DELAWARE VALLEY
dvrpc
REGIONAL
PLANNING COMMISSION

October 2012

Traffic-Calming Alternatives for Routes 130 & 206 in Bordentown, NJ

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The Delaware Valley Regional Planning Commission is dedicated to uniting the region's elected officials, planning professionals, and the public with a common vision of making a great region even greater. Shaping the way we live, work, and play, DVRPC builds consensus on improving transportation, promoting smart growth, protecting the environment, and enhancing the economy. We serve a diverse region of nine counties: Bucks, Chester, Delaware, Montgomery, and Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer in New Jersey. DVRPC is the federally designated Metropolitan Planning Organization for the Greater Philadelphia Region — leading the way to a better future.

The symbol in our logo is adapted from the official DVRPC seal and is designed as a stylized image of the Delaware Valley. The outer ring symbolizes the region as a whole while the diagonal bar signifies the Delaware River. The two adjoining crescents represent the Commonwealth of Pennsylvania and the State of New Jersey.

DVRPC is funded by a variety of funding sources including federal grants from the U.S. Department of Transportation's Federal Highway Administration (FHWA) and Federal Transit Administration (FTA), the Pennsylvania and New Jersey departments of transportation, as well as by DVRPC's state and local member governments. The authors, however, are solely responsible for the findings and conclusions herein, which may not represent the official views or policies of the funding agencies.

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Executive Summary

This study was prompted by local concern for pedestrian and motorist safety on Route 130 and Route 206, two major arterials that share a 0.8 mile section bounded by numerous commercial establishments, but with only a single controlled crossing location. Recent efforts, a Road Safety Audit and a Bicycle and Pedestrian Plan, raised multiple potential solutions, but did not analyze the impacts upon vehicular mobility. This study built upon the recommendations of earlier efforts and has developed conceptual alternatives. All evaluated alternatives sought to reduce excessive speeding and improve pedestrian crossing opportunities. Many of these explored potential solutions to the large presence of heavy vehicles along Farnsworth Avenue and for economic redevelopment opportunities throughout the corridor. Preferred alternatives were identified only after receiving local stakeholder feedback, and they were based upon their feasibility for implementation and suitability for gradual adoption.

Routes 130 and 206 are two of the longest and most traveled arterials in New Jersey. They serve long-distance trips between southern and northern areas of the state, while also providing direct and local access to businesses and residences. These dual purposes are often conflicting and have contributed to unsafe conditions for all roadway users, but especially for pedestrians. This is underscored by Route 130 having been rated the most dangerous road for pedestrians in New Jersey since 2008.

Routes 130 and 206 merge, share a 0.8 mile section, and then diverge in the Bordentown area. They serve as an informal boundary between the denser mixed-use environment of Bordentown City to the west and the primarily residential suburban areas of Bordentown Township to the east. Individually, the roadways are four lanes apiece, with posted speed limits of up to 55MPH. Within their merged section, the roadway is up to eight lanes wide, with a posted speed limit of 40MPH. Businesses are most prevalent along this section, which is reflected in the increased frequency of driveways and pedestrian activity.

This study was initiated by NJDOT and Burlington County to address local stakeholder concerns for pedestrian, bicyclist, and motorist safety. The magnitude of these safety issues prompted a Road Safety Audit by DVRPC’s Office of Transportation Safety and Congestion Management Planning Unit in the fall of 2010 and a NJDOT-funded Bicycle and Pedestrian Plan conducted by Michael Baker Jr., in May 2011. However, neither of these efforts quantified the impacts of their recommendations upon vehicular capacity and delay. This study seeks to identify and prioritize those impacts while maintaining their safety goals.

Opportunities to deliver these safety goals include:

- A decline in the prevalence of vehicular speeds exceeding the posted speed limit;
- New controlled pedestrian crossing locations to eliminate dangerous midblock crossings;

- Reduced dependency upon vehicular weaving to reach desired destinations;
- The mitigation of heavy vehicle presence upon inappropriate roadways;
- Increased street network connectivity; and
- Access management tools to streamline ingress and egress for businesses located on Routes 130 and 206.

Numerous short- and long-term concepts were conceived to address these goals and those of the economic development of vacant and underutilized parcels, as per stakeholder desires. Some concepts were combined into corridor-wide alternatives, whereas others served as site-specific alternatives. A select few were analyzed in detail, including five corridor-wide alternatives evaluated with VISSIM, a micro-simulation traffic analysis software program.

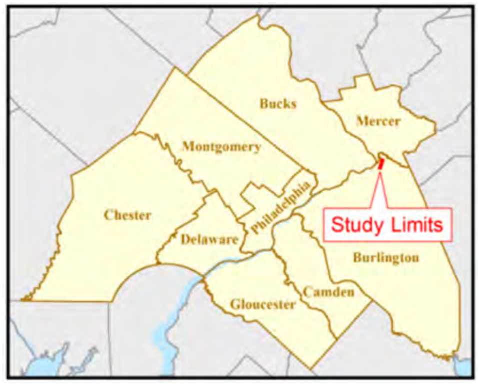
Preferred alternatives emerged after receiving feedback from multiple stakeholder meetings. They include:

- Access and safety improvements along Routes 130 and 206 near the Mastoris Diner to curb excessive speeding and improve ingress and egress for adjacent businesses; these would occur within existing right-of-way (ROW), with some simple improvements installed via existing NJDOT maintenance programs.
- A new one-way single lane road between Dunns Mill Road and Rising Sun Road to provide heavy vehicles an alternative to Farnsworth Avenue; revised and new wayfinding signage would direct heavy vehicles onto this and other appropriate roads.
- A road diet of the shared section of Routes 130 and 206, via the removal of one north and southbound through lane; this ROW may be repurposed as a shoulder and more robust median. This recommendation may be introduced on a trial—and thus reversible-basis, as it requires no major capital investment.
- A two-lane roundabout at the southern merge-diverge point of Routes 130 and 206; it would reduce excessive speeding and weaving opportunities, while providing heavy vehicles an alternative to Farnsworth Avenue, and serve as a gateway for the shared section of the corridor. It may be installed within the current ROW but require the removal of the existing Route 206 overpass.
- A two-lane roundabout at the currently signalized intersection of Route 206 and Farnsworth Avenue/Georgetown Road; it would create less vehicular delay, while reducing excessive speeding, and may be installed mostly within the existing ROW without impacting any existing structures.
- A signalized intersection where Routes 130 and 206 intersect Ward Avenue and Elizabeth Street; this would provide a controlled pedestrian crossing where the next closest crossing is over 1,800 feet away, while also providing a direct east-west vehicular connection that would eliminate the dependence upon downstream median breaks.

CHAPTER 1

Purpose and Need

Study Purpose



The purpose of this project is to develop solutions to improve safety for pedestrians and vehicles within the corridor; reduce delays at specific locations of the transportation network; enhance local and regional economic development opportunities through improved access; and improve roadway connectivity. This study is intended to achieve the following objectives:

- Improve safety for vehicular access to Route 130 and Route 206 from intersecting roads and driveways;
- Reduce occurrences of vehicular speeds exceeding the posted speed limits along Routes 130 and 206;
- Improve safety for pedestrians and bicyclists crossing and traveling along Route 130 and Route 206;
- Improve access management to businesses and residences located along Routes 130 and 206;
- Improve the consistency, safety, and expediency of highway goods movement to major area destinations;
- Improve connectivity and access to public transit alternatives in the area;
- Reduce the extent of impervious surface and thereby minimize localized flooding; and
- Leverage transportation improvements to encourage economic redevelopment.

Study Need

The following is a list of the study area's needs which will be addressed by this study.

- Difficult conditions and too few locations for pedestrians to cross Routes 130 and 206: There are very few controlled pedestrian crossing locations along the corridor—a pedestrian seeking to cross at Ward Avenue would have to walk at least an additional 0.75 miles to complete this crossing—and at those few existing locations, they require crossing up to eight lanes of vehicular traffic.

- High rate of excessive speeding and lack of transition to reinforce reduced speed limit: Measurements along the shared section of Routes 130 and 206 indicate a prevalence of 85th percentile speeds that exceed the posted speed limit of 40MPH by at least 10MPH, and that are comparable to speeds along adjacent upstream sections with higher posted speed limits.
- Lack of a direct east-west connection between Ward Avenue and Elizabeth Street: Vehicles seeking to complete either through or left movements from these roads are required to travel an additional 0.5 to 0.85 miles via downstream median breaks or jughandles.
- Frequent weaving along north and southbound Routes 130 and 206: The merging, crossing, and diverging of Route 130 and Route 206 require motorists to change up to two or even three lanes to reach their desired destination, contributing to the high rate of sideswipe crashes, 38 percent of all crashes within the shared section.
- Improved access management along the shared section of Routes 130 and 206: This 0.8 mile section has 44 access points or driveways without deceleration and acceleration opportunities for ingress and egress vehicles.
- Poorly defined and inadequate median breaks: Very few of the study area's 14 unsignalized median breaks clearly delineate the permitted movements and provide acceleration or deceleration lanes.
- The lack of appropriate connections for heavy vehicles between I-295 and the New Jersey Turnpike: Due to the partial interchange at I-295 and Rising Sun Road and the four ton weight restriction along Dunns Mill Road, many heavy vehicles utilize Farnsworth Avenue between Route 130 and Route 206 to travel between interstates. These heavy vehicles comprise 8.46 percent of all eastbound Farnsworth Avenue vehicles—greater than any portion of Route 130 within the study area.
- Flooding and pollution of local waterbodies: Due to the study area's large extent of impervious surfaces, nearby tributaries of the Delaware River experience localized flooding and pollution from stormwater runoff and outfalls.
- Presence of vacant or underutilized parcels along the corridor: Despite its high volume of pass-through traffic, direct connections to major interstates, and proximity to large residential areas, many of the corridor's commercial parcels are vacant or underutilized.

Related Studies

Route 130/206 Bicycle and Pedestrian Plan

This is a NJDOT-funded study completed by Michael Baker Jr., Inc. (Baker) in May 2011. This plan, a result of requests from Burlington County and both Bordentown municipalities, analyzed bicycling and pedestrian infrastructure along and surrounding Routes 130 and 206 from Farnsworth Avenue/Georgetown Road to Park Street/Amboy Road and further north. Baker recommended tiers of physical bicycling facilities to complement the bicycling network identified the study team. Baker also recommended improvements for pedestrian mobility, particularly at current and potential Routes 130 and 206 crossing locations.

Road Safety Audit

In the fall of 2010, DVRPC's Office of Transportation Safety and Congestion Management Planning conducted the US 130/US 206 Road Safety Audit (pub. #10012) on sections of Routes 130 and 206 similar to Baker's *Bicycle and Pedestrian Plan*. The study area extended from Farnsworth Avenue/Georgetown Road to Park Street/Amboy Road. Using the most recent multiyear crash data, the study identified crash concentration areas and trends, as well as unsafe areas for pedestrians, bicyclists, and motorists. This information, along with local stakeholder input, led to a series of recommendations that ranged from simple short-term fixes to more complex long-term improvements.

The current study's efforts build upon the recommendations reached in both of the earlier reports. Their inclusion will strengthen the applicability and effectiveness of this study's recommendations, which, if implemented, would improve safety and mobility.

CHAPTER 2

Environmental Justice and Health Planning

Title VI of the Civil Rights Act of 1964 and the 1994 President's Executive Order on Environmental Justice (#12898) states that no person or group shall be excluded from participation in or denied the benefits of any program or activity utilizing federal funds. Metropolitan Planning Organizations (MPOs), as a part of the United States Department of Transportation's Certification requirements, are charged with evaluating their plans and programs for environmental justice (EJ) sensitivity to identify any disproportionately high and adverse health or environmental effects of its programs on these groups. DVRPC developed a method of analysis in 2001. U.S. Census data is used to assess eight degrees of disadvantage (DOD): non-Hispanic minority, Hispanic, the physically disabled, carless households, households in poverty, female heads of household with children, elderly (75 years and older), and Limited English Proficient (LEP). Using U.S. Census data from the American Community Survey's (ACS) five-year estimate (2006 to 2010), disadvantaged groups are identified and located at the census tract level. Data is gathered at the regional level, combining populations from each of the nine counties, for either individuals or households, depending on the indicator. From there, the total number of persons in each demographic group is divided by the appropriate universe (either population or households) for the nine-county region, providing a regional average for that population group. Any census tract that meets or exceeds the regional average level, or threshold, is considered an EJ-sensitive tract for that group.

EJ Analysis of Study Area

The study area includes three census tracts: Tract 7017 (Bordentown City), Tract 7015.02 (Bordentown Township), and Tract 7042 (Bordentown Township). Using ACS estimates data for 2006 to 2009, Tract 7017 and Tract 7042 do not have any DODs. Tract 7015.02 exceeds the regional thresholds for two DODs: elderly over age 75 and LEP. The extent of these DODs within this census tract is shown in Table 1.

Table 1: Degrees of Disadvantage Exceeding the Regional Threshold

Degree of Disadvantage	Regional Threshold	Tract 7015.02
Elderly (75 years and older)	6.66%	8.42%
Limited English Proficiency	3.24%	6.50%

Source: DVRPC 2012

Improvement projects recommended in the study area were evaluated based on the extent to which they may impact sensitive populations. Elderly persons often rely on alternative modes of transportation for their mobility needs, and accessible streets and sidewalks are especially important. As their rate of driving decreases with an increase in age, their mobility is dramatically impacted by the quality and connectivity of the pedestrian network, the breadth and frequency of transit service, and the availability and accessibility of local services and employment.

LEP populations are defined in the ACS as “Speak English not well” and “Speak English not at all” as indicated by the percent of people five years and over who speak English “not well” or “not at all.” It is assumed that an inability to speak English well can be a barrier to accessing goods and services, including transportation. LEP populations may impact how an agency or municipality reaches out to a particular audience, such as providing translated materials.

Health Planning

The efforts of modern planning professionals have long been associated with the health of communities, beginning with sanitation services that removed wastewater and zoning laws that separated incongruous land-uses. Such efforts have dramatically reduced the rate of infectious diseases, but unfortunately, contemporary society is increasingly prone to chronic diseases, such as heart disease and diabetes, whose risk factors include obesity and physical inactivity. However, by increasing the opportunities for active transportation, mixed-use development patterns, and other health-planning tools, planning can again serve as an instrument to reduce the occurrence of common diseases and thus improve the health of communities.

Public Health Issues

Heart Disease

Heart disease refers to several types of heart conditions, the most common being coronary artery disease, which can cause heart attacks, angina, heart failure, and arrhythmias. Heart disease is the leading cause of death in the United States, representing a quarter of all deaths. Among the 50 states, New Jersey experienced the 18th highest rate of heart-disease-related deaths per capita, and Burlington County had the seventh highest mortality rate from heart disease among the 21 New Jersey counties. Behavioral risk factors for heart disease include physical inactivity, obesity, poor diet, and tobacco use.

Obesity

For adults, obesity is defined via a measure of one’s weight in relation to one’s height, specifically a Body Mass Index (BMI) of 30 or higher. Obesity is associated with increased risk for a variety of conditions, including coronary artery disease, type 2 diabetes, certain cancers, hypertension, dyslipidemia, and stroke, among others. According to the Centers for Disease Control and Prevention (CDC), 26 percent of adults within the United States are obese, though New Jersey has the 10th lowest prevalence of adult obesity. Within New Jersey, Burlington County is the sixth highest county for adult obesity. Obesity is the result of an energy imbalance, in which more calories are consumed than expended. Though a multitude of factors contribute to this imbalance, behavior and environment are the principal factors for preventative and treatment actions.

Respiratory Illnesses

The occurrence and severity of respiratory illnesses, such as asthma and chronic obstructive pulmonary disease (or lung disease), are linked to an individual's exposure to air pollution. According to the CDC, almost nine percent of adults and children in New Jersey are currently diagnosed with asthma. According to the state's Department of Health and Senior Services, Burlington County experiences a lower than average rate of hospital visits for asthma-related issues, though asthma was still responsible for around 1,000 emergency department discharges in 2006. It is well recognized that certain pollutants, such as nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOC), and particulate matters (PM), have negative impacts upon human health. These pollutants are generated by both natural and anthropogenic sources, and within the latter, vehicular emissions are a large contributor.

Health Planning Tools

Active Transportation Facilities

One tool to combat heart disease, obesity, and respiratory illnesses is an increase in the opportunities for active transportation. Increased potential for walking or cycling is facilitated by the presence of well-designed and maintained facilities. A comprehensive sidewalk network, highly visible crosswalks, and informative pedestrian signals are just a few of the potential facilities that encourage walking. The appeal and comfort of cycling is significantly improved by specific facilities, such as adequate bike lanes, formal bicycling routes, and targeted wayfinding signage. Another benefit of these facilities is their ability to provide an alternative mode of travel to the automobile. Trips that can be completed entirely or even just partially via foot or bicycle place fewer vehicles on the roadway, thus decreasing the amount of pollutants that enter the immediate environment from vehicle emissions.

Mixed-Use and Neo-Traditional Design

The design and orientation of a community's built environment has a strong influence upon the travel behavior of its residents, employees, and visitors. When planned well, a mix of uses decreases the distance between destinations, while increasing their accessibility, thus reducing automobile dependence. Consequently, a physical design that encourages walking, cycling, and transit use will be helpful with reducing the levels of physical inactivity among adults and children. Elements of this design may be accomplished via shorter block lengths, a high level of street connectivity, reduced building setbacks, and traffic-calming measures. In addition, all of these measures are particularly effective for the elderly population, which was identified in the EJ analysis as having exceeded the regional threshold for a portion of the study area.

CHAPTER 3

Environmental Resources and Management

The study area's natural resources and the ecosystem services these resources provide are critical to the area's sustainability, overall health, and quality of life. The information provided in this section can be used to make informed decisions about appropriate development and improvements that allow for the highest level of preservation and restoration of the area's natural resources.

Of particular interest to the study area are the water resources, which are influenced by features including land use, geology, and soils. In addition, this section will address "Green Infrastructure," which also includes infrastructure investments like multimodal trails and pedestrian sidewalks, and capital investments like greenways, wildlife corridors, and parks. An understanding of these resources, their influence on stormwater quality and quantity, and the system of "Green Infrastructure," will promote better decision-making with regard to transportation issues within the study area.

Water Resources

The study area includes a variety of water resources that serve not only regional significance, but are also essential for area residents who depend on them for drinking supply and recreational activities. The prevalence of suburban sprawl and development continues to threaten these resources through an increase of stormwater runoff and a reduction of natural infiltration and recharge processes. Strategies to protect water resources are also often the cheapest and best ways to provide for the meaningful conservation of other natural resources, including land and wildlife.

Physical changes or alterations to the study area can potentially have both direct and indirect impacts on its natural resources. Direct impacts include increases or decreases in stormwater runoff, additional sources of nonpoint source pollution, and/or fragmentation of critical habitat areas. Indirect impact could include the fragmentation of critical habitat areas through resulting development responding to transportation decisions. In order to minimize these impacts and to help to preserve and improve the available natural resources, Best Management Practices (BMPs) can be implemented both within the roadway right-of-way, as well as along adjacent lands.

Watersheds

The study area is divided between two watersheds, with the division line running along the ridge that is Crosswicks Street. The watersheds include Crosswicks Creek Watershed and Blacks

Creek Watershed, both of which drain directly into the Upper Estuary of the Delaware River, less than a mile west of the study area.

Streams

The streams that exist within the study area require special attention, as they all, with the exception of Blacks Creek, represent headwaters. Mile Hollow Run and Laurel Run, first-order streams, and Thorton Creek, a second-order stream, can be classified as headwaters. These headwaters are of particular importance because they tend to contain a diversity of aquatic species and their condition affects the water quality found downstream. They also serve as spawning or nursery areas for fish.

Wetlands

Wetlands support unique communities that serve as natural water filters and as incubators for many beneficial species. New Jersey protects freshwater wetlands under the New Jersey Freshwater Wetlands Protection Act Rules: N.J.A.C.A 7:7A.

Floodplains

Areas naturally subject to flooding are called floodplains, or flood hazard areas. Floodplains in the study area can be seen on Figure 1: Water Resources. Although the terms “flood hazard area” and “100-year floodplain” denote similar concepts, NJDEP defines them in slightly different ways. New Jersey’s regulations define the flood hazard area as the area inundated by a flood resulting from the 100-year discharge increased by 25 percent. This type of flood is called the “flood hazard area design flood” and it is the flood regulated by NJDEP.

In New Jersey and throughout the country, building in areas subject to flooding is regulated to protect lives, property, and the environment.

