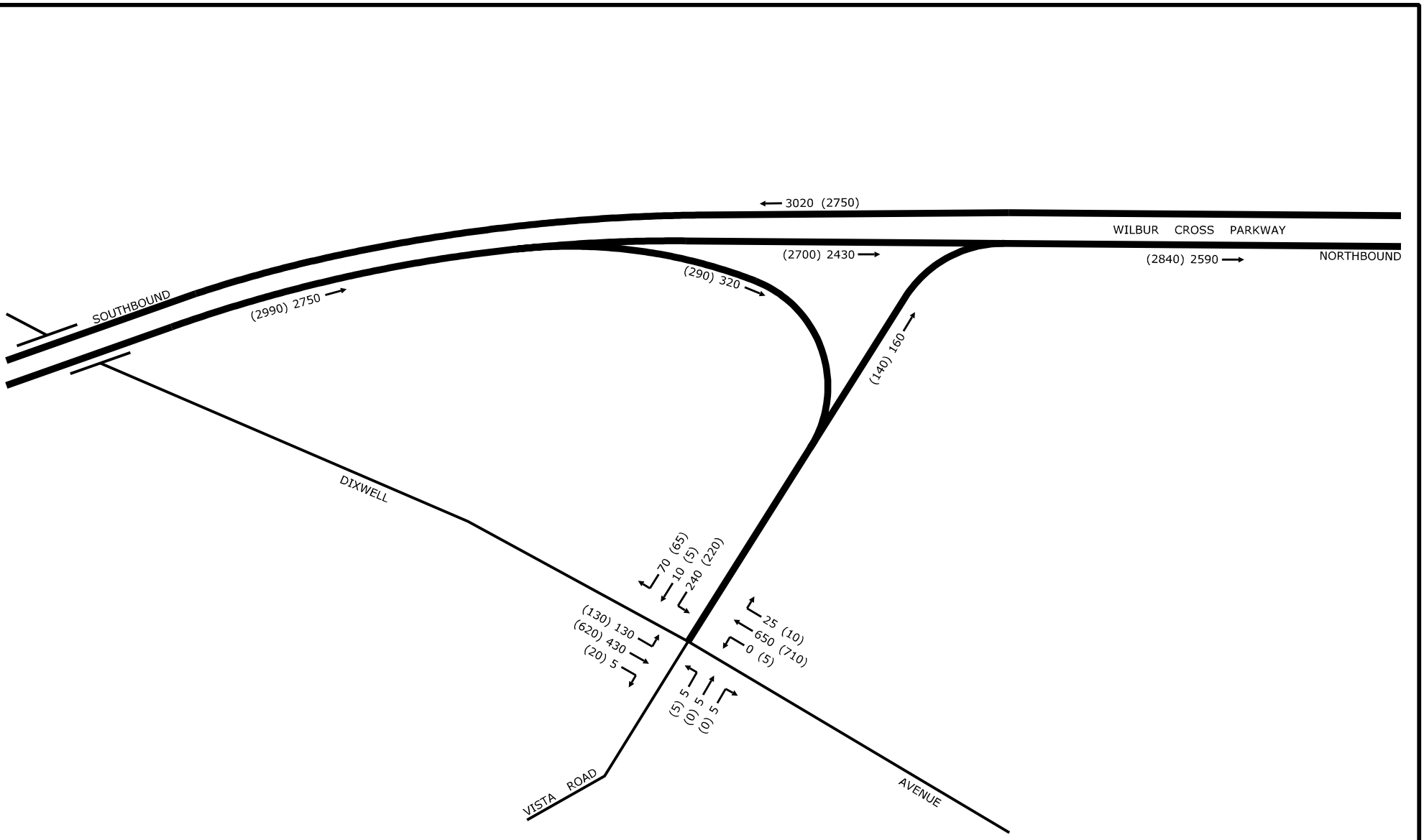


Figure 62-4 presents the 2008 weekday peak hour traffic volumes for the morning (AM) and afternoon (PM) peak commuting periods. The study team worked with ConnDOT's traffic forecasting unit to develop these volumes from intersection turning movement counts obtained by SCRCOG and available traffic data for Interchange 62 provided by ConnDOT.

Figure 62-5 presents the estimated 2030 weekday peak hour traffic volumes that were developed by ConnDOT's traffic forecasting unit. These volumes reflect an increase in traffic at Interchange 62 that is primarily a function of regional background traffic growth as no major developments in the interchange area are expected to significantly affect future traffic estimates.

The notable traffic conditions presented in Figures 62-3, 62-4, and 62-5 include:

- Highest daily ramp volumes occur on the northbound off ramp
- Lowest daily ramp volumes occur on the northbound on ramp
- Approximately 53% of WCP traffic is traveling southbound in the morning
- Approximately 52% of WCP traffic is traveling northbound in the afternoon
- Overall traffic growth by 2030 is estimated to be approximately 23%, or 1.0% annually


3020 (2750)
WILBUR CROSS PARKWAY
(2700) 2430
(2840) 2590
NORTHBOUND
SOUTHBOUND
(2990) 2750
(290) 320
(140) 160
DIXWELL
70 (65)
10 (5)
240 (220)
(130) 130
(620) 430
(20) 5
25 (10)
650 (710)
0 (5)
(5) 5
(0) 5
(0) 5
VISTA ROAD
AVENUE
LEGEND
(PM) AM
NOT TO SCALE
CHA
WilburSmith
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 62-4.
Existing (2008) Peak Hour Volumes:
Interchange 62

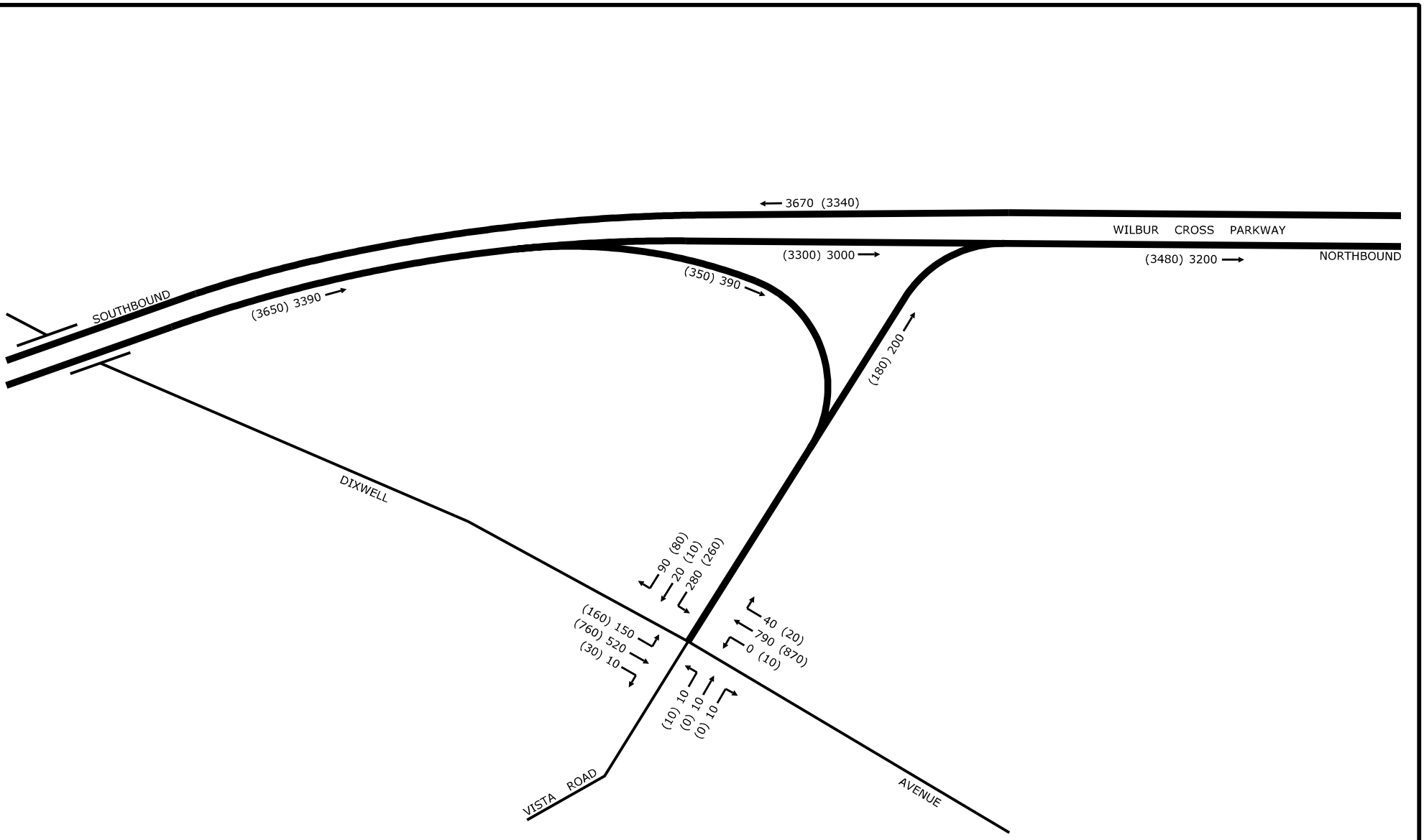

3670 (3340)
WILBUR CROSS PARKWAY
(3300) 3000
(3480) 3200
NORTHBOUND
SOUTHBOUND
(3650) 3390
(350) 390
(180) 200
DIXWELL
90 (80)
20 (10)
280 (260)
(160) 150
(760) 520
(30) 10
40 (20)
790 (870)
0 (10)
(10) 10
(0) 10
(0) 10
VISTA ROAD
AVENUE
LEGEND
(PM) AM
NOT TO SCALE
CHA
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Figure 62-5.
Future (2030) Peak Hour Volumes:
Interchange 62

Traffic Operations

The study team analyzed the operations of the mainline segments, ramp junctions, and ramp intersection in the Interchange 62 study area. The analyses were conducted for the weekday AM and PM peak hours under the 2008 and estimated 2030 traffic conditions. The results of the analyses, which are reported as Levels of Service (LOS), are presented below in tabular form and illustrated in Figures 62-6 and 62-7.

As described in the *Needs Assessment Overview* section, LOS D or better represents an acceptable degree of congestion for mainline segments, ramp junctions, and intersections. LOS E and F, which are indicated in red in the tables and figures, represent unacceptable degrees of congestion. Locations operating at LOS E and F are highlighted in this report to indicate locations where traffic capacity and operational issues exist, or could exist under future traffic.

Mainline

Table 62-2. Mainline Operations Summary: Interchange 62

Direction	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
Northbound				
South of Interchange 62	C (21.9)	D (28.2)	C (24.0)	D (31.5)
Between Interchange 62 Ramps	C (19.3)	C (24.1)	C (21.5)	D (27.2)
North of Interchange 62	C (20.6)	C (26.1)	C (22.7)	D (29.3)
Southbound				
At Interchange 62	C (24.3)	D (31.8)	C (21.9)	D (27.6)

[1] Mainline density is reported in passenger cars per mile per lane (pc/mi/ln).

The mainline analysis shows that all mainline segments currently operate at LOS C during both the AM and PM peak hours. The higher traffic densities in the southbound direction in the AM and in the northbound direction in the PM correspond to the predominant direction of travel during the respective peak hours. Levels of service are reduced under 2030 traffic conditions but operations are expected to be acceptable (LOS C and D) during both peak hours.

Ramp Junctions

Table 62-3. Ramp Merge/Diverge Operations Summary: Interchange 62

Direction	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
Northbound				
Off Ramp to Dixwell Avenue	D (28.8)	D (34.9)	D (31.1)	E (37.4)
On Ramp from Dixwell Avenue	C (27.2)	D (33.1)	D (29.4)	E (35.5)

[1] Ramp junction density is reported in passenger cars per mile per lane (pc/mi/ln).

The ramp analysis shows that the northbound ramps currently operate at LOS D or better during both the AM and PM peak hours. Levels of service deteriorate under 2030 traffic conditions resulting in LOS E at the northbound ramp junctions in the PM peak hour.

Intersections

The study team analyzed traffic operations at the following intersection:

- **Northbound Ramps at Dixwell Avenue:** Signalized, four-legged intersection with Vista Road. Dixwell Avenue is oriented in an east-west direction; ramps and Vista Road are oriented in a north-south direction. Dixwell Avenue is a two lane roadway with both approaches consisting of a shared left-through-right lane. The northbound off ramp and Vista Road approaches also consist of shared left-through-right lanes.

Results of the intersection analysis are presented in Table 62-4.

Table 62-4. Intersection Operations Summary: Interchange 62

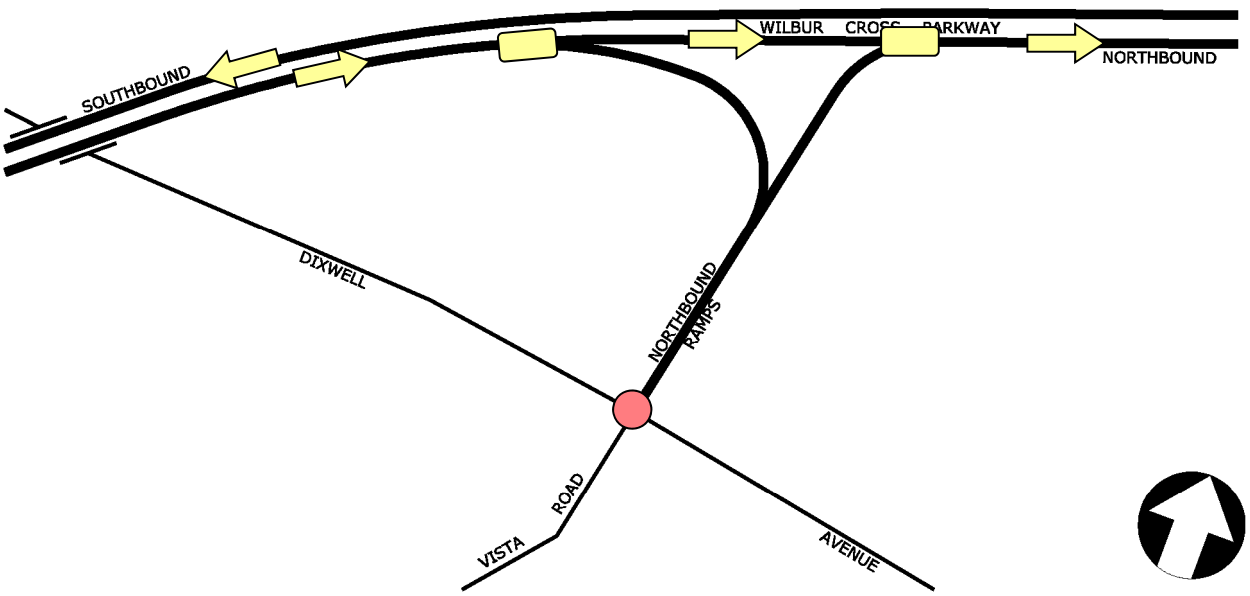
Intersection / Approach	AM LOS (Delay[1])		PM LOS (Delay[1])	
	2008	2030	2008	2030
NB Ramps at Dixwell Avenue				
Eastbound – Dixwell Avenue	F (>80)	F (>80)	D (49.8)	F (>80)
Westbound – Dixwell Avenue	C (20.4)	C(34.4)	C (23.7)	D (53.9)
Northbound – Vista Road	C (20.7)	B(19.9)	C (25.4)	C (25.6)
Southbound – Route 15 NB Ramps	F (>80)	F (>80)	F (>80)	F (>80)
Overall	**F (>80)**	**F (>80)**	**D (46.3)**	**F (>80)**

[1] Delays are reported in seconds.

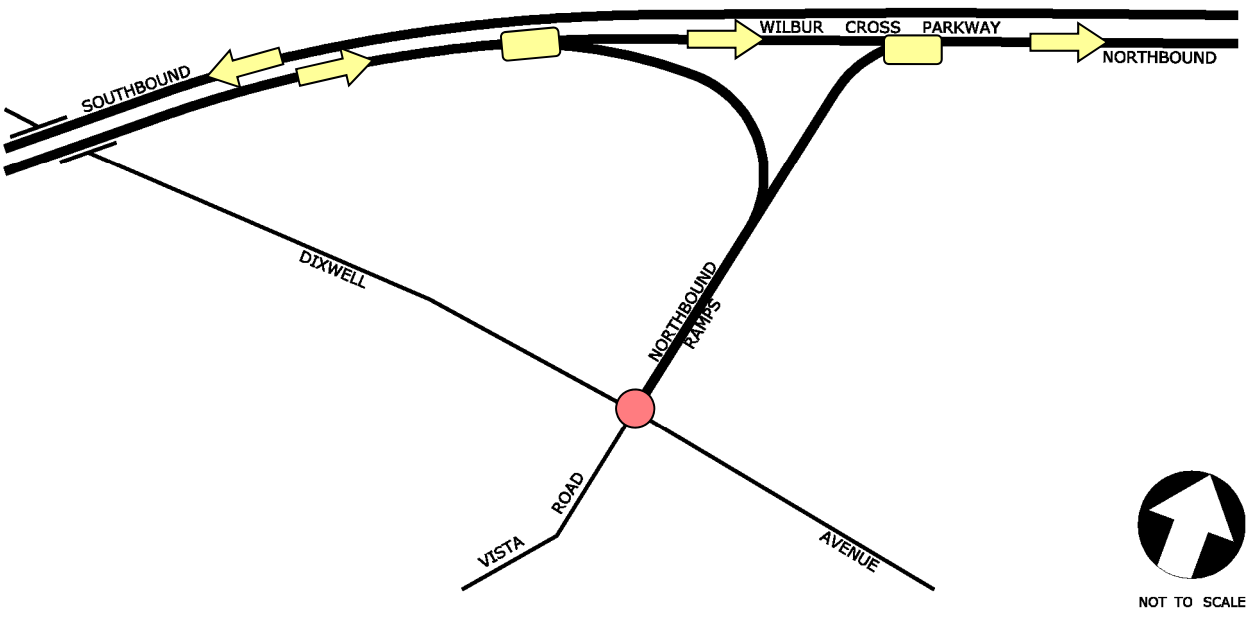
The intersection analysis shows that the northbound ramps intersection currently operates at LOS F during the AM peak hour with long delays being experienced on the eastbound Dixwell Avenue approach and the northbound off ramp approach to the intersection. Levels of service are expected to deteriorate under 2030 traffic conditions resulting in LOS F for the overall intersection during both the AM and PM peak hours. Increasingly long delays and the resulting traffic queues on the northbound off ramp will extend back from the intersection on to the ramp curve where sight distance from the mainline to the back of queue is limited by the curve of the ramp and vegetation along the inside of the curve.

Figures 62-6 and 62-7 summarize the results of the traffic operations analyses for the AM and PM peak hour traffic conditions, respectively.

Existing (2008) Traffic Operations – AM



Future (2030) Traffic Operations – AM

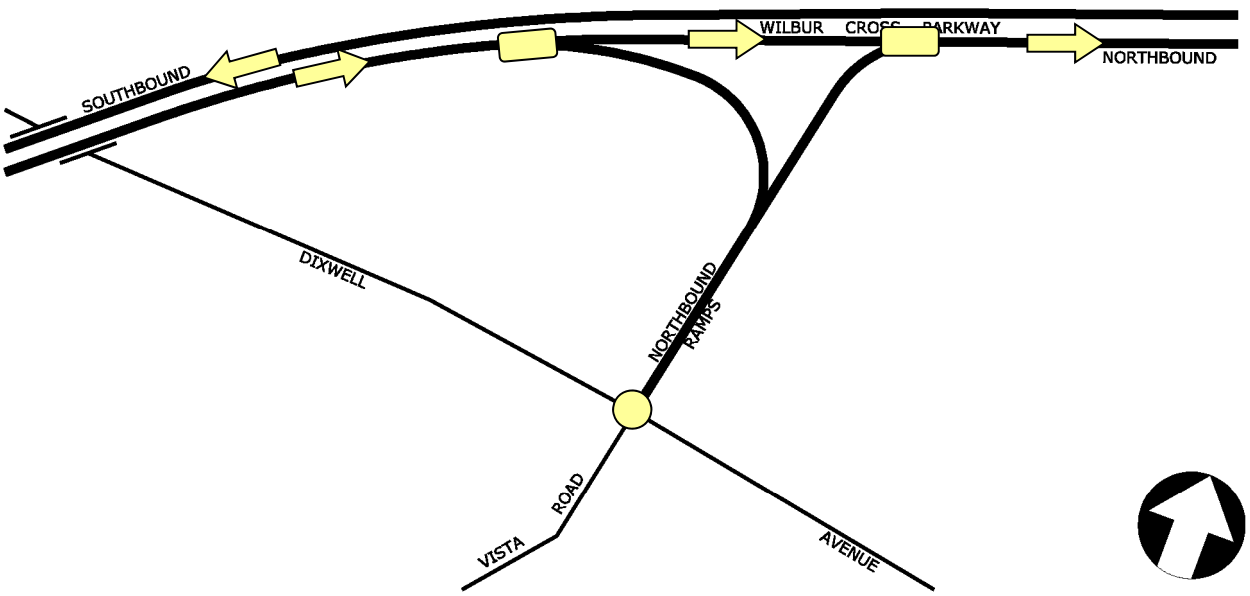


LOS	Intersection	Mainline	Merge/Diverge
A-B			
C-D			
E-F			

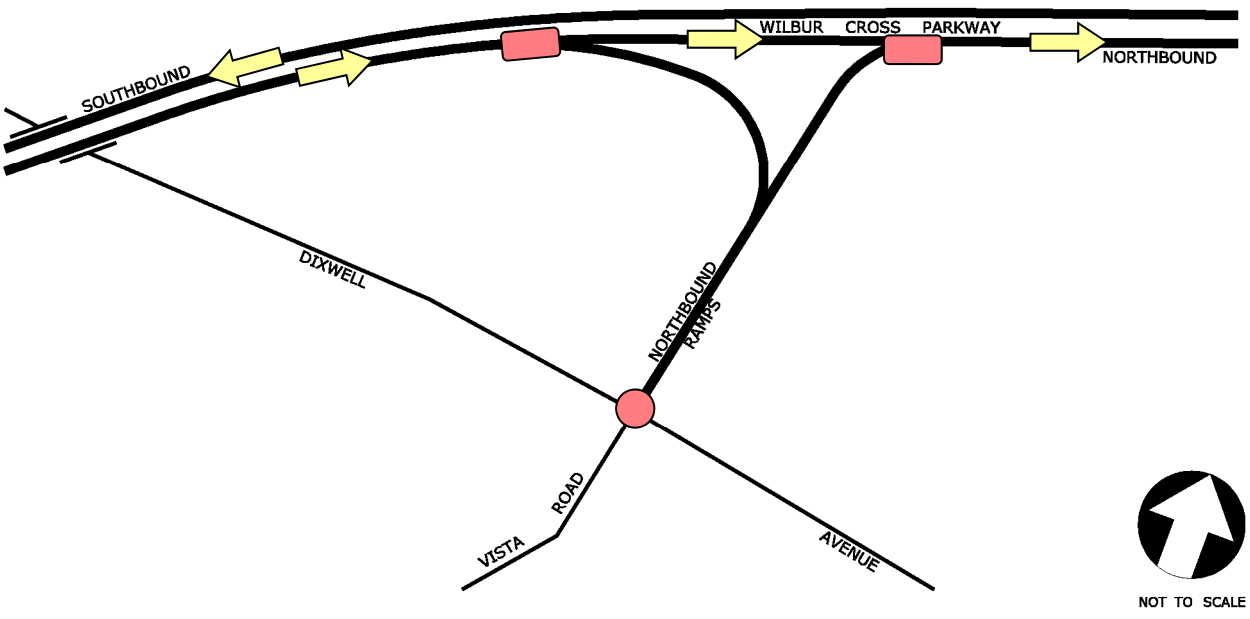
Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 62-6.
AM Traffic Operations Summary:
Interchange 62

Existing (2008) Traffic Operations – PM



Future (2030) Traffic Operations – PM



LOS	Intersection	Mainline	Merge/Diverge
A-B			
C-D			
E-F			

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 62-7.
PM Traffic Operations Summary:
Interchange 62

Accidents and Safety

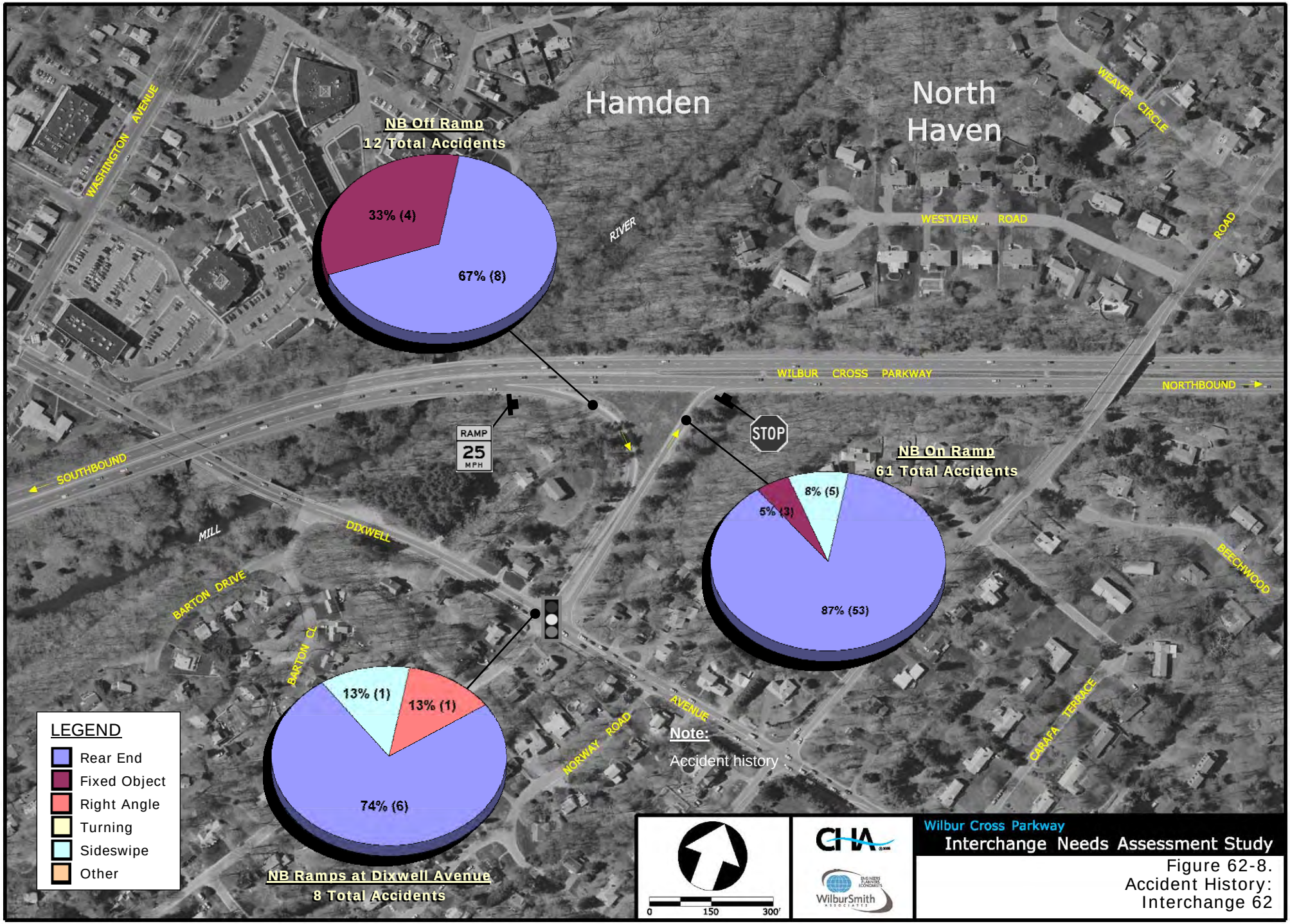
The study team obtained accident data from ConnDOT's *Traffic Accident Viewing System* (TAVS) for the three-year period beginning January 1, 2005 and ending December 31, 2007. The data shows that 86 accidents occurred in the interchange area during this period, the majority of which were rear-end accidents. Table 62-5 summarizes the types of collisions that occurred at various locations in the interchange area. Figure 62-8 illustrates the accident trends that have developed over the last few years.

The study team notes that Interchange 62 is considered a *high accident location*. By definition, a high accident location is one that has experienced an accident rate that is higher than expected based on accident rates for similar locations.

Table 62-5. Accident History: Interchange 62

Location	Collisions by Type					
	Rear End	Fixed Object	Side Swipe	Right Angle	Other	Total
Northbound						
Off Ramp	8	4	-	-	-	**12**
Between Off and On Ramps	1	2	1	-	-	**5**
On Ramp	53	3	5	-	-	**61**
Secondary Roadway						
Dixwell Avenue at NB Ramps	6	-	1	1	1	**8**
Total Number	**68**	**9**	**7**	**1**	**1**	**86**
Percentage	**79%**	**11%**	**8%**	**1%**	**1%**	**100%**

As shown in Table 62-5, the northbound on ramp experienced the highest number of collisions. The collisions at the on ramp were predominantly rear-end collisions, which the study team believes is a direct result of the *stop* condition and lack of acceleration lane that precedes the merge with mainline traffic. Stop conditions at the end of interchange ramps are not consistent with driver expectations for limited access facilities like the Wilbur Cross Parkway. Insufficient warning to drivers of such a condition; poor visibility of stopped vehicles by approaching drivers; and driver uncertainty and hesitation while attempting to enter a high volume and high speed corridor are all likely factors that contribute to the accident history on this ramp.


Hamden
North Haven
NB Off Ramp
12 Total Accidents
33% (4)
67% (8)
NB On Ramp
61 Total Accidents
8% (5)
5% (3)
87% (53)
NB Ramps at Dixwell Avenue
8 Total Accidents
13% (1)
13% (1)
74% (6)
RAMP
25
MPH
STOP
WILBUR CROSS PARKWAY
NORTHBOUND
SOUTHBOUND
WASHINGTON AVENUE
WESTVIEW ROAD
WEAVER CIRCLE
RIVER
MILL
DIXWELL
BARTON DRIVE
BARTON CL
NORWAY ROAD
AVENUE
CARAFA TERRACE
BEECHWOOD
LEGEND
Rear End
Fixed Object
Right Angle
Turning
Sideswipe
Other
Note:
Accident history
0
150
300'
CHA
WilburSmith
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 62-8.
Accident History:
Interchange 62

Recommended Improvement Plan

The study team worked with the Town of North Haven, ConnDOT, SCRCOG, and other stakeholders to develop and refine a set of near-term, mid-term, and long-term improvement plans to address the identified deficiencies and needs at Interchange 62. The recommended improvement plans are detailed and illustrated below along with discussion regarding other design and implementation considerations. Also included are summaries of constraints, impacts, and estimated construction costs.

Near-term Improvement Plan (Figure 62-9)

Northbound:

- Clear trees and vegetation on right side of off ramp to improve sight lines for motorists exiting mainline. Install a signal ahead warning sign on off ramp.
- Relocate existing 25 mph ramp advisory speed sign for off ramp to improve visibility of sign and to provide motorists a greater advance warning of ramp speed condition.
- Provide stop ahead warning sign along on ramp to provide adequate advance warning of stop condition.
- Provide stop signs on left and right sides of on ramp at the mainline junction to improve visibility of stop condition.

Near, Mid, and Long-term Definitions

Near-term:

- Implementation period of 1 to 3 years.
- Includes low cost improvements such as signing and striping improvements, existing signal timing modifications, tree clearing, etc.

Mid-term:

- Implementation period of 3 to 10 years.
- Includes acceleration and deceleration lane improvements, new turn lanes, new traffic signals, and minor ramp modifications that could be implemented with little or no impacts to rights-of-way, environmental features, or existing bridge structures.

Long-term:

- Implementation period greater than 10 years.
- Includes higher-cost improvements that could significantly impact existing bridge structures, rights-of-way, or environmental features.

Mid-term Improvement Plan (Figure 62-10)

Northbound:

- Provide left turn lane on the off ramp approach at Dixwell Avenue intersection to improve intersection capacity and provide additional storage to minimize the potential for traffic queuing back to the Route 15 mainline. Install lane control sign.

Dixwell Avenue:

- Provide eastbound left turn lane on Dixwell Avenue at the northbound ramps intersection to improve capacity on Dixwell Avenue. Existing roadway is sufficiently wide to accommodate the turn lane by re-striping the lanes; no pavement widening is required. Install lane control sign. Revise traffic signal timings at the Dixwell Avenue/northbound ramps intersection in conjunction with turn lane improvements.

Long-term Improvement Plan (Figure 62-11)

Northbound:

- Provide standard deceleration length for the off ramp and improve ramp curvature. The deceleration lane improvements will require widening the Route 15 bridge structure over the Mill River. It is anticipated that the deceleration lane would ultimately connect to the northbound auxiliary lane improvements from Interchange 61 (see Interchange 61 improvements).
- Provide standard acceleration length for the on ramp and improve ramp curvature. The acceleration lane improvements will require constructing a cut-and-cover tunnel behind the existing Ridge Road bridge structure to convey the northbound on ramp under existing Ridge Road. The length of acceleration lane that is located parallel to the mainline can be extended northerly under the Route 40 bridge structures if necessary to provide a greater opportunity for motorists to find sufficient gaps in mainline traffic for merging. There is sufficient horizontal and vertical clearance beneath the Route 40 structures to accommodate lengthening of the acceleration lane without the need to modify the structures. As shown in Figure 62-11, the parallel acceleration/merge area is the minimum standard length of 300 ft.

Other Considerations

- Provide northbound auxiliary lane between Interchange 61 on ramp and Interchange 62 off ramp. As a potential first phase, provide the standard deceleration length for the Interchange 62 northbound off ramp while avoiding impacts to the existing Route 15 bridge structure over Dixwell Avenue (see Interchange 61 improvement plans).
- Consider providing a mid-term improvement for a northbound acceleration lane that would run adjacent to the mainline for a distance of approximately 300 ft and terminate immediately south of the Ridge Road overpass (See Appendix 4 for figure). The study team notes that the configuration of the ramp/mainline merge would not meet current ConnDOT standards and that there could be safety issues associated with a limited merging area and a merge taper that terminates near the Ridge Road bridge abutment. However, the benefits of removing the stop condition from the on ramp would have to be weighed against the possible safety issues associated with a nonstandard acceleration lane in this location. The study team recommends further discussions with ConnDOT regarding the appropriateness of providing a mid-term improvement at this location.
- As a potential alternative to providing a cut-and-cover tunnel, replace the existing Ridge Road bridge structure in conjunction with providing a standard acceleration lane for the northbound on ramp. Whether a cut-and-cover tunnel or new bridge structure is the preferred alternative will likely be a function of the condition of the bridge at the time the northbound acceleration lane improvements are programmed. The estimated construction cost for a new bridge structure is approximately $3.6 million (2009 $).
- The geometric requirements of the intersection improvements will be further evaluated and refined through subsequent stages of planning and design.

Potential Constraints, Limitations and Impacts

- The Route 15 bridge structure over the Mill River will have to be widened to accommodate the northbound deceleration lane improvements. The study team does not anticipate that full replacement of the bridge structure would be required.
- The Route 15 bridge structure over Dixwell Avenue will have to be widened to accommodate the northbound auxiliary lane improvements. The study team does not anticipate that full replacement of the bridge structure would be required.
- The Ridge Road bridge structure over the Parkway limits the opportunity for a typical northbound acceleration lane improvement.
- **Potential Environmental Impacts:** No significant impacts are anticipated with the mid-term improvement plan. However, the long-term improvement plan could result in approximately 0.72 ac of wetland impacts (0.21 ac associated with the northbound on ramp and acceleration lane; 0.51 ac associated with the northbound off ramp and deceleration lane).
- **Potential Right-of-Way (ROW) Impacts:** No significant right-of-way impacts are anticipated with the mid or long-term improvement plans at Interchange 62.

Estimated Construction Costs

The study team developed planning-level construction cost estimates for the near, mid, and long-term improvement plans at Interchange 62 in accordance with ConnDOT's guidelines for preliminary cost estimating dated January 2009. The planning-level costs shown in Table 62-6 are based on estimates of major construction items and do not include allowances for engineering or any potential right-of-way acquisitions, utility relocations, or environmental mitigation.

