October 2013

Traffic/Conceptual Design Study Report

Olneyville Circulator

PREPARED FOR

City of Providence
Department of Planning and Development

IN PARTNERSHIP WITH

Olneyville Housing Corporation

PREPARED BY

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Introduction

Introduction

The City of Providence retained Vanasse Hangen Brustlin (VHB), Inc. to perform transportation planning/engineering services for the Olneyville Circulator Traffic Study. The study, led by the City of Providence in partnership with the Olneyville Housing Corporation, summarizes the existing transportation system serving the Olneyville Square area; identifies existing and future areas of traffic congestion; evaluate the impacts of potential circulation changes, and suggests potential implementation phases.

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Study Methodology

The following tasks were key components of the methodology in assessing the existing and future transportation conditions within the study area:

- Inventory of the roadway infrastructure around the Olneyville Square areas.
- Observations of traffic and pedestrian flows.
- Collection of daily and peak period traffic and pedestrian counts.
- Identification of planned transportation improvement projects.
- Evaluation of the impact of future growth on the transportation system.
- Evaluation of the impact of changes in circulation.

Study Area

The general study area for this assessment includes the following roadways:

- Plainfield Street and Hartford Avenue, from US 6/Route 10 ramps to Westminster Street.
- Manton Avenue and Valley Street, from Delaine Street to Westminster Street.
- San Souci Drive, Delaine Street, Service Road, Atwood Street, Magnolia Street, and Troy Street.

- Harris Avenue, from Delaine Street to Broadway.
- Broadway, from US 6/Route 10 to Westminster Street.
- Westminster Street, from US 6/Route 10 to Manton Avenue.

Table 1-1 provides a list of the eleven study area intersections included in this report. More detailed descriptions of the intersections can be found in the corresponding section of this report.

Table 1-1 List of Study Intersections

Intersection Number	Intersection
1	Delaine Street at Manton Avenue/Library Court
2	Delaine Street at Valley Street
3	Delaine Street at Harris Avenue
4	San Souci Drive at Manton Avenue
5	San Souci Drive at Valley Street
6	Hartford Avenue at Atwood Street
7	Manton Avenue at Westminster Street/Plainfield Street
8	Westminster Street at Broadway/Valley Street/Troy Street
9	Broadway at Harris Avenue
10	Dike Street at Troy Street
11	Plainfield Street at Atwood Street

Olneyville Circulator Concept

The City of Providence Department of Planning & Development has identified new potential connections and roadway enhancements referred to as the Olneyville Circulator. The proposed Olneyville Circulator, which is evaluated in detail in this report includes the following:

- The extension of Delaine Street across Manton Avenue through the former Price Rite Plaza over the river to Hartford Avenue (aligning with Atwood Street), and the creation of a new linear park along the river on the site.
- Converting Atwood Street (Service Road) to two-way traffic from Plainfield Street to Hartford Avenue and the realignment of the intersection of Atwood Street and Plainfield Street.
- The realignment of the intersection of Valley Street, Broadway, Westminster Street, and Troy Street to connect Troy Street to Valley Street.
- The rerouting of San Souci Drive to eliminate it as a cut through to Manton Avenue, and the creation of a linear greenway along the Woonasquatucket River along the right-of-way for San Souci Drive.
- The extension of the bike path into Olneyville Square and reconnecting to Riverside Park by crossing back over the river behind the Atlantic Mills site.

Stakeholder/Public Input

To help guide the study and to help validate goals, objectives and recommendations the City of Providence Department of Planning and Development assembled a group of stakeholders made up of the following:

- City of Providence Department of Planning and Development
- City of Providence Department of Public Works
- City of Providence Emergency Management Agency
- Olneyville Housing Corporation
- Rhode Island Public Transit Authority (RIPTA)
- Rhode Island Department of Transportation (RIDOT)
- Narragansett Bay Commission (NBC)
- Woonasquatucket River Watershed Council (WRWC)

The following stakeholder meetings were held at key stages during the study process:

- Stakeholder Meeting #1: September 18, 2012
- Stakeholder Meeting #2: January 15, 2013
- Stakeholder Meeting #3: May 9, 2013
- Expanded Stakeholder Group Meeting: June 13, 2013

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Existing Conditions

Introduction

As the first step in the development of the Olneyville Circulator Traffic Study, Vanasse Hangen Brustlin Inc. has reviewed the existing transportation conditions based on field visits, observations, and traffic counts. The existing transportation conditions including roadway and intersection geometrics, traffic controls, and traffic data collected are described below.

Vehicular Access

The Olneyville Square area is accessible from Route 10 and Route 6, which intersect Westminster Street, Broadway, Hartford Avenue, and Plainfield Street, all minor urban arterial roadways. The square is bisected by an east-west roadway (Westminster Street) and a north-south roadway (Manton Avenue). Westminster Street and Broadway provide access to/from the east that intersect at Valley Street and continue as Westminster Street through the square ending at Manton Avenue, which provides access to/from the north. At Manton Avenue, the roadway name splits into Hartford Avenue and Plainfield Street, which provide access to/from the west. South of the square is serviced by several city streets including Atwood Street, Magnolia Street, Troy Street, and Dike Street. Delaine Street, Harris Avenue, Valley Street, and San Souci Drive also provide connections to/from the north.

Freeway Connections

Olneyville Square can be accessed via existing connections to Route 6 and Route 10. From Route 6 eastbound, access can be gained via the Hartford Avenue (Route 6A) exit or via the Broadway exit. From Route 10 northbound, access can be gained via the Westminster Street/Olneyville Square exit. From Route 6 westbound/Route 10 southbound, access can be gained following Route 6 and exiting via Plainfield Street or Hartford Avenue (Route 6A). Exiting the Olneyville Square area to US 6 and Route

10 is possible via the Hartford Avenue (Route 6A) and Plainfield Street on-ramps. Route 10 southbound can also be accessed via the Westminster Street on-ramp.

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Roadways

The primary study area roadways are described below.

Westminster Street

Westminster Street is an east-west minor urban arterial roadway, which runs from Downtown Providence to the center of the square. Within the study area, Westminster Street is approximately 45 to 50 feet wide. Parking is provided on both sides of the roadway between Troy Street and Manton Avenue, and it is prohibited along both sides of the roadway between Troy Street and the Route 10 South off-ramp. Sidewalks are provided on both sides of Westminster Street, and there are several RIPTA bus stops along the roadway. Land use along Westminster Street is mainly commercial/retail developments.

The intersections of Westminster Street with Manton Avenue/Library Court and Broadway/Valley Street are signal-controlled.

Broadway

Broadway is an east-west minor urban arterial roadway, which runs from Downtown Providence to Westminster Street. Within the study area, Broadway is approximately 55 feet wide. Parking is prohibited along both sides of the roadway from Harris Avenue to Valley Street. Broadway is a designated bicycle route with a dedicated bike lane that ends at the Route 6 eastbound off-ramp. Sidewalks are provided on both sides of Broadway, and there are several RIPTA bus stops along the roadway. Land use along Broadway is a mix of residential and commercial/retail developments.

The unsignalized intersection with Harris Avenue is stop-controlled on the southbound "minor street" approach.

Hartford Avenue

Hartford Avenue (Route 6A) is an east-west minor urban arterial roadway, which runs from Johnston to Plainfield Street. Within the study area, Hartford Avenue is approximately 34 feet wide. Hartford Avenue is one-way roadway in the westbound direction between Plainfield Street and Service Road, and parking is prohibited along both sides of the roadway in this segment. Parking is generally allowed on the south side of Hartford Avenue and prohibited on the north side between Service Road and the Route 6 ramps. Sidewalks are provided on both sides of Hartford Avenue, and there are several RIPTA bus stops along the roadway. Land use along Hartford Avenue is mainly commercial/retail developments.

The intersections of Hartford Avenue with Plainfield Street and with Service Road are both uncontrolled, with free flowing operation.

Plainfield Street

Plainfield Street (Route 14) is an east-west minor urban arterial roadway, which runs from Cranston/Johnston to Manton Avenue. Within the study area, Plainfield Street is approximately 40 feet wide. There is parking on both sides of the roadway west of Service Road/Atwood Street, and parking is on provided on the south side of the roadway between Service Road/Atwood Street and Hartford Avenue. Sidewalks are provided on both sides of Plainfield Street, and there are several RIPTA bus stops along the roadway. Land use along Plainfield Street is mainly commercial/retail developments.

The intersection of Plainfield Street with Hartford Avenue is uncontrolled, with free flowing operation. The intersection of Plainfield Street with Service Road/Atwood Street is signal-controlled, and Service Road is one-way toward Plainfield Street.

Manton Avenue

Manton Avenue is a north-south minor urban arterial roadway that runs from Chalkstone Avenue to Westminster Street. Within the study area, Manton Avenue is approximately 36 feet wide, and parking is prohibited along both sides of the roadway. Manton Avenue between Delaine Street and Aleppo Street is a designated bicycle route. Sidewalks are provided on both sides of Manton Avenue, and there are several RIPTA bus stops along the roadway. Land use along Manton Avenue is mainly commercial/retail developments.

The intersections of Manton Avenue with Delaine Street and Westminster Street/Plainfield Street are signal-controlled. The intersection of Manton Avenue with San Souci Drive is stop-controlled on the westbound "minor street" approach.

Valley Street

Valley Street is a north-south minor urban arterial roadway that runs from Pleasant Valley Parkway to Broadway. Within the study area, Valley Street is approximately 32-37 feet wide, and parking is prohibited along both sides of the roadway. Valley Street is a designated bicycle route, and sidewalks are provided on both sides of the roadway. Land use along Valley Street is a mix of residential and commercial/industrial developments.

The intersection of Valley Street with Westminster Street/Broadway is signal-controlled. The intersection of Valley Street with San Souci Drive is stop-controlled on the eastbound "minor street" approach. The intersection of Valley Street with Delaine Street is stop-controlled on all approaches.

Delaine Street

Delaine Street is an east-west urban collector roadway that runs from Harris Avenue to Manton Avenue. Within the study area, Delaine Street is approximately 30 feet wide between Manton Avenue and Audrey Street and approximately 25 feet wide between Audrey Street and Harris Avenue. Delaine Street is a designated bicycle route. Parking is prohibited along both sides of Delaine Street and sidewalks are provided on both sides of the roadway. Land use along Delaine Street is a mix between residential and commercial/industrial developments.

The intersection of Delaine Street with Manton Avenue is signal-controlled. The intersection of Delaine Street with Valley Street is stop-controlled on all approaches. The intersection of Delaine Street with Harris Avenue is stop-controlled on the eastbound "minor street" approach.

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Intersections

The intersections included in this study are described below. At signalized intersections, VHB conducted a field inventory of the existing traffic signal equipment, photographed the inside of each traffic signal controller cabinet, and recorded traffic signal timing information from the traffic signal controllers. The traffic signal timing information were used as inputs into the Synchro software for capacity analysis.

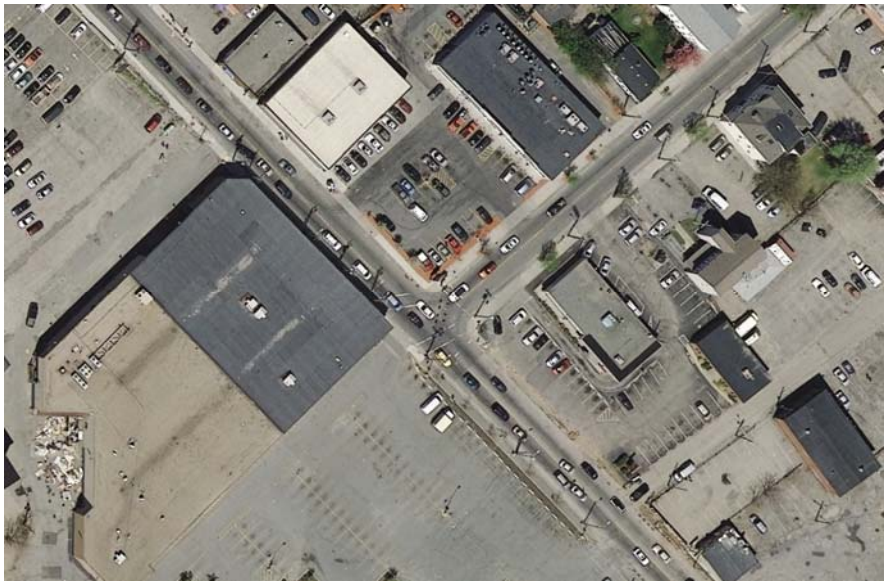
Delaine Street at Manton Avenue

Delaine Street and the Price Rite plaza entrance intersect Manton Avenue to form a four-way signalized intersection. All intersection approaches consist of one general purpose lane. Sidewalks are present along both sides of the northbound,

southbound, and westbound approaches, where signalized pedestrian crossings are provided.

Traffic at this intersection is controlled by an Eagle EPAC controller in a NEMA TS1 configuration housed in a ground mounted cabinet. The traffic signal operates with two phases: phase 2/6 is for the Manton Avenue northbound and southbound approaches, and phase 4/8 is for the Price Rite plaza eastbound and Delaine Street westbound approaches. Overall, the traffic signal equipment at this intersection was observed to be old and in fair condition.

Aerial View of the Delaine Street/Manton Avenue Intersection



Source: RIGIS Aerial Map

Delaine Street at Valley Street

Delaine Street intersects Valley Street to form a four-way unsignalized intersection with stop signs on all approaches. All intersection approaches consist of one general purpose lane. Sidewalks are present along both sides of all approaches. There appeared to be pedestrian crosswalks at this intersection, but the markings are very faded.

Aerial View of the Delaine Street/Valley Street Intersection

Source: RIGIS Aerial Map

Delaine Street at Harris Avenue

Delaine Street intersects Harris Avenue to form a three-way unsignalized intersection with the Delaine Street eastbound approach under stop sign control. All intersection approaches consist of one general purpose lane. Sidewalks are present along both sides of Delaine Street and along the west side of Harris Avenue. There are no marked pedestrian crossings at this intersection.

Aerial View of the Delaine Street/Harris Avenue Intersection

Source: RIGIS Aerial Map

San Souci Drive at Manton Avenue

San Souci Drive intersects Manton Avenue to form a three-way unsignalized intersection with the San Souci Drive westbound approach under stop sign control. All intersection approaches consist of one general purpose lane. Sidewalks are present along both sides on Manton Avenue and along the south side of San Souci Drive. Faded unsignalized pedestrian crossings are provided across the southbound and westbound approaches.

Aerial View of the San Souci Drive/Manton Avenue Intersection

Source: RIGIS Aerial Map

San Souci Drive at Valley Street

San Souci Drive intersects Valley Street to form a three-way unsignalized intersection with the San Souci Drive eastbound approach under stop sign control. All intersection approaches consist of one general purpose lane. Sidewalks are present along both sides of all approaches, and there are no marked pedestrian crossings at this intersection.