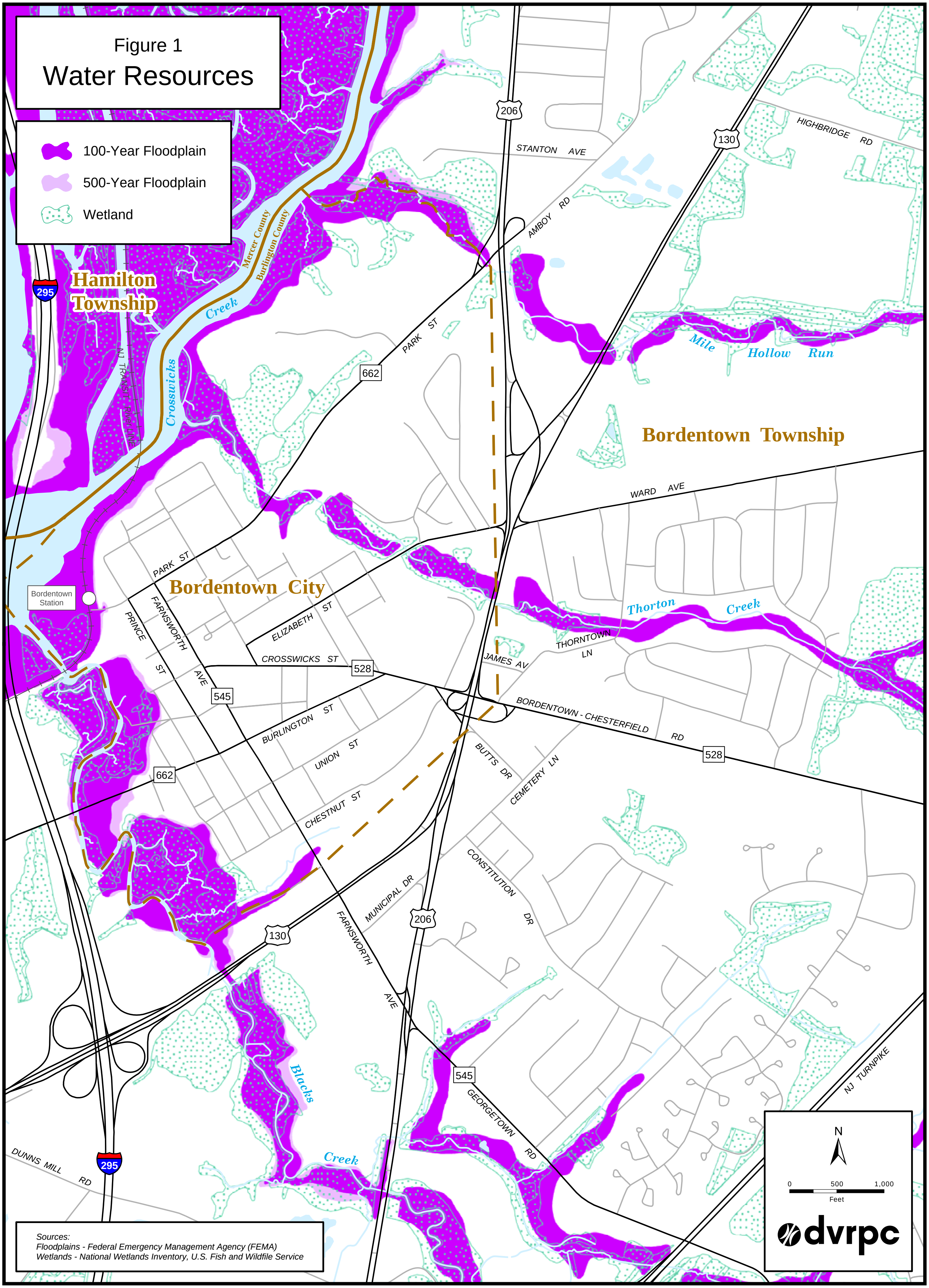


Figure 1
Water Resources
100-Year Floodplain
500-Year Floodplain
Wetland
Hamilton Township
Bordentown Township
Bordentown City
Mercer County
Burlington County
Crosswicks Creek
Mile Hollow Run
Thorton Creek
Blacks Creek
Bordentown Station
NJ TRANSIT RIVERLINE
295
206
130
662
528
545
STANTON AVE
HIGHBRIDGE RD
AMBOY RD
PARK ST
WARD AVE
PRINCE ST
FARNSWORTH AVE
ELIZABETH ST
CROSSWICKS ST
THORNTOWN LN
JAMES AV
BORDENTOWN - CHESTERFIELD RD
BURLINGTON ST
UNION ST
CHESTNUT ST
BUTTS DR
CEMETERY LN
CONSTITUTION DR
MUNICIPAL DR
GEORGETOWN RD
DUNNS MILL RD
NJ TURNPIKE
N
0
500
1,000
Feet
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Sources:
Floodplains - Federal Emergency Management Agency (FEMA)
Wetlands - National Wetlands Inventory, U.S. Fish and Wildlife Service

Stormwater Management

Despite the breadth and importance of the water resources in the study area, they are increasingly threatened by development patterns with inadequate stormwater management. Sprawling development with large expanses of parking and overbuilt transportation facilities have contributed to high levels of impervious surface coverage that disrupt natural absorption, filtration, and recharge processes. Stormwater management facilities can be integrated into the corridor to better support runoff.

Stormwater Management Design

The best stormwater management practices are those that increase the amount of infiltration into the ground. This can be achieved through designed interruptions in the paved surface that break up stormwater and infiltrate it at various points. Stormwater from smaller rainstorms can often be handled entirely by various low-impact or nonstructural designs. It is the runoff from these smaller storms that tends to have the greater effect on waterways and water quality because of the frequency of these events.

Specific measures to manage stormwater from smaller storms rely on utilizing the natural contours and features of the land on a site, whenever possible. The best designs often use a mix of many small solutions, such as:

- Designing or redesigning vegetated islands, which are usually raised beds in parking lots, so they capture and recharge rainfall.
- Incorporating filter strips to receive runoff and removing or slotting curbs to allow stormwater to reach these strips.
- Designing or replacing drain pipes with infiltration trenches.
- Creating bioretention facilities in existing natural depressions.
- Utilizing existing right-of-way to reduce total impervious surface, while replacing unnecessary travel lanes with stormwater management facilities. Adopting a Road Diet for the shared section of Route 130 and Route 206 would provide the needed right-of-way for these facilities.

Stormwater Best Management Practices (BMPs)

Good stormwater management uses a combination of BMPs in a treatment train; a series of small to large structures and devices that will capture, break up, and infiltrate the stormwater throughout the site. An effective and well-implemented inspection and maintenance program for any transportation facility design is critical. This should be part of the stormwater management plan that is part of the site plan approved by a municipality, with standards for permanent maintenance outlined in site plan requirements. In addition, a municipality can impose a requirement in its ordinance that makes an owner responsible to make corrective measures if any stormwater management facility is eliminated, altered, or improperly maintained.

Stormwater Management BMPs most appropriate to the Routes 130 and 206 Corridors

Rain Gardens

These are suitable for medians and other unpaved areas within highway rights-of-way.

- Small bioretention areas planted with native vegetation.
- Can be positioned to capture the first level of runoff.

Vegetated Filter Strips

These are particularly suited for wide medians in the northern and southern ends of the corridor.

- Strips of close-growing grasses or forest along impervious area.
- Can reduce runoff volumes by up to 40 percent.

Bioretention Facilities

These are suited for jughandles particularly in the Crosswicks area.

- Utilized to capture stormwater runoff from a diversion structure in a traditional drainage system.
- Can be installed in median strips, parking lot islands, lawn areas, grass swales, or other conveyance systems.

Drainage Swales

These are particularly suited for wide medians in the northern and southern ends of the corridor.

- Long, grassed, shallow depressions designed to intercept sheet flow.
- Swales reduce the volume and the speed of runoff and will capture the coarser sediment.

Infiltration Trenches

These are best suited along Routes 130 and 206 near waterways

- Stone-filled subsurface trench in which stormwater is collected and percolates slowly into the soil.
- Can capture and treat water from an area no larger than five to 10 acres.

Detention Basin Redesign or replacement

These are most appropriate at existing detention basins in the corridor

- Channel the stormwater to an outflow structure and out to a waterway.
- Alternative to conventional large dry detention basin is series of smaller basins.

Green Infrastructure

Green infrastructure is a term used to describe a community’s interconnected network of open spaces and natural areas.

A green infrastructure system assists in managing stormwater, reducing flood risk, improving water quality, regulating temperatures, maintaining viable populations of native plants and animals, and contributing to cleaner air.

A regional vision for restoring and preserving green infrastructure throughout the Delaware Valley region is embodied by DVRPC’s 2030 Greenspace Network. Blacks Creek is one of 100 individually named Greenspace corridors.

Parks, Trails, and Protected Open Space

The study area includes a variety of publicly held land that provides open space and recreational opportunities to the community. Though limited in number directly adjacent to Routes 130 and 206, there are several municipal parks that are designated, as shown in Figure 2. Beyond these protected spaces, DVRPC's 2030 Greenspace Network has identified Blacks Creek as a priority greenway corridor. This designation suggests special attention by the municipalities to prioritize preservation and restoration activities along this corridor. Beyond this regionally important corridor, local planning efforts have provided for suggested improvements along Thorton Creek which extends east to west through the center of the corridor. The preservation and improvement of this riparian corridor is essential for wildlife habitat and should be respected as a part of any improvements within this portion of the study area.

Priority Habitats

The New Jersey Department of Environmental Protection has established a program called the Landscape Project, an ecosystems-level approach to identify and protect species habitat. Figure 3 shows the Landscape Project Priority Habitats in the study area. Of the areas designated as critical habitats, the majority are identified by the U.S. Fish and Wildlife Service as foraging areas for the endangered Bald Eagle. The protection of these areas relies not only on minimizing the intrusion or disturbance of these habitats, but also on the protection of the water sources that provide the life blood to these habitats.

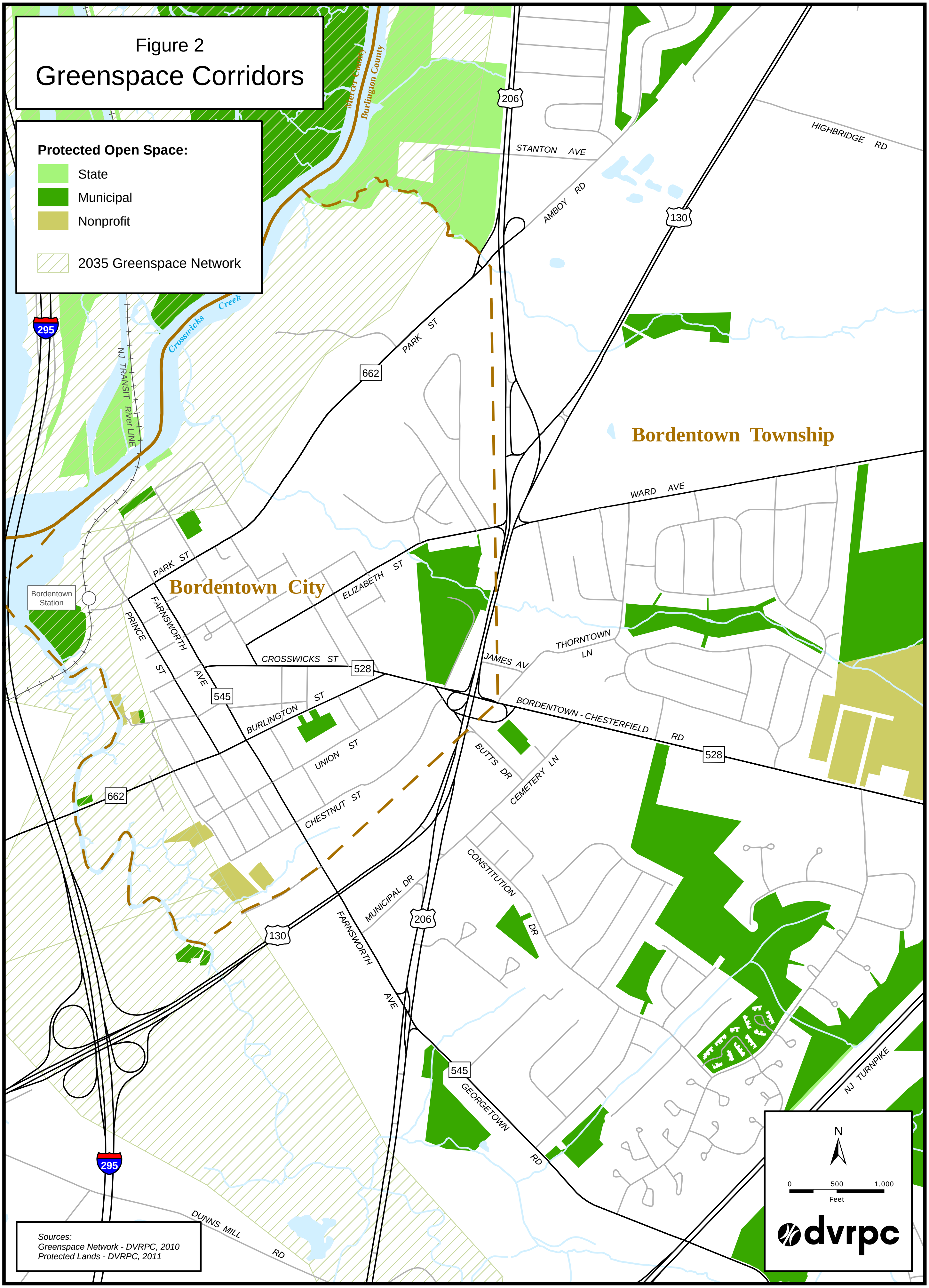
Figure 2
Greenspace Corridors
Protected Open Space:
State
Municipal
Nonprofit
2035 Greenspace Network
Bordentown City
Bordentown Township
Bordentown Station
Crosswicks Creek
Mercer County
Burlington County
NJ TRANSIT River LINE
STANTON AVE
AMBOY RD
HIGHBRIDGE RD
PARK ST
WARD AVE
THORNTOWN LN
JAMES AV
BORDENTOWN - CHESTERFIELD RD
ELIZABETH ST
CROSSWICKS ST
FARNSWORTH AVE
PRINCE ST
BURLINGTON ST
UNION ST
CHESTNUT ST
BUTTS DR
CEMETERY LN
CONSTITUTION DR
MUNICIPAL DR
GEORGETOWN RD
DUNNS MILL RD
NJ TURNPIKE
206
130
295
662
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Sources:
Greenspace Network - DVRPC, 2010
Protected Lands - DVRPC, 2011

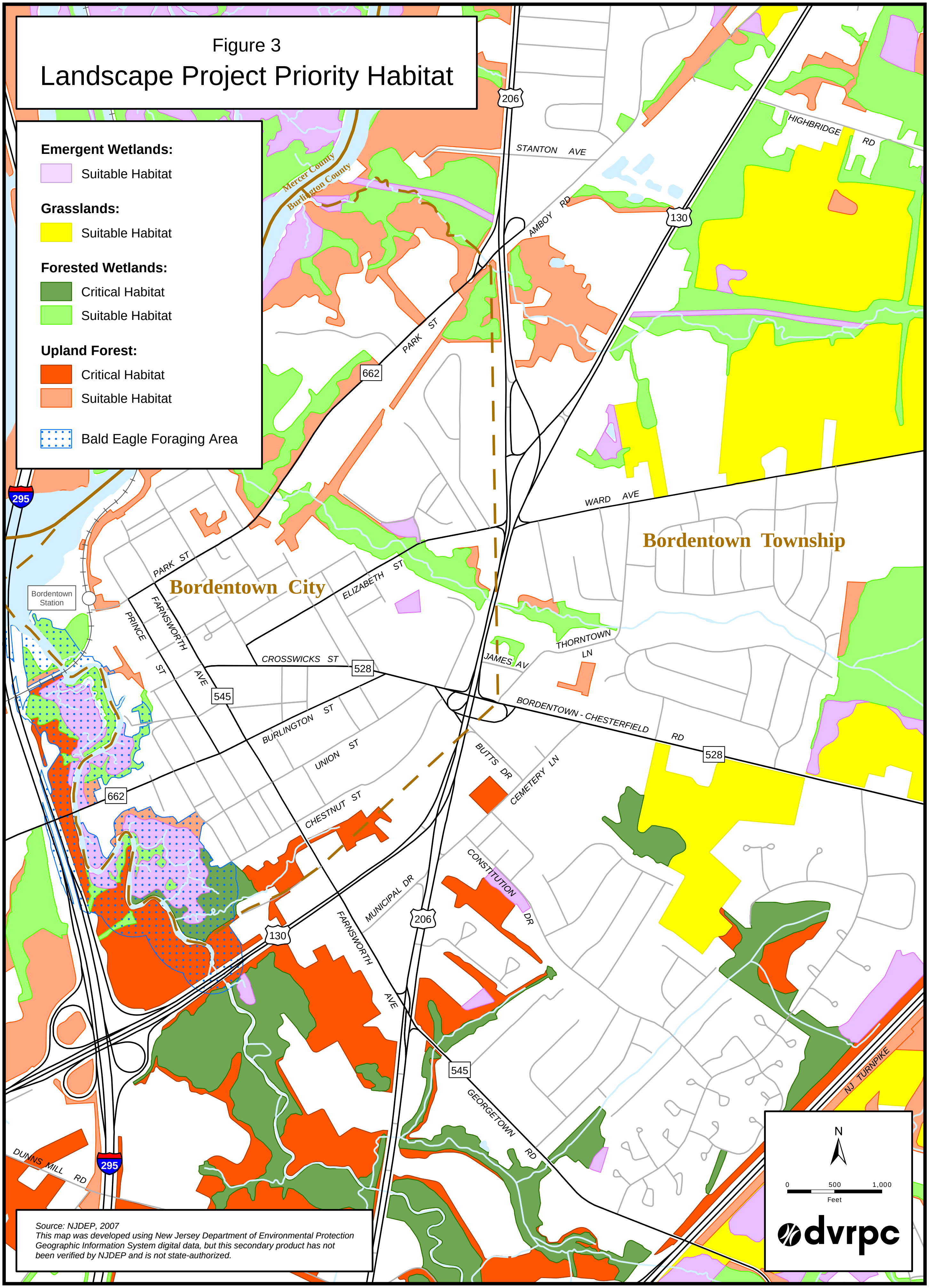


Figure 3
Landscape Project Priority Habitat

Source: NJDEP, 2007
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

CHAPTER 4

Land Use

In order to improve the mobility and safety of the trips being taken to, from, and through the study area, it is necessary to understand the area’s historical and ongoing development patterns. These patterns are represented by land use—where and how people live, work, and play—which greatly affects what, when, and how trips are taken. This relationship illustrates the significance of understanding an area’s various land uses prior to analyzing, and ultimately transforming, its transportation network.

The study area’s land use can be divided into two areas: Routes 130 and 206, along with their abutting parcels, and the surrounding areas that are influenced by, but not defined by these arterials. Routes 130 and 206 lies mostly within Bordentown Township and serves as a major gateway for both municipalities. The surrounding areas contain two closely related, yet physically distinct municipalities.

- Bordentown City hosts a walkable, mixed-use land use scheme typical of many boroughs and small cities. Due to these traits and a strong sense of community, Bordentown City was recently selected as one of the Classic Towns of Greater Philadelphia. This designation is targeted to foster the growth of the region's older communities, with their vibrant residential districts, diverse architecture, bustling business and entertainment districts, and remarkable recreation.
- Bordentown Township is defined by single-use zones, including highway commercial land use and its expansive parking along Routes 130 and 206. These land uses are typified by gas stations, auto repair and maintenance, banks, restaurants, and motels-land uses whose current designs cater to automobile travel. This commercial area is surrounded by primarily, but not entirely, single-family detached housing, as per the style of post-war suburban communities. East of the residential areas exists an abundance of agricultural lands.

Scattered throughout the study area are significant parcels that greatly affect nearby land use and transportation characteristics. Within Bordentown City but adjacent to Routes 130 and 206 is the Ocean Spray Cranberries manufacturing facility, a major employer in Bordentown City. Along Ward Avenue in Bordentown Township are the Regional High School and the Albert Wagner Youth Correctional Facility. Multiple eating establishments are located along the corridor, including a cluster of large restaurants and bars at the northern end of the shared section near Ward Avenue, such as Mastoris Diner, Chickie’s and Pete’s, Town and Country Diner, and Dublin Square. The existing land use designations of these parcels and of all others within the study area are consolidated into 10 simplified categories, which are shown in Figure 4.

