Final Report • September 2013

Warwick Station Redevelopment District

Circulation and Access Management Plan

SUBMITTED TO

City of Warwick Planning Department

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Warwick, RI 02886

SUBMITTED BY

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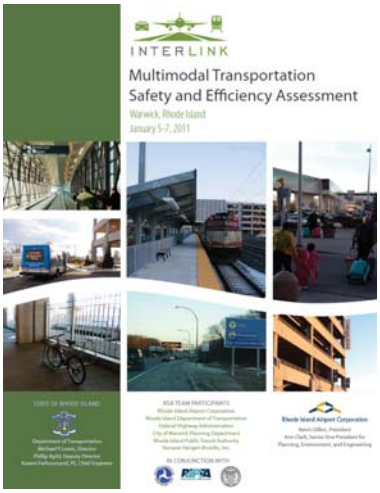
Study Process and Framework

This Circulation and Access Management Plan for the Warwick Station Development District (WSDD) is critically important to the future economic viability and quality of life within this district and in the region. This plan reviews existing traffic conditions and land uses, and seeks to make improvements that will address future traffic conditions and development opportunities. These improvements are aimed at increasing overall mobility, accessibility and safety for residents, businesses, employees, and visitors while decreasing traffic congestion and its negative impacts on the environment, economy and sustainability.

1.1 Study Background

The Warwick Station Development District (WSDD) was established by the City of Warwick to recognize the underutilized character of the land located between the T.F. Green Airport and the InterLink facility. The WSDD is bounded by Post Road to the east, the railroad right-of-way to the west, Kilvert Street to the north, and Montebello Road to the south. The abutting properties along Jefferson Boulevard, between Coronado Road and the Airport Connector, are also part of the WSDD. The land included in the WSDD is illustrated in **Figure 1**.



In June 2011, a Warwick Station Development District Master Plan was developed addressing issues related to the traffic generated from the proposed developments within the district. It also made a series of recommendations to mitigate any impacts created by the district, both on the adjacent roadway network and internal to the district. It also gave an overview of the street design, key pedestrian links and other visions for the district.

An InterLink Multi-modal Transportation Safety and Efficiency Assessment (MTSEA) was conducted at the InterLink facilities, including the T.F. Green Airport Campus, the WSDD, and the Adjacent Roadway Network. One recommendation that came out of this assessment was the need for a circulation and access management plan to identify access management principles and designs that can and should be implemented to reduce congestion and improve safety within the district with the projected increase in