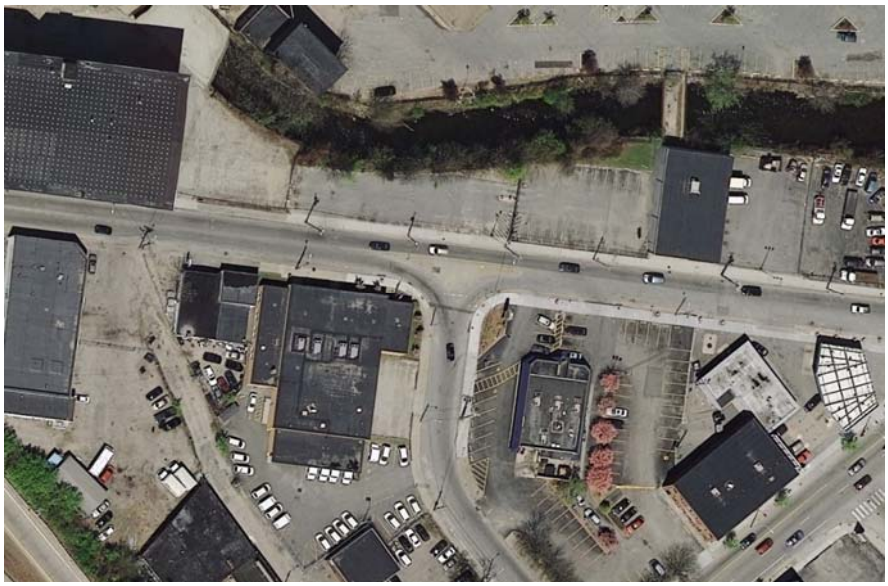
Aerial View of the San Souci Drive/Valley Street Intersection

Source: RIGIS Aerial Map

Hartford Avenue at Service Road

Hartford Avenue intersects Service Road to form a three-legged unsignalized intersection. Hartford Avenue is one-way in the westbound direction between Plainfield Street and Atwood Street. The Hartford Avenue westbound approach consists of one exclusive left-turn lane and one through lane, and the Hartford Avenue eastbound approach consists of an exclusive right-turn lane. Both the exclusive left-turn and exclusive right-turn lanes are channelized by a raised concrete median, which allows for both turning movements to be free flowing. Service Road is one-way in the southbound direction toward Plainfield Street. Sidewalks exist along both sides of all approaches, and an unsignalized pedestrian crossing is provided across Service Road. The pavement markings at the intersection are very faded.

Aerial View of the Hartford Avenue/Atwood Street Intersection



Source: RIGIS Aerial Map

Manton Avenue at Westminster Street/Plainfield Street

Manton Avenue intersects Westminster Street/Plainfield Street to form a four-way signalized intersection across from Library Court. The Manton Avenue southbound approach consists of one shared left-turn/through lane and one channelized yield-controlled right-turn lane. The Library Court northbound approach consists of one general purpose lane. The Westminster Street westbound approach consists of one shared left-turn/through lane and one right-turn lane, and the Plainfield Street eastbound approach consists of one left-turn lane and one shared through/right-turn lane. Sidewalks exist along both sides of the southbound, westbound, and eastbound approaches. At the time of the field review, unsignalized pedestrian crossings were provided across the southbound, northbound, and westbound approaches. However, new signalized pedestrian crossings were being constructed across the southbound and westbound approaches as part of the City of Providence Westminster Street/Olneyville Square construction project.

Aerial View of the Manton Avenue/Westminster Street/Plainfield Street Intersection

Source: RIGIS Aerial Map

Traffic at this intersection is controlled by an Eagle EPAC controller in a NEMA TS1 configuration housed in a ground mounted cabinet. The traffic signal operates with three phases: phase 1 is for the Plainfield Street eastbound approach including the advance eastbound left turn, phase 2 is for the Plainfield Street and Westminster Street eastbound/westbound approaches including the permitted eastbound left turn, and phase 3 is for the Manton Avenue and Library Court southbound/northbound approaches. At the time of the field review, the traffic signal equipment at this intersection was observed to be old and in poor condition. However, new traffic signal equipment was being installed as part of the City of Providence Westminster Street/Olneyville Square construction project.

Westminster Street at Broadway/Valley Street/Troy Street

Westminster Street intersects Broadway and Valley Street to form a four-way signalized intersection. The Westminster Street eastbound approach consists of one shared left-turn/through lane and one shared through/right-turn lane with the right-turn movement separated by a channelized island and free flowing. Troy Street intersects Westminster Street at an unsignalized location within the channelized eastbound right-turn allowing for right-in/right-out only. The Westminster Street northbound approach consists of two left-turn lanes and one shared through/right-turn lane. The Broadway westbound approach consists of one through lane and one shared through/right-turn lane (left-turn movement is prohibited by the raised concrete median). The Valley Street southbound approach consists of one general purpose lane for right and left-turn movements only (through movement is prohibited by the raised concrete median). Sidewalks exist along both sides of all

approaches, and signalized pedestrian crossings are provided across the northbound, southbound, and westbound approaches.

Aerial View of the Westminster Street/Broadway/Valley Street/Troy Street Intersection

Source: RIGIS Aerial Map

Traffic at the intersection is controlled by an Eagle EPAC controller in a NEMA TS1 configuration housed in a ground mounted cabinet. The traffic signal operates with three phases: phase 1 is for the Westminster Street and Broadway eastbound/westbound approaches, phase 2 is for the Westminster Street northbound approach, and phase 3 is for the Valley Street southbound approach. Overall, the traffic signal equipment at this intersection was observed to be in good condition.

Broadway at Harris Avenue

Broadway intersects Harris Avenue to form a three-way unsignalized intersection with the Harris Avenue southbound approach under stop sign control. The Broadway eastbound approach consists of one shared left-turn/through lane and one through lane. The Broadway westbound approach consists of one through lane and one shared through/right-turn lane. The Harris Avenue southbound approach consists of one very wide general purpose lane, which at times operates as two lanes. Sidewalks exist along both sides of all approaches, and an unsignalized pedestrian crossing is provided across the southbound approach.

Aerial View of the Broadway/Harris Avenue Intersection

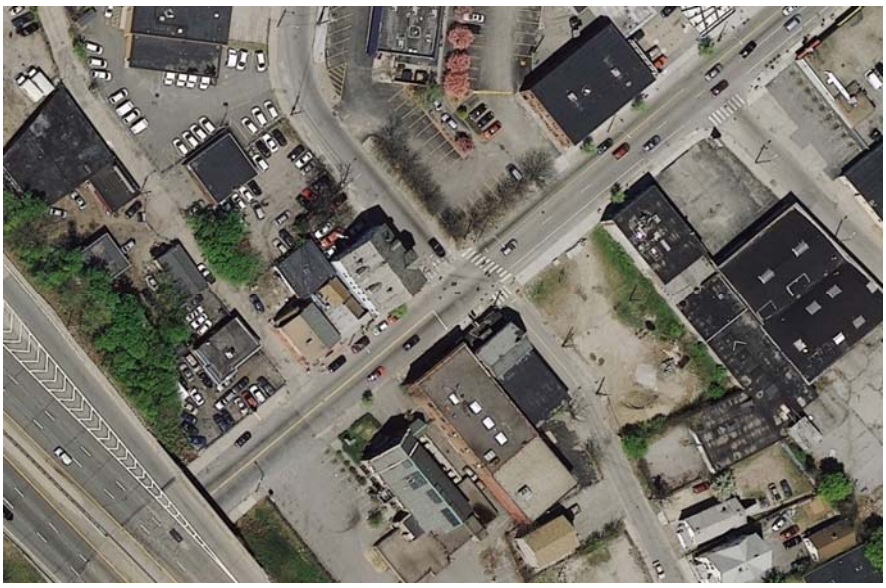
Source: RIGIS Aerial Map

Plainfield Street at Service Road/Atwood Street

Plainfield Street intersects Service Road/Atwood Street to form a slightly offset four-way signalized intersection. Service Road is one-way in the southbound direction toward Plainfield Street. The Service Road southbound approach consists of one shared left-turn/through lane and one right-turn lane. The Atwood Street northbound approach consists of one general purpose lane that is slightly offset from Service Road. Both the Plainfield Street northbound and southbound approaches consist of one general purpose lane. Sidewalks exist along both sides of all approaches, and unsignalized pedestrian crossings are provided across the northbound, southbound, and westbound approaches.

Traffic at the intersection is controlled by a Crouse Hinds controller in a NEMA TS1 configuration housed in a ground mounted cabinet. The traffic signal operates with two phases: phase 1 is for the Plainfield Street eastbound/westbound approaches and phase 2 is for the Service Road/Atwood Street southbound/northbound approaches. Overall, the traffic signal equipment at this intersection was observed to be old and in fair condition.

Aerial View of the Plainfield Street/Atwood Street Intersection



Source: RIGIS Aerial Map

Dike Street at Troy Street

Dike Street intersects Troy Street to form a four-way unsignalized intersection with stop signs on all approaches. All intersection approaches consist of one general purpose lane. Sidewalks exist along both sides of all approaches. There appeared to be pedestrian crosswalks at this intersection but the markings are very faded.

Aerial View of the Dike Street/Troy Street Intersection

Source: RIGIS Aerial Map

Observed Conditions

During the course of the study, VHB observed peak hour traffic conditions along the various roadways and intersections within the study area. Specific highlights of the traffic observations are presented below.

- Traffic flow through and around the Square is influenced and interrupted by pedestrians/bicyclists, bus blockages, parking maneuvers, and difficult turning movements entering/exiting the numerous curb cuts and side streets.
- The ongoing Narragansett Bay Commission (NBC) work around Manton Avenue had some impacts to the traffic flow at the Square. Access to San Souci Drive was restricted and/or prohibited to/from Manton Avenue. The observations below are the baseline condition before and during the NBC work.
- Traffic congestion at the intersection of Westminster Street/Manton Avenue causes the vehicle queues on Manton Avenue to extend beyond San Souci Drive and at times extends to Delaine Street.
- The existing Bank of America Driveway on Valley Street just north of Broadway can have a significant impact on traffic operations at the intersection. At times, traffic waiting to turn into the driveway blocks northbound through traffic on Valley Street, which can result in a queue of vehicles that extends back through the signalized intersection at Broadway/Westminster Street.
- The queue for the Plainfield Street/Hartford Avenue left-turn onto Manton Avenue extends beyond Dike Street and at times extends to Service Road/Atwood Street.
- Due to the heavy through volumes on Westminster Street approaching Manton Avenue in one lane, the queue often extends almost to the Valley Street/Broadway signal. At times, drivers would use the right-turn only lane to continue through the intersection.
- Traffic operations at other signalized intersections within the study area is influenced by the traffic operations at the Westminster Street/Manton Avenue intersection.
- Vehicle queues on Westminster Street westbound approaching Valley Street/Broadway extend almost to the Route 10 ramps.
- Vehicles queues on Service Road approaching Plainfield Street extend almost to Hartford Avenue.
- Due to the all-way stop control at the intersection of Valley Street and Delaine Street, the Valley Street northbound approach to the intersection experienced long delay and vehicle queues. Although a traffic signal warrant analysis was not conducted as part of this study, based on observations, a traffic signal at this location did not appear to be warranted.
- The lack of signage and the poor pavement conditions/faded pavement markings likely contribute to confusion for pedestrians, bicyclists, and drivers traveling through and around the Square.

Traffic Volumes

An extensive transportation data collection program was conducted in September 2012 to establish base traffic conditions within the study area. Traffic volumes for the study area roadways and intersections were collected by Connecticut Counts LLC. This effort included weekday morning and afternoon peak hour manual turning movement counts (TMCs) between 7:30 AM and 9:30 AM and between 4:00 PM and 6:00 PM at the study area intersections.

In addition to TMCs, Automatic Traffic Recorder (ATR) counts were also conducted for a one-week period at the following locations:

- Broadway east of Harris Avenue.
- Westminster Street west of Route 6/10.
- Valley Street north of San Souci Drive.
- Manton Avenue north of San Souci Drive.
- Hartford Avenue west of Manton Avenue.

Table 2-1 presents a summary of the observed daily and peak hour traffic from the ATR data.

Table 2-1
Existing Traffic Volume Summary

	Daily	Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
Location	Weekday (vpd)[1]	Volume (vph)[2]	"K" Factor[3]	Directional Distribution	Volume (vph)	"K" Factor	Directional Distribution
Broadway (east of Harris Avenue)	6,400	525	8.2	59% WB	535	8.4	62% WB
Westminster Street (west of Route 6/10)	24,000	1,250	5.2	61% WB	1,280	5.3	72% EB
Valley Street (north of San Souci Dr.)	11,900	610	5.1	80% NB	620	5.2	73% NB
Manton Avenue (north of San Souci Dr.)	14,200	450	3.2	53% SB	535	3.8	56% SB
Hartford Avenue (west of Manton Ave.)	7,500	505	6.7	100% WB	645	8.6	100% WB

Source: Compiled by VHB from automatic traffic recorder (ATR) counts conducted by Connecticut Counts LLC in September 2012.
1 Daily traffic expressed in vehicles per day (vpd)
2 Peak hour volumes expressed in vehicles per hour (vph).
3 "K" factor = percent of daily traffic that occurs during the peak hour

In addition to performing new traffic counts, traffic counts conducted for the RIDOT Route 6/10 Interchange Improvement Study as well as assumptions previously made for traffic redistribution were also reviewed for consistency and to inform the methodology for developing future traffic growth in this study, as discussed later in this document.

Seasonal Traffic Variation

To evaluate the potential for seasonal fluctuation of traffic volumes on roadways within the study area, monthly Rhode Island Department of Transportation (RIDOT) seasonal adjustment factors were reviewed. According to the RIDOT statistics for urban facilities, traffic on urban facilities in the month of September is higher than the average month. The September counts also include school-related traffic in the area. To provide a conservatively high estimate of traffic operations and impacts, RIDOT seasonal adjustment factors were not applied to the traffic counts collected in September 2012. The existing weekday morning and weekday afternoon peak hour traffic volumes are presented in Figures 2-1 and 2-2, respectively.

Traffic Operations Analysis

Measuring existing traffic volumes quantifies traffic flow within the study area. To assess quality of flow, intersection capacity analyses were conducted with respect to existing traffic volumes, intersection geometry, and traffic control. Capacity analyses provide an indication of how well the roadway facilities serve the traffic demands placed upon them. Roadway operating conditions are classified by calculated levels of service as described in the following section.

Level-Of-Service Criteria

Level-of-service (LOS) is the term used to denote the different operating conditions which occur on a given roadway segment under various traffic volume loads. It is a qualitative measure of the effect of a number of factors including roadway geometrics, speed, travel delay and freedom to maneuver. Level-of-service provides an index to the operational qualities of a roadway segment or an intersection. Level-of-service designations range from A to F, with LOS A representing the best operating conditions with little or no delay and LOS F representing the worst operating conditions with highly congested operations and long delays. The evaluation criteria used to analyze study area intersections are based on the Highway Capacity Manual[1].

The level-of-service designation is reported differently for signalized and unsignalized intersections. For signalized intersections, the analysis considers the operation of each lane or lane group entering the intersection and the LOS designation is for the overall conditions at the intersection. For unsignalized intersections, however, the analysis assumes that traffic on the mainline is not affected by traffic on the side streets. The LOS is only determined for left turns from the main street and all movements from the minor street. The overall LOS

[1] Highway Capacity Manual; Transportation Research Board; Washington D.C.; 2010.

