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I. INTRODUCTION

A. Foreword

Project UPC #083720 (Drainage); # 084091 (Edward Ave); #084092 (5th Ave).

This report documents the results of three Concept Development (CD) studies along Route 20 in the City of Paterson, Passaic County, New Jersey. The three CDs are: Concept Development for Route 20 Drainage Improvements MP 0.70 to MP 3.35, Concept Development for Route 20 Safety Improvements at Edward Avenue (MP 1.92), and Concept Development for Route 20 Safety Improvements at 5th Avenue (MP 3.35) (see Appendix G for location map and photos).

Route 20 is a north/south urban principal arterial divided highway along the west bank of the Passaic River. The speed limit varies from 35 mph to 45 mph within the project limits. The site is located in a suburban area.

The existing conditions of the roadway are described within this report. The problem assessments as well as the project needs and improvements are also evaluated and discussed.

B. Original and Successor Projects

Route 20 within the project limits was originally constructed in 1930 by the New Jersey State Highway Department (Section 4). Various improvements have been performed over the years as follows: Section 4A (1936), Section 4C (1955), Section 4D & 3B (1956), Section 3C & 4F (1959), Section 4A (1961), Section 4F & 4H (1978), Section 4G (1978), and as part of Route 80 Section 4D project (2004).

C. Data Reviewed

During the data collection phase of this project, specific sources were consulted to obtain information on the existing conditions of the study area. This information was evaluated to determine areas of nonconformance with current design standards and will be the base data for use during the development of improvement alternatives.

The following information was obtained and reviewed:

- Bridge Re-evaluation Survey Report, Structure No. 0205-150, 14th Cycle Inspection, prepared by STV Incorporated in June 16, 2009 and Bridge Re-evaluation Survey Report, Structure No. 1602-151, 15th Cycle Inspection, prepared by Stantec Consulting Services in August 25, 2008 (Appendix B).

- As-Built Plans (Appendix C)
 1. Route 20 Original Construction Section 4, 1930
 2. Route 20 Traffic Circle at 10th Avenue and 33rd Street, Section 4A, 1936
 3. Route 20 From Route 4 to 10th Avenue Traffic Circle, Section 4C, 1955
 4. Route 20 From 10th Avenue to 4th Avenue, Section 4D & 3B, 1956
 5. Route 20 From Crooks Avenue to Broadway, Section 3C & 4F, 1959
 6. Route 20 From South Drive to Broadway, Section 4A, 1961
 7. Route 20 From East of E. 35th Street to 1st Avenue, Section 4F & 4H, 1978
 8. Route 20 From South of 20th Avenue to South of Route 4, Section 4G, 1978
 9. Route 80 From Madison Avenue to the Vicinity of River Drive and Route 20 from the Vicinity of Route 46 to Vicinity of 20th Avenue, 2004
- Tax Map Plans (Appendix D)
- Crash Records (Appendix E)
- Traffic Counts (Appendix F)

D. Design Standards

The following design standards were used in the development of the project alternatives:

AASHTO

- A Policy on Geometric Design of Highways and Streets, AASHTO, 2011
- Standard Specifications for Highway Bridges, 17TH Edition
- LRFD Bridge Design Specifications, 6TH Edition, 2012 with Interims

NJDOT Design Manuals

- New Jersey Department of Transportation Design Manual – Roadway
- New Jersey Department of Transportation Design Manual – Bridges and Structures

E. Characteristics of the Roadways and Surrounding Area

Route 20 is an urban principal arterial, four or six lane highway divided by a concrete median barrier or grass median through the project site. The existing roadway cross section consists of three (3) 12' lanes with variable width shoulders in both the northbound and southbound directions from the southern project limit (MP 0.70) to approximately MP 1.6. From MP 1.6 to the northern project limit (MP 3.35), the existing roadway cross section consists of two (2) 12' lanes with variable width shoulders in both the northbound and southbound directions. Route 20 is situated along the west bank of the Passaic River.

Edward Avenue is a two lane undivided municipal roadway. The existing cross section consists of a 40' wide travel way.

Immediately south of the Edward Avenue intersection is the Route 4 Bridge over Route 20 (Structure No. 0205-150). Route 4 is an urban principal arterial, four lane highway divided by a median barrier at the project site.

5th Avenue (CR 652) is a two lane undivided Passaic County roadway. The existing cross section consists of a variable 32' to 38' wide traveled way.

Appendix G includes a Project Location Plan and various photographs of the project area.

Land use through the project limits consists of a mixture of uses: commercial (i.e. gas stations, fast food restaurants, home improvement stores, car washes, auto repair, etc.), residential and parks.

Two-directional Average Daily Traffic (ADT) on Route 20 is 49,741 vehicles per day based on traffic counts taken by Dewberry in 2010.

II. PURPOSE AND NEED

The purpose of the proposed project is to improve safety and reduce the crash rate at the Edward Avenue and 5th Avenue intersections of Route 20. The crash rate at both intersections is above the statewide average. In addition, the purpose of the project is to improve the substandard drainage of Route 20 from MP 0.70 to MP 3.35 and reduce the frequency of flooding of Route 20 caused by Passaic River.

The following summarizes existing conditions and project needs. Data substantiating these needs can be found in Section III and the Appendices of this report.

A. Roadway Needs

1. Drainage (MP 0.70 to MP 3.35)

Flooding along Route 20 from M.P. 0.7 to 3.35 has been reported by representatives of NJDOT and the City of Paterson (see meeting memoranda in appendix N and O). Flooding occurs both as a result of runoff from storm events flowing directly onto the roadway and exceeding the capacity of the drainage system, and flooding from the Passaic River following prolonged periods of rainfall which is widespread over the Passaic River Basin. This flooding has resulted in traffic back-ups, road closures and increased accident rates. Major storms in March of 2010 and 2011 caused roadway flooding during the initial phases of the storm. Days later the Passaic River crested resulting in prolonged roadway closures at Broadway (MP 1.92) and 5th Avenue (MP 3.35). During both March storms the Passaic River and Route 20 “became one” at the aforementioned locations as the river bank and northbound shoulder of Route 20 were underwater for days. Just south of 5th Avenue flooding reached the top of the median barrier. During late August of 2011 Hurricane Irene

resulted in near record flooding of Route 20. This flood topped the floods of March 2010 and 2011. Prolonged roadway closures have occurred regularly due to Passaic River flooding. Comparison of the low point roadway elevations at Broadway and 5th Avenue to stage-frequency curves developed from FEMA flood elevations for the Passaic River indicate that the roadway is subject to Passaic River flooding by an approximate 3 year storm event. Over an extended period this would average out to flooding of the roadway once every 3 years. The March storms were between 10 and 15 recurrence intervals.

The NJDOT provided crash data from MP 0.60 to MP 3.45 of Route 20 for accidents occurring between 2006 and 2008. The section of Route 20 from MP 1.68 to 2.48 had a crash rate higher than statewide average. This is the area in the vicinity of Edward Avenue. More recent crash data (2009 – 2011) obtained from NJDOT confirmed this area of Route 20 is still above the statewide average.

Between MP 0.60 and MP 3.45, the statewide average for accidents on a wet surface is exceeded in 2 areas, from MP 0.60 to 1.68 (27.72% vs. 22.05% average) and from MP 1.68 to 2.48 (36.88% vs. 22.05%).

2. Safety (Edward Avenue)

In addition to the crash data obtained as part of the drainage CD, NJDOT provided Route 20 crash data in the vicinity of the Edward Avenue (MP 1.92) intersection for accidents occurring between 2007 and 2009. The overall crash rate in this area was 3.44 crashes/mvm, higher than the statewide average of 1.83 crashes/mvm. In addition, numerous crash types were over-represented including same direction - sideswipe (18.95% vs. 15.72% average), fixed object (34.74% vs. 12.01% average), wet surface (44.21% vs. 24.30% average) and night (41.05% vs. 26.08% average).

Based on traffic analysis, the length of the Route 20 NB left turn lane at Edward Avenue was found to be substandard, resulting in frequent overflow of left turning vehicles onto the through lanes. The collision diagrams show a cluster of crashes in this area.

3. Safety (5th Avenue)

In addition to the crash data obtained as part of the drainage CD, NJDOT provided Route 20 crash data in the vicinity of the 5th Avenue (MP 3.35) intersection for accidents occurring between 2007 and 2009. The overall crash rate in this area was 2.23 crashes/mvm, higher than the statewide average of 1.83 crashes/mvm. In addition, numerous crash types were over-represented including same direction – rear end (55.77% vs. 47.12% average), at signalized intersections (46.15% vs. 12.98% average) and at unsignalized intersections (23.08% vs. 16.29% average).

Based on traffic analysis, the length of the Route 20 NB left turn lane at Ramp B was found to be substandard, resulting in frequent overflow of left turning vehicles onto the through lanes. However, the collision diagrams do not show extensive crashes in this area.

B. Goals and Objectives

A set of project goals and objectives to be addressed by the project beyond the state transportation issue identified in the Purpose has been developed. While the project may not be able to satisfy all goals and objectives listed herein, it seeks to address as many as possible. The project’s goals and objectives are as follows:

- Eliminate the number of controlling substandard design features within project limits.
- Improve traffic operations through Edward Avenue and 5th Avenue intersections.
- Minimize property acquisitions.
- Develop a staging scheme that minimizes delays to the public.
- Avoid, minimize, or mitigate hydrologic, hydraulic and environmental impacts for this project located adjacent to Passaic River.

III. EXISTING INVENTORY AND CONDITION

A. Existing Roadway Inventory and Condition

1. Highway Classification

The functional classification of Route 20 is an Urban Principal Arterial as published in the NJDOT Straight Line Diagrams (Appendix H).

2. Project Category

National Highway System

According to the NJDOT Straight Line Diagrams, Route 20 is categorized as part of the National Highway System.

NJDOT Construction Cost Estimating Guide

This project is classified as a reconstruction project according to the NJDOT Construction Cost Estimating Guide.

3. Management Systems Summary

<u>Unit and Management System</u>	<u>Rating/Input</u>
Bridge Management System	No materials received
Systems Development and Analysis	Part of M.P. 0.80-3.50 of NJ 20 is "Severely

Unit and Management System	Rating/Input
<i>Congestion Management System (CMS)</i>	Congested" with some of the remainder of this section being "Very Congested". The Edward Ave. (MP 1.92) intersection is ranked # 178 and the 5th Ave. (MP 3.35) intersection is ranked # 180 out of 190 high need signalized intersections on State highways.
Pavement Management Unit <i>Pavement Management System (PMS)</i>	MP 0.10 to 4.0 is scheduled for resurfacing in 2012 and is ranked #10 out of 354 potential projects. IRI is rated Fair and SDI is rated Poor in both NB and SB.
<i>Drainage Management System (DMS)</i>	No materials received
Operations Support <i>Maintenance Management System (MMS)</i>	No materials received
Geotechnical Engineering <i>Rockfall Hazard Rating System Underground Strata</i>	No rock cuts within the project limits. Existing subsurface data does exist at Route 4 and Route 80 on website.
Traffic Engineering and Investigations	No materials received
Major Access	No pending development.

4. Roadway Cross Section Elements

Cross sectional data for Route 20 was developed using topographical survey data, orthophotography, and through a review of the As-Built plans. The existing data is shown below at select locations.

Route 20 M.P. 0.70 to M.P. 0.87		
Roadway Element	Southbound	Northbound
Through Lanes	2 – 12'	2 – 12'
Inside Shoulder	1' and varies	2' and varies
Outside Shoulder	12'	0' to 12'
Auxiliary Lane	N/A	0' to 12'
Median	12' and varies	

Route 20 M.P. 0.87 to M.P. 1.66		
Roadway Element	Southbound	Northbound
Through Lanes	3 – 12'	3 – 12'
Inside Shoulder	1' and varies	1' and varies
Outside Shoulder	0'	3' and varies
Auxiliary Lane	N/A	0' to 12'
Median	2' wide concrete barrier curb	

Route 20 M.P. 1.66 to M.P. 1.86		
Roadway Element	Southbound	Northbound
Through Lanes	2 or 3 – 12'	2 – 12'
Inside Shoulder	0'	1' and varies
Outside Shoulder	0'	1' to 12'
Auxiliary Lane	0' to 12'	N/A

Route 20 M.P. 1.66 to M.P. 1.86		
Roadway Element	Southbound	Northbound
Median	Varies	

Route 20 M.P. 1.86 to M.P. 2.45		
Roadway Element	Southbound	Northbound
Through Lanes	2 – 12'	2 – 12'
Inside Shoulder	0' to 2'	0' to 1'
Outside Shoulder	11'	8'
Auxiliary Lane	N/A	Lt. Turn @ Edward Ave.
Median	2' wide concrete barrier curb	

Route 20 M.P. 2.45* to M.P. 3.35		
Roadway Element	Southbound	Northbound
Through Lanes	2 – 12'	2 – 12'
Inside Shoulder	1'	0'
Outside Shoulder	8'	10'
Auxiliary Lane	N/A	Lt. Turn @ 5 th Ave
Median	2' wide concrete barrier curb & varies	

*excludes E 33rd St./Morlot Ave. Interchange

Broadway (Route 4)		
Roadway Element	Southbound	Northbound
Through Lanes	2 – 12' & varies	2 – 12' & varies
Inside Shoulder	0'	0'
Outside Shoulder	0'	0'
Sidewalk	4' min	4' min
Median	2' wide concrete barrier curb	

The existing roadway cross slopes vary throughout the length of the project. Locations with substandard cross slopes or substandard superelevation can be found in Section 6-D; Controlling Substandard Design Elements.

5. Right-of-Way / Border Widths

Right-of-Way (ROW) information was gathered from as-built drawings and tax maps for this area in City of Paterson, Passaic County (see Appendix D).

Typically, Route 20 is centered within a 100' State ROW. Starting at the 29th Street intersection and going north, the easterly ROW line of Route 20 extends into Passaic River and the State ROW in this area is varying in width.