Table 62-6. Planning-level Construction Cost Estimates: Interchange 62

Improvement	Planning-level Costs		
	(2009 $)	Mid-term (2014 $)	Long-term (2024 $)
Near-term Improvement Plan			
• All signage improvements; tree clearing	$ 13,000	-	-
Mid-term Improvement Plan			
• NB off ramp turn lane improvements; Dixwell Avenue turn lane improvements; traffic signal modification	$ 210,000	$ 280,000	-
Long-term Improvement Plan			
• NB off ramp and deceleration lane improvements	$ 2.0 million	-	$ 4.8 million
• NB on ramp and acceleration lane improvements	$ 3.6 million	-	$ 8.6 million

Note: Costs shown for long-term plan do not include northbound auxiliary lane from Interchange 61. Cost of auxiliary lane is included with the Interchange 61 planning-level construction cost estimate.

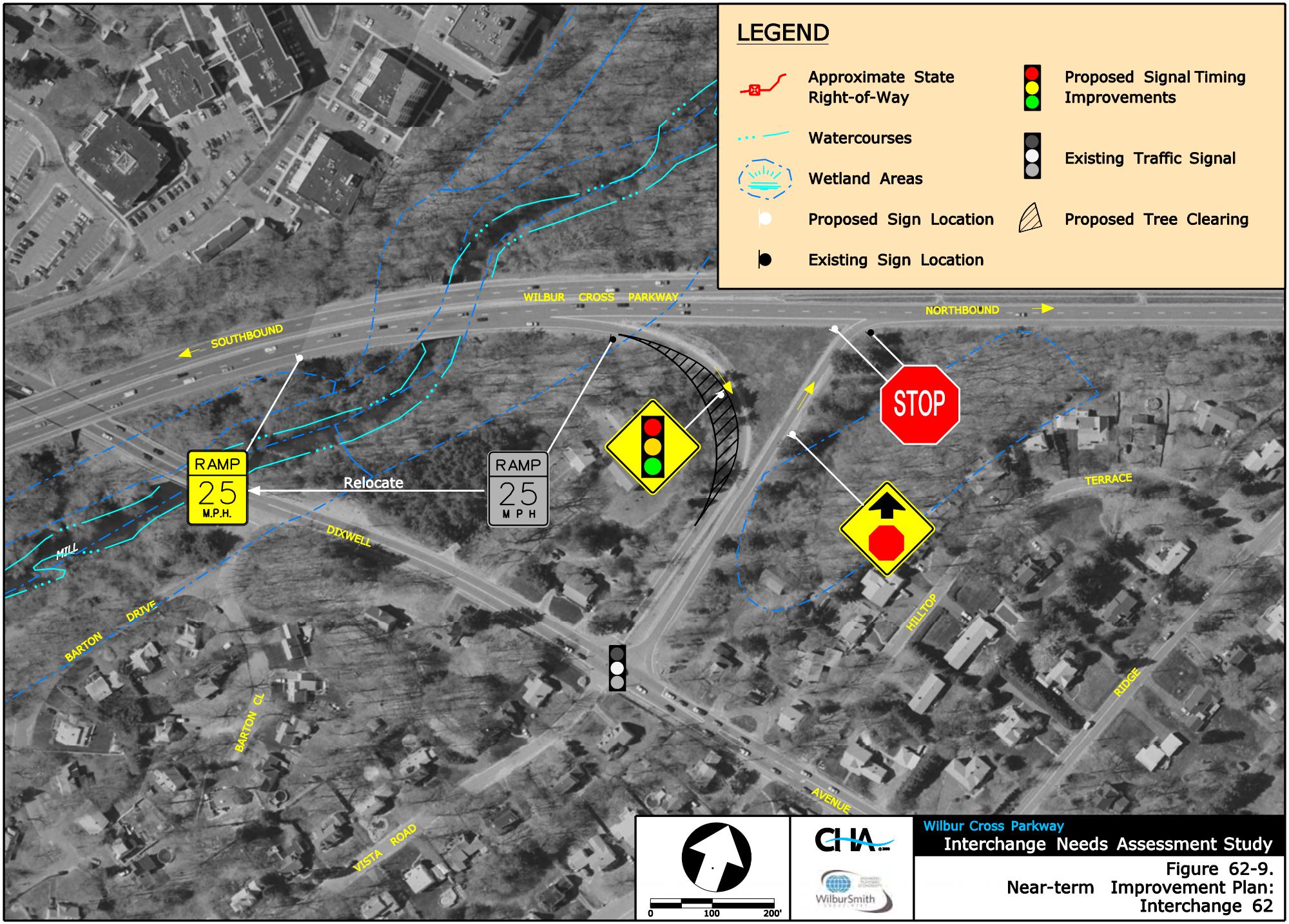

LEGEND
Approximate State Right-of-Way
Watercourses
Wetland Areas
Proposed Sign Location
Existing Sign Location
Proposed Signal Timing Improvements
Existing Traffic Signal
Proposed Tree Clearing
WILBUR CROSS PARKWAY
SOUTHBOUND
NORTHBOUND
RAMP 25 M.P.H.
Relocate
RAMP 25 M P H
STOP
DIXWELL
MILL
BARTON DRIVE
BARTON CL
VISTA ROAD
AVENUE
HILLTOP
TERRACE
RIDGE
0
100
200'
CHA
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Figure 62-9.
Near-term Improvement Plan:
Interchange 62

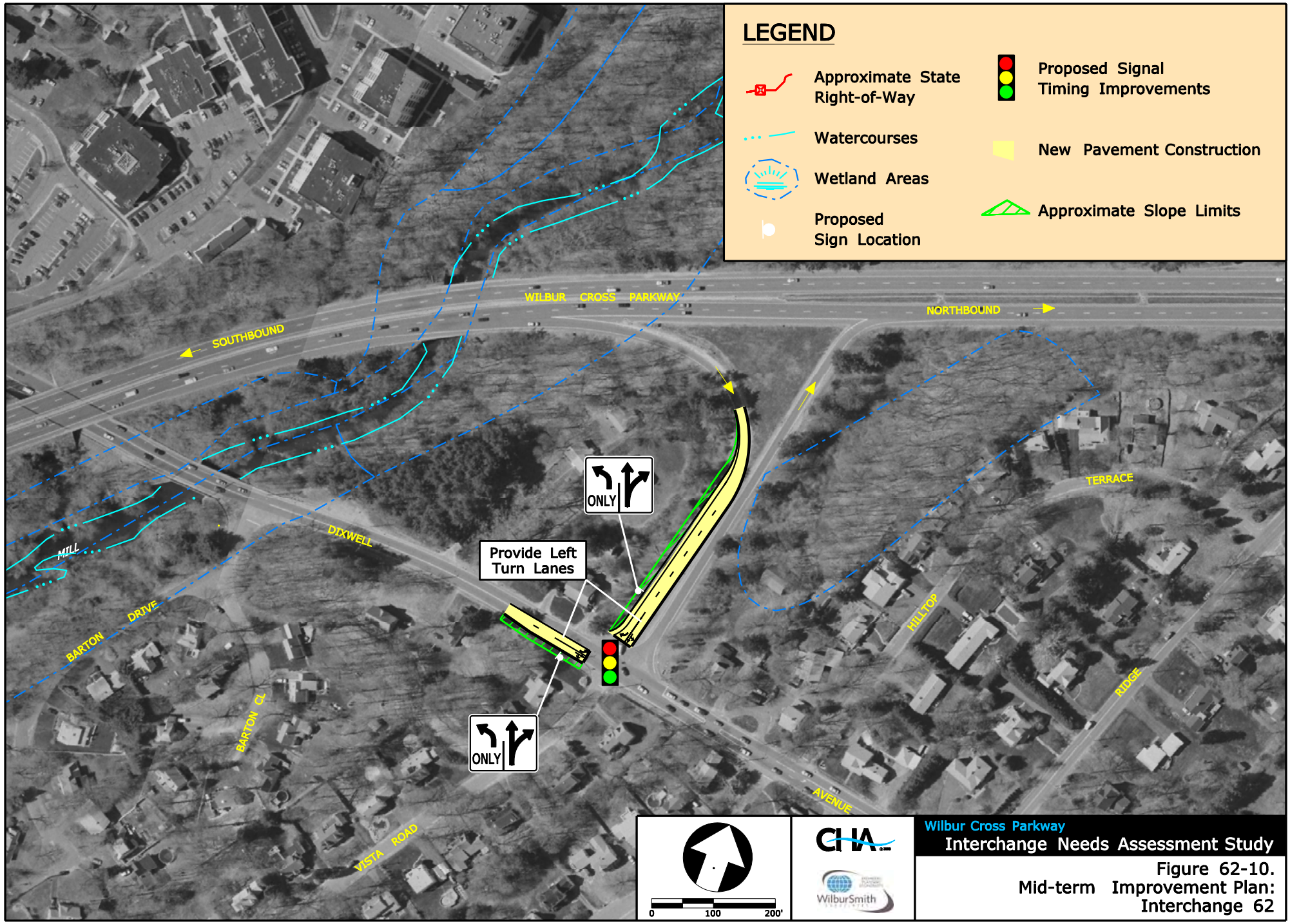
LEGEND
Approximate State Right-of-Way
Watercourses
Wetland Areas
Proposed Sign Location
Proposed Signal Timing Improvements
New Pavement Construction
Approximate Slope Limits
WILBUR CROSS PARKWAY
SOUTHBOUND
NORTHBOUND
ONLY
ONLY
Provide Left Turn Lanes
DIXWELL
MILL
BARTON DRIVE
BARTON CL
VISTA ROAD
AVENUE
HILLTOP
TERRACE
RIDGE
0
100
200'
CHA
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Figure 62-10.
Mid-term Improvement Plan:
Interchange 62

LEGEND

- Approximate State Right-of-Way
- Watercourses
- Wetland Areas
- Approximate Slope Limits
- Structures (Including Bridges, Retaining Walls, and Tunnels)
- Proposed Traffic Signal
- Existing Traffic Signal
- New Pavement Construction
- Existing Pavement to be Removed
- Mid-term Improvements

Provide Auxiliary Lane Interchange 61 to 62

Realign Northbound Off Ramp

Widen Bridge Structure to Accommodate New Travel Lane (Typ.)

Match Mid-term Improvements

Realign Northbound Off Ramp

Provide Cut-and-Cover Tunnel

Provide Full Acceleration Length

WASHINGTON AVENUE

WESTVIEW ROAD

WILBUR CROSS PARKWAY

NORTHBOUND

SOUTHBOUND

DIXWELL

BARTON DRIVE

BARTON CL

VISTA ROAD

NORWAY ROAD

AVENUE

HILLTOP

RIDGE

CARAFA TERRACE

BEECHWOOD

DRIVE

TERRACE

ROAD

0 150 300'

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 62-11.
Long-term Improvement Plan:
Interchange 62

Interchange 63

In Brief

Location: Town of North Haven
- 1.1 miles north of Interchange 62
- 0.4 mile south of Service Area
- 5.0 miles south of Interchange 64

Access to: Route 22 (Bishop Street)
Hartford Turnpike

Interchange 63 of the Wilbur Cross Parkway is located in the Town of North Haven and provides access to Route 22 (Bishop Street). The interchange primarily serves residential land uses in the immediate interchange area. Route 22 also provides access to US Route 5, southbound I-91 via Valley Service Road, and downtown North Haven via Route 103.

The interchange was originally constructed in the late 1940s with no significant geometric improvements made to the ramps since that time.

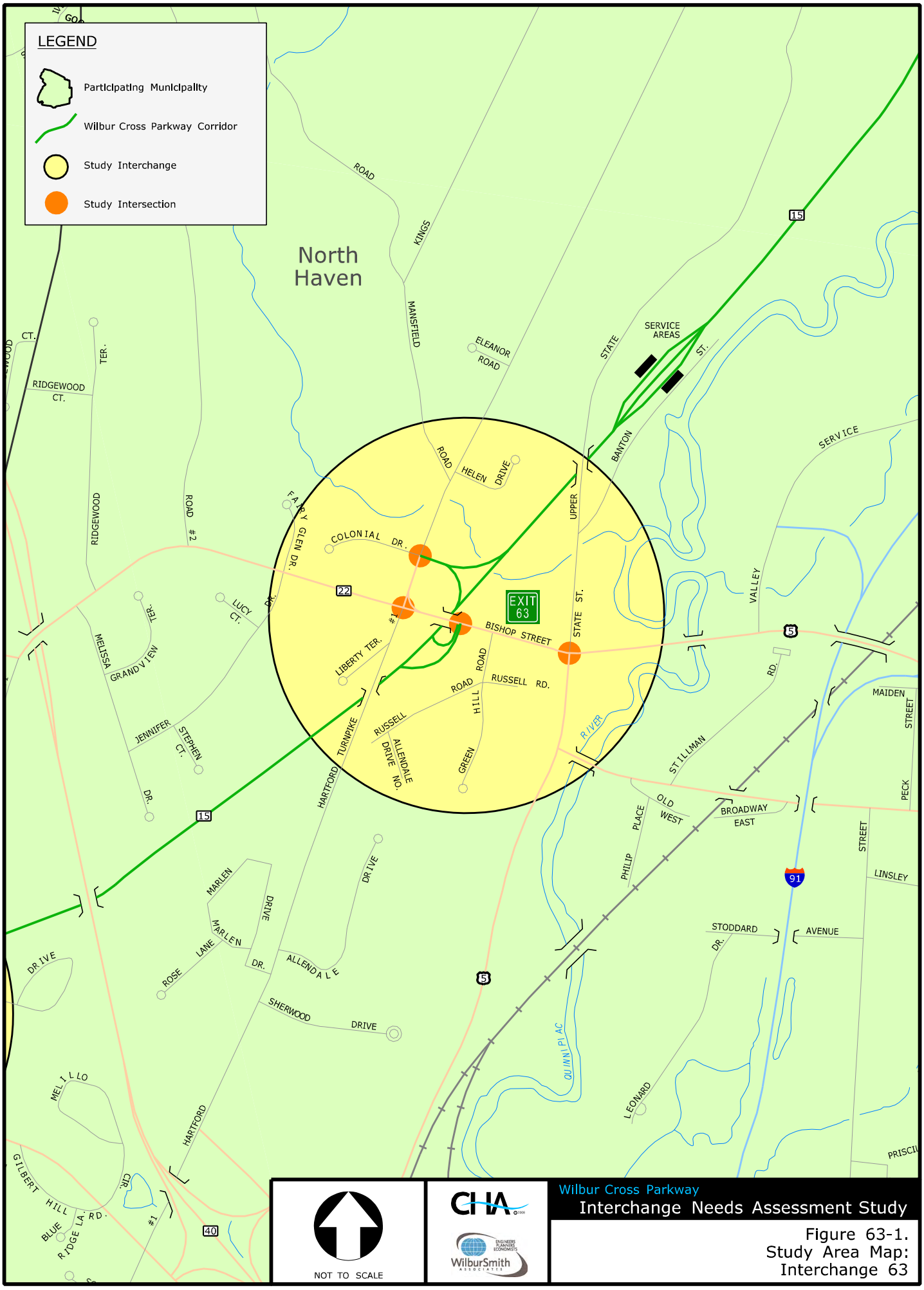
The northbound off ramp diverges from the mainline in a taper-type exit and follows a reversing curve before terminating on the south side of Route 22 at a signalized T-intersection. The northbound on ramp is located between the off ramp and mainline and follows a relatively tight 180-degree loop from the intersection with Route 22 before meeting the Parkway at a stop-controlled approach.

The southbound off ramp also diverges from the mainline in a taper-type exit and terminates at Hartford Turnpike creating a four-legged signalized intersection with Colonial Drive. The southbound on ramp is located parallel to the off ramp and is characterized by a stop-controlled approach to the Wilbur Cross Parkway.

The Parkway in the interchange area consists of two travel lanes in the northbound and southbound directions separated by a narrow depressed grassed median with metal beam guide railing. The typical lane and shoulder configuration includes 11 ft wide lanes, 3 ft to 4 ft wide left shoulders, and 8 ft to 10 ft wide right shoulders.

The study area, as shown in Figure 63-1, includes the interchange ramps, the junctions of these ramps with the Wilbur Cross Parkway, and the following intersections:

- Northbound ramps at Route 22 (signalized)
- Southbound ramps at Hartford Turnpike (signalized)
- Route 22 at Hartford Turnpike (signalized)
- Route 22 at US Route 5/Upper State Street (signalized)


LEGEND
Participating Municipality
Wilbur Cross Parkway Corridor
Study Interchange
Study Intersection
North Haven
EXIT 63
BISHOP STREET
COLONIAL DR.
HELEN DRIVE
ROAD
STATE ST.
UPPER
BANTON
SERVICE AREAS
ST.
STATE
ELEANOR ROAD
MANSFIELD
KINGS
ROAD
RIDGEWOOD CT.
CT.
TER.
RIDGEWOOD
ROAD #2
FAIRY GLEN DR.
LUCY CT.
DR.
MELISSA
GRANDVIEW
TER.
LIBERTY TER.
#1
JENNIFER
STEPHEN CT.
DR.
HARTFORD
TURNPIKE
RUSSELL
ALLENDALE DRIVE NO.
GREEN
HILL ROAD
RUSSELL RD.
RIVER
VALLEY
RD.
MAIDEN
STREET
STILLMAN
OLD WEST
PLACE
PHILIP
BROADWAY
EAST
PECK
STREET
LINSLEY
STODDARD
DR.
AVENUE
QUINNIPIAC
LEONARD
PRISCILLA
MARLEN
DRIVE
MARLEN
LANE
ROSE
DR.
ALLENDALE
DRIVE
SHERWOOD
DRIVE
DRIVE
MELILLO
HARTFORD
GILBERT
HILL
RD.
CIR.
BLUE
RIDGE LA.
#1
15
22
5
91
40
NOT TO SCALE
CHA
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Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 63-1.
Study Area Map:
Interchange 63

Needs and Deficiencies Assessment

Roadway Geometry

For this study, the critical geometric characteristics of the Wilbur Cross Parkway and its interchanges are those that are closely related to vehicular safety. These critical geometric characteristics include deceleration lane lengths; acceleration lane lengths; and ramp curvatures and speeds. The study team determined the existing geometric characteristics of Interchange 63 and compared them to the minimum design standards obtained from ConnDOT's *Highway Design Manual 2003 Edition* (HDM).

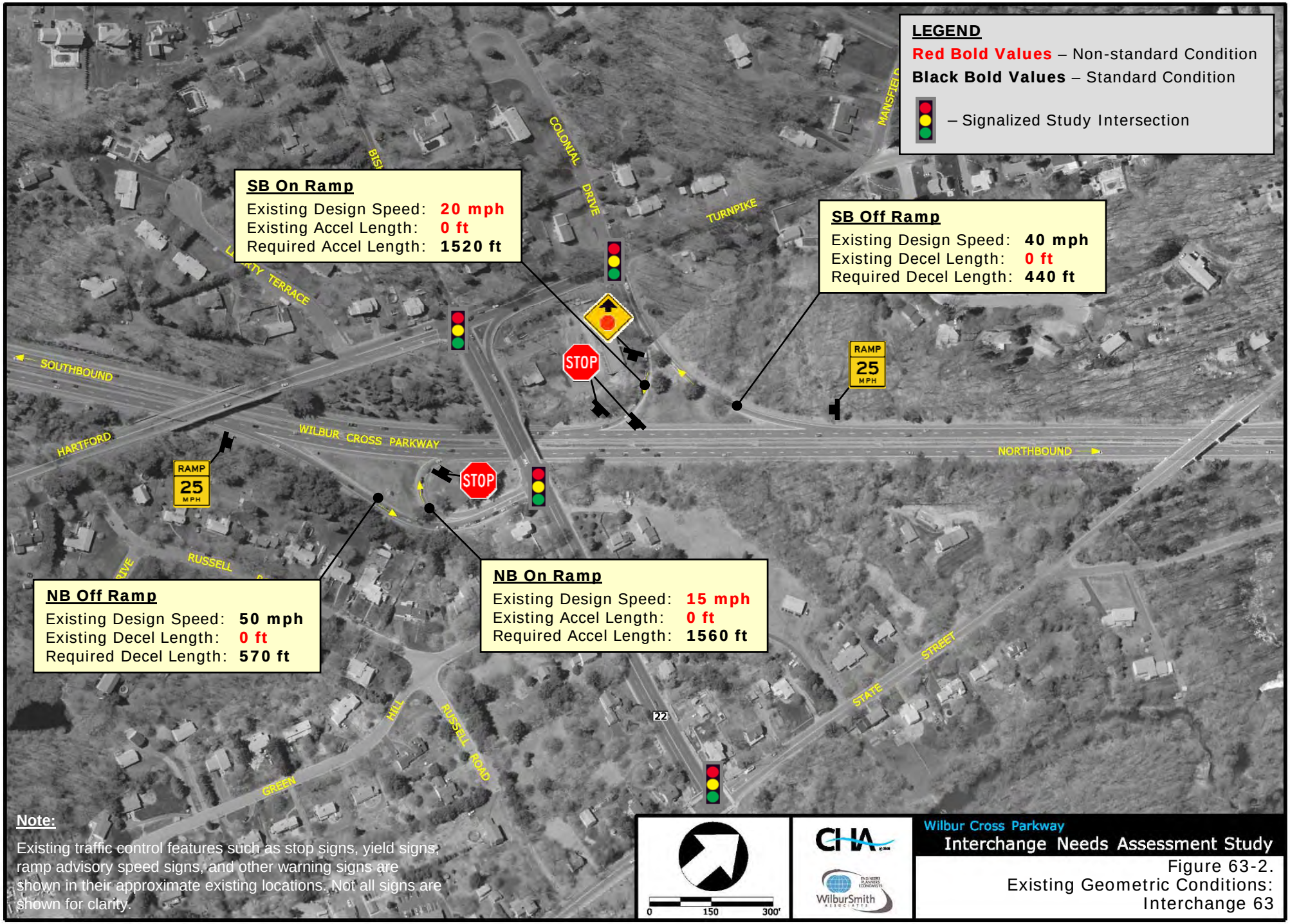
The results of the existing geometric conditions assessment are summarized in Table 63-1 and illustrated in Figure 63-2. Non-standard conditions, or deficiencies, are noted in bold red text in the table and figure.

Table 63-1. Existing Geometric Conditions Summary: Interchange 63

Location	Ramp		Acceleration/Deceleration Lanes		Other Notes
	Curve Radius	Design Speed	Existing Length	Required Length	
Northbound					
Off Ramp	**130 ft**	**20 mph**	**190 ft**	570 ft	-
On Ramp	**70 ft**	**15 mph**	**0 ft**	1560 ft	Stop Condition
Southbound					
Off Ramp	440 ft	35 mph	**175 ft**	490 ft	-
On Ramp	**140 ft**	**20 mph**	**0 ft**	1520 ft	Stop Condition

As shown in Table 63-1, the following geometric conditions are deficient:

- **Northbound Off Ramp and Deceleration Lane:** Ramp curvature and 20 mph design speed are non-standard. Limited deceleration lane exists to accommodate deceleration from mainline to ramp speeds. Most deceleration must occur on the mainline creating unsafe conditions for through and exiting traffic.
- **Northbound On Ramp and Acceleration Lane:** Ramp curvature and 15 mph design speed are non-standard. Stop-controlled approach requires motorists to perceive gaps in traffic flow sufficient to accommodate merging and acceleration to mainline speeds. No acceleration lane exists to accommodate acceleration prior to merging.
- **Southbound Deceleration Lane:** Limited deceleration lane exists to accommodate deceleration from mainline to ramp speeds. Most deceleration must occur on the mainline creating unsafe conditions for through and exiting traffic.
- **Southbound On Ramp and Acceleration Lane:** Ramp curvature and 20 mph design speed are non-standard. Stop-controlled approach requires motorists to perceive gaps in traffic flow sufficient to accommodate merging and acceleration to mainline speeds. No acceleration lane exists to accommodate acceleration prior to merging.



Note:

Existing traffic control features such as stop signs, yield signs, ramp advisory speed signs, and other warning signs are shown in their approximate existing locations. Not all signs are shown for clarity.

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 63-2.
Existing Geometric Conditions:
Interchange 63

Traffic Conditions

The study team compiled traffic data for Interchange 63 that included average daily traffic (ADT) volumes, existing (2008) weekday peak hour traffic volumes, and estimated future (2030) weekday peak hour traffic volumes. This data was used as the basis for assessing traffic conditions on the mainline Wilbur Cross Parkway (WCP), at the interchange ramp junctions, and at key secondary roadway intersections. Figure 63-3 illustrates the most recent (2006) ADT volumes that were collected by ConnDOT at Interchange 63.

Figure 63-3. 2006 Average Daily Traffic Volumes (in vehicles per day, vpd): Interchange 63

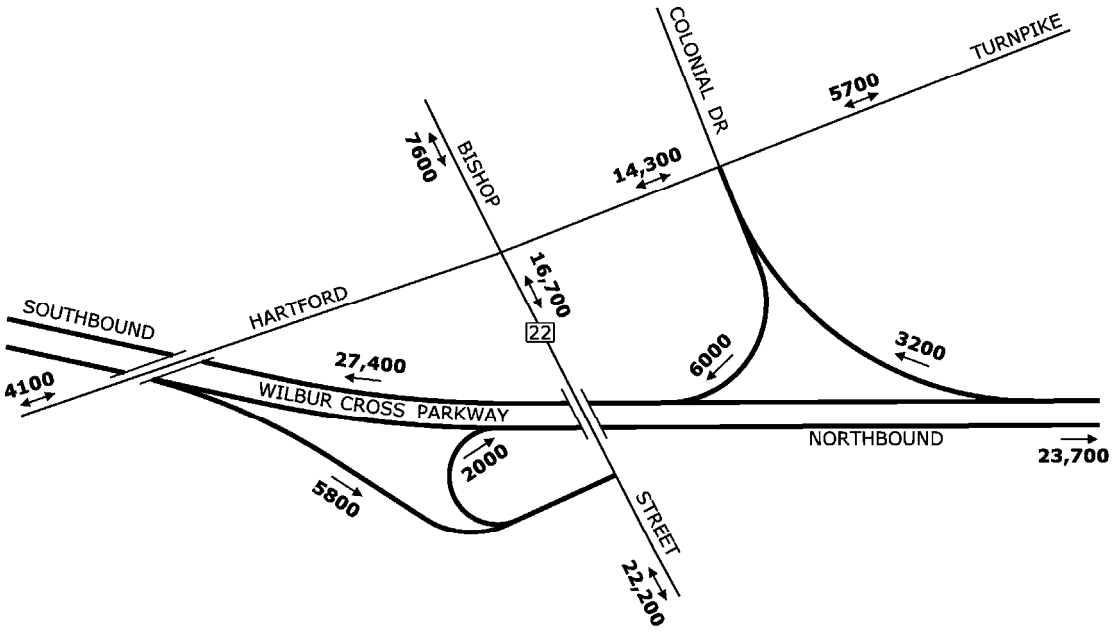
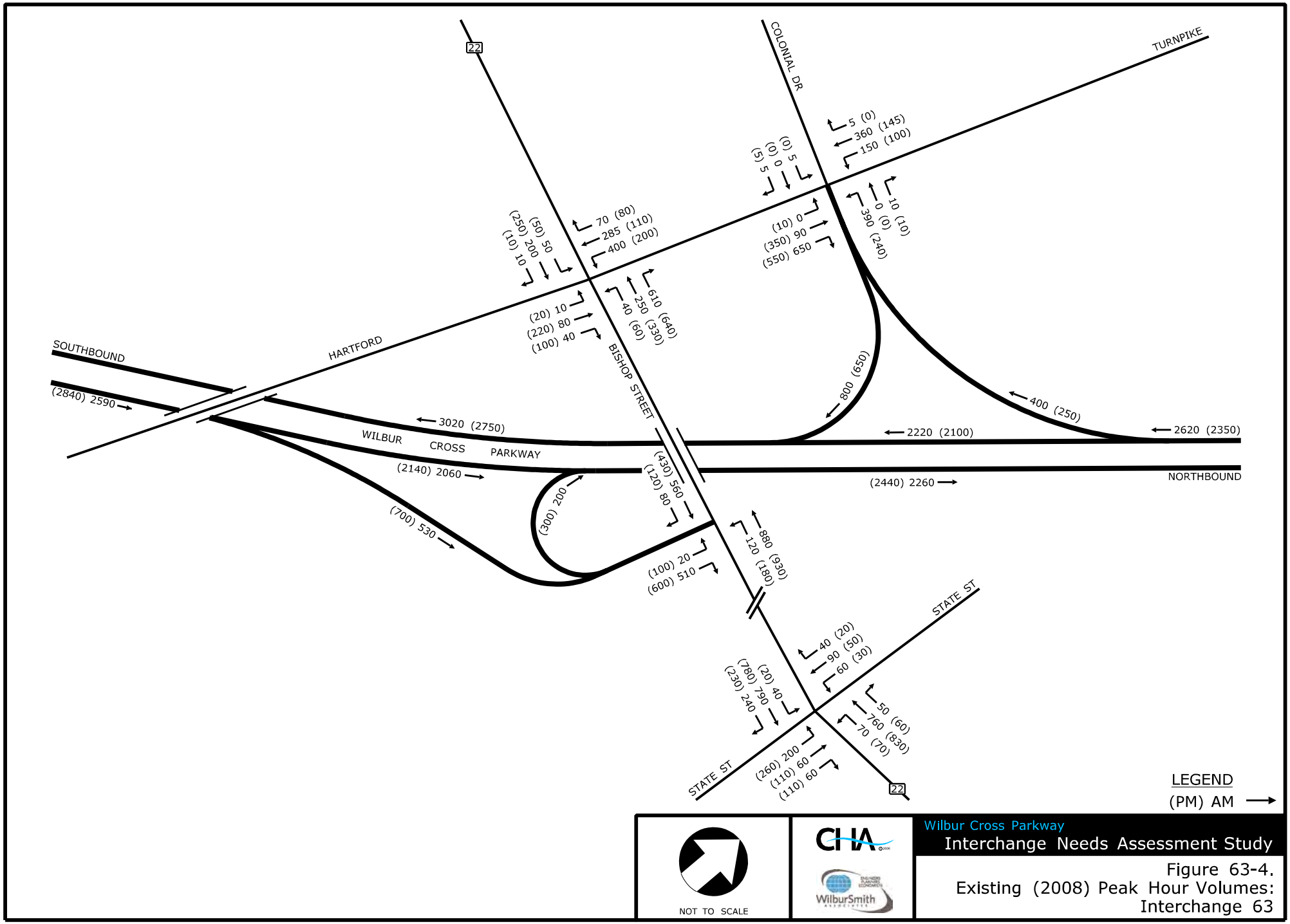


Figure 63-4 presents the 2008 weekday peak hour traffic volumes for the morning (AM) and afternoon (PM) peak commuting periods. The study team worked with ConnDOT's traffic forecasting unit to develop these volumes from intersection turning movement counts obtained by SCRCOG and available traffic data for Interchange 63 provided by ConnDOT.

Figure 63-5 presents the estimated 2030 weekday peak hour traffic volumes that were developed by ConnDOT's traffic forecasting unit. These volumes reflect an increase in traffic at Interchange 63 that is primarily a function of regional background traffic growth as no major developments in the interchange area are expected to significantly affect future traffic estimates.

The notable traffic conditions presented in Figures 63-3, 63-4, and 64-5 include:

- Highest daily ramp volumes occur on the southbound on ramp and northbound off ramp
- Lowest daily ramp volumes occur on the northbound on ramp
- Approximately 54% of WCP traffic is traveling southbound in the morning
- Approximately 51% of WCP traffic is traveling northbound in the afternoon
- Overall traffic growth by 2030 is estimated to be approximately 19%, or 0.8% annually


22
COLONIAL DR
TURNPIKE
SOUTHBOUND
HARTFORD
BISHOP STREET
WILBUR CROSS PARKWAY
NORTHBOUND
STATE ST
STATE ST
22
(2840) 2590
3020 (2750)
(2140) 2060
(700) 530
(300) 200
(430) 560
(120) 80
(100) 20
(600) 510
880 (930)
120 (180)
2220 (2100)
(2440) 2260
2620 (2350)
400 (250)
800 (650)
70 (80)
285 (110)
400 (200)
(250) 200
(10) 10
(50) 50
(20) 10
(220) 80
(100) 40
610 (640)
250 (330)
40 (60)
(10) 0
(350) 90
(550) 650
5 (0)
360 (145)
150 (100)
(5) 5
(0) 0
(0) 5
390 (240)
0 (0)
10 (10)
40 (20)
90 (50)
60 (30)
(780) 790
(230) 240
(20) 40
(260) 200
(110) 60
(110) 60
50 (60)
760 (830)
70 (70)
LEGEND
(PM) AM
NOT TO SCALE
CHA
WilburSmith
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 63-4.
Existing (2008) Peak Hour Volumes:
Interchange 63

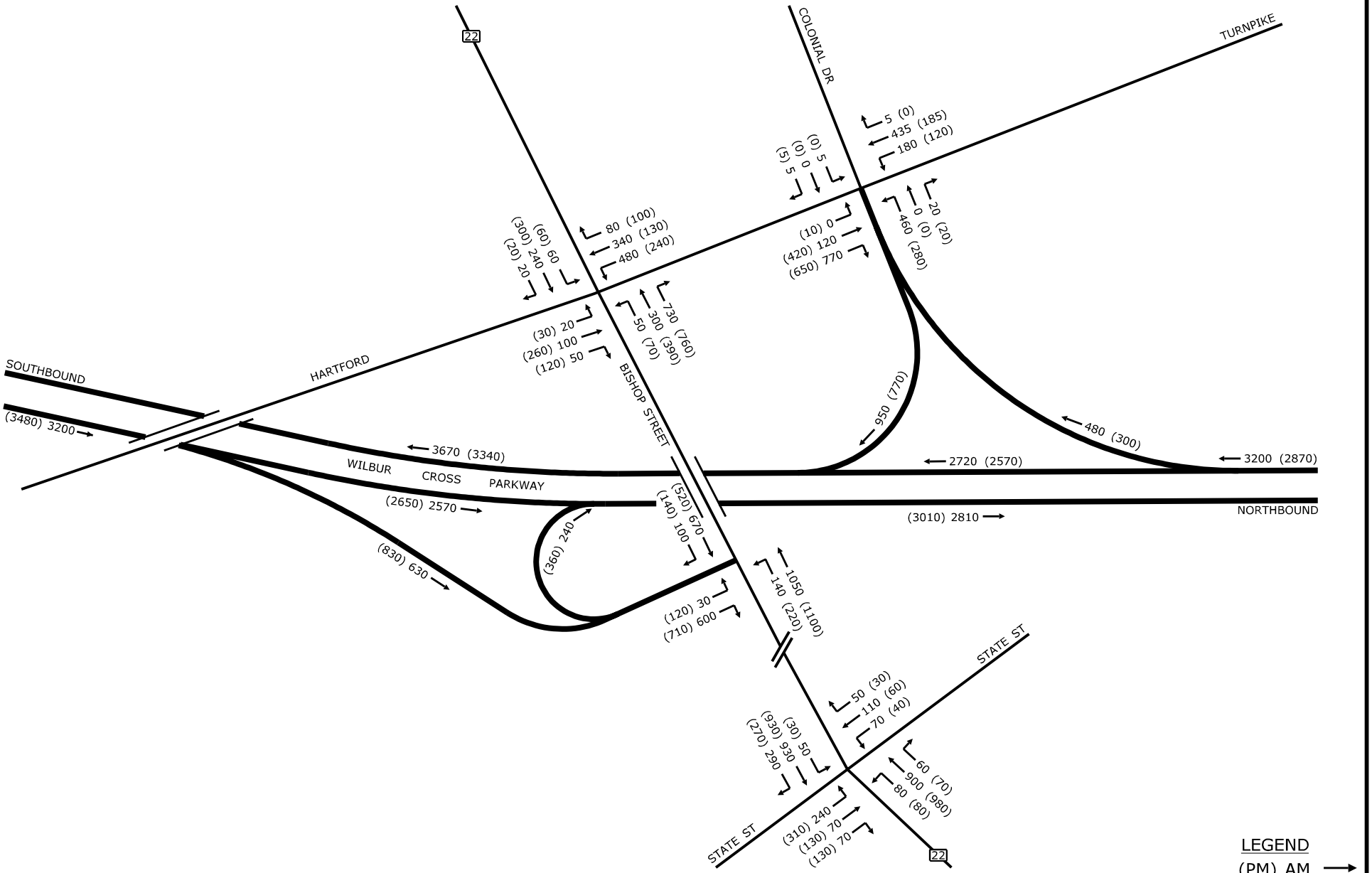

22
COLONIAL DR
TURNPIKE
SOUTHBOUND
HARTFORD
BISHOP STREET
WILBUR CROSS PARKWAY
NORTHBOUND
STATE ST
STATE ST
22
(3480) 3200
3670 (3340)
(2650) 2570
(830) 630
(360) 240
(520) 670
(140) 100
(120) 30
(710) 600
1050 (1100)
140 (220)
(3010) 2810
2720 (2570)
3200 (2870)
480 (300)
950 (770)
(300) (60) 60
(20) 20 240
80 (100)
340 (130)
480 (240)
(30) 20
(260) 100
(120) 50
730 (760)
300 (390)
50 (70)
(5) 5
(0) 0
(0) 5
5 (0)
435 (185)
180 (120)
(10) 0
(420) 120
(650) 770
460 (280)
0 (0)
20 (20)
50 (30)
110 (60)
70 (40)
(930) 930
(270) 290
(30) 50
(310) 240
(130) 70
(130) 70
60 (70)
900 (980)
80 (80)
LEGEND
(PM) AM
NOT TO SCALE
CHA
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Figure 63-5.
Future (2030) Peak Hour Volumes:
Interchange 63

Traffic Operations

The study team analyzed the operations of the mainline segments, ramp junctions, and intersections in the Interchange 63 study area. The analyses were conducted for the weekday AM and PM peak hours under the 2008 and estimated 2030 traffic conditions. The results of the analyses, which are reported as Levels of Service (LOS), are presented below in tabular form and illustrated in Figures 63-6 and 63-7.