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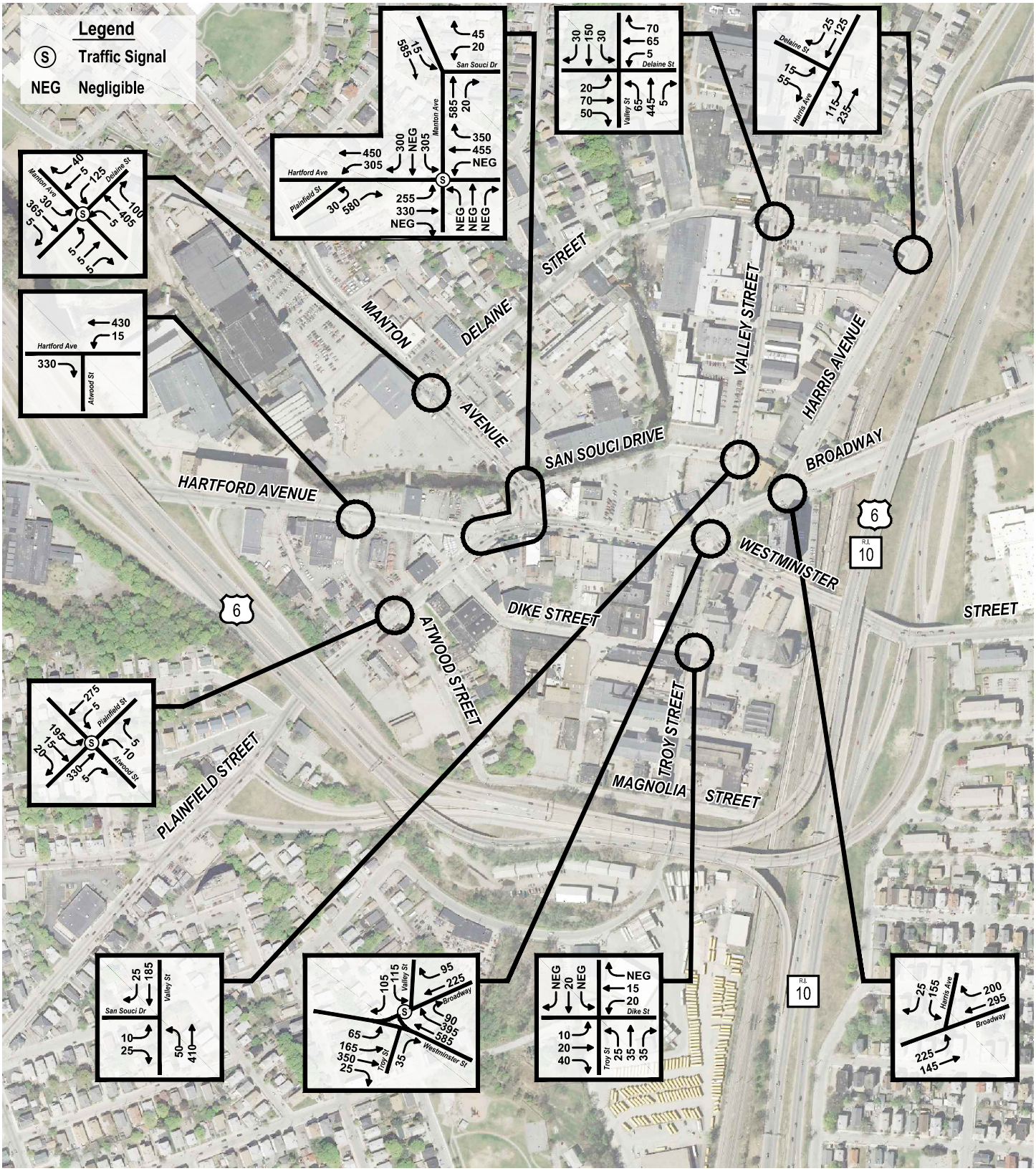
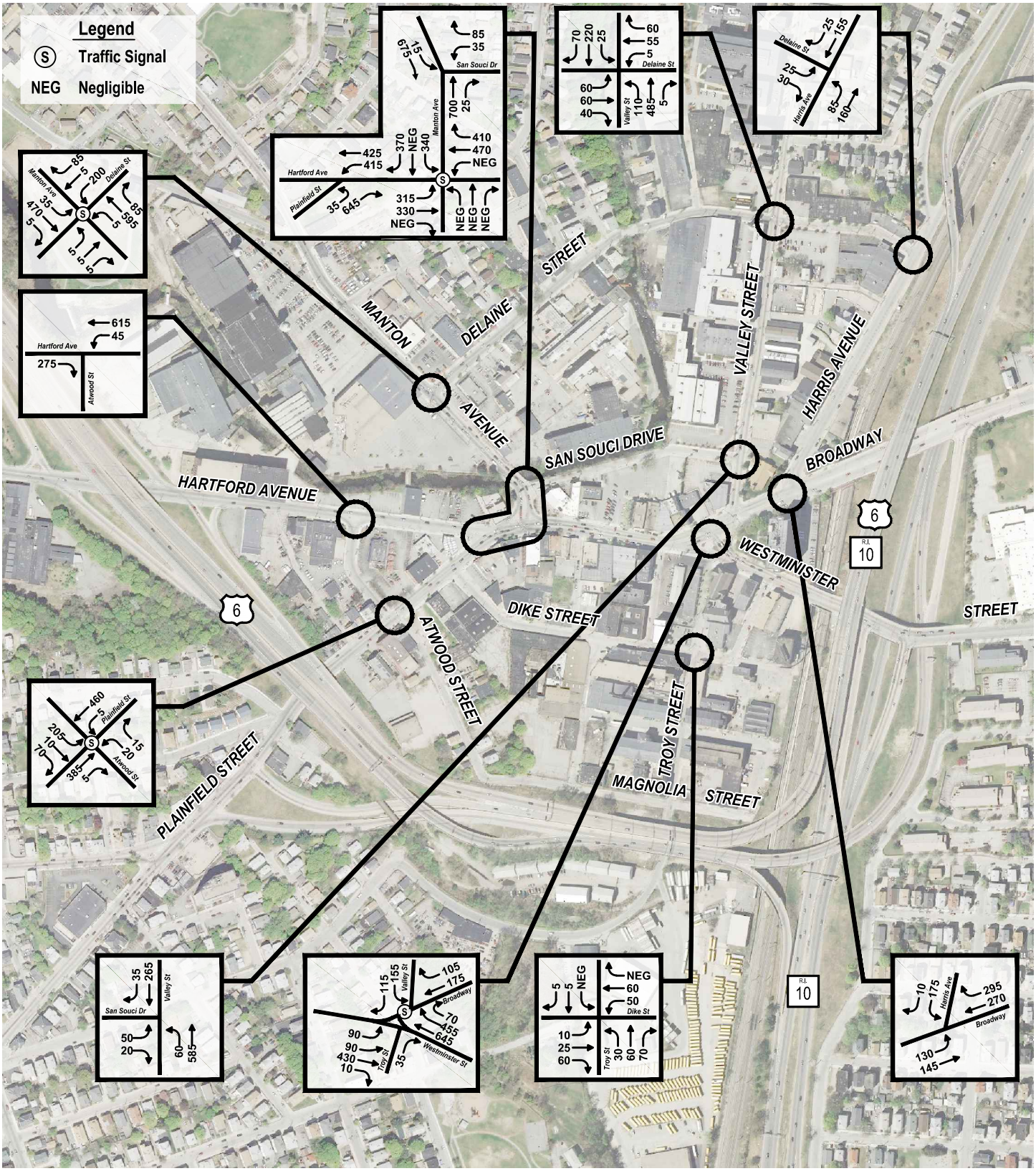


Vanasse Hangen Brustlin, Inc.

Not to Scale

Existing Weekday Morning Peak Hour Traffic Volumes
Olneyville Circulator
Providence, Rhode Island

Figure 2-1



Not to Scale

Vanasse Hangen Brustlin, Inc.

Existing Weekday Evening Peak Hour Traffic Volumes
Olneyville Circulator
Providence, Rhode Island

Figure 2-2

designation is for the most critical movement, which is most often the left turn out of the side street.

Signalized Intersections

Capacity analyses were conducted at the signalized study intersections included in this study. The traffic signal timings used for the analysis were based on extracted traffic signal controller data obtained by VHB. A summary of the signalized intersection capacity analyses under existing conditions is presented in Table 2-2.

It is important to note that the capacity analysis software analyzes the operation at the intersections only. Interruptions to traffic flow caused by pedestrians/bicyclists, bus blockages, parking maneuvers, and extended vehicle queues from adjacent intersections can occur at signalized intersections. These interruptions can block traffic from getting to and/or through the signalized intersections resulting in congestion between intersections. Blockages of traffic on approaches or departures of a signalized intersection will degrade the overall operation of the intersection and can result in severe congestion if the volume of traffic at the intersection is at or near capacity.

Due to the fact that the capacity analysis does not totally take into account disruptions to traffic flow between intersections, the reported delay times and resulting levels of service could be underestimated. In this case, the capacity analysis software is a tool used to identify problem areas and to give a comparison between existing and future conditions.

As shown in Table 2-2, the results of the capacity analyses indicate that all of the signalized intersections within the study area operate at an overall calculated levels of service (LOS) C or better during the weekday morning and weekday afternoon peak hour periods. However, the calculated queues on some of the intersections' approaches often backup onto and beyond adjacent intersections. This is consistent with the field observations discussed previously. For example, the analysis as well as field observations reveal lengthy queues and long delays on all of the approaches to the intersections of Westminster Street and Manton Avenue/Library Court during the peak hour periods. The Westminster Street westbound approach to Valley Street/Broadway also experienced long delays and queues, as this the one of the major access/egress to the Square.

Table 2-2
2012 Existing Conditions Signalized Intersection Analysis

Location	Peak Hour	2012 Existing V/C[1]	Delay[2]	LOS[3]
Delaine Street at	Weekday AM	0.63	13.1	B
Manton Avenue	Weekday PM	0.82	17.8	B
Manton Avenue at	Weekday AM	0.82	30.6	C
Westminster St / Plainfield St	Weekday PM	0.89	34.1	C
Westminster Street at	Weekday AM	0.73	23.9	C
Broadway / Valley St / Troy St	Weekday PM	0.72	23.8	C
Hartford Avenue at	Weekday AM	0.47	9.5	A
Route 6 West	Weekday PM	0.74	20.5	C
Plainfield Street at	Weekday AM	0.61	18.1	B
Atwood Street	Weekday PM	0.76	17.3	B

Source: Synchro 7 software using the procedures in the 2000 Highway Capacity Manual. Compiled by VHB.

1 V/C = volume to capacity ratio
2 Delay = Vehicle delay expressed in seconds per vehicle (See note below)
3 LOS = Level of service

Notes:

1 Interruptions to traffic flow caused by pedestrians/bicyclists, bus blockages, parking maneuvers, difficult turning movements entering/exiting the numerous curb cuts and side streets were observed on the project roadways between intersections. These interruptions caused congestion along these roadways during the peak hour periods. As a result, the observed delay times at the signalized intersections exceeded the calculated values.
2 See Appendix for Synchro reports for operation of individual traffic movements at the intersections.

Unsignalized Intersections

Capacity analyses were also conducted at the unsignalized intersections included in this study. A summary of the unsignalized intersection capacity analysis results under existing conditions is presented in Table 2-3.

As stated in the signalized intersections analysis section, the capacity analysis software analyzes the operation at the intersections only and does not totally take into account disruptions to traffic flow between intersections. As a result, the reported delay times and resulting levels of service can be underestimated. In this case, the capacity analysis software is a tool used to identify problem areas and to give a comparison between existing and future conditions.

As shown in Table 2-3, the heavy traffic volumes on Valley Street northbound approaching Delaine Street experience long delays and queues under the all-way stop sign control resulting in LOS D and LOS F during the weekday morning and evening peak hours, respectively. Prior to the NBC work, the left-turn movement from San Souci Drive to Manton Avenue was often blocked by the vehicle queues on Manton Avenue from the Westminster Street signal. As discussed, the actual delays experienced on San Souci Drive may have been longer than the reported LOS D. Although the left-turns from Harris Avenue to Broadway (away from the Square) shown a calculated LOS F, the traffic signal at the Westminster

Street/Broadway/Valley Street intersection creates gaps in the traffic flow on Broadway, which allows traffic from Harris Avenue to enter Broadway with actual delay times much less than the calculated delay times.

Table 2-3
2012 Existing Conditions Unsignalized Intersection Analysis

		2012 Existing			
Location	Peak Hour	Critical Movement[1]	Demand[2]	Delay[3]	LOS[4]
Delaine Street at Valley Street	Weekday AM	NB LTR	515	29.9	D
	Weekday PM	NB LTR	600	68.8	F
Delaine Street at Harris Avenue	Weekday AM	EB LR	70	12.6	B
	Weekday PM	EB LR	55	12.2	B
San Souci Drive at Manton Avenue	Weekday AM	WB LR	65	20.5	C
	Weekday PM	WB LR	120	33.7	D
San Souci Drive at Valley Street	Weekday AM	EB LR	35	12.5	B
	Weekday PM	EB LR	70	27.9	D
Harris Avenue at Broadway	Weekday AM	SB L	155	>100	F
	Weekday PM	SB L	175	67.5	F
Dike Street at Troy Street	Weekday AM	NB LTR	95	7.7	A
	Weekday PM	NB LTR	160	9.1	A

Source: Synchro 7 software using the procedures in the 2000 Highway Capacity Manual. Compiled by VHB.

1 L= Left-turn movement, T= Through movement, R= Right-turn movement
2 Demand = Demand of critical movement, expressed in vehicles per hour
3 Delay = Vehicle delay expressed in seconds per vehicle (See note below)
4 LOS = Level of service

Notes:

1 Interruptions to traffic flow caused by pedestrians/bicyclists, bus blockages, parking maneuvers, difficult turning movements entering/exiting the numerous curb cuts and side streets were observed on the project roadways between intersections. These interruptions caused congestion along these roadways during the peak hour periods. As a result, the observed delay times at the signalized intersections exceeded the calculated values.
2 See Appendix for Synchro reports for operation of individual traffic movements at the intersections.

Based on the findings of the traffic analysis, field observations, and feedback from City of Providence and project stakeholders, the potential "hotspots" described above within the Olneyville Square area will need to be further reviewed as part of the future conditions analysis and for consideration of potential capacity enhancement measures.

Public Transportation

The Olneyville Square area is served by several Rhode Island Public Transit Authority (RIPTA) routes. Commuters and visitors without direct service from their area can take any bus service to Kennedy Plaza and transfer to one of four existing RIPTA bus routes that currently serve the Square:

- Route 17 Dyer/Pocasset.

- Route 19 Plainfield/Westminster.
- Route 27 Broadway/Manton.
- Route 28 Broadway/Hartford.

RIPTA bus service to the Square begins at approximately 6 AM and ends at 11 PM.

Bicycle Accommodations

There are a number of existing City of Providence bikeways in the Olneyville area including the Woonasquatucket River Greenway (along on-road sections along Valley Street, Delanie Street, Manton Avenue and Aleppo Street and off-road shared-use path behind the Atlantic Mill complex) and a signed on-road section of the East Coast Greenway (also along Valley Street across Broadway and Westminster then along Troy Street).