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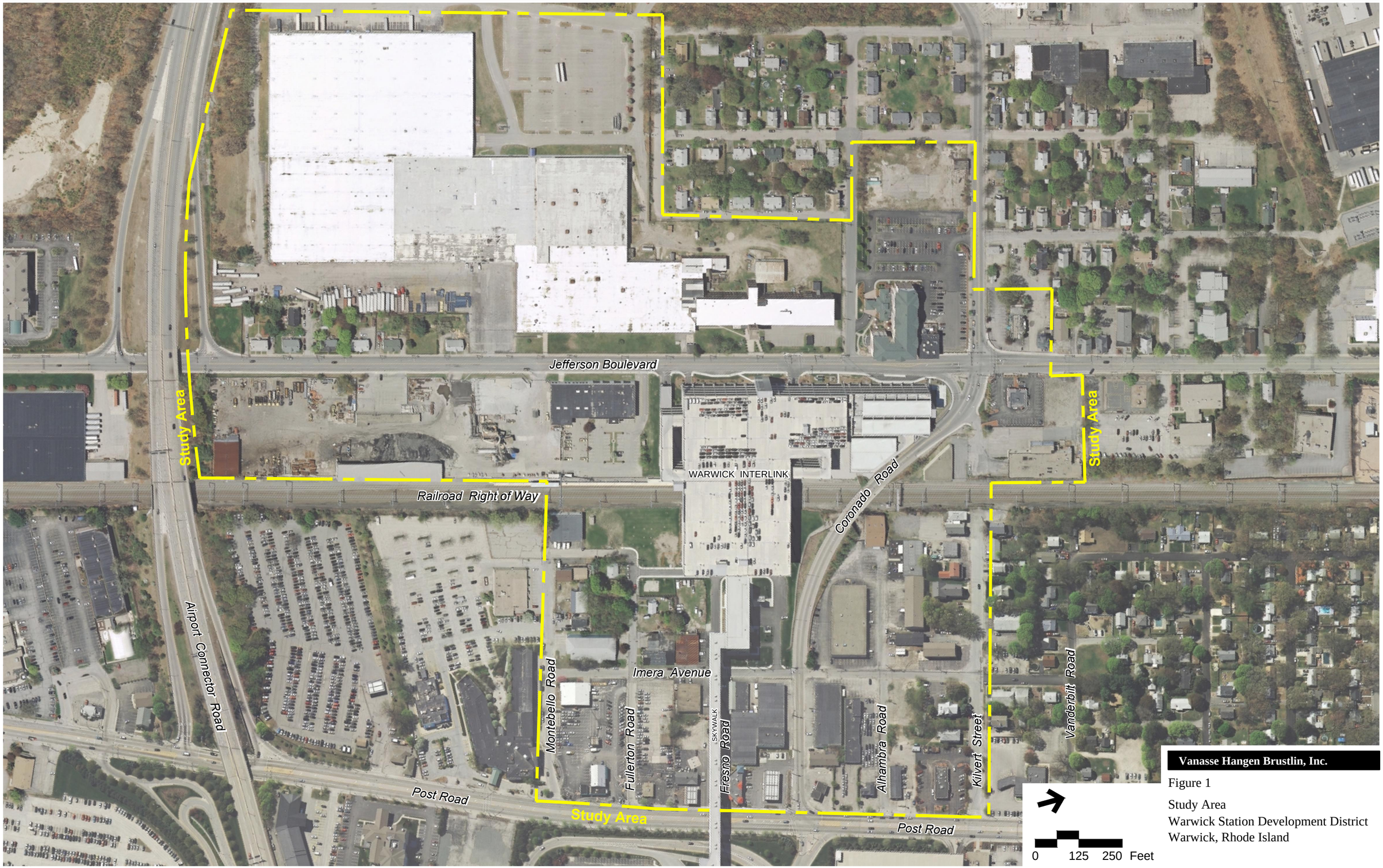

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Figure 1

Study Area
Warwick Station Development District
Warwick, Rhode Island

traffic. These access management principles can be incorporated into an ordinance that can be adopted by the City and used within this district, as well as be modified or expanded upon to be used in other areas of the City.

1.1.1 Access Management – An Overview

The goal of access management is to control the location, number, spacing, and design of curb cuts/access points along a major roadway while promoting alternate access to parcels through supporting street systems and interconnecting driveways between parcels. Promoting improved access results in a roadway that operates more safely and efficiently for all users. Poor access management can result in the following consequences:

- An increase in vehicle crashes;
- Collisions involving pedestrians or bicyclists;
- Reduction in roadway efficiency;
- Unsightly commercial strip development;
- Degradation of roadside landscaping;
- Promotion of cut-through traffic on residential streets;
- An increase in commuting times;
- Costly improvements to correct poor access management; and
- Safe access concerns for businesses.

Therefore, it is important to preserve a public roadway through the management of roadway access. The following section reviews principles to promote access management.

1.1.2 Ten Principles of Access Management

It is important to start an access management study by first defining the principles of access management before developing recommendations. Access management can be accomplished by applying the following principles, which have been developed by the Transportation Research Board (TRB):

1. Provide a Specialized Roadway System
2. Limit Direct Access to Major Roadways
3. Promote Intersection Hierarchy
4. Locate Signals to Favor Through Movements
5. Preserve the Functional Area of Intersections
6. Limit the Number of Conflict Points
7. Separate Conflict Areas
8. Remove Turning Vehicles from Through Traffic Lanes
9. Use Raised Medians to Manage Left-Turn Movements

10. Provide a Supporting Street and Circulation System

Promoting access management techniques can benefit the businesses, motorists, cyclists, pedestrians, transit riders, government agencies and communities.

1.1.3 A Need for Access Management

While traffic volumes in the region have somewhat remained unchanged over the last five years, and in fact may have actually declined over the last two years due to the economy and high gas prices, there is a potential for a significant increase in traffic and the number of driveways along the corridors. The proximity to major freeways including Interstate 95 and the closeness to T.F. Green Airport and the InterLink facility makes properties within this district very desirable for potential development. The location coupled with the large amount of vacant properties in the area, could result in a large increase in traffic along the study area roadways. With the potential for future development and traffic growth, access conditions are expected to degrade. Therefore, a specific access management plan is needed for the area to plan for the future.