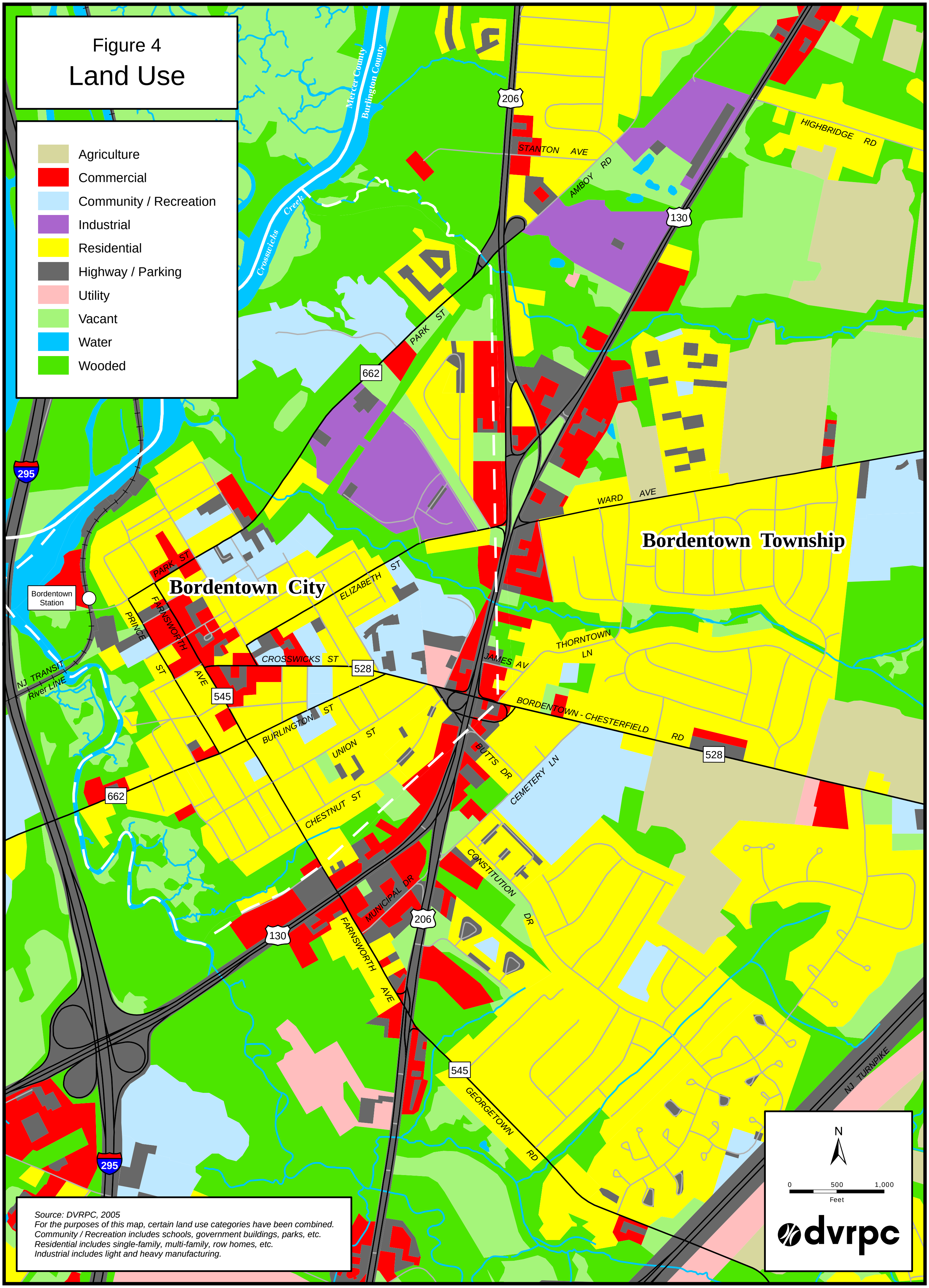


Figure 4
Land Use
Agriculture
Commercial
Community / Recreation
Industrial
Residential
Highway / Parking
Utility
Vacant
Water
Wooded
Bordentown City
Bordentown Township
Bordentown Station
Mercer County
Burlington County
Crosswicks Creek
NJ TRANSIT River LINE
STANTON AVE
AMBOY RD
HIGHBRIDGE RD
PARK ST
WARD AVE
ELIZABETH ST
FARNSWORTH AVE
PRINCE ST
CROSSWICKS ST
JAMES AV
THORNTOWN LN
BORDENTOWN - CHESTERFIELD RD
BURLINGTON ST
UNION ST
CHESTNUT ST
BUTTS DR
CEMETERY LN
CONSTITUTION DR
MUNICIPAL DR
GEORGETOWN RD
NJ TURNPIKE
206
130
662
528
545
295
N
0
500
1,000
Feet
dvrpc
Source: DVRPC, 2005
For the purposes of this map, certain land use categories have been combined.
Community / Recreation includes schools, government buildings, parks, etc.
Residential includes single-family, multi-family, row homes, etc.
Industrial includes light and heavy manufacturing.

There are several developments planned, proposed, or under construction within the study area and its vicinity. Their land use, design, and scale will influence the area's character and traffic circulation.

- Bordentown Waterfront Community in southwest Bordentown Township. The development is proposed as a transit-oriented development, which will include 648 apartment units, 31,382 square feet of retail, a new RiverLINE rail station, and commuter parking. The location is west of Route 130, south of Fieldsboro Borough, and straddling the Conrail line shared by the RiverLINE. While the potential for increased vehicular traffic in the study area is possible, I-295 intersects Route 130 south of the study area and would likely intercept most northbound trips.

- A medical services and office complex is currently being constructed adjacent to the Agway grain silo between Route 206 and Route 130 in the northern portion of the study area. The site is nearly 30 acres and will include 230,000 square feet of office space in five buildings. This new development will diversify the area's land use.

- Located about one mile east of the study area, Old York Village is a 1,200-unit residential development in Chesterfield Township in its final stages of construction. Many of the units are already occupied. The project is the receiving portion of a transfer of development rights (TDR) plan. Much of the remaining undeveloped land in Chesterfield will become off limits to future development. Old York Village is comprised of schools and residences. The residents will likely seek services along Routes 130 and 206, or beyond.

- The vacant Acme grocery store in the western quadrant of the Route 130 and Farnsworth Avenue intersection has been redeveloped as a Bottom Dollar grocery store. The total parcel area is 3.5 acres. The new occupant has refurbished the existing building.

- Barracks Trading Post, an electronics retailer is expanding its current facility. The store is located along the southbound side of the shared section of Routes 130 and 206, just south of Elizabeth Street.

Future growth will be limited to redevelopment, infill development and a limited number of previously undeveloped sites; the only outstanding major development opportunity lies adjacent to the study area, in Chesterfield Township. However, several constraining factors will limit significant outward growth of the contiguous built environment within the study area. Built structures limit expansion to both the west (I-295) and to the east (the New Jersey Turnpike). Natural features, from the Delaware River to local streams, also limit development opportunities.

Parcels along Routes 130 and 206 are currently zoned for highway commercial. Thus, the zoning ordinance for each municipality appears to have been written for and applied to accommodate the current land uses. However, restaurants and auto repair and maintenance businesses dominate. A more diverse mix of land uses may be appropriate for the corridor. The new offices and grocery store will contribute to the corridor's diversity, as would additional retail and office space. Assuming land use regulations remain unchanged (in highway commercial zones, Bordentown City and Township require a minimum lot size of 0.35 acres and one acre, respectively), there are several vacant or undeveloped parcels along the corridor or in the immediate area to accommodate future (re)development.

- The 62-acre Ocean Spray Cranberries facility is expected to be vacated in 2013. The facility is located within Bordentown City, north of the business district, and adjacent to Routes 130 and 206. No redevelopment plans currently exist for the site, though it is believed that Bordentown City prefers for it to remain in industrial use. Any future industrial-oriented tenants must be cautious to not introduce heavy vehicles into adjacent residential areas. Should a nonindustrial use, such as a residential or mixed-use development, occur on the site, the city should ensure that it connects to the existing downtown area, rather than as a separate and isolated development.
- Despite its large size (6.5 acres) and proximity to major roadways, development opportunities are limited at the currently wooded parcel near the Route 206 and Farnsworth Avenue/Georgetown Road intersection. This is due to its immediate proximity to the open-air municipal sewage plant.
- A 1.5-acre triangle-shaped parcel at the intersection of Route 206 and Cemetery Lane is available for development. Offices, retail, or a combination thereof may be appropriate for this parcel, which has been cleared.
- A 2.5-acre site along southbound Route 206 north of Elizabeth Street is also available for development. It is also currently cleared.

The corridor serves as the gateway to both Bordentown municipalities. Thus, both municipalities would be better served by a more attractive and diverse built environment along it. This transition may be served by land development, but also by reconfiguration of the roadway network.

Land Use Changes via a Reconfigured Corridor

Land use and transportation facilities are intertwined; thus, impacts to one directly affect the other. In other words, improvements to the roadway network may spur land use and development opportunities. Since pedestrian and motorist safety is a key issue for the study area, recommendations to address these will seek to reduce excessive speeding, reduced weaving conditions, and narrower roadways for shorter pedestrian crossings. There are several physical improvements that may accomplish these goals:

- Gateway intersections or features.
- Road diets.
- Pedestrian median refuges and curb bumpouts.
- Sidewalks and bike lanes.
- Shoulders.

The introduction of these facilities may induce land use improvements. The attractiveness of specific parcels may increase due to safer and easier pedestrian or vehicular access. Reduced speeding or concern for weaving may allow new or improved visual impressions of existing buildings.

Several initial opportunities present themselves when assuming a roadway reconfiguration.

- A new building(s) in an improved southern merge area would provide prominent and desired siting and a visual focal point, and would contribute to any gateway treatments.
- Any new transportation connections that redirect heavy vehicle traffic between I-295 and the NJ Turnpike, would allow Farnsworth Avenue between Routes 130 and 206 to better reflect its context as a residential, small business, and municipal services street.

Improving the land use and aesthetic qualities of the corridor is possible. A reconfigured roadway network may help catalyze these positive changes. By implementing improvements that, for example, promote reduced speeding and safer accessibility, land uses along the corridor may diversify and become more attractive.

Access Management

Access management is the intersection of land use and transportation. It strives for an orderly and predictable motorist experience through effective design of the interface between a roadway and the destinations along it. Successful access management reduces the frequency and severity of vehicular crashes, while maintaining or increasing mobility along the roadway. Common access management techniques include the following:

- Adequate shoulders or auxiliary turning lanes.
- Channelized and clearly defined driveways.
- Shared driveways.
- Corner parcel access from the lesser functionally classified roadway.
- Adequate signal spacing.

In New Jersey, permitting or restricting access along state roadways, such as Route 130 and Route 206, is controlled by NJDOT by protocol defined in the *New Jersey Administrative Code, Title 16, Chapter 47 – State Highway Access Management Code* (1992). Municipalities and the respective county can work with NJDOT to create a corridor access management plan. Municipalities can also influence access via the subdivision and land development approval process.

The administrative code assigns access levels (AL) to all state roadways. Within the study area, Route 130 and Route 206 are Urban Principal Arterials and thus assigned as AL 3. With a 40MPH posted speed limit, this AL *code* requires a minimum of 185 feet between access points or driveways along Routes 130 and 206 (1992, p. 19). Furthermore, the Transportation Research Board's (TRB) 2003 *Access Management Manual* recommends an minimum average of 300 feet to prevent overlapping right turns between driveways (2003, p. 152). However, within the shared section of Routes 130 and 206, the northbound direction averages one driveway per 160 feet, while the southbound averages one driveway per 190 feet. Consequently, most of these driveways do not adhere to either NJDOT's administrative code or TRB's access management ideal. Figure 5 shows the location of all access points and shoulders along Routes 130 and 206.

Another important requirement of the administrative code applicable to all access levels is that driveways should be “designed to enable vehicles to leave the State highway without restriction, queuing, or hesitation on the highway” (1992, p. 24). Due to a lack of deceleration lanes or shoulders, few, if any, driveways along the shared section adhere to this requirement.

The northeast quadrant of the Routes 130/206 and Crosswicks Street intersection is an example of poor access management. Access is located in the functional area of the intersection’s northbound acceleration lane. The driveway is wide and lacks meaningful definition. Vehicles turning into the service station from Route 130/206 must cross the channelized acceleration lane. This does not conform to the administrative code.

Wide and poorly defined access point

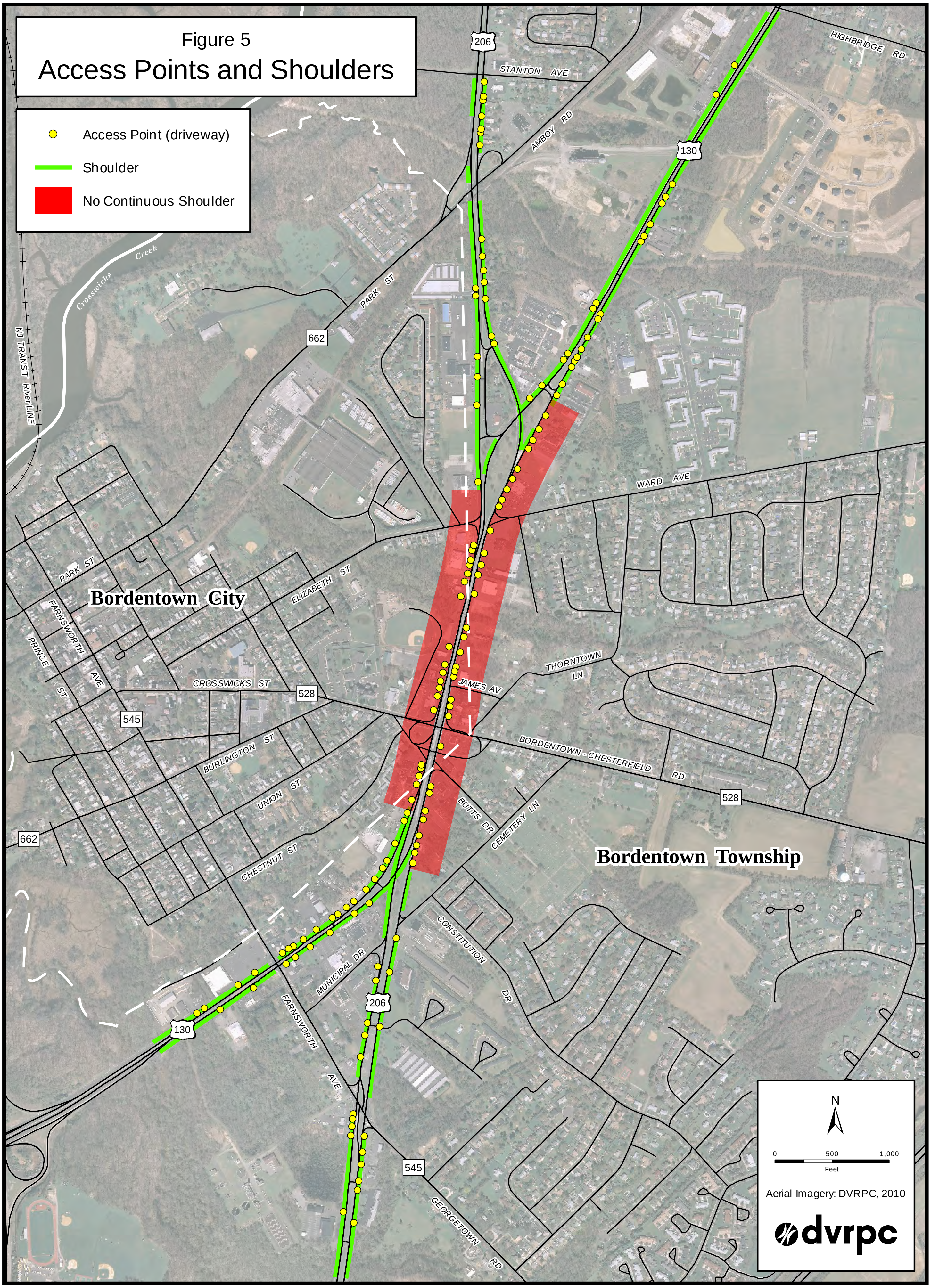
Despite these deficiencies, examples of effective access management are present within the study area. The shared section benefits from a nontraversable center median which prevents left turns across traffic. Sections of Route 130 and Route 206 have comparable driveway densities to the shared section and yet are provided shoulders. The southeast quadrant of the Route 130/206 and Crosswicks Street intersection utilizes effective access management practices. Of the parcel’s four driveways, only one is along Route 130/206, and is channelized as a right-in-only driveway. Exiting the parcel must be done onto either of the lower functionally classified roadways of Crosswicks Street or the jug handle. All driveways are clearly defined to accommodate specific movements.

Access point with defined movement onto lower functionally classified roadway

These effective practices should serve as a foundation for future access management improvements within the study area. Shoulders for acceleration and deceleration may be installed where currently lacking. Driveways may be consolidated, clearly defined, and channelized. These improvements may be more easily brought into conformance or improved during a change of use or redevelopment of the host parcel.

Effective access management results in a safer and more efficient motorist experience. Currently, the study area has a high density of driveways, many of which are poorly defined, lack channelization, and lack of shoulders along the shared section of Routes 130 and 206. However, shoulders are present along other sections of Routes 130 and 206, and recently redeveloped parcels incorporate effective access management. Opportunities to expand upon these effective practices will arise as more parcels redevelop or the roadway is reconfigured.

Figure 5
Access Points and Shoulders



CHAPTER 5

Transportation Network

Roadway Network

Major Streets

Route 130 is a major north-south Urban Principal Arterial linking southern and central New Jersey. For the study area, it provides the most direct link with Burlington County's "River Towns" and to rapidly developing portions of Mercer County. Approximately two miles of Route 130 is a divided four-lane roadway within the study area, except where it is merged with Route 206, and is up to eight lanes wide. Route 130 has access to I-295 (Exit 57A and B) via an interchange that provides seven of the eight potential movements. Route 130's posted speed limit ranges from 40MPH to 55MPH.

Route 206 is a major north-south Urban Principal Arterial that extends from Atlantic County to the Pennsylvania border in northwest New Jersey. From the study area, Route 206 travels north to Trenton and south to suburban and rural communities, as well as providing a direct connection to the New Jersey Turnpike (Exit 7). About two miles of this divided four-lane roadway are within the study area. Its posted speed limit ranges from 40MPH to 55MPH.

Crosswicks Street, Burlington County Route 528, is an east-west two-lane Urban Collector. It links Bordentown City with Bordentown Township and suburban communities further east. Within the study area, its posted speed limit ranges from 25MPH to 35MPH.

Farnsworth Avenue/Georgetown Road, Burlington County Route 545, is an east-west two-lane Urban Collector. It links Bordentown City with Bordentown Township and suburban communities further east. Within the study area, its posted speed limit ranges from 25MPH to 40MPH.

Ward Avenue is an east-west two-lane local street. It extends about three miles through Bordentown Township from northbound Route 130 to Crosswicks. The Bordentown Regional High School and the Albert Wagner Youth Correctional Facility are located on Ward Avenue immediately east of the study area. Its posted speed limit is 35MPH.

Elizabeth Street is an east-west two-lane local street. It is less than one mile in length and connects southbound Route 130 to Bordentown City. Its posted speed limit is 25MPH.

Park Street, Burlington County Route 662, is a north-south two-lane Urban Collector. It provides a direct connection to Bordentown City from Route 206 north of the study area.

Historical Context

The study area's street network has been constantly evolving since the mid-20th century. Multiple locations employed large circular intersections along Routes 130 and 206, including Crosswicks Street and Ward Avenue/Elizabeth Street, until at least 1959. By 1965, both of the at-grade merge points were replaced with grade-separated overpasses to allow a seamless transition on to the shared section of Routes 130 and 206. By 1990, construction had begun on the "Trenton Complex," a northward extension of I-295 from its current interchange with Route 130 through the Trenton area. However, the study area's roadways have not undergone significant changes since the completion of the "Trenton Complex" in 1994.

Existing Roadway Conditions

In the spring of 2011, vehicular volumes, speeds, and classifications were measured along major roadways within the study area via automatic traffic recorders (ATR). These roadways include Routes 130 and 206, Farnsworth Avenue/Georgetown Road, Crosswicks Street, and Ward Avenue.