As described in the *Needs Assessment Overview* section, LOS D or better represents an acceptable degree of congestion for mainline segments, ramp junctions, and intersections. LOS E and F, which are indicated in red in the tables and figures, represent unacceptable degrees of congestion. Locations operating at LOS E and F are highlighted in this report to indicate locations where traffic capacity and operational issues exist, or could exist under future traffic conditions.

Mainline

Table 63-2. Mainline Operations Summary: Interchange 63

Direction	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
Northbound				
South of Interchange 63	C (20.6)	D (26.1)	C (22.7)	D (29.3)
Between Interchange 63 Ramps	B (16.3)	C (20.4)	B (17.0)	C (21.1)
North of Interchange 63	B (17.9)	C (22.4)	B (19.4)	C (24.2)
Southbound				
North of Interchange 63	C (20.8)	D (26.1)	C (18.7)	C (22.9)
Between Interchange 63 Ramps	B (17.6)	C (21.7)	B (16.7)	C (20.4)
South of Interchange 63	C (24.3)	D (31.8)	C (21.9)	D (27.6)

[1] Mainline density is reported in passenger cars per mile per lane (pc/mi/ln).

The mainline analysis shows that all mainline segments currently operate at LOS B and C during both the AM and PM peak hours. The slightly higher traffic densities in the southbound direction in the AM and in the northbound direction in the PM correspond to the predominant direction of travel during the respective peak hours. Levels of service are generally reduced under 2030 traffic conditions but operations are expected to be acceptable (LOS C and D) during both peak hours.

Ramp Junctions

Table 63-3. Ramp Merge/Diverge Operations Summary: Interchange 63

Direction	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
Northbound				
Off Ramp to Route 22	C (27.3)	D (33.1)	D (29.7)	E (35.8)
On Ramp from Route 22	C (25.0)	D (29.7)	C (26.5)	D (31.4)
Southbound				
Off Ramp to Hartford Turnpike	C (27.0)	D (33.3)	C (25.1)	D (30.1)
On Ramp from Hartford Turnpike	D (29.0)	E (36.8)	D (29.0)	D (34.0)

[1] Ramp junction density is reported in passenger cars per mile per lane (pc/mi/ln).

The ramp analysis shows that the northbound and southbound ramps currently operate at LOS C and D during the AM and PM peak hours. Levels of service deteriorate under 2030 traffic conditions resulting in LOS E at the northbound off ramp during the PM peak hour and the southbound on ramp during the AM peak hour.

Intersections

The study team analyzed traffic operations at the following intersections:

- **Northbound Ramps at Route 22:** Signalized, T-intersection. Route 22 is oriented in an east-west direction; northbound ramps are oriented in a north-south direction. The eastbound and westbound approaches on Route 22 consist of two travel lanes in each direction. The northbound approach on the northbound off ramp consists of exclusive left and right turn lanes.

- **Southbound Ramps at Hartford Turnpike:** Signalized, four-legged intersection with Colonial Drive. Southbound ramps and Colonial Drive are oriented in an east-west direction; Hartford Turnpike is oriented in a north-south direction. The eastbound approach on the southbound off ramp and westbound approach on Colonial Drive each consist of a single travel lane. The northbound approach on Hartford Turnpike consists of a shared left-through lane and an exclusive right turn lane; the southbound approach consists of a single travel lane.

- **Route 22 at Hartford Turnpike:** Signalized, four-legged intersection located 400 ft south of Interchange 63 southbound ramps. Route 22 is oriented in an east-west direction; Hartford Turnpike is oriented in a north-south direction. The westbound approach on Route 22 consists of a single through lane, an exclusive left turn lane, and a channelized right turn lane; the eastbound approach consists of a single travel lane. The northbound approach on Hartford Turnpike consists of a shared left-through lane and an exclusive right turn lane; the southbound approach consists of a shared right-through lane and an exclusive left turn lane.

- **Route 22 at US Route 5/Upper State Street:** Signalized, four-legged intersection located 850 ft east of Interchange 63 northbound ramps. Route 22 is oriented in an east-west direction; US Route 5/Upper State Street are oriented in a north-south direction. The eastbound and westbound approaches on Route 22 consist of two travel lanes in each direction. The northbound approach on US Route 5 and southbound approach on Upper State Street each consist of a shared right-through lane and an exclusive left turn lane.

Because of the close proximity of the study intersections at Interchange 63, a micro-simulation traffic model (SYNCHRO/SimTraffic) was used to demonstrate the effect that the combination of heavy traffic volumes and a stop-control on the southbound on ramp has on the adjacent secondary roadway intersections. Results of the intersection analysis are presented in Table 63-4.

Table 63-4. Intersection Operations Summary: Interchange 63

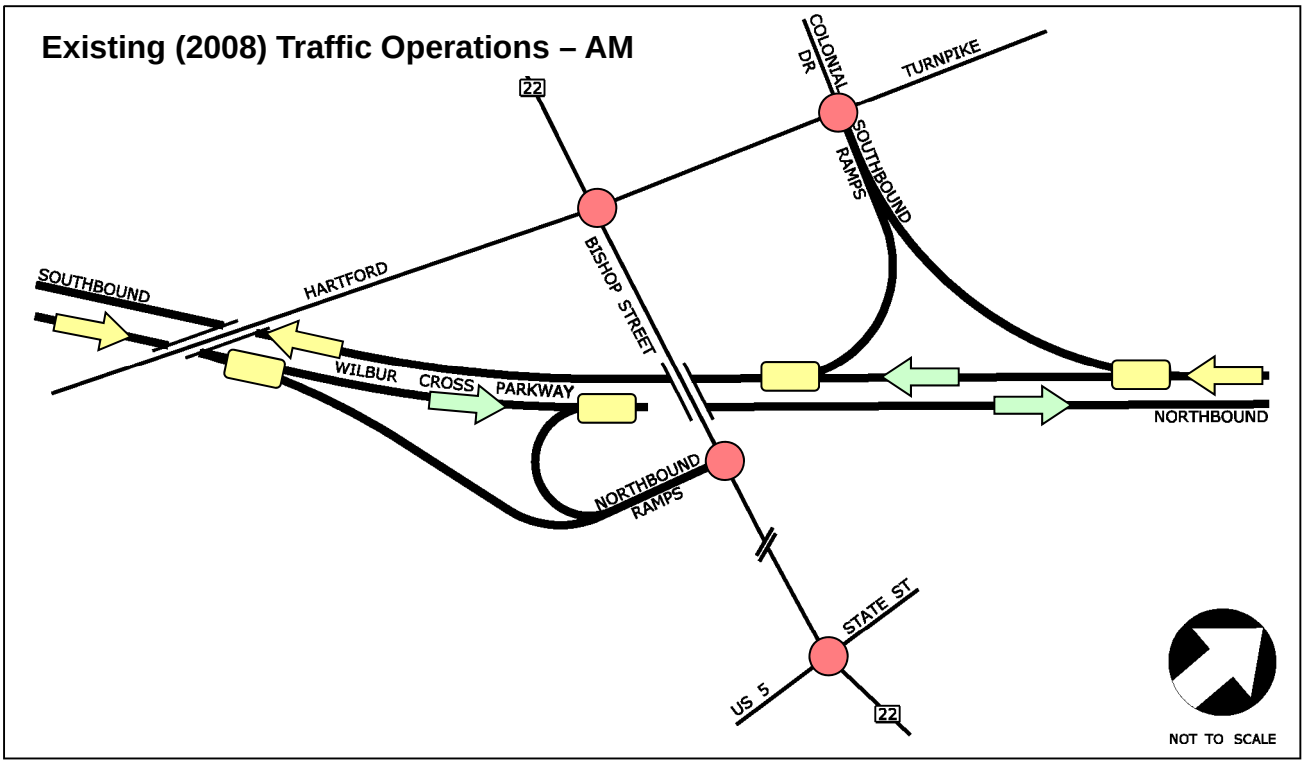
Intersection / Approach	AM LOS (Delay[1])		PM LOS (Delay[1])	
	2008	2030	2008	2030
SB Ramps at Hartford Turnpike				
Eastbound – Colonial Drive	B(12.7)	A (5.8)	A (1.1)	A (1.6)
Westbound – Route 15 SB Ramps	D (48.1)	E (57.8)	C (25.0)	C (26.7)
Northbound – Hartford Turnpike	F (>80)	F (>80)	D (47.2)	E (74.1)
Southbound – Hartford Turnpike	F (>80)	F (>80)	B (15.7)	B (19.9)
Overall	**F (>80)**	**F (>80)**	**D (37.0)**	**D (50.6)**
Route 22 at Hartford Turnpike				
Eastbound – Route 22	F (>80)	F (>80)	E (52.3)	F (>80)
Westbound – Route 22	E (73.4)	F (>80)	C (26.5)	D (52.3)
Northbound – Hartford Turnpike	F (>80)	F (>80)	F (>80)	F (>80)
Southbound – Hartford Turnpike	F (>80)	E (58.5)	B(19.5)	C (28.1)
Overall	**F (>80)**	**F (>80)**	**E(60.6)**	**F (>80)**
NB Ramps at Route 22				
Eastbound – Route 22	D (39.2)	C (34.6)	C (23.3)	C (24.43)
Westbound – Route 22	F (>80)	F (>80)	B (16.3)	F (>80)
Northbound – Route 15 NB Ramps	B (11.0)	C (28.7)	C (25.6)	F (>80)
Overall	**E (76.1)**	**F (>80)**	**C (20.7)**	**F (>80)**
Route 22 at US Route 5/Upper State Street				
Eastbound – Route 22	C (32.5)	E (65.3)	B (12.4)	C(27.0)
Westbound – Route 22	F (>80)	F (>80)	B (19.4)	F (>80)
Northbound– State Street	F (>80)	F (>80)	C (25.6)	F (>80)
Southbound – State Street	D (38.5)	E (66.4)	C (23.8)	E (58.4)
Overall	**F (>80)**	**F (>80)**	**B (18.1)**	**F (>80)**

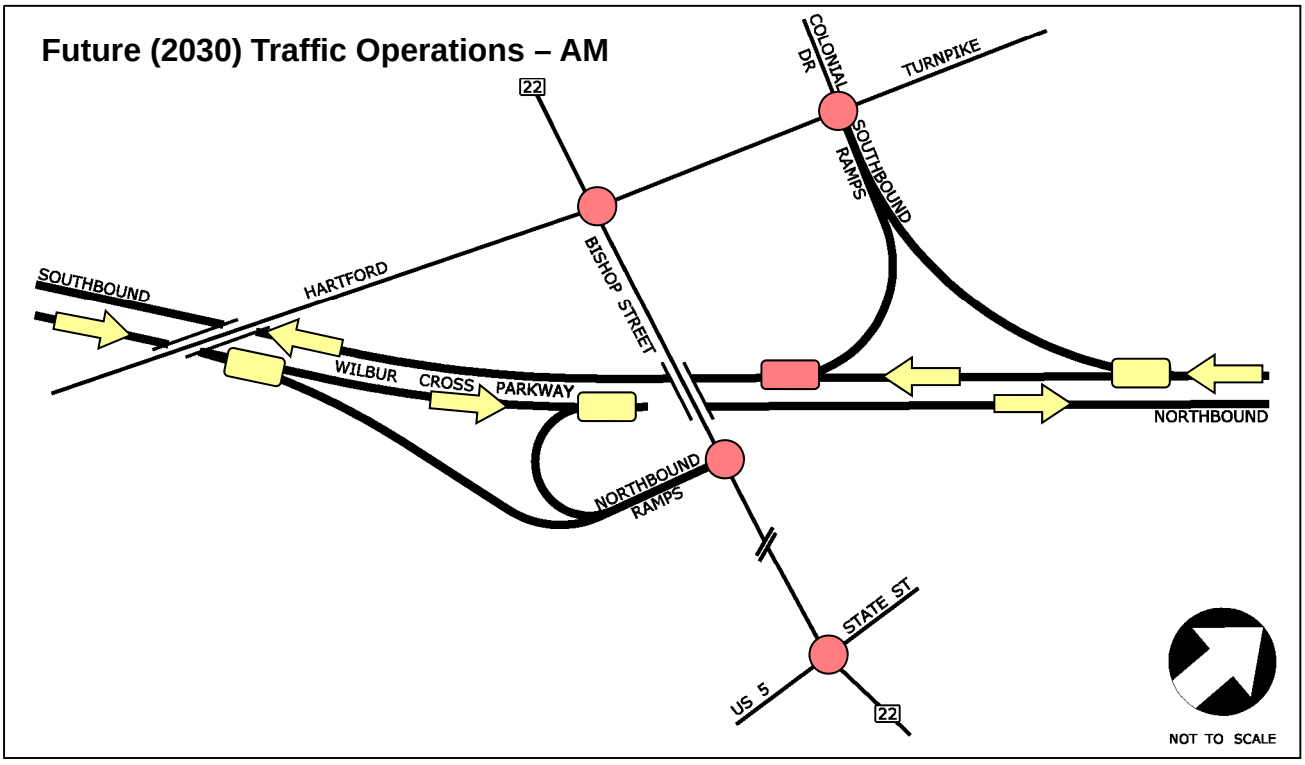
[1] Delays are reported in seconds.

The intersection analysis shows that the four study intersections currently operate at overall LOS E and F during the AM peak hour. The Route 22 at Hartford Turnpike intersection also operates at overall LOS E during the PM peak hour. Levels of service will generally deteriorate under 2030 traffic conditions resulting in LOS F and significant delays at all intersections during the AM and PM peak hours with the exception of the southbound ramps at Hartford Turnpike intersection, which will operate at LOS D.

It should be noted that the stop condition at the southbound on ramp causes a traffic queue that extends from the on ramp, south on Hartford Turnpike, and east on Route 22. Occasionally, this queue will extend back to the US Route 5/Upper State Street intersection

Figures 63-6 and 63-7 summarize the results of the traffic operations analyses for the AM and PM peak hour traffic conditions, respectively.





LOS	Intersection	Mainline	Merge/Diverge
A-B			
C-D			
E-F			

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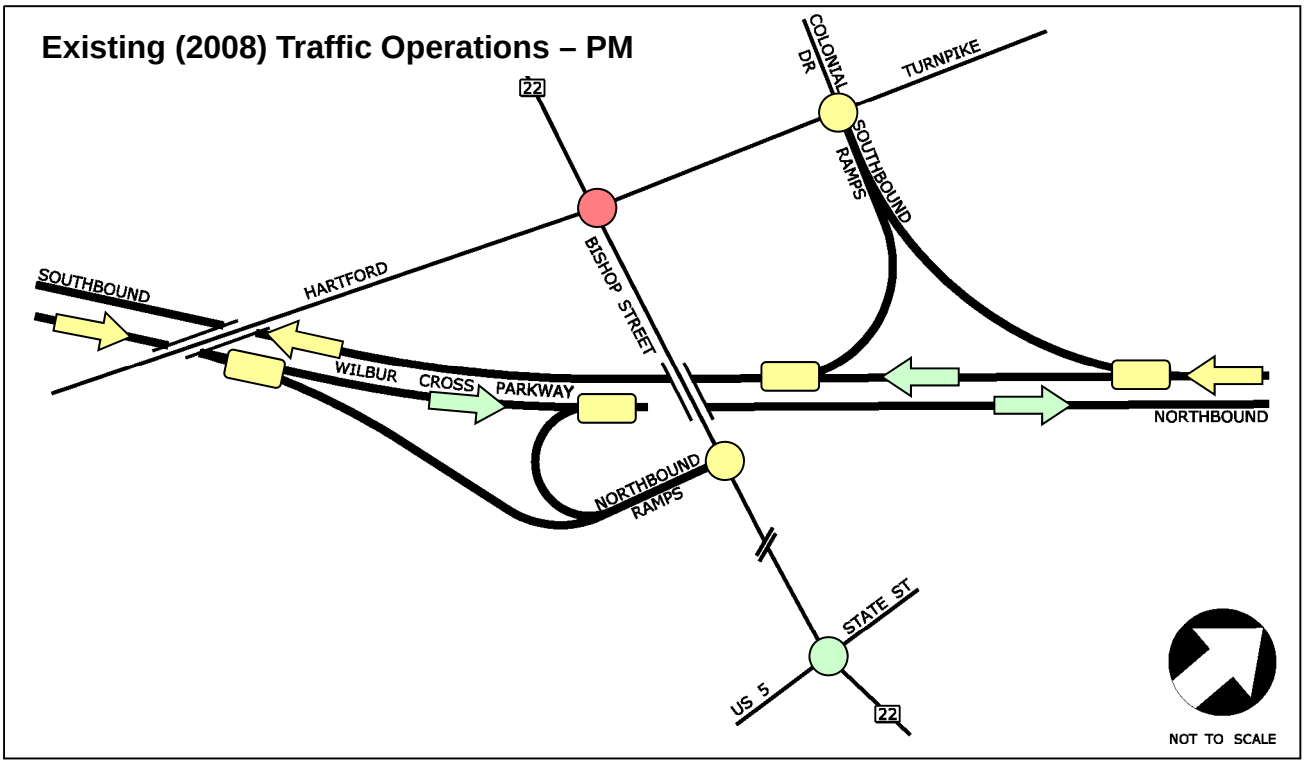
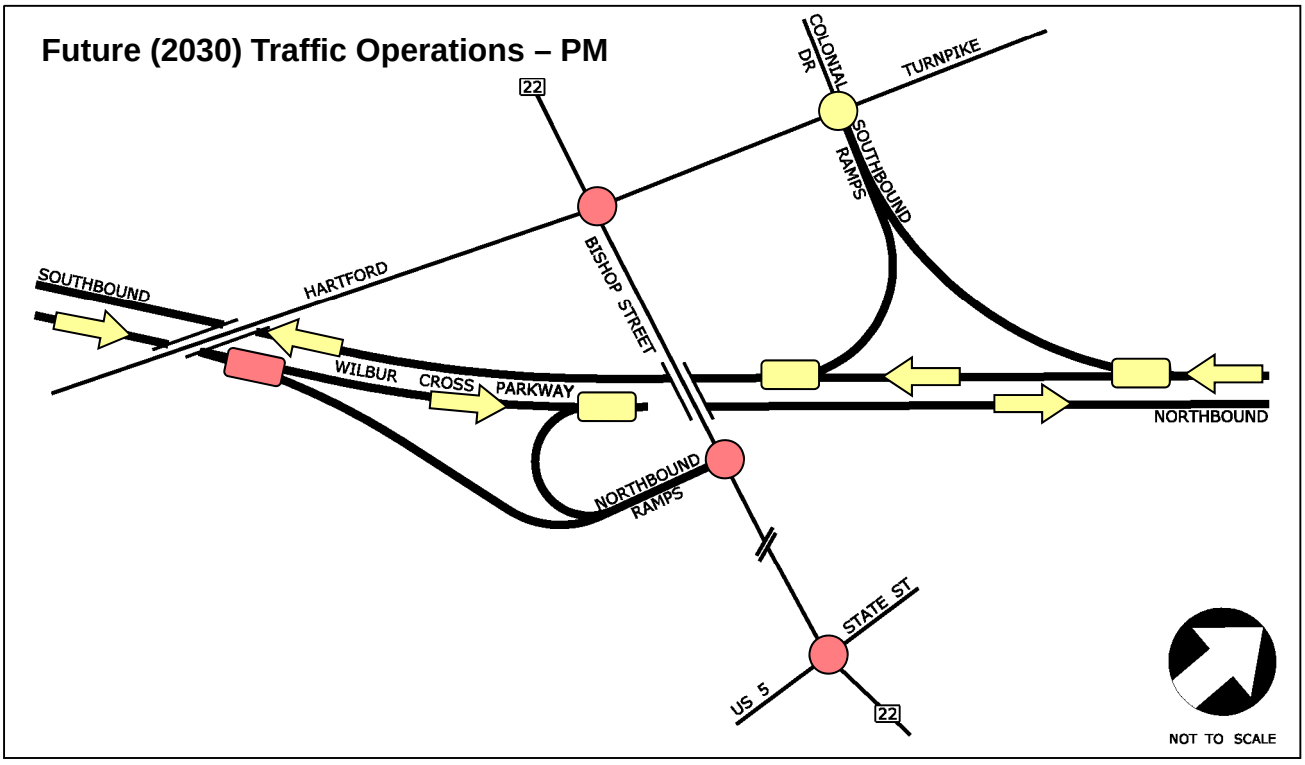
Figure 63-6.
AM Traffic Operations Summary:
Interchange 63





LOS	Intersection	Mainline	Merge/Diverge
A-B			
C-D			
E-F			

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure 63-7.
PM Traffic Operations Summary:
Interchange 63

Accidents and Safety

The study team obtained accident data from ConnDOT's *Traffic Accident Viewing System* (TAVS) for the three-year period beginning January 1, 2005 and ending December 31, 2007. The data shows that 319 accidents occurred at Interchange 63 during this period, the majority of which were rear-end accidents. Table 63-5 summarizes the types of collisions that occurred at various locations in the interchange area. Figure 63-8 illustrates the accident trends that have developed over the last few years at the interchange.

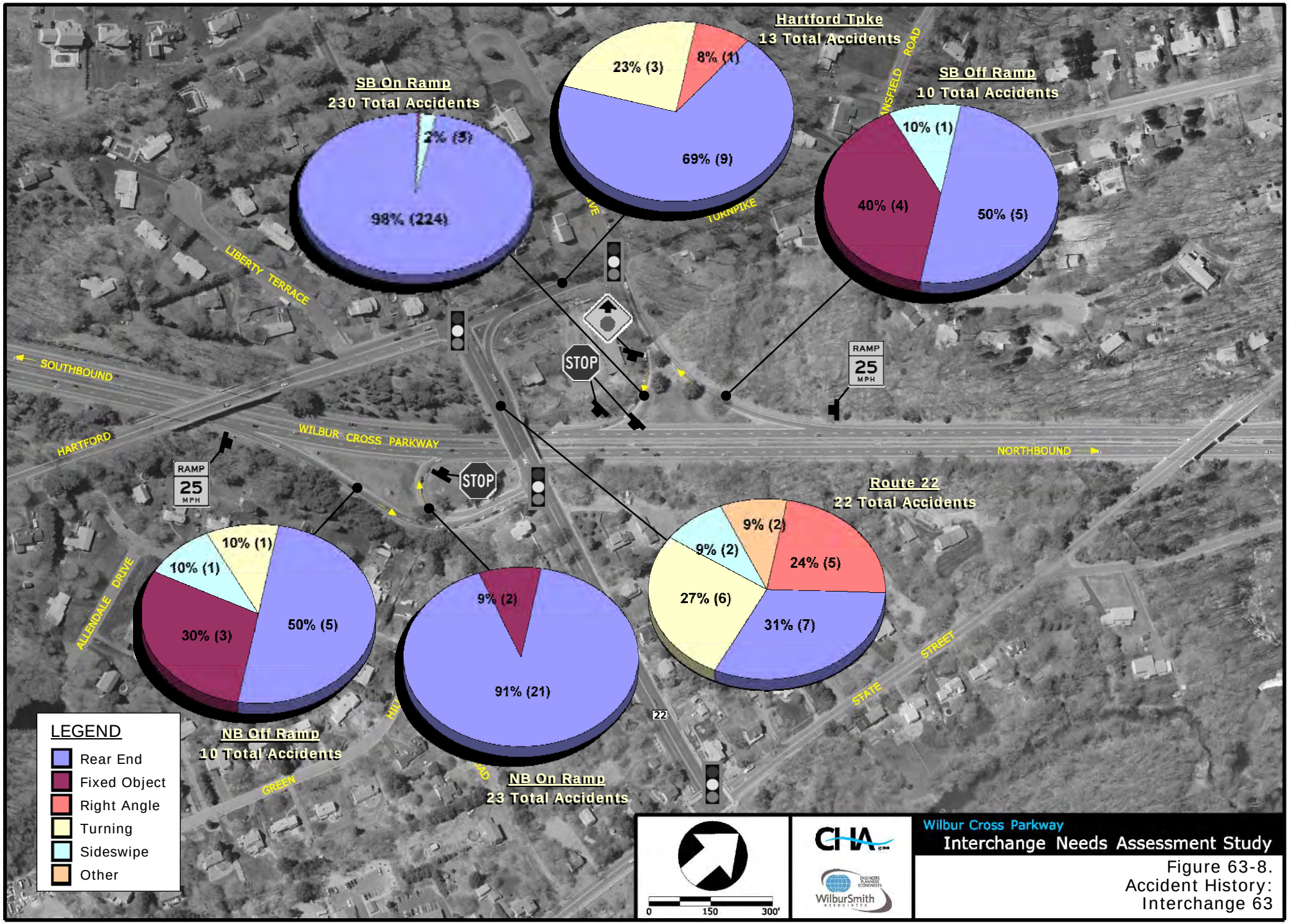
The study team notes that Interchange 63 is considered a *high accident location*. By definition, a high accident location is one that has experienced an accident rate that is higher than expected based on accident rates for similar locations.

Table 63-5. Accident History: Interchange 63

Location	Collisions by Type						
	Rear End	Fixed Object	Side Swipe	Left Turn	Right Turn	Other	Total
Northbound							
Off Ramp	5	3	1	-	-	1	**10**
Between Off and On Ramps	4	-	-	-	-	-	**4**
On Ramp	21	2	-	-	-	-	**23**
Southbound							
Off Ramp	5	4	1	-	-	-	**10**
Between Off and On Ramps	5	2	-	-	-	-	**7**
On Ramp	224	1	5	-	-	-	**230**
Secondary Roadways							
Rte. 22 - NB Ramps to Turnpike	7	-	2	6	5	2	**22**
Turnpike - SB Ramps to Rte. 22	9	-	-	3	1	-	**13**
Total Number	**280**	**12**	**9**	**9**	**6**	**3**	**319**
Percentage	**87%**	**4%**	**3%**	**3%**	**2%**	**1%**	**100%**

As shown in Table 63-5, the southbound on ramp experienced the highest number of accidents – 72% of the total number of accidents at Interchange 63. The accidents on this ramp were nearly all rear-end collisions, which the study team believes is a direct result of the *stop* condition and lack of acceleration lane that precedes the merge with mainline traffic. The stop condition and lack of acceleration lane at the northbound on ramp has led to the second highest number of accidents at this interchange, 91% of which were also rear-end collisions.

Stop conditions at the end of interchange ramps are not consistent with driver expectations for limited access facilities like the Wilbur Cross Parkway. Insufficient warning to drivers of the stop condition; poor sight lines to the existing stop signs; and driver uncertainty and hesitation while attempting to enter the high volume and high speed corridor are all likely factors that contribute to the accident history on these ramps.


Hartford Tpke
13 Total Accidents
23% (3)
8% (1)
69% (9)
SB On Ramp
230 Total Accidents
2% (5)
98% (224)
SB Off Ramp
10 Total Accidents
10% (1)
40% (4)
50% (5)
Route 22
22 Total Accidents
9% (2)
9% (2)
24% (5)
27% (6)
31% (7)
NB Off Ramp
10 Total Accidents
10% (1)
10% (1)
30% (3)
50% (5)
NB On Ramp
23 Total Accidents
9% (2)
91% (21)
LEGEND
Rear End
Fixed Object
Right Angle
Turning
Sideswipe
Other
LIBERTY TERRACE
SOUTHBOUND
HARTFORD
WILBUR CROSS PARKWAY
NORTHBOUND
RAMP
25
MPH
STOP
ALLENDALE DRIVE
GREEN
STATE
STREET
TURNPIKE
ROAD
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Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure 63-8.
Accident History:
Interchange 63

The significantly lower number of accidents at the northbound on ramp (compared to the southbound on ramp) is likely a function of several factors including lower volumes of traffic entering resulting in fewer conflicts with mainline traffic; higher volumes of traffic exiting upstream creating more gaps for traffic entering in the northbound direction; and better approach alignment and mainline curvature upstream of the interchange that could make perceiving traffic gaps in the right travel lane easier for northbound motorists.

In addition to the safety issues that the study team has identified through analysis of the recent accident data, input received from the Town indicated the following safety concern at Interchange 63:

- Commercial vehicles occasionally access the Parkway from Route 22 and the Hartford Turnpike. Although there are existing signs located near the Interchange 63 ramps prohibiting commercial vehicle access to the Parkway, it is believed that the lack of directional route signage in the area for I-91 is contributing to this issue.

Recommended Improvement Plan

The study team worked with the Town of North Haven, ConnDOT, SCRCOG, and other stakeholders to develop and refine a set of near-term, mid-term, and long-term improvement plans to address the identified deficiencies and needs at Interchange 63. The recommended improvement plans are detailed and illustrated below along with discussion regarding other design and implementation considerations. Also included are summaries of constraints, impacts, and estimated construction costs.

Near-term Improvement Plan (Figure 63-9)

Northbound:

- Relocate existing 25 mph ramp advisory speed sign for off ramp to improve visibility of sign.

Other:

- Install truck route signs at intersection of Bishop Street (Route 22) and State Street (US 5) to direct trucks to I-91 and minimize the likelihood of unauthorized commercial vehicle access to the Parkway.

Near, Mid, and Long-term Definitions

Near-term:

- Implementation period of 1 to 3 years.
- Includes low cost improvements such as signing and striping improvements, existing signal timing modifications, tree clearing, etc.

Mid-term:

- Implementation period of 3 to 10 years.
- Includes acceleration and deceleration lane improvements, new turn lanes, new traffic signals, and minor ramp modifications that could be implemented with little or no impacts to rights-of-way, environmental features, or existing bridge structures.

Long-term:

- Implementation period greater than 10 years.
- Includes higher-cost improvements that could significantly impact existing bridge structures, rights-of-way, or environmental features.

Mid-term Improvement Plan (Figure 63-10)

Southbound:

- Provide standard deceleration length for southbound off ramp. Deceleration lane should be a parallel-type design to be consistent with recommended long-term auxiliary lane improvement to the North Haven Service Area.

The study team notes that due to the proximity of the Route 22 bridge structure to the northbound on ramp and southbound on ramp, it is not feasible in the mid-term to provide acceleration lanes for these ramps that would result in the removal of the existing stop conditions on their mainline approaches.

Long-term Improvement Plan (Figure 63-11)

Northbound:

- Provide standard deceleration length for the off ramp. The deceleration lane improvements will require constructing a cut-and-cover tunnel east of the existing Hartford Turnpike bridge to convey the off ramp under the Hartford Turnpike.
- Relocate the on ramp to the north side of Route 22 to eliminate non-standard ramp curvature and to facilitate acceleration lane improvements.
- Provide northbound auxiliary lane between the Interchange 63 on ramp and the North Haven Service Area off ramp. Auxiliary lane improvements will require reconstruction or replacement of the existing State Street bridge over Route 15.

Southbound:

- Provide required acceleration length for the on ramp. The acceleration lane improvements will require realigning the on ramp and constructing two cut-and-cover tunnels – one west of the existing Route 22 bridge structure and one west of the existing Hartford Turnpike bridge structure – to convey the on ramp and acceleration lane under the existing roadways.
- Provide southbound auxiliary lane between the North Haven Service Area on ramp and Interchange 63 off ramp. Auxiliary lane improvements will require reconstruction or replacement of the existing State Street bridge over Route 15.

Other Considerations

- Relocate the northbound on ramp to the north side of Route 22 and terminate the acceleration lane south of the existing State Street bridge structure over Route 15 as a mid-term improvement. The northbound auxiliary lane improvement, which will require replacement or reconstruction of the State Street bridge structure, could be implemented as a subsequent long-term project. This phasing would expedite the lower cost northbound on ramp improvements and address the safety issues associated with the existing stop-controlled approach to the mainline.
- As a potential alternative to providing cut-and-cover tunnels, replace the existing Hartford Turnpike and/or Route 22 bridge structures in conjunction with providing standard acceleration lane and deceleration lane improvements. Whether cut-and-cover tunnels or new bridge structures are the preferred alternative will likely be a function of the condition of these bridges at the time acceleration and deceleration lane improvements are programmed. The estimated construction costs for new bridge structures are approximately $6.0 million and $3.8 million (2009 $) for the Hartford Turnpike and Route 22 bridge structures, respectively.

- The study team investigated the feasibility of relocating the southbound on ramp to the Hartford Turnpike so that the ramp and acceleration lane could be provided without affecting the Hartford Turnpike bridge. However, the resulting change in traffic patterns (which would result in a heavy left turn volume from Route 22 to the Hartford Turnpike) and negative impacts on traffic operations precluded the feasibility of this concept.
- Construction of cut-and-cover tunnels on Route 22 and Hartford Turnpike would require phased construction operations that would likely result in partial closure of these roadways during construction. Construction on Hartford Turnpike would likely require maintaining traffic in a single lane over the bridge utilizing alternating one-way traffic patterns controlled by temporary traffic signals. Construction on Route 22 would likely require reducing the number of travel lanes from four to two in order to maintain two-way traffic over the bridge. The study team notes that complete closure of either bridge could be necessary. Detailed construction phasing and maintenance and protection of traffic plans would be developed during final design of the improvements. These plans will ultimately consider the potential traffic impacts associated with phased construction, partial road closures, and/or temporary traffic detours as required.

Constraints, Limitations and Impacts

- Significant rock excavation and ledge removal will be required for construction of the southbound on ramp improvements.
- **Potential Right-of-Way (ROW) Impacts:** No significant right-of-way impacts are anticipated with the mid or long-term improvement plans at Interchange 63.
- **Potential Environmental Impacts:** No significant impacts are anticipated with the mid-term improvement plan. However, the long-term improvement plan could result in approximately 0.40 ac of wetland impacts associated with the southbound on ramp and acceleration lane.

Estimated Construction Costs

The study team developed planning-level construction cost estimates for the near, mid, and long-term improvement plans at Interchange 63 in accordance with ConnDOT's guidelines for preliminary cost estimating dated January 2009. The planning-level costs shown in Table 63-6 are based on estimates of major construction items and do not include allowances for engineering or any potential right-of-way acquisitions, utility relocations, or environmental mitigation.