Access management and corridor planning is largely a balancing act where safety and congestion issues must be addressed in the context of land use visions, economic development goals, environmental resource preservation, and funding constraints.

How a transportation system can best serve a region with changing demographics and behaviors is an important and difficult question to answer. Access management principles and design, as well as social, land use, environmental and economic evaluations must be considered and presented in an effective and open public outreach process to assure that all impacted parties have been heard.

This Circulation and Access Management Plan for the WSDD builds on previous work to begin developing a more comprehensive answer to the existing and future congestion and safety issues. The objective is to identify access management principles and designs that can be employed with the district and along the surrounding roadway network, specifically Post Road and Jefferson Boulevard, to reduce congestion and to increase safety. Once identified, these management principles and designs can be incorporated into an ordinance that can be adopted by the City and used in this district when reviewing development proposals.

1.2 Study Vision and Goals

The objective of this project is to identify access management principles and designs that can and should be implemented to reduce congestion and increase safety with

the potential increase in traffic. This access management plan presents balanced, comprehensive guidelines for the WSDD. The plan discusses existing and future transportation deficiencies, and incorporates the potential for future development in the district. The plan also identifies transportation infrastructure needs and improvement opportunities that should be considered for the district roadways

This study is critically important to the future economic viability and sustainability within the WSDD and the region. This plan reviews existing traffic conditions and land uses and seeks to recommend improvements that can address future traffic conditions and development/redevelopment opportunities. These improvements are aimed at increasing overall mobility, accessibility and safety for residents, businesses, employees, and visitors while decreasing traffic congestion and its negative impacts on the environment, economy and quality of life.

To guide the development of this plan, the following objectives were established:

1. Inventory and Report Review: to review previously completed traffic studies in the area, including but not limited to the Warwick Station Development District (WSDD) Master Plan, T.F. Green Expansion E.I.S, InterLink MTSEA, and the miscellaneous Traffic Impact Studies. The traffic data from these reports will be used as a basis for the existing transportation network and traffic volumes as well as the projected traffic volumes generated from the WSDD and other proposed developments in the immediate area expected to have a significant impact on traffic operations.

2. Operational Characteristics: to qualitatively determine existing and future operational characteristics and deficiencies of the transportation system by reviewing capacity analyses of existing and future build-out conditions (performed under other studies).

3. Future Recommendations: to formulate recommendations that are compatible with and help preserve the capacity of future transportation improvements, including identifying primary and secondary access points, internal and traffic flow, roadway circulation, and additional infrastructure improvements that enable these recommendations.

4. Access Management Techniques: to identify applicable access management techniques that can be applied within the WSDD.

2

Existing Conditions

This Chapter provides an assessment of the existing traffic conditions along the roadway network within and surrounding the WSDD. Sections included in this Chapter present an evaluation of the transportation infrastructure (including demands, safety, and traffic operations), current proposed property uses, and traffic/roadway issues. This information will set the framework for analyzing future roadway conditions, incorporating recommended improvements and access management techniques to mitigate existing/future issues, and the development of circulation and access management strategies and opportunities presented later in this study. The existing conditions data was compiled from a limited field review and previously completed studies in the area, including but not limited to:

- Warwick Station Development District Master Plan;
- T.F. Green Airport Environmental Impact Statement (EIS);
- InterLink Multi-modal Transportation Safety and Efficiency Assessment (MTSEA); and
- 800 Jefferson Boulevard Traffic Impact and Access Study (D'Ambra Property)

2.1 Existing Transportation Infrastructure

This section includes an evaluation of the physical conditions of the transportation network surrounding and within the WSDD. This information is intended to identify current roadway design issues.

2.1.1 Study Area Roadways

As previously mentioned in Chapter 1, the WSDD is generally bounded by Post Road to the east, the railroad right-of-way to the west, Kilvert Street to the north, and Montebello Road to the south. The abutting properties along Jefferson Boulevard, between Coronado Road and the Airport Connector, are also part of the WSDD. The following key roadways are located within the WSDD and are described in more depth in this section:

The Airport Connector

The Airport Connector is a limited access freeway that connects I-95 (Exit 13) to three destinations (exits): Jefferson Boulevard, Post Road, and the T.F. Green Airport Campus. The freeway consists of two travel lanes with shoulders in each direction.