Annual Average Daily Traffic

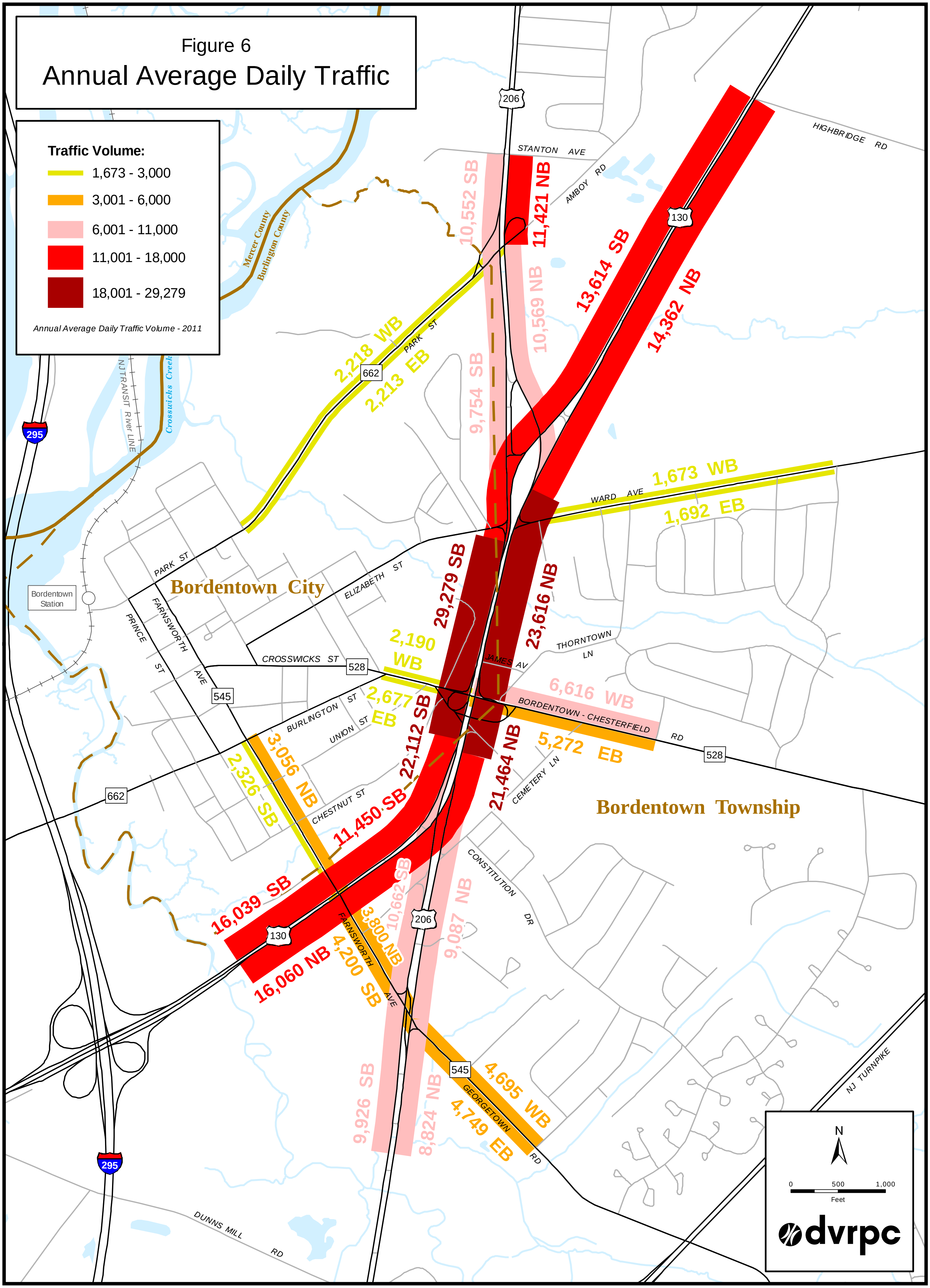
Annual average daily traffic (AADT) represents a normalized 24-hour "snapshot" of vehicular volume along a roadway. The study area's AADTs are depicted in Figure 6 .

- Vehicular volume is greatest along the shared section of Routes 130 and 206, with AADTs of 23,000 to 29,000 per direction of travel.
- Route 130 carries a noticeably larger AADT than Route 206.
- AADTs of the major east-west cross streets are larger east of Routes 130 and 206.

In 1986, DVRPC examined the then current and projected vehicular volumes of roadways to be affected by the impending construction of the "Trenton Complex."

- In 1986, the shared section of Routes 130 and 206 recorded an AADT of 61,500 vehicles. Current volumes are almost 10,000 less vehicles per day, despite 25 years of background growth to replace the vehicles redistributed by the completion of the "Trenton Complex."
- AADT along Route 206 north of the shared section is currently 20,300 vehicles, a fraction of its 1986 AADT of 38,000.
- Current AADTs from the southern portion of the study area are less distinct from their 1986 values. Route 130 between I-295 and Farnsworth Avenue still carries about 35,000 vehicles, and Route 206 from Farnsworth Avenue/Georgetown Road to Dunns Mill Road was about 19,000 in both 1986 and 2011.

Figure 6
Annual Average Daily Traffic



Speed

- A roadway's 85th percentile speed is considered the prevailing speed of travel. It is defined as the speed below which 85 percent of vehicles are traveling; alternatively, only 15 percent of a roadway's vehicles are traveling faster than this speed. Figure 7 reflects the 85th percentile speeds and posted speed limits of the study area's major roadways.
- Speeds are generally greater in the northern half of the study area.
- The 85th percentile speed exceeds the posted speed limit throughout much of the study area.
- The most substantial violation of the posted speed limit is along the shared section of northbound Routes 130 and 206, with 85th percentile speeds between 56 and 60MPH in a 40MPH speed limit.

Heavy Vehicles

- The percent of heavy vehicles demonstrates what proportion of a roadway's volume is comprised of large vehicles, from single-unit trucks to large tractor-trailers. The scale of the heavy vehicle presence is shown in Figure 8.
- The presence of heavy vehicles is greatest within the southern half of the study area, likely due to its proximity to two interstates.
- At 10.6 percent, the highest percent of heavy vehicles is along Route 206 between Farnsworth Avenue/Georgetown Road and Dunns Mill Road.
- Farnsworth Avenue between Route 130 and Route 206 exhibits a large disparity of percent heavy vehicles between directions of travel, with eastbound's 8.46 percent overshadowing westbound's 5.76 percent.

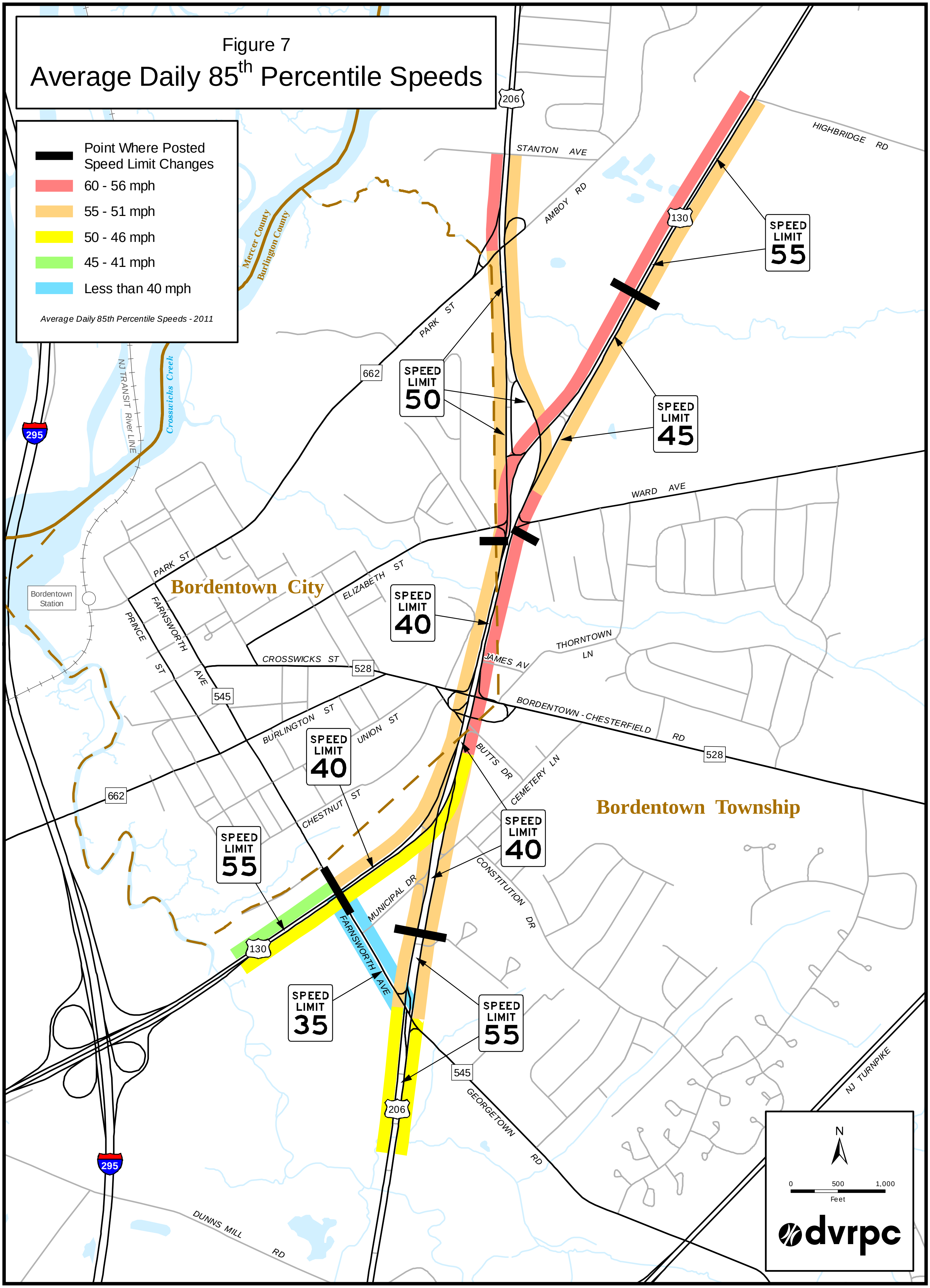
Median Breaks

There are 14 median breaks along Routes 130 and 206 within the study area, not including signalized intersections. Their locations and layouts are identified in Figure 9. Many provide the only nearby opportunity for U-turns or direct access to residential developments. Most do not have deceleration or storage lanes, nor channelization to separate opposing movements, particularly in the southern half of the study area. Additional deficiencies include:

- Absence of an acceleration lane, despite the high prevailing speeds along Routes 130 and 206. Breaks number four and seven on Figure 9 are indicative of this deficiency.
- Insufficient width to accommodate two-stage movements from the cross-street or driveway; numbers one, six, and eight on Figure 9 are examples of this.
- Multiple median breaks are closely spaced together despite their redundant roles; numbers 11 through 14 on Figure 9 exemplify this.

Figure 7

Average Daily 85th Percentile Speeds



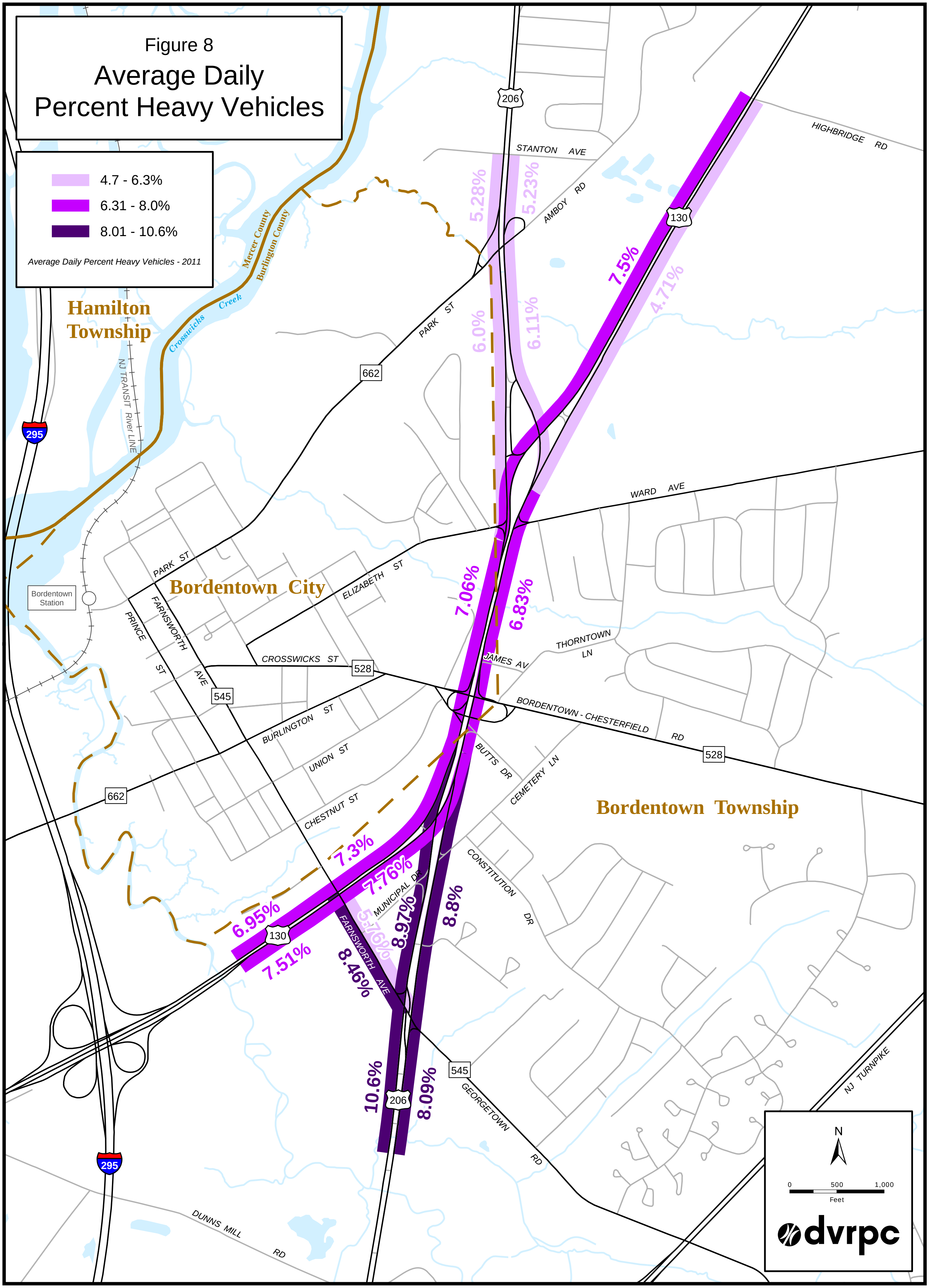
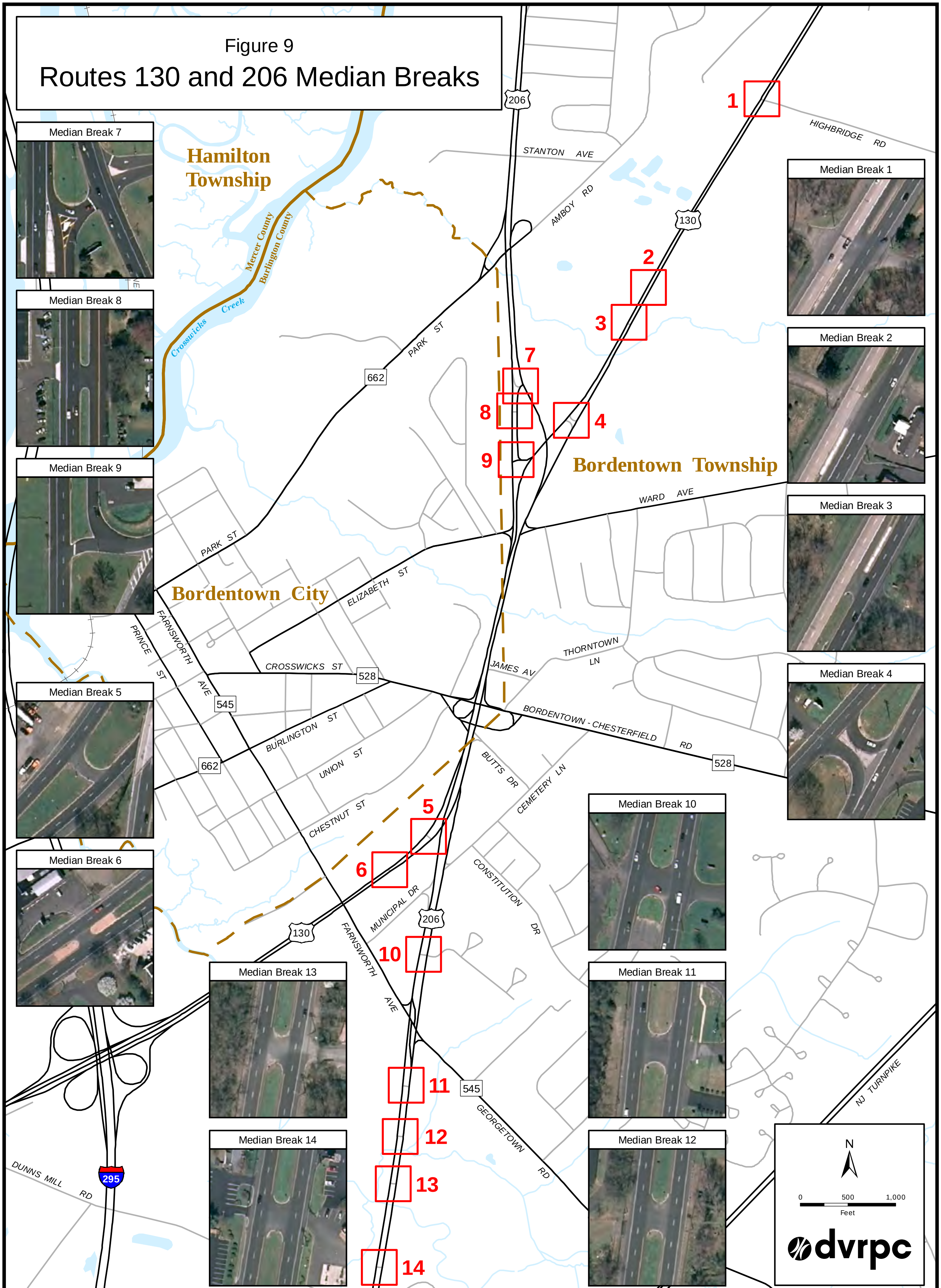


Figure 8
Average Daily Percent Heavy Vehicles
4.7 - 6.3%
6.31 - 8.0%
8.01 - 10.6%
Average Daily Percent Heavy Vehicles - 2011
Hamilton Township
Bordentown City
Bordentown Township
Mercer County
Burlington County
Crosswicks Creek
NJ TRANSIT River LINE
Bordentown Station
5.28%
5.23%
6.0%
6.11%
7.5%
4.71%
7.06%
6.83%
7.3%
7.76%
6.95%
7.51%
5.76%
8.97%
8.8%
8.46%
10.6%
8.09%
HIGHBRIDGE RD
STANTON AVE
AMBOY RD
PARK ST
WARD AVE
THORNTOWN LN
JAMES AV
BORDENTOWN - CHESTERFIELD RD
ELIZABETH ST
CROSSWICKS ST
PRINCE ST
FARNSWORTH AVE
BURLINGTON ST
UNION ST
CHESTNUT ST
BUTTS DR
CEMETERY LN
CONSTITUTION DR
MUNICIPAL DR
GEORGETOWN RD
DUNNS MILL RD
NJ TURNPIKE
N
0 500 1,000
Feet
dvrpc