6. Horizontal Alignment

Route 20 at Edward Avenue

Route 20 NB runs tangentially north and south of Route 4. North of Route 4 as it intersects Edward Avenue, Route 20 curves in a westerly direction with compound curves. Route 20 SB curves away from Route 20 NB approximately 1350' south of Route 4 to accommodate the interchange. With the proper superelevation, the radii are adequate for a 40 mph design speed at this location. The interchange consists of 3 ramps.

Ramp A is a slip ramp that carries traffic from Route 4 EB to Route 20 SB. Ramp B is a left lane exit from Route 20 NB to Route 4 EB. The ramp merges with Ramp C prior to merging with Route 4 EB. Ramp C is a loop ramp taking traffic from Route 20 SB to Route 4 EB. North of Route 4, access and egress to Route 4 WB and Route 20 is accomplished using East 43rd Street and Edward Avenue.

Route 20 at 5th Avenue

Approaching 5th Avenue from the south, Route 20 curves to the east. It features an interchange south of 5th Ave.

Ramp A is a jughandle which allows Route 20 SB traffic to make a U-turn on to Route 20 NB. This allows access to the Fair Lawn Avenue bridge approximately 500' north of the 5th Avenue intersection. Grimes Place/Ramp B/Ramp C is a ramp that allows several movements. Using the Route 20 NB left turn lane, vehicles can access this ramp and either make a U-turn onto Route 20 SB or access 5th Avenue. From 5th Avenue, vehicles can use the ramp to access route 20 SB.

Reference the as-built plans in Appendix C for detailed Route 20 roadway alignment information.

7. Vertical Alignment

Reference the as-built plans in Appendix C for Route 20 vertical alignment information.

8. Sight Distance

There are 5 locations within the project limits where horizontal stopping sight distance does not meet minimum design standards. The locations are:

Route 20 NB:	M.P. 1.21 to 1.32
Route 20 NB:	M.P. 1.92 to 2.00
Route 20 NB:	M.P. 3.10 to 3.41
Route 20 SB:	M.P. 1.43 to 1.54

Route 20 SB: M.P. 3.10 to 3.21

There are 6 locations within the project limits where a substandard vertical curve creates substandard stopping sight distance. All other locations meet or exceed the required stopping sight distance. The locations are:

Route 20 NB: M.P. 0.84 to 0.91

Route 20 SB: M.P. 0.84 to 0.91

Route 20 SB: M.P. 1.58 to 1.74

Route 4 EB: M.P. 0.00 to 0.08

Route 4 WB: M.P. 0.00 to 0.08

Ramp B at Route 4: M.P. 1.71 to 1.73

9. Existing Pavement

A visual inspection and a review of the as-built drawings indicate Route 20 pavement consists mainly of an asphalt overlay on top of reinforced concrete pavement.

Existing ramps at Edward Avenue intersection consist of asphalt pavement.

10. Curbs and Sidewalks

Along Route 20 NB, sidewalks only exist in approximately a 500 foot long area in the vicinity of E. 33rd Street.

Along Route 20 SB, there is existing sidewalk or paved area useable for pedestrians from:

- 7th Avenue to E. 37th Street
- E. 39th Street to E. 42nd Street
- Overlook Avenue to 21st Avenue

Route 20 is mostly curbed within the project limits. Areas without curb include a 600 foot stretch on Route 20 NB south of Route 4 overpass, Route 20 NB from Edward Avenue to E. 36th Street, and Route 20 NB from 30th Street to 5th Avenue.

11. Highway Lighting

A detailed investigation of lighting has not been performed. Route 20 within the project area has continuous roadway lighting although there are several gaps where the lighting levels are likely below NJDOT standards. Lighting on the roadway approaches is generally provided by luminaires on mast arms fastened to wooden utility poles. Lighting between MP 2.5 (E. 35th Street) and MP 2.7 consist of standard NJDOT lighting standards.

Along Route 20 in the vicinity of Edward Avenue intersection, the highway is lighted by utility pole mounted cobra head / cutoff luminaires. The ramps at the interchange that run for considerable distance parallel to the mainline are lighted by poles on the mainline. Route 20 under Route 4 has several under deck luminaires, two for each of the two barrels that are in poor condition.

Along Route 20 in the vicinity of 5th Avenue intersection, highway is lighted by both non-cutoff and cutoff luminaires mounted on utility poles. The Fair Lawn Avenue intersection has one NJDOT type aluminum lighting pole and luminaire.

12. Land Use

Land use through the project limits consists of a mixture of uses: commercial (i.e. gas stations, fast food restaurants, home improvement stores, etc.), residential, health care, education and parks.

13. Posted/Design Speeds

The posted speed limit for Route 20 is either 35 mph or 45 mph depending on the location. The design speed for the project is 5 mph over the posted speed limit. The actual posted speed limit signs do not agree with the speed limits designated on Straight Line Diagrams. Based on the posted speed limit signs, the speed limits along Route 20 within the project limits are as follows: South of Route 4/Broadway = 45 mph, from Route 4/Broadway to 42nd Street = 35 mph, from 42nd Street to E. 36th Street = 45 mph, from E. 36th Street to 9th Avenue = 35 mph, north of 9th Avenue = 45 mph.

14. Storm Drainage System

The storm drainage system along Route 20 consists of B Inlets, E Inlets, Reinforced Concrete Pipe (RCP), Vitrified Clay Pipe (VCP), Cast Iron Pipe (CIP) and Corrugated Metal Pipe (CMP) with pipe sizes ranging from 12-inches to 48-inches in diameter. Much of the existing drainage system is undersized for its contributing drainage area which consists mainly of areas west of Route 20 which are outside of the right-of-way. The primary reason Route 20 floods due to short duration storms is that the drainage from a significant portion of the City of Paterson (290 acres) enters the Route 20 ROW and must be conveyed to the Passaic River via the Route 20 drainage system. The existing Route 20 drainage system does not have sufficient capacity to convey flows entering the ROW from adjacent drainage areas.

The City of Paterson drainage system is a “combined sewer system” meaning that surface runoff flows to drainage inlets and enters the same system that carries the sanitary sewage from the City. There are some locations within the study area that have separate supplemental drainage systems. These include portions of: Nineteenth Avenue; Broadway; East 33rd Street; Ninth Avenue; and the Riverside Terrace Housing Project. The majority of the Riverside Terrace Housing Project drainage connects to the

NJDOT drainage system and crosses under Route 20 at the NB left turn slot at Grimes Place (MP 3.35) which floods. The separate drainage systems collect a very small portion of the City's runoff. The vast majority of the runoff relies upon the combined sewer system that is inadequate to handle storms greater than fractions of an inch of rainfall. The typical response of the combined sewer system is that the first flush of rainfall enters the system, which typically has 8 and 12 inch pipes on local streets, with pipes larger in size as various tributary areas combine, and surcharges the system. As the storm intensifies low point inlets surcharge causing ponding, and gutter inlets allow water to bypass. Manholes and inlets at the downstream portions of the system will surcharge where hydraulic grade lines rise above the ground surface, resulting in flooding. Since many of the low areas surcharge and/or pond, there is a detention effect which results in continued surcharging long after the heavy rainfall is over. These conditions have been reported and observed along the Route 20 corridor particularly at Edward and Overlook Avenues. The result is that that drainage during more the intense storms bypasses the surcharged combined sewer system and flows overland to Route 20 and ultimately the Passaic River. This runoff overwhelms the Route 20 storm drainage system.

The combined storm water runoff and sewage from the City are eventually conveyed to a interceptor owned and operated by the Passaic Valley Sewerage Commission (PVSC). This trunk line flows south, for the most part within the Route 20 right-of-way, and varies from 66 inches in diameter at 5th Avenue to 72 inches in diameter at 20th Avenue. The depth of the line under Route 20 (to top of pipe) varies from 15 feet at 5th Avenue to 20 feet at 20th Avenue. When combined flows exceed the capacity of the interceptor, the "combined sewer overflows" are allowed to discharge to the Passaic River via regulator chambers. Within the study area there are four regulator chambers: 2nd Avenue, 3rd Avenue, 10th Avenue/East 33rd Street, and 20th Avenue. When the Passaic River is high, flows from the combined sewer system cannot discharge to the River. This condition results in surcharging of the interceptor and under certain conditions results in hydraulic grade lines within the interceptor matching flood elevations of the River.

Flooding occurs both as a result of runoff from storm events flowing directly onto the roadway and exceeding the capacity of the drainage system, and flooding of the Passaic River following prolonged periods of rainfall which is widespread over the Passaic River Basin. Comparison of the low point elevations at Broadway and 5th Avenues to stage-frequency curves developed from FEMA flood elevations indicate that the roadway is subject to Passaic River flooding by an approximate 3 year storm. Over an extended period this would average out to flooding once every 3 years. The March storms were between a 10 and 15 recurrence intervals.

15. Traffic Barriers

Concrete median barrier runs continuously on Route 20 through the project limits with the exception of the area from E. 36th Street to 10th Avenue where there is a grass median. The locations of beam guide rail within the project limits are as follows:

Route 20 Southbound:

- MP 2.0 to MP 1.92 (Edward Ave)
- At Route 4/Broadway Bridge (MP 1.86)
- At Ramp B Bridge (MP 1.68)
- Vicinity of Overlook Avenue intersection (MP 1.54)
- Vicinity of Park Avenue intersection (MP 1.43)
- Vicinity of U-turn at MP 1.22
- At railroad bridge (MP 0.85)

Route 20 Northbound:

- MP 1.3 to MP 1.5
- Route 4 Bridge (MP 1.86) to E. 35th Street (MP 2.5)
- MP 2.9 to MP 3.35

All existing guide rail was found to be substandard and will need to be replaced if within the limit of PPA.

16. Mapping

Topographic mapping and a digital terrain model (DTM) was furnished by NJDOT for the project area and was used for this project in addition to aerials. A review of the mapping revealed inaccuracies in the DTM since spot elevations, though shown on the topographic mapping, were not used in the development of the DTM. This should be corrected during Preliminary Engineering.

The as-built plans are based on NGVD 29 vertical and NAD 27 horizontal datums. The digital terrain model (DTM) surface is based on NAVD 88 vertical and NAD 83 horizontal datums. The difference between the vertical datums is about 1 foot.

17. Utilities

A detailed investigation of utilities on-site has not been performed. From as-built information and site observations the existing utilities in the project area include:

Telephone:	Verizon
Electric:	Public Service Electric & Gas
Gas:	Public Service Electric & Gas
Water:	Passaic Valley Water Commission
Sewer:	City of Paterson, Passaic Valley Sewerage Commission (PVSC)

There is a large PSE&G substation located on the southbound side of Route 20 in between 7th Avenue and 8th Avenue (Block 2607, Lot 1). Overhead aerial lines exist throughout the project on both sides of Route 20. Aerial electric facilities include transmission, distribution, highway lighting and solar panels. Lighting is provided by luminaires on mast arms fastened to wooden utility poles. Public Service Electric & Gas, Passaic Valley Water Commission, Passaic Valley Sewerage Commission and Verizon were contacted to provide utility information within the project limits. The responses and information provided by the utilities can be found in Appendix V.

The Passaic Valley Sewerage Commission provided an AutoCAD file of their interceptor sewer alignment within the Route 20 corridor. This AutoCAD file was overlaid on the aerial survey and adjustments were made based upon manholes identified by survey as PVSC manholes.

18. Access

Route 20 is a divided Urban Principal Arterial with numerous points of access within project limits. In addition to the numerous unsignalized local road intersections, the following signalized intersections on Route 20 are within project limits:

- MP 1.22 NB U Turn
- Edward Avenue
- MP 2.55 SB U Turn
- E. 33rd Street
- 10th Avenue
- Ramp B @ 5th Avenue interchange
- 5th Avenue

In addition, at the Edward Avenue interchange, there is a northbound off-ramp (Ramp B) to Route 4 eastbound, a southbound off-ramp (Ramp C) to Route 4 eastbound, and a southbound on-ramp (Ramp A) from Route 4 eastbound. At the 5th Avenue interchange, there is a southbound on-ramp from 5th Avenue. There are numerous driveways, both residential and commercial, throughout project limits.

19. Bicycle and Pedestrian Compatibility

Bicycle and pedestrian traffic is not fully accommodated on Route 20. As mentioned previously, there are multiple locations along the project that are lacking shoulders and/or sidewalks. There were no observations of bicycles on Route 20 during traffic counts. Pedestrians can cross Route 20 via the Route 4 bridge. There is a pedestrian walkway on the existing Fair Lawn Avenue bridge; however, there are no nearby crosswalks to cross Route 20.

20. Concurrent Projects

There is a concurrent NJDOT project that addresses Complete Streets Policy within the area. This project is currently in final design. Passaic County has plans to begin design of the replacement of the Fair Lawn Avenue Bridge which crosses Passaic River one block north of 5th Avenue.

21. Landscaping

The only formal landscaping within project limits consists of small trees in the Route 20 SB roadside border along Home Depot north of 5th Avenue.

22. Jurisdiction

Route 20, all ramps and traffic signals are under the jurisdiction of NJDOT. See Appendix G for project location map. 5th Avenue is under the jurisdiction of Passaic County.

23. Geotechnical Information

Based on management data received from NJDOT Geotechnical Engineering, there are no rock cuts within the project limits and existing subsurface information consisting of soil borings is available along Route 20 near Route 80 and Route 4 from the NJDOT website.

B. Existing Bridge Inventory and Condition

There are three (3) bridges within the project limits, Structure No. 1602150 carrying New York, Susquehanna and Western Railroad over Route 20 (MP 0.85), Structure No. 1602151 carrying Ramp B over Route 20 SB at the Edward Avenue interchange (MP 1.68) and Structure No. 0205150 carrying Route 4 over Route 20 and Passaic River (MP 1.86).

Route 4 over Passaic River, Route 20 and CR 507 (Structure No. 0205150)

The 560 foot long, 67 foot wide bridge was constructed in 1931 and rehabilitated in 1988. The seven (7) span bridge consists of three (3) open spandrel arch main spans over the Passaic River and four (4) steel stringer approach spans. The bridge is not individually eligible for listing on the State and/or National Register of Historic Places.

Based on the Bridge Re-Evaluation Survey Report dated June 16, 2009, the bridge has a sufficiency rating of 55.3. The deck, superstructure and substructure elements all received a condition rating of 5 (fair). The minimum vertical clearance is 15.17'.