Pedestrian Activity

Pedestrian volumes were counted at the study area intersections in conjunction with the traffic volumes, as previously described, on typical weekdays in September 2012 during the weekday morning and weekday afternoon peak hour periods. The majority of the pedestrian activity throughout the Square was along routes the major east-west routes and along Manton Avenue. Although pedestrian volumes were not counted at the midblock crosswalk on Westminster Street between Stokes Street and Bough Street, a good deal of pedestrian activity was observed at this crosswalk which connects to the large shared parking lot between Westminster Street and San Souci Drive.

3

Future Conditions

Future Year No-Build Conditions and Analysis

Transportation conditions in and around the Olneyville Square area can be expected to change in the future due to potential development/growth and planned transportation infrastructure improvements in the area. To assess the magnitude of that change, traffic volumes were projected to 2035 and analyzed. The future analysis year of 2035 is consistent with recent traffic modeling and analyses completed by VHB for the RIDOT Improvements to the U.S. Route 6/Route 10 Interchange project. The 2035 projected traffic volumes includes growth in traffic volumes associated with generalized regional growth and the redistribution of traffic resulting from the planned transportation infrastructure improvements. The 2035 transportation analyses are presented in detail in this chapter.

Transportation Infrastructure Improvements

Based on discussions with the City of Providence Department of Planning & Development, the Rhode Island Department of Transportation (RIDOT), and the Rhode Island Public Transit Authority (RIPTA), five planned transportation infrastructure improvement projects were identified that will have an impact on the study area roadways. The scopes of these projects are outlined below.

Route 6/10 Interchange Improvements

The RIDOT Improvements to the US Route 6/Route 10 Interchange project will have a significant impact on regional traffic flow along Route 6/Route 10 and access to/through the Olneyville Square area. It will also free up land in the area of the existing highway for potential redevelopment and/or for enhanced connections through the area of the existing elevated roadway. The future primary Route 6/10 Interchange connections are shown in Figure 3-1. Highlights of the changes as they are expected to impact traffic within the study area include:

- A new direct ramp connection will be constructed from Route 10 North to Route 6 West. The existing traffic from Route 10 North that has to exit at Westminster

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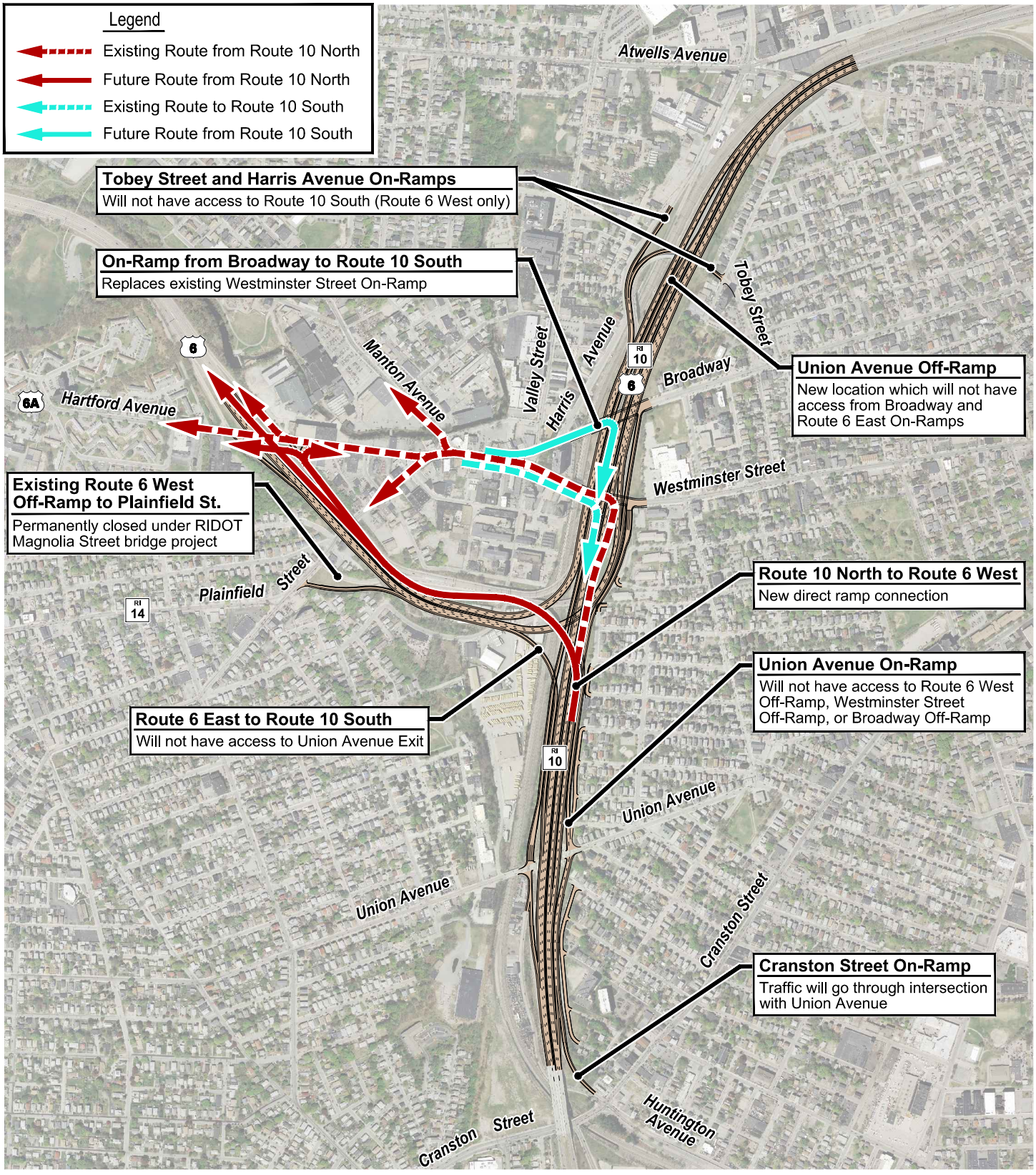

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Future Route 6/10 Interchange Connections Figure 3-1
Olneyville Circulator
Providence, Rhode Island

Street to head to Route 6 West or the Olneyville Square area will be able to make this new connection to continue directly on to Route 6 West or take the Hartford Avenue exit as needed for local access.

- The Plainfield Street Off-Ramp from Route 6 West will be permanently closed under the RIDOT Magnolia Street Bridge project that is expected to start construction in 2013 and be completed in 2014/2015. Existing traffic taking this ramp to access the Olneyville Square will use the Hartford Avenue exit.
- The existing Westminster Street On-Ramp to Route 10 South will be replaced with a new On-Ramp to Route 10 South from Broadway. As a result, the primary egress for the Olneyville Square would change from Westminster Street to Broadway.
- The existing Harris Avenue and Tobey Street On-Ramps will no longer have access to Route 10 South, as they connect to Route 6 West only. The existing traffic using those ramps to access Route 10 South would be redistributed to new Broadway On-Ramp. As part of the Route 6/10 Interchange project, a new traffic signal is proposed at Broadway/Harris Avenue to accommodate the projected increase in traffic along Harris Avenue.

Redistribution of future traffic volumes within the revised roadway network from the proposed interchange configuration was based on the Rhode Island Statewide Travel Demand Model, assumptions made in the Route 6/10 Interchange EIS and recent supplemental analyses, existing traffic patterns, newly collected data, origin/destination observations, and balancing of traffic volumes within the network. The schedule for construction of the Route 6/Route 10 Interchange project improvements is unknown at time due to funding; however, it is expected to be completed by the future design year of 2035 used by the RIDOT for recent analysis for the project.

Westminster Street/Olneyville Square Enhancements

Construction of the City of Providence Westminster Street/Olneyville Square Enhancements project was not completed during the data collection phase of this study. Work to be completed included the installation of new traffic signal equipment (including new detection and pedestrian signals) and pavement markings. The project is expected to be completed in 2013.

Narragansett Bay Commission CSO

The Narragansett Bay Commission (NBC) Combined Sewer Overflow (CSO) Abatement project, which was under construction during this study, is expected to be completed in the first quarter of 2015 . As part of the project, San Souci Drive east of Manton Avenue was closed due to construction in and around the area. Because of the construction impacts, some of the improvements including curb/island work (including restricting turning movements into and out of San Souci Drive to right-turns only) and sidewalks along Manton Avenue north of Westminster Street that were initially proposed under the Westminster Street/Olneyville Square

Enhancements project were removed from that project and will be done by NBC at the completion of their project. In addition, NBC has an easement over a portion of the former Price Rite parking lot, where they are responsible for constructing a new greenway upon completion of their project.

Providence Bicycle Master Plan

In the early 2000's, the City of Providence identified bicycling as a central component to improving transportation and mobility options. The City implemented Phase I of a Bike Network plan. The majority of the city's original bike plan developed in the early 2000's focused on signing and striping bike corridors throughout the city, and was implemented in 2007 and 2008. The final piece of the original plan was completed in Fall 2011 with the striping of bike lanes on Broadway ending east of the Olneyville Circulator study area.

The City is currently developing a bicycle master plan called "Bike Providence." This new planning effort will identify additional bicycle infrastructure improvements throughout the City as well as bicycle education, encouragement and enforcement components. A comprehensive plan will facilitate the continued and orderly development of bicycle facilities and will provide implementation strategies that **encourage** cycling as a safe, effective and efficient means of travel in and around the City. The plan is expected to:

- Guide the City in expanding the existing bicycle system and improve bicycle travel throughout the community
- Create a lasting bicycle transportation program that includes engineering (and planning), education, encouragement and enforcement components
- Identify the next layer of convenient and attractive on-street and off-street routes for bicycling to important nodes and destinations
- Identify connections to other modes of transportation and gaps in the existing system
- Improve the quality of the existing system
- Address the needs of all cyclists regardless of ability, age and skill level
- Address maintenance needs
- Be consistent with current and future plans for bicycle facilities in adjacent communities

Providence Roads Bond Paving Plan

The City of Providence is planning on a $40 million roads improvement project that will repair more than 65 miles of roadway across the City of Providence over the next three years. The preliminary list of roadways to be repaired as part of the project includes the following roadways within the general study area:

- Valley Street
- Harris Avenue

- Broadway, from Harris Avenue to Route 6/10
- Dike Street
- Magnolia Street, east of Atwood Street
- Agnes Street
- Troy Street

Regional Traffic Growth

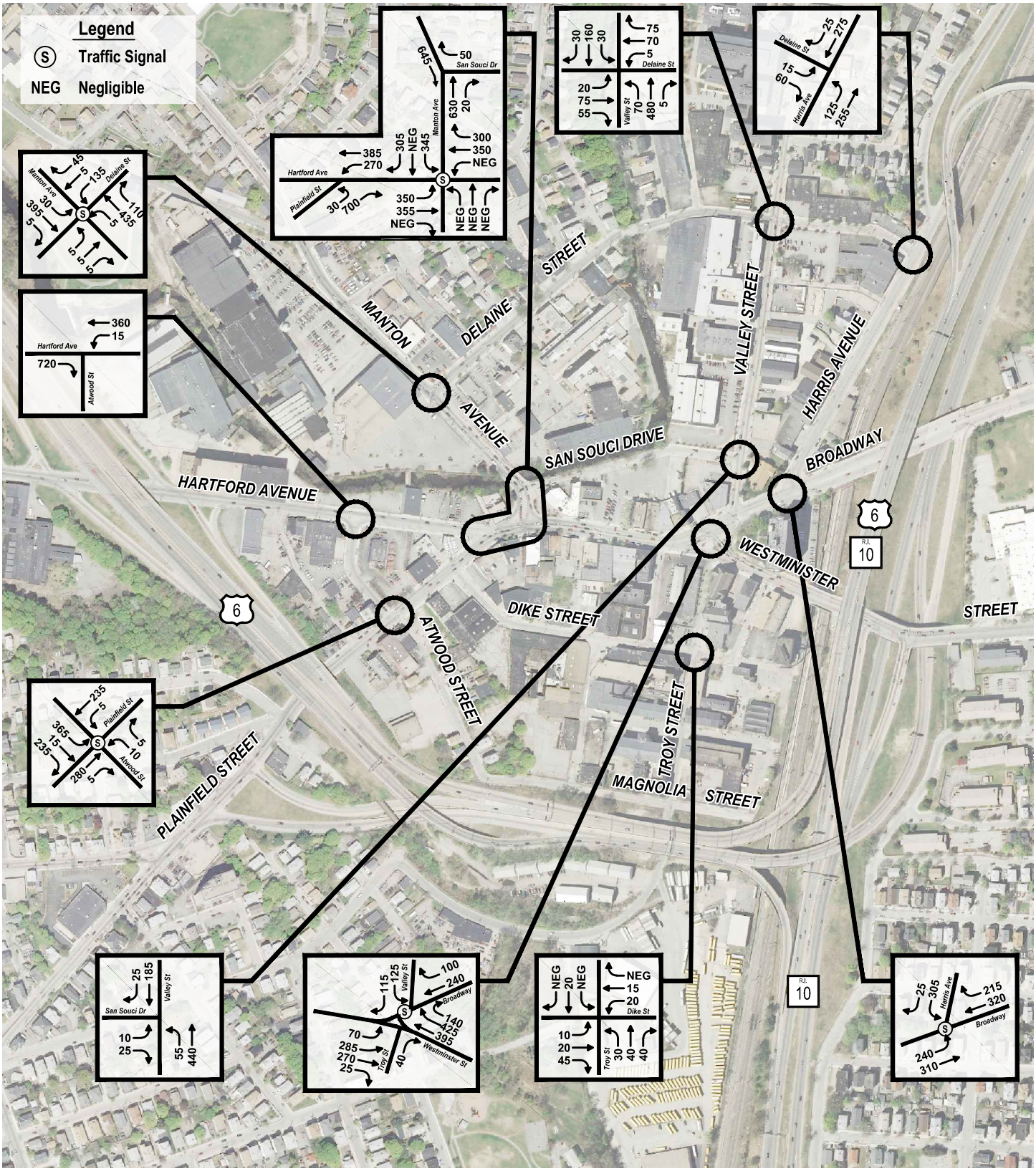
Based on traffic volumes recorded at RIDOT count station along I-95, Route 6, and Route 10, traffic volumes grew at an average rate of 0.33 percent per year between 2007 and 2011. Additionally, Rhode Island Statewide Planning population projections predict that population will grow at an average rate of 0.29 percent per year in the City of Providence, 0.24 percent per year in Providence County, and 0.28 percent per year statewide between 2005 and 2030. These percentages were averaged to estimate an overall average growth rate of 0.29 percent per year.

For the purpose of this study, a conservative average annual growth rate of 0.50 percent per year was used. This growth factor was applied to existing 2012 traffic volumes plus the redistribution of traffic resulting from the planned transportation infrastructure improvements to obtain the projected 2035 No-Build traffic volumes shown in Figures 3-2 and Figure 3-3.

2035 No-Build Traffic Analysis

The results of the projected 2035 No-Build conditions signalized intersection capacity analyses are presented in Table 3-1. As shown, the differences in calculated delay at the signalized intersections between 2012 Existing and 2035 No-Build conditions are minimal.