Table 63-6. Planning-level Construction Cost Estimates: Interchange 63

Improvement	Planning-level Costs		
	(2009 $)	Mid-term (2014 $)	Long-term (2024 $)
Near-term Improvement Plan			
• All signage improvements	$ 3,000	-	-
Mid-term Improvement Plan			
• SB deceleration lane improvement	$ 380,000	$ 500,000	-
Long-term Improvement Plan			
• NB deceleration lane and off ramp improvements	$ 4.0 million	-	$ 9.6 million
• NB on ramp and acceleration lane improvements	$ 1.3 million	-	$ 3.1 million
• NB and SB auxiliary lane improvements	$ 8.1 million	-	$ 19.4 million
• SB on ramp and acceleration lane improvements	$ 12.6 million	-	$ 30.2 million

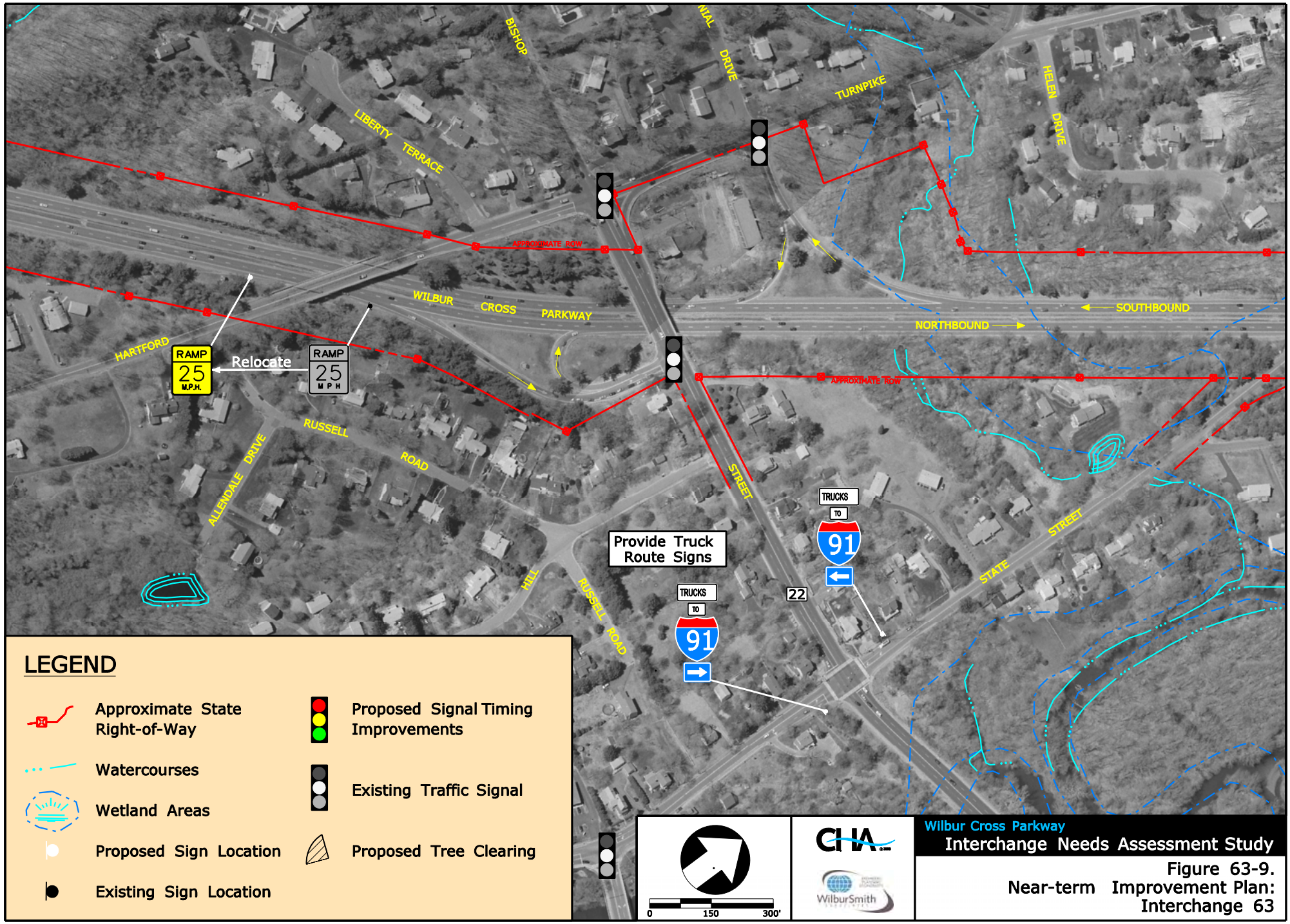
BISHOP
DRIVE
TURNPIKE
HELEN
DRIVE
LIBERTY
TERRACE
APPROXIMATE ROW
WILBUR
CROSS
PARKWAY
SOUTHBOUND
NORTHBOUND
HARTFORD
RAMP
25
M.P.H.
Relocate
RAMP
25
M P H
APPROXIMATE ROW
RUSSELL
ROAD
ALLENDALE
DRIVE
STREET
TRUCKS
TO
91
Provide Truck
Route Signs
TRUCKS
TO
91
22
HILL
RUSSELL
ROAD
STATE
STREET
LEGEND
Approximate State
Right-of-Way
Watercourses
Wetland Areas
Proposed Sign Location
Existing Sign Location
Proposed Signal Timing
Improvements
Existing Traffic Signal
Proposed Tree Clearing
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Figure 63-9.
Near-term Improvement Plan:
Interchange 63

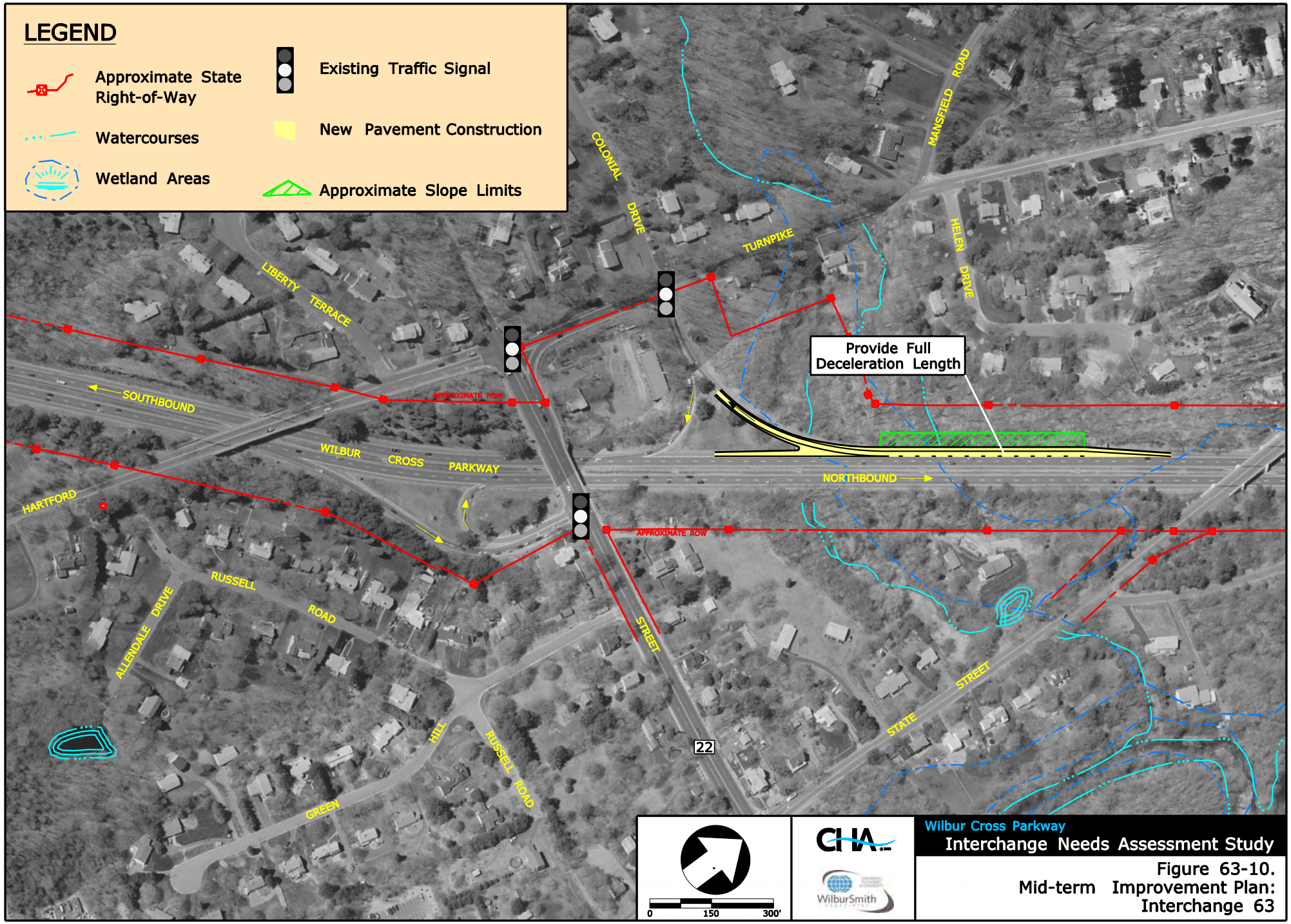
LEGEND
Approximate State Right-of-Way
Watercourses
Wetland Areas
Existing Traffic Signal
New Pavement Construction
Approximate Slope Limits
COLONIAL DRIVE
MANSFIELD ROAD
TURNPIKE
HELEN DRIVE
LIBERTY TERRACE
SOUTHBOUND
APPROXIMATE ROW
WILBUR CROSS PARKWAY
Provide Full Deceleration Length
NORTHBOUND
HARTFORD
APPROXIMATE ROW
RUSSELL ROAD
ALLENDALE DRIVE
STREET
HILL
RUSSELL ROAD
GREEN
22
STATE STREET
0
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Figure 63-10.
Mid-term Improvement Plan:
Interchange 63

LEGEND

- Approximate State Right-of-Way
- Watercourses
- Wetland Areas
- Approximate Slope Limits
- Structures (Including Bridges, Retaining Walls, and Tunnels)
- Proposed Traffic Signal
- Existing Traffic Signal
- New Pavement Construction
- Existing Pavement to be Removed
- Mid-term Improvements

Provide Full Acceleration Length

Provide Cut-and-Cover Tunnel

Realign Southbound On Ramp

Reconstruct Bridge Structure

Provide Cut-and-Cover Tunnel

Realign Northbound Off Ramp

Close Northbound On Ramp

Relocate Northbound On Ramp

Provide Auxiliary Lanes Between Interchange 63 and Service Areas

LIBERTY TERRACE

BISHOP

COLONIAL DRIVE

TURNPIKE

HELEN DRIVE

SOUTHBOUND

NORTHBOUND

APPROXIMATE ROW

WILBUR CROSS PARKWAY

HARTFORD

ALLENDALE DRIVE

RUSSELL

HILL

RUSSELL ROAD

GREEN

STATE STREET

22

BANTON STREET

QUINNIPIAC

0 150 300'

CHA

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Interchange Needs Assessment Study

Figure 63-11.
Long-term Improvement Plan:
Interchange 63

North Haven Service Areas

In Brief

Location: Town of North Haven

- 0.4 mile north of Interchange 63
- 4.6 miles south of Interchange 64

The northbound and southbound Service Areas in North Haven are located approximately 0.4 mile north of Interchange 63 (refer to Figure 63-1 under Interchange 63 for location map). The Service Areas each contain gas pumps, a convenience mart, and restrooms that are only accessible to the public from the Wilbur Cross Parkway.

The configurations of the on ramps and off ramps are similar for both Service Areas. The off ramps diverge from the mainline in taper-type exits and immediately widen significantly on the approach to the gas pumps. The on ramps each consist of a short section of ramp that extends from the parking area and meets the mainline in a yield-controlled tapered merge.

The Parkway travel lanes are separated from each Service Area by an 8 ft wide shoulder and an 8 ft wide curbed and grassed island that extends along the length of the Service Area between the off and on ramps.

Needs and Deficiencies Assessment

Roadway Geometry

For this study, the critical geometric characteristics of the Wilbur Cross Parkway and its interchanges and Service Areas are those that are closely related to vehicular safety. These critical geometric characteristics include deceleration lane lengths; acceleration lane lengths; and ramp curvatures and speeds. The study team determined the existing geometric characteristics of Service Area ramps and compared them to the minimum design standards obtained from ConnDOT's *Highway Design Manual 2003 Edition* (HDM).

Because of the unique nature of the Service Area sites that include gas pumps located downstream of the off ramps, the study team assumed that a stop condition located 50 ft upstream of the gas pumps, rather than ramp curvature, would control the required deceleration length at the Service Areas.

The results of the existing geometric conditions assessment are summarized in Table NS-1 and illustrated in Figure NS-1. Non-standard conditions, or deficiencies, are noted in bold red text in the table and figure.

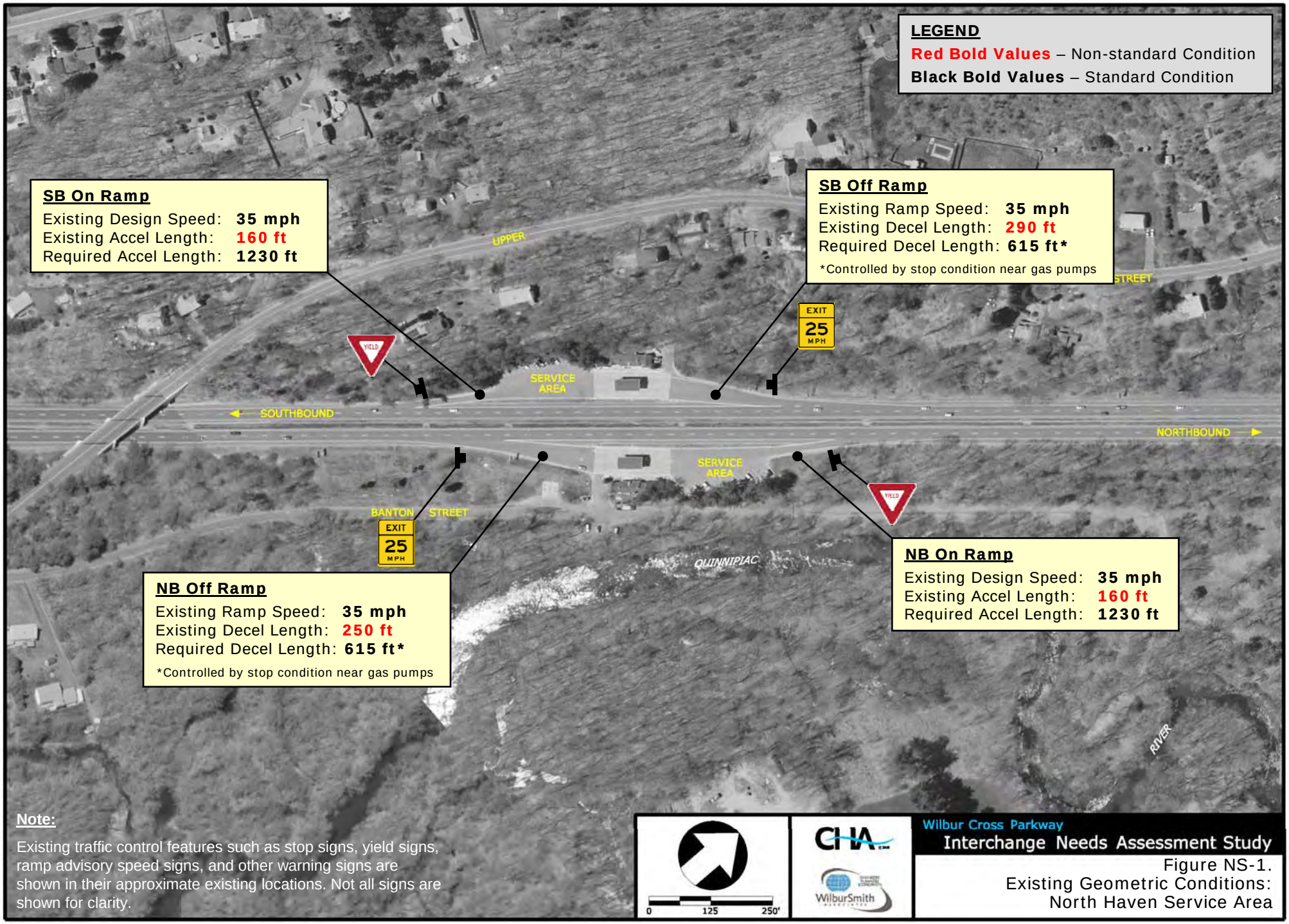
Table NS-1. Existing Geometric Conditions Summary: North Haven Service Areas

Location	Ramp		Acceleration/Deceleration Lanes		Other Notes
	Curve Radius	Design Speed	Existing Length	Required Length	
Northbound					
Off Ramp	>385 ft	35 mph	**250 ft**	615 ft	Stop Condition[1]
On Ramp	>385 ft	35 mph	**160 ft**	1230 ft	Yield Control
Southbound					
Off Ramp	>385 ft	35 mph	**290 ft**	615 ft	Stop Condition[1]
On Ramp	> 385 ft	35 mph	**160 ft**	1230 ft	Yield Control

[1] A stop condition located 50 ft upstream of the gas pumps was assumed to be the controlling factor in determining the required deceleration length.

As shown in Table NS-1, the following geometric conditions are deficient:

- **Northbound Deceleration Lane:** Limited deceleration lane exists to accommodate deceleration from mainline speed to stop condition near gas pumps. Most deceleration must occur on the mainline creating unsafe conditions for through and exiting traffic.
- **Northbound Acceleration Lane:** Yield-controlled approach requires motorists to perceive gaps in traffic flow sufficient to accommodate merging and acceleration to mainline speeds. Limited acceleration lane exists to accommodate acceleration prior to merging.
- **Southbound Deceleration Lane:** Limited deceleration lane exists to accommodate deceleration from mainline speed to stop condition near gas pumps. Most deceleration must occur on the mainline creating unsafe conditions for through and exiting traffic.
- **Southbound Acceleration Lane:** Yield-controlled approach requires motorists to perceive gaps in traffic flow sufficient to accommodate merging and acceleration to mainline speeds. Limited acceleration lane exists to accommodate acceleration prior to merging.



Note:

Existing traffic control features such as stop signs, yield signs, ramp advisory speed signs, and other warning signs are shown in their approximate existing locations. Not all signs are shown for clarity.

Traffic Conditions

The study team collected automatic traffic recorder (ATR) counts on the Service Area ramps for a 72-hour period that included a Friday, Saturday, and Sunday in December 2008. The count data was used as the basis for assessing traffic conditions at the Service Area ramp junctions.

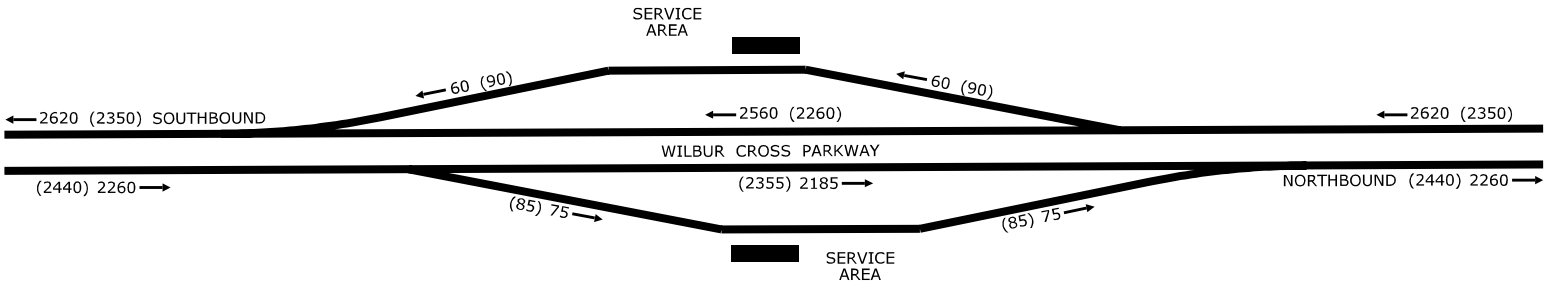
Figure NS-2 presents the existing (2008) weekday peak hour traffic volumes for the morning (AM) and afternoon (PM) peak commuting periods that the study team developed from the 72-hour ATR counts. Although the actual entering and exiting traffic volumes varied slightly during any given hour, it was assumed for analysis purposes that the on ramp volume would equal the off ramp volume so that the volume on the mainline would be constant upstream and downstream of the Service Areas.

Figure NS-3 presents the estimated future (2030) weekday peak hour traffic volumes that were developed by the study team assuming that traffic growth on the Service Area ramps would be similar to the projected growth on the adjacent mainline segment. The 2030 volumes reflect an approximate 22% increase in traffic at the Service Areas.

Traffic Operations

The study team analyzed the operations of the mainline segments and ramp junctions at the Service Areas. The analyses were conducted for the weekday AM and PM peak hours under the 2008 and estimated 2030 traffic conditions. The results of the analyses, which are reported as Levels of Service (LOS), are presented in Tables NS-2 and NS-3 and illustrated in Figures NS-4 and NS-5.

As described in the *Needs Assessment Overview* section, LOS D or better represents an acceptable degree of congestion for mainline segments, ramp junctions, and intersections. LOS E and F, which are indicated in red in the tables and figures, represent unacceptable degrees of congestion. Locations operating at LOS E and F are highlighted in this report to indicate locations where traffic capacity and operational issues exist, or could exist under future traffic conditions.



LEGEND

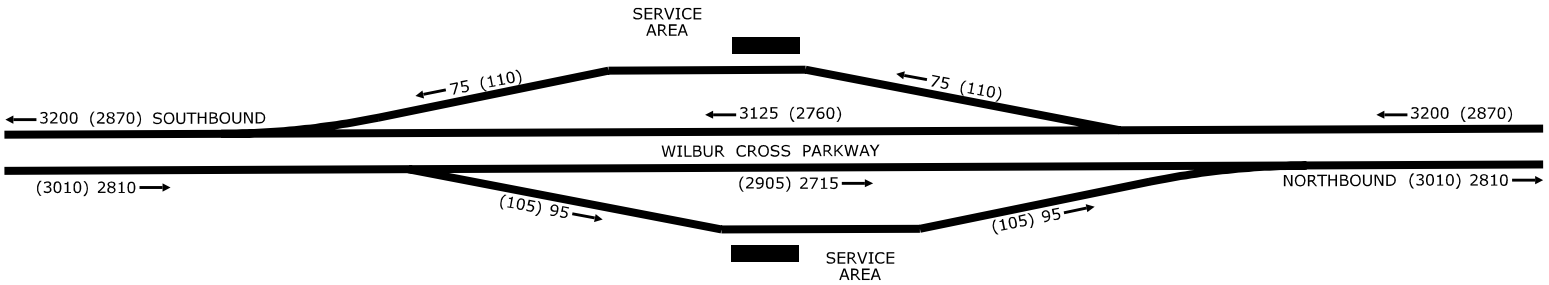
(PM) AM →

NOT TO SCALE

Wilbur Cross Parkway

Interchange Needs Assessment Study

Figure NS-2.
Existing (2008) Peak Hour Volumes:
North Haven Service Areas



LEGEND

(PM) AM →

NOT TO SCALE

Wilbur Cross Parkway

Interchange Needs Assessment Study

Figure NS-3.
Future (2030) Peak Hour Volumes:
North Haven Service Areas

Mainline

Table NS-2. Mainline Operations Summary: North Haven Service Areas

Direction	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
Northbound				
South of Service Area	B (17.9)	C (22.4)	C (19.4)	C (24.2)
North of Service Area	B (17.9)	C (22.4)	C (19.4)	C (24.2)
Southbound				
North of Service Area	C (20.8)	D (26.1)	C (18.7)	C (22.9)
South of Service Area	C (20.8)	D (26.1)	C (18.7)	C (22.9)

[1] Mainline density is reported in passenger cars per mile per lane (pc/mi/ln).

The mainline analysis shows that the mainline segments adjacent to the Service Areas currently operate at LOS B and C during both the AM and PM peak hours. Traffic densities are slightly higher under 2030 traffic conditions resulting in lower levels of service in the northbound and southbound directions during the AM peak hour. It should be noted that the levels of service are the same north and south of the Service Areas during any given peak hour because the mainline volumes north and south of the Services Areas are the same.

Ramp Junctions

Table NS-3. Ramp Merge/Diverge Operations Summary: North Haven Service Areas

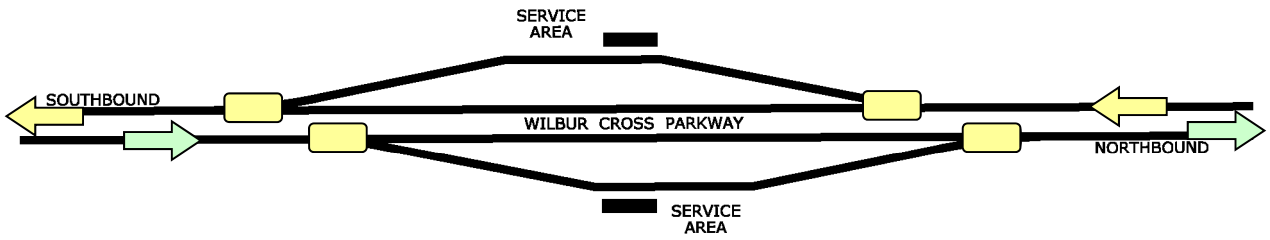
Direction	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
Northbound				
Off Ramp	C(24.5)	D(29.7)	C(26.2)	D(31.6)
On Ramp	C(24.3)	D(29.0)	C(25.8)	D(30.8)
Southbound				
Off Ramp	C(27.6)	D(32.8)	C(25.5)	D(30.2)
On Ramp	C(26.9)	D(31.9)	C(24.5)	D(29.0)

[1] Ramp junction density is reported in passenger cars per mile per lane (pc/mi/ln).

The ramp analysis shows that the northbound and southbound ramps currently operate at LOS C during the AM and PM peak hours. Levels of service are reduced under 2030 traffic conditions but are still acceptable at LOS D.

Figures NS-4 and NS-5 summarize the results of the traffic operations analyses for the AM and PM peak hour traffic conditions, respectively.

Existing (2008) Traffic Operations – AM



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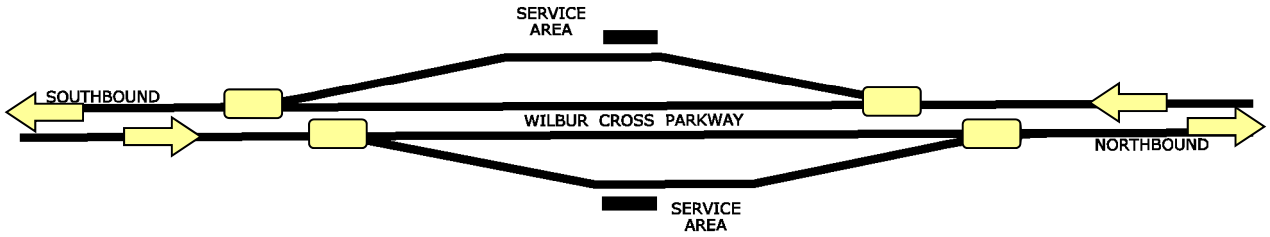
Future (2030) Traffic Operations – AM



NOT TO SCALE

LOS	Mainline	Merge/Diverge
A-B		
C-D		
E-F		

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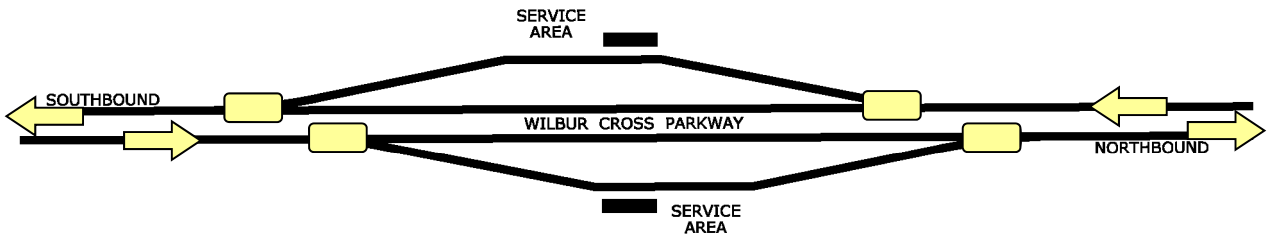
Figure NS-4.
AM Traffic Operations Summary:
North Haven Service Areas

Existing (2008) Traffic Operations – PM



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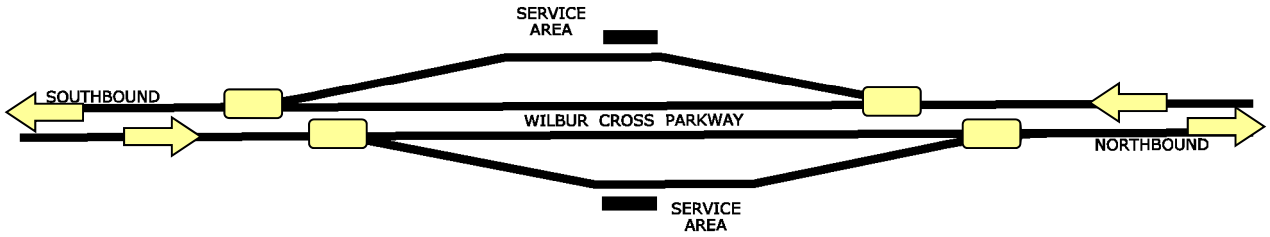
Future (2030) Traffic Operations – PM



NOT TO SCALE

LOS	Mainline	Merge/Diverge
A-B		
C-D		
E-F		

Wilbur Cross Parkway
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Figure NS-5.
PM Traffic Operations Summary:
North Haven Service Areas

Accidents and Safety

The study team obtained accident data from ConnDOT's *Traffic Accident Viewing System* (TAVS) for the three-year period beginning January 1, 2005 and ending December 31, 2007. The data shows that seven accidents occurred on the Parkway at the North Haven Service Areas during this period. Table NS-4 summarizes the accident history for the Service Areas.

Table NS-4. Accident History: North Haven Service Areas

Location	Collisions by Type			
	Rear End	Fixed Object	Moving Object	Total
Northbound				
Off Ramp	1	1	1	**3**
On Ramp	1	-	-	**1**
Southbound				
Within Rest Area	1	-	-	**1**
Between Off and On Ramps	1	1	-	**2**
Total Number	**4**	**2**	**1**	**7**
Percentage	**57%**	**29%**	**14%**	**100%**

As shown in Table NS-4, three of the seven accidents occurred at the northbound off ramp, though all three accidents were different collision types. The low number of accidents and the lack of any trends or significant concentration of accidents indicate that despite the non-standard geometry of the deceleration and acceleration lanes, few if any of the accidents are directly related to the geometric deficiencies of the ramps. The study team believes that the generally low accident history at the Service Areas could be due to a combination of factors including:

- Relatively low traffic volumes accessing the Service Areas during peak commuter periods thus limiting the number of potential vehicle conflicts.
- Generally level, open terrain in the vicinity of the Service Areas that provide unobstructed sight lines for motorists.

The study team notes that the lack of any substantial physical separation between the mainline traffic and the gas pumps is a potential safety issue. An errant mainline vehicle could relatively easily traverse or vault over the narrow curbed island at a high travel speed and collide with a gas pump, pedestrian, or other vehicle in the Service Area. The gas pumps are located just beyond the 30-ft mainline clear zone, but fueling vehicles and associated pedestrian activity do occur within the clear zone.

Recommended Improvement Plan

The study team worked with the Town of North Haven, ConnDOT, SCRCOG, and other stakeholders to develop a mid-term improvement plan to address the identified deficiencies and needs at the North Haven Service Areas. The recommended improvement plan is detailed and illustrated below along with discussion regarding other design and implementation considerations. Also included are summaries of constraints, impacts, and estimated construction costs.

Mid-term Improvement Plan (Figure NS-6)

- Improve the physical separation between mainline Route 15 and the service areas by replacing the existing curbed island with concrete barrier and impact attenuator. The purpose of the barrier is to better protect the existing gas pumps and pedestrian activity within the service area from potential errant vehicles off the mainline.
- Provide standard deceleration length for the northbound and southbound off ramps in conjunction with barrier improvements.
- Provide standard acceleration length for the northbound on ramp.

Near, Mid, and Long-term Definitions

Near-term:
- Implementation period of 1 to 3 years.
- Includes low cost improvements such as signing and striping improvements, existing signal timing modifications, tree clearing, etc.

Mid-term:
- Implementation period of 3 to 10 years.
- Includes acceleration and deceleration lane improvements, new turn lanes, new traffic signals, and minor ramp modifications that could be implemented with little or no impacts to rights-of-way, environmental features, or existing bridge structures.

Long-term:
- Implementation period greater than 10 years.
- Includes higher-cost improvements that could significantly impact existing bridge structures, rights-of-way, or environmental features.

Other Considerations

- Provide northbound and southbound auxiliary lane improvements between the Service Areas and Interchange 63 in conjunction with the long-term improvements at Interchange 63 (see Interchange 63 Long-term Improvement Plan).

Constraints, Limitations and Impacts

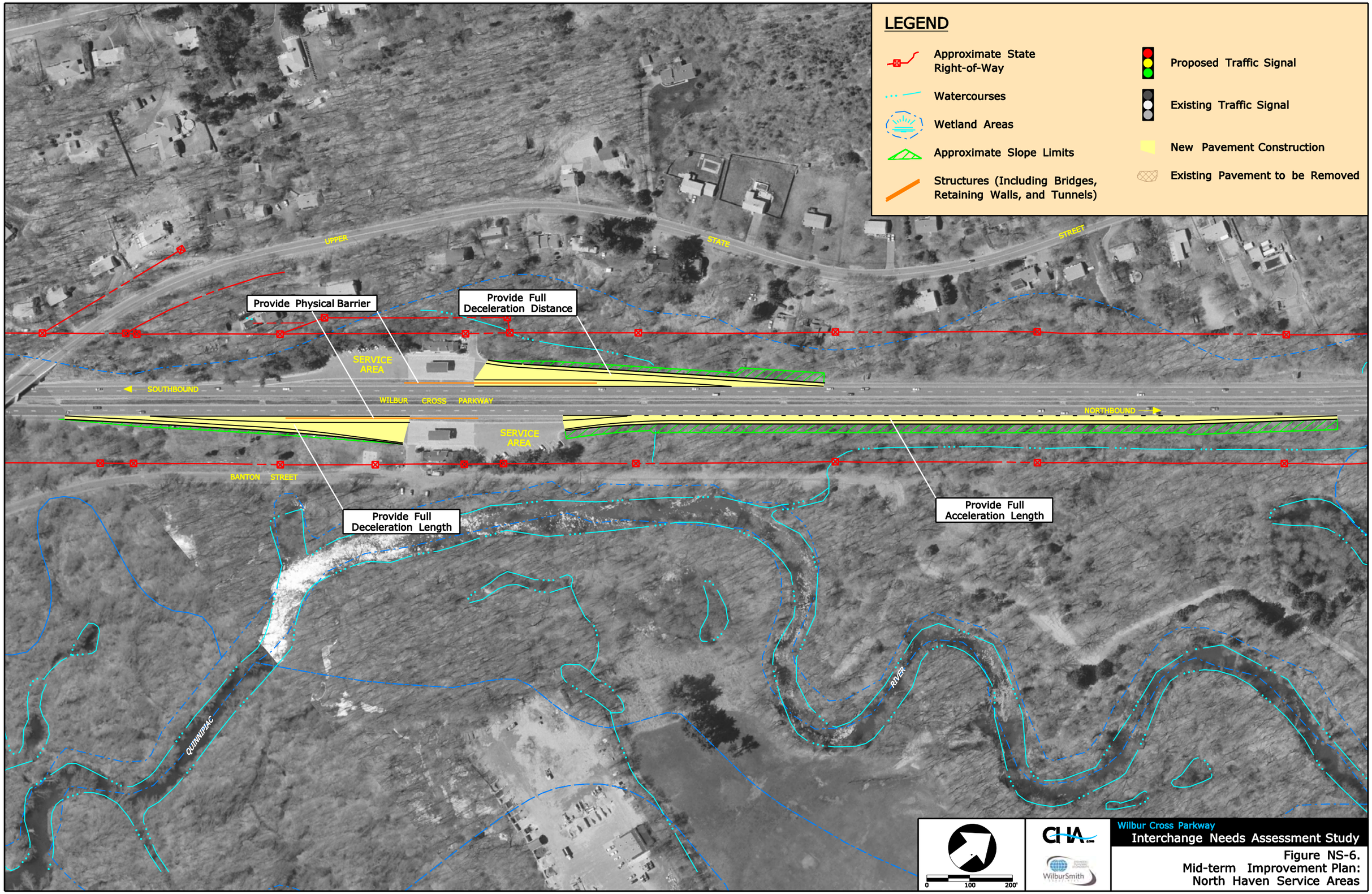
- The proximity of the existing State Street bridge structure over Route 15 to the Service Areas precludes any substantial mid-term acceleration lane improvements to the southbound on ramp.
- No significant right-of-way or wetland impacts are anticipated with the improvement plans at the North Haven Service Areas.

Estimated Construction Costs

The study team developed planning-level construction cost estimates for the mid-term improvement plan at the North Haven Service Areas in accordance with ConnDOT's guidelines for preliminary cost estimating dated January 2009. The planning-level costs shown in Table NS-5 are based on estimates of major construction items and do not include allowances for engineering or any potential right-of-way acquisitions, utility relocations, or environmental mitigation.