Post Road (US Route 1)

Post Road (US Route 1) is a principal arterial bisecting the City of Warwick, with numerous hotels, restaurants, other businesses, and T.F. Green Airport along this roadway. Post Road offers access to I-95 by way of the Airport Connector and access to Route 37, a limited access freeway that intersects with I-95 and I-295. Post Road also provides access to the InterLink Monthly Cardholder Commuter lot via Fresno Road.

Within the study area, Post Road consists of two travel lanes with narrow shoulders and sidewalks in each direction, and parking is not allowed. There is a continuous center left-turn lane that provides refuge for left-turning vehicles in both directions.

Jefferson Boulevard

Jefferson Boulevard is a minor arterial that mainly serves commercial and industrial uses along its entire length. Jefferson Boulevard offers access to I-95 via the Airport Connector. The InterLink Rental Car operations and Daily Commuter lot are accessed from Jefferson Boulevard. Within the study area, Jefferson Boulevard consists of two travel lanes with narrow shoulders and sidewalks in each direction, and parking is not allowed.

Coronado Road

Coronado Road is a collector roadway that spans the railroad tracks and connects Post Road and Jefferson Boulevard. The road consists of one travel lane with shoulders in both directions. The InterLink Monthly Cardholder Commuter lot can be accessed off of Coronado Road via Imera Avenue. There are sidewalks on both sides of Coronado Road, west of Imera Avenue.

Coronado Road is one of only three roadways in the area that offer a cross connection between the east and west sides of the railroad tracks. The other two access point are the Airport Connector, with limited access, and Lincoln Avenue, which operates with alternating two-way traffic due to sight-distance and width constraints from the railroad bridge overpass.

Kilvert Street

Kilvert Street is a collector roadway that connects Jefferson Boulevard to Metro Center Boulevard (corporate business park). The road consists of one travel lane with shoulders in both directions. There are sidewalks on both sides of Kilvert Street immediately west of Jefferson Boulevard. Kilvert Street provides an alternate access to Interstate 95, via Metro Center Boulevard and Greenwich Avenue (Route 5).

Fresno Road

Fresno Road is a local road that connects Post Road with the InterLink Monthly Cardholder Commuter lot. There are also a few small businesses along the relatively short roadway. There are no pavement marking along Fresno Road, but it operates as a two-way roadway with one travel lane in each direction. Fresno Road lies under the InterLink skywalk, where there are no posted or striped parking restrictions. As part of the InterLink project, a new sidewalk was added to the north side of Fresno Road, west of Imera Avenue.

Imera Avenue

Imera Avenue is a local road connecting Montebello Road and Vanderbilt Road. Vehicles can access the InterLink Monthly Cardholder Commuter lot from Coronado Road via Imera Avenue to Fresno Road. There are a few small businesses located along the short roadway. There are no pavement markings along the Imera Avenue, but it operates as a two-way roadway with one travel lane in each direction. There are no posted or striped parking restrictions along this roadway. As part of the InterLink project, a new sidewalk was added to the west side of Imera Avenue, between Fresno Road and Coronado Road.

Local Roadways

Glenham Avenue, Fullerton Road and Montebello Road are local roads within the WSDD area. There are some residential uses and small businesses as well as airport parking along these roadways. There are no pavement markings along the roadways, but all operate as two-way roadways with one travel lane in each direction, and there are no sidewalks present. There are no posted or striped parking restrictions along these roadways, except on Montebello Road, immediately adjacent to the Radisson hotel. Fullerton Road and Montebello Road both intersect Post Road parallel to Fresno Road and Coronado Road.

As part of the InterLink project, a new drive was constructed adjacent to the InterLink and Customer Service Office building on the east side of the rail. North of Fresno Road, this roadway is restricted to InterLink use only. South of Fresno Road, the road is one-way southbound, which is primarily used by vehicles exiting the InterLink Monthly Cardholder Commuter lot and the shuttle that drops off passengers seeking the rental car facility. There is a sidewalk located along portions of this new drive.

2.1.2 Access Points

Currently, the WSDD on the east side of the railroad right-of-way has numerous access points along Post Road in addition to Coronado Road, including intersections with Montebello Road, Fullerton Road, Fresno Road, Alhambra Road, and Kilvert Street. All access points are currently designed for full access and are all unsignalized with the exception of Coronado Road. Imera Avenue offers access from the WSDD to Coronado Road. On the west side of the railroad right-of-way, access is provided off of Jefferson Boulevard via numerous driveways as well as Kilvert Street and Thurber Street.