The intersection of Manton Avenue/Westminster Street/Plainfield Street would continue to operate at the same LOS C. Although the overall calculated delays at the intersection would be slightly reduced due to the shift in traffic from the completion of the Route 6/10 Interchange project, the delays and queues on the approaches are projected to continue to be long. Similarly, the volumes on Westminster Street entering the Olneyville Square area at the Broadway/Valley Street signal would be reduced, but the existing traffic leaving the Square that continue on Westminster Street under free flow (channelized right-turn) conditions would have to be brought into the signal to continue on Broadway to access the new on-ramp to Route 10 South. This causes the operation at this intersection to degrade to LOS D during the weekend evening peak hour. Traffic at the Broadway/Harris Avenue intersection is projected to operate efficiently with the proposed traffic signal. Finally, as traffic shifts from the Westminster Street off-ramp to the Hartford Avenue off-ramp, the traffic signals at the Hartford Avenue/Route 6 West Off-ramp and the Plainfield Street/Service Road/Atwood Street intersection would experience longer delays and queues.



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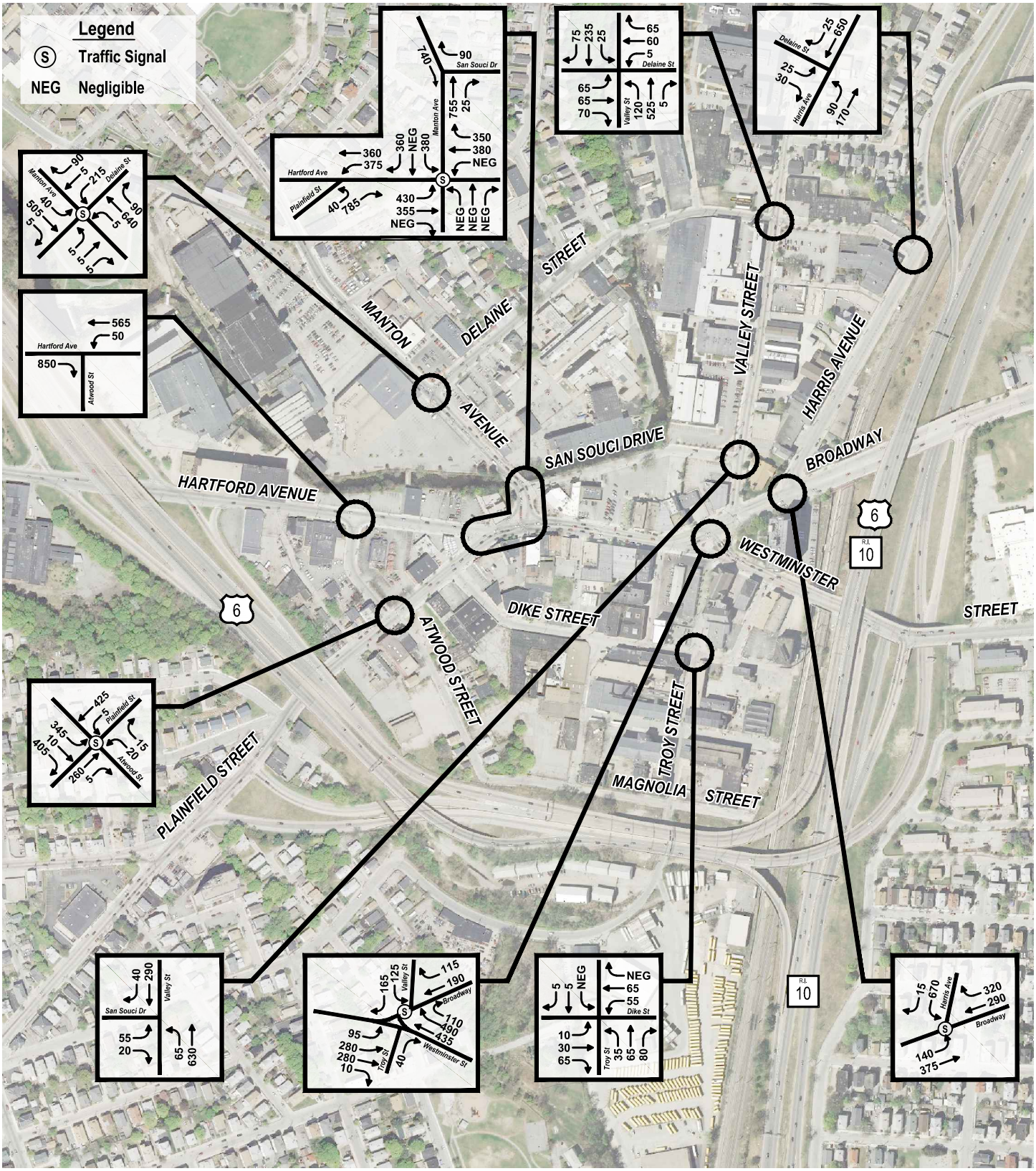
Not to Scale

2035 No-Build Weekday Morning Peak Hour Traffic Volumes
Olneyville Circulator
Providence, Rhode Island

Figure 3-2



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Not to Scale

2035 No-Build Weekday Evening Peak Hour Traffic Volumes
Olneyville Circulator
Providence, Rhode Island

Figure 3-3

Table 3-1
2035 No-Build Conditions Signalized Intersection Analysis

		2012 Existing			2035 No-Build		
Location	Peak Hour	V/C[1]	Delay[2]	LOS[3]	V/C[1]	Delay[2]	LOS[3]
Delaine Street at	Weekday AM	0.63	13.1	B	0.68	14.3	B
Manton Avenue	Weekday PM	0.82	17.8	B	0.88	21.9	C
Manton Avenue at	Weekday AM	0.82	30.6	C	0.87	26.4	C
Westminster St / Plainfield St	Weekday PM	0.89	34.1	C	0.92	32.7	C
Westminster Street at	Weekday AM	0.73	23.9	C	0.86	34.6	C
Broadway / Valley St / Troy St	Weekday PM	0.72	23.8	C	0.89	36.6	D
Broadway at	Weekday AM				0.66	15.6	B
Harris Avenue	Weekday PM		Unsignalized		0.57	15.2	B
Hartford Avenue at	Weekday AM	0.47	9.5	A	0.41	17.3	B
Route 6 West	Weekday PM	0.74	20.5	C	0.61	28.9	C
Plainfield Street at	Weekday AM	0.61	18.1	B	0.84	20.6	C
Service Road/Atwood Street	Weekday PM	0.76	17.3	B	0.84	23.2	C

Source: Synchro 7 software using the procedures in the 2000 Highway Capacity Manual. Compiled by VHB.

1 V/C = volume to capacity ratio
2 Delay = Vehicle delay expressed in seconds per vehicle (See note below)
3 LOS = Level of service

Notes:

1 Interruptions to traffic flow caused by pedestrians/bicyclists, bus blockages, parking maneuvers, difficult turning movements entering/exiting the numerous curb cuts and side streets were observed on the project roadways between intersections. These interruptions caused congestion along these roadways during the peak hour periods. As a result, the observed delay times at the signalized intersections exceeded the calculated values.
2 See Appendix for Synchro reports for operation of individual traffic movements at the intersections.

The results of the projected 2035 No-Build conditions unsignalized intersection capacity analyses are presented in Table 3-2. As shown, the operation at the existing unsignalized intersection of Delaine Street/Valley Street will continue to deteriorate, resulting in long delays and queues. Based on the peak hour traffic counts collected, threshold volumes for a traffic signal based on the peak hour warrant do not appear to be met at this location. A full traffic signal warrant analysis would require a minimum of 12-hour turning movement count.

Under 2035 No-Build conditions, traffic exiting Delaine Street onto Harris Avenue would also experience increases in delays, as traffic along Harris Avenue headed to the new Broadway On-Ramp to Route 10 South is projected to increase because there will no longer be a ramp from Harris Avenue to Route 10 South. At the intersection of Manton Avenue and San Souci Drive, the calculated delays decrease under the future No-Build conditions, as access to San Souci Drive is proposed to be limited right-turns in/out upon completion of the NBC project.

Table 3-2
2035 No-Build Conditions Unsignalized Intersection Analysis

		2012 Existing				2035 No-Build			
Location	Peak Hour	Critical Movement[1]	Demand[2]	Delay[3]	LOS[4]	Critical Movement	Demand	Delay	LOS
Delaine Street at Valley Street	Weekday AM	NB LTR	515	29.9	D	NB LTR	555	44.2	E
	Weekday PM	NB LTR	600	68.8	F	NB LTR	650	>100	F
Delaine Street at Harris Avenue	Weekday AM	EB LR	70	12.6	B	EB LR	75	16.3	C
	Weekday PM	EB LR	55	12.2	B	EB LR	55	30.9	D
San Souci Drive at Manton Avenue	Weekday AM	WB LR	65	20.5	C	WB R	50	15.4	C
	Weekday PM	WB LR	120	33.7	D	WB R	90	20.6	C
San Souci Drive at Valley Street	Weekday AM	EB LR	35	12.5	B	EB LR	35	12.9	B
	Weekday PM	EB LR	70	27.9	D	EB LR	75	39.1	E
Broadway at Harris Avenue	Weekday AM	SB L	155	>100	F	Signalized			
	Weekday PM	SB L	175	67.5	F				
Dike Street at Troy Street	Weekday AM	NB LTR	95	7.7	A	NB LTR	95	7.8	A
	Weekday PM	NB LTR	160	9.1	A	NB LTR	165	9.6	A

Source: Synchro 7 software using the procedures in the 2000 Highway Capacity Manual. Compiled by VHB.

1 L= Left-turn movement, T= Through movement, R= Right-turn movement
2 Demand = Demand of critical movement, expressed in vehicles per hour
3 Delay = Vehicle delay expressed in seconds per vehicle (See note below)
4 LOS = Level of service

Notes:

1 Interruptions to traffic flow caused by pedestrians/bicyclists, bus blockages, parking maneuvers, difficult turning movements entering/exiting the numerous curb cuts and side streets were observed on the project roadways between intersections. These interruptions caused congestion along these roadways during the peak hour periods. As a result, the observed delay times at the signalized intersections exceeded the calculated values.
2 See Appendix for Synchro reports for operation of individual traffic movements at the intersections.

Olneyville Circulator Concept

The existing Olneyville Square area, where five roadways converge, results in congestion and confusion, which can be a detriment to the redevelopment of the square. The City of Providence Department of Planning & Development has identified new potential connections and roadway enhancements referred to as the Olneyville Circulator. By creating other viable options to travel through and around the square, several parcels could become attractive for redevelopment and create opportunities for mixed use, urban development that would enhance the square and the interaction between the neighborhood and business district. The new circulator through and around Olneyville Square will improve mobility and livability and the overall character of the area, as it will bring residents to the Woonasquatucket River's edge, and better connect the bike path to the neighborhood. It will also provide an opportunity to incorporate "complete streets" to benefit the diversity of users including bicycles, pedestrians, motorists, and transit riders.

■

Proposed Roadway Improvements

The overall Olneyville Circulator concept is shown graphically in Figure 3-4. Specific elements of the proposed improvements are described below. It is recommended that all of the traffic signals within the study limits be upgraded to include new traffic signal control equipment (where needed) and connected to the City of Providence MESH network for communication and for maximum flexibility to incorporate and adjust time-of-day traffic signal and coordination plans. It is also recommended that all pedestrian crossings at traffic signals include working ADA compliant pushbuttons and high visibility crosswalks.

Delaine Street Extension

As shown in Figure 3-5, the proposed Delaine Street extension from Manton Avenue to Hartford Avenue (aligned with Atwood Street) would provide a new connection through the former Price Rite site, which would allow traffic to bypass Olneyville Square. The new roadway would also provide direct access to potential redevelopment of the former Price Rite site. To accommodate projected traffic volumes, the Delaine Street extension would be one lane in each direction (with bicycle share the lane markings) with a northbound left-turn lane at the intersection with Manton Avenue. New sidewalks would be provided on both sides of the Delaine Street extension, and depending on the City's preference and available funding, on-street parking could be provided along a portion of the east side of the new roadway.

The Manton Avenue southbound approach to Delaine Street would need to be restriped to provide a right-turn lane onto the new extension, which could impact some existing on-street parking along Manton Avenue in the area. On the southern end of the proposed Delaine Street extension, Hartford Avenue would need to be restriped to provide an exclusive left-turn lane and an exclusive right-turn lane, which would have an impact on some existing on-street parking along Hartford Avenue in this area. A new traffic signal is proposed to control traffic at the intersection of Hartford Avenue and the Delaine Street extension/Atwood Street (proposed to be changed to two-way traffic as described below).

The proposed Delaine Street extension is expected to have the biggest impact of the proposed Olneyville Circulator elements to help through traffic bypass Olneyville Square.

The estimated order of magnitude construction cost estimate for the Delaine Street Extension including contingencies for construction and police details is approximately $2,650,000 including the following elements and assumptions:

- New roadway with drainage and signing/striping along with required traffic control.

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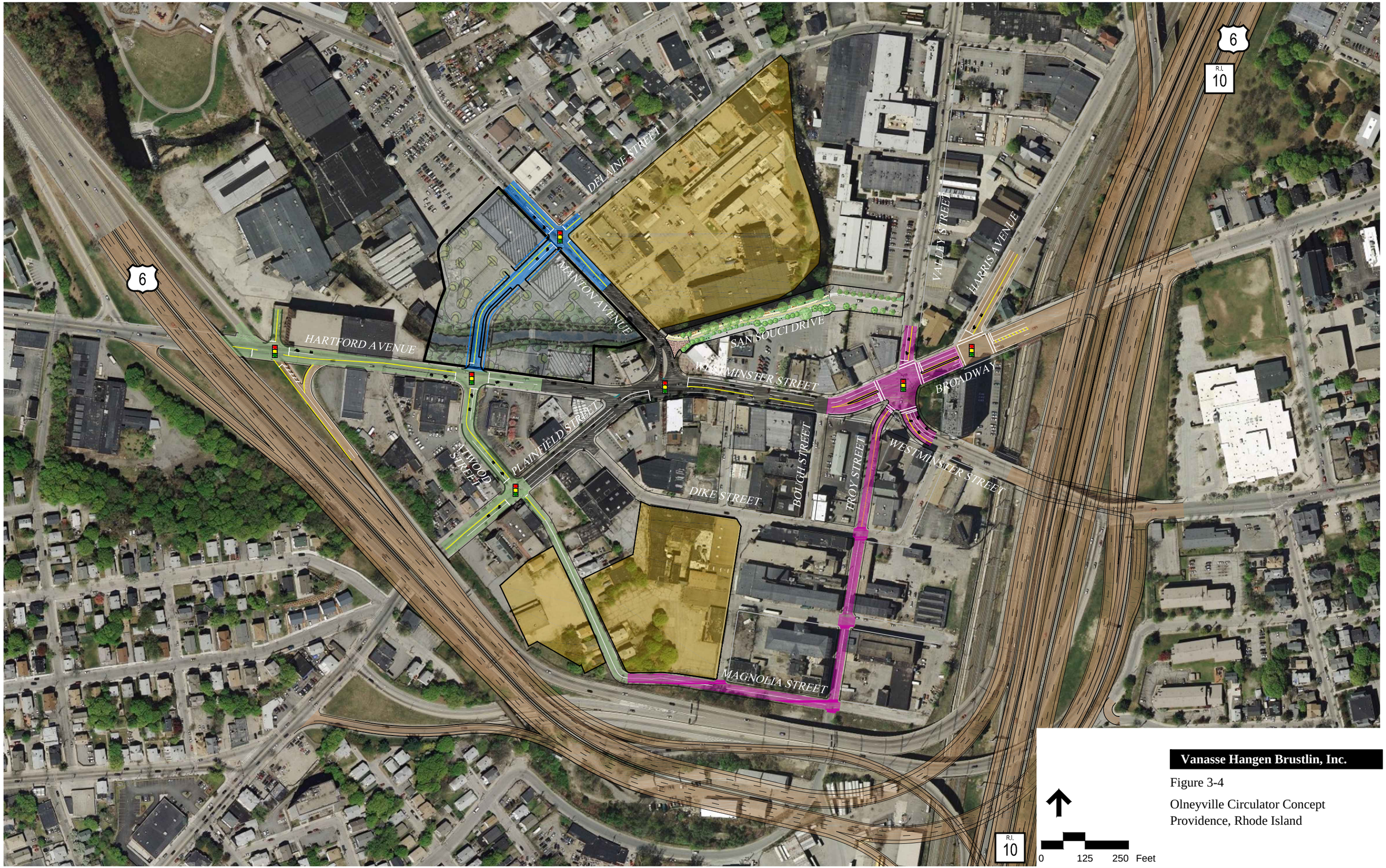