Figure 9

Routes 130 and 206 Median Breaks



Guide Signage

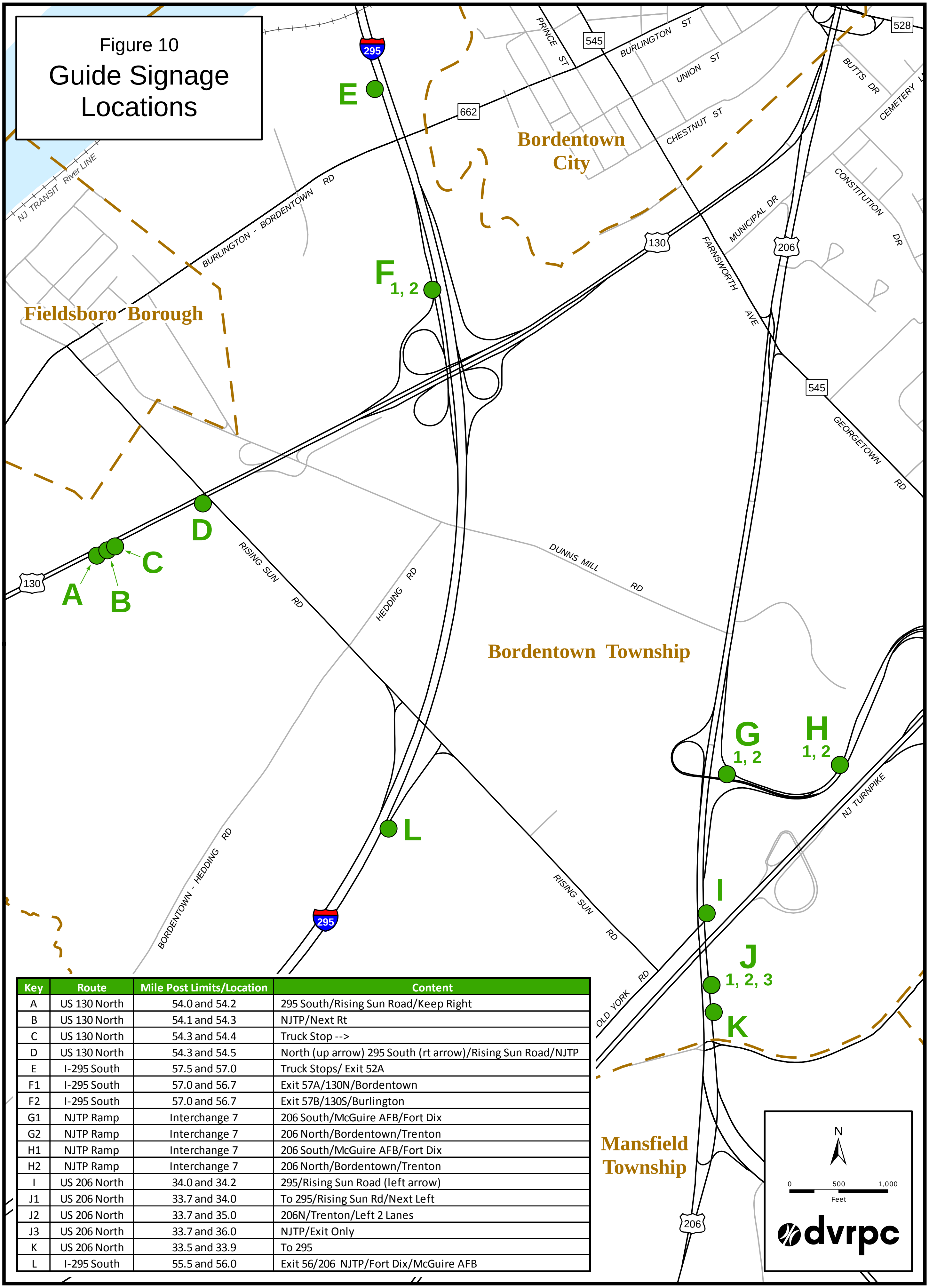
An evaluation of existing guide signage between the primary highways of Route 130, Route 206, I-295 and the New Jersey Turnpike (NJTP) was performed to better understand any deficiencies that would be creating unnecessary traffic on Farnsworth Avenue. The location and content of guide signs included in this evaluation are shown in Figure 10.

The evaluation revealed a strong system of guide signage directing northbound traffic on Route 206 and Route 130. Both routes demonstrated ample directional signage leading users on the preferred route of Rising Sun Road for access from Route 206 north to I-295 and Route 130 north to the NJTP. For example, to access I-295, the NJTP, and the truck stops Petro Stopping Center and Love's Travel Stop, guide signage along both Routes 130 and 206 communicate Rising Sun Road as the suggested route, a roadway appropriate for passenger and heavy vehicles.

One notable deficiency of the signage system was found to be the overhead signage on the NJTP exit ramps. Overhead guide signs currently lack any information directing users between the turnpike and I-295. The addition of signage guiding user to Route 206 South and onto Rising Sun Road for access to I-295 is an opportunity for improvement.

Finally, a large deficiency exists in the signage system for movements between I-295 South to the NJTP. This is likely the result of a convoluted network linking the two routes. No direct connection exists for both passenger vehicles and heavy trucks. Due to the lack of an ideal route between I-295 South and the NJTP, any signage directing users to use Exit 57 for NJTP would put them on either a narrow and congested roadway with limited turning radii (Farnsworth Avenue) or a weight restricted route (Dunns Mill Road).

Figure 10
Guide Signage Locations



Key	Route	Mile Post Limits/Location	Content
A	US 130 North	54.0 and 54.2	295 South/Rising Sun Road/Keep Right
B	US 130 North	54.1 and 54.3	NJTP/Next Rt
C	US 130 North	54.3 and 54.4	Truck Stop -->
D	US 130 North	54.3 and 54.5	North (up arrow) 295 South (rt arrow)/Rising Sun Road/NJTP
E	I-295 South	57.5 and 57.0	Truck Stops/ Exit 52A
F1	I-295 South	57.0 and 56.7	Exit 57A/130N/Bordentown
F2	I-295 South	57.0 and 56.7	Exit 57B/130S/Burlington
G1	NJTP Ramp	Interchange 7	206 South/McGuire AFB/Fort Dix
G2	NJTP Ramp	Interchange 7	206 North/Bordentown/Trenton
H1	NJTP Ramp	Interchange 7	206 South/McGuire AFB/Fort Dix
H2	NJTP Ramp	Interchange 7	206 North/Bordentown/Trenton
I	US 206 North	34.0 and 34.2	295/Rising Sun Road (left arrow)
J1	US 206 North	33.7 and 34.0	To 295/Rising Sun Rd/Next Left
J2	US 206 North	33.7 and 35.0	206N/Trenton/Left 2 Lanes
J3	US 206 North	33.7 and 36.0	NJTP/Exit Only
K	US 206 North	33.5 and 33.9	To 295
L	I-295 South	55.5 and 56.0	Exit 56/206 NJTP/Fort Dix/McGuire AFB

Transit Network

There are two transit modes within the study area, light rail and bus, with only one service route for each. Both service areas are focused within Bordentown City. They each travel to Camden and Trenton, where there are direct or intermodal connections to Philadelphia and New York City, respectively.

RiverLINE

NJ Transit's RiverLINE is a light rail service that parallels the Delaware River, connecting Camden to Trenton. This 60-minute one-way trip costs an adult $1.50. Peak-period headways are 15 minutes, whereas off-peak headways are 30 minutes. Service begins at approximately 6AM and concludes around 10PM. Passenger boardings and alightings are greatest between 7AM and 9AM, and between 4PM and 7PM, respectively.

The study area's RiverLINE station is located on Park Street, at the western periphery of Bordentown City's downtown business area. It has 183 parking spaces and is also pedestrian accessible via adequate sidewalk connections. Multiple field visits to the station indicated a utilization rate of the parking lot in excess of 90 percent. Walk-up passengers were also noticed, as were those picked up or dropped off by private vehicles.

Bus Route 409

NJ Transit's Bus Route 409 connects Trenton and Philadelphia via Camden and western Burlington County's "river towns." Its service area significantly overlaps with the RiverLINE, but its stops are more frequent. Travel time between Trenton and Camden averages about two hours, with headways around 10 minutes during peak periods to slightly over one hour during non-peak periods; this six-zone trip costs an adult $3.90, one-way.

Within the study area, Bus Route 409 travels along Route 206 to the north, enters and exits Bordentown City via Park Street, traverses the city's downtown business area along Farnsworth Avenue, and enters or exits the city as well as the study area, along Burlington Street. Of the Route's overall passengers, 78 percent walked to and from the bus stop, with 51 percent belonging to a carless household, according to a fall 2010 passenger survey conducted by DVRPC for NJ Transit.

Crash Analysis

In the fall of 2010, with the participation of numerous local officials, the DVRPC Office of Transportation Safety and Congestion Management led a Road Safety Audit (RSA) of Routes 130 and 206 in the study area. For this effort, an analysis of crashes from 2007 to 2009, the latest available data, was prepared to provide an objective, data-driven perspective into the crash patterns and concentrations in the study area. The following are some of the findings of the RSA within the study area:

- There were 309 total crashes, of which 227, or 73 percent, occurred along Route 130, which includes the shared section.
- Rear end and sideswipe crashes were the first and second most prevalent crash types; the proportion of the latter among Route 130 crashes was more than double the statewide average.
- There were 220 property-damage-only, 89 injury, and zero fatal crashes. These proportions are within one percent of statewide averages.

The RSA also evaluated the study area as five separate segments defined by their respective cross-section types. Route 206 contained two sections and Route 130 comprised three sections, including the central shared section. Each section's crash rate was compared to state averages for like cross-section types.

- 128 crashes, or 41 percent of the study area total, occurred within the shared section; of these, the most common type was same direction – sideswipe with, 38 percent, or 49 crashes.
- With a crash rate of 4.43 (crashes per million vehicle miles traveled), the segment of Route 130 between Farnsworth Avenue and the southern merge had the highest crash rate of the five segments and is over twice the statewide average.

Additionally, the RSA investigated seven crash concentration areas, four of which were at signalized intersections.

- With 62 crashes, the closely spaced intersections of Route 130 at Crosswicks Street and Butts Avenue experienced the greatest number of crashes; this area equals one-fifth of Routes 130 and 206 crashes in the study area.
- The second highest crash concentration area was the intersection of Route 130 at Farnsworth Avenue, with 31 crashes, which included two pedalcyclist crashes.
- The third highest crash concentration was the intersection of Route 206 and Farnsworth Avenue/Georgetown Road, which also included a pedestrian and a pedalcyclist crash.
- The area surrounding Mastoris Diner's access to Route 130 was another concentration area, with all of its sideswipe crashes occurring in the southbound direction, the side of the divided roadway closest to Mastoris Diner.

Origin–Destination Study

In order to better understand the distribution of movements within and around the study area, an origin-destination study was performed. Utilizing BlueTOAD remote receivers from TrafficCast, the study compiled a network of origin-destination trips for a period of one week, between August 18 and August 25, 2011. Receivers were placed at the corridor's principal entry and exit points to capture a comprehensive set of potential routes. Daily volumes were recorded and compared to AADT volumes to determine specific origin-destination routes, thus providing a detailed evaluation of travel patterns throughout the study area.

Key Movements

There are several major routes that intersect or connect within the study area. The vehicles carried along these routes are a significant component of the area's entire traffic flow. This is compounded by the extended north-south crossing of Routes 130 and 206 along a 0.8 mile shared section. Many motorists are required to weave across multiple lanes if they desire to remain on the same route. In addition to the north-south weave, there are several significant east-west movements across Routes 130 and 206. One is Elizabeth Street and Ward Avenue, as both currently provide only right-in, right-out access from Routes 130 and 206, without direct east-west crossing opportunities to each other. Another movement is east-west Farnsworth Avenue (CR 545) between Routes 130 and 206. Also, Ward Avenue and Farnsworth Avenue are two of only three east-west routes that continue past the New Jersey Turnpike, requiring them to serve as primary access routes to the study area from points east. Farnsworth Avenue provides a key link for heavy vehicles wishing to travel between the turnpike and I-295.

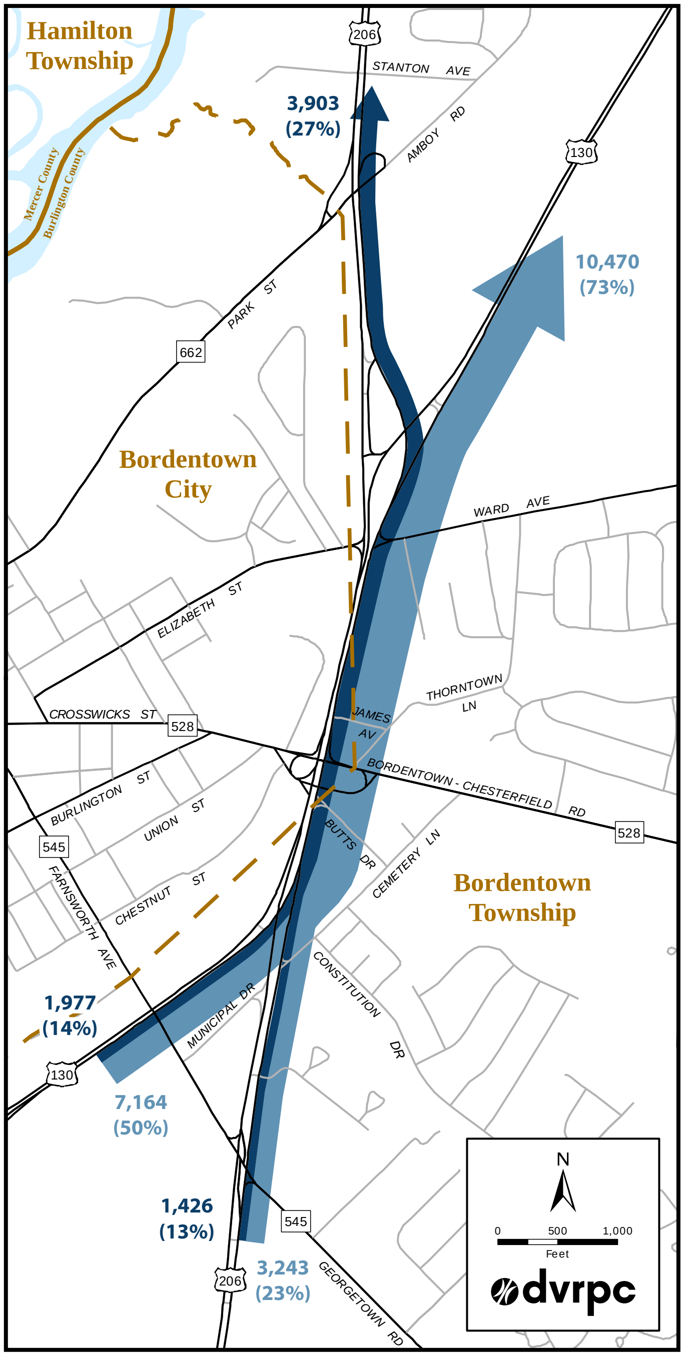
Route 130 & Route 206 Weave

Central to the study is north-south travel along Routes 130 and 206, which merge and diverge twice in the study area: at a northern point near Ward Avenue and Elizabeth Street, and at a southern point immediately south of Crosswicks Street. Though both routes share an overall north-south orientation within the study area, Route 130 travels along a northeast-southwest axis, while Route 206 is along a northwest-southeast axis. The significance of either roadway is demonstrated by their direct nearby connections to either the turnpike or I-295. Figure 11 shows the volume and percentages of southbound through travel originating from either Route 130 or Route 206. Approximately 40 percent of these vehicles originate from Route 206 South, of which over 60 percent must merge with and across Route 130 to continue southbound on Route 206. Of the 60 percent of all southbound through trips that originate from Route 130, 55 percent must merge across the Route 206 South vehicles to continue onto Route 130 South. As a result, 58 percent of all southbound through trips must weave across at least one lane within the 0.8 mile shared section to reach their respective destinations.

Figure 11

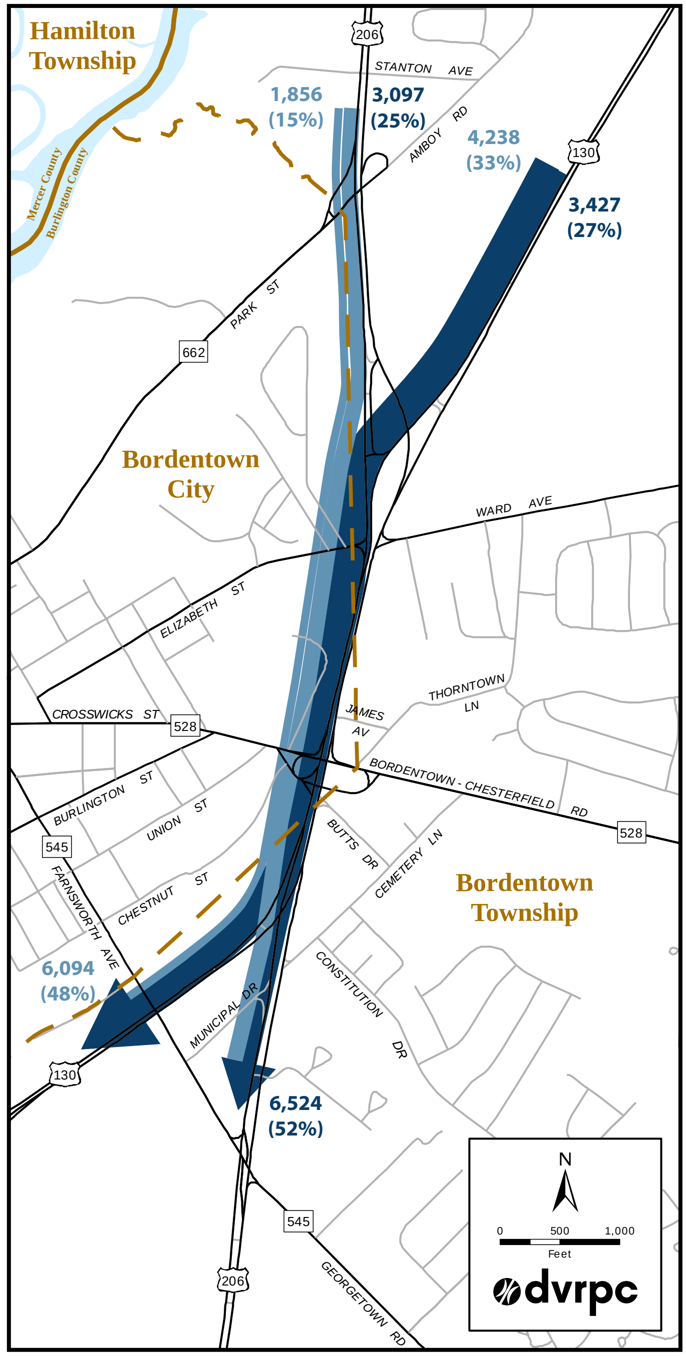
Routes 130 and 206 Northbound and Southbound Weaving

Northbound



Origin-Destination Trips: DVRPC - August, 2011

Southbound



Origin-Destination Trips: DVRPC - August, 2011

The volume and percentages of northbound Routes 130 and 206 through movements are shown in Figure 11. It shows that 64 percent of northbound through trips originate from Route 130 North. Of these, 73 percent must either change lanes or withstand weaving vehicles bound for Route 206 North to continue along Route 130 North. In contrast, only 36 percent of northbound through trips originate from Route 206 North. Of these, only 31 percent must change lanes to continue onto Route 206 North. For all northbound through trips originating from Routes 130 and 206, 62 percent must either change lanes or accommodate weaving vehicles to reach their respective destinations within the 0.8 mile shared section.

Elizabeth Street & Ward Avenue

The intersections of Elizabeth Street and Ward Avenue with Route 130 are an origin point of interest due to their direct alignment but otherwise incomplete connectivity. They each provide only right-in and right-out movements, thus forcing motorists to utilize indirect routes to complete movements that would otherwise be afforded by a full movement intersection with throughs and left-turns. Figure 12 shows the most direct routes, with their percentage and daily volume, currently available on the existing network for these desired movements.

Figure 12 shows the distribution of vehicles entering the study area on eastbound Elizabeth Street, a residential street connecting southbound Route 130 to Bordentown City. Approximately 65 percent of this location's trip origins are destined for southbound Routes 130 and 206, or Crosswicks Street. The remaining 35 percent of trips require motorists to travel an extra 0.8 miles to complete an otherwise basic left or through movement from Elizabeth Street.

Figure 12 shows the distribution of vehicles entering the study area on westbound Ward Avenue, which connects northbound Route 130 and 206 to the Bordentown Regional High School and Chesterfield Township east of the turnpike. Only 43 percent of trip origins from this location are able to directly complete their desired movement: right turns to northbound Routes 130 or 206. A similar amount, 40 percent, must first travel north and complete a U-turn before traveling southbound along Routes 130 and 206, their desired destinations. The remaining 17 percent must travel a similar indirect route to reach Elizabeth Street. Consequently, 57 percent of this location's trip origins would ordinarily reach their desired destinations via basic left and through movements from Ward Avenue.

When combining Elizabeth Street and Ward Avenue origins, about 51 percent must travel an indirect route to reach their destinations. These vehicles add additional volume to adjacent intersections, jughandles, and median breaks. Extra signal green time, queue storage, lane changes, and merges are required due to the lack of a full movement intersection at this location.