Table NS-5. Planning-level Construction Cost Estimates: North Haven Service Areas

Improvement	Planning-level Costs	
	(2009 $)	Mid-term (2014 $)
Mid-term Improvement Plan		
• Northbound deceleration lane and off ramp	$ 500,000	$ 700,000
• Northbound on ramp and acceleration lane	$ 800,000	$ 1.1 million
• Southbound deceleration lane and off ramp	$ 500,000	$ 700,000



Wilbur Cross Parkway

Interchange Needs Assessment Study

Figure NS-6.
Mid-term Improvement Plan:
North Haven Service Areas

DOT Maintenance Exit

In Brief

Location: City of Meriden
- 1.8 miles north of Interchange 66
- 1.0 mile south of Interchange 67

Access to: DOT Maintenance Facility
Miller Avenue

The DOT Maintenance Exit on the Wilbur Cross Parkway is an unnumbered interchange located in the City of Meriden between Interchange 66 and Interchange 67. The primary function of the interchange is to provide access to the DOT maintenance facility located on the west side of the Parkway adjacent to the interchange. The interchange also provides access to Miller Avenue, a local street, that serves residential land uses in the interchange area. The interchange also provides indirect access to commercial/industrial uses located along Research Parkway approximately 1.5 miles to the east via Miller Avenue, Paddock Avenue, and Murdock Avenue.

The interchange was originally constructed in the late 1940s and was improved since then to provide improvements to the north and southbound ramps.

The northbound off ramp diverges from the mainline in a parallel-type exit and follows a tight reversing curve before aligning parallel to the mainline and terminating on the south side of Miller Avenue in a stop-controlled T-intersection. The northbound on ramp is located parallel to the off ramp and follows a tight 180-degree loop before meeting the Parkway at a stop-controlled approach. The northbound ramps are not physically separated and essentially form a bi-directional roadway between the Parkway and Miller Avenue. The southbound off ramp also diverges from the mainline in a parallel-type exit and loops approximately 180 degrees before aligning parallel to the mainline and terminating on the south side of Miller Avenue in a stop-controlled T-intersection. The southbound on ramp is located parallel to the off ramp and follows a reversing curve before merging with the mainline with a parallel acceleration lane. The southbound ramps are not physically separated for most of their length and essentially form a bi-directional roadway between the Parkway and Miller Avenue that provides access to and from the DOT maintenance facility drive.

The Parkway in the interchange area consists of two travel lanes in the northbound and southbound directions separated by a narrow depressed grassed median with metal beam guide rail. The typical lane and shoulder configuration includes 11 ft to 12 ft wide lanes, 1 ft to 2 ft wide left shoulders, and 9 ft to 11 ft wide right shoulders.

The study area, shown in Figure DE-1, includes the interchange ramps, the junctions of these ramps with the Wilbur Cross Parkway, and the following intersections:

- Northbound ramps at Miller Avenue (unsignalized)
- Southbound ramps at Miller Avenue (unsignalized)

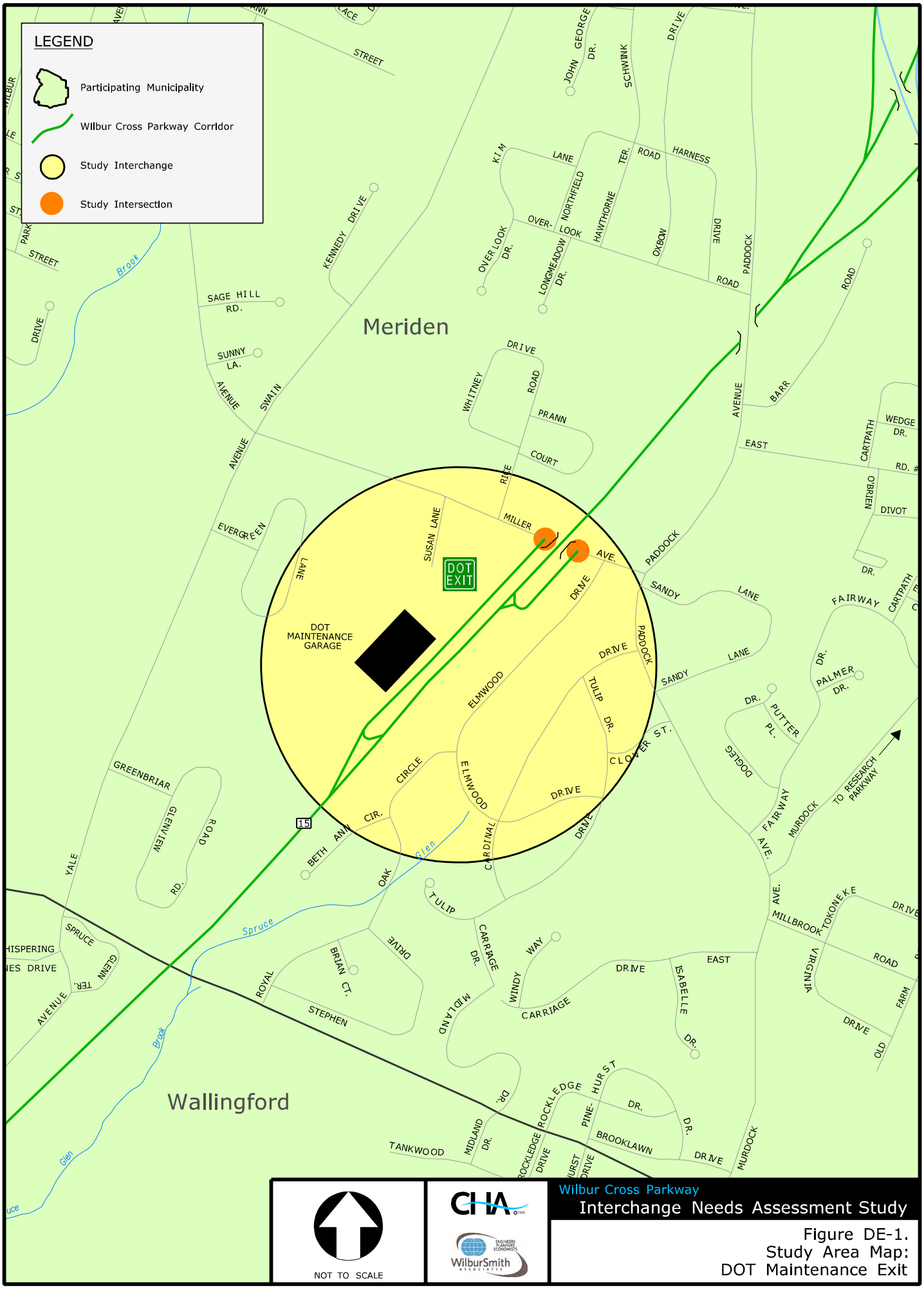

LEGEND
Participating Municipality
Wilbur Cross Parkway Corridor
Study Interchange
Study Intersection
Meriden
Wallingford
DOT EXIT
DOT MAINTENANCE GARAGE
15
MILLER AVE.
SUSAN LANE
EVERGREEN LANE
ELMWOOD DRIVE
ELMWOOD CIRCLE
TULIP DR.
CLOVER ST.
CARDINAL DRIVE
BETH ANN CIR.
OAK
TULIP
CARRIAGE DR.
WINDY WAY
CARRIAGE DRIVE
EAST
ISABELLE DR.
MIDLAND DR.
ROYAL
BRIAN CT.
STEPHEN
DRIVE
ROCKLEDGE DRIVE
HURST DR.
PINE
BROOKLAWN DRIVE
MURDOCK
TANKWOOD
MILLBROOK AVE.
TOKONEKE DRIVE
VIRGINIA ROAD
FARM
OLD
FAIRWAY AVE.
TO RESEARCH PARKWAY
PUTTER PL.
PALMER DR.
SANDY LANE
PADDOCK AVE.
PADDOCK DRIVE
CARTPATH
WEDGE DR.
EAST RD.
O'BRIEN
DIVOT
DR.
BARR AVENUE
WHITNEY ROAD
PRANN COURT
DRIVE
SAGE HILL RD.
SUNNY LA.
AVENUE
SWAIN
KENNEDY DRIVE
OVER LOOK DR.
LONGMEADOW DR.
OVER LOOK
NORTHFIELD
HAWTHORNE
OXBOW
KIM
LANE
TER.
ROAD
HARNESS
DRIVE
JOHN GEORGE DR.
SCHWINK
DRIVE
STREET
PARK
STREET
Brook
DRIVE
GREENBRIAR
GLENVIEW ROAD
RD.
YALE
AVENUE
SPRUCE
GLENN TER.
HISPERING
NES DRIVE
Spruce
Brook
Glen
Glen
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Figure DE-1.
Study Area Map:
DOT Maintenance Exit

Needs and Deficiencies Assessment

Roadway Geometry

For this study, the critical geometric characteristics of the Wilbur Cross Parkway and its interchanges are those that are closely related to vehicular safety. These critical geometric characteristics include deceleration lane lengths; acceleration lane lengths; and ramp curvatures and speeds. The study team determined the existing geometric characteristics of the DOT Maintenance Exit and compared them to the minimum design standards obtained from ConnDOT's *Highway Design Manual 2003 Edition* (HDM).

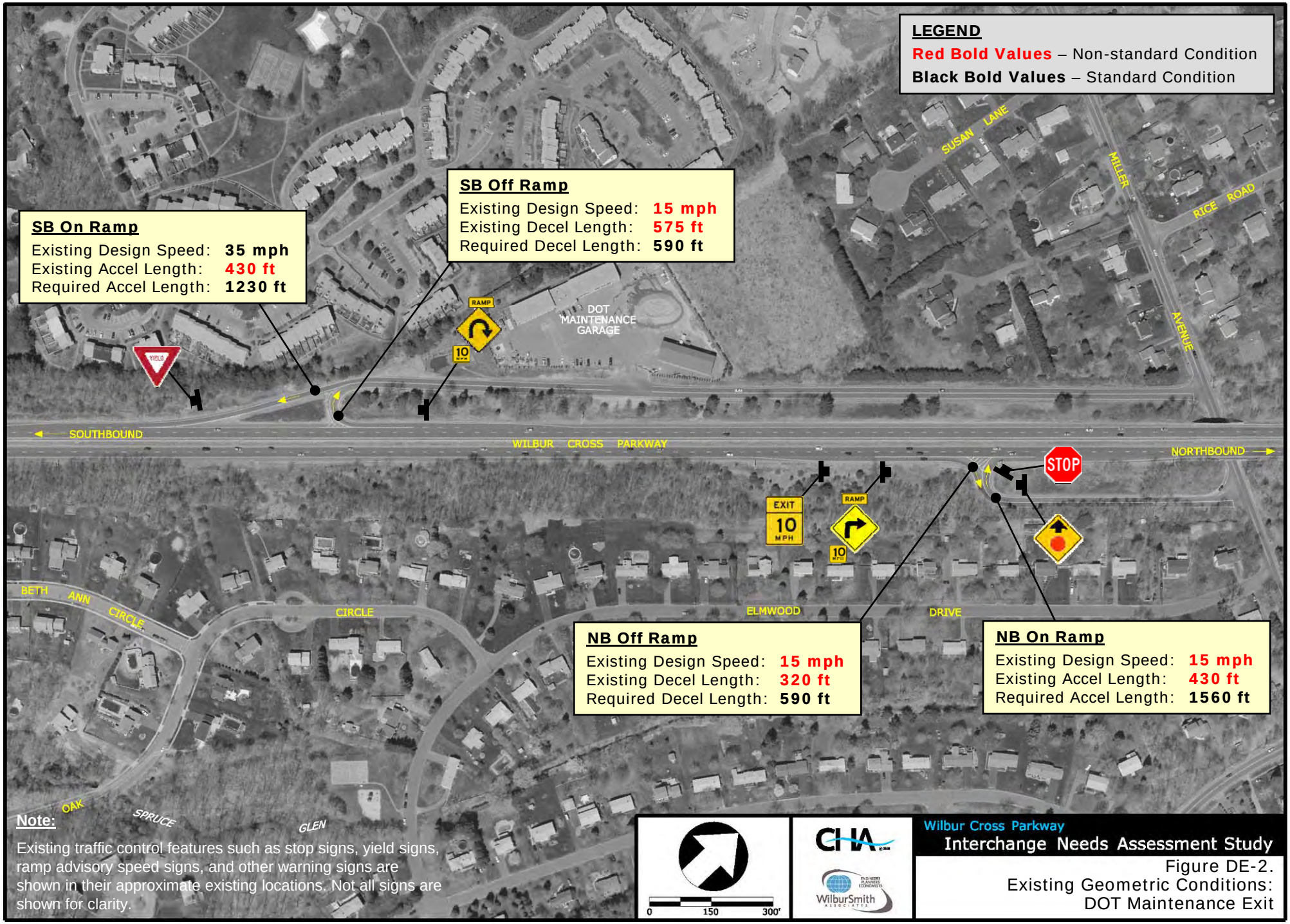
The results of the existing geometric conditions assessment are summarized in Table DE-1 and illustrated in Figure DE-2. Non-standard conditions, or deficiencies, are noted in bold red text.

Table DE-1. Existing Geometric Conditions Summary: DOT Maintenance Exit

Location	Ramp		Acceleration/Deceleration Lanes		Other Notes
	Curve Radius	Design Speed	Existing Length	Required Length	
Northbound					
Off Ramp	**55 ft**	**15 mph**	**320 ft**	590 ft	-
On Ramp	**55 ft**	**15 mph**	**430 ft**	1560 ft	Stop Controlled
Southbound					
Off Ramp	**45 ft**	**15 mph**	**575 ft**	590 ft	-
On Ramp	385 ft	35 mph	**430 ft**	1230 ft	Yield Controlled

As shown in Table DE-1, the following geometric conditions are deficient:

- **Northbound Off Ramp and Deceleration Lane:** Ramp curvature and 15 mph design speed are non-standard. Limited deceleration lane exists to accommodate deceleration from mainline to ramp speeds. Some deceleration must occur on the mainline creating unsafe conditions for through and exiting traffic. No physical separation, such as a grassed gore, exists between the off ramp and on ramp that would prevent an errant exiting vehicle from colliding with vehicles at the on ramp approach.
- **Northbound On Ramp and Acceleration Lane:** Ramp curvature and 15 mph design speed are non-standard. Stop-controlled approach requires motorists to perceive gaps in traffic flow sufficient to accommodate merging and acceleration to mainline speeds. Limited acceleration lane exists to accommodate acceleration prior to merging. No physical measures exist to deter or prevent motorists from turning left at the ramp/mainline junction and entering the Parkway in the wrong direction of travel.
- **Southbound Off Ramp and Deceleration Lane:** Ramp curvature and 15 mph design speed are non-standard. Insufficient deceleration lane exists to accommodate full deceleration from mainline to ramp speeds. Some deceleration must occur on the mainline creating unsafe conditions for through and exiting traffic.
- **Southbound Acceleration Lane:** Yield-controlled approach requires motorists to perceive gaps in traffic sufficient to accommodate merging and acceleration to mainline speeds. Limited acceleration lane exists to accommodate acceleration prior to merging.



Note:

Existing traffic control features such as stop signs, yield signs, ramp advisory speed signs, and other warning signs are shown in their approximate existing locations. Not all signs are shown for clarity.

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure DE-2.
Existing Geometric Conditions:
DOT Maintenance Exit

Traffic Conditions

The study team compiled traffic data for the DOT Maintenance Exit that included average daily traffic (ADT) volumes, existing (2008) weekday peak hour traffic volumes, and estimated future (2030) weekday peak hour traffic volumes. This data was used as the basis for assessing traffic conditions on the mainline Wilbur Cross Parkway (WCP), at the interchange ramp junctions, and at key secondary roadway intersections. Figure DE-3 illustrates the most recent (2006) ADT volumes that were obtained by ConnDOT at the DOT Maintenance Exit.

Figure DE-3. 2006 Average Daily Traffic Volumes (in vehicles per day, vpd): DOT Maintenance Exit

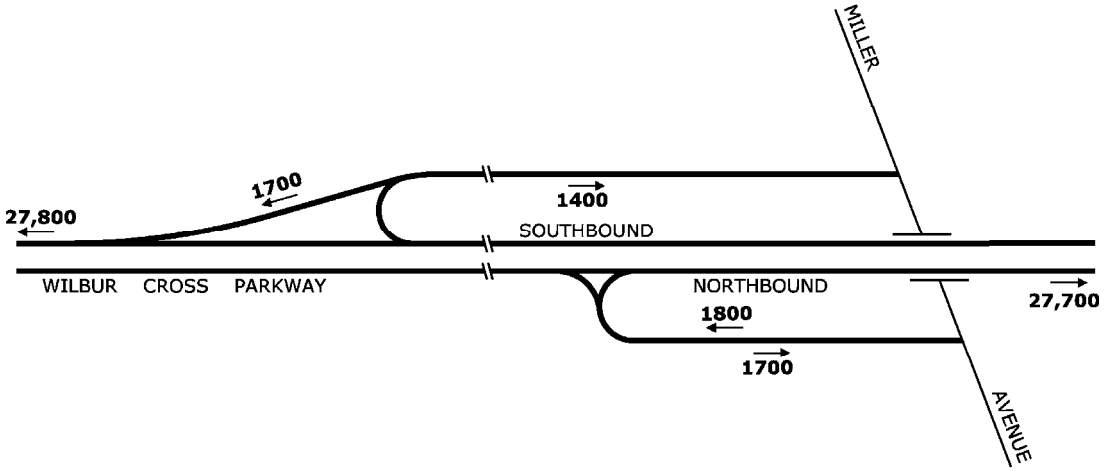
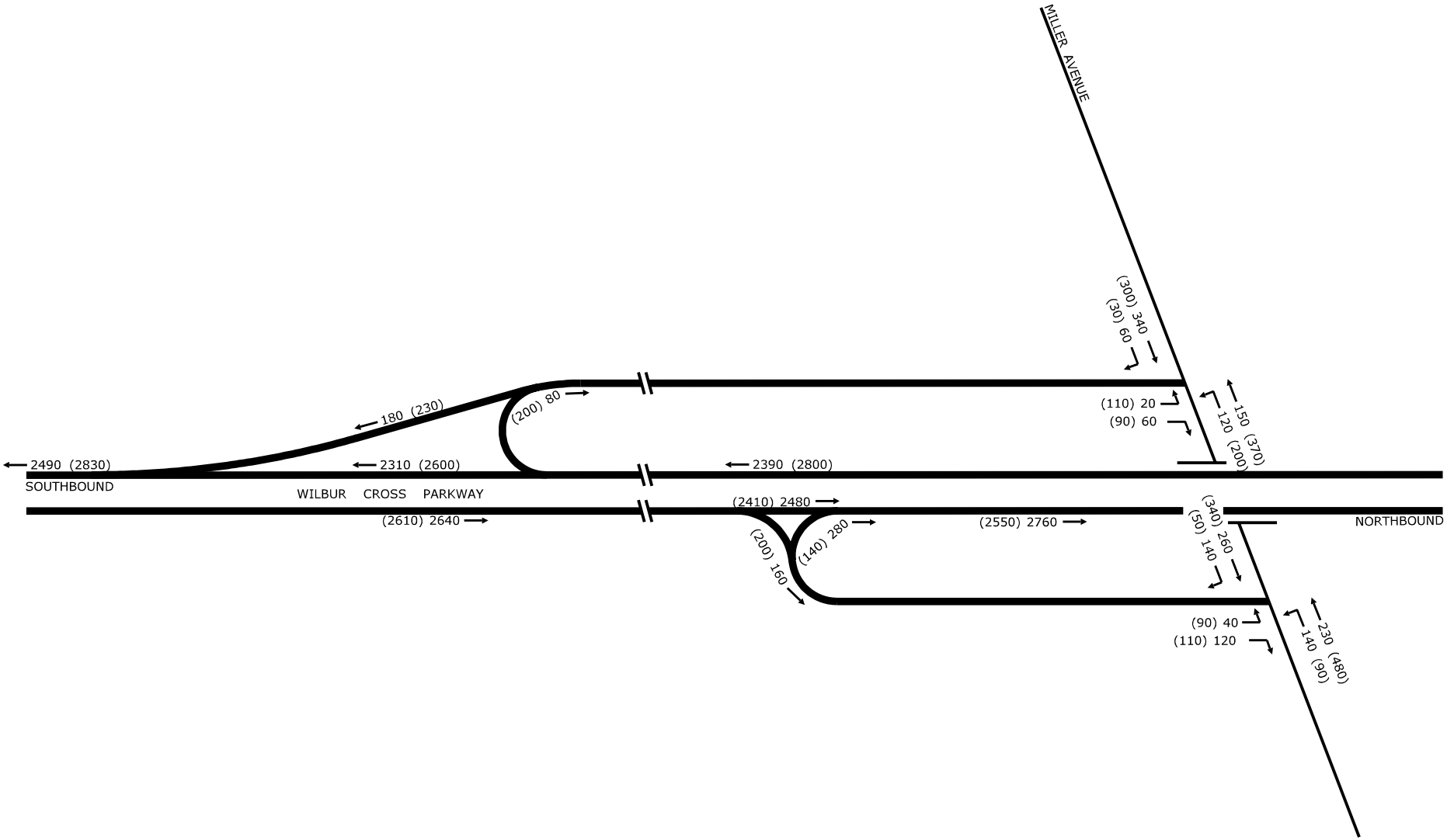


Figure DE-4 presents the 2008 weekday peak hour traffic volumes for the morning (AM) and afternoon (PM) peak commuting periods. The study team worked with ConnDOT's traffic forecasting unit to develop these volumes from intersection turning movement counts obtained by SCRCOG and available traffic data for the DOT Maintenance Exit provided by ConnDOT.

Figure DE-5 presents the estimated 2030 weekday peak hour traffic volumes that were developed by ConnDOT's traffic forecasting unit. These volumes reflect an increase in traffic at the DOT Maintenance Exit that is primarily a function of regional background traffic growth as no major developments in the interchange area are expected to significantly affect future traffic estimates.

The notable traffic conditions presented in Figures DE-3, DE-4, and DE-5 include:

- Highest daily ramp volumes occur on the northbound on ramp
- Lowest daily ramp volumes occur on the southbound off ramp
- Approximately 51% of WCP traffic is traveling northbound in the morning
- Approximately 53% of WCP traffic is traveling southbound in the afternoon
- Overall traffic growth by 2030 is estimated to be approximately 17%, or 0.7% annually


MILLER AVENUE
(300) 340
(30) 60
(110) 20
(90) 60
150 (370)
120 (200)
180 (230)
(200) 80
2490 (2830)
SOUTHBOUND
2310 (2600)
2390 (2800)
WILBUR CROSS PARKWAY
(2610) 2640
(2410) 2480
(2550) 2760
(340) 260
(50) 140
NORTHBOUND
(200) 160
(140) 280
(90) 40
(110) 120
230 (480)
140 (90)
LEGEND
(PM) AM
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DE-4.
Existing (2008) Peak Hour Volumes:
DOT Maintenance Exit

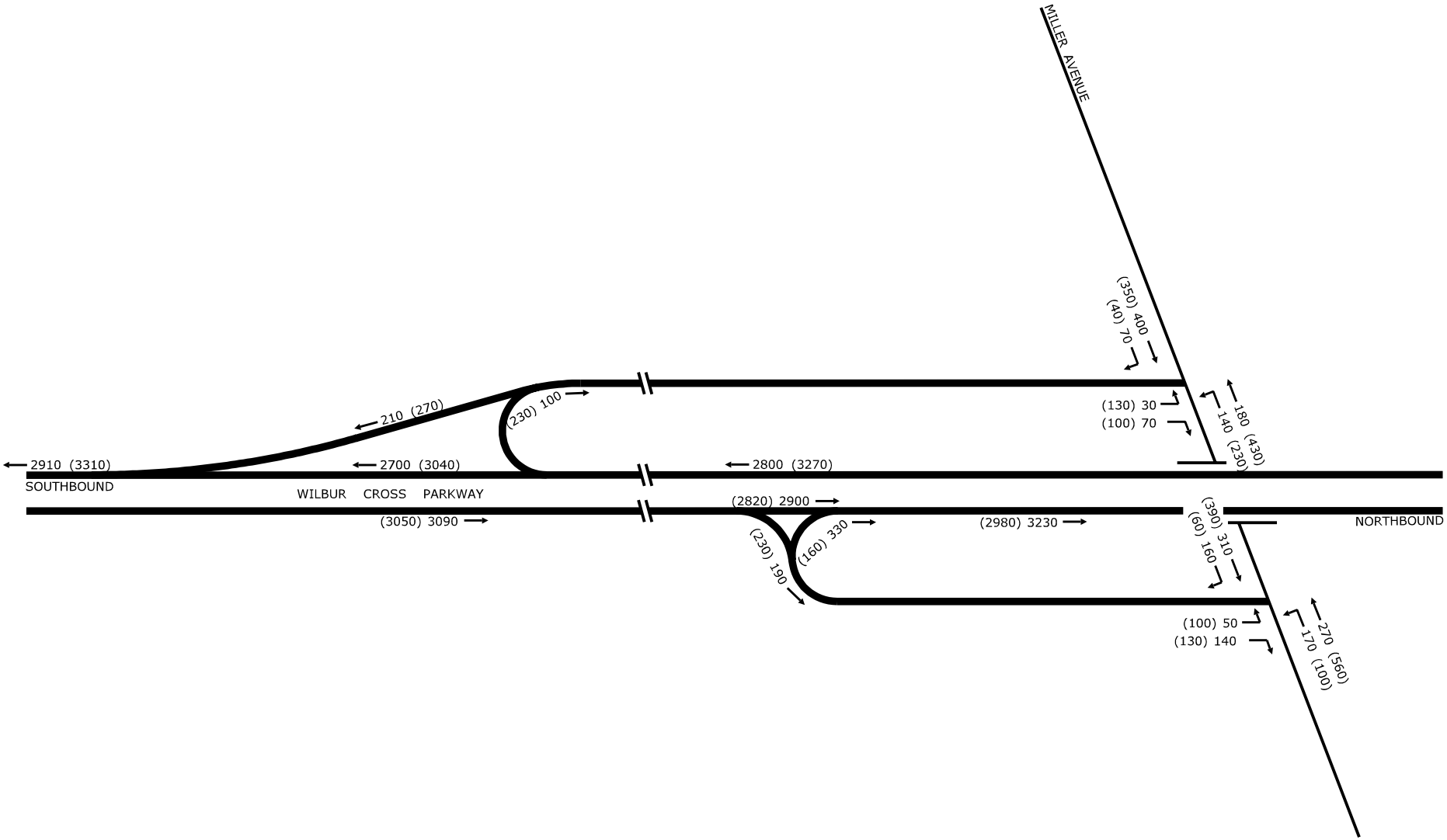
MILLER AVENUE
(350) 400
(40) 70
(130) 30
(100) 70
180 (430)
140 (230)
210 (270)
(230) 100
2910 (3310)
SOUTHBOUND
2700 (3040)
WILBUR CROSS PARKWAY
2800 (3270)
(2820) 2900
(3050) 3090
(230) 190
(160) 330
(2980) 3230
(390) 310
(60) 160
NORTHBOUND
(100) 50
(130) 140
270 (560)
170 (100)
LEGEND
(PM) AM
NOT TO SCALE
CHA
WilburSmith
Wilbur Cross Parkway
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Figure DE-5.
Future (2030) Peak Hour Volumes:
DOT Maintenance Exit

Traffic Operations

The study team analyzed the operations of the mainline segments, ramp junctions, and intersections in the DOT Maintenance Exit study area. The analyses were conducted for the weekday AM and PM peak hours under the 2008 and estimated 2030 traffic conditions. The results of the analyses, which are reported as Levels of Service (LOS), are presented below in tabular form and illustrated in Figures DE-6 and DE-7.

As described in the *Needs Assessment Overview* section, LOS D or better represents an acceptable degree of congestion for mainline segments, ramp junctions, and intersections. LOS E and F, which are indicated in red in the tables and figures, represent unacceptable degrees of congestion. Locations operating at LOS E and F are highlighted in this report to indicate locations where traffic capacity and operational issues exist, or could exist under future traffic.

Mainline

Table DE-2. Mainline Operations Summary: DOT Maintenance Exit

Direction	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
Northbound				
South of DOT Exit	C (21.0)	C (25.0)	C (20.7)	C (24.6)
North of DOT Exit	C (22.0)	D (26.4)	C (20.3)	C (24.0)
Southbound				
North of DOT Exit	C (19.0)	C (22.3)	C (22.3)	D (26.9)
South of DOT Exit	C (19.8)	C (23.3)	C (22.6)	D (27.3)

[1] Mainline density is reported in passenger cars per mile per lane (pc/mi/ln).

The mainline analysis shows that all mainline segments currently operate at LOS C during both the AM and PM peak hours. The slightly higher traffic densities in the northbound direction in the AM and in the southbound direction in the PM reflect the predominant direction of travel during the respective peak hours. Levels of service are generally reduced under 2030 traffic conditions but operations are expected to be acceptable (LOS C and D) during both peak hours.

Ramp Junctions

Table DE-3. Ramp Merge/Diverge Operations Summary: DOT Maintenance Exit

Direction	AM LOS (Density[1])		PM LOS (Density[1])	
	2008	2030	2008	2030
Northbound				
Off Ramp to Miller Avenue	C (26.6)	D (30.9)	C (26.3)	D (30.5)
On Ramp from Miller Avenue	C (26.6)	D (30.6)	C (24.8)	D (28.5)
Southbound				
Off Ramp to Miller Avenue	C (21.9)	C (25.8)	C (25.8)	D (30.3)
On Ramp from Miller Avenue	C (24.3)	C (27.9)	C (27.2)	D (31.3)

[1] Ramp junction density is reported in passenger cars per mile per lane (pc/mi/ln).

The ramp analysis shows that the northbound and southbound ramp junctions operate at LOS C during the AM and PM peak hours. Levels of service are generally reduced under 2030 traffic conditions but operations are expected to be acceptable (LOS C and D) during both peak hours.

Intersections

The study team analyzed traffic operations at the following intersections:

- **Northbound Ramps at Miller Avenue:** Unsignalized, stop-controlled T-intersection. Ramps are oriented in a north-south direction on the south side of Miller Avenue; Miller Avenue is oriented in an east-west direction. The eastbound and westbound approaches on Miller Avenue consist of a single travel lane in each direction with no stop controls. The northbound off ramp approach consists of a shared left-right lane and is stop-controlled.
- **Southbound Ramps at Miller Avenue:** Ramps are oriented in a north-south direction on the south side of Miller Avenue; Miller Avenue is oriented in an east-west direction. The eastbound and westbound approaches on Miller Avenue consist of a single travel lane in each direction with no stop controls. The southbound off ramp approach consists of a shared left-right lane and is stop-controlled.

Results of the intersection analysis are presented in Table DE-4.

Table DE-4. Intersection Operations Summary: DOT Maintenance Exit

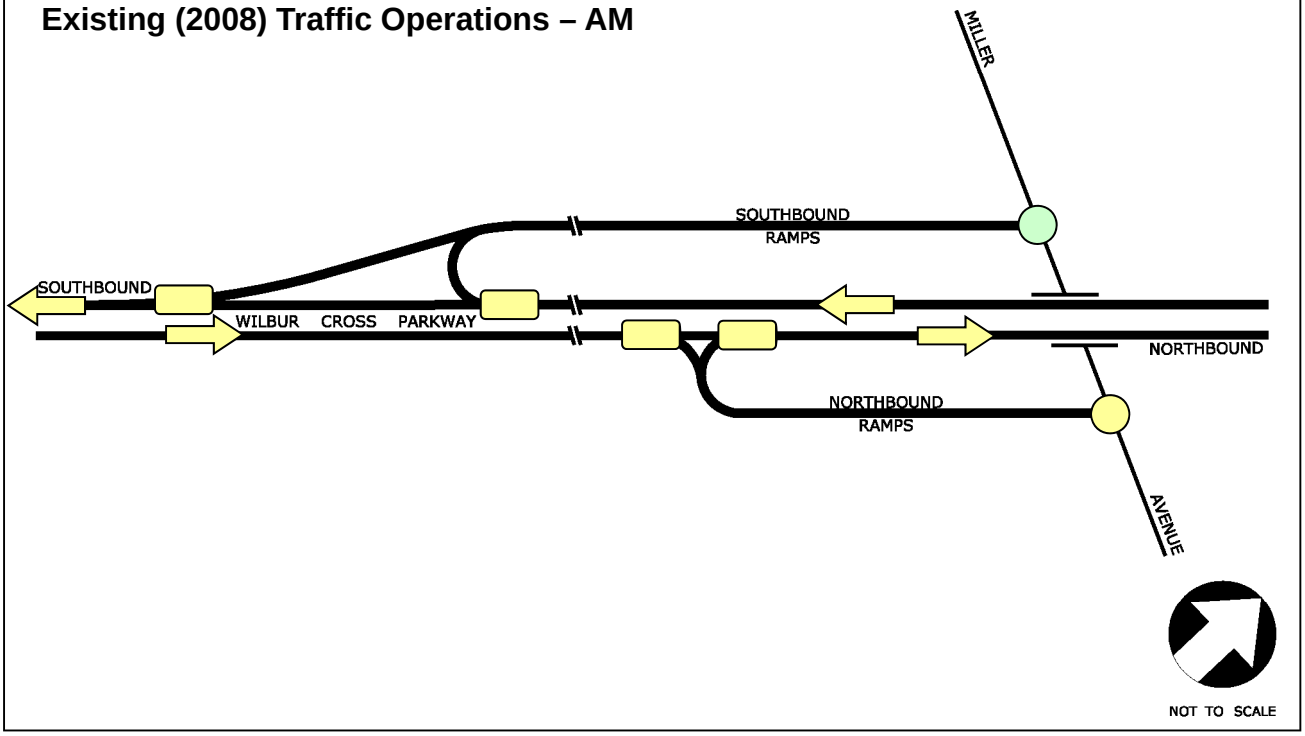
Intersection / Approach	AM LOS (Delay[1])		PM LOS (Delay[1])	
	2008	2030	2008	2030
NB Ramps at Miller Avenue (Unsignalized)				
Westbound – Miller Avenue	A (4.2)	A (4.8)	A (2.3)	A (2.6)
Northbound – NB Off Ramp	C (16.9)	C (24.7)	**E (36.8)**	**F (83.8)**
SB Ramps at Miller Avenue (Unsignalized)				
Westbound – Miller Avenue	A (4.5)	A (4.8)	A (4.4)	A (5.1)
Northbound – SB Off Ramp	B (13.9)	C (17.4)	**F (73.2)**	**F (249.7)**

[1] Delays are reported in seconds.

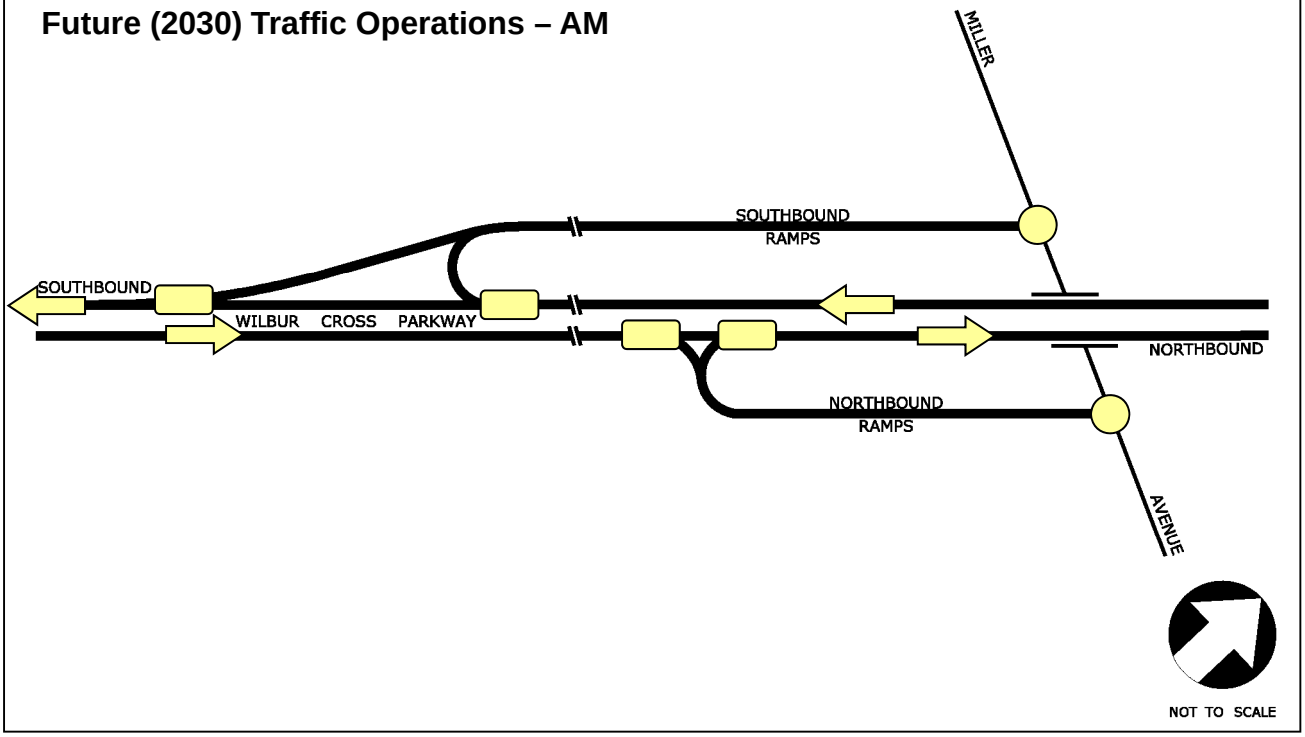
The intersection analysis shows that the northbound and southbound off ramp approaches currently operate LOS E and F, respectively, during the PM peak hour. Traffic growth in the future will exacerbate existing delays and result in LOS F at both off ramp approaches during the PM peak hour. Delays at this location result in part from the volume of left turning vehicles and the single lane approach that creates delays for right turning vehicles.