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Figure 3-4

Olneyville Circulator Concept
Providence, Rhode Island

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DELAINE STREET

DELAINE STREET EXTENSION

ONLY

ONLY

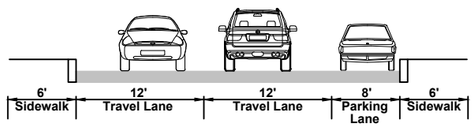
MANTON AVENUE

HARTFORD AVENUE

ONLY

ONLY

ONLY



Delaine Street Extension

0 30 60 Feet

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Figure 3-5

Delaine Street Extension
Olneyville Circulator
Providence, Rhode Island

- New traffic signal at intersection with Hartford Avenue and upgrade of signal at intersection with Manton Avenue.
- Removal of raised median island at intersection with Hartford Avenue.
- 70 feet long bridge over the Woonasquatucket River (with parking lane assumed, cost would be reduced by approximately $400,000 if parking lane is eliminated).
- Not including landscaping or lighting or the creation of the liner park along the river (assumed to be done by NBC).
- Not including design costs, right-of-way acquisition, underground utility relocation (if required), and environmental mitigation (if required).

Atwood Street (Service Road) Realignment

As shown in Figure 3-6, Atwood Street (Service Road) between Hartford Avenue and Plainfield Street would be converted to a two-way roadway and widened to a 3-lane cross-section to provide turning lanes at the intersections. The two-way conversion would allow traffic from Plainfield Street to have direct access to the proposed Delaine Street extension and Hartford Avenue to the west (which provides access to the Route 6 On-ramps) and bypass Olneyville Square. Also, it is proposed that the southern end of the roadway be shifted to align with Atwood Street south of Plainfield Street. The realignment would provide better connections and access to/from potential redevelopment in the area along Atwood Street. This would involve right-of-way taking and would have an impact on the existing Burger King parking lot; however, the impacted area appears to be underutilized.

The estimated order of magnitude construction cost estimate for the Atwood Street Realignment including contingencies for construction and police details is approximately $400,000 including the following elements and assumptions:

- Widening of existing roadway with drainage and signing/striping along with required traffic control.
- Relocation of four utility poles needed for roadway widening.
- Not including new landscaping or lighting
- Not including design costs, right-of-way acquisition, underground utility relocation (if required), and environmental mitigation (if required).

Realignment of Valley Street/Broadway/ Westminster Street/Troy Street

To achieve the City's goal of reconfiguring the intersection of Valley Street/ Broadway/Westminster Street/Troy Street to connect Troy Street to Valley Street, VHB prepared and evaluated different conceptual improvement options. The existing geometry and five legs of the intersection make the reconfiguration challenging without significant right-of-way impacts or creating additional confusion for pedestrians. The connection of Troy Street and Valley Street at the intersection would not have a significant overall benefit for traffic flow in the area, but it would

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HARTFORD AVENUE

ATWOOD STREET

PLAINFIELD STREET

ONLY

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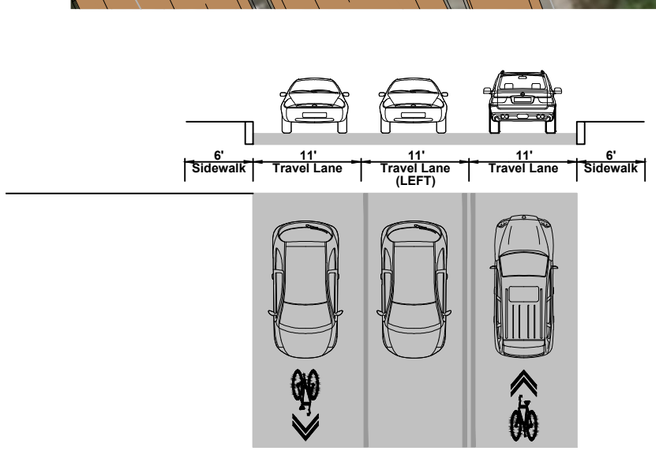

Atwood Street Realignment

0 30 60 Feet

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Figure 3-6

Atwood Street Realignment
Olneyville Circulator
Providence, Rhode Island

provide for additional connections and mobility options which could also help with development in the areas south of Westminster Street.

VHB evaluated a potential roundabout at this location in place of a traffic signal. However, due to the close proximity of Harris Avenue (and the proposed traffic signal at that location in the future) and the right-of-way impacts required, the roundabout option did not appear feasible.

After evaluating various intersection reconfiguration options and discussing the options with the project stakeholder group, the proposed realignment concept shown in Figure 3-7 was determined to be the preferred concept. As shown, the proposed reconfiguration would eliminate the existing raised median island that block some of the existing movements at the intersection, and vehicles would be able to travel through to/from Troy Street and Valley Street. In addition, southbound traffic on Valley Street would be able to continue through on Westminster Street. With the future change in access to Route 10 South from Westminster Street to Broadway, the demand for the "through" movement on Westminster Street eastbound will diminish. As shown in Figure 3-7, the proposed concept would make Broadway the through movement at the intersection, and vehicles traveling eastbound on Westminster Street would need to turn right at the traffic signal. The realignment would require land takings on the southeastern corner of the intersection; however, a portion of the existing roadway on the southwestern corner would be abandoned, allowing for a reallocation of green space at the intersection.

Consideration should be given to closing the existing Bank of America driveway on Valley Street, where vehicles could access the site via San Souci Drive, which is located further away from the traffic signal at the intersection with Westminster Street/Broadway. In addition, if it becomes problematic during final design, the unsignalized Bank of America driveway on Westminster Street could be restricted to right-in/right-out, which is how it operates under existing conditions.

The traffic signal at this located would need to be coordinate with the proposed traffic signal at Broadway/Harris Avenue under the Route 6/10 Interchange project.

The estimated order of magnitude construction cost estimate for the realignment of the Valley Street/Broadway/Westminster Street/Troy Street intersection including contingencies for construction and police details is approximately $780,000 including the following elements and assumptions:

- Realignment of the intersection as shown in Figure 3-7 including drainage and signing/striping along with required traffic control.
- New traffic signal at the reconfigured intersection.
- New decorative lighting at the intersection.
- Not including landscaping
- Not including design costs, right-of-way acquisition, underground utility relocation (if required), and environmental mitigation (if required).

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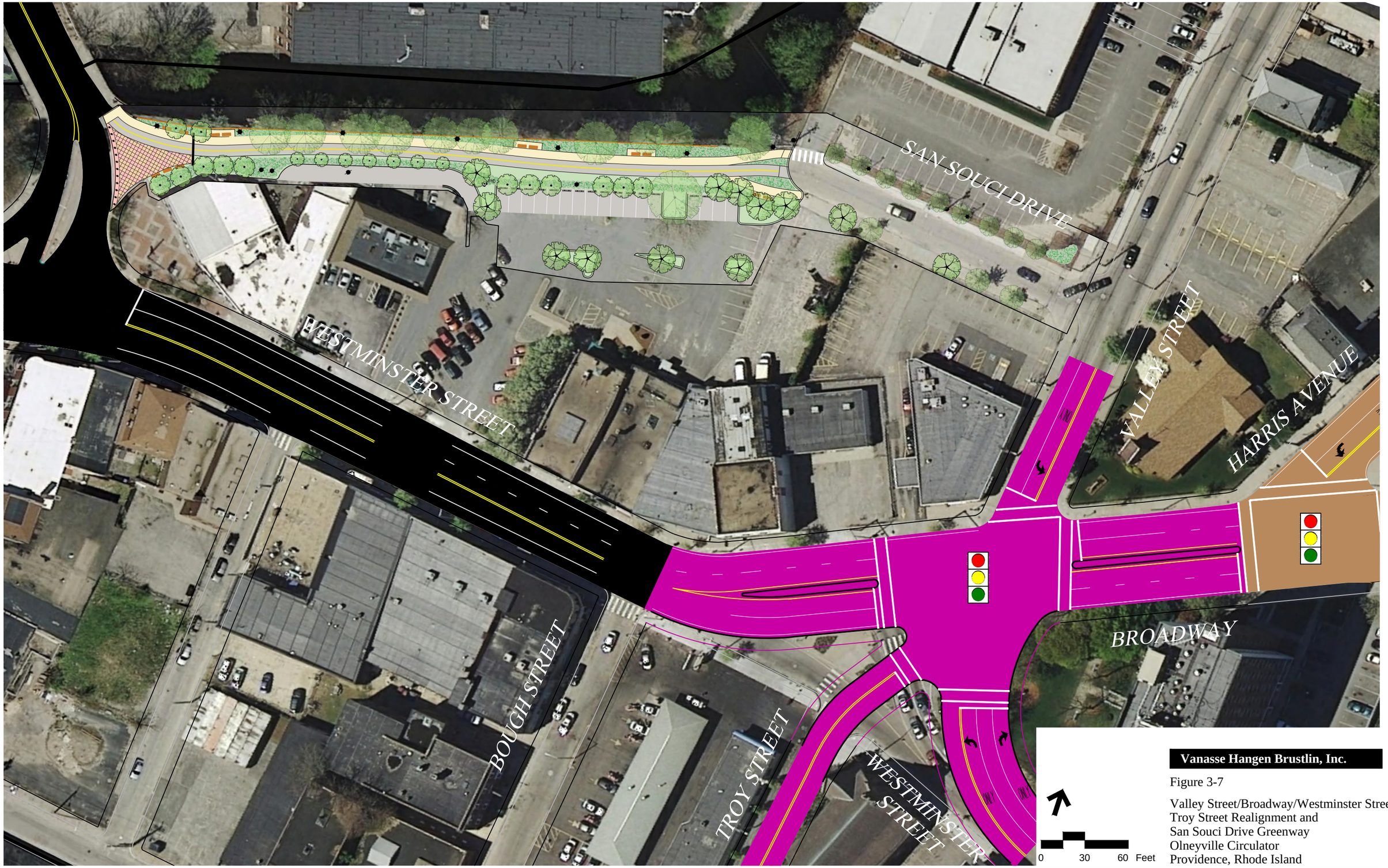

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Figure 3-7

Valley Street/Broadway/Westminster Street/
Troy Street Realignment and
San Souci Drive Greenway
Olneyville Circulator
Providence, Rhode Island

San Souci Drive

At the conclusion of the Narragansett Bay Commission CSO project, San Souci Drive was originally intended to be reopened but with restricted turning movements into and out of San Souci Drive to right-turns only. As part of the Olneyville Circulator concept, it is proposed that San Souci Drive be closed permanently at Manton Avenue to eliminate cut through traffic between Valley Street and Manton Avenue and create a greenway to accommodate pedestrians and bicyclists along the Woonasquatucket River. The eastern portion of San Souci Drive would remain open to traffic and provide access from Valley Street to the existing United Way parking lot and the shared parking for businesses that generally face Westminster Street.

The rerouting of existing traffic using San Souci Drive would have minimal impact to the adjacent signalized intersection, as traffic using San Souci Drive are relative low.

The Opportunities and Constraints Plan for the San Souci Drive Greenway (Figure 3-8) identifies key existing conditions which influence design of the improvements in detail. Conditions of existing improvements are identified to better understand where improvements are best targeted. Existing and potential plazas and gateways are also identified to provide an overview of how these may compliment the San Souci Drive Greenway experience. Design challenges are noted on the east side of Manton Avenue in the location of a potential crosswalk, key among these being the need to relocate a recently installed light pole to provide adequate ADA compliant area for a new curb ramp.

The schematic design of the bikeway, pedestrian walkway, overall landscape design and a gateway treatment for the new Gateway Plaza at Manton Avenue is shown in Figure 3-9. The interface with the existing parking lot alongside the Greenway is shown in a manner which will not impede existing surficial drainage. An access drive to the service area of the building at the western end of the Greenway is also indicated conceptually. The final design of the access drive will need to consider delivery vehicle turning movements to access existing loading bays.

Additionally, Figure 3-9 shows several features not included in the original concept plan but which are suggested as improvements that merit consideration. These include replacement of the existing deteriorated metal guard rail with a timber guard rail alongside the river top of bank; provision of a gateway sign at the Manton Avenue entrance; and use of colored concrete and a grid scoring pattern in the Manton Avenue entrance plaza. These elements have been included in the order of magnitude construction cost estimate provided below. It is further suggested that a premanufactured metal railing be considered as an upgrade to replace the guard rail at the top of river bank; however, this would carry an additional estimated premium of approximately $50,000.