2.1.3 Circulation

Currently, all streets within the WSDD on the east side of the railroad right-of-way are two-way streets and all intersections are full access.

2.1.4 Planned Roadway Improvements

As part of the study, planned roadway infrastructure improvements related to proposed developments and improvement projects were reviewed. The following planned projects were noted in the WSDD area:

- **Intersection Improvements to Post Road/Coronado Road –** Currently on the state's Transportation Improvement Program (TIP) in the Study & Development stage, the following is proposed to improve the capacity at this intersection:
  - Upgrade traffic signal
  - Widen to provide Post Road southbound right-turn lane

- **800 Jefferson Boulevard Property (D'Ambra Property) –** As currently proposed, the traffic generation from the development of this site requires the following improvements along Jefferson Boulevard:
  - New traffic signal at the site driveway (south of the InterLink)
  - Reconfiguration of the Airport Connector Ramps

- The traffic impact and access study prepared for this development also recommended that the intersection of Jefferson Boulevard and Kilvert Street/Coronado Road be monitored as WSDD area properties are developed over time to determine if additional capacity is needed if delays significantly increase.

- **T.F. Green Airport Improvement Program –** As part of the EIS for the airport's improvement program, the following is currently proposed:
  - Close existing airport south entrance
  - Construct new south access road, near Strawberry Field Road
  - Construct new Gateway entrance, between Coronado Road and the Airport Connector

- **Jefferson Boulevard Road Diet Feasibility Study** - RIDOT has also investigated the implementation of a "Road Diet" along Jefferson Boulevard which would involve converting the existing 4-lane cross section to a 2-lane cross section with a center median and on-road bike lanes in each direction.

2.1.5 Public Transportation

Bus service is provided along and to the district by the Rhode Island Public Transit Authority (RIPTA) via Route 14, Route 20, and Route 8. A summary of the bus service based in input from RIPTA during the Interlink MTSEA is provided below.

Route 14 operates between Kennedy Plaza in Providence and Newport. This service runs 6 days a week and offers 14 trips per day during the week and 7 trips on Saturday. The daily ridership from the airport inbound to downtown Providence averages between 1-2 passengers per trip and less than 1 passenger per trip outbound from Providence.

Route 20 operates between Kennedy Plaza in Providence and the airport. This service runs 7 days a week and offers 35 trips per day during the week and 20+ trips on weekends. The ridership from the airport inbound to downtown Providence averages 66-67 passengers per trip and 40-46 passengers per trip outbound from Providence.

The RIPTA currently provides service to the InterLink on Route 8. This route operates between Kennedy Plaza in Providence and the Buttonwoods and Greenwood neighborhoods in Warwick, and offers peak service only (6-7 trips per day). The only ridership activity from the InterLink is inbound to downtown Providence in the afternoon, averaging less than 1 passenger per trip

There is a Warwick Intermodal Station Plan for Feeder Bus Service that proposed the rededication of existing bus services and the addition of new services focusing on enabling people to use RIPTA to access the InterLink and the airport from adjacent areas.

2.1.6 Pedestrian Accommodations

Currently, both Post Road and Jefferson Boulevard have sidewalks on both sides of the roadway. Coronado Road has sidewalks on both sides west of Imera Avenue and a sidewalk on the south side only east of Imera Avenue. There are pedestrian crossings at the signalized intersections in the district. The Skywalk, connecting the InterLink facility and Jefferson Boulevard to the T.F. Green Airport, offers a pedestrian walkway across Post Road. This skywalk can be also accessed from Imera Avenue, offering access to pedestrians in the WSDD. There are no sidewalks within the east side of the WSDD, with the exception of the roadways reconstructed under the InterLink facility project.

2.1.7 Bicycle Accommodations

There are no roadways within the WSDD that are designated as "Suitable Roads" for bicycle travel according to the 2009-2010 "Guide to Cycling in the Ocean State". Both Post Road and Jefferson Boulevard offer 0-2 foot shoulders, forcing bicyclists to share the roadways with drivers. As previously mentioned, RIDOT has also investigated the implementation of a "Road Diet" along Jefferson Boulevard. This road diet would result in converting the existing 4-lane cross section to a 2-lane cross section with a center median and on-road bike lanes in each direction. This would potentially provide a key connection for bicyclists, connecting the InterLink facility and the WSDD with the City of Warwick Bicycle Network in Apponaug.