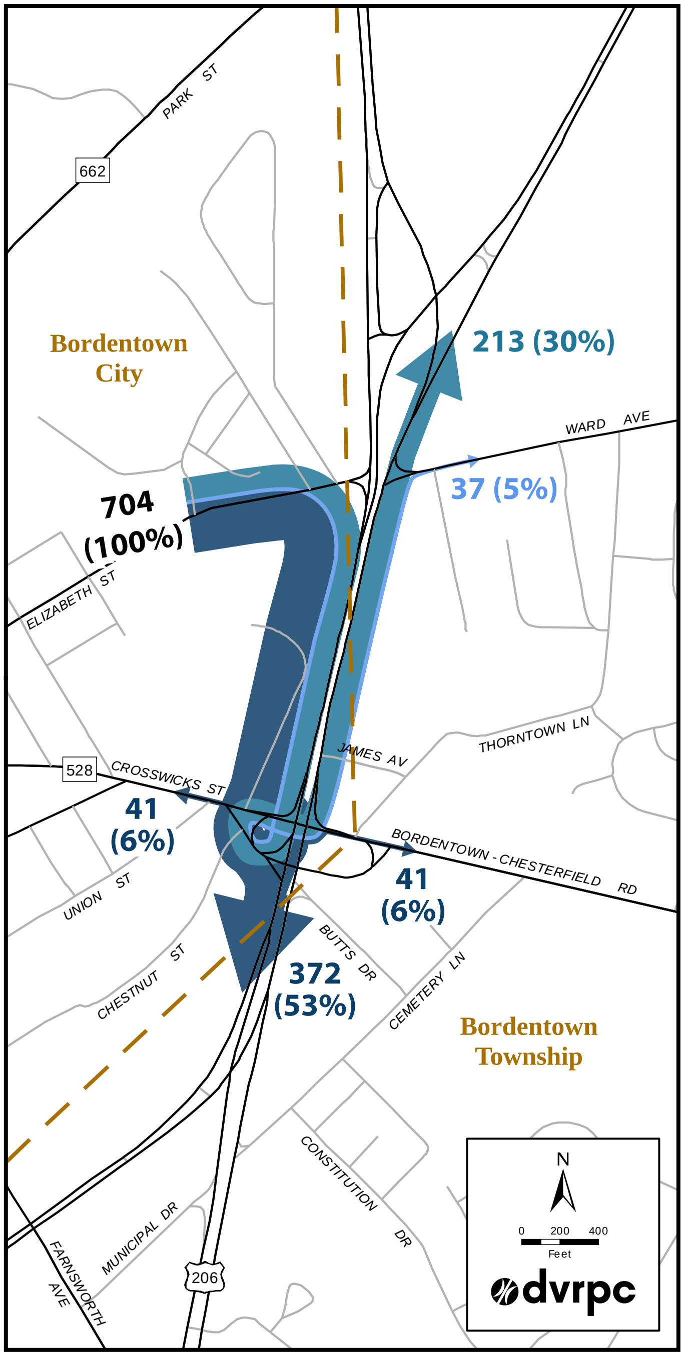
East-West Connections between I-295 and the New Jersey Turnpike

The usage of Farnsworth Avenue between Route 130 and Route 206 is of particular interest to the study. It represents one of only three east-west routes south of Crosswicks Street that connect Route 130 and Route 206, which have an interchange with I-295 and the turnpike, respectively. As shown in Figure 13, motorists seeking entry onto the turnpike from I-295 South must either use Dunns Mill Road or Farnsworth Avenue; however, the former is weight restricted

Figure 12

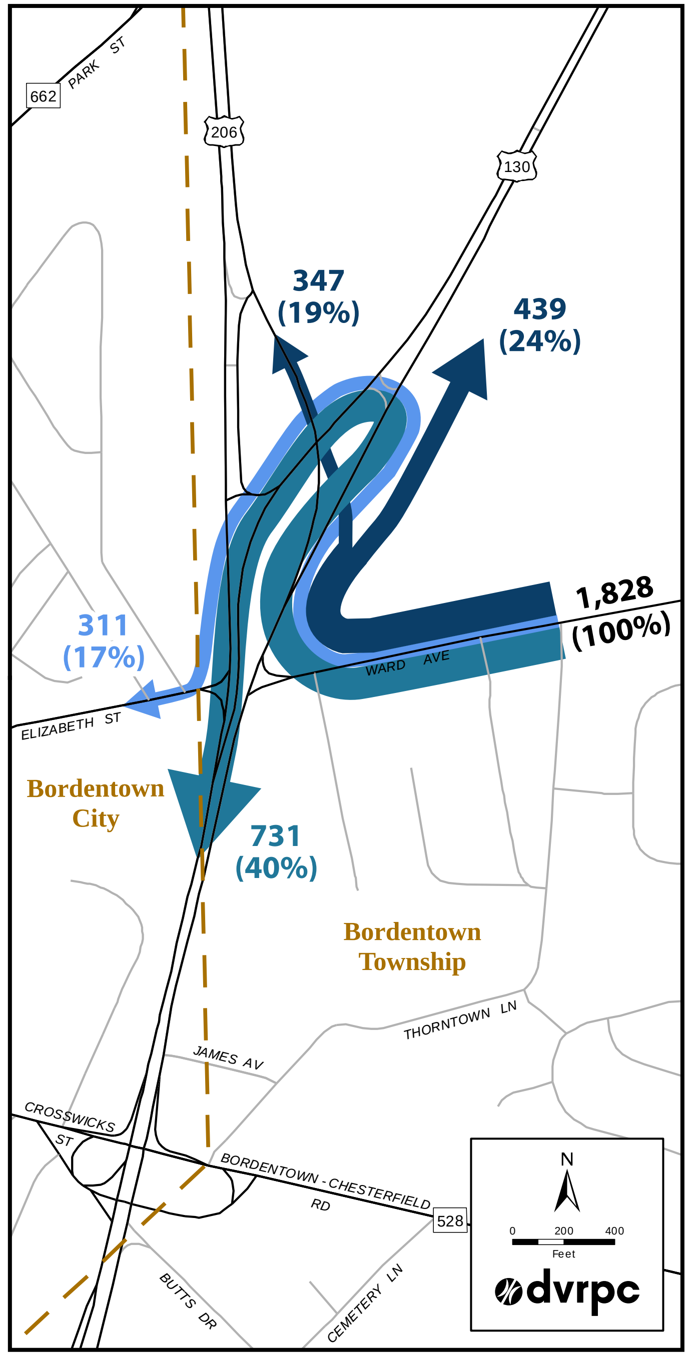
Elizabeth Street and Ward Avenue Origins and Destinations

Elizabeth Street



Origin-Destination Trips: DVRPC - August, 2011

Ward Avenue



Origin-Destination Trips: DVRPC - August, 2011

to four tons and is not a viable option for heavy vehicles, despite being the most direct route. Farnsworth Avenue carries about 16 percent of trips between the I-295 South and turnpike's interchange; presumably, the vast majority of heavy vehicle traffic travels this route. About 21 percent of trips begin on Dunns Mill Road, turn south onto Hedding Road, and connect to Rising Sun Road to reach the turnpike. The remaining 63 percent travel completely on Dunns Mill Road.

The reverse trip between the turnpike interchange and I-295 North is also shown in Figure 13; 21 percent of these trips used Farnsworth Avenue, while the remaining trips were split between the more direct Dunns Mill Road and the less-obstructed Rising Sun Road to the south. The trip between the turnpike interchange and I-295 North has more efficient options in this direction. The expanded use of Dunns Mill Road and Rising Sun Road for these purposes would remove unnecessary vehicles from the more congested Farnsworth Avenue.

Site-Specific Short-Term Improvements

Some effective recommendations could be installed with only moderate capital investments. They could provide immediate benefits for their respective issue. These recommendations may be implemented independent of each other and of the Route 130 and 206 recommendations from the alternatives analysis.

New Road Connection between I-295 and the NJTP

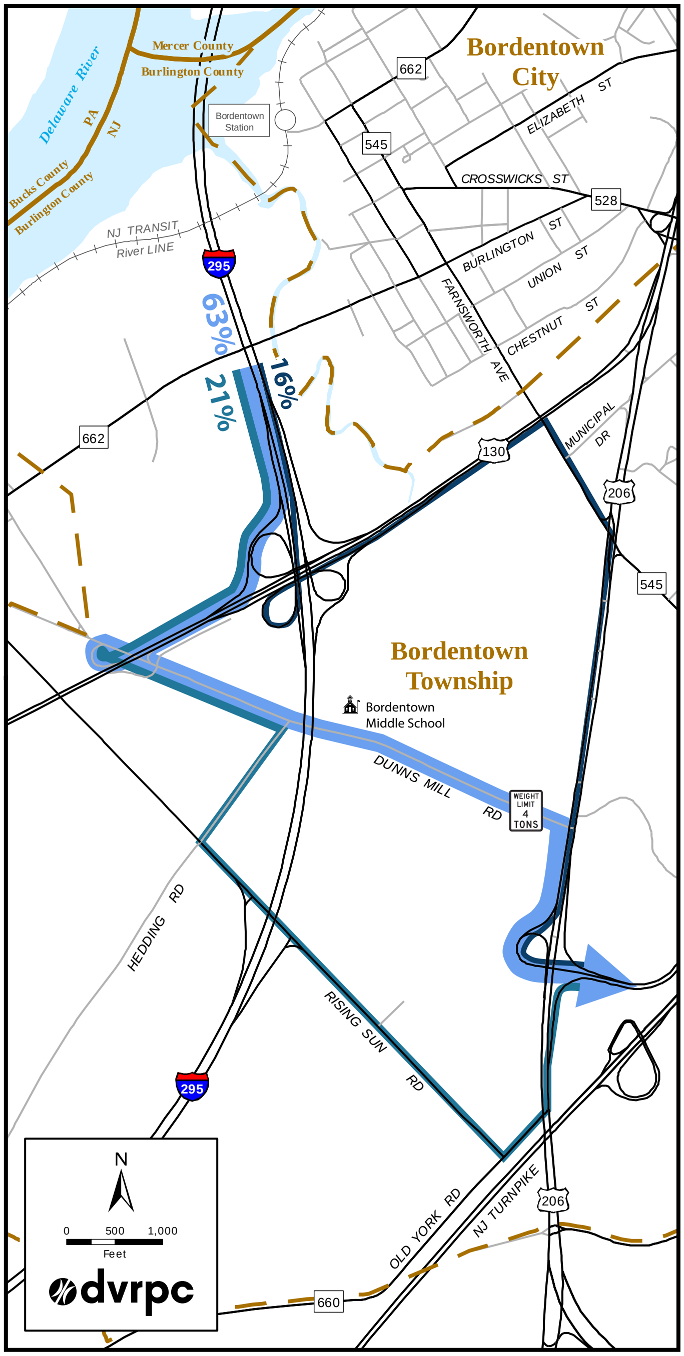
As indicated earlier, the percentage of heavy vehicles is greatest within the southern portion of the study area, along Route 206 and Farnsworth Avenue. Also, 16 to 21 percent of vehicles traveling between I-295 and the NJTP do so along Farnsworth Avenue, which is one of only two connections between these two interstates that are not weight restricted. Both of this route's two intersections are difficult to navigate for large vehicles, and on-street bicycle lanes were recommended along this portion of Farnsworth Avenue by the Michael Baker Jr., study. The other non-weight-restricted route traverses Rising Sun Road, a road designed to accommodate a high volume of heavy vehicles, and sometimes Hedding Road via Dunns Mill Road, neither of which were intended to carry heavy vehicles.

To reduce the volume of heavy vehicle traffic where inappropriate, a new one-way bypass road is recommended between Dunns Mill Road and Rising Sun Road to provide NJTP-bound heavy vehicles with an alternative that avoids both Farnsworth Avenue and Hedding Road. These two roads are not affected by heavy vehicles destined for I-295 because such trips are completed via the full length of Rising Sun Road, thus, the new road may be one way, southwestbound. The location and orientation of this recommendation is shown in Figure 14. In addition, there should be corresponding signage on I-295 and Route 130 directing heavy vehicles to this new bypass road.

Figure 13

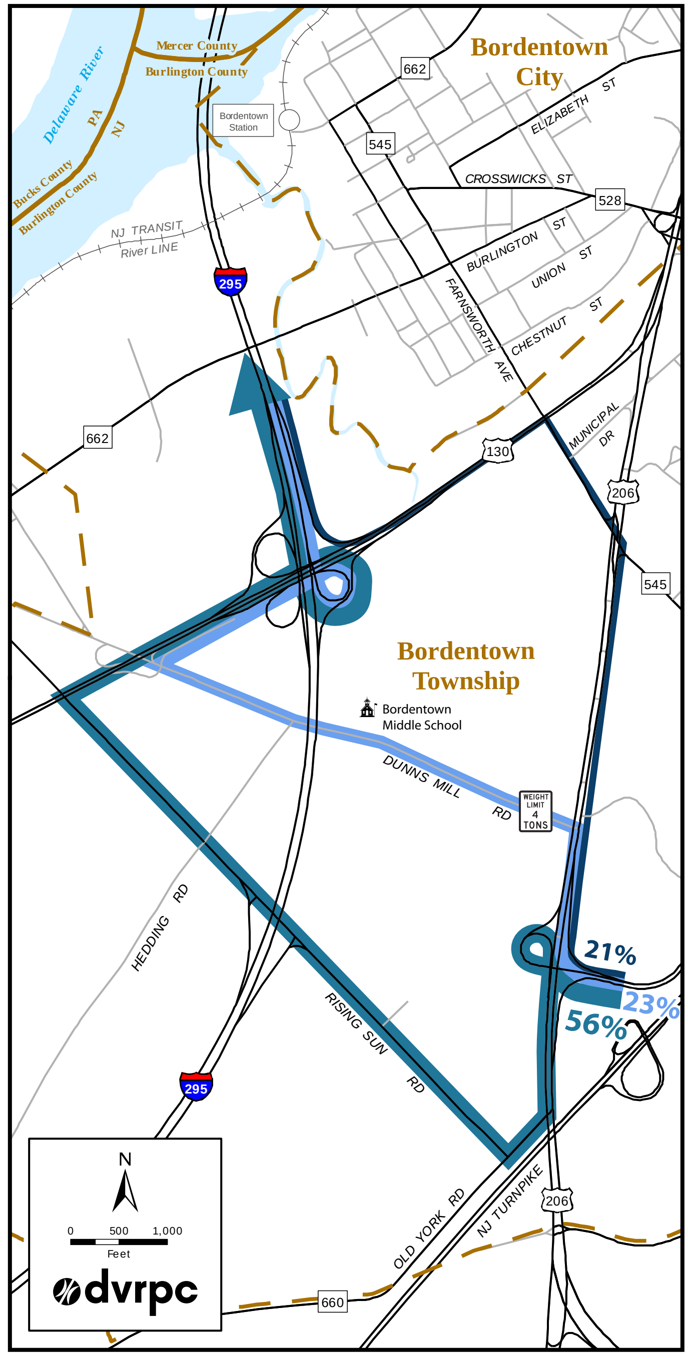
Route Choices between I-295 and the New Jersey Turnpike

I-295 to NJ Turnpike



Origin-Destination Trips: DVRPC - August, 2011

NJ Turnpike to I-295



Origin-Destination Trips: DVRPC - August, 2011

Figure 14
Heavy Vehicle Bypass Road Recommendation

Improved Safety and Access Management Near Mastoris Diner

The segments of Routes 130 and 206 around Mastoris Diner, immediately north of the Ward Avenue/Elizabeth Street intersection, experience excessive speeding and limited sight distances, which negatively impacts motorist safety. As discussed earlier, via Figure 15, posted speed limits in this area range between 45 to 55MPH, with 85th percentile speeds at or greater than these limits. Sight distance is compromised by vertical and horizontal curvature due to grade separation of the roadways, as well as the area's natural rolling topography. In addition, four median breaks in the area allow vehicles to enter, exit, and cross the roadways at often unexpected locations. This combination of high speeds, limited sight distance, and multiple access points creates difficult and unsafe driving conditions.

Converging chevrons within the existing shoulder along the northbound Route 206 overpass may mitigate some of the excessive speeding. New acceleration and deceleration lanes, as indicated in Figure 15, would reduce the speed differential for entering and existing vehicles. Similarly, a reorientation of the north and southbound entry points would assist with increased storage length and sight distance, as well as speed differentials. The number of ingress and egress points for Mastoris Diner would not be affected, nor would any private right-of-way be necessary to complete these improvements.

Alternatives Analysis

Within the study area, Routes 130 and 206 experience issues with safety, access management, congestion, and redevelopment potential. As a result, alternatives have been conceived, visualized, and quantified in an attempt to address each and all of these issues. They were shaped via consultation and review from Burlington County's Departments of Engineering and Economic Development and Regional Planning, New Jersey Department of Transportation, and the local municipalities of Bordentown City and Bordentown Township. These alternatives include improvements to intersections, median breaks, and arterial cross-sections. Consistent throughout all alternatives are: elimination of excessive speeding, reduced frequency of weaving, improved expectations for motorists, more robust street network, and safer pedestrian crossing opportunities. In addition to the dramatic physical changes to the roadway, these alternatives may also impact how the immediate area is perceived by locals and visitors alike. These changes may serve as a catalyst for reinvestment in the parcels and communities served by these roadways.

Methodology

In addition to an existing conditions scenario, three alternative scenarios were analyzed to gauge the impacts of various improvements. Each scenario incorporated improvements at multiple issue areas that corresponded to a central theme specific to that scenario. For instance, the "Roundabout" scenario included roundabouts at several intersections. However, many of the improvements for an issue area are not dependent upon its scenario, and thus may be arranged with improvements from other scenarios for another issue area. Each scenario was analyzed

Figure 15

Safety and Access Improvements near Mastoris Diner

during morning and evening peak-period conditions, with traffic data collected in spring 2011. These volumes were used consistently for all scenarios, except when adjusted to reflect a new network connection where one currently does not exist. Current signal timing schedules were provided by NJDOT and used to analyze existing conditions. Signal timing was optimized to reflect new intersection operations or arterial flow within the alternative scenarios. Performance measures were produced from a microsimulation model of the scenarios created via VISSIM software. Each scenario was measured for travel time, intersection delay and Level of Service (LOS), and volume-capacity ratio.

The Scenarios

All scenarios (existing conditions and four alternatives) examined Routes 130 and 206 from their upstream approaches to the intersections with Farnsworth Avenue/Georgetown Road (County Route 545), through their shared designation section, past the Park Street/Amboy Road intersection for Route 206 or north of Mastoris Diner for Route 130. Within this section, four intersections and merge-diverge points were evaluated. The former included the aforementioned intersections, as well as those at Crosswicks Street and Ward Avenue/Elizabeth Street. The latter included the two locations where Routes 130 and 206 merge and diverge from another. An index of the four issue areas is shown in Figure 16. The existing conditions of these four locations are shown in Appendix Figures A-1, A-2, A-3, and A-4.

The “Road Diet” scenario affects only three of the four issue areas, with its greatest impact at the Crosswicks Street issue area, where a through lane is removed for both north and southbound Routes 130 and 206 approaches; all auxiliary and shared turn lanes remain. This reduction in travel lanes is accomplished via two lane drops along Route 206, the lesser traveled of the two arterials. The northbound lane drop occurs within the Southern Merge issue area, upstream of the merge point. Conversely, the southbound lane drop occurs within the Ward Avenue and Elizabeth Street issue area. The outer through lane is converted into an auxiliary right-turn lane onto Elizabeth Street. This scenario’s alternatives are shown in Appendix Figures A-5, A-6, and A-7.

The “Roundabout” scenario employs three roundabouts at the four issue areas. Two-lane roundabouts are proposed for the intersection of Route 206 and Farnsworth Avenue/Georgetown Road, the southern merge-diverge point, and a northern merge-diverge point shifted to overlap with the intersection of Ward Avenue/Elizabeth Street. The remaining issue area, Routes 130 and 206 at Crosswicks Street, does not incorporate a roundabout due to right-of-way constraints; hence it is only slightly modified from existing conditions. The existing northbound jughandle is reversed to function as a near-side jughandle for northbound left- and U-turns, with westbound throughs accommodated along Crosswicks Street instead of at Crosswicks Extension. These alternatives are shown in Appendix Figures A-8, A-8, A-10, and A-11.

The “Left Turns” scenario emphasizes auxiliary left-turn lanes in lieu of jughandles to accommodate left-and U-turns along Routes 130 and 206. This is most evident at the Crosswicks Street intersection, where all movements are condensed from two clustered intersections and two jughandles into an expanded single intersection. At the intersection of Route 206 and Farnsworth Avenue/Georgetown Road, the north-south left-turn lanes remain; however, the median is drastically narrowed via a removal of the obsolete NJDOT weigh station, thus creating a much smaller intersection. At the Northern Merge issue area, southbound Routes 130 and 206 merge upstream of a new signalized intersection at Elizabeth Street and Ward Avenue. This new intersection employs auxiliary left-turn lanes for all approaches. The Southern Merge Issue Area remains unaffected. The alternatives are shown in Appendix Figures A-12, A-13, and A-14.