A perspective rendering of the new Gateway Plaza at Manton Avenue, which illustrates the proposed improvements as they would appear upon completion is shown in Figure 3-10. A Palette of Materials to communicate a family of site

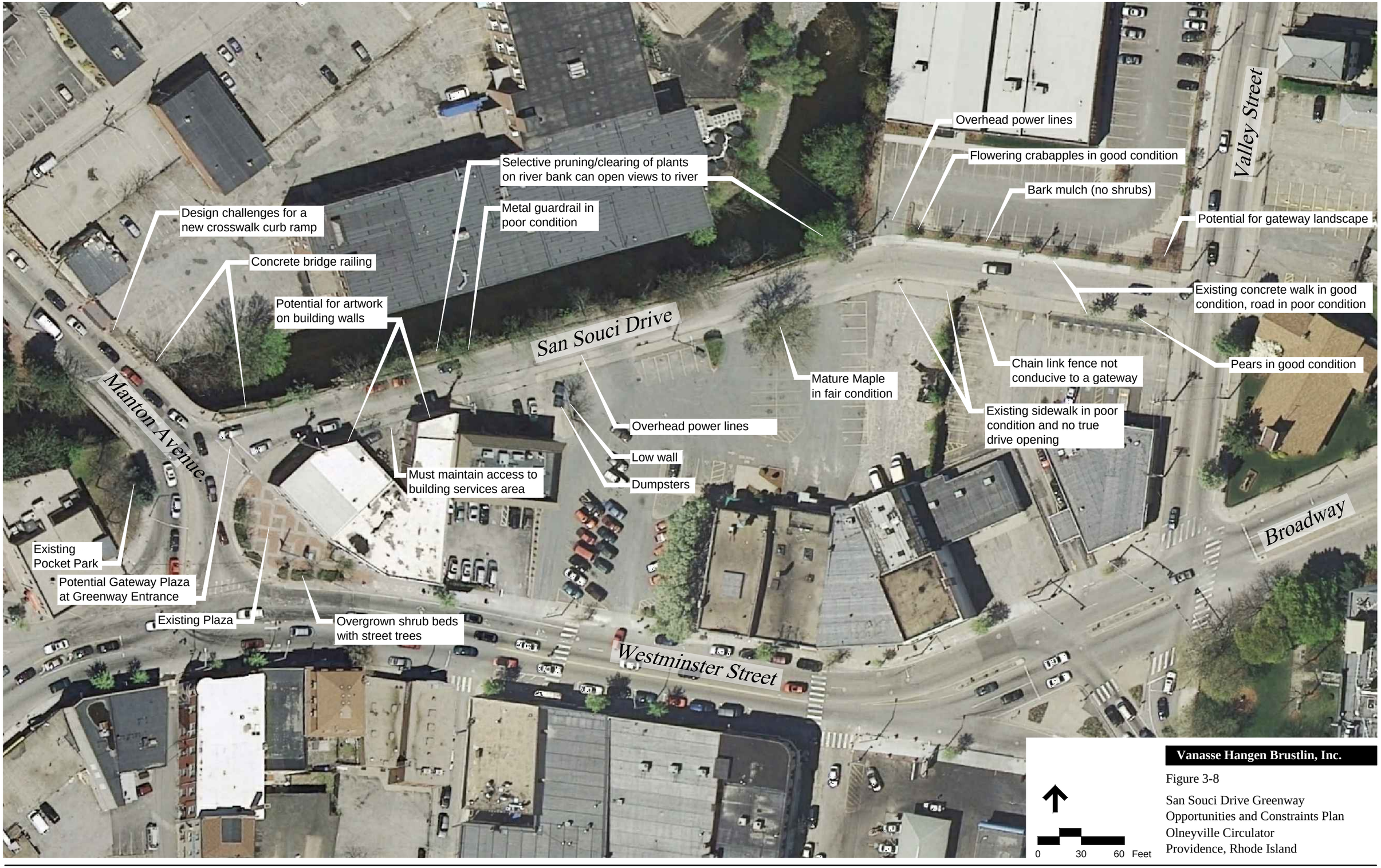

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Figure 3-8

San Souci Drive Greenway
Opportunities and Constraints Plan
Olneyville Circulator
Providence, Rhode Island

Prepared for:
Date:

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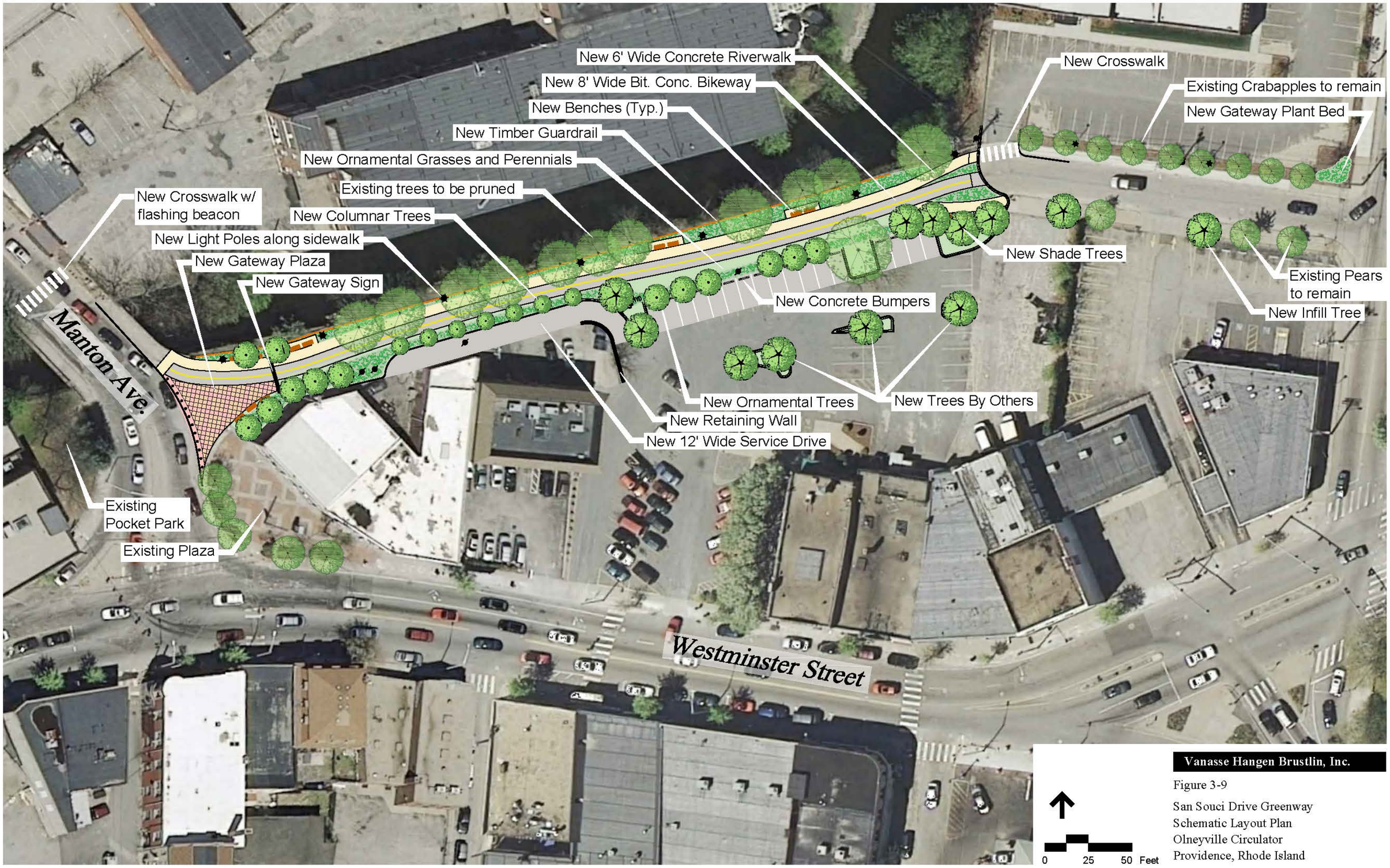

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Figure 3-9

San Souci Drive Greenway
Schematic Layout Plan
Olneyville Circulator
Providence, Rhode Island

furnishings, amenities, and plantings to be considered for the final design is included as Figure 3-11.

The estimated order of magnitude construction cost estimate for the creation of the San Souci Drive Greenway including contingencies for construction and police details is approximately $500,000 including the following elements and assumptions:

- Removal of existing pavement along San Souci Drive and the construction of an 8 feet wide bike path and a 6 feet wide sidewalk as depicted in Figures 3-8 and 3-9.
- Drainage and signing/striping along with required traffic control.
- Decorative lighting (pedestrian scale).
- Not including any special pavement treatments (asphalt and concrete are assumed) outside of the new Gateway Plaza at Manton Avenue.
- Not including landscaping or curbing outside of the City right-of-way (i.e. parking areas)
- Not including design and/or permitting costs, right-of-way acquisition, underground utility relocation (if required), and environmental mitigation (if required).

Hartford Avenue at Route 6 West Ramps/ Contech Medical Drive

Although not directly part of the Olneyville Circulator concept, it is recommended that the access to the Contech Medical facility from Hartford Avenue across from the Route 6 West Off-Ramp be addressed. Due to a collapsed sluiceway in the existing parking area east of the Route 6 West Off-Ramp, a temporary driveway opening was installed directly across from the Route 6 West Off-Ramp. However, it is an unsignalized approach in the middle of a signalized intersection with limited sight distance to the east.

Unless the collapsed sluiceway is repaired, the access to Contech Medical off Hartford Avenue is expected to remain at its current location. It is recommended that the corner of the existing building adjacent to the drive be demolished, and the driveway be better aligned and brought into the traffic signal as shown graphically in Figure 3-4.

The estimated order of magnitude construction cost estimate for the upgrade of the Contech Medical Drive across from the Route 6 West Off-Ramp including contingencies for construction and police details is approximately $150,000 including the following elements and assumptions:

- Driveway realignment with the Route 6 West Off-Ramp along with required traffic control.
- Modifications to the existing traffic signal to accommodate the additional movement at the intersection.
- Relocation of three existing utility poles needed for the new driveway alignment.

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Figure 3-10

San Souci Drive Greenway
Manton Avenue Gateway Plaza
Olneyville Circulator
Providence, Rhode Island

Metal Bench

Trash Receptacle

Solar Bollard

Bike Posts

Plaza Pavement

Ornamental Grasses

Perennials

Redspire Pear

Karpic Maple

Sunset Red Maple

Eastern Redbud

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Figure 3-11

San Souci Drive Greenway
Palette of Materials
Olneyville Circulator
Providence, Rhode Island

- Not including lighting or landscaping.
- Not including additional improvements inside of parking lot including, but not limited to building demolition and sluiceway repairs.
- Not including design and/or permitting costs, right-of-way acquisition, underground utility relocation (if required), and environmental mitigation (if required).

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Site Specific Traffic Growth

Discussions with the City of Providence Department of Planning & Development identified three potential redevelopment sites that would help revitalize the Olneyville Square area as briefly described below.

Paragon Mills Site

The Paragon Mills site is located on the south side of Delaine Street, between Manton Avenue and the Woonasquatucket River. Conceptual redevelopment plans envisioned by the City of Providence include a major office tenant and potential incubator-type artist work space with as many as 204 parking spaces on the site. Access to the redevelopment site is envisioned from Manton Avenue and Delaine Street.

Colonial Knife Site

The Colonial Knife site is located on the east side of Atwood Street and the south side of Dike Street and west of Agnes Street. Conceptual redevelopment plans envisioned by the City of Providence include supplemental office/storage buildings and parking for trucks for the potential tenant envisioned for the Paragon Mills site. Access to the redevelopment site is envisioned from Atwood Street and Dike Street.

Former Price Rite Site

The existing Price Rite site is located on the west side of Manton Avenue across from Delaine Street. The City envisions multistory mixed use developments with commercial uses on the ground floor and residential units above on both sides of a new Delaine Street Extension from Manton Avenue to Hartford Avenue, as described in the next Chapter. One concept master plan developed for the site included approximately 30 residential units, 27,000 square feet of commercial/retail space, and 155 parking spaces. Access to the redevelopment sites is envisioned from Manton Avenue and the proposed Delaine Street extension.

Future Year Bicycle Accommodations

As noted earlier, the City of Providence is developing a bicycle master plan for the City. Although the plan is still being finalized, it is likely that the following recommendations will be included in the plan for the Olneyville area:

Short Term (0-2 years)

- Improve the connection from the Woonasquatucket River Greenway and from the East Coast Greenway to the Cranston/Warwick Washington Secondary bike path via shared lane markings on existing roadways.

Mid Term (3-5 years)

- Extend the off-road section of the Greenway along the River/Kinsley Avenue/Promenade Place from Eagle Square to Waterplace Park. This would most likely result in a significant increase of user volume on the Greenway.
- Extend the bike lanes on Broadway to the west.
- Utilize a reconfigured San Souci Drive as an off-road bike and pedestrian connection between Valley Street and Manton Avenue
- Extend the off-road bike and pedestrian connection across Manton Avenue along the River crossing the new Delaine Street Extension and continuing along the River behind the Atlantic Mill building. If room is not available along the River bank behind the Atlantic Mill building, an alternative would be to cross the River via the existing bridge (which would need to be repaired from recent flood damage) then continue north along the edge of the existing mill parking lot adjacent to the Route 6 on-ramp to the off-road section of the Greenway off of Aleppo Street. An additional river crossing would be needed in the area where there is an existing steel truss bridge at the north rear side of the Atlantic Mill building.

Future Year Build Conditions and Analysis

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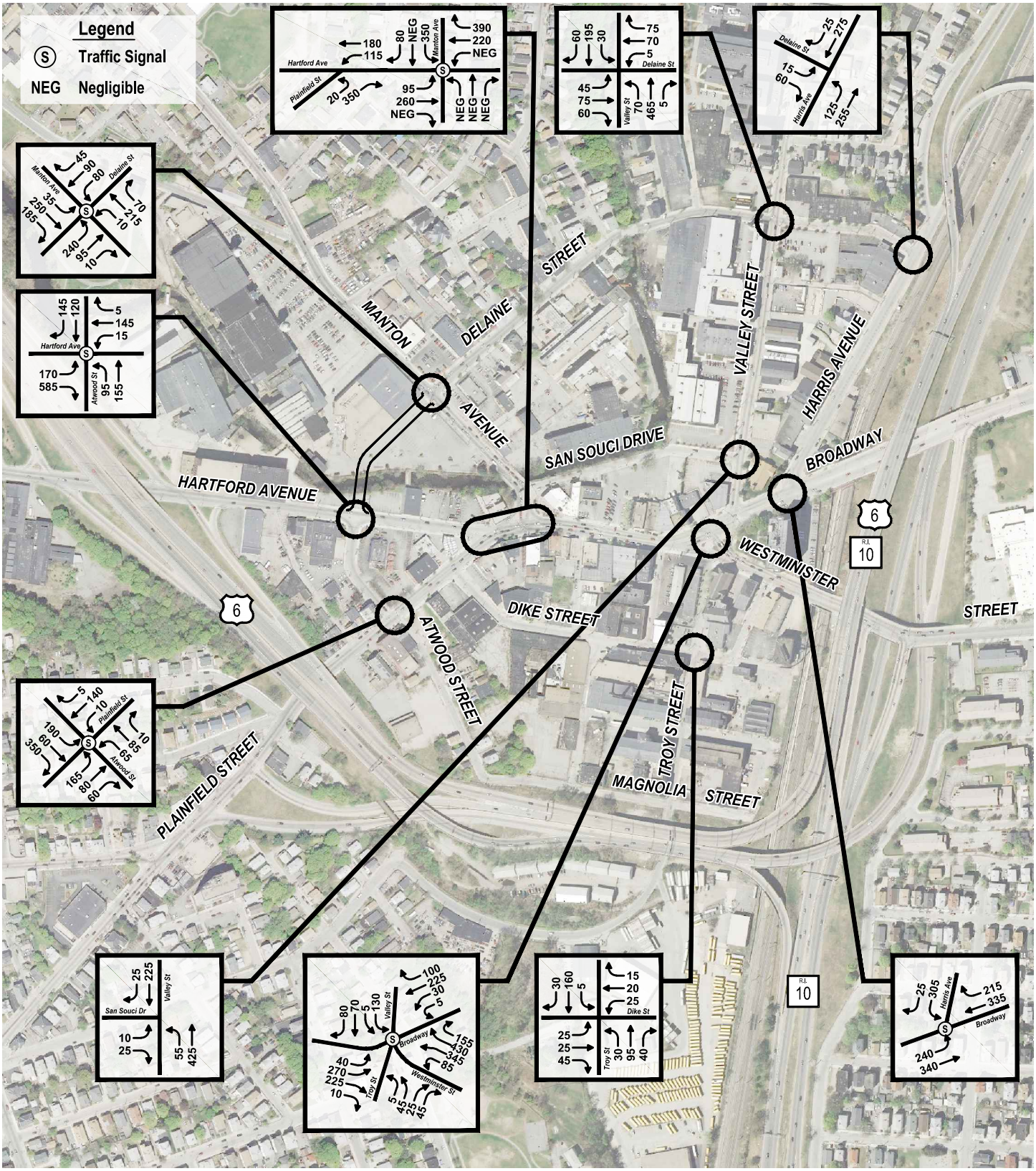
2035 Projected Build Traffic Volumes

The 2035 No-Build condition traffic volumes were modified to reflect redistribution of traffic resulting from the proposed Olneyville Circulator improvements and projected site specific traffic volumes based on the redevelopment assumptions described above. The resulting traffic volumes for the projected 2035 Build conditions are shown in Figure 3-12 and Figure 3-13.