Figures DE-6 and DE-7 summarize the results of the traffic operations analyses for the AM and PM peak hour traffic conditions, respectively.

Existing (2008) Traffic Operations – AM



Future (2030) Traffic Operations – AM

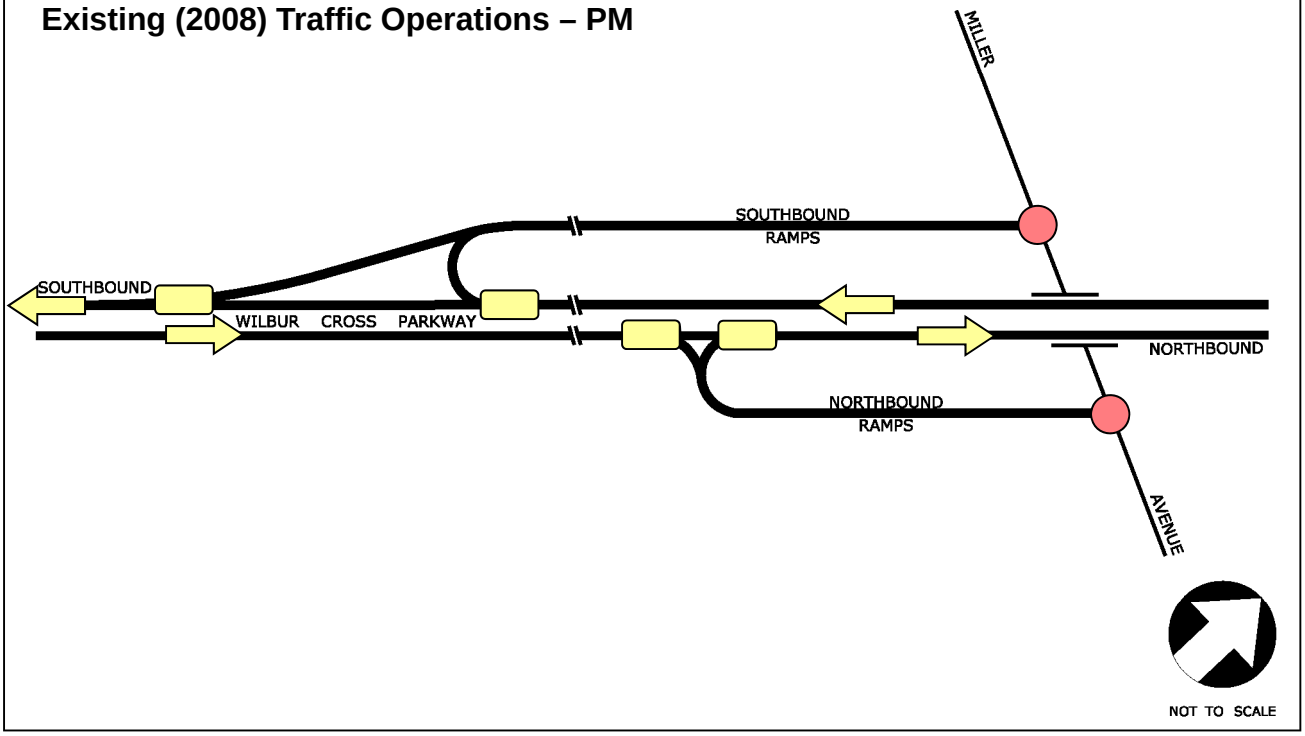


LOS	Intersection	Mainline	Merge/Diverge
A-B			
C-D			
E-F			

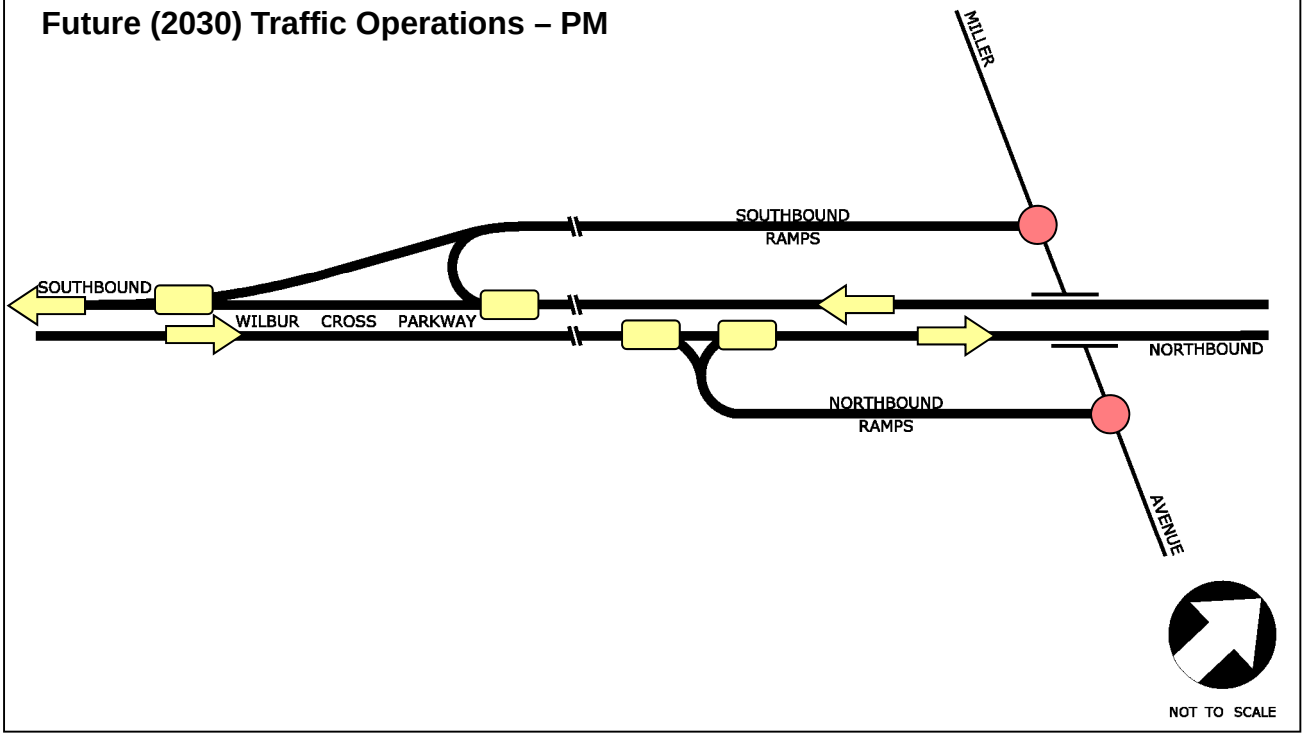
Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure DE-6.
AM Traffic Operations Summary:
DOT Maintenance Exit

Existing (2008) Traffic Operations – PM



Future (2030) Traffic Operations – PM



LOS	Intersection	Mainline	Merge/Diverge
A-B			
C-D			
E-F			

Wilbur Cross Parkway
Interchange Needs Assessment Study

Figure DE-7.
PM Traffic Operations Summary:
DOT Maintenance Exit

Accidents and Safety

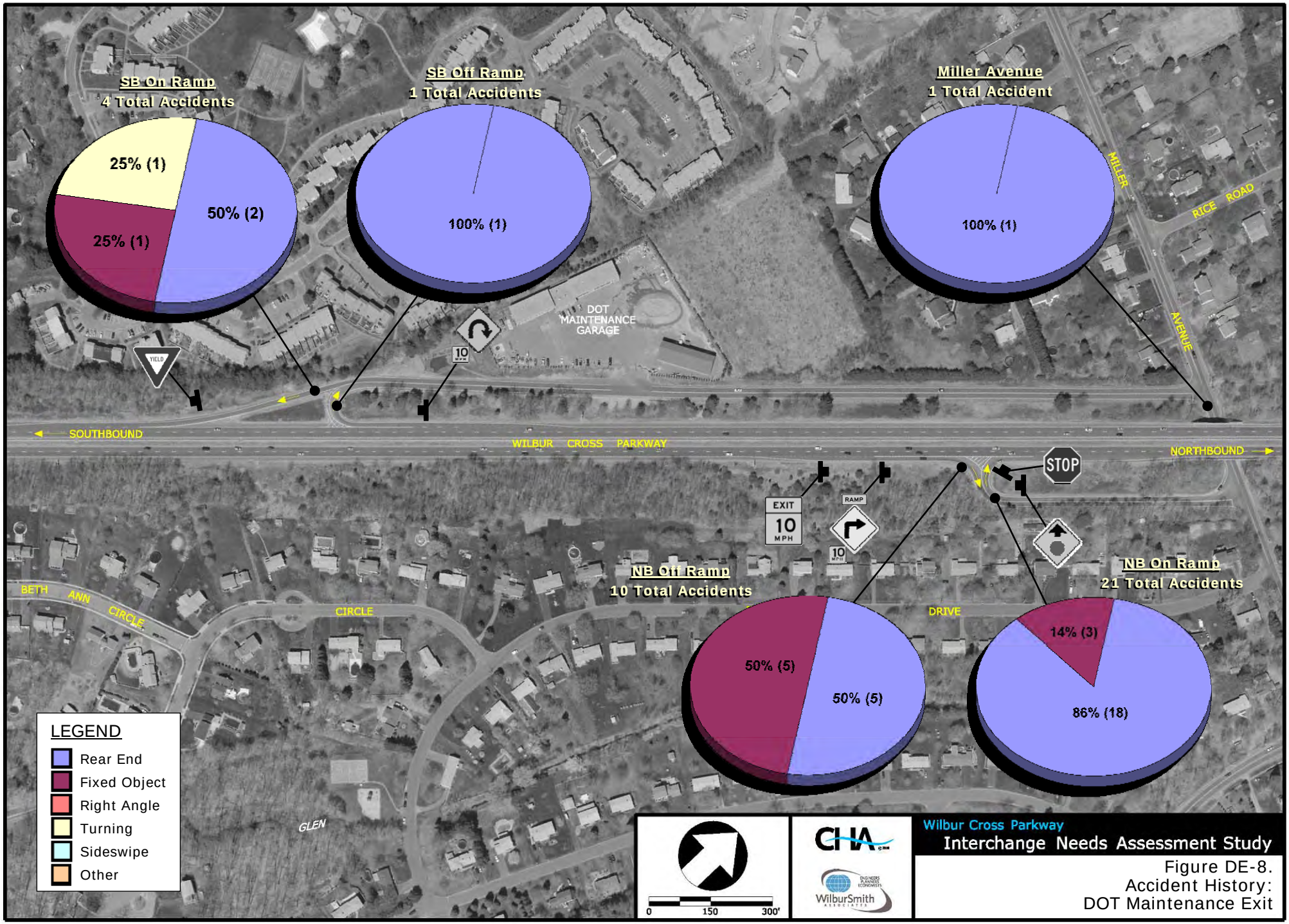
The study team obtained accident data from ConnDOT's *Traffic Accident Viewing System* (TAVS) for the three-year period beginning January 1, 2005 and ending December 31, 2007. The data shows that 37 accidents occurred in the interchange area during this period, 73% of which were rear-end collisions. Table DE-5 summarizes the types of collisions that occurred at various locations in the interchange area. Figure DE-8 illustrates the accident trends that have developed over the last few years.

Table DE-5. Accident History: DOT Maintenance Exit

Location	Collisions by Type			
	Rear End	Fixed Object	Other	Total
Northbound				
Off Ramp	5	5	-	**10**
On Ramp	18	3	-	**21**
Southbound				
Off Ramp	1	-	-	**1**
On Ramp	2	1	1	**4**
Secondary Roadway				
Miller Ave. between Ramps	1	-	-	**1**
Total Number	**27**	**9**	**1**	**37**
Percentage	**73%**	**24%**	**3%**	**100%**

As shown in Table DE-5, the northbound on ramp experienced the highest number of accidents – 57% of the total number of accidents at the DOT Maintenance Exit. The accidents on this ramp were predominantly rear-end collisions, which the study team believes is a direct result of the *stop* condition and non-standard acceleration lane that precedes the merge with mainline traffic.

Stop conditions at the end of interchange ramps are not consistent with driver expectations for limited access facilities like the Wilbur Cross Parkway. Insufficient warning to drivers of the stop condition; poor sight lines to the existing stop signs; and driver uncertainty and hesitation while attempting to enter the high volume and high speed corridor are all likely factors that contribute to the accident history at the northbound on ramp.


SB On Ramp
4 Total Accidents
25% (1)
50% (2)
25% (1)
SB Off Ramp
1 Total Accidents
100% (1)
Miller Avenue
1 Total Accident
100% (1)
MILLER
AVENUE
RICE
ROAD
DOT
MAINTENANCE
GARAGE
YIELD
10
MPH
SOUTHBOUND
WILBUR CROSS PARKWAY
NORTHBOUND
STOP
EXIT
10
MPH
RAMP
10
MPH
NB Off Ramp
10 Total Accidents
50% (5)
50% (5)
NB On Ramp
21 Total Accidents
14% (3)
86% (18)
BETH
ANN
CIRCLE
CIRCLE
DRIVE
GLEN
LEGEND
Rear End
Fixed Object
Right Angle
Turning
Sideswipe
Other
0
150
300'
CHA
WilburSmith
ASSOCIATES
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure DE-8.
Accident History:
DOT Maintenance Exit

Other notable accident trends illustrated in Table DE-5 and Figure DE-8 include:

- 50% of all accidents at the northbound off ramp were fixed object collisions suggesting that the non-standard deceleration lane and non-standard ramp speed and curvature are contributing to run-off-the-road accidents.
- No fixed object collisions occurred at the southbound off ramp despite the non-standard deceleration lane and non-standard ramp speed and curvature. It is possible that the substantial existing advance warning signage for the ramp curve and ramp speed are effective measures in limiting the number of run-off-the-road accidents in this location.

Additionally, attendees at the public information meetings conducted in March and May 2009 in Meriden noted the following safety issues:

- Local experience suggests that the number of fixed object collisions reflected in the TAVS data for both the southbound and northbound off ramps is significantly lower than the actual number of fixed object collisions and run-off-the-road accidents. The study team believes that a discrepancy between the accident data and local experience could be due to some accidents going unreported or not resulting in a serious collision or damage.

- Sight lines from the northbound off ramp to the east along Miller Avenue are obscured by overhanging trees and vegetation on Miller Avenue near the ramp.
- Commercial vehicles and school buses occasionally access the Parkway from Miller Avenue. The study team notes that there are no existing signs at the northbound or southbound on ramps to regulate the prohibition of commercial vehicle access to the Parkway.

It is also important to note that there was a fatal head-on accident at the northbound on ramp in November 2000 that is not reflected in the TAVS data that the study team analyzed for this study. The accident was caused by an elderly motorist entering the Parkway from the northbound on ramp and turning left, heading southbound into oncoming traffic. Due to the configuration of the northbound ramps, there are no physical measures to deter or prevent motorists from turning left at the ramp/mainline junction and entering the Parkway in the wrong direction of travel.

Improvement Recommendations

The study team worked with the City of Meriden, ConnDOT, SCRCOG, and other stakeholders to develop and refine a set of near-term, mid-term, and long-term improvement plans to address the identified deficiencies and needs at the DOT Maintenance Exit. The recommended improvement plans are detailed and illustrated below along with discussion regarding other design and implementation considerations. Also included are summaries of constraints, impacts, and estimated construction costs.

Near-term Improvement Plan (Figure DE-9)

Northbound:

- Install a "One Way" sign in the median opposite the approach for the on ramp and install a left turn prohibition sign in conjunction with the stop sign at the on ramp approach to discourage wrong turns into northbound traffic.
- Install regulatory sign on the northbound on ramp near Miller Avenue to indicate the prohibition of commercial vehicles on the Parkway.
- Trim tree branches and brush along south side of Miller Avenue east of the northbound off ramp intersection to improve sight lines.

Near, Mid, and Long-term Definitions

Near-term:

- Implementation period of 1 to 3 years.
- Includes low cost improvements such as signing and striping improvements, existing signal timing modifications, tree clearing, etc.

Mid-term:

- Implementation period of 3 to 10 years.
- Includes acceleration and deceleration lane improvements, new turn lanes, new traffic signals, and minor ramp modifications that could be implemented with little or no impacts to rights-of-way, environmental features, or existing bridge structures.

Long-term:

- Implementation period greater than 10 years.
- Includes higher-cost improvements that could significantly impact existing bridge structures, rights-of-way, or environmental features.

Southbound:

- Install advisory ramp speed sign along existing deceleration lane to supplement the existing curve warning sign located near the off ramp curve.
- Install regulatory sign on the southbound on ramp near Miller Avenue to indicate the prohibition of commercial vehicles on the Parkway.

Mid-term Improvement Plan (Figure DE-10)

Northbound:

- Realign/relocate off ramp approximately 700 feet south of existing location to improve exit geometry and to provide a physical separation between the off ramp and on ramp. Provide standard deceleration length.
- Modify curvature of the on ramp and provide stop signs on the left and right sides of the ramp to discourage wrong turns on Route 15.
- Provide separate left and right turn lanes at the northbound off ramp approach to Miller Avenue to allow right turning traffic to bypass stopped left turning traffic. Install lane control signs.

Southbound:

- Relocate off ramp approximately 50 feet south of existing location to improve physical separation between off and on ramps and to provide more recovery area in the gore area. Provide standard deceleration length. Consider providing dynamic curve warning system to better alert motorists to non-standard ramp curvature and slow ramp speed. See appendix for dynamic curve warning system details.
- Provide separate left and right turn lanes at southbound off ramp approach to Miller Avenue to allow right turning traffic to bypass stopped left turn movements. Install lane configuration signs.
- Provide standard acceleration length for on ramp.

Long-term Improvement Plan (Figure DE-11)

Northbound:

- Relocate northbound on ramp to north side of Miller Avenue to eliminate non-standard ramp curvature and facilitate acceleration lane improvements. Maximize acceleration length and taper within the constraint of the Paddock Avenue bridge structure over Route 15.
- Restripe lane configuration for northbound off ramp approach to Miller Avenue to provide a shared left-through lane and a right turn lane. Install lane control signs.
- The study team notes that a design exception would be required for the relocation of the northbound on ramp. The acceleration length is constrained by the Paddock Avenue bridge over Route 15. The standard acceleration length should be provided in conjunction with future replacement or reconstruction of the bridge.

Other Considerations

- The study team investigated the feasibility of relocating the southbound off ramp to the north side of Miller Avenue in a diamond interchange configuration to eliminate the existing non-standard ramp. Due to significant environmental constraints on the north side of Miller Avenue in that area and safety concerns regarding DOT maintenance vehicles crossing Miller Avenue (from a location with poor sight lines to Miller Avenue), the study team determined that relocation of the off ramp was not a viable alternative.
- The study team investigated the feasibility of relocating the existing northbound ramp junction with the mainline further south in order to accommodate a standard acceleration lane for on ramp. This concept would avoid impacts to the bridge structure over Miller Avenue and preclude the need to relocate the northbound on ramp to the north side of Miller Avenue. Although the concept is physically feasible, DOT expressed safety concerns associated with lengthening the on ramp and providing an opportunity for motorists to gain excessive speed on the ramp before requiring them to rapidly decelerate to negotiate a sharp, 180-degree curve back to the mainline. Failure to negotiate the curve at a high rate of speed could result in vehicles skidding into on-coming mainline traffic.
- Any turn lane additions will be evaluated throughout project advancement to determine necessary turn bay lengths and other final design details.
- Alternatively to providing separate left and right turn lanes for the stop controlled northbound off ramp approach to Miller Avenue and the soutbound off ramp approach to Miller Avenue, provide a widened shoulder for a right turn bypass and a signle lane approach.

Constraints, Limitations and Impacts

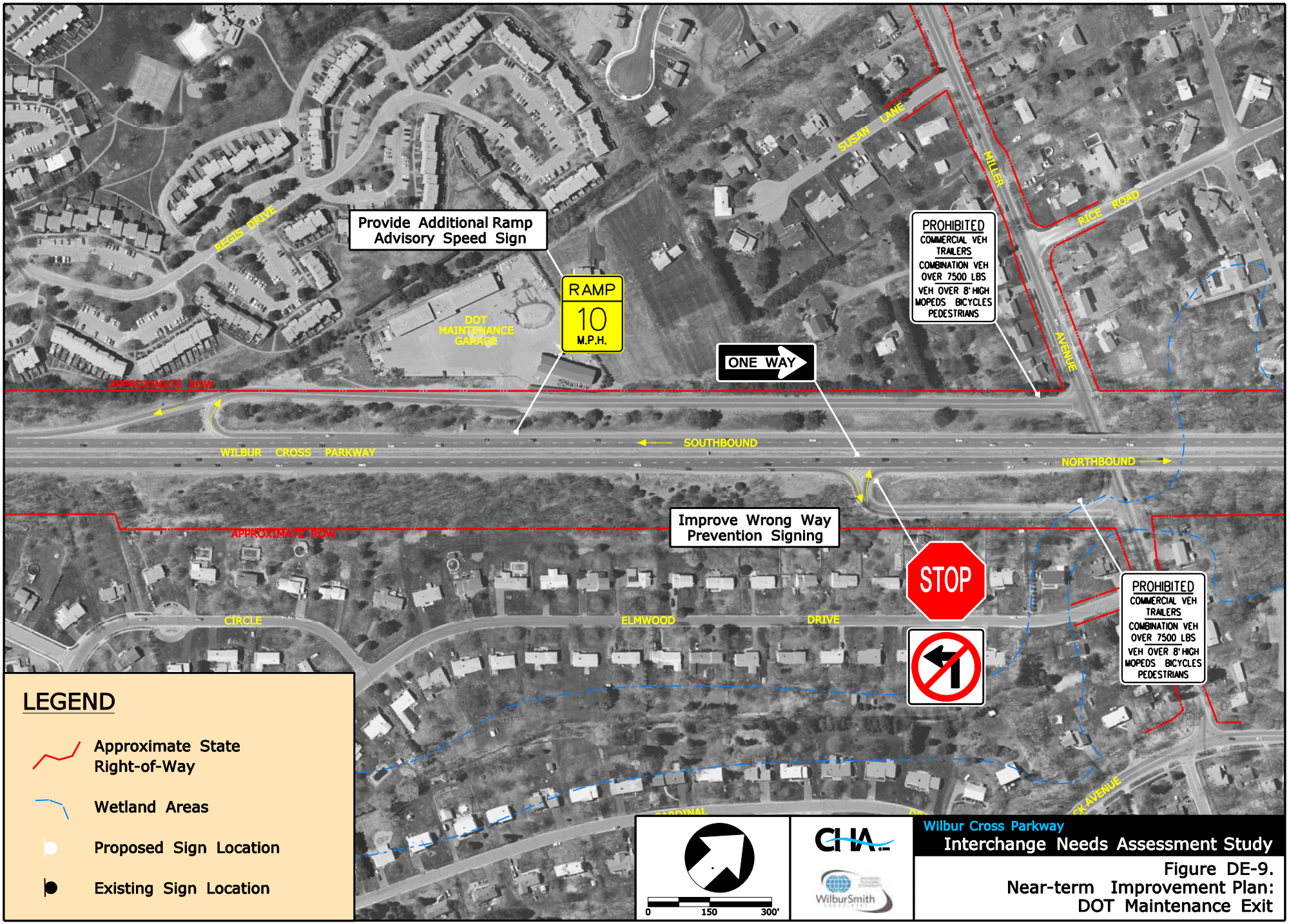
- The existing Route 15 bridge structure over Miller Avenue is a concrete arch structure that cannot be widened to accommodate improvements to the existing northbound acceleration lane.
- **Potential Right-of-Way (ROW) Impacts:**
  - Mid-term improvements to provide separate left and right turn lanes on the northbound off ramp approach to Miller Avenue could require approximately 0.03 ac of ROW from two parcels located near the ramp.
  - Long-term improvement to relocate the northbound on ramp to the north side of Miller Avenue could require approximately 0.12 ac of ROW from one parcel.
- **Potential Environmental Impacts:**
  - Mid-term improvements to the southbound on ramp and acceleration lane could result in approximately 0.39 ac of wetland impacts.
  - Long-term improvement to relocate the northbound on ramp to the north side of Miller Avenue could result in approximately 1.40 ac of wetland impacts.

Estimated Construction Costs

The study team developed planning-level construction cost estimates for the near, mid, and long-term improvement plans at the DOT Maintenance Exit in accordance with ConnDOT's guidelines for preliminary cost estimating dated January 2009. The planning-level costs shown in Table DE-6 are based on estimates of major construction items and do not include allowances for engineering or any potential right-of-way acquisitions, utility relocations, or environmental mitigation.

Table DE-6. Planning-level Construction Cost Estimates: DOT Maintenance Exit

Improvement	Planning-level Costs		
	(2009 $)	Mid-term (2014 $)	Long-term (2024 $)
Near-term Improvement Plan			
• All signage improvements; minor tree clearing	$ 9,000	-	-
Mid-term Improvement Plan			
• NB ramp improvements	$ 600,000	$ 800,000	
• SB ramp improvements	$ 1.6 million	$ 2.2 million	-
Long-term Improvement Plan			
• NB on ramp relocation	$ 1.4 million	-	$ 3.4 million


Provide Additional Ramp Advisory Speed Sign
RAMP
10
M.P.H.
ONE WAY
PROHIBITED
COMMERCIAL VEH TRAILERS
COMBINATION VEH OVER 7500 LBS
VEH OVER 8' HIGH
MOPEDS BICYCLES PEDESTRIANS
REGIS DRIVE
SUSAN LANE
MILLER AVENUE
RICE ROAD
DOT MAINTENANCE GARAGE
APPROXIMATE ROW
WILBUR CROSS PARKWAY
SOUTHBOUND
NORTHBOUND
Improve Wrong Way Prevention Signing
STOP
APPROXIMATE ROW
CIRCLE
ELMWOOD DRIVE
PROHIBITED
COMMERCIAL VEH TRAILERS
COMBINATION VEH OVER 7500 LBS
VEH OVER 8' HIGH
MOPEDS BICYCLES PEDESTRIANS
LEGEND
Approximate State Right-of-Way
Wetland Areas
Proposed Sign Location
Existing Sign Location
0
150
300'
CHA
WilburSmith
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure DE-9.
Near-term Improvement Plan:
DOT Maintenance Exit

LEGEND

- Approximate State Right-of-Way
- Wetland Areas
- Proposed Sign Location
- Existing Sign Location
- New Pavement Construction
- Approximate Slope Limits

Provide Full Acceleration Distance

Increase Physical Separation Between Ramps

Increase Physical Separation Between Ramps

Realign Northbound Off Ramp

Provide Full Deceleration Length

Provide Full Deceleration Length

Provide Gateposted Stop Signs

GREENBRIAR ROAD

BEGIS DRIVE

EVERGREEN DRIVE

WALT DRIVE

SUSAN LANE

MILLER AVENUE

RICE ROAD

DOT MAINTENANCE GARAGE

APPROXIMATE ROW

SOUTHBOUND

PARKWAY

NORTHBOUND

ONLY ONLY

STOP

ONLY ONLY

APPROXIMATE ROW

BETH ANN CIRCLE

CIRCLE

ELMWOOD DRIVE

OAK

CARDINAL DRIVE

PADDOCK AVENUE

0 150 300'

CHA

WilburSmith

Wilbur Cross Parkway

Interchange Needs Assessment Study

Figure DE-10.
Mid-term Improvement Plan:
DOT Maintenance Exit


LEGEND
Approximate State Right-of-Way
Wetland Areas
New Pavement Construction
Approximate Slope Limits
Mid-term Improvements
EVERGREEN DRIVE
WALT DRIVE
WHITNEY DRIVE
SUSAN LANE
HILLER AVENUE
RICE ROAD
PRANN COURT
REGIS DRIVE
DOT MAINTENANCE GARAGE
Close Northbound On Ramp
APPROXIMATE ROW
WILBUR CROSS PARKWAY
NORTHBOUND
SOUTHBOUND
APPROXIMATE ROW
Maintain Mid-term Improvements
Relocate Northbound On Ramp
CIRCLE
DRIVE
CARDINAL DRIVE
PADDOCK AVENUE
0 150 300'
CHA
WilburSmith
Wilbur Cross Parkway
Interchange Needs Assessment Study
Figure DE-11.
Long-term Improvement Plan:
DOT Maintenance Exit

Appendix Table of Contents

Appendix 1

Schedule of Public Information, ConnDOT, and Municipal Meetings

Public Information Meetings

- **North Haven – Hamden Public Meeting No. 1**
  - Date, Time: March 3, 2009, 6 pm
  - Location: North Haven Memorial Library, 17 Elm Street, North Haven, CT
  - Advertising: Post Chronicle; North Haven Citizen; NHTV Cable Access
- **Meriden Public Meeting No. 1**
  - Date, Time: March 9, 2009, 6 pm
  - Location: Meriden Pubic Library, Griffin Room, 105 Miller Street, Meriden, CT
  - Advertising: Record Journal; Meriden Post; Wallingford Post
- **Milford – Orange Public Meeting No. 1**
  - Date, Time: March 23, 2009, 6 pm (Rescheduled from March 2 due to weather)
  - Location: Milford Public Library, 57 New Haven Avenue, Milford, CT
  - Advertising: Milford Mirror; CT Post; Orange Town News
- **Milford – Orange Public Meeting No. 2**
  - Date, Time: May 20, 2009, 6 pm
  - Location: Orange Town Hall, 617 Orange Center Road, Orange, CT
  - Advertising: Milford Mirror; CT Post;
- **North Haven – Hamden Public Meeting No. 2**
  - Date, Time: May 27, 2009, 6 pm
  - Location: Hamden Government Center, 2750 Dixwell Avenue, Hamden, CT
  - Advertising: Post Chronicle; North Haven Citizen
- **Meriden Public Meeting No. 2**
  - Date, Time: 6/02/2009, 6 pm
  - Location: Meriden Pubic Library, Griffin Room, 105 Miller Street, Meriden, CT
  - Advertising: Record Journal; Meriden Post

ConnDOT Meetings

- **Work Session/Kick-Off Meeting**
  - Date: October 10, 2008
- **Design Workshop**
  - Date: March 27, 2009

Municipal Work Sessions

- **Meriden**
  - Work Session No. 1: October 22, 2008
  - Work Session No. 2: February 4, 2009
  - Work Session No. 3: April 23, 2009
- **Hamden**
  - Work Session No. 1: October 23, 2008
  - Work Session No. 2: February 3, 2009
  - Work Session No. 3: April 22, 2009
- **North Haven**
  - Work Session No. 1: October 23, 2008
  - Work Session No. 2: February 4, 2009
  - Work Session No. 3: April 22, 2009
- **Orange Kick-Off Meeting**
  - Work Session No. 1: November 6, 2008
  - Work Session No. 2: February 3, 2009
  - Work Session No. 3: April 24, 2009
- **Milford Kick-Off Meeting**
  - Work Session No. 1: November 6, 2008
  - Work Session No. 2: April 21, 2009

Public Comments

Comment Form

Please provide us any comments, concerns, or insights you have regarding the study information and potential improvement concepts that were presented tonight.

All the entrances should have STOP SIGNS!! It is by far the safest way to do it. Every one I know agrees, including a grandson who learned to drive here and wishes they would install them (Stop Signs) on the Colorado bridge.

Please submit your completed comment form in the box before you leave tonight or mail to:

Stephen Dudley
South Central Regional Council of Governments
127 Washington Avenue – 4th Floor West
North Haven, CT 06473-1715

THANK YOU FOR YOUR INPUT.

For additional information, please contact the South Central Regional Council of Governments at:
(203) 234-7555 or visit our website at **www.scrcog.org**

Comment Form

Please provide us any comments, concerns, or insights you have regarding the study information and potential improvement concepts that were presented tonight.

Please accept my preference for Interchange Concept #3 by relocating the Southbound off ramp

Please submit your completed comment form in the box before you leave tonight or mail to:

Stephen Dudley
South Central Regional Council of Governments
127 Washington Avenue – 4th Floor West
North Haven, CT 06473-1715

THANK YOU FOR YOUR INPUT.

For additional information, please contact the South Central Regional Council of Governments at:
(203) 234-7555 or visit our website at **www.scrcog.org**

Comment Form

Please provide us any comments, concerns, or insights you have regarding the study information and potential improvement concepts that were presented tonight.

Pleased to hear an "acceleration lane" is planned for Exit 61 going North

Please submit your completed comment form in the box before you leave tonight or mail to:

Stephen Dudley
South Central Regional Council of Governments
127 Washington Avenue – 4th Floor West
North Haven, CT 06473-1715

THANK YOU FOR YOUR INPUT.

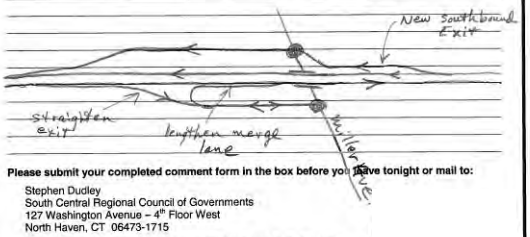
For additional information, please contact the South Central Regional Council of Governments at:
(203) 234-7555 or visit our website at **www.scrcog.org**

Comment Form

We want to hear about the issues that are important to you. Please provide us any comments, concerns, and ideas you have regarding traffic safety and operations at the study interchanges in the Wilbur Cross Parkway corridor. For instance:

- What specific issues do you have with the DOT Maintenance Exit?
- What safety concerns do you have entering and exiting the highway?
- Where do you think improvements are needed?

Grooves horizontally across lane to warn and slow down. Northbound exit, straighten it. Northbound on-ramp, lengthen merge lane. Southbound exit, move it to before Miller Ave. bridge. There is a walkway that no one uses, that can be the off-ramp. This also solves to problem of cars doubleing at the southbound exit, at intersection



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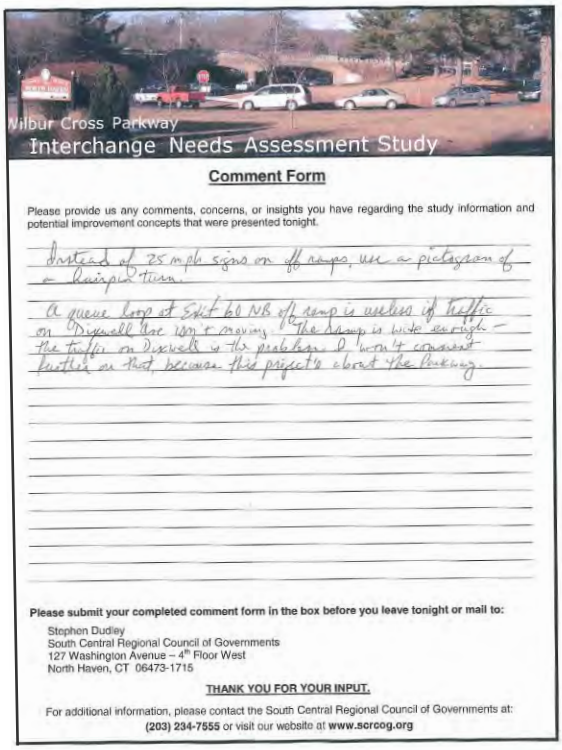
(203) 234-7555

Public Comments (Continued)



Comment Form

Please provide us any comments, concerns, or insights you have regarding the study information and potential improvement concepts that were presented tonight.

Instead of 25 mph signs on off ramps, use a pictogram of a hairpin turn.

A queue loop at Exit 66 NB off ramp is useless if traffic on Dixwell Ave isn't moving. The ramp is wide enough. The traffic on Dixwell is the problem. I won't comment further on that, because this project is about the freeway.