New York, Susquehanna and Western Railroad Bridge over Route 20 (Structure No. 1602150)

The 94 foot long, 27 foot wide bridge was constructed in 1937. The minimum vertical underclearance is 14.17 feet based on the SI&A sheet.

Ramp B at Edward Avenue over Route 20 SB (Structure No. 1602151)

The 165 foot long, 30 foot wide bridge was constructed in 1960. This three (3) span bridge, based on the Bridge Re-Evaluation Survey Report dated August 25, 2008, has a sufficiency rating of 94.4. The minimum vertical clearance is 15.50'.

C. Maintenance Issues

Dewberry representatives met with representatives of Region North Maintenance on October 28, 2009. Flooding and maintenance issues were discussed. A summary of those discussions can be found in Appendix O. Region North maintenance personnel are very aware of maintenance and flooding issues on Route 20. Maintenance crews are proactive and routinely clear inlets of leaves and debris particularly prior to rainy weather to prevent clogged inlets which cause water to spread into the travel lanes resulting in traffic delays and accidents. In 2009 NJDOT contracted with National Water Main Cleaning to perform a cleaning and video inspection of the Route 20 drainage system. Region North indicated that there were no reports or video information regarding the pipes that were cleaned and that there did not appear to be any problems with the existing pipes that were cleaned.

D. Summary of Existing Deficiencies

Information gathered from available record plans, aerial images, topographic survey, combined with data obtained during field visits were used to identify areas as deficient according to current design criteria. Documentation of field visits for storms and flooding during March of 2010 can be found in Appendix O. The storm of March 2011 produced similar flooding to the storm of March 2010. Hurricane Irene (August 2011) produced flooding on the Passaic River significantly higher than the storms of March 2010 and 2011. High water elevations obtained by Dewberry during post Hurricane Irene flooding approximated a 70 year storm elevation based upon interpolation of FEMA and NJDEP Passaic River floodplain mapping.

Drainage Deficiencies

An aerial survey of the subject Route 20 watershed was obtained to accurately determine the contributing drainage area size and hydrologic characteristics. Base mapping was generated from the aerial survey and includes 1-foot contour intervals in the northern section and 2-foot contour intervals in the southern section of the watershed. Information on the existing drainage systems and roadway geometry was obtained via field survey and as-built drawings. The following additional items were obtained to accurately determine design flows and assess the hydraulic performance of the existing drainage system:

- Township tax maps
- Route 20 as-built plans
- U.S. Natural Resources Conservation Service (NRCS) soil survey
- FEMA Flood Insurance Rate Map for Passaic County
- Gas, water, sanitary sewer, and electric utility location plans
- USGS topographic quadrangles
- NJDEP Flood Hazard Area Mapping for the Passaic River

- Maps and cad file depicting the location of the PVSC Interceptor

Hydrologic and Hydraulic Analysis

The Bentley StormCAD v8i computer program was used to evaluate the existing storm sewer systems lying within the Route 20 right-of-way. Drainage areas and times of concentration for each inlet were measured using the contour mapping generated for this project. The Rational Method was used to estimate peak flows draining towards each inlet. Rational coefficients were estimated from Table 3-2 of the NJDOT Drainage Manual and are based on land use characteristics shown on the aerial surveys, which were confirmed during site visits. Rainfall intensities for each storm event were derived from the site-specific intensity curves obtained from the National Oceanic and Atmospheric Administration.

In accordance with NJDOT standards for a land service highway, the gutter spread along each road in the watershed was evaluated for the 10-year storm event. The maximum allowable spread for Route 20 is equivalent to 1/3 of the travel lane width. For local roads adjacent to Route 20, the maximum allowable spread is 1/3 of the travel lane width (no shoulders are present).

Hydraulic grade line (water surface elevation) computations within the Route 20 storm sewer pipes were performed for the 10-year storm event above roadway low points and the 15-year storm event below low points. The resulting hydraulic grade lines are required to be at least 1 foot below corresponding grate elevations in accordance with NJDOT standards.

Results and Conclusions

It was determined that the major contributing factors to flooding in the project area include both an inadequate number of inlets and undersized drainage pipes serving both Route 20 and the City of Paterson. Approximately 253 acres of runoff flow towards Route 20. The analysis of the existing Route 20 drainage systems revealed substandard gutter spreads and pipe capacity throughout the study area. The following table illustrates a breakdown of the existing subject watershed. As can be seen from this table, only 13.7% of the drainage system's contributing area emanates from Route 20 itself.

Table 4: Watershed Summary

Region	Drainage Area		Peak 25-Year Flow	
	Acres	Percent	CFS	Percent
Route 20 ROW	40	13.7	210	17.6
West of Route 20	253	86.3	985	82.4
Total	293	100.0	1,195	100.0

Geometric Deficiencies

Geometric deficiencies are discussed in Section VI.D of this report. In addition, a complete list of Controlling Substandard Design Elements (CSDE's) can be found in Appendix E.

IV. TRAFFIC AND CRASH SUMMARY

A. Traffic Operations

Traffic operations at the Edward Avenue intersection and 5th Avenue intersection were studied as part of this CD based on manual traffic counts and ATR data. The AM peak hour was determined to be from 7:45 AM to 8:45 AM and the PM peak hour was determined to be from 5:15 PM to 6:15 PM for both subject interchanges. The Saturday peak hour for the Route 20 at Edward Avenue intersection was determined to be 11:30 AM to 12:30 PM and the Route 20 at Ramp B/5th Avenue intersection to be 12:00 PM to 1:00 PM. Traffic analysis was performed using Synchro/Sim Traffic.

B. Traffic Data

Existing Traffic Volumes

To determine existing traffic volumes within the study area, manual traffic counts and ATR data was taken by Dewberry in June 2009 and June 2011. See Traffic Volume Maps in Appendix F for the various AM and PM peak turning volumes. Route 20 (2-way ADT) was calculated to be 50,406 VPD (2010) at Edward Avenue.

Route 20 and Edward Avenue Level of Service

Using the existing traffic volumes referenced above, a traffic analysis was performed at the Edward Avenue intersection with Synchro/SimTraffic. **Table 1** shows the average delay per vehicle and level of service for the signalized movements of the intersection.

Table 1

Route 20 at Edward Avenue Existing Conditions Intersection Level of Service

	AM Peak		PM Peak		Saturday Peak	
	Delay/Veh (s)	LOS	Delay/Veh (s)	LOS	Delay/Veh (s)	LOS
Route 20 NB Left	33.3	C	41.2	D	22.7	B
Route 20 SB Thru	82.1	F	124.7	F	39.3	D
Edward Ave EB Right	6.0	A	9.2	A	3.3	A

Route 20 and Ramp B/5th Avenue Level of Service

Table 2 shows the average delay per vehicle and level of service for the signalized movements of the Ramp B/5th Avenue intersections. While the intersections operate using different controllers, we have evaluated the signals at the same time.

Table 2

Route 20 at Ramp B/5th Avenue Existing Conditions

	AM Peak		PM Peak		Saturday Peak	
	Delay/Veh (s)	LOS	Delay/Veh (s)	LOS	Delay/Veh (s)	LOS
Route 20 NB Left (at Ramp B)	41.5	D	62.5	E	41.0	D
Route 20 SB Thru	3.8	A	4.5	A	2.4	A

	AM Peak		PM Peak		Saturday Peak	
	Delay/Veh (s)	LOS	Delay/Veh (s)	LOS	Delay/Veh (s)	LOS
(at Ramp B)						
Route 20 NB Thru (at 5 th Avenue)	3.3	A	3.4	A	3.5	A
Route 20 SB Thru (at 5 th Avenue)	6.2	A	8.4	A	5.3	A
Route 20 SB Right (at 5 th Avenue)	5.5	A	7.5	A	4.0	A
5 th Avenue Left	25.2	C	27.0	C	26.4	C

Northbound Left Turn Queue Analysis

Since the problem statement at both the Edward Avenue and 5th Avenue intersections are related to the overflow of the left turn lane, both the percentage of time and the percentage of cycles that the left turn lane overflows were analyzed at each intersection. As part of the field investigation, the percentage of cycles that the left turn queue extends beyond the available space was recorded and is shown in **Table 3**. In addition, Table 3 shows the percentage of time the left lane queue was beyond the storage space available during the simulation.

Table 3
Northbound Left Turn Queue versus Storage Analysis

	AM Peak		PM Peak		Saturday Peak	
	% Of Cycles Queue Exceeds Storage (Actual)	% Of Time Queue Exceeds Storage (Simulation)	% Of Cycles Queue Exceeds Storage (Actual)	% Of Time Queue Exceeds Storage (Simulation)	% Of Cycles Queue Exceeds Storage (Actual)	% Of Time Queue Exceeds Storage (Simulation)
Route 20 NB Left (At Edward Ave)	30%	24%	30%	39%	10%	8%
Route 20 NB Left (At Ramp B)	74%	32%	78%	57%	72%	29%

As can be seen from Table 3 above, the traffic analysis showed that at both intersections there are significant periods of time that the left turn lane overflows into the through lanes.

C. Crash Data Analysis

Crash data was received from NJDOT for 2006 thru 2009 and can be found in Appendix E as well as updated crash data for 2009 thru 2011 received from NJDOT in October 2012. A summary of the data for the various locations of the project is below:

1. Drainage (MP 0.70 to MP 3.35)

The NJDOT provided crash data from MP 0.60 to MP 3.45 of Route 20 for accidents occurring between 2006 and 2008. The following table summarizes the data.

2006 – 2008 Crash Data

MILE POST LIMITS	ACTUAL CRASH RATES (crashes/mvm)	STATEWIDE CRASH RATES FOR 2008 (crashes/mvm)
0.60 – 1.68	2.51	2.93
1.68 – 2.48	3.41	1.81
2.48 – 2.86	1.80	4.84
2.86 – 3.45	1.60	1.81

The only section of Route 20 that had a crash rate higher than statewide average was MP 1.68 to 2.48 and this was confirmed by the more recent crash data. This is the area in the vicinity of Edward Avenue. Additional discussion of crashes in this area can be found in Subsection 2 below.

Between MP 0.60 and MP 3.45, the statewide average for accidents in wet surface is exceeded in 2 areas, from MP 0.60 to 1.68 (27.72% vs. 22.05% average) and from MP 1.68 to 2.48 (36.88% vs. 22.05%). All other areas of the project have a wet surface crash rate less than the statewide average.

2. Safety (Edward Avenue)

In addition to the crash data obtained as part of the drainage CD, NJDOT provided Route 20 crash data in the vicinity of the Edward Avenue (MP 1.92) intersection for accidents occurring between 2007 and 2009. The overall crash rate in this area was higher than the statewide average as shown in the following table:

2007 – 2009 Crash Data

MILE POST LIMITS	ACTUAL CRASH RATES (crashes/mvm)	STATEWIDE CRASH RATES FOR 2009 (crashes/mvm)
1.67 – 2.17	3.44	1.83

The rate of the following crash types were higher than the statewide average:

- Same Direction - Sideswipe (18.95% vs. 15.72% average)
- Overturned (2.11% vs. 0.76%)
- Fixed object (34.74% vs. 12.01% average)
- At Signalized Intersections (22.11% vs. 12.98%)
- Wet surface (44.21% vs. 24.30% average)
- Ice (2.11% vs. 1.40%)
- Night (41.05% vs. 26.08% average)
- Dawn (3.16% vs. 1.41% average)

The overall crash rate for this section was nearly double the statewide average. The sideswipe crash rate is also higher than the statewide average. For the NB direction (which has 2 travel lanes), these sideswipe crashes appear to result from drivers

making lane changes—specifically from the left lane to the right lane - to avoid vehicles that typically queue-up on the left lane due to the upcoming signalized intersection (see Section IV – Traffic and Crash Summary for additional traffic analysis discussion).

Adding to the dilemma, drivers have difficulty seeing the upcoming signal because the Route 4 (Broadway) Bridge, median barriers and trees block their view. The signals in general provide adequate sight distance for the 35 mph speed limit; however, due to the 45 mph speed limit immediately in advance of the intersection, speeds are higher through the intersection. Signal sight distance is not adequate for 45 mph speeds. In addition, although there is adequate sight distance of the through movement signal, the left turn signals are not visible until the motorist is directly underneath the Route 4 Bridge. Since the NB through movement signals are always green, the visibility of the left turn signals is critical in the safety of the intersection.

This intersection also experiences much higher than statewide average fixed object accidents and wet surface accidents. 34.74% of accidents at this intersection are with a fixed object, nearly 3 times the 2009 statewide average of 12.01%. 44.21% of accidents occur while the road surface is wet, which is nearly double the 2009 statewide average of 24.30%. These accidents are interrelated as 59% of all fixed object accidents at this location occurred with a road surface wet, snowy, or icy. This intersection also exceeds the 2009 statewide average for night accidents (41.05% vs. 26.08% average).

Same direction rear end type accidents make up the majority of accidents at this intersection although the rates do not exceed the 2009 statewide average. Nearly all of these accidents occur in the SB direction approaching the signal. These crashes are likely caused by the combination of high traffic volumes, long queues and the signal being located just beyond a horizontal curve. Although the SB horizontal curve provides adequate horizontal sight distance for the 35 mph speed limit, it is not adequate for 45 mph. The problem statement from the previous Tier 2 Screening mentions that there is a missing “Signal Ahead” sign in the SB direction. There is currently a W3-3 “Signal Ahead” warning sign approximately 900 feet in advance of the intersection which may have been installed after the Tier 2 Screening.

3. Safety (5th Avenue)

In addition to the crash data obtained as part of the drainage CD, NJDOT provided Route 20 crash data in the vicinity of the 5th Avenue (MP 3.35) intersection for accidents occurring between 2007 and 2009. Similar to Edward Avenue, the crash rate in this area was higher than the statewide average as shown in the following table:

2007 – 2009 Crash Data

MILE POST LIMITS	ACTUAL CRASH RATES (crashes/mvm)	STATEWIDE CRASH RATES FOR 2009 (crashes/mvm)
3.10 – 3.60	2.23	1.83

It should be noted that the 2006 to 2008 crash data obtained as part of the drainage CD did not show the crash rate in this area to be above statewide average. The increase in crash rate is likely due to the opening of the Home Depot in summer of 2008 at the northwest corner of the 5th Avenue intersection. The 2009 collision diagram shows a cluster of rear end accidents at Route 20 SB at 5th Avenue that is not evident in prior years.