The “T-signals” scenario’s distinction is due to its use of signalized intersections to complete the merging and diverging movements of Routes 130 and 206 at both the Northern and Southern Merge issue areas. Included in this scenario is the signalization of Routes 130 and 206 at Ward Avenue/Elizabeth Street intersection, similar to the “Left Turns” scenario. The signalization of the merge points allows only two travel lanes per direction to extend into the shared section of Routes 130 and 206. The Crosswicks Street issue area is a hybrid of existing and alternate scenarios, with east and westbound movements occurring at separate locations as they currently do. However, north and southbound left turns are completed via exclusive left-turn lanes instead of their existing jughandles. The intersection of Route 206 at Farnsworth Avenue/Georgetown Road is downsized via a narrowing of the Route 206 median, similar to the “Left Turns” scenario. This scenario is displayed in Appendix Figures A-15, A-16, A-17, and A-18.

Each issue area is analyzed within four scenarios (existing conditions and four alternatives), as discussed above. The specific combination of alternatives at each issue area per scenario was primarily developed to streamline analysis. In fact, an issue area’s alternatives are independent from the remainder of that scenario’s alternatives, minus the Road Diet scenario, which operates cohesively as a single alternative. As a result, the Roundabout, Left Turns, and T-Signals alternatives may be viewed from another perspective: from each issue area. This perspective is summarized in Table 2.

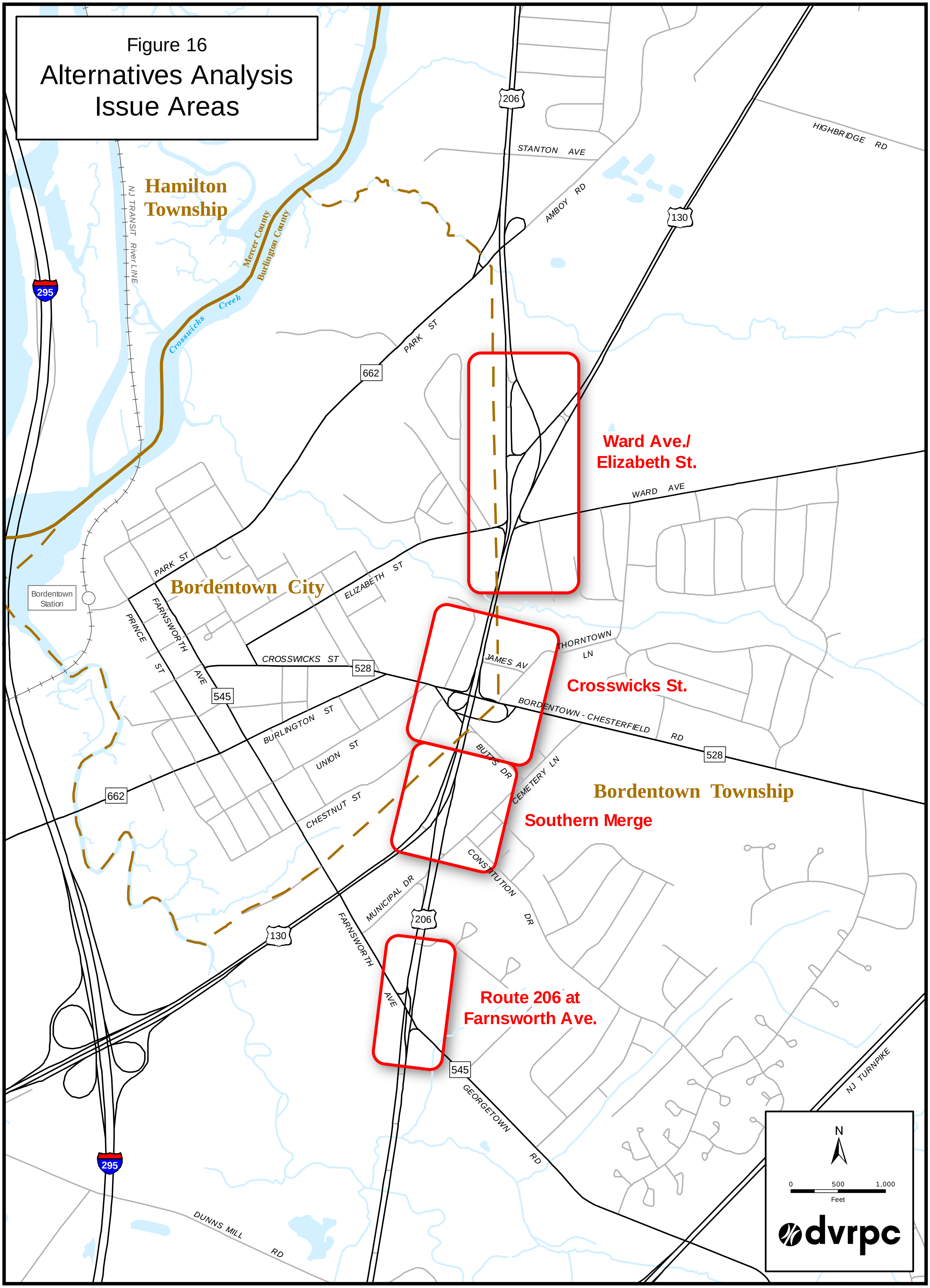


Figure 16
Alternatives Analysis
Issue Areas
Hamilton Township
Bordentown City
Bordentown Township
Mercer County
Burlington County
Crosswicks Creek
NJ TRANSIT River LINE
Bordentown Station
Ward Ave./
Elizabeth St.
Crosswicks St.
Southern Merge
Route 206 at
Farnsworth Ave.
STANTON AVE
HIGHBRIDGE RD
AMBOY RD
PARK ST
WARD AVE
ELIZABETH ST
CROSSWICKS ST
JAMES AV
THORNTOWN LN
BORDENTOWN - CHESTERFIELD RD
FARNSWORTH AVE
PRINCE ST
BURLINGTON ST
UNION ST
CHESTNUT ST
BUTTS DR
CEMETERY LN
CONSTITUTION DR
MUNICIPAL DR
GEORGETOWN RD
DUNNS MILL RD
NJ TURNPIKE
206
130
295
662
528
545
N
0
500
1,000
Feet
dvrpc

Table 2: Scenario Highlights per Issue Area

	Issue Areas			
Scenarios	Northern Merge, Ward Avenue-Elizabeth Street	Crosswicks Street	Southern Merge	Route 206 at Farnsworth Avenue/Georgetown Road
Existing	2 unsignalized right-in right-out intersections	2 signalized intersections with 2 signal phases	Unsignalized merge/diverge	1 signalized intersection with 4 signal phases
	No direct east-west connection	Left turns via jughandles		Large intersection footprint
Road Diet	One less SB Route 206 through lane compared to existing	One less NB and SB through lanes compared to existing	One less NB Route 206 through lane compared to existing	No change compared to existing
Roundabout	5-legged 2-lane roundabout	1 signalized intersection with 3 signal phases	3-legged 2 lane roundabout	4-legged 2 lane roundabout
		Left turns via jughandles		
Left Turns	1 signalized intersection	1 signalized intersection with 4 signal phases	No change compared to existing	Signalized intersection with 4 signal phases
	Left turns from all approaches via left-turn lanes	Left turns via left-turn lanes		Smaller footprint via narrowed Route 206 median
T-Signals	2 signalized intersections with 3 signal phases	2 signalized intersections with 3 signal phases	1 signalized intersection with 2 signal phases	Signalized intersection with 4 signal phases
	Direct east-west connection	Left turns via left-turn lanes		Smaller footprint via narrowed Route 206 median

Source: DVRPC, 2012

Analysis

The VISSIM models for each scenario per AM and PM peak hours generated a wealth of delay measurements. These results are displayed at the approach level in Figure 17 and Figure 18. A comprehensive table of each issue area's approach and intersection levels of delay and LOS is available in Appendix B-1. As stated earlier, each issue area's alternative is independent of the other alternatives within that scenario. Consequently, an issue area's delay and LOS performance measures may be directly compared across multiple scenarios.

Figure 17
Vehicular AM Peak Hour Approach Delay

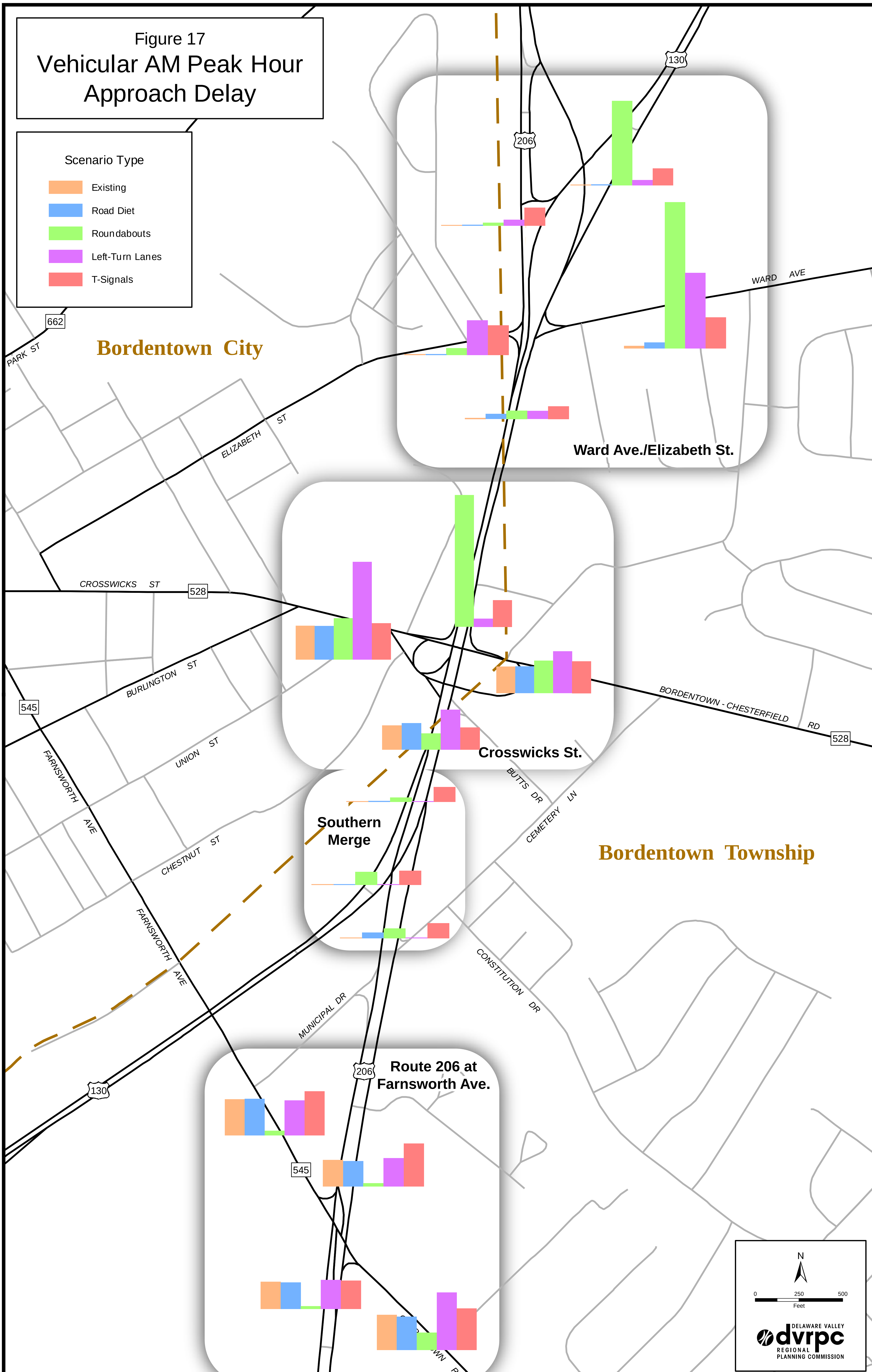
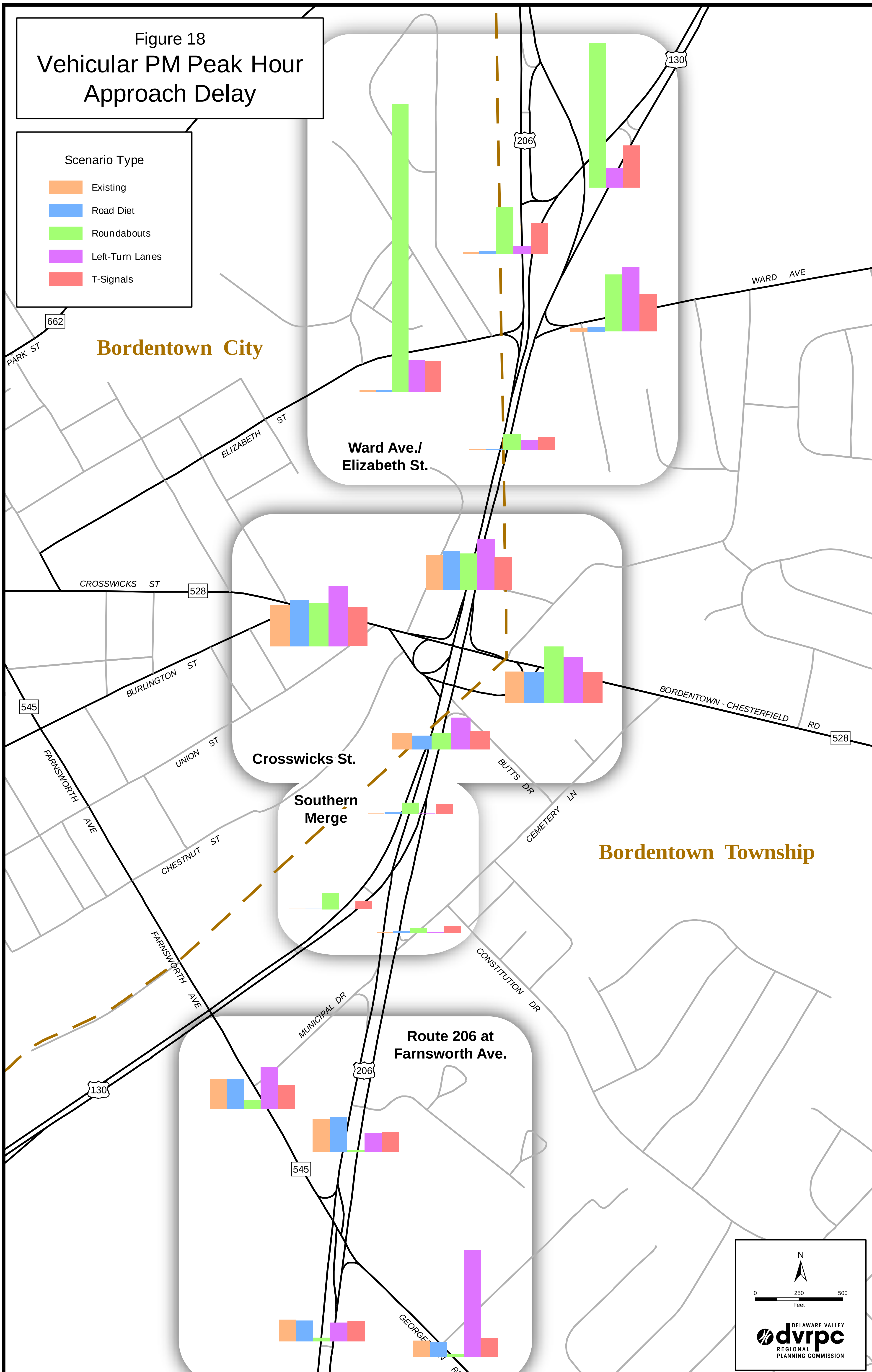


Figure 18
Vehicular PM Peak Hour Approach Delay



Existing Conditions

During the morning peak hour, all four issue areas operated with a LOS of C or better. In the afternoon peak hour, delays were slightly greater, with all intersections operating at a LOS of D or better. Additional details include:

- During both the morning and afternoon peak hours, the intersection of Route 206 and Farnsworth Avenue/Georgetown Road was the poorest performing, with an overall average delay of 34.8 and 43.5 seconds, respectively.
- The Route 130 intersections at Ward Avenue and Elizabeth Street experience very little overall delay, since the low volumes from the right-turn-only side streets are dwarfed by unimpeded north and southbound Route 130 through traffic.
- The Northern and Southern Merge issue areas experienced zero control delay due to their current arrangement as free merges.

Road Diet

The Road Diet scenario involves removing a travel lane in each direction in order to reduce capacity and speed. During both peak hours, all issue areas and their approaches experienced delays very similar to existing conditions. Outside of the Crosswicks Street issue area, this similarity should be expected, since only a few critical aspects are changed between scenarios.

- At the Crosswicks Street issue area, all four approaches perform comparably to existing conditions, despite there being one less through lane for north and southbound travel.
- Neither lane drop results in dramatic delay increases. The lane drop along northbound Route 206 in the Southern Merge issue area creates the largest delay increase incurred by this scenario along Routes 130 and 206; after combining the AM and PM peak hours, average delay increased by only 7.4 seconds.

Roundabouts

Some issue areas experience a significant increase in overall delay, whereas for others it is a significant decrease from existing conditions. Additionally, these differences are mostly consistent between peak hours, which imply a greater influence from operational changes than variations in volume.

- A two-lane roundabout at the intersection of Route 206 and Farnsworth Avenue/Georgetown Road would operate with a LOS of A in both peak hours. Overall delays average a 30-second improvement from existing conditions.
- A two-lane roundabout at the intersection of Route 130 at Ward Avenue and Elizabeth Street, which incorporate the functions of the Northern Merge, operates at a LOS of F during both peak hours. The most severe delays were experienced by southbound Route 130 and the side-street approaches.
- The issue area at Crosswicks Street performs comparably to existing conditions, minus the Crosswicks Street approaches, where delays rose steeply during the afternoon peak hour.

Left-Turn Lanes

Almost all issue areas during both peak hours experience greater overall delays and corresponding deteriorations in LOS.

- Compared to existing conditions, the issue area at the Route 130 and Crosswicks Street intersection experiences the greatest increase in overall average delay.
- The introduction of a full-movement signalized intersection along Route 130 at Ward Avenue and Elizabeth Street creates about 20 seconds of additional overall average delay, most of which is endured by the side street approaches.
- Overall, average delay increased during both peak hours at the intersection of Route 206 and Farnsworth Avenue/Georgetown Road.

T-signals

This alternative introduced additional control delay via the installation of three signalized intersections at currently unsignalized locations: Routes 130 and 206 merge points and the intersection of Route 130 at Ward Avenue and Elizabeth Street.

- The northern merge and the Ward Avenue and Elizabeth Street signalized intersections contribute a combined 30 seconds of overall delay per peak hour
- The signalization of the southern merge introduces about 10 seconds of overall delay per peak hour and operates at a LOS of B.
- Overall delay at the Crosswicks Street issue area remains comparable to existing conditions during both peak hours, though southbound left and U-turns experience significant additional delay in the morning peak hour.

Preferred Alternatives

The study's objectives and the area's physical context as urban commercial corridors requires a solution that reduces vehicular speeding and improves pedestrian crossing opportunities, without burdening vehicular throughput. Since the area lacks statewide safety and congestion prioritization, resources to address these issues are limited. Thus, identifying low-cost and scalable alternatives are necessary.

Due to its shorter pedestrian crossing distances, reducing weaving opportunities, improved access management via shoulders, negligible impact upon vehicular delay, and low-cost, the Road Diet scenario is the preferred alternative. Physical changes would occur in three issue areas, the two merge areas, and the Crosswicks Street intersection. However, these changes could be built with very few capital investments, since no additional right-of-way nor heavy highway construction is necessary; only a restriping of lane dividers and edge lines or shoulders would be required. Because only surface treatments are necessary, this alternative may be introduced on a trial basis before being permanently installed. This alternative is also scalable, as it does not interfere with the more complex scenarios and would thus serve as an effective first phase or foundation for future improvements. Figure 19 depicts the Crosswicks Street intersection as it would appear in this alternative, with a narrower cartway, shoulders, and robust median refuges. The performance measures of the road diet alternative at Crosswicks Street are shown in Table 3.