Please submit your completed comment form in the box before you leave tonight or mail to:

Stephen Dudley
South Central Regional Council of Governments
127 Washington Avenue – 4th Floor West
North Haven, CT 06473-1715

THANK YOU FOR YOUR INPUT.

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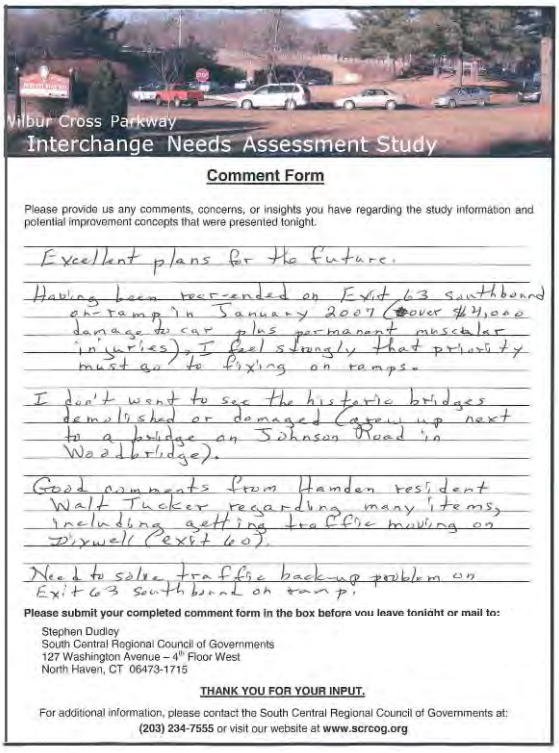


Comment Form

Please provide us any comments, concerns, or insights you have regarding the study information and potential improvement concepts that were presented tonight.

Excellent plans for the future.

Having been rear-ended on Exit 63 southbound on-ramp in January 2007 (over $4,000 damage to car plus permanent muscular injuries), I feel strongly that priority must go to fixing on ramps.

I don't want to see the historic bridges demolished or damaged (agreed up next to a bridge on Johnson Road in Woodbridge).

Good comments from Hamden resident Walt Tucker regarding many items, including getting traffic moving on Dixwell (Exit 60).

Need to solve traffic backup problem on Exit 63 southbound on ramp.

Please submit your completed comment form in the box before you leave tonight or mail to:

Stephen Dudley
South Central Regional Council of Governments
127 Washington Avenue – 4th Floor West
North Haven, CT 06473-1715

THANK YOU FOR YOUR INPUT.

For additional information, please contact the South Central Regional Council of Governments at:
(203) 234-7555 or visit our website at www.scrcog.org

Comment Form

Please provide us any comments, concerns, or insights you have regarding the study information and potential improvement concepts that were presented tonight.

① Greater traffic volume Friday afternoons especially, prior to 3 day week-ends. Also Rte 15 impacted by incidents on N 95/91.

② Present exit makes it difficult to approach at normal speed, pull over and then make the sharp right turn while reducing speed to only 10 mph. It is also difficult for large emergency vehicles (fire trucks) to exit safely.

③ Sluggish and slow moving traffic also occurs when cars are attempting to head in to East Main St and the lanes back up, 91 and 66E causing backup down (south) past the Wallingford Town Line on 15.

④ Illegal vehicles - box trucks, smaller school buses, pickup trucks pulling trailers or equipment, dumpsters and other commercial vehicles use Rte 15

⑤ Litter run off from present ramp area effects property owners on Elmwood Drive.

Please submit your completed comment form in the box before you leave tonight or mail to:

Stephen Dudley
South Central Regional Council of Governments
127 Washington Avenue – 4th Floor West
North Haven, CT 06473-1715

Over

THANK YOU FOR YOUR INPUT.

For additional information, please contact the South Central Regional Council of Governments at:
(203) 234-7555 or visit our website at www.scrcog.org

⑥ We would prefer and hope you consider moving the location of the exit/entrance further South and not build a new entrance ramp that has a steep grade as proposed on the North side of Miller Ave. ending prior to the Paddock Ave. bridge.

The state land is wide enough that the exit could start back by the town line. By moving the entrance so it runs parallel there could be more space to reach speed before the Miller Ave. Bridge.

If you have any questions or need any further input from us, you may call us:

My husband recently completed 22 years on the ZBA here in Meriden.

Sincerely yours,

RECEIVED
JUN - 9 2009
SOUTH CENTRAL REGIONAL COUNCIL OF GOVERNMENTS

P.S. Thank you for the presentation.

Appendix 2

Level of Service Criteria

Level of service (LOS) is a qualitative measure describing driver satisfaction with a number of factors that influence the degree of traffic congestion. These factors include speed and travel time, traffic interruption, freedom of maneuverability, safety, driving comfort and convenience, and delay. In general, there are six levels of service describing flow conditions:

- **LOS A**: Highest level of service; describes a condition of free flow, with low volumes and high speeds.
- **LOS B:** Represents a stable traffic flow with operating speeds beginning to be restricted somewhat by traffic conditions.
- **LOS C:** Describes a stable condition of traffic operation. It entails moderately restricted movements due to higher traffic volumes, but traffic conditions are not objectionable to motorists.
- **LOS D:** Reflects a condition of more restrictive movements for motorists and influence of congestion becomes more noticeable. It is generally considered the lower end of acceptable service.
- **LOS E:** Representative of the actual capacity of the roadway or intersection and involves delay to all motorists due to congestion.
- **LOS F:** Lowest level of Service; describes a condition of force flow and is characterized by volumes greater than the theoretical roadway capacity. Complete congestion occurs, and in extreme cases, the volume passing a given point drops to zero. This is considered an unacceptable traffic operating condition.

Mainline Segment LOS Criteria

Table 1 presents the LOS criteria for freeway mainline segments. The level of service criteria for freeway mainline segments is based on maximum density defined in terms of passenger cars per mile per lane (pc/mi/lane).

Table 1. LOS Criteria for Mainline Segments

Level of Service	Maximum Density (pc/mi/lane)
A	11
B	18
C	26
D	35
E	45
F	>45

Source: 2000 Highway Capacity Manual

Ramp Junction LOS Criteria

Table 2 presents the LOS criteria for freeway-ramp junctions, or merge/diverge areas. The level of service criteria for freeway-ramp junctions is based on maximum density defined in terms of passenger cars per mile per lane (pc/mi/lane) within the influence area of the merge/diverge.

Table 2. LOS Criteria for Ramp Junctions

Level of Service	Maximum Density (pc/mi/lane)
A	10
B	20
C	28
D	35
E	>35

Source: 2000 Highway Capacity Manual

Signalized Intersection LOS Criteria

Table 3 presents the level of service criteria for signalized intersections. The level of service criteria for signalized intersections is based on control delay per vehicle measured in seconds.

Table 3. LOS Criteria for Signalized Intersections

Level of Service	Control Delay per Vehicle (Seconds)
A	≤10
B	>10 and ≤20
C	>20 and ≤35
D	>35 and ≤55
E	>55 and ≤80
F	> 80

Source: 2000 Highway Capacity Manual

Unsignalized Intersection LOS Criteria

Table 4 presents the level of service criteria for unsignalized intersections. The level of service criteria for unsignalized intersections is based on control delay per vehicle measured in seconds.

Table 4. LOS Criteria for Unsignalized Intersections

Level of Service	Control Delay per Vehicle (Seconds)
A	≤10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	> 50

Source: 2000 Highway Capacity Manual

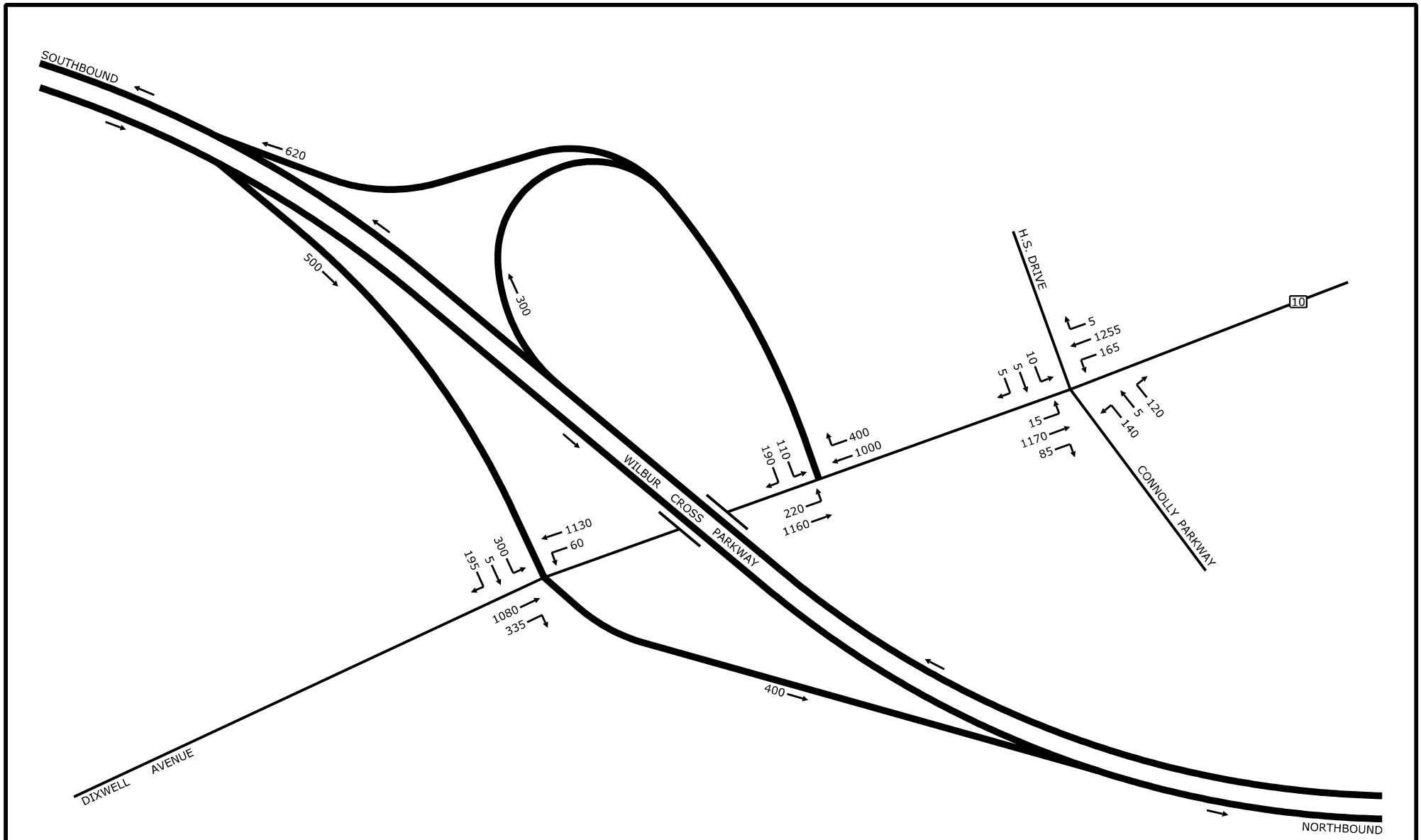
Existing Bridge Structure Inventory

Location	BIN Number	Sufficiency Rating	Year Built	Last Major Rehab
Interchange 55				
Route 15 over Wheelers Farms Road	06178	85.00	1993	-
Orange Service Areas & Interchange 56				
Route 15 over Derby Milford Road	00764	78.44	1941	1990
Route 15 over Route 121 (Grassy Hill Road)	00765	79.12	1941	1990
Interchange 60				
Benham Street over Route 15	00781	73.44	1949	1990
Route 15 over Route 10 (Dixwell Avenue)	00643	77.89	1948	1997
Route 15 over Connolly Parkway	00782	83.00	1948	1999
Interchange 61				
Skiff Street over Route 15	00783	79.51	1948	-
Route 15 over Mill Brook	02153	98.00	1943	-
Route 15 over SR 707 (Whitney Avenue)	00\658	82.81	1946	1990
Route 15 over SR 717 (Dixwell Avenue)	00784	89.57	1946	1989
Interchange 62				
Route 15 over Mill River	00785	94.00	1943	1989
Ridge Road over Route 15	00786	94.05	1949	1992
Route 40 SB Over Route 15	03829	86.15	1976	-
Route 40 NB Over Route 15	03828	87.16	1976	-
Interchange 63 & North Haven Service Areas				
Hartford Turnpike over Route 15	00787	92.35	1947	1989
Route 22 (Bishop Street) over Route 15	00788	63.00	1947	1988
Upper State Street over Route 15	00789	93.55	1947	-
DOT Maintenance Exit				
Route 15 over Miller Avenue	00797	81.21	1946	-
Paddock Avenue over Route 15	05382	82.85	1946	1986

Interchange 60: Saturday Peak Hour Information

Intersection Operations Summary – Interchange 60: Saturday Peak Hour

Intersection / Approach	SATURDAY LOS	
	2008	2030
NB Ramps at Route 10		
Eastbound – NB Off Ramp	C (28.0)	C (33.6)
Northbound – Route 10	B (16.4)	B (15.8)
Southbound – Route 10	A (9.5)	A (8.1)
Overall	**B (14.9)**	**B (15.6)**
SB Ramps at Route 10		
Eastbound – SB Off Ramp	C (26.5)	C (28.0)
Northbound – Route 10	A (7.4)	B (10.8)
Southbound – Route 10	A (5.4)	A (5.2)
Overall	**A (8.3)**	**A (9.9)**
Route 10 at Connolly Parkway		
Eastbound – High School Drive	C (33.4)	C (34.2)
Westbound – Connolly Parkway	E (64.8)	F (>80)
Northbound – Route 10	E (69.9)	F (>80)
Southbound – Route 10	C (21.3)	C (24.1)
Overall	**D (46.0)**	**F (91.4)**



NOT TO SCALE

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WilburSmith

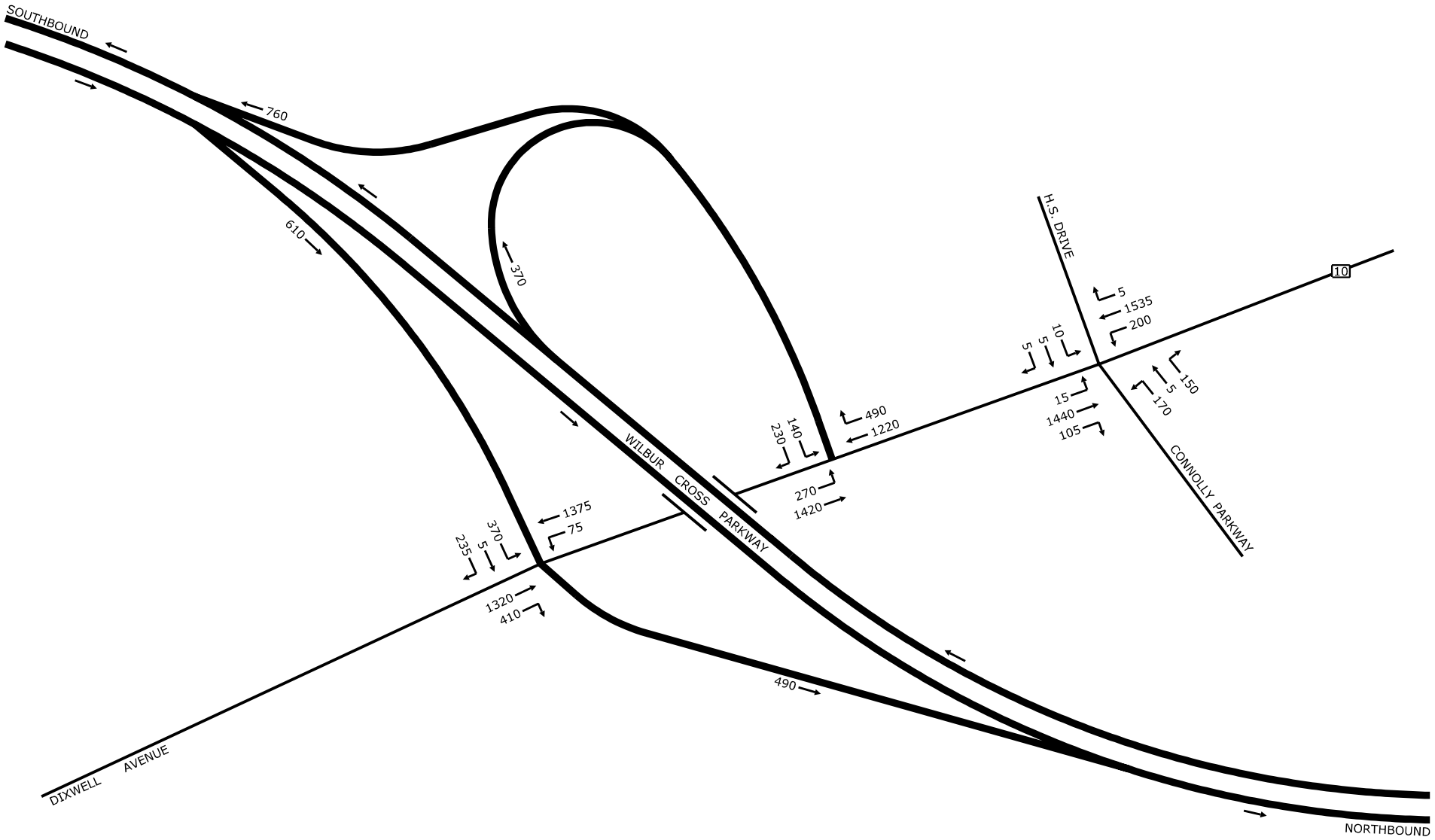
Wilbur Cross Parkway

Interchange Needs Assessment Study

Interchange 60 - Hamden

Existing (2008) Peak Hour Volumes

SATURDAY



NOT TO SCALE

Wilbur Cross Parkway

Interchange Needs Assessment Study

Interchange 60 - Hamden

Future (2030) Peak Hour Volumes

SATURDAY

Appendix 3

Interchange 55 Future Build Conditions

Geometric Conditions for Recommended Improvements: Interchange 55

Location	Ramp		Acceleration/Deceleration Lanes		Other Notes
	Curve Radius	Design Speed	Lane Length	Taper Length	
Mid-term Improvements					
NB On Ramp	108 ft	20 mph	1400 ft	350 ft	Ramp curve radius and design speed, though less than the minimum ramp design speed of 35 mph, are improvements over the existing condition (See 55-19 for additional discussion).
SB Off Ramp	660 ft	45 mph	345 ft	230 ft	-

Future Mainline Operations Comparison: Interchange 55

Segment	AM LOS (Density)		PM LOS (Density)	
	No Build	Build	No Build	Build
Northbound				
South of Interchange 55A Off Ramp	C (29.7) [1]	E (35.0) [1]	F (52.6) [1]	F (60.6) [1]
Between Interchange 55A Off & 55B Ramps	C (20.5)	N/A [2]	E (35.5)	N/A [2]
Between Interchange 55B Ramps	C (19.8)	C (19.8)	D (34.1)	D (34.1)
North of Interchange 55	C (20.7)	C (20.7)	E (40.1)	E (40.1)
Southbound				
North of Interchange 55	E (42.0)	E (42.0)	C (18.6)	C (18.6)
Between Interchange 55 Off & 54 Off Ramp	E (36.2)	E (36.2)	B (17.1)	B (17.1)
Between Interchange 54 Off & 54/55 On Ramps	C (24.0)	C (24.0)	B (11.7)	B (11.7)
South of Interchange 54/55 On Ramp	D (29.5)	D (29.5)	C (22.3)	C (22.3)

[1] There is a northbound auxiliary lane between Interchange 54 and Interchange 55A in the no-build and build conditions. LOS is determined by weave analysis.

[2] The northbound off ramp (55B) is recommended for future removal, therefore the segment between the Interchange 55A off ramp and 55B off ramp would not exist in the build condition.

Interchange 55 Future Build Conditions (Continued)

Future Ramp Merge/Diverge Operations Comparison: Interchange 55

Location	AM LOS (Density)		PM LOS (Density)	
	No Build	Build	No Build	Build
Northbound				
Off Ramp to Wheelers Farm Road (55A)	N/A[1]	N/A[1]	N/A[1]	N/A[1]
Off Ramp to Wolf Harbor Road (55B)	D (28.1)	N/A[2]	E (40.7)	N/A[2]
On Ramp from Wolf Harbor Road (55B)	D (28.1)	B (18.6)	F (41.1)	D (31.7)
Southbound				
Off Ramp to Wellington Road	E (42.5)	E (39.3)	C (24.6)	C (21.4)
On Ramp from Wellington Road Extension	N/A[3]	N/A[3]	N/A[3]	N/A[3]

[1] There is a northbound auxiliary lane between Interchange 54 and Interchange 55A in the no-build and build conditions. LOS is determined by weave analysis; merge/diverge analyses do not apply. See Future Mainline Operations Comparison table for weave LOS.

[2] The northbound off ramp (55B) is recommended for future removal, therefore diverge analysis is not applicable.

[3] Merge analysis does not apply to this location because the southbound on ramp continues ahead as a 4700 ft auxiliary lane between Interchange 54/55 on ramp and Interchange 53 off ramp.

Interchange 55 Future Build Conditions (Continued)

Future Intersection Operations Comparison: Interchange 55

Intersection / Approach	AM LOS (Delay)		PM LOS (Delay)	
	No Build	Build	No Build	Build
NB Off Ramp (55A) at Wheelers Farms Road (Signalized)				
Eastbound – NB Off Ramp	C (21.9)	C (23.0)	C (25.6)	C (24.9)
Westbound – Wolf Harbor Road	A (8.0)	A (6.2)	A (7.2)	B (10.8)
Northbound – Wheelers Farms Road	A (7.2)	B (12.9)	B (14.7)	B (18.7)
Southbound – Wheelers Farms Road	A (5.1)	A (7.5)	A (8.6)	A (6.0)
Overall	**B (11.4)**	**B (14.2)**	**B (16.0)**	**B (18.2)**
Wheelers Farms Road at Wellington Road and Wellington Road Extension (Signalized)				
Northbound – Wheelers Farms Road	C (21.7)	B (17.4)	B (19.8)	A (7.2)
Southbound – Wheelers Farms Road	A (9.1)	B (19.0)	A (8.8)	B (15.4)
Eastbound – Wellington Road Extension	B (11.3)	B (15.9)	B (14.0)	B (16.0)
Westbound – Wellington Road	C (35.0)	C (30.0)	C (31.5)	C (27.9)
Overall	**B (19.2)**	**C (20.5)**	**B (19.2)**	**B (11.6)**
SB Off Ramp at Wellington Road and Drives (Unsignalized)				
Northbound – Commercial Drive	B (12.5)	B (12.5)	B (10.4)	B (10.8)
Southbound – Commercial Drive	B (11.2)	B (11.2)	A (9.1)	A (9.4)
NB Ramps at Wolf Harbor Road (Unsignalized)				
Southbound – NB Off Ramp	A (8.2)	N/A	A (8.6)	N/A
Eastbound – Wolf Harbor Road	A (8.3)	N/A	B (10.8)	N/A
Westbound – Wolf Harbor Road	A (7.9)	N/A	A (8.1)	N/A
SB Ramps at Wellington Road Extension (Unsignalized)				
Southbound – SB On Ramp	A (8.5)	A (8.5)	A (8.5)	A (8.5)
Eastbound – Wellington Road Extension	A (6.9)	A (6.9)	A (6.8)	A (6.8)
Westbound – Wellington Road Extension	C (19.4)	C (19.4)	B (13.4)	B (13.4)

Orange Service Areas Future Build Conditions

Geometric Conditions for Recommended Improvements: Orange Service Areas

Location	Ramp		Acceleration/Deceleration Lanes		Other Notes
	Curve Radius	Design Speed	Lane Length	Taper Length	
Mid-term Improvements					
NB Off Ramp	> 385 ft	35 mph	750 ft	230 ft	Stop Condition[1]
NB On Ramp	> 385 ft	35 mph	1950 ft [2]	-	-
SB Off Ramp	> 385 ft	35 mph	1550 ft [2]	-	Stop Condition[1]
SB On Ramp	> 385 ft	35 mph	625 ft	350 ft	Ramp acceleration lane length, though less than standard, is an improvement over the existing condition (See OS-12 for additional discussion).

[1] A stop condition located 50 ft upstream of the gas pumps was assumed to be the controlling factor in determining the required deceleration length.
[2] Acceleration/deceleration lane is part of an auxiliary lane. Auxiliary lane length is shown.

Future Mainline Operations Comparison: Orange Service Areas

Direction	AM LOS (Density)		PM LOS (Density)	
	No Build	Build	No Build	Build
Northbound				
South of Service Area	C (20.7)	C (20.7)	E (40.1)	E (40.1)
North of Service Area	C (20.7)	B (16.3) [1]	E (40.1)	C (27.9) [1]
Southbound				
North of Service Area	E (42.0)	D (29.3) [1]	C (18.6)	D (29.3) [1]
South of Service Area	E (42.0)	E (42.0)	C (18.6)	C (18.6)

[1] There is a northbound and southbound auxiliary lane recommended between the Service Areas and Interchange 56 in the build condition. LOS is determined by weave analysis.

Future Ramp Merge/Diverge Operations Comparison: Orange Service Areas

Direction	AM LOS (Density)		PM LOS (Density)	
	2008	2030	2008	2030
Northbound				
Off Ramp to Service Area	D (29.2)	C (25.6)	E (43.7)	E (40.1)
On Ramp from Service Area	D (28.0)	N/A[1]	E (41.2)	N/A[1]
Southbound				
Off Ramp to Service Area	E (44.5)	N/A[1]	C (26.6)	N/A[1]
On Ramp from Service Area	E (41.9)	E (35.3)	C (25.7)	B (19.1)

[1] There is a northbound and southbound auxiliary lane recommended between Service Areas and Interchange 56 in the build condition. LOS is determined by weave analysis; merge/diverge analyses do not apply. See Future Mainline Operations Comparison table for weave LOS.

Interchange 56 Future Build Conditions

Geometric Conditions for Recommended Improvements: Interchange 56

Location	Ramp		Acceleration/Deceleration Lanes		Other Notes
	Curve Radius	Design Speed	Lane Length	Taper Length	
Mid-term Improvements					
NB Off Ramp	415 ft	35 mph	1950 ft [1]	-	-
SB Off Ramp	150 ft [2]	25 mph	250 ft	270 ft	Improvement maintains existing ramp geometry; deceleration length, though less than standard, is an improvement over the existing condition (See 56-18 for additional discussion).
SB On Ramp	470 ft	35 mph	1550 ft [1]	-	-
Long-term Improvements: Plan A					
NB On Ramp	840 ft	50 mph	1100 ft	350 ft	-
SB Off Ramp	> 1065 ft	55 mph	800 ft	440 ft	-
SB On Ramp	385 ft	35 mph	1900 ft [1]	-	-
Long-term Improvements: Plan B					
NB On Ramp	> 1065 ft	55 mph	915 ft	350 ft	-
SB Off Ramp	> 1065 ft	55 mph	800 ft	440 ft	-
SB On Ramp	385 ft	35 mph	1900 ft [1]	-	-

[1] Acceleration/deceleration lane is part of an auxiliary lane. Auxiliary lane length is shown.

Future Mainline Operations Comparison: Interchange 56

Direction	AM LOS (Density)		PM LOS (Density)	
	No Build	Build	No Build	Build
Northbound				
South of Interchange 56	C (20.7)	B (16.3) [1]	E (40.1)	C (27.9) [1]
Between Interchange 56 Ramps	C (19.2)	C (19.2)	D (34.0)	D (34.0)
North of Interchange 56	C (21.2)	C (21.2)	E (38.6)	E (38.6)
Southbound				
North of Interchange 56	E (37.8)	E (37.8)	C (19.2)	C (19.2)
Between Interchange 56 Ramps	D (34.0)	D (34.0)	B (16.9)	B (16.9)
South of Interchange 56	E (42.0)	D (29.3) [1]	C (18.6)	B (15.1) [1]

[1] There is a northbound and southbound auxiliary lane recommended between the Service Areas and Interchange 56 in the build condition. LOS is determined by weave analysis.

Interchange 56 Future Build Conditions (Continued)

Future Ramp Merge/Diverge Operations Comparison: Interchange 56

Direction	AM LOS (Density)		PM LOS (Density)	
	No Build	Build	No Build	Build
Northbound				
Off Ramp to Route 121	D (29.2)	N/A[1]	E (43.7)	N/A[1]
On Ramp from Route 121	D (28.5)	B (19.4)	E (40.5)	D (31.4)
Southbound				
Off Ramp to Route 121	E (42.4)	E (38.7)	C (27.2)	C (23.4)
On Ramp from Route 121	E (41.8)	N/A[1]	C (25.6)	N/A[1]

[1] There is a northbound and southbound auxiliary lane recommended between Service Areas and Interchange 56 in the build condition. LOS is determined by weave analysis; merge/diverge analyses do not apply. See Future Mainline Operations Comparison table for weave LOS.

Future Intersection Operations Comparison: Interchange 56

Intersection/Approach	AM LOS (Delay)			PM LOS (Delay)		
	No Build	Plan A	Plan B	No Build	Plan A	Plan B
NB Ramps at Route 121						
Eastbound – NB Off Ramp	F (>80)	C (21.9)	C (21.3)	F (>80)	C (31.6)	C (28.4)
Westbound – Old Grassy Hill Road	C (34.7)	B (12.6)	B (14.6)	C (24.6)	C (31.2)	C (31.4)
Northbound – Route 121	D (45.1)	B (19.8)	B (19.8)	F (>80)	D (37.7)	C (27.2)
Southbound – Route 121	B (12.1)	A (6.2)	B (16.5)	F (>80)	C (20.8)	C (34.5)
Overall	**E (57.0)**	**B (12.5)**	**B (17.3)**	**F (>80)**	**C (30.3)**	**C (30.5)**
Route 121 at SR 915 (Unsignalized No-Build)						
Eastbound – SR 915	C (17.4)	C (21.7)	C (21.3)	F (82.5)	C (30.1)	C (29.0)
Westbound – SB Off Ramp	N/A[1]	B (19.8)	C (20.8)	N/A[1]	D (42.8)	D (50.0)
Northbound – Route 121	N/A[1]	B (13.2)	B (16.2)	N/A[1]	B (10.2)	B (11.9)
Southbound – Route 121	N/A[1]	B (17.9)	B (17.0)	N/A[1]	C (30.8)	C (29.1)
Overall	N/A[1]	**B (16.7)**	**B (17.4)**	N/A[1]	**C (20.9)**	**C (22.7)**
SR 915 & Turkey Hill Road (Unsignalized)						
Eastbound – Turkey Hill Road	B (12.7)	B (11.4)	B (11.4)	B (10.2)	B (10.2)	B (10.1)

[1] Intersection of Route 121 and SR 915 is currently unsignalized. Both build conditions provide signalization and addition of a westbound approach from relocated southbound of ramp.

Interchange 60 Future Build Conditions

Geometric Conditions for Recommended Improvements : Interchange 60

Location	Ramp		Acceleration/Deceleration Lanes		Other Notes
	Curve Radius	Design Speed	Lane Length	Taper Length	
Mid-term Improvements					
NB Off Ramp SB On Ramp	> 1065 ft 280 ft	55 mph 30 mph	1600 ft 1350 ft	300 ft 350 ft	Two lane exit Improvement maintains existing ramp design speed and curvature; provides standard acceleration length for design speed.

Future Ramp Merge/Diverge Operations Comparison: Interchange 60

Direction	AM LOS (Density)		PM LOS (Density)	
	No Build	Build	No Build	Build
Northbound				
Off Ramp to Route 10	E (35.2)	C (20.6)	F (43.7)	F (29.1)
On Ramp from Route 10	D (32.5)	D (32.5)	D (34.2)	D (34.2)
Southbound				
Off Ramp to Route 10	D (35.0)	D (35.0)	D (31.5)	D (31.5)
On Ramp from Route 10	F (38.8)	F (34.4)	D (33.7)	D (29.4)

Interchange 61 Future Build Conditions

Geometric Conditions for Recommended Improvements: Interchange 61

Location	Ramp		Acceleration/Deceleration Lanes		Other Notes
	Curve Radius	Design Speed	Lane Length	Taper Length	
Mid-term Improvements					
NB Off Ramp	330 ft [2]	30 mph [2]	520 ft	180 ft	Improvement maintains existing ramp design speed and curvature; provides standard deceleration length for design speed.
NB On Ramp	120 ft	20 mph	900 ft	350 ft	Improvement maintains existing ramp design speed and curvature; provides improved acceleration length.
SB On Ramp	130 ft	20 mph	1170 ft	350 ft	Improvement maintains existing ramp design speed and curvature; provides improved acceleration length.
Long-term Improvements: Plan A					
NB Off Ramp	> 1065 ft	55 mph	580 ft	230 ft	-
NB On Ramp	1000 ft	50 mph	2050 ft [1]	-	-
SB Off Ramp	> 1065 ft	55 mph	750 ft	230 ft	-
SB On Ramp	385 ft	35 mph	1270 ft	350 ft	-
Long-term Improvements: Plan B					
NB On Ramp	120 ft	20 mph	1550 ft [1]	-	-
SB Off Ramp	> 1065 ft	55 mph	770 ft	230 ft	-
SB On Ramp	385 ft	35 mph	1270 ft	350 ft	-

[1] Acceleration/deceleration lane is part of an auxiliary lane. Auxiliary lane length is shown.
[2] Maintain ramp geometry and provide improvements to acceleration/deceleration length.

Interchange 61 Future Build Conditions (Continued)

Future Mainline Operations Comparison: Interchange 61

Segment	AM LOS (Density)			PM LOS (Density)		
	No Build	Plan A	Plan B	No Build	Plan A	Plan B
Northbound						
South of Interchange 61	D (32.7)	D (32.6)	D (32.6)	E (35.9)	E (35.9)	E (35.9)
Between Interchange 61 Ramps	C (25.3)	C (25.3)	C (25.3)	D (28.0)	D (28.0)	D (28.0)
North of Interchange 61	D (28.2)	C (24.9)[1]	C (26.0)[1]	D (31.5)	D (31.5)[1]	D (31.5)[1]
Southbound						
North of Interchange 62 Off Ramp	D (31.8)	D (33.4)	D (33.4)	D (27.6)	D (27.6)	D (27.6)
Between Interchange 62 Off &61 Off	D (29.0)	N/A[2]	N/A[2]	C (25.4)	N/A[2]	N/A[2]
Between Interchange 61 Ramps	D (26.2)	D (26.2)	D (26.2)	C (23.3)	C (23.3)	C (23.3)
South of Interchange 61	E (35.2)	E (35.2)	E (35.2)	D (29.8)	D (29.8)	D (29.8)

[1] There is a northbound auxiliary lane recommended Interchange 61 and Interchange 56 in the build condition. LOS is determined by weave analysis.

[2] The northbound off ramp (Exit 61) is recommended for future removal under both long-term plans, therefore the segment between the Exit 62 off ramp and Exit 61 off ramp would not exist in the build condition.

Future Ramp Merge/Diverge Operations Comparison: Interchange 61

Location	AM LOS (Density)			PM LOS (Density)		
	No Build	Plan A	Plan B	No Build	Plan A	Plan B
Northbound						
Off Ramp to Whitney Avenue	E (39.2)	D (31.9)	E (35.4)	E (41.0)	D (33.7)	E (37.2)
On Ramp from Whitney Avenue	D (34.7)	N/A[1]	N/A)[1]	E (37.0)	N/A[1]	N/A[1]
Southbound						
Off Ramp to Whitney Avenue (62)	E (39.3)	E (36.6)	E (36.6)	E (36.2)	D (33.5)	D (33.5)
Off Ramp to SB Whitney Avenue	E (37.3)	N/A[2]	N/A[2]	D (34.2)	N/A[2]	N/A[2]
On Ramp from Whitney Avenue	E (38.8)	D (29.4)	D (29.4)	E (35.7)	C (26.3)	C (26.3)

[1] There is a northbound auxiliary lane recommended between Interchange 61 Interchange 62 under both long-term plans in the build condition. LOS is determined by weave analysis; merge/diverge analyses do not apply. See Future Mainline Operations Comparison table for weave LOS.

[2] The southbound off ramp (Exit 61) is recommended for future removal, therefore the diverge analysis is not applicable.