The rate of the following crash types were higher than the statewide average:

- Same Direction – Rear End (55.77% vs. 47.12% average)
- Same Direction - Sideswipe (17.31% vs. 15.72% average)
- Angle (11.54% vs. 10.71% average)
- Head On (3.85% vs. 1.84% average)
- Backing (3.85% vs. 0.80% average)
- At signalized intersections (46.15% vs. 12.98% average)
- At unsignalized intersections (23.08% vs. 16.29% average)
- Wet surface (25.00% vs. 24.30% average)
- Snow (3.85% vs. 2.19%)
- Ice (3.85% vs. 1.40%)
- Night (30.77% vs. 26.08% average)
- Dawn (1.92% vs. 1.41%)

For the NB direction (which has 2 travel lanes), similar to Edward Avenue, crashes appear to result from drivers making lane changes—specifically from the left lane to the right lane—to avoid vehicles that typically queue-up on the left lane due to the Ramp B signalized intersection (see Section IV – Traffic and Crash Summary for additional traffic analysis discussion). Although the collision diagrams do not show excessive crashes at this location, based on discussions with local officials as well as the crash data provided by Paterson Police Department as part of the Problem Statement which stated that 24 crashes occurred at this location between January 2007 and November 2007, this is a problem area for crashes.

Same direction rear end accidents are the most common accident. The majority of them occurred in the SB direction, with most occurring in 2009. A retaining wall that runs along the Route 20 SB side of the Home Depot obstructs sight distance and may be a contributing factor but sight distance is still adequate for the 45 mph speed limit. Trees planted along the border obstruct the view of the traffic signal at 5th Avenue.

D. Traffic Volume Forecasts

In order to establish design year traffic volumes, the NJTPA database for their 2035 Regional Transportation Plan (adopted August 24, 2009) was consulted for growth rates that would apply to Passaic County, NJ where this project is located.

The NJTPA year 2035 forecasts (and their base year 2005 data) of population and employment for Passaic County are presented in the following table.

NJTPA GROWTH FORECASTS	Population		Employment	
	2005	2035	2005	2035
Passaic County	492,800	609,000	184,400	222,400
Annual growth rate	0.7%		0.6%	

Based on the above information, the recommended annual growth rate is 0.7%, which is the averaged value of the growth rates for population and employment. By applying this growth rate to the Route 20 traffic counts that were collected in 2010 under this project, the design **year 2031 volumes** can be calculated using **growth factor of 1.16**.

TRAFFIC VOLUMES	Base Year	Design Year
	2010	2031
Route 20 At Edward Ave AM peak, VPH (NB peak direction, 1-way)	2,170	2,517
Route 20 At Edward Ave PM peak, VPH (SB peak direction, 1-way)	2,200	2,552
Route 20 At Edward Ave ADT, veh/day (2-way)	50,406	58,358
Route 20 At 5 th Ave AM peak, VPH (SB peak direction, 1-way)	1,296	1,503
Route 20 At 5 th Ave PM peak, VPH (NB peak direction, 1-way)	1,545	1,792
Route 20 At 5 th Ave ADT, veh/day (2-way)	45,438	52,606

V. SOCIAL, ECONOMIC AND ENVIRONMENTAL CONSIDERATIONS

A. Community Outreach

Meeting with Paterson Officials to Discuss Flooding (October 27, 2009)

Dewberry officials met with the City Engineer and the DPW Director to discuss flooding problems along Route 20. The results of the meeting can be found in a meeting memo located in Appendix N.

Paterson Local Officials Briefing (September 7, 2011)

A presentation was made to Paterson Local Officials on September 7, 2011. The purpose of this meeting was to present the results of the Safety CD at Edward Avenue, the Safety CD at 5th Avenue and Drainage CD along Route 20 and the Preliminary Preferred Alternatives (PPA) for each CD to the Paterson Local Officials. The PPAs presented were generally well received.

Hongchao Yu, the Paterson Traffic Engineer, requested that the feasibility of adding a left turn movement from Broadway onto the Route 20 SB ramp be investigated to improve the level of service of the right turn movement from Edward Avenue to Route 20 SB. However, this will require an additional phase at the new intersection and could have negative impacts on the overall traffic performance.

Paterson Local Officials Briefing (February 23, 2012)

The purpose of this meeting was to review materials presented in the previous local officials briefing held September 7, 2011 and to present some new information requested at the previous presentation. Paterson officials were informed that the option of adding a Route 4 WB left turn at the new signalized intersection was investigated. Although it improved the Edward Avenue right turn onto Route 20 SB movement to a LOS A, the LOS at the new intersection is not good. The WB left turn and the EB thru movement are both a LOS F in the AM and PM peak.

Steve Edmond, Passaic County Engineer, inquired if a left turn from E. 43rd Street to Route 4EB was investigated. This was not investigated but it would have a detrimental effect on the traffic operations. In addition, the left turn lane would need to be opposite the left turn lane in the opposite direction which could result in a motorist going through the intersection in the wrong direction down Ramp B. For these reasons, it was concluded that it would not be a good option to investigate.

Paterson Council Workshop Presentation (March 20, 2012)

The Edward Avenue, 5th Avenue and drainage improvement PPAs were presented by Shaenna Miller, Ted Terasaki, and Peter Black to the Paterson Council at their workshop. The PPAs were presented for the purpose of obtaining a resolution of support of the PPAs from Paterson. In general, the PPAs were well received by the Council. Councilman McKoy commented that he would like to see a left turn movement from Edward Avenue to Route 20 NB. Because there is no access to Route 20 NB, it is creating a traffic congestion at 10th Avenue and he requested that the State look at providing a roundabout at 10th Avenue. It was clarified that the purpose of the CD is to primarily improve safety and traffic considerations are secondary. In addition, Councilwoman Ames- Garnes commented that in snowy conditions, vehicles have difficulty traversing Route 4 west of E. 43rd Street and tow trucks need to be called. This should be addressed during Preliminary Engineering Design Phase.

A resolution of support endorsing the project was passed by the City of Paterson on May 22, 2012 and is included in Appendix S.

Coordination with Paterson will be required throughout the design to develop a construction staging plan that balances maintenance of Route 20 traffic with minimizing construction duration. Public Involvement Action Plan (PIAP) for the PE phase has been prepared and can be found in Appendix T. It outlines the type and number of meetings, briefings and public information centers that are planned for the next phase of the project.

B. Cultural Resources

Based on the Environmental and Landscaping Screening (Appendix I) performed by NJDOT, most of the project area appears to be located within an area previously known for prehistoric archaeological sites. On the western side of Route 20 from MP 1.4 (Park Avenue) to approximately MP 1.66, the Eastside Park Historic District (NR: 7/7/04) (SR: 5/10/04), is immediately adjacent and at points within the project area.

C. Ecology/Wetlands

Based on the Environmental and Landscaping Screening (Appendix I) performed by NJDOT, wetlands areas were identified within the project area. During preliminary engineering, a reevaluation will be required to determine the actual level of impacts.

D. Floodplain

Floodplains exist on and along Route 20 based on FEMA FIRM Mapping and NJDEP Flood Hazard Area Mapping for the Passaic River.

E. Waterfront Development

A NJDEP Waterfront Development permit is not required for the project.

F. Threatened/Endangered Species

Based on the Environmental and Landscaping Screening (Appendix I) performed by NJDOT, there is no potential for rare, threatened or endangered species or their habitats within the project limits.

G. Stormwater

The project currently has no net increase in impervious area. However, there will be runoff from the raised northbound roadway in the vicinity of 5th Avenue (for the 5th Avenue PPA) that is proposed to be collected via inlets and curbing. This runoff currently sheet flows off of the umbrella section and flows into the river. The area that currently sheet flows and is proposed to be collected and discharged must not exceed 0.25 acres, otherwise water

quality will be required. If water quality is required a basin could be installed in the infield Ramp B area. If it is a dry basin, a Manufactured Treatment Device will be required for pretreatment to achieve 80% TSS removal. Therefore, compliance with the NJDEP Stormwater Management Rules may be necessary. This assessment will have to be revisited as the design progresses during the Preliminary Engineering phase of the project. Stormwater quantity and recharge requirements will also need to be met by matching pre and post hydrographs.

H. Socioeconomics

Based on the Environmental and Landscaping Screening (Appendix I) performed by NJDOT, there are no anticipated impacts to the residences or businesses within the project area.

I. Hazardous Waste

Based on the Environmental and Landscaping Screening (Appendix I) performed by NJDOT, there is a potential for involvement with contamination. Therefore, additional studies will be required in Preliminary Engineering Design Phase.

J. Environmental Summary

In summary, the project has the potential to impact historic architectural and archaeological resources, wetlands, and floodplains. A letter from the NJDEP Historic Preservation Office was received concurring with NJDOT's assessment that the PPAs selected will have no effect upon historic properties and that the submission of an Application for Project Authorization pursuant to the New Jersey Register of Historic Places Act will not be required. A copy of the correspondence can be found in Appendix N.

The project also has the potential for involvement with hazardous waste or contaminated sites. The probable NEPA document for this project is a Categorical Exclusion Document (CED). See Appendix I for the Environmental and Landscape Screening Report.

K. Environmental Permits Anticipated

The following environmental permits may be potentially necessary:

Flood Hazard Area Individual Permit for fill associated with the raising of the road, riparian disturbances for the construction of a retaining wall, and stormwater management for a major project (exceeding one acre of disturbance and/or an increase of impervious area of more than 0.25 acres), Fresh Water Wetlands GP11 for outfalls/intakes for new outfalls into the Passaic River and a Transition Area Waiver Special Activity Linear Development permit for work within the 50 foot transition area of any fringe wetlands along the Passaic River.

VI. EVALUATION OF CONCEPTUAL ALTERNATIVES

A. Conceptual Alternatives - Drainage

The conceptual alternatives considered for reduction/mitigation of flooding are described below. Plans for each of the alternatives are provided as Sheets 1 through 10 in Appendix J, and supporting computations for cost estimates appear in Appendix Q of this report. An Alternatives Comparison Matrix summarizing the differences between the drainage alternatives can be found in Appendix R.

Milepost (MP) 0.7- Low Point under the Route 80 Underpass Alternative 1 – Installation of Additional Inlets

Operational and safety improvements, including drainage improvements, were performed at this location in 2004. The existing pipes at MP 0.70 are compliant with NJDOT standards during the 10-year flood above low points and the 15-year flood below low points. However, the gutter spreads in this section do not comply with NJDOT standards. In order to achieve compliance with NJDOT standards for allowable gutter spreads, this alternative includes the installation of B inlets, double B inlets and Reinforced Concrete Pipe (RCP). The upgraded drainage system would yield compliant gutter spreads for the 10-year flood. The conceptual cost for this alternative is \$215,000 and Sheet 1 depicts the improvements proposed for this alternative.

Milepost (MP) 0.7- Low Point under the Route 80 Underpass Alternative 2 – No Build

During meetings with NJDOT Maintenance on October 28, 2009 and with the City of Paterson on October 27, 2009, it was discussed that there were no known flooding problems at this area. This alternative proposes no improvements to this area. Under this No Build Alternative the gutter spreads would not comply with the NJDOT standards but the existing pipes in this section would remain compliant with NJDOT standards during the 10-year flood above low points and the 15-year flood below low points.

MP 0.85 - Low Point under the Railroad Bridge North of 21st Avenue Alternative 1 – Installation of Additional Inlets and Larger Pipes

This section of Route 20 was reported as one of the worst flash flooding locations by representatives of NJDOT and the City of Paterson. The City of Paterson reported that during heavy rainfall water depths rise quickly and reach to approximately three (3) feet under the New York Susquehanna & Western Railroad Bridge (low point). The City of Paterson reported that the drainage system at the low point under the railroad bridge was cleaned and that the low point did not flood as quickly and as severely as it did in the past. The existing pipes in this section are noncompliant with NJDOT standards during the 10-year flood above low points and the 15-year flood below low points. The gutter spreads are also noncompliant with NJDOT standards. Flooding in this section is

due to extraneous overland/over street flow, which runs down Market Street and 21st Avenue from the City of Paterson, entering the Route 20 drainage system. In order to meet the current NJDOT hydraulic grade line (HGL) and spread requirements larger pipes and additional inlets are required at this location. Under this alternative the existing outfall pipe that drains the low point under the railroad is proposed to be lined using Cured in Place Pipe (CIPP) lining instead of being replaced due to its close proximity to an existing sign structure. Lining the existing 30" RCP using a CIPP lining will provide additional capacity to the drainage system without disturbing the sign structure due to CIPP having a lower Manning's n-value than concrete. Double B inlets, B inlets, a manhole and RCP will be provided to either augment or replace the existing drainage system. These improvements yield compliant HGLs for the 10 and 15-year floods above and below low points, respectively. The upgraded drainage system would not yield compliant gutter spreads for the 10-year flood. The conceptual cost for this alternative is \$776,000 and Sheet 1 depicts the improvements.

MP 0.85 - Low Point under the Railroad Bridge North of 21st Avenue
Alternative 2 – Installation of Additional Inlets, Larger Pipes and Trench Drains

This alternative includes the improvements mentioned above in Alternative 1 plus an extensive amount of additional inlets, pipes and trench drains. In order to achieve compliance with NJDOT standards for allowable gutter spreads, additional inlets and trench drains must be installed along 21st Avenue, Market Street and East 42nd Street to collect runoff that bypasses the City of Paterson drainage system. This causes the runoff to be captured by the inlets and conveyed to the Passaic River before it reaches (floods) Route 20. This alternative includes B inlets, Double B inlets, D-1 inlets, trench drains, RCP and a headwall. The upgraded drainage system yields compliant gutter spreads for the 10-year flood and compliant HGLs for the 10 and 15-year floods above and below low points, respectively. The conceptual cost for this alternative is \$1.59 million and Sheet 2 depicts the improvements.