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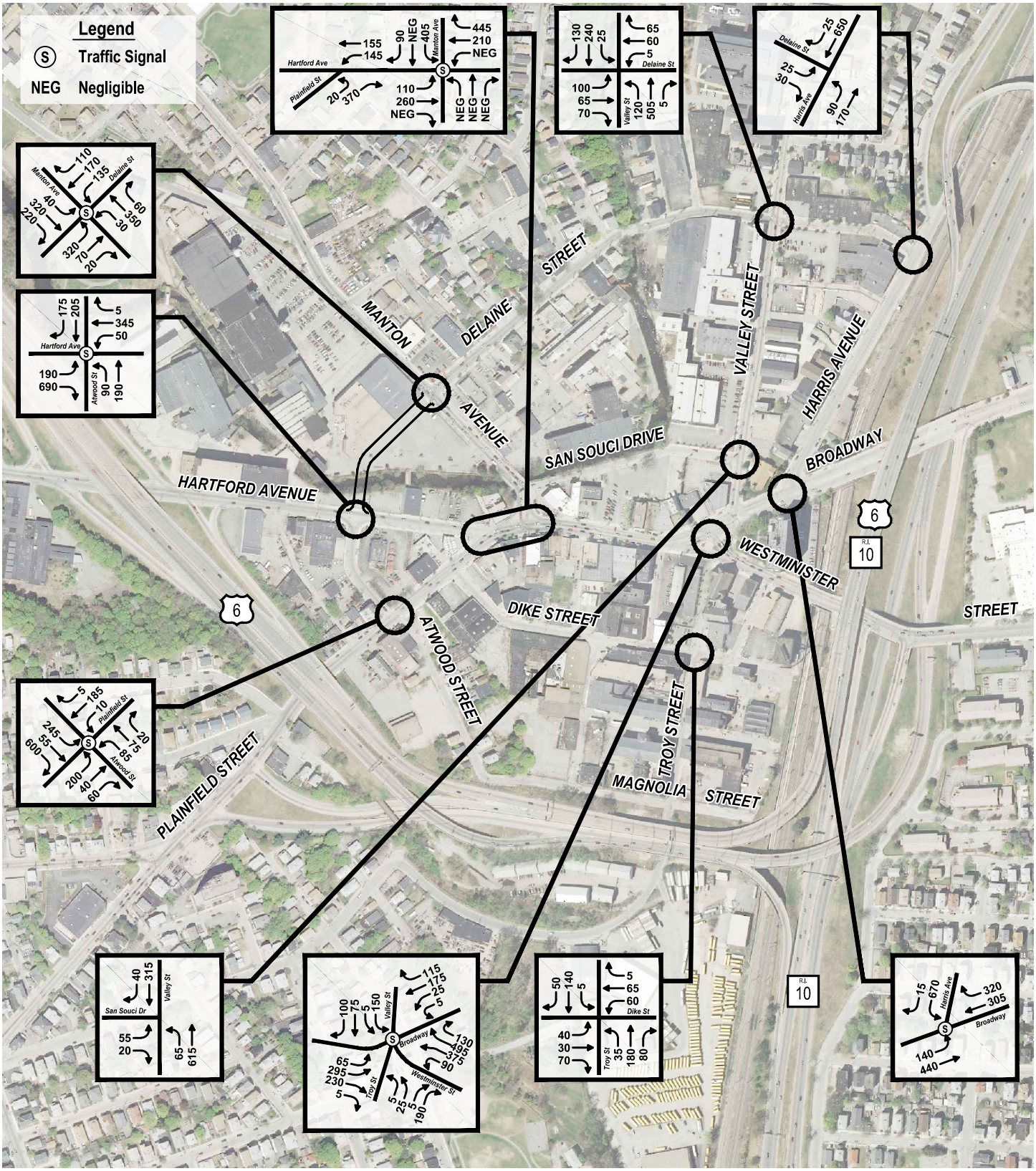
Not to Scale

2035 Build Weekday Morning Peak Hour Traffic Volumes
Olneyville Circulator
Providence, Rhode Island

Figure 3-12



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Not to Scale

2035 Build Weekday Evening Peak Hour Traffic Volumes
Olneyville Circulator
Providence, Rhode Island

Figure 3-13

■

2035 Build Traffic Analysis

The results of the projected 2035 Build conditions signalized intersection capacity analyses are presented in Table 3-3. As shown, the calculated delay at the signalized intersections under 2035 Build conditions are comparable to or less than under 2035 No-Build conditions.

Table 3-3
2035 Build Conditions Signalized Intersection Analysis

		2035 No-Build			2035 Build		
Location	Peak Hour	V/C[1]	Delay[2]	LOS[3]	V/C[1]	Delay[2]	LOS[3]
Delaine Street at Manton Avenue	Weekday AM	0.68	14.3	B	0.57	9.4	A
	Weekday PM	0.88	21.9	C	0.90	22.6	C
Manton Avenue at Westminster St / Plainfield St	Weekday AM	0.87	26.4	C	0.64	18.9	B
	Weekday PM	0.92	32.7	C	0.65	20.1	C
Westminster Street at Broadway / Valley St / Troy St	Weekday AM	0.86	34.6	C	0.81	35.8	D
	Weekday PM	0.89	36.6	D	0.81	33.2	C
Broadway at Harris Avenue	Weekday AM	0.66	15.6	B	0.54	14.2	B
	Weekday PM	0.57	15.2	B	0.61	15.1	B
Hartford Avenue at Route 6 West	Weekday AM	0.41	17.3	B	0.59	9.8	A
	Weekday PM	0.61	28.9	C	0.82	18.8	B
Hartford Avenue at Delaine Street Extension	Weekday AM	Unsignalized (Free Flow)			0.37	10.7	B
	Weekday PM				0.62	15.9	B
Plainfield Street at Service Road/Atwood Street	Weekday AM	0.84	20.6	C	0.81	22.8	C
	Weekday PM	0.84	23.2	C	0.95	36.9	D

Source: Synchro 7 software using the procedures in the 2000 Highway Capacity Manual. Compiled by VHB.

1 V/C = volume to capacity ratio
2 Delay = Vehicle delay expressed in seconds per vehicle (See note below)
3 LOS = Level of service

Notes:

1 Interruptions to traffic flow caused by pedestrians/bicyclists, bus blockages, parking maneuvers, difficult turning movements entering/exiting the numerous curb cuts and side streets were observed on the project roadways between intersections. These interruptions caused congestion along these roadways during the peak hour periods. As a result, the observed delay times at the signalized intersections exceeded the calculated values.
2 See Appendix for Synchro reports for operation of individual traffic movements at the intersections.

With the new connections, the operation at the intersection of Manton Avenue/Westminster Street/Plainfield Street would improve as less traffic would travel through the intersection. There would be an increase in calculated delay at the intersection of Plainfield Street at Atwood Street when the Atwood Street is converted to two-way traffic and more traffic utilizes the connection.

The results of the projected 2035 Build conditions unsignalized intersection capacity analyses are presented in Table 3-4. As shown, the differences in calculated delay at the unsignalized intersections between 2035 No-Build and 2035 Build conditions are minimal.

Table 3-4
2035 Build Conditions Unsignalized Intersection Analysis

		2035 No-Build				2035 Build			
Location	Peak Hour	Critical Movement[1]	Demand[2]	Delay[3]	LOS[4]	Critical Movement	Demand	Delay	LOS
Delaine Street at	Weekday AM	NB LTR	555	44.2	E	NB LTR	540	58.5	F
Valley Street	Weekday PM	NB LTR	650	>100	F	NB LTR	630	>100	F
Delaine Street at	Weekday AM	EB LR	75	16.3	C	EB LR	75	16.3	C
Harris Avenue	Weekday PM	EB LR	55	30.9	D	EB LR	55	30.9	D
San Souci Drive at	Weekday AM	WB R	50	15.4	C	Closed to Traffic			
Manton Avenue	Weekday PM	WB R	90	20.6	C				
San Souci Drive at	Weekday AM	EB LR	35	12.9	B	EB LR	35	13.5	B
Valley Street	Weekday PM	EB LR	75	39.1	E	EB LR	75	37.5	E
Dike Street at	Weekday AM	NB LTR	95	7.8	A	SB LTR	195	9.0	A
Troy Street	Weekday PM	NB LTR	160	9.6	A	NB LTR	295	11.8	B

Source: Synchro 7 software using the procedures in the 2000 Highway Capacity Manual. Compiled by VHB.

1 L= Left-turn movement, T= Through movement, R= Right-turn movement
2 Demand = Demand of critical movement, expressed in vehicles per hour
3 Delay = Vehicle delay expressed in seconds per vehicle (See note below)
4 LOS = Level of service

Notes:

1 Interruptions to traffic flow caused by pedestrians/bicyclists, bus blockages, parking maneuvers, difficult turning movements entering/exiting the numerous curb cuts and side streets were observed on the project roadways between intersections. These interruptions caused congestion along these roadways during the peak hour periods. As a result, the observed delay times at the signalized intersections exceeded the calculated values.
2 See Appendix for Synchro reports for operation of individual traffic movements at the intersections.

4

Conclusions/Implementation

The proposed Olneyville Circulator envisioned by the City of Providence Department of Planning and Development will improve mobility options and circulation through the Olneyville Square area. By creating other viable options to travel through and around the square, several parcels could become attractive for redevelopment and create opportunities for mixed use, urban development that would enhance the square and the interaction between the neighborhood and business district. The new circulator through and around Olneyville Square will also improve livability and the overall character of the area, as it will bring residents to the Woonasquatucket River's edge, and better connect the bike path to the neighborhood. Finally, the proposed improvements will provide an opportunity to incorporate "complete streets" to benefit the diversity of users including bicycles, pedestrians, motorists, and transit riders.

Independent of the proposed Olneyville Circulator project, the RIDOT Improvements to the US Route 6/Route 10 Interchange project will have a significant impact on regional traffic flow along Route 6/Route 10 and access to/through the Olneyville Square area. It will also free up land in the area of the existing highway for potential redevelopment and/or for enhanced connections through the area of the existing elevated roadway. With the proposed improvements, traffic flow through the Olneyville Square area will change significantly. Existing traffic from Route 10 North that has to exit at Westminster Street to head to Route 6 West or the Olneyville Square area will be able to take a new direct ramp connection from Route 10 North to Route 6 West to continue directly on to Route 6 West or take the Hartford Avenue exit as needed for local access. In addition, the existing Westminster Street On-Ramp to Route 10 South will be replaced with a new On-Ramp to Route 10 South from Broadway, and as a result, the primary egress for the Olneyville Square would change from Westminster Street to Broadway.

Implementation

The Build conditions analyses presented in this report reflect future year 2035 conditions, by which time the Route 6/Route 10 Interchange project is expected to be completed. Some of the elements of the proposed Olneyville Circulator concept would provide a benefit under existing conditions, while it is recommended that others be implemented after the larger interchange project (or phases of that project)

are complete. Recommended implementation timeframes are discussed below. The actual implementation will depend on available funding and right-of-way acquisition.

Delaine Street Extension

As discussed previously, the proposed Delaine Street extension between Manton Avenue and Hartford Avenue is expected to have the biggest impact of the proposed Olneyville Circulator elements to help "through" traffic bypass Olneyville Square. The extension would have a benefit to traffic flow with or without the Route 6/Route 10 Interchange project. However, due to the planned construction detours as part of the RIDOT Magnolia Street Bridge project, it is recommended that the Delaine Street Extension be implemented after completion of that project as funding becomes available.

Atwood Street (Service Road) Realignment

The proposed conversion of Atwood Street (Service Road) to two-way traffic along with the realignment of Atwood Street at Plainfield Street would also help reduce the amount of traffic in the Olneyville Square area. The extension would have a benefit to traffic flow with or without the Route 6/Route 10 Interchange project, provided the Delaine Street extension was in place. However, due to the planned construction detours as part of the RIDOT Magnolia Street Bridge project, it is recommended that the Atwood Street Realignment be implemented after completion of that project (and after completion or in conjunction with the Delaine Street extension) as funding becomes available. If for some reason, the Plainfield Street On-Ramp to Route 6 East (which is being temporary closed under the Magnolia Street Bridge project) does not reopen after that project, it is recommended that additional analysis be done to determine the impacts of the Atwood Street realignment prior to the completion of the Route 6/Route 10 Interchange project.

Realignment of Valley Street/Broadway/ Westminster Street/Troy Street

As previously discussed, the connection of Troy Street and Valley Street at the intersection would not have a significant overall benefit for traffic flow in the area, but it would provide for additional connections and mobility options which could also help with development in the areas south of Westminster Street. The proposed realignment would result in additional traffic congestion if implemented prior to the completion of the Route 6/Route 10 Interchange project and the resulting change in egress for the Olneyville Square area from Westminster Street to Broadway. As a result, it is recommended that the realignment concept be implemented after completion of the larger interchange project as funding becomes available. If

funding becomes available prior to the completion of the interchange project, right-of-way acquisition or other elements of the design could be advanced.

San Souci Drive

At the conclusion of the Narragansett Bay Commission CSO project, the original intent was for San Souci Drive to be reopened but with restricted turning movements into and out of San Souci Drive to right-turns only. As part of the Olneyville Circulator concept, it is proposed that San Souci Drive be closed permanently at Manton Avenue to eliminate cut-through traffic between Valley Street and Manton Avenue and create a greenway to accommodate pedestrians and bicyclists along the Woonasquatucket River. Since the roadway is current closed for the NBC project, if funding is available, it would be desirable to have San Souci Drive greenway work done upon completion of that project at the same time that the greenway along the river west of Manton Avenue is constructed.

Hartford Avenue at Route 6 West Ramps/ Contech Medical Drive

Although not directly part of the Olneyville Circulator concept, it is recommended that the access to the Contech Medical facility from Hartford Avenue across from the Route 6 West Off-Ramp be addressed. The temporary driveway opening installed across from the Route 6 West Off-Ramp is unsignalized and the sight distance is restricted. With the increase in traffic in the area from the Magnolia Street Bridge project detours, it will become more difficult for vehicles to exit the unsignalized intersection. As a result, it is recommended that the driveway be upgraded and signalized as soon as funding becomes available.

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