Figure 19: Simulation of Road Diet Scenario at Crosswicks Street

Source: DVRPC, 2012

Due to its ability to calm traffic, minimize weaving, serve as a community gateway, and its marginal impact of vehicular delay, a two-lane roundabout at the Southern Merge issue area is the preferred alternative for a longer-term second phase. A roundabout would reshape and thus introduce new redevelopment opportunities at the southern merge, via newly available roadway frontage or increased parcel sizes. Its footprint would be primarily within the existing right-of-way and require the removal of the northbound Route 130 overpass bridge. Figure 20 depicts the southern merge with a two-lane roundabout, accompanied by potential structures within redevelopment sites.

Due to its ability to provide a signal-controlled pedestrian crossing, a direct east-west vehicular connection, and a gateway for north-south through vehicles, the Left-Turn Lanes scenario's signalized intersection is recommended for the Northern Merge/Ward-Elizabeth issue area. This would be a long-term recommendation that could be incorporated as an additional second- or even third-phase into the Road Diet scenario, the preferred first phase alternative. This alternative would provide a second protected pedestrian crossing of the shared section of Routes 130 and 206, and at a location where pedestrians are currently observed crossing. Figure 22 demonstrates the various amenities made available to pedestrians, including median refuges, countdown timers, and continental crosswalks via this recommendation. The nearest controlled crossing and signalized intersection is almost 2,000 feet away at Crosswicks Street, which does not interfere with NJDOT signal spacing minimums and saves pedestrians up to an additional three-quarters of a mile walking distance. The circuitous route required for vehicles to travel between Ward Avenue and Elizabeth Street will be streamlined, though additional motorists may elect to travel along Elizabeth Street. Several traffic-calming measures may be taken to deter cut-through vehicles and additional occurrences of speeding. Figure 21 depicts how bulb-outs, brightly colored speed limit pavement markings, and painted edge lines could be incorporated onto Elizabeth Street without impeding local traffic or major capital investments.

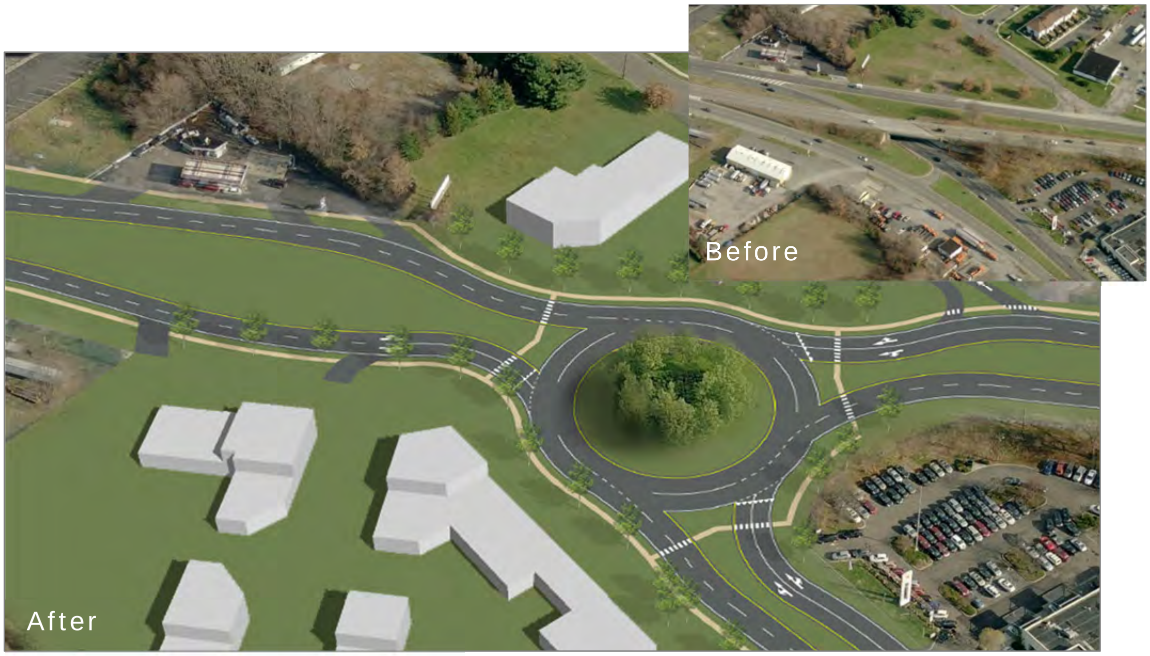


Figure 20: Simulation of Roundabout Scenario at Southern Merge

Source: DVRPC, 2012

Figure 21: Simulation of Traffic-Calming Recommendations along Elizabeth Street

Source: DVRPC, 2012

Figure 22: Simulation of Left-Turn Lanes Scenario at Ward Avenue and Elizabeth Street

Source: DVRPC, 2012

Table 3: Existing and Road Diet Performance Measures for AM and PM Peak Hours

		AM Peak Hour		PM Peak Hour	
		Existing (Crosswicks Street)	Road Diet (Crosswicks Street)	Existing (Crosswicks Street)	Road Diet (Crosswicks Street)
Overall	Delay	22.9	23.5	32.0	32.4
	LOS	C	C	C	C
Northbound	Delay	19.8	21.6	23.7	19.4
	LOS	B	C	C	B
	V/C	0.47	0.62	0.39	0.50
	Remaining Capacity	2404	1311	2942	1826
Southbound	Delay	20.6	19.8	34.5	38.5
	LOS	C	B	C	D
	V/C	0.36	0.46	0.71	0.90
	Remaining Capacity	2409	1591	1150	313
Eastbound	Delay	36.8	36.6	41.4	40.8
	LOS	D	D	D	D
	V/C	0.21	0.21	0.47	0.47
	Remaining Capacity	1129	1129	617	617
Westbound	Delay	27.8	28.0	37.5	36.7
	LOS	C	C	D	D
	V/C	0.61	0.61	0.45	0.45
	Remaining Capacity	351	351	447	447

Source: DVRPC, 2012

Summary

In order to address the safety and congestion issues present throughout the study area, multiple alternatives were developed for four critical issue areas. In addition, all of the alternatives provide an opportunity to restructure the corridor via a reduction in through lanes, changing the context and its perception to visitors and locals alike. They would provide improved pedestrian crossing opportunities, reduced motorist confusion, and increased redevelopment potential. Despite being grouped into five scenarios (existing and four alternatives) to streamline their modeling and delay analysis, many of the alternatives may also function independently. Thus, a comprehensive restructuring is unnecessary, since an incremental yet substantial benefit may be derived from improvements to a single issue area.

Based upon the study's needs and goals, a road diet is suggested as a short-term alternative for the shared section of Route 130 and Route 206. It would be low-cost and effective, while also capable of being introduced on a trial basis. Because it is scalable, it can be complemented by the long-term addition of both or either the two-lane roundabout alternative at the Southern Merge and the Left Turn Lanes scenario's signalized connection of the stop-controlled partial intersections at Ward Avenue and Elizabeth Street. Overall, pedestrian and motorist safety would be improved, with increased redevelopment opportunities, via a transformation of the corridor by the systematic installation of these alternatives.

Implementation

The *Implementation Matrix* **(Table 4)** can be used as a dynamic long-range tool for the systematic selection of projects to create a significantly improved transportation system within the study area. This document can serve as a punch list for the government agencies with a stake in the implementation of improvements. The text (page number cited) generally offers a more elaborate description of each recommendation.

Characteristics

In choosing which projects should advance first, stakeholders can be guided by the information presented below. Each improvement scenario identified is evaluated in terms of project phasing, cost range, and project benefits.

Phasing

The phasing of projects is estimated in terms of three categories: short, medium, and long term. Priorities are assigned based on the perception of the extent of the problems they present road users, with safety being most important, but congestion (or time delay) and mobility also being important.

Cost Range

Costs are also assigned to categories of high, moderate, and low. High-cost projects usually involve a major commitment from one or more funding sources, lengthy public involvement, and several years lead time in programming the required funds. They are typically large-scale, complex, or multiphase improvements and can entail the construction of new facilities. In general, a project in this category is estimated to cost in excess of $2 million. An improvement estimated to have a moderate cost could involve a major reconstruction of an intersection, construction of a short connector road, or a widening of an existing road. In general, a project in this category is estimated to cost between $100,000 and $2 million. Low-cost projects can often be fast tracked with maintenance or pool funding. They are often operational-type improvements at isolated locations and typically cost less than $100,000. These cost ranges are generalized estimates and could be significantly changed for a specific location due to environmental, right-of-way, or other factors uncovered during detailed design of the improvement.

Benefits

Benefits describe the kind of impact the improvement will yield, such as enhancing safety, improving mobility, or encouraging economic development.

Responsible Agency

Municipalities make land use decisions in the corridor, which ultimately affect traffic levels. Many of the cross streets are local streets that are designed, built and maintained by the local municipalities. The New Jersey Department of Transportation has jurisdiction over the state highways in the corridor. The state ultimately makes the decision on what improvements are done to their facilities, but often coordinates with the respective county or local municipalities.

Table 4: Implementation Matrix

Recommendations and Preferred Alternatives	Location	Phasing (Short, Medium, Long)	Benefit	Cost	Responsible Agency
Safety and access improvements near Mastoris Diner (page 45)	Routes 130 and 206 near Mastoris Diner	Short-Term	Safety Mobility	L	NJDOT
New bypass road to connect I-295 to NJTP and Route 206 (page 42)	Between Dunns Mill Rd. and Rising Sun Rd.	Medium-Term	Mobility	H	Municipal, Burlington County
Road Diet (page 47)	Shared section of Routes 130 and 206	Short-Term	Safety Development	M	NJDOT, Municipal
2-lane roundabout (page 47)	Southern Merge	Medium-Term	Safety Development	H	NJDOT, Municipal
Signalized Intersection (page 47)	Ward Avenue-Elizabeth Street	Medium-Term	Safety Mobility	H	NJDOT, Municipal

L=Low M=Moderate H=High

Source: DVRPC, 2012

Appendix A

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Figure A-1
Existing Conditions at Ward Ave./Elizabeth St.
206
130
206
130
Ward Avenue
Elizabeth Street
N
0
50
100
Feet
dvrpc

Figure A-2
Existing Conditions at Crosswicks St.

Figure A-3

Existing Conditions at Southern Merge

Figure A-4

Existing Conditions at Route 206 and Farnsworth Ave.

Figure A-5

Road Diet Scenario at Ward Ave./Elizabeth St.

Figure A-6

Road Diet Scenario at Crosswicks St.

Figure A-7
Road Diet Scenario at Southern Merge

Figure A-8

Roundabout Scenario at Ward Ave./Elizabeth St.

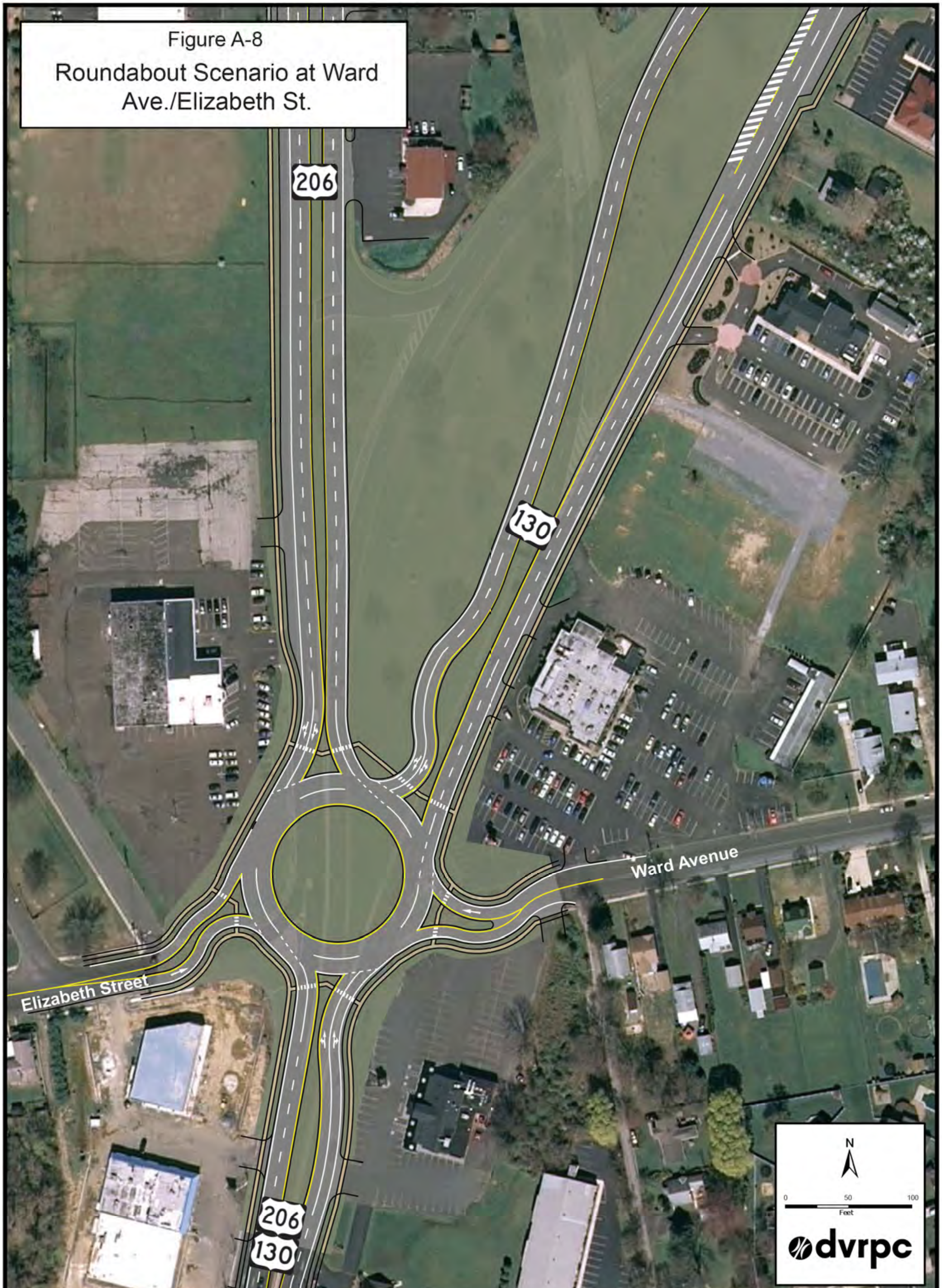

Figure A-9

Roundabout Scenario at Crosswicks St.

Figure A-10

Roundabout Scenario at Southern Merge

Figure A-11

Roundabout Scenario at Route 206 and Farnsworth Ave.

Figure A-12

Left Turns Scenario at Ward Ave./Elizabeth St.

Figure A-13

Left Turns Scenario at Crosswicks St.

Figure A-14
Left Turns Scenario at Route 206 and Farnsworth Ave.

Figure A-15

T-signals Scenario at Ward Ave./ Elizabeth St.

Figure A-16

T-signals Scenario at Crosswicks St.

Figure A-17
T-signals Scenario at Southern Merge

Figure A-18

T-signals Scenario at Route 206 and Farnsworth Ave.

Appendix B

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Appendix B: Performance Measures per Alternative and Issue Area

Performance measures for AM peak hour							
			Existing	Road Diet	Roundabouts	Left Turn Lanes	T-Signals
Northern Merge	NB	LOS	A	A	B	B	C
		Delay	1.9	8.4	13.7	13.1	20.5
	SB 130	LOS	A	A	F	A	C
		Delay	0.1	0.0	156.0	9.9	31.6
	SB 206	LOS	A	A	A	B	C
		Delay	0.2	0.4	5.1	10.2	30.1
	EB	LOS	A	A	B	D	D
		Delay	1.4	0.6	10.6	52.3	44.6
	WB	LOS	A	B	F	F	E
		Delay	5.4	12.2	294.2	**151.8**	62.6
	Overall	LOS	A	A	F	C	B
		Delay	1.4	5.7	52.0	22.3	11.5
Crosswicks	NB	LOS	B	C	B	C	B
		Delay	19.8	21.6	13.3	32.6	18.0
	SB	LOS	C	B	B	C	C
		Delay	20.6	19.8	15.4	30.2	29.1
	EB	LOS	D	D	D	F	D
		Delay	36.8	36.6	45.0	**106.2**	39.4
	WB	LOS	C	C	C	D	C
		Delay	27.8	28.0	33.9	43.6	33.3
	Overall	LOS	C	C	B	D	C
		Delay	22.9	23.5	19.6	39.0	25.5
Southern Merge	NB 130	LOS	A	A	A	A	B
		Delay	0.0	0.5	9.3	0.0	10.1
	NB 206	LOS	A	A	A	A	B
		Delay	0.0	4.9	8.2	0.0	12.6
	SB 130/206	LOS	A	A	A	A	B
		Delay	0.0	0.8	3.6	0.0	12.4
	Overall	LOS	A	A	A	A	B
		Delay	0.0	1.8	6.6	0.0	11.8
Route 206 at Farnsworth Avenue/Georgetown Road	NB 206	LOS	C	C	A	C	C
		Delay	31.6	30.8	3.2	33.6	32.8
	SB 206	LOS	C	C	A	D	D
		Delay	33.4	32.0	4.0	35.9	**54.1**
	EB Farnsworth Ave	LOS	D	D	A	D	D
		Delay	42.7	43.3	5.4	41.3	52.1
	WB Georgetown Rd	LOS	D	D	B	E	D
		Delay	37.7	35.8	18.7	**61.9**	44.6
	Overall	LOS	C	C	A	D	D
		Delay	34.8	33.5	7.6	42.0	43.4

Source: DVRPC, 2012

Performance measures for PM peak hour							
			Existing	Road Diet	Roundabouts	Left Turn Lanes	T-Signals
Northern Merge	NB	LOS	A	A	B	B	B
		Delay	1.0	1.5	19.6	12.9	16.4
	SB 130	LOS	A	A	F	B	D
		Delay	0.1	0.0	199.3	16.6	36.4
	SB 206	LOS	A	A	D	A	D
		Delay	0.4	3.2	53.8	8.8	35.2
	EB	LOS	A	A	F	E	E
		Delay	3.2	1.2	695.7	57.5	56.7
	WB	LOS	A	A	E	E	D
		Delay	3.3	4.5	58.5	66.0	38.0
	Overall	LOS	A	A	F	B	B
		Delay	0.7	1.6	87.9	17.1	11.7
Crosswicks	NB	LOS	C	B	C	D	C
		Delay	23.7	19.4	23.6	44.8	25.5
	SB	LOS	C	D	D	D	C
		Delay	34.5	38.5	36.3	50.1	32.7
	EB	LOS	D	D	F	F	E
		Delay	41.4	40.8	**220.3**	**204.0**	62.3
	WB	LOS	D	D	E	E	D
		Delay	37.5	36.7	67.7	55.0	37.4
	Overall	LOS	C	C	D	E	C
		Delay	32.0	32.4	46.8	61.7	33.3
Southern Merge	NB 130	LOS	A	A	C	A	B
		Delay	0.0	0.3	20.4	0.0	10.6
	NB 206	LOS	A	A	A	A	A
		Delay	0.0	2.5	7.4	0.0	9.9
	SB 130/206	LOS	A	A	B	A	A
		Delay	0.0	1.9	11.3	0.0	10.0
	Overall	LOS	A	A	B	A	B
		Delay	0.0	1.6	13.1	0.0	10.1
Route 206 at Farnsworth Avenue/Georgetown Road	NB 206	LOS	C	C	A	C	C
		Delay	31.9	30.5	5.7	27.5	29.6
	SB 206	LOS	D	E	A	C	C
		Delay	53.6	57.4	3.8	31.3	32.2
	EB Farnsworth Ave	LOS	D	D	B	E	D
		Delay	48.2	46.9	13.8	**66.1**	38.3
	WB Georgetown Rd	LOS	C	C	A	F	D
		Delay	31.1	27.5	4.8	**204.0**	35.4
	Overall	LOS	D	D	A	E	C
		Delay	43.5	43.9	6.0	61.1	32.8

Source: DVRPC, 2012

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Key Words: roundabout, road diet, pedestrian safety, access management, traffic calming, connectivity, water resources, origin-destination study, stormwater management, green infrastructure, alternatives analysis, road safety audit

Abstract: This study was conducted to address local stakeholder concerns for pedestrian and motorist safety within the corridor. Several short- and long-term concepts were conceived and developed as solutions to the safety and mobility needs for the study area. Some concepts were combined into corridor-wide alternatives, whereas others served as site-specific alternatives. Five corridor-wide alternatives were evaluated in detail, with a microsimulation software, to quantify existing conditions and estimate the impact of the proposed improvements on corridorwide safety and mobility

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