MP 0.96 - 20th Avenue Intersection
Alternative 1 – Installation of Additional Inlets and Larger Pipes

During separate meetings with representatives of NJDOT and the City of Paterson in October of 2009 flooding was not reported at this location. The City indicated that flooding occurred at this location prior to the construction of the roadway and drainage improvements which were part of the Lowe's project. Review of the Lowe's project indicates that drainage improvements were constructed on the NB side of Route 20 but not the SB side. The existing pipes in this section are noncompliant with NJDOT standards during the 10-year flood above low points and the 15-year flood below low points. The gutter spreads are also noncompliant with NJDOT standards. In order to meet current NJDOT HGL and spread requirements B inlets, double B inlets, manholes, D-1 inlets and RCP will be provided to either augment or replace the existing drainage system. These improvements yield compliant HGLs for the 10 and 15-year floods above and below low points, respectively. The upgraded drainage system would not yield

compliant gutter spreads for the 10-year flood. This alternative focuses on improving the drainage conditions at the intersection of Route 20 and 20th Avenue and along the median barrier. The conceptual cost for this alternative is \$548,000 and Sheet 1 depicts the improvements.

MP 0.96 - 20th Avenue Intersection

Alternative 2 – Installation of Additional Inlets, Larger Pipes and Trench Drains

This alternative includes the improvements mentioned above in Alternative 1 plus an extensive amount of additional inlets, pipes and trench drains along Route 20 and 20th Ave to collect runoff that bypasses the City of Paterson drainage system. This alternative focuses on improving the gutter spread along Route 20 by collecting run off from the contributing drainage area before it reaches the 20th Avenue intersection (low point). In order to meet current NJDOT hydraulic grade line (HGL) and spread requirements, B inlets, D-1 inlets, a manhole, RCP, and trench drains will be provided to either augment or replace the existing drainage system. These improvements yield compliant HGLs for the 10- and 15-year floods above and below low points, respectively. The upgraded drainage system yields compliant gutter spreads for the 10-year flood and compliant HGLs for the 10 and 15-year floods above and below low points, respectively. The conceptual cost for this alternative is \$1.046 million and Sheet 2 depicts the improvements.

MP 0.96 - 20th Avenue Intersection

Alternative 3 – Installation of Additional Inlets

This alternative focuses on improving localized ponding along the Route 20 southbound median barrier near 20th Ave. Pavement depressions were observed along the median barrier where as-built drawings indicate a drainage inlet. During a site visit it was difficult to identify if the inlet existed. The proposed improvements do not yield compliant gutter spreads for the 10-year flood but would yield compliant HGLs for the 10 and 15-year floods above and below low points, respectively. This alternative proposes B inlets, D-1 inlets, a manhole and RCP. The conceptual cost for this alternative is \$110,000 and Sheet 3 depicts the improvements.

MP 1.4 to 1.55 – Park Avenue to Overlook Drive

Alternative 1 – Installation of Additional Inlets and Larger Pipes

Flooding at this section of Route 20 occurs at the inner southbound lane low point at Park Avenue and extends towards Overlook Drive. Flooding is due to extraneous flow from Park Avenue, Overlook Drive, Park Road and East Side Park entering Route 20 from the City of Paterson. The existing pipes in this section are noncompliant with NJDOT standards during the 10-year flood above low points and the 15-year flood below low points. The gutter spreads are also noncompliant with NJDOT standards. In order to meet current NJDOT HGL requirements and to improve spread conditions Double B inlets, B inlets, manholes, D-1 inlets, RCP and headwalls are proposed to either augment

or replace the existing drainage system. These improvements yield compliant HGLs for the 10 and 15-year floods above and below low points, respectively. The upgraded drainage system would not yield compliant gutter spreads for the 10-year flood but would improve the existing conditions. The conceptual cost for this alternative is \$2.290 million (\$715,000 + \$1,576,000) and Sheet 4 depicts the improvements.

MP 1.4 to 1.55 – Park Avenue to Overlook Drive

Alternative 2 – Installation of Additional Inlets, Larger Pipes, Trench Drains and Cutoff Swales

Alternative 2 was evaluated to provide drainage improvements including closely spaced inlets, cut off swales adjacent to the athletic fields, and trench drains along Route 20, Park Avenue, Park Road and Overlook Drive to capture the flow from the City of Paterson before entering Route 20. Due to the large drainage area and high amount of flow entering the right-of-way, a drainage system could not be designed that would comply with NJDOT spread requirements. This alternative was developed only to a very rough conceptual level, presented at the first Core Group meeting held April 25, 2011 and then eliminated from further consideration without detailed analysis. The conceptual cost for this alternative is \$3.407 million (\$874,000 + \$2,533,000) and Sheet 5 depicts the improvements.

MP 1.78 –Route 20 Southbound Under the Route 20 Northbound to Broadway Route 4

Alternative 1 – Installation of Additional Inlets and Larger Pipes

Flooding at this section of Route 20 occurs at the Route 20 southbound under pass for Broadway/Route 4. Flooding is due to extensive amounts of runoff from East Side Park and Broadway/Route 4 entering the onramp for Route 20 southbound from Broadway/Route 4. The onramp drainage system surcharges and causes flooding at the Route 20 southbound under pass. The existing pipes in this section are noncompliant with NJDOT standards during the 10-year flood above low points and the 15-year flood below low points. The gutter spreads are also noncompliant with NJDOT standards. Flooding in this section is due to inadequate pipe sizes and insufficient inlets. In order to meet current NJDOT hydraulic grade line (HGL) and spread requirements, Double B inlets, B inlets, a headwall and RCP will be provided to either augment or replace the existing drainage system. The upgraded drainage system yields compliant gutter spreads for the 10-year flood and compliant HGLs for the 10 and 15-year floods above and below low points, respectively. The conceptual cost for this alternative is \$602,000 and Sheet 4 depicts the improvements.

MP 1.78 –Route 20 Southbound Under the Route 20 Northbound to Broadway Route 4

Alternative 2 – Installation of Additional Inlets and Cutoff Swale

Alternative 2 was evaluated to contain runoff from East Side Park using a cut off swale adjacent to the athletic field along Broadway and the Route 20 southbound onramp. Due to the large drainage area and high amount of flow entering the right-of-way, a

drainage system could not be designed that complies with NJDOT spread requirements. This alternative was developed only to a conceptual level, presented at the first Core Group meeting held April 25, 2011 and then eliminated from further consideration without detailed analysis. The conceptual cost for this alternative is \$1.081 million and Sheet 5 depicts the improvements.

MP 1.86 to 1.92 – Broadway to Edward Avenue
Alternative 1 – Installation of Additional Inlets and Pipes

This location floods as a result of runoff from storm events flowing directly onto the roadway and from Passaic River flooding following prolonged periods of rainfall. During the Passaic River flooding of March 2010 and 2011, approximately 600 feet of the northbound and southbound roadways were inundated including the Edward Avenue intersection causing Route 20 to be closed. Based upon our analysis of the FEMA flood mapping, Route 20 begins to flood at the 3-4 year Passaic River flood level.

As a result of runoff from the City of Paterson streets and City property adjacent to Route 20 entering the roadway, flooding occurs at the north corner of the Edward Avenue/Route 20 intersection (water spreads into the outer lane), the southbound shoulder and outer lane between Edward Avenue and the Route 4 (Broadway) overpass, and at the low point with some water ponding in the Route 20 northbound left turn lane. The existing pipes at this section are noncompliant with NJDOT standards during the 10-year flood above low points and the 15-year flood below low points. The gutter spreads are also noncompliant with NJDOT standards.

Raising the roadway at this location was evaluated to prevent Passaic River flooding. Raising the Route 20 profile requires the replacement of the Route 4 Bridge over Route 20 just south of the Edward Avenue intersection. The estimated replacement cost of the bridge is \$17 million. The high cost of the bridge replacement precludes raising the Route 20 profile. In addition, federal funds would not be available since the bridge has a sufficiency rating greater than 50 which precludes it from federal funding.

In order to improve the drainage system to reduce the flooding along the SB inner lane, and at the low point and NB left turn slot to Edward Avenue and corner of Route 20/Edward Avenue, Double B inlets, B inlets, headwalls and RCP will be provided to either augment or replace the existing drainage system. The upgraded drainage system would not yield compliant gutter spreads for the 10-year flood but would yield compliant HGLs for the 10 and 15-year floods above and below low points, respectively. The conceptual cost for this alternative is \$727,000 and Sheet 4 depicts the improvements.

MP 1.86 to 1.92 – Broadway to Edward Avenue
Alternative 2 – Installation of Additional Inlets, Pipes and Trench Drains

This alternative includes the improvements mentioned above in Alternative 1 with the addition of trench drains on Edward Avenue and Route 20. This alternative focuses on improving the gutter spread along Route 20 by collecting run off from the contributing drainage area (primarily outside the Right of Way) and reducing spread before it reaches the Route 20 and Edward Ave intersection. The upgraded drainage system would not yield compliant gutter spreads for the 10-year flood but would yield compliant HGLs for the 10 and 15-year floods above and below low points, respectively. The conceptual cost for this alternative is \$1.067 million and sheet 5 depicts the improvements.

MP 1.86 to 1.92 – Broadway to Edward Avenue
Alternative 3 – Installation of Additional Inlets and Pipes -Safety PPA

Alternative 3 was developed for the PPA safety improvements at this location. The improvements are similar to Alternative 1 with modifications to the drainage system along the median barrier. The upgraded drainage system would not yield compliant gutter spreads for the 10-year flood but would yield compliant HGLs for the 10 and 15-year floods above and below low points, respectively. The conceptual cost for this alternative is \$810,000 and Sheet 6 depicts the improvements.

MP 2.66 to 2.68 - E. 33rd Street and 10th Avenue
Alternative 1 – Installation of Additional Inlets

The existing pipes in this section are noncompliant with NJDOT standards during the 10-year flood above low points and the 15-year flood below low points. The gutter spreads are also noncompliant with NJDOT standards. Flooding in this section is due to inadequate pipe sizes and insufficient inlets. Parts of the drainage in this section of Route 20 are connected directly to the combined sewer system (upstream of the regulator chamber) located on East 33rd Street. The City of Paterson has reported seeing the sewer system surcharging in this area. Options were evaluated to provide drainage improvements including closely spaced inlets, trench drains along Route 20, and drainage facilities on East 33rd and 34th streets. Due to the large drainage area and high amount of flow entering the right-of-way via East 33rd and 34th Streets, spreads cannot be controlled to within NJDOT criteria. During the storm of March 13, 2010, flooding was observed at the intersection of East 33rd Street and Route 20 SB and along Route 20 SB adjacent to the Dunkin Donuts. No flooding was observed at the East 33rd Street/Route 20 NB intersection or at MP 2.68. In order to decrease the flooding along Route 20, Double B inlets, B inlets and RCP will be provided to either augment or replace the existing drainage system. The upgraded drainage system would not yield compliant gutter spreads for the 10-year flood but would yield compliant HGLs for the 10 and 15-year floods above and below low points, respectively. The conceptual cost for this alternative is \$324,000 and Sheet 7 depicts the improvements.

An alternative to separate the roadway drainage system from the combined sewer system at this location was briefly evaluated (not included in this report) to determine cost and feasibility. It was determined that such an alternative would cost in excess of one million dollars due to the need to install all new roadway drainage and a new outfall heading north down East 33rd Street to the Passaic River. Currently sufficient right-of-way is unavailable for this outfall as East 33rd Street just north (east) of Route 20 northbound is occupied by a sizable regulator chamber owned by the City of Paterson. This information was presented to the Core Group and it was determined that separation of the combined sewer system is not a goal of this project and the benefit gained would be minimal. For this reason the separation alternative was not studied in detail.

MP 2.60 to 2.68 - E. 33rd Street and 10th Avenue
Alternative 2 – Installation of Additional Inlets

This alternative was developed after the April 25, 2011 Core Group Meeting. It was discussed that since the drainage system at this section of Route 20 is connected directly to the combined sewer system upstream of the regulator chamber located on East 33rd Street, the improvements proposed in alternative 1 would not be effective during significant storm events due to surcharging of the combined sewer system. Therefore this alternative focuses on addressing flooding observed at the intersection of E 34th Street and Route 20 southbound adjacent to the Dunkin Donuts. This alternative proposes B inlets and RCP to augment the existing drainage system. The upgraded drainage system would not yield compliant gutter spreads for the 10-year flood but would yield compliant HGLs for the 10 and 15-year floods above and below low points, respectively. The conceptual cost for this alternative is \$64,000 and Sheet 8 depicts the improvements.

MP 3.10 to 3.35- 7th Avenue to 5th Avenue
Alternative 1 – Installation of Additional Inlets

This location floods as a result of runoff from storm events flowing directly onto the roadway and from Passaic River flooding following prolonged periods of rainfall (from the intersection of 5th Ave to Grimes Place). During the Passaic River flooding of March 2010 and 2011, approximately 900 feet of the northbound and southbound roadway was inundated including the 5th Avenue intersection. Route 20 was closed at this location. Based upon our analysis of the FEMA flood mapping, Route 20 begins to flood at the approximate 3-year Passaic River flood level. This alternative focuses on addressing flooding caused by runoff from storm events flowing directly onto the roadway. Extensive amounts of runoff from the City of Paterson bypass the City's combined sewer system and enter Route 20 causing flooding due to inadequate pipe sizes and insufficient inlets.

The Route 20 drainage system at this location is not compliant with NJDOT drainage requirements. The proposed drainage improvements will reduce the flooding along the

southbound inner lane, at the low point and northbound left turn slot to Grimes Place and the corner of Route 20/5th Avenue. The improvements focus on capturing runoff from the City of Paterson at 7th Ave, Grimes Place and 5th Ave and decreasing spread along the Route 20 southbound median barrier. The proposed improvements would not yield compliant gutter spreads for the 10-year flood but yields compliant HGLs for the 10 and 15-year floods above and below low points. This alternative proposes Double B inlets, B inlets and RCP to augment the existing drainage system. The conceptual cost for this alternative is \$2.61 million (\$723,000 + \$1,887,000) and Sheet 9 depicts the improvements.