Interchange 61 Future Build Conditions (Continued)

Future Intersection Operations Comparison: Interchange 61

Intersection/Approach	AM LOS (Delay)			PM LOS (Delay)		
	No Build	Plan A	Plan B	No Build	Plan A	Plan B
NB Ramps at Whitney Avenue (Unsignalized No-Build, Signalized Plans A & B)						
Eastbound – NB Off Ramp	N/A[1,2]	D (46.4) [1]	N/A[1]	N/A[1]	D (36.9) [1]	N/A[1]
Westbound – NB Off Ramp	F (>80) [1,2]	N/A[1]	B (15.2)[1]	F (>80)[1,2]	N/A[1]	B (17.1)[1]
Northbound – Whitney Avenue	N/A[2]	C (26.5)	C (23.6)	N/A[2]	C (26.0)	B (18.6)
Southbound – Whitney Avenue	N/A[2]	A (9.1)	A (5.5)	N/A[2]	A (7.3)	A (5.1)
Overall	N/A[2]	**C (24.5)**	**B (13.9)**	N/A[2]	**C (21.5)**	**B (13.2)**
SB Ramps at Whitney Avenue (Unsignalized No-Build, Signalized Plans A & B)1						
Eastbound – SB Off Ramp	D(33.4) [2,3]	N/A[3]	N/A[3]	D(29.3) [2,3]	N/A[3]	N/A[3]
Westbound – SB Off Ramp	D (33.2) [2]	C (26.7)	C (29.8)	E (46.3) [2]	C (25.2)	C (26.2)
Northbound – Whitney Avenue	N/A[2]	B (14.3)	B (10.2)	N/A[2]	A (8.3)	A (8.5)
Southbound – Whitney Avenue	N/A[2]	D (36.1)	B (15.8)	N/A[2]	C (26.7)	B (14.6)
Overall	N/A[2]	**C (26.2)**	**B (16.0)**	N/A[2]	**B (18.7)**	**B (13.8)**

[1] Plan A relocates northbound off ramp to the west side of Whitney Avenue, creating an eastbound approach at the intersection of the NB ramps and Whitney Avenue and removing the existing westbound approach.

[2] Intersection is unsignalized in No-Build condition; therefore delay is only shown for stop-controlled approaches.

[3] The southbound off ramp (Exit 61) is recommended for future removal, therefore no eastbound approach to the intersection of the SB Ramps and Whitney Avenue would exist under either long-term plan in the build condition.

Interchange 62 Future Build Conditions

Geometric Conditions for Recommended Improvements: Interchange 62

Location	Ramp		Acceleration/Deceleration Lanes		Other Notes
	Curve Radius	Design Speed	Lane Length	Taper Length	
Long-term Improvements					
NB Off Ramp	730 ft	45 mph	1550 ft [1]	-	-
NB On Ramp	450 ft	40 mph	1600 ft	270 ft	-

[1] Deceleration lane is part of an auxiliary lane. Auxiliary lane length associated with Interchange 61 Long-term Plan B is shown.

Future Mainline Operations Comparison: Interchange 62

Location	AM LOS (Density)			PM LOS (Density)		
	No Build	Plan A[1]	Plan B[1]	No Build	Plan A[1]	Plan B[1]
Northbound						
South of Interchange 62	D (28.2)	C (24.9)[2]	C (26.0)[2]	D (31.5)	C (26.3)[2]	C (27.5)[2]
Between Interchange 62 Ramps	C (24.1)	C (24.1)	C (24.1)	D (27.2)	D (27.2)	D (27.2)
North of Interchange 62	C (26.1)	C (26.1)	C (26.1)	D (29.3)	D (29.3)	D (29.3)
Southbound						
At Interchange 62	D (31.8)	D (31.8)	D (31.8)	D (27.6)	D (27.6)	D (27.6)

[1] The long-term plans for Interchange 61 provide different auxiliary lane lengths between Interchange 61 and Interchange 62. Please see Interchange 61 for information on Long-term Plan A and Plan B.

[2] There is a northbound auxiliary lane recommended between the Interchange 61 and Interchange 62 in the build condition. LOS is determined by weave analysis.

Future Ramp Merge/Diverge Operations Comparison: Interchange 62

Location	AM LOS (Density)		PM LOS (Density)	
	No Build	Build	No Build	Build
Northbound				
Off Ramp to Dixwell Avenue	D (34.9)	N/A[1]	E (37.4)	N/A[1]
On Ramp from Dixwell Avenue	D (33.1)	C (23.7)	E (35.5)	C (26.1)

[1] There is a northbound auxiliary lane recommended between Interchange 61 and Interchange 62 in the build condition. LOS is determined by weave analysis; diverge analysis does not apply. See Future Mainline Operations Comparison table for weave LOS.

Interchange 62 Future Build Conditions (Continued)

Future Intersection Operations Comparison: Interchange 62

Intersection / Approach	AM LOS (Delay)		PM LOS (Delay)	
	No Build	Build	No Build	Build
Dixwell Avenue at Route 15 NB Ramps (Signalized)				
Eastbound – Dixwell Avenue	F (868.5)	B (14.0)	F (231.5)	B (14.1)
Westbound – Dixwell Avenue	C (34.4)	D (45.9)	D (53.9)	D (50.9)
Northbound – Vista Road	B (19.9)	B (18.6)	C (25.6)	C (27.3)
Southbound – Route 15 NB Ramps	F (230.7)	D (54.8)	F (166.2)	D (53.6)
Overall	**F (367.9)**	**D (36.0)**	**F (147.9)**	**D (35.4)**

Interchange 63 Future Build Conditions

Geometric Conditions for Recommended Improvements: Interchange 63

Location	Ramp		Acceleration/Deceleration Lanes		Other Notes
	Curve Radius	Design Speed	Lane Length	Taper Length	
Mid-term Improvements					
SB Off Ramp	740 ft	45 mph	480 ft	210 ft	-
Long-term Improvements					
NB Off Ramp	> 1065 ft	55 mph	1100 ft	200 ft	-
NB On Ramp	840 ft	50 mph	950 ft [1]	-	Appx. Grade -4.3%
SB Off Ramp	740 ft	45 mph	1300 ft [1]	-	-
SB On Ramp	980 ft	50 mph	840 ft	350 ft	-

[1] Acceleration/deceleration lane is part of an auxiliary lane. Auxiliary lane length is shown.

Future Mainline Operations Comparison: Interchange 63

Segment	AM LOS (Density)		PM LOS (Density)	
	No Build	Build	No Build	Build
Northbound				
South of Interchange 63	D (26.1)	D (26.1)	D (29.3)	D (29.3)
Between Interchange 63 Ramps	C (20.4)	C (20.4)	C (21.1)	C (21.1)
North of Interchange 63	C (22.4)	B (17.7) [1]	C (24.2)	B (19.7) [1]
Southbound				
North of Interchange 63	D (26.1)	C (21.3) [1]	C (22.9)	B (18.3) [1]
Between Interchange 63 Ramps	C (21.7)	C (21.7)	C (20.4)	C (20.4)
South of Interchange 63	D (31.8)	D (31.8)	D (27.6)	D (27.6)

[1] There is a northbound and southbound auxiliary lane recommended between the Service Areas and Interchange 63 in the build condition. LOS is determined by weave analysis.

Future Ramp Merge/Diverge Operations Comparison: Interchange 63

Location	AM LOS (Delay)		PM LOS (Delay)	
	No Build	Build	No Build	Build
Northbound				
Off Ramp to Route 22	D (33.1)	D (29.7)	E (35.8)	D (32.4)
On Ramp from Route 22	D (29.7)	N/A [2]	D (31.4)	N/A [2]
Southbound				
Off Ramp to Hartford Turnpike	D (33.3)	N/A [2]	D (30.1)	N/A [2]
On Ramp from Hartford Turnpike	E (36.8)	C (27.4)	D (34.0)	C (24.6)

[1] There is a northbound and southbound auxiliary lane recommended between the Service Areas and Interchange 63 in the build condition. LOS is determined by weave analysis; merge/diverge analyses do not apply. See Future Mainline Operations Comparison table for weave LOS.

Interchange 63 Future Build Conditions (Continued)

Future Intersection Operations Comparison: Interchange 63

Intersection / Approach	AM LOS (Delay)		PM LOS (Delay)	
	No Build	Build	No Build	Build
Hartford Turnpike at Route 15 SB				
Eastbound – Colonial Drive	A (5.8)	A (9.5)	A(1.6)	A(1.6)
Westbound – Route 15 SB Ramps	E (57.8)	C (29.0)	C (26.7)	C (24.6)
Northbound – Hartford Turnpike	F (101.8)	A (7.2)	E (74.1)	A (6.2)
Southbound – Hartford Turnpike	F (778.0)	F (897.8)	B (19.9)	B (20.3)
Overall	**F (313.0)**	**F (244.4)**	**D (50.6)**	**B (12.2)**
Route 22 at Hartford Turnpike				
Eastbound – Route 22	F (2290.2)	C (23.3)	F (603.3)	C (27.8)
Westbound – Route 22	F (80.2)	A (9.7)	D (52.3)	A (8.9)
Northbound – Hartford Turnpike	F (801.7)	C (33.2)	F (3934.8)	C (34.1)
Southbound – Hartford Turnpike	E (58.5)	C (20.4)	C (28.1)	C (22.9)
Overall	**F (365.2)**	**B (17.2)**	**F (475.7)**	**B (19.4)**
Route 22 at Route 15 NB Ramps				
Eastbound – Route 22	C (34.6)	A (8.6)	C (24.4)	C (27.0)
Westbound – Route 22	F (171.0)	E (62.3)	F (111.4)	F (85.0)
Northbound – Route 15 NB Ramps	C (28.7)	C (24.1)	F (762.2)	D (48.2)
Overall	**F (81.2)**	**D (36.8)**	**F (254.0)**	**E (58.5)**
Route 22 at State Street				
Eastbound – Route 22	E (65.3)	D (39.5)	C (27.0)	C (26.3)
Westbound – Route 22	F (1751.1)	F (338.3)	F (404.2)	F (873.9)
Northbound– State Street	F (2070.5)	E (63.2)	F (1086.1)	F (121.3)
Southbound – State Street	E (66.4)	C (32.5)	E (58.4)	C (22.9)
Overall	**F (743.2)**	**F (148.0)**	**F (346.6)**	**F (313.7)**

North Haven Service Areas Future Build Conditions

Geometric Conditions for Recommended Improvements : North Haven Service Areas

Location	Ramp		Acceleration/Deceleration Lanes		Other Notes
	Curve Radius	Design Speed	Lane Length	Taper Length	
Mid-term Improvements					
NB Off Ramp	> 385 ft	35 mph	580 ft	240 ft	Stop Condition[1]
NB On Ramp	> 385 ft	35 mph	1400 ft	350 ft	-
SB Off Ramp	> 385 ft	35 mph	600 ft	180 ft	-
Long-term Improvements					
NB Off Ramp	> 385 ft	35 mph	950 ft [2]	-	Stop Condition[1]
SB On Ramp	> 385 ft	35 mph	1300 ft [2]	-	-

[1] A stop condition located 50 ft upstream of the gas pumps was assumed to be the controlling factor in determining the required deceleration length.
[2] Acceleration/deceleration lane is part of an auxiliary lane. Auxiliary lane length is shown.

Future Mainline Operations Comparison: North Haven Service Areas

Segment	AM LOS (Density)		PM LOS (Density)	
	No Build	Build	No Build	Build
Northbound				
South of Service Area	C (22.4)	B (17.7) [1]	C (24.2)	B (19.7) [1]
North of Service Area	C (22.4)	C (22.4)	C (24.2)	C (24.2)
Southbound				
North of Service Area	D (26.1)	D (26.1)	C (22.9)	C (22.9)
South of Service Area	D (26.1)	C (21.3) [1]	C (22.9)	B (18.3) [1]

[1] There is a northbound and southbound auxiliary lane recommended between the Interchange 63 and the Service Areas in the build condition. LOS is determined by weave analysis.

Future Ramp Merge/Diverge Operations Comparison: North Haven Service Areas

Location	AM LOS (Density)		PM LOS (Density)	
	No Build	Build	No Build	Build
Northbound				
Off Ramp to Service Area	D (29.7)	N/A[1]	D (31.6)	N/A[1]
On Ramp from Service Area	D (29.0)	C (21.9)	D (30.8)	C (23.7)
Southbound				
Off Ramp to Service Area	D (32.8)	D (30.0)	D (30.2)	C (27.4)
On Ramp from Service Area	D (31.9)	N/A[1]	D (29.0)	N/A[1]

[1] There is a northbound and southbound auxiliary lane recommended between Interchange 63 and the Service Areas in the build condition. LOS is determined by weave analysis; merge/diverge analyses do not apply. See Future Mainline Operations Comparison table for weave LOS.

DOT Maintenance Exit Future Build Conditions

Geometric Conditions for Recommended Improvements : DOT Maintenance Exit

Location	Ramp		Acceleration/Deceleration Lanes		Other Notes
	Curve Radius	Design Speed	Lane Length	Taper Length	
Mid-term Improvements					
NB Off Ramp	1065 ft	55 mph	250 ft	140 ft	-
SB Off Ramp	55 ft	10 mph	600 ft	215 ft	Improvement maintains existing ramp geometry; provides standard deceleration length for design speed.
SB On Ramp	1000 ft	50 mph	1300 ft	350 ft	-
Long-term Improvements					
NB On Ramp	840 ft	50 mph	1400 ft	270 ft	Appx. Grade 3.5%

Future Mainline Operations Comparison: DOT Maintenance Exit

Segment	AM LOS (Density)		PM LOS (Density)	
	No Build	Build	No Build	Build
Northbound				
South of Interchange DOT Exit	C (25.0)	C (25.0)	C (24.6)	C (24.6)
North of Interchange DOT Exit	D (26.4)	D (26.4)	C (24.0)	C (24.0)
Southbound				
North of DOT Exit	C (22.3)	C (22.3)	D (26.9)	D (26.9)
South of DOT Exit	C (23.3)	C (23.3)	D (27.3)	D (27.3)

Future Ramp Merge/Diverge Operations Comparison: DOT Maintenance Exit

Location	AM LOS (Density)		PM LOS (Density)	
	No Build	Build	No Build	Build
Northbound				
Off Ramp to Miller Avenue	D (30.9)	D (29.3)	D (30.5)	D (30.5)
On Ramp from Miller Avenue	D (30.6)	C (25.5)	D (28.5)	C (23.4)
Southbound				
Off Ramp to Miller Avenue	C (25.8)	C (25.6)	D (30.3)	D (30.1)
On Ramp from Miller Avenue	C (27.9)	C (22.7)	D (31.3)	C (26.2)

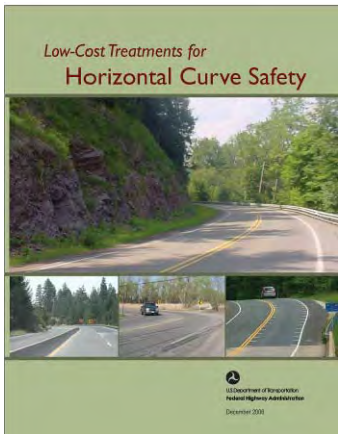
DOT Maintenance Exit Future Build Conditions (Continued)

Future Intersection Operations Comparison: DOT Maintenance Exit

Intersection / Approach	AM LOS		PM LOS	
	No Build	Build	No Build	Build
Miller Avenue at Route 15 NB Ramps (Unsignalized)				
Northbound – Route 15 NB Ramps	C(24.7)	C(18.3)	F(83.8)	F(66.2)
Miller Avenue at Route 15 SB Ramps (Unsignalized)				
Northbound – Route 15 SB Ramps	C(17.4)	C(15.4)	F(249.7)	F(232.9)

Appendix 4

Dynamic Curve Warning System



A *dynamic curve warning system* supplements a standard curve warning sign with flashing beacons and/or messages (powered by hard-wire connection or solar panel) that activate when a motorist approaches a curve at a high speed. The system is designed to slow high-speed vehicles as they approach and enter a horizontal curve. It works by measuring the speeds of approaching vehicles using loop detectors or radar and providing flashing beacons and/or variable messages alerting drivers to the advisory speed condition. The dynamic curve warning system is suggested by the Federal Highway Administration (FHWA) as a low cost treatment for horizontal curve safety.

The study team recommends consideration of providing dynamic curve warning systems on the deceleration lanes at the following locations in conjunction with the other mid-term improvement recommendations at these locations:

- **Interchange 56 Southbound Off Ramp** – 180-degree ramp curve with an entering design speed of 25 mph preceded by a recommended 250 ft deceleration lane.
- **Interchange 61 Northbound Off Ramp** – 180-degree ramp curve with an entering design speed of 30 mph preceded by a recommended 520 ft deceleration lane.
- **DOT Maintenance Exit Southbound Off Ramp** – 180-degree ramp curve with an entering design speed of 10 mph preceded by a recommended 600 ft deceleration lane.

In these locations on the Wilbur Cross Parkway, the warning system could be activated for a specified vehicle speed threshold and distance from the curve, or it could be activated for any vehicle that exits the mainline at that location. The advantage of the dynamic curve warning system is that it can have a greater effect on high-speed vehicles than a static curve warning sign due to the enhanced visibility of the advisory condition. A variety of these systems are deployed in the United States, including the following examples:

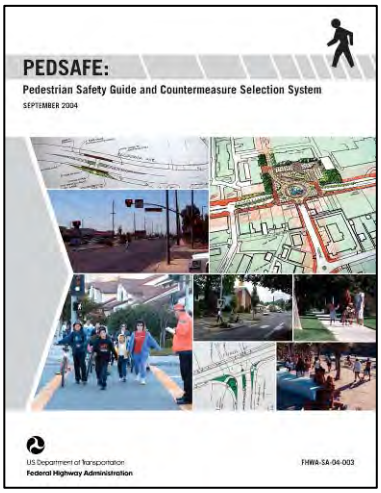
Actuated Sign – Augusta, ME

Flashing Beacon on Warning Sign

*Information contained herein, including images, obtained from **FHWA Report No. FHWA-SA-07-002**, Low-Cost Treatments for Horizontal Curve Safety (McGee and Hanscom, 2006).*

Right Turn on Red Prohibition

The study team recommends consideration of a part-time prohibition of right-turn-on-red (RTOR) movements at the northbound and southbound off ramp approaches to Dixwell Avenue (Route 10) at Interchange 60. The RTOR restriction is recommended in response to several pedestrian accidents that have occurred since 2003 as a result of RTOR movements at these ramps. Further study of the pedestrian volumes and potential impacts of part-time RTOR prohibitions on traffic capacity and operations will be required to determine if the RTOR restriction is an appropriate countermeasure to the pedestrian accidents at Interchange 60. However, the study team believes that the proximity of Hamden High School and the Town of Hamden's expressed concerns over pedestrian safety at the interchange should prompt careful consideration of the measure.



The part-time restriction of RTOR movements is a countermeasure to pedestrian accidents suggested in *PEDSAFE* published by the FHWA.

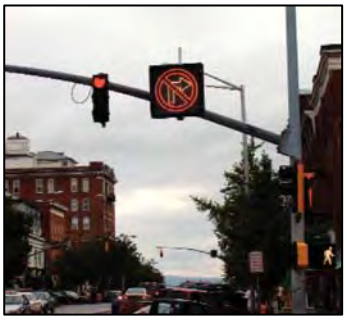
The part-time restriction of RTOR movements should apply during peak pedestrian periods and/or during school hours when pedestrian activity is highest. The part-time restriction could be indicated by a new "No Turn on Red" (NTOR) sign mounted adjacent to the existing signal head with a supplemental sign indicating the time of day restriction.

An alternative method – and possibly more effective method – for indicating part-time RTOR prohibitions could include installing an electronic NTOR sign that is illuminated only during certain times of the day or that is activated by a pedestrian push button located at the intersection. An electronic sign could have a variable message that displays "No Turn on Red" during red signal phases and "Yield to Peds" during green signal phases.

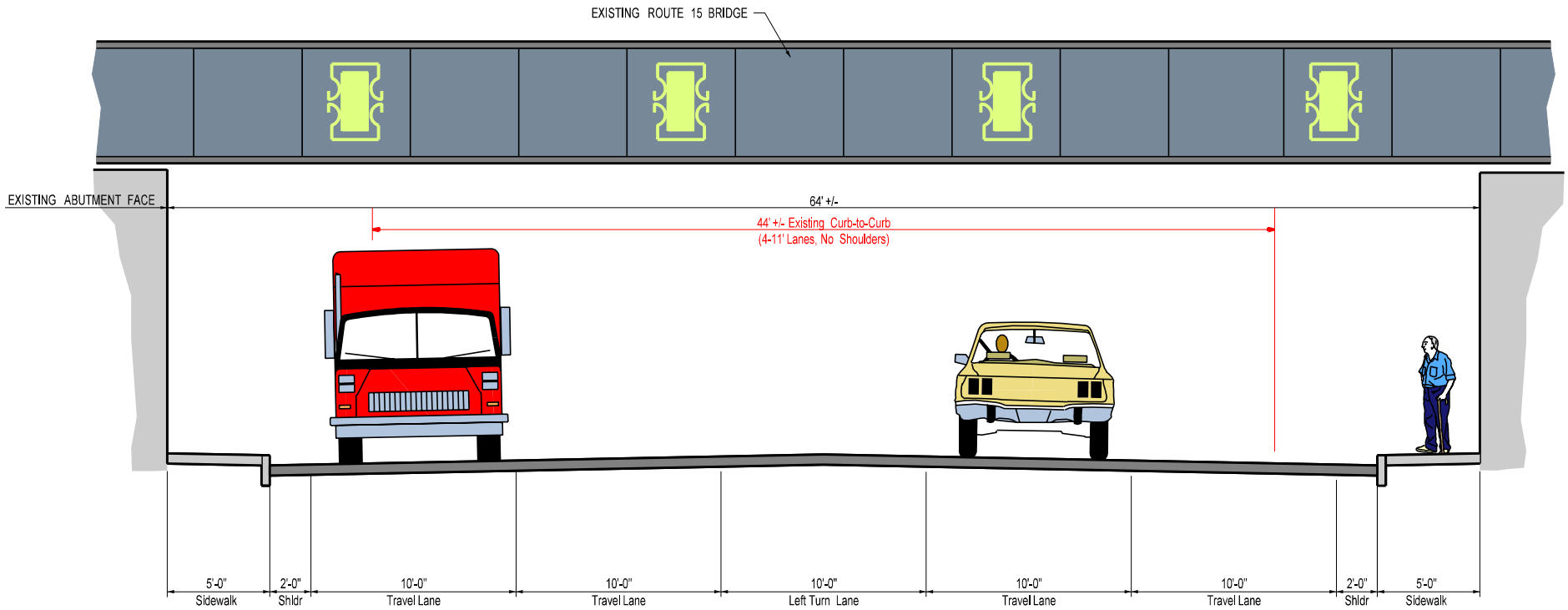
Example time-of-day restriction

Electronic sign with variable message display

Regardless of type, all signs are intended to improve the awareness of motorists to the potential for pedestrian activity in the area of the interchange and to proactively address the need for improved pedestrian safety.



Electronic sign with illuminated right turn prohibition



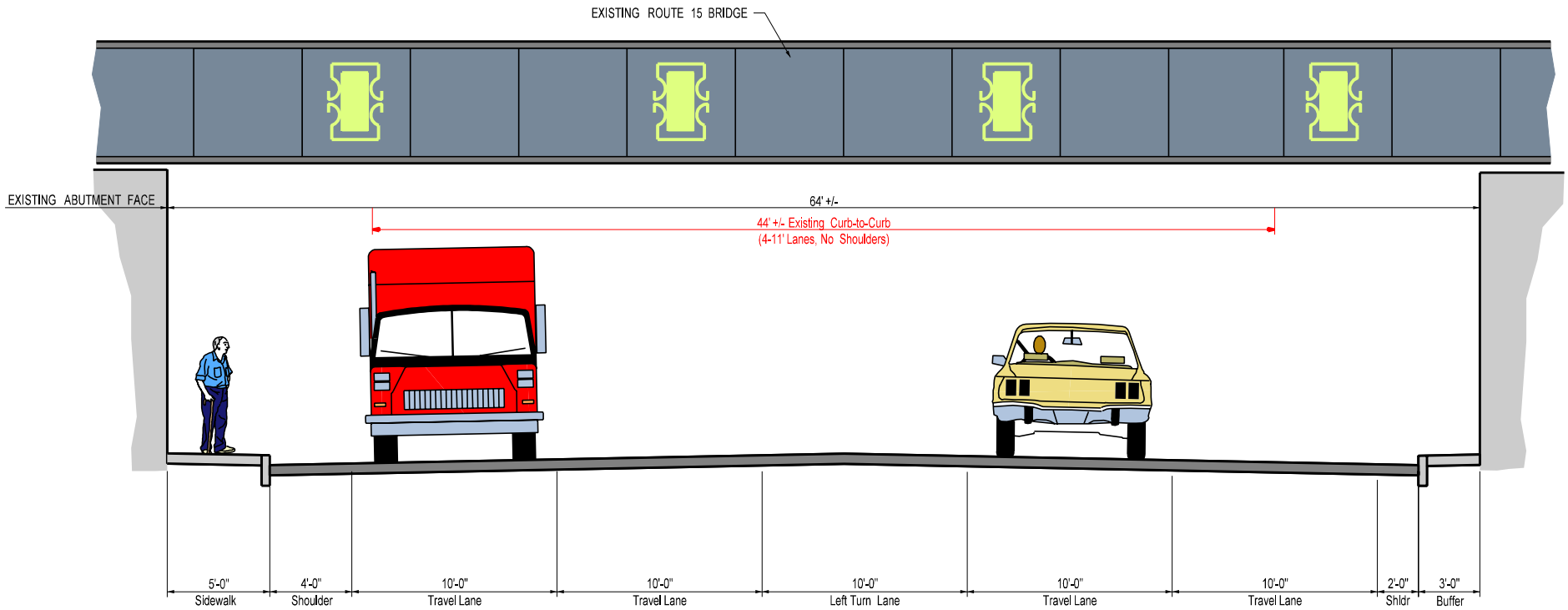
TYPICAL SECTION ALTERNATIVE 1
FIVE LANES WITH SIDEWALK ON BOTH SIDES
(LOOKING NORTH)

CHA

WilburSmith

Wilbur Cross Parkway
Interchange Needs Assessment Study

Interchange 61: Whitney Avenue
Five Lane Typical Section
Alternative 1

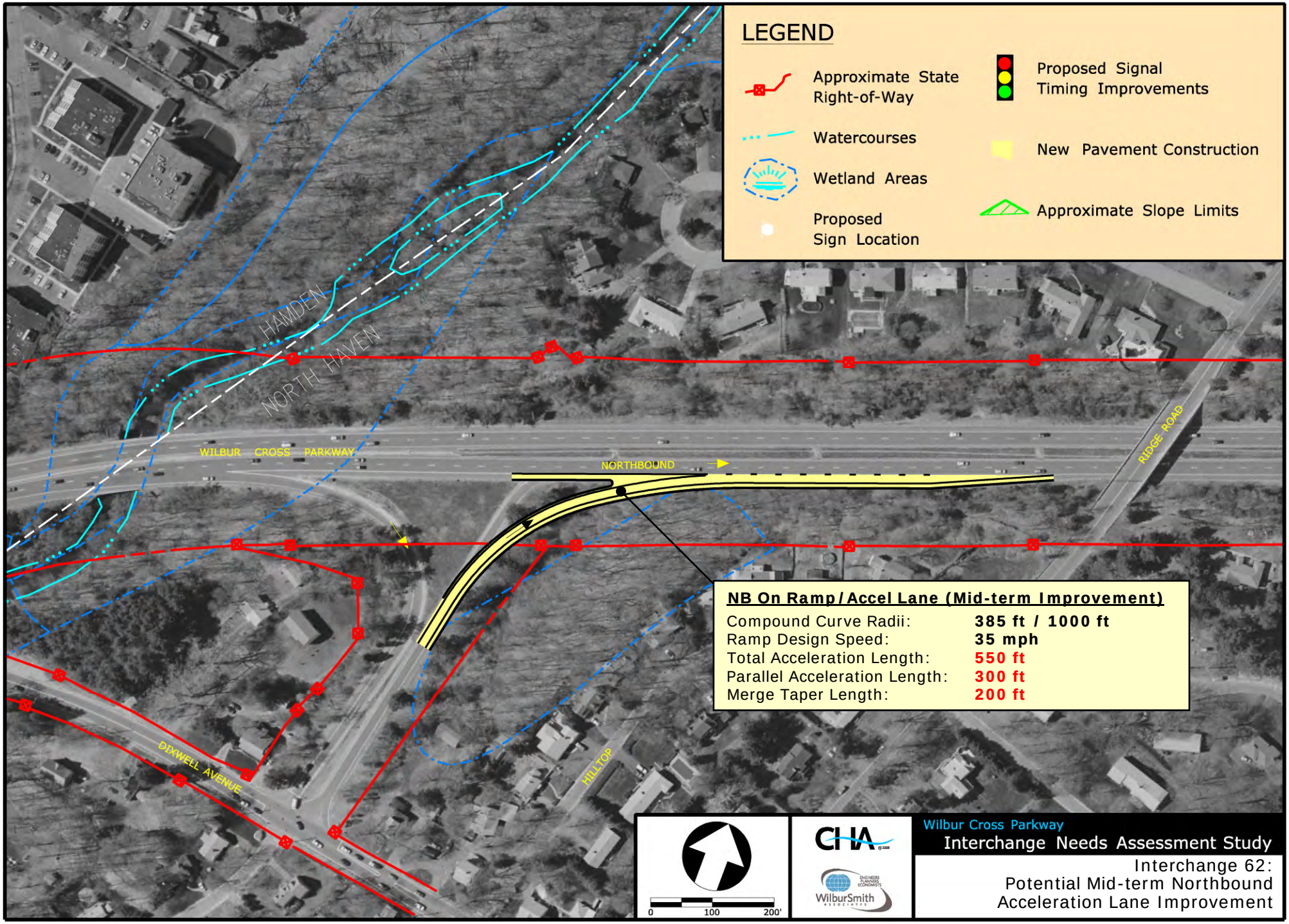


TYPICAL SECTION ALTERNATIVE 2
FIVE LANES WITH SIDEWALK AND 4' SHOULDER ON WEST SIDE
(LOOKING NORTH)

CHA
WilburSmith

Wilbur Cross Parkway
Interchange Needs Assessment Study

Interchange 61: Whitney Avenue
Five Lane Typical Section
Alternative 2


LEGEND
Approximate State Right-of-Way
Watercourses
Wetland Areas
Proposed Sign Location
Proposed Signal Timing Improvements
New Pavement Construction
Approximate Slope Limits
HAMDEN
NORTH HAVEN
WILBUR CROSS PARKWAY
NORTHBOUND
RIDGE ROAD
DIXWELL AVENUE
HILLTOP
NB On Ramp / Accel Lane (Mid-term Improvement)
Compound Curve Radii: 385 ft / 1000 ft
Ramp Design Speed: 35 mph
Total Acceleration Length: 550 ft
Parallel Acceleration Length: 300 ft
Merge Taper Length: 200 ft
0
100
200'
CHA
WilburSmith
Wilbur Cross Parkway
Interchange Needs Assessment Study
Interchange 62:
Potential Mid-term Northbound
Acceleration Lane Improvement

Suggested Priority Levels for Improvement Locations

The near, mid, and long-term designations assigned to the improvement recommendations were based on the relative complexity of each project, potential level of impacts, and likely implementation timeline given funding availability. The designations were assigned to help illustrate the duration of the project development process for the study participants and general public and were intended to provide some indication as to when the various improvements could potentially be implemented considering the project development process. The near, mid, and long-term designations are not intended to suggest project priorities.

Need-based priority is an independent measure which may or may not correlate with the near, mid, and long-term designations contained in this report. Because the recommendations of this study directly involve five municipalities and would impact the regional transportation network, the study team believes that assigning priority to locations for improvement should be conducted with input from the municipalities, region, and state. To assist this exercise, the consultant study team assigned a suggested priority level to each interchange ramp and service area location. The suggested priority level reflects a qualitative assessment of the urgency for improvement at each location based primarily on documented accident history and the potential for accidents as a consequence of existing geometric deficiencies.

Table ES-1 summarizes the suggested priority level for each location as determined by the consultant study team. Since the consultant study team believes that the relatively low-cost, low-impact near-term improvements should be considered high priority and implemented immediately, the priority levels shown in the table generally apply to the implementation of the mid and long-term improvements at each location.

Table ES-1. Suggested Priority Levels for Improvement Locations

Location	Suggested Priority Level	Comments
Interchange 61 Southbound On Ramp	Critical	• Ramp has highest three-year accident total of any location in study area. • High percentage of rear-end collisions attributable to stop condition at ramp approach to mainline. Removal of stop condition should be considered a very high priority.
Interchange 63 Southbound On Ramp	Critical	• Ramp has second highest three-year accident total of any location in study area. • High percentage of rear-end collisions attributable to stop condition at ramp approach to mainline. Removal of stop condition should be considered a very high priority.
Interchange 62 Northbound On Ramp	High	• Ramp has third highest three-year accident total of any location in study area. • High percentage of rear-end collisions attributable to stop condition at ramp approach to mainline. Removal of stop condition should be considered a very high priority.
Interchange 61 Northbound On Ramp	High	• Ramp has fourth highest three-year accident total of any location in study area. • High percentage of rear-end collisions attributable to stop condition at ramp approach to mainline. Removal of stop condition should be considered a very high priority.

Location	Suggested Priority Level	Comments
Interchange 56 Northbound On Ramp	High-Medium	• High percentage of rear-end collisions attributable to stop condition at ramp approach to mainline.
Interchange 56 Southbound On Ramp	High-Medium	• High percentage of rear-end collisions attributable to stop condition at ramp approach to mainline.
Interchange 63 Northbound On Ramp	Medium	• High percentage of rear-end collisions attributable to stop condition at ramp approach to mainline.
Interchange 61 Northbound Off Ramp	Medium	• Relatively minor accident history, however, non-standard ramp curvature and lack of deceleration lane create potential for severe accidents.
Interchange 56 Southbound Off Ramp	Medium	• High percentage of fixed object collisions suggests non-standard ramp curvature and lack of deceleration lane are safety concerns.
Orange Service Areas North/Southbound	Medium	• Potential for catastrophic accident due to lack of physical barrier protection between mainline and gas pumps in service area.
North Haven Service Areas North/Southbound	Medium	• Potential for catastrophic accident due to lack of physical barrier protection between mainline and gas pumps in service area.
DOT Maintenance Exit Northbound Off Ramp	Medium	• Non-standard ramp curvature and lack of physical separation between off ramp and stop condition at northbound on ramp increases need for improvement.
DOT Maintenance Exit Northbound On Ramp	Medium	• High percentage of rear-end collisions attributable to stop condition at ramp approach to mainline.
Interchange 55 Northbound Off Ramp (B)	Medium	• Relatively minor accident history, however, non-standard ramp curvature and lack of deceleration lane create potential for severe accidents.
Interchange 55 Northbound On Ramp	Medium	• High percentage of rear-end collisions attributable to stop condition at ramp approach to mainline.
Interchange 55 Southbound On Ramp	Medium-Low	• Ramp has relatively high accident history that could be attributable to non-standard merge with Interchange 54 on ramp or partially inflated by accidents associated with the past construction of Sikorsky Bridge.
DOT Maintenance Exit Southbound Off Ramp	Medium-Low	• Relatively minor accident history, however, sharp ramp curvature and non-standard deceleration lane create potential for severe accidents.
Interchange 61 Southbound Off Ramp (Exit 61)	Medium-Low	• Relatively minor accident history, however, sharp ramp curvature and lack of deceleration lane create potential for severe accidents.
Interchange 62 Northbound Off Ramp	Low	• Relatively minor accident history.
Interchange 61 Southbound Off Ramp (Exit 62)	Low	• Relatively minor accident history.
Interchange 63 Northbound Off Ramp	Low	• Relatively minor accident history.
Interchange 63 Southbound Off Ramp	Low	• Relatively minor accident history.

Location	Suggested Priority Level	Comments
Interchange 56 Northbound Off Ramp	Low	• Relatively minor accident history.
DOT Maintenance Exit Southbound On Ramp	Low	• Relatively minor accident history.
Interchange 55 Northbound Off Ramp (A)	Low	• Relatively minor accident history.
Interchange 55 Southbound Off Ramp	Low	• Relatively minor accident history.
Interchange 60 Northbound Off Ramp	Low	• Relatively minor accident history. Long-term improvements designed to address operations, not safety.
Interchange 60 Northbound On Ramp	Low	• Relatively minor accident history. Geometric upgrades in mid-1990s addressed major safety concerns.
Interchange 60 Southbound Off Ramp	Low	• Relatively minor accident history. Geometric upgrades in mid-1990s addressed major safety concerns.
Interchange 60 Southbound On Ramp	Low	• Relatively minor accident history. Geometric upgrades in mid-1990s addressed major safety concerns.