MP 3.10 to 3.35- 7th Avenue to 5th Avenue
Alternative 2 – Installation of Additional Inlets & Raising Road

This alternative was developed for the PPA safety improvements and for the raising of Route 20 above the 10-year Passaic River flood elevation. The drainage at the intersection of 7th Ave and Route 20 is proposed to be the same as presented in alternative 1. For the raising of Route 20, conceptual roadway drainage was developed without inverts and pipe sizes because a new roadway design is required. It is estimated that the proposed improvements requires two new outfalls and the associated drainage pipe and inlets shown on sheet 10. The conceptual cost for this alternative is approximately \$5.0 million.

B. Conceptual Alternatives – Safety (Edward Avenue)

In addition to the No Build alternative, seven (7) alternatives were considered for safety improvements at Edward Avenue and are described in this section. An Alternatives Comparison Matrix summarizing the differences between the alternatives can be found in Appendix R. Some of the alternatives described below were developed only to a conceptual level, presented at the first Core Group meeting held April 25, 2011 and then eliminated from further consideration without detailed analysis. Those alternatives are not included in the Alternatives Comparison Matrix. The traffic analysis of the alternatives were performed using existing traffic volumes projected to the year 2031 as described in Section IV D – Traffic Volume Forecasts. A Traffic Performance Summary of the various alternatives can be found in Appendix F.

No Build Alternative

Under this alternative, the percentage of time that the Route 20 NB left lane overflows into the through lane increases compared to existing conditions during the AM peak (30% vs. 24%) and Saturday peak (16% vs. 8%). This will in all likelihood result in increased crashes at this location. The Route 20 SB queues will increase as well, especially during the Saturday peak (1996' vs. 520'). This may result in additional crashes in the SB direction as well since the collision diagrams show numerous rear end crashes.

Positives:

- No cost

Negatives:

- Increase in Route 20 NB left lane overflow
- Increase in the SB direction traffic queue

1. Retiming of Signal & Install Advanced Warning Signs, Tree Clearing

This alternative provides advanced warning signs in both NB and SB directions and adds time to left turn/right turn phase of the traffic signal. The warning signs would consist of either a static or blankout sign northbound and a flashing “Red Signal Ahead” sign in the southbound direction. In addition existing loop detectors will be replaced with image detectors and trees will be cleared in the northbound direction to improve sight distance of the traffic signal.

Based on the traffic analysis, the percentage of time that the left turn lane overflows into the through lane is reduced compared to the 2031 No Build scenario during the AM peak (23% vs. 30%), the PM peak (32% vs. 39%) and Saturday peak (15% vs. 16%). The drawback is the traffic operations of the Route 20 SB movement would be worsened. The SB average queue length would increase during the AM peak (3067’ vs. 1216’), the PM peak (2442’ vs. 2159’) and Saturday peak (2349’ vs. 1996’).

Positives:

- Proper signing will allow for better driver expectation in advance of the signal which has limited sight distance
- The amount of time left turn traffic encroaches onto the thru lane is reduced compared to No-Build
- Traffic signal sight distance is improved in NB direction
- Minimal construction cost

Negatives:

- Traffic delays would be increased in the SB direction.

2. Left Turn Storage Length Increase (50’), Retiming of Signal & Install Advanced Warning Signs, Tree Clearing

This alternative provides advanced warning signs in both NB and SB directions and adds time to left turn/right turn phase of the traffic signal. Similar to Alternative 1, the warning signs would consist of either a static or blankout sign NB and a flashing “Red Signal Ahead” sign in the SB direction. This alternative also increases the Route 20 NB left turn storage length by 50 feet by reconstructing and realigning the median barrier without impacting the Route 4 bridge. In addition existing loop detectors will be

replaced with image detectors and trees will be cleared in the NB direction to improve sight distance of the traffic signal.

Based on the traffic analysis, the percentage of time that the left turn lane overflows into the through lane is reduced compared to the 2031 No Build scenario during the AM peak (9% vs. 30%), the PM peak (17% vs. 39%) and Saturday peak (5% vs. 16%). Although better than Alternative 1, the traffic operations of the Route 20 SB movement would still be worsened. The SB average queue length would increase during the AM peak (1699' vs. 1216'), the PM peak (2359' vs. 2159') and Saturday peak (2120' vs. 1996').

Positives:

- Proper signing will allow for better driver expectation in advance of signal which has limited sight distance
- Amount of time left turn traffic encroaches onto thru lane is reduced compared to No-Build
- Traffic signal sight distance improved in NB direction
- Minimal construction cost
- No impact to Route 4 Bridge over Route 20

Negatives:

- Traffic delays increased in the SB direction
- Encroachment of left turn traffic onto thru lane is not eliminated, only reduced

3. Provide NB Double Left turn lanes, Retiming of Signal & Install Advanced Warning Signs, Tree Clearing

This alternative provides advanced warning signs in both NB and SB directions and adds time to left turn/right turn phase of the traffic signal. Similar to Alternative 1 and 2, the warning signs would consist of either a static or blankout sign NB and a flashing "Red Signal Ahead" sign in the SB direction. NB lane assignments would be changed from one exclusive left turn lane and 2 exclusive (free movement) thru lanes to two exclusive left turn lanes and 1 exclusive thru lane (free movement). SB right turn would be signalized, and the channelization reconstructed and additional time will be allocated to the SB movement. In addition existing loop detectors will be replaced with image detectors and trees will be cleared in the NB direction to improve sight distance of the traffic signal.

Based on the traffic analysis, the percentage of time that the left turn lane overflows into the through lane is reduced compared to the 2031 No Build scenario during the AM peak (2% vs. 30%), the PM peak (3% vs. 39%) and Saturday peak (5% vs. 16%). In addition, the traffic operations of the Route 20 SB movement would be considerably improved. The SB average queue length would decrease during the AM peak (287' vs. 1216'), the PM peak (277' vs. 2159') and Saturday peak (315' vs. 1996'). However, the impacts to the Route 20 NB through traffic are extensive as the number of through lanes is reduced to one. The slowdowns on Route 20 NB occur much further south as drivers

heading north move to the right lane. During the first Core Group meeting, it was determined that this alternative is infeasible due to the poor traffic performance and increase to driver confusion for NB vehicles.

Positives:

- Proper signing will allow for better driver expectation in advance of signal which has limited sight distance
- Amount of time left turn traffic encroaches onto thru lane is reduced compared to No-Build and Alternative 1 and 2
- Overall signal performance is improved due to better SB direction performance
- Traffic signal sight distance improved in NB direction

Negatives:

- Slowdowns on Route 20 NB occur much further south as drivers heading thru move to right lane (2400 vph in one lane), results in unacceptable traffic operations
- Route 20 roadway reconstruction required at median island and channelized island
- Widening of Edward Avenue required
- Utility pole relocation and drainage inlet replacement required on Edward Avenue
- Possible impact to existing parking lot on Edward Avenue

4. Creation of New Signalized Intersection at Route 4 / E. 43rd Street

This alternative eliminates the Route 20 NB left turn movement by extending the median barrier through the Edward Avenue intersection. The NB traffic signal would be removed since the NB traffic would become a free flow movement. The left turning vehicles would be redirected to the existing Route 20 NB to Route 4 EB ramp (Ramp B) and a new Ramp B/Route 4 signalized intersection would be created at the end of the ramp to allow for vehicles to access Route 4 WB and East 43rd Street. The existing ramp from Route 20 SB to Route 4 EB (Ramp C) would remain unchanged as an access to only Route 4 EB and access to the new intersection at Route 4 will not be allowed to prevent weaving with the Ramp B traffic. Advance warning signs will be required on Route 4 WB for the right lane which will be for right turns only. "Red Signal Ahead" warning signs will be required on Route 4 EB as well for the new traffic signals since the visibility of the new signals are restricted by the preceding vertical curve and pedestrian bridge.

Having signals along this part of Route 4/Broadway is within its existing character as there are other existing signals nearby both to the west and east. Pedestrian accessibility can be provided using an existing pedestrian bridge crossing Route 4 to the west of the proposed signal location. Traffic analysis of this new intersection showed that the AM and PM peak level of service to be as follows:

Route 4 / Ramp B Intersection Levels of Service

	LOS AM (PM)
Ramp B LT	D (C)
Ramp B Thru	C (D)
Route 4 WB Thru	A (C)
Route 4 EB Thru	B (B)

Based on the above, the LOS for the Ramp B movements are slightly better compared to the Route 20 NB left turn LOS of E (F) under the No Build alternative. There are improvements on Route 20 SB as well. Although the LOS remains an F under Alternative 4, the queues during the PM peak would decrease from 2159' to 620'. This could help reduce the number of crashes in the SB direction. The LOS of the right turn movement from Edward Avenue to Route 20 SB is D (D) which is worse than the No Build alternative LOS of B (C). If desired, the signal timing can be adjusted to provide more green time to the Edward Avenue right turn movement.

During a local officials briefing, Paterson requested the option of adding a left turn movement from Route 4 WB to Route 20 SB be investigated to improve the Edward Avenue right turn LOS mentioned above. The subsequent traffic analysis showed excessive delays in both the WB and EB directions of Route 4 and was deemed infeasible. Also, during the presentation to the Paterson Council, it was mentioned that during snow storms, cars have difficulty negotiating the slope to the west of E. 43rd Street. Although the new intersection is not located on a slope but at the low point, provisions for improving the friction factor of the pavement on the slope should be investigated during design.

Positives:

- Elimination of Route 20 NB left turns at Edward Avenue intersection will enhance safety in both directions of Route 20
- Construction cost minimized because existing ramp can be used.

Negatives:

- Introduces a new signal on Route 4 as well as a gap in the existing median barrier curb
- Additional advanced signing is required in both directions of Route 4

5. Eliminate Left Turns at Edward Avenue

This alternative, similar to Alternative 4, eliminates the Route 20 NB left turn movement by extending the median barrier through the Edward Avenue intersection. The left turn movement would be moved to another location north of Edward Avenue (possibly E 39th St., E 38th St. or E 37th St.). Because the left turn lane would not be restricted by bridge piers and the SB approach would no longer be after a horizontal curve, this alternative would be safer and operate better than the existing condition. However,

sending all of the Route 4 WB bound traffic through local streets was seen as not acceptable and was not further evaluated.

Positives:

- Greater left turn storage length can be provided without nearby bridge restriction

Negatives:

- Redirects additional traffic down local streets
- New study area required

6. Provide 300' Left Turn Lane for Route 20 NB

This alternative creates a 300' long left turn lane able to store most of the Route 20 NB left turning vehicles. Two variations of this alternative were investigated - Alternative 6A which widens Route 20 to the west and Alternative 6B which widens Route 20 towards the river. Both would necessitate major reconstruction of the Route 4 bridge costing an estimated \$4.6 million. In addition, the bridge sufficiency rating is 55.3 which is above the threshold of 50, precluding it from federal funding.

Compared to the 2031 No Build scenario, the percentage of time that the left turn lane overflows into the through lane is significantly reduced during the AM peak (1% vs. 30%), the PM peak (0% vs. 39%) and Saturday peak (0% vs. 16%). However, there would be little change to the traffic operations of the Route 20 SB movement. The SB average queue length during the AM peak is 1218' (vs. 1216'), the PM peak is 2112' (vs. 2159') and Saturday peak is 2077' (vs. 1996').

Since this alternative would require the replacement of an otherwise structurally adequate bridge and since the State would be responsible for the total cost of the bridge replacement, it was not deemed feasible by the Core Group.

Positives:

- Amount of time Route 20 NB left turn traffic encroaches onto thru lane is essentially eliminated

Negatives:

- Costly construction due to major bridge reconstruction. Sufficiency Rating of 55.3 precludes federal funding of bridge replacement.
- No traffic operation improvement for Route 20 SB

7. Eliminate the 45 mph speed limit zones

This alternative eliminates the 45 mph speed limit zone in the vicinity of the intersection. Due to the fluctuating speed limit from 45 mph to 35 mph throughout the

project limits, motorists frequently speed in the lower speed limit zones. This alternative would provide a consistent 35 mph speed limit through Route 20.

Positives:

- Lower speeds and less confusion along Route 20
- Inexpensive construction

Negatives:

- Strict enforcement would be required for any benefit

C. Conceptual Alternatives – Safety (5th Avenue)

In addition to the No Build alternative, six (6) alternatives were considered for safety improvements at 5th Avenue and are described in this section. An Alternatives Comparison Matrix summarizing the differences between the alternatives can be found in Appendix R. Some of the alternatives described below were developed only to a conceptual level, presented at the first Core Group meeting held April 25, 2011 and then eliminated from further consideration without detailed analysis. Those alternatives are not included in the Alternatives Comparison Matrix. The traffic analysis of the alternatives were performed using existing traffic volumes projected to the year 2031 as described in Section IV D – Traffic Volume Forecasts. A Traffic Performance Summary of the various alternatives can be found in Appendix F.

No Build Alternative

Under this alternative, the percentage of time that the Route 20 NB left lane overflows into the through lane increases compared to existing conditions during the AM peak (47% vs. 32%), PM peak (57% vs. 35%) and Saturday peak (29% vs. 21%). This will in all likelihood result in increased crashes at this location.

Positives:

- No cost

Negatives:

- Increase in Route 20 NB left lane overflow

1. Retiming of Signal, Install Advanced Warning Signs, Remove Trees

This alternative provides advanced warning signs in NB direction and adds time to the Route 20 NB left turn phase of the traffic signal at Ramp B. The warning signs would consist of either a static or blankout sign. In addition, existing loop detectors will be replaced with image detectors and trees will be cleared in the NB and SB direction to improve sight distance of the traffic signal.

Based on the traffic analysis, the percentage of time that the left turn lane overflows into the through lane is reduced compared to the 2031 No Build scenario during the AM peak (31% vs. 47%), the PM peak (46% vs. 57%) and Saturday peak (20% vs. 29%).

Positives:

- Proper signing will allow for better driver expectation in advance of signal which has limited sight distance
- Amount of time left turn traffic encroaches onto thru lane is reduced compared to No-Build
- Overall signal performance is improved
- Minimal construction cost

Negatives:

- Amount of time NB left turn traffic encroaches onto thru lane remains high

2. Increase Left Turn Storage (440' Total), Retiming of Signal, Install Advanced Warning Signs, Remove Trees

This alternative would increase the Route 20 NB left turn storage length to 440' to eliminate instances of left turn lane overflowing into the through lanes. Two variations of this alternative were investigated. Alternative 2A widens Route 20 to the west, which necessitates cutting into a steep slope, installing a retaining wall and some right-of-way taking. Alternative 2B widens Route 20 to the east towards the Passaic River, requiring fill within the floodplain. This alternative was deemed not feasible due to permitting issues of fill within the floodplain. In addition, similar to Alternative 1, this alternative provides advanced warning signs in NB direction consisting of either a static or blankout sign and adds time to the Route 20 NB left turn phase of the traffic signal at Ramp B.

Based on the traffic analysis, the percentage of time that the left turn lane overflows into the through lane is reduced compared to the 2031 No Build scenario during the AM peak (0% vs. 47%), the PM peak (0% vs. 57%) and Saturday peak (0% vs. 29%).

Positives:

- Proper signing will allow for better driver expectation
- Left turn traffic encroaching onto thru lane is eliminated
- Overall signal performance is improved

Negatives:

- Considerable construction required to realign Route 20
- Alternative 2B will require fill in the flood plain

3. Eliminate Ramp B signal, Move Left Turn to 5th Avenue, Retiming of Signal & Install Advanced Warning Signs, Remove Trees

This alternative eliminates the Route 20 NB left turn signal at Ramp B as well as Ramp B and moves the left turn movement to the existing signal at 5th Avenue with a left turn lane approximately 400' long. In addition, this alternative includes all the elements of Alternative 1 such as advanced warning signs in NB direction, image detectors and tree clearing.

The traffic signal performance at the new combined intersection at 5th Avenue would perform much worse than the No Build alternative since the new signal would operate as a three phase operation instead of the current two phase. This would cause longer queues because the available green time would have to be split for another phase. For example, the SB LOS in the AM peak would be E for Alternative 3 vs. A for the No Build and the NB LOS in the PM peak would be D vs. A for the No Build. However, the percentage of time that the left turn lane overflows into the through lane is reduced compared to the 2031 No Build scenario during the AM peak (3% vs. 47%), the PM peak (56% vs. 57%) and Saturday peak (0% vs. 29%).

Geometrically, Route 20 SB would have to be realigned closer to the Home Depot retaining wall to accommodate the introduction of a NB left turn lane. This results in a substandard horizontal sight distance for the SB curve.

Positives:

- More room available to construct longer left lane at 5th Avenue
- Proper signing will allow for better driver expectation
- Left turn traffic encroaching onto thru lane is greatly reduced in AM peak
- Reduces number of signals along Route 20

Negatives:

- Left turn traffic encroaching onto thru lane is virtually the same as No-Build in PM peak – no benefit to longer left lane
- Signal performance worsens
- The right border of Route 20 SB is reduced by 10', bringing the existing keystone wall for Home Depot within the clear zone
- Horizontal sight distance is reduced below standard
- Substandard horizontal curves required to tie back into existing alignment

4. Geometric revisions to Ramp B/5th Avenue intersections, Combine signal at 5th Avenue with Ramp B signal, Retiming of Signal & Install Advanced Warning Signs, Remove Trees

This alternative introduces various geometric revisions to the Ramp B and 5th Avenue intersections. First, it moves the Ramp B intersection to a new location approximately 110' north of the current location and converts Ramp B to a 2-way ramp. The NB and SB

u-turn ramps would be eliminated. Based on the new geometry, NB traffic would make a u-turn by making a left turn at Ramp B, a right turn at 5th Avenue and a right turn onto Route 20 SB. SB traffic would make a u-turn by making a right turn at 5th Avenue, left turn at Grimes Place/Ramp B and a left turn onto Route 20 NB.

This alternative reconfigures the entrance ramp onto Route 20 SB to make it more parallel to Route 20 and to provide a short (50'±) acceleration lane. The existing ramp provides no acceleration lane.

This alternative also combines the Ramp B signal and the 5th Avenue signal at the new Ramp B intersection location which provides improved sight distance of the signal in the SB direction because it will be further from the horizontal curve. In addition, it will allow for a longer left turn storage lane (400' long) with limited roadway realignment required. Also, by moving the 5th Avenue signal to the south, it can be disconnected from the single controller that operates the Fair Lawn Avenue intersection and 4th Avenue intersection signals. By operating with a timed offset, coordination can be ensured without sacrificing optimal signal performance.

In addition, this alternative includes all the elements of Alternative 1 such as advanced warning signs in NB direction, image detectors and tree clearing. A wall and some ROW taking will be required between 7th Avenue and the SB entrance ramp due to the widening of Route 20 in this area.

Based on the traffic analysis, the percentage of time that the left turn lane overflows into the through lane is reduced compared to the 2031 No Build scenario during the AM peak (0% vs. 47%), the PM peak (5% vs. 57%) and Saturday peak (0% vs. 29%).

Positives:

- Proper signing will allow for better driver expectation
- Increased left turn storage space allowing for minimal instances of left turn storage being full
- Reduces number of signals along Route 20 and proposed signal is further from Fair Lawn Avenue Bridge signal
- Significantly better signal operation when compared to Alternative 3 due to use of double left turn lane for rerouted 5th Avenue vehicles, and U-turning traffic has easier movements
- SB vehicles will have better sight distance at new signal location.

Negatives:

- Considerable construction along Route 20 and Ramp B infield area is required
- Route 20 SB u-turn movement (necessary for Route 20 SB vehicles to access Fair Lawn Avenue) requires use of non-state highway roads
- Substandard acceleration lane

5. Geometric revisions to Ramp B/5th Avenue intersections, Eliminate signal at 5th Avenue, combine with Ramp B Intersection, 2 Phase Signal Operation, Retiming of Signal & Install Advanced Warning Signs, Remove Trees

This alternative, like Alternative 4, combines the Ramp B signal and the 5th Avenue signal at a new location between the two existing locations, but reverses the direction of traffic on the access roadway to the proposed signal. This allows for the signal to function as a two phase signal as opposed to a three phase signal, allowing for better performance. During the 2031 PM Peak, the Route 20 NB left turn and relocated 5th Avenue double left turn will function at a LOS D with Alternative 4 as opposed to a LOS C with Alternative 5.

In addition, this alternative includes all the elements of Alternative 1 such as advanced warning signs in NB direction, image detectors and tree clearing.

Members of the Core Group were concerned that the lane assignments would be confusing for drivers and would need to be extensively signed. As a result, this alternative was not further evaluated.

Positives:

- Proper signing will allow for better driver expectation
- increased left turn storage space results in minimal instances of left turn storage being full
- Reduces number of signals along Route 20
- Significantly better signal operation when compared to Alternative 4 because intersection functions as a 2 phase signal maximizing green times

Negatives:

- Signal timing for Route 20/5th Avenue is tied to Route 20/Fair Lawn Avenue Bridge and Route 20/4th Avenue so more traffic data needs to be collected for those streets to see what affect this alternative may have
- Considerable construction along Route 20 and Ramp B infield area is required
- Atypical driver movements required to accomplish 2 phase signal operation.

6. Clearance interval for Route 20 Southbound, Retiming of Signal & Install Advanced Warning Signs, Remove Trees

This alternative involves retiming the 4th Avenue, 5th Avenue and Fair Lawn Avenue signals to provide a clearance interval for Route 20 SB. This will help reduce accidents on Route 20 SB since queues back from the 5th Avenue intersection will be reduced.

In addition, this alternative includes all the elements of Alternative 1 such as retiming of NB left turn signal, advanced warning signs in NB direction, image detectors and tree clearing.

The percentage of time that the left turn lane overflows into the through lane compared to the 2031 No Build scenario is the same as Alternative 1 during the AM peak (31% vs. 47%), the PM peak (46% vs. 57%) and Saturday peak (20% vs. 29%).

Positives:

- Will prevent long SB queues at Route 20/5th Avenue in a location where numerous rear-end accidents are occurring due to stopping sight distance issues

Negatives:

- Amount of time NB left turn traffic encroaches onto thru lane remains high

D. Controlling Substandard Design Elements

Route 20 Safety PPA at Edward Avenue

On Route 20, it is anticipated that the existing substandard left (1') and right shoulder (0' to 8') widths on NB and SB within the project limits will remain. The standard width right shoulder (8') can be provided for most of the PPA limit but it must transition to meet the substandard shoulder widths (0') underneath Route 4 bridge. At the north end of the project, Route 20 would need to be widened to provide the standard left shoulder width of 3' but it would be of limited benefit since it would need to quickly transition to meet existing.

The substandard superelevation on Route 20 NB and SB will remain as well. Based on survey, the existing superelevation varies from 0.8% to 3.7% on NB and 1.0% to 4.7% on SB. Superelevation of approximately 4% would be required to comply with current design standards for a 40 mph, 575' R roadway. If the superelevation were to be improved, it would need to be improved along the whole length of curve which would require extending the project 600' to the north and reprofiling of Route 20 by either resurfacing or excavation. Although the overall crash rate in this area was above the statewide average, the collision diagrams show that crashes are clustered at the Edward Avenue intersection and there is not excessive crashes along the curve north of Edward Avenue.

The existing substandard horizontal sight distance (170') on Route 20 NB north of the Edward Avenue intersection will also remain since the existing 1' left shoulder would need to be widened to 14' to provide the 305' minimum sight distance for a 40 mph design speed on the existing 574' R curve.

The existing vertical clearances underneath the Route 4 bridge over Route 20 and the Ramp B bridge over Route 20 SB are substandard at 15.17' and 15.5' respectively (minimum = 16.5'). Improvements to the vertical clearance would require reconstruction of the bridges and raising of Route 4 profile over the Passaic River as well as the raising of Ramp B profile and is beyond the scope of this project.

On Route 4, it is anticipated that the existing substandard left (2') and right shoulder (0') widths on EB and WB as well as substandard left shoulder cross slope (1.5%) within the

project limits will remain. 9' widening of Route 4 would be required to provide the standard 3' and 8' left and right shoulder and is beyond the scope of the project. Since the length of project along Route 4 is only approximately 300', any widening would need to transition quickly to meet existing. The existing Route 4 profile consists of a sag curve ($K=41$) with a low point approximately at the E. 43rd Street intersection. This sag curve is substandard for a 45 mph design speed ($K_{min}=79$) and will require approximately a 4' raise in profile extending back to the bridge over Passaic River and down East 43rd Street as well as walls at the River View Post Acute Center to comply with current standards. These improvements are beyond the scope of the project.

On Ramp B, a sag vertical curve of $K=11$ adequate for 15 mph connecting Ramp B with Route 4 is proposed. There is an existing sag curve of $K=14$ on Ramp B. Since there are no profile changes proposed for Route 4, and the existing Ramp B bridge over Route 20 SB will not be touched, and since the Ramp B profile cannot deviate from the adjacent existing Ramp C profile, there is little flexibility in the design of the Ramp B profile. The standard sag K value is 26 for a 25 mph design speed.

Reasonable assurance of design exceptions has been approved by NJDOT and can be found in Appendix O. As noted by NJDOT, every effort should be made to improve the CSDEs to the greatest extent possible.

Route 20 Safety PPA at 5th Avenue/Ramp B

It is anticipated that the existing substandard left shoulder width (1') on Route 20 NB and SB will remain. The existing substandard horizontal sight distance on Route 20 NB and SB located south of the Ramp B intersection will remain as well. The proposed horizontal sight distance is 325' and 206' in the NB and SB direction respectively and the minimum required is 425' for 50 mph design speed. In order to comply with the shoulder width and horizontal sight distance standards, the NB left and right shoulder would need to be widened to 3' and 21' respectively and the SB left shoulder would need to be widened to 20'.

In the Route 20 SB direction, since the PPA eliminates the traffic signal at the 5th Avenue intersection, the lack of a deceleration lane will require a design exception. In addition, the proposed acceleration lane length (50') for Grimes Place onto Route 20 SB is less than the standard 450' and will require a design exception. This is however an improvement over existing conditions since there currently is no acceleration lane for Grimes Place. In addition, the collision diagrams show very few crashes in this area of the project. In order to construct a 450' long acceleration lane, high walls will be required since the roadside border in this area is heavily treed and sloped.

Finally, the proposed radius of Route 20 at the southern limit of PPA is substandard. The existing Route 20 alignment satisfies the minimum radius (926'R) design criteria for 50 mph and the proposed alignment is parallel to the existing alignment but a slight reduction in the radius to 840' is required to shift Route 20 to accommodate the lengthened NB left turn lane.

Reasonable assurance of design exceptions has been approved by NJDOT and can be found in Appendix O. As noted by NJDOT, every effort should be made to improve the CSDEs to the greatest extent possible.

Route 20 Drainage PPAs

The drainage PPAs within the project limits consist of installation of inlets and pipes at various locations along Route 20 (MP 0.85, MP 0.96, MP 1.4, MP 1.55, MP 1.78, MP 1.86, MP 1.92, MP 2.6, MP 3.10 & MP 3.35). Most of these drainage improvements are standalone drainage improvements with no other improvements anticipated. Drainage improvements are generally exempt from design exception procedure; however, since both the drainage and safety improvements will be combined into one project, design exceptions will be required in the drainage improvement areas. Some of the drainage improvements (at MP 1.86, MP 1.92 and MP 3.35) are within the limit of the safety PPAs and the discussion of the CSDEs in those areas are above.

The complete list of CSDEs anticipated within the limits of the drainage and safety PPAs is listed in Appedix E.

E. Discussions with Subject Matter Experts/Stakeholders

Core Group Meeting (April 25, 2011)

The purpose of this meeting was to present the results of the three CDs to NJDOT SMEs from various disciplines and to reach consensus on the PPAs at each location. See minutes in Appendix N. The PPAs as listed in this report were agreed upon by the Core Group.

Paterson Local Officials Briefing (September 7, 2011)

The PPAs presented were generally well received. See minutes in Appendix N.

Core Group Meeting (February 7, 2012)

The purpose of this meeting was to present the geometric layout of the safety PPAs since the safety PPAs were only presented schematically in the first Core Group meeting held April 25, 2011. In addition, the drainage PPAs discussed in the first Core Group meeting were reviewed.

For the Edward Avenue intersection, the horizontal and vertical sight distance along Ramp B approaching the location of the new signalized intersection on Route 4 were reviewed using Google Maps. The sight distance to back of proposed queues and signal heads will need to be verified. Some tree clearing may be required. In addition, a variation to the PPA was presented for Core Group consideration. It involves changing the E. 43rd Street southbound lane at the new signalized intersection from a right turn only movement to a right turn and through movement. This lane will then be controlled by the signal and will no longer be a free flow movement as it is under the original PPA. Generally, the traffic operation of this variation is slightly worse than the original PPA. However, the benefit of this variation is

twofold: the LOS of the Edward Avenue to Route 20 SB right turn is slightly improved and it provides an alternate access to Route 20 SB for the E. 43rd Street SB traffic when Route 20 is flooded and impassable. It was decided by the Core Group that the original PPA is preferred because of better traffic operations and to limit potential queues on Ramp B.

For the 5th Avenue intersection, reduced lane widths and a truck detour may be considered to expedite construction. Another way to expedite construction would be with short term (weekend) lane closures. Construction staging options will need to be discussed with Paterson. A one day staging workshop with stakeholders was suggested.

Paterson Local Officials Briefing (February 23, 2012)

Paterson officials were informed that the option of adding a Route 4WB left turn at the new signalized intersection was investigated and found to be unfeasible due to traffic impacts on Route 4. See minutes in Appendix N.

Paterson Council Workshop Presentation (March 20, 2012)

The Edward Avenue, 5th Avenue and drainage improvement PPAs were presented to the Paterson Council at their workshop. The PPAs were well received by the Council. Minor comments were made at the workshop. See minutes in Appendix N.

F. Preliminary Preferred Alternative

1. Drainage

MP 0.7 - Low Point under the Route 80 Underpass

The Preliminary Preferred Alternative is Alternative 2 – No Build as agreed upon at the April 25, 2011 Core Group meeting. The No Build alternative was selected for this location because operational, safety and drainage improvements were performed at this location in 2004. The existing drainage system meets the NJDOT hydraulic grade line criteria and the gutter spread is very close to meeting NJDOT spread criteria. Therefore it was agreed to utilize funds for improvements elsewhere.

MP 0.85 - Low Point under the Railroad Bridge North of 21st Avenue

The Preliminary Preferred Alternative is Alternative 1 – Installation of Additional Inlets and Larger Pipes as agreed upon at the April 25, 2011 Core Group meeting. Alternative 2 requires extensive amounts of inlets and trench drains to reduce the gutter spread along Route 20. Trench drains typically lead to maintenance problems and the closely spaced inlets are not practical; therefore, Alternative 1 was selected over Alternative 2.

MP 0.96 - 20th Avenue Intersection

The Preliminary Preferred Alternative is Alternative 3 – Installation of Additional Inlets as agreed upon at the April 25, 2011 Core Group meeting. Note that Alternative 3 was

developed after the Core Group meeting and includes a portion of Alternative 1 improvements. Alternative 3 was selected over the other two alternatives because it was the most practical solution to solving the ponding problem along the median barrier and also due to the limited downstream capacity of the drainage system which is .

MP 1.4 to 1.55 – Park Avenue to Overlook Drive

The Preliminary Preferred Alternative is Alternative 1 – Installation of Additional Inlets and Larger Pipes as agreed upon at the April 25, 2011 Core Group meeting. Alternative 2 was not selected because it requires Right of Way through the East Side Park ball fields (Green Acres) and parking area, extensive clearing and grading, and creates utility conflicts. The East Side Park is located in the East Side Park Historic District, and it is impractical to construct a 6 foot deep ditch along the Park Ball fields and Route 20.

MP 1.78 –Route 20 Southbound Under the Route 20 Northbound to Broadway Route 4

The Preliminary Preferred Alternative is Alternative 1 – Installation of Additional Inlets and Larger Pipes as agreed upon at the April 25, 2011 Core Group meeting. Alternative 2 was not select for the same reasons as mention above for MP 1.4 to 1.55.

MP 1.86 to 1.92 – Broadway to Edward Avenue

The Preliminary Preferred Alternative is Alternative 3 – Installation of Additional Inlets and Pipes -Safety PPA as agreed upon at the April 25, 2011 Core Group meeting. Note that Alternative 3 was developed after the Core Group meeting and includes a portion of Alternative 1 and drainage for the safety PPA improvements. Alternatives 1 and 2 were not selected due to the development of the Safety PPA for Edward Avenue and because of the maintenance problems associated with trench drains.

MP 2.60 to 2.68 - E. 33rd Street and 10th Avenue

The Preliminary Preferred Alternative is Alternative 2 – Installation of Additional Inlets as agreed upon at the April 25, 2011 Core Group meeting. Note that Alternative 2 was developed after the Core Group meeting and includes a portion of Alternative 1 improvements. It was discussed that since the drainage system at this section of Route 20 is connected directly to the combined sewer system upstream of the regulator chamber located on East 33rd Street, the improvements proposed under Alternative 1 would not be effective during significant storm events due to surcharging of the combined sewer system.

MP 3.10 to 3.35- 7th Avenue to 5th Avenue

The Preliminary Preferred Alternative is Alternative 2 – Installation of Additional Inlets & Raising Road as agreed upon at the April 25, 2011 Core Group meeting. Note that Alternative 2 was developed after the Core Group meeting which represents a portion

of Alternative 1 improvements combined with the safety PPA at 5th Avenue. Alternative 2 was selected to reduce the frequency of Route 20 flooding due to the Passaic River. This location floods approximately for the 3-year Passaic River flood level and raising the road will protect Route 20 for the 10-year Passaic River flood.

2. Safety Improvements @ Edward Avenue

The Preliminary Preferred Alternative (PPA) is Alternative 4 - Creation of New Signalized Intersection at Route 4 / E. 43rd Street as agreed upon at the Core Group meeting.

Of the eight alternatives, only Alternatives 3, 4, 5 and 6 address the problem statement and significantly reduce the overflow of the left turn lane into the through lane. Out of these four alternatives, only Alternative 4 has no fatal flaws. Alternative 3 is not feasible due to traffic impacts to Route 20 NB, Alternative 5 is not feasible due to impacts to local roads and Alternative 6 is not feasible due to excessive cost required to reconstruct an otherwise structurally sufficient bridge.

Alternative 4 directly addresses the problem statement by eliminating the unsafe Route 20 NB left turn lane and does this in a cost efficient manner by utilizing existing ramps and has the added benefit of improving traffic operations in the Route 20 SB direction which could help to reduce crashes in that direction. There were no significant differences in environmental or permitting issues between the alternatives.

Combining Alternative 4 with Alternative 7 to provide a consistent 35 mph speed limit through Route 20 from Edward Avenue to 5th Avenue was also considered. Based on discussions with NJDOT Bureau of Traffic Engineering, changes in posted speed limit on state highways that are within local municipal boundaries can be initiated by the municipalities. After submission of a speed limit change request, NJDOT will then conduct the necessary speed studies and recommend an appropriate course of action based on these studies. Coordination with the City of Paterson will be required during Preliminary Design to establish any speed limit revisions.

There are no access management issues as no existing access on State highways will be affected by the PPA. There are no sidewalks along Route 20; however, there are sidewalks along both sides of Route 4 which will need to comply with all ADA guidelines. Any existing sidewalk and curb ramps disturbed on E. 43rd Street and Edward Avenue will need to comply with ADA guidelines as well.

Existing signs along Route 20 NB and SB consist of various regulatory signs, warning signs, route signs and guide signs. It is recommended that all signage within the project limits be replaced to comply with latest retroreflectivity standards. In addition, the geometric changes proposed by the PPA will require removal of the overhead "Broadway Paterson Keep Left" sign mounted on the south fascia of the Route 4 Bridge.

The following environmental permits may be potentially necessary for the Edward Avenue PPA:

- Fresh Water General Wetlands GP11 - for new outfalls/intakes into the Passaic River
- Transition Area Waiver Special Activity Linear Development permit - for work within the 50 foot transition area of any fringe wetlands along the Passaic River

3. Safety Improvements @ 5th Avenue

The Preliminary Preferred Alternative is Alternative 4 - Geometric revisions to Ramp B/5th Avenue intersections, Combine signal at 5th Avenue with Ramp B signal, Retiming of Signal, Install Advanced Warning Signs & Remove Trees as agreed upon at the April 25, 2011 Core Group meeting.

Of the seven alternatives, only Alternatives 2(A/B), 4, and 5 address the problem statement and significantly reduce the overflow of the left turn lane into the through lane. Alternative 2B was considered unfeasible during the Core Group for permitting reasons and Alternative 5 was not deemed feasible or safe due to the unorthodox geometry. Of the remaining Alternative 2A and 4, Alternative 4 was chosen as the PPA due to the additional benefits of reducing the number of traffic signals along Route 20 and to eliminate the existing traffic signal at 5th Avenue where collisions diagrams showed a cluster of rear end crashes after the opening of Home Depot.

The selection of the safety PPA was coordinated with the drainage PPA at this location. Since the selected drainage PPA of raising the profile of Route 20 at this location would require extensive construction, construction requirements were less of a consideration in selecting the safety PPA.

There are no access management issues as no existing access on State highways will be affected by the PPA. In addition, there is no existing sidewalk or ADA issues within the limit of PPA.

Existing signs along Route 20 NB and SB consist of various regulatory signs, warning signs, and guide signs. It is recommended that all signage within the project limits be replaced to comply with latest retroreflectivity standards.

The following environmental permits may be potentially necessary for the 5th Avenue PPA:

- Flood Hazard Area Individual Permit - for fill associated with the raising of the road, riparian disturbances for the construction of a retaining wall, and stormwater management for a major project (exceeding one acre of disturbance and/or an increase of impervious area of more than 0.25 acres)
- Fresh Water General Wetlands GP11 - for new outfalls/intakes into the Passaic River

- Transition Area Waiver Special Activity Linear Development permit - for work within the 50 foot transition area of any fringe wetlands along the Passaic River

G. Constructability

Due to the high volume of traffic on Route 20, it is preferable to maintain two lanes of through traffic in both directions of Route 20 in the vicinity of 5th Avenue as well as a NB left turn lane during construction of the 5th Avenue PPA during peak hours. This will require a carefully coordinated staging scheme, especially considering the proposed 3.1' raise in profile. In order to maintain traffic, temporary widening of Route 20 to the west will be required to shift traffic to the west and construct the eastern half of Route 20. Construction on the east side will include the construction of proposed wall and the temporary relocation of the utility poles behind the Route 20 NB guide rail. The final finished grade in all areas cannot be constructed though since access to the ramps and streets on the west side will need to be maintained after traffic is shifted onto the east side. A temporary profile would need to be constructed from the eastern portion of Route 20 to the existing ramps on the west. The amount of raise in profile that can be constructed will be dependent on the duration of road closures that will be allowed. Proceeding in this manner, Route 20 would be constructed in multiple stages with traffic shifted from east to west and back again as required as Route 20 profile is incrementally raised. Elimination of the Route 20 SB u-turn loop ramp with traffic detoured to the u-turn at E. 34th Street about 4000 feet south of 5th Avenue would help the staging and keep the work zone safe. The traffic volume on this loop ramp is very light and closure should not extensively affect traffic. In addition, 10th Avenue could be used as an alternate route to 5th Avenue for Route 20 NB traffic to alleviate the Route 20 NB left turn movement at 5th Avenue during construction.

Although it would be ideal to maintain traffic on Route 20 during peak hours, the incremental construction of Route 20 described above would require an extended construction duration. Discussions with the Core Group, Passaic County and City of Paterson have all indicated that a short term closure of Route 20 to expedite construction would be beneficial. Due to the frequent flooding of Route 20 which requires the complete closure of Route 20 for days at a time, the general public as well as the local officials are already accustomed to closures on Route 20. Passaic County has indicated that they could provide appropriate detours should closures of Route 20 be pursued.

VII. CONCEPT DEVELOPMENT RECOMMENDATION

The project need is confirmed and this project was presented to the CPC Screening Committee to obtain approval to advance this study to Preliminary Engineering.

It has been recommended that Alternative 4 – Creation Of A New Signalized Intersection At Route 4/E. 43rd St. and Alternative 4 - Geometric Revisions To Ramp B/5th Avenue Intersections, Combine Signal At 5th Avenue With Ramp B Signal, Retiming Of Signal & Install Advanced Warning Signs, Remove Trees be constructed for the Route 20 Safety improvements section of the project.

On February 20, 2013, the Capital Program Committee endorsed the Screening Committee’s recommendation to combine the drainage and safety improvement projects and advance the combined project for PE, FD and construction renaming the projects to Route 20 Paterson, Safety and Drainage – UPC No. 083720.

The following project costs are estimated:

Concept Development	\$0.20M
Preliminary Engineering (CED)	\$1.10M
Final Design	<u>\$1.50M</u>
Subtotal	\$2.80M

Construction Cost -
(including CE, CI, Utilities, Contingency) \$12.23M

The Drainage project is listed in the NJDOT Draft FY 2012 – 2021 Statewide Transportation Improvement Program (STIP) for construction in FY 2018 (see Appendix A for STIP form).

A timeline of events is proposed as follows:

Preliminary Engineering	FY2014	1 year	\$1.1 M
Final Design	FY2015	1 year	\$1.5 M
Right of Way	FY2016	1 year	\$0.2 M
Construction (incl. CE, CI, Util., Contingency)	FY2018	1 year	\$12.23 M

Documentation of important decisions that were made during the Concept Development phase is recorded in the Design Communication Report (DCR) that can be found in Appendix P. Activities that will be required in the PE phase are identified in the Preliminary Engineering Scope Statement (see Appendix U).