2.2 Existing Traffic Volumes

This section includes a qualitative evaluation of the existing traffic volumes within the study. Traffic volumes were collected and reviewed from various sources for the major roadways in the area. **Table 2-1** lists the average daily traffic (ADT) volumes for the Airport Connector, Jefferson Boulevard, and Post Road.

Table 2-1 Daily Traffic Volume

Subject Roadway	ADT (vpd)[1]
Airport Connector	50,600
Jefferson Boulevard	13,200
Post Road	33,800

Source: T.F. Green EIS. July 2010
1 ADT: Average daily traffic, vpd: vehicles per day

The peak hour along the adjacent roadways occurs between 7:30 – 8:30 AM for the morning peak and between 4:30 – 5:30 PM during the evening peak.

To help determine congestion and capacity issues adjacent to the WSDD, capacity analyses were reviewed for the major signalized intersections within the adjacent roadway network, including:

- Post Road at Coronado Road/Airport Campus Exit.
- Post Road at Airport Connector Ramps.
- Jefferson Boulevard at Coronado Road/Kilvert Street.
- Jefferson Boulevard at Airport Connector Ramps.
- Jefferson Boulevard at InterLink Exit.

All the study area intersections operate with overall acceptable levels of service. Under future conditions, the Post Road/Coronado Road intersection is projected to operate near capacity during the evening peak hour with some approaches experiencing high delays.

As part of the InterLink project, roadway improvements along Jefferson Boulevard were implemented. The Jefferson Boulevard intersection with Coronado Road has recently been reconstructed to provide exclusive left-turn lanes and updated signal equipment. In addition, new traffic signal equipment was installed at the Jefferson Boulevard intersections with the Airport Connector ramps.

3

Future Traffic Conditions

This Chapter provides a general assessment of the future traffic conditions within the WSDD. Sections of this chapter present discussions on future traffic growth, which includes potential developments and future traffic operations.

The WSDD Master Plan addressed issues related to the traffic generated from the proposed developments within the district. It also made a series of recommendations to mitigate any impacts created by the district, both on the adjacent roadway network and internal to the district, and it gave an overview of the street design, key pedestrian links and other visions for the district.

3.1 Traffic Forecasts

Projected traffic volumes generated from the WSDD and other proposed developments in the immediate area expected to have a significant impact on traffic operations were reviewed to determine the future traffic operations and circulation options. The future conditions data was compiled from the following:

- **Warwick Station Development District Master Plan** - 1.5 Million square feet of office, retail, hotel, and residential development.
- **800 Jefferson Boulevard Traffic Impact and Access Study (D'Ambra Property)** - 550,000 square feet of office, retail, hotel, and restaurant development.
- **Intermodal Train Station Study** - Full commuter occupancy of the InterLink facility.
- **T.F. Green Environmental Impact Statement –** Background and site specific growth identified.
- **Leviton Property Redevelopment** - Although a formal development has not been identified, based on conversations with the City of Warwick, VHB made general assumptions of the potential redevelopment to project new trips that would be generated.

The additional traffic generated by the proposed developments was then distributed on the study area roadways. The vehicles generated by the proposed development

are expected to be distributed on study area roadways following future travel patterns identified in the above mentioned reports.

3.2 Future Traffic Operations Assessment

Measuring existing traffic volumes and projecting future traffic volumes quantifies traffic flow within the study area. To assess quality of flow, roadway capacity analyses were reviewed from the previous published studies. VHB assessed and identified primary and secondary access points from the WSDD to the surrounding roadways and the circulation within the WSDD, and identified additional infrastructure improvements that would enhance the traffic operations around and within the WSDD. These recommendations are illustrated on **Figure 2** for the west side of the district and on **Figure 3** for the east side of the district. It should be noted that as part of this initial traffic operations assessment, roundabouts were not analyzed as an alternative to signalization. Based on projected future traffic volumes, two-lane roundabouts would likely be required along Post Road and Jefferson Boulevard, and therefore right-of-way takings would be necessary. As the development of the WSDD advances, the feasibility of installing roundabouts with regards to traffic operations and impacts to adjacent properties should be reviewed. The role roundabouts play in terms of good access management is explained in Chapter 4.

3.1.1 Access Points

Based on the review of the potential access points identified in previous studies and a general review of the projected future traffic operations, the following primary connections and related circulation to the WSDD are recommended:

- **Post Road/Montebello Road –** Full access signalized driveway that will serve as the "gateway" to the WSDD adjacent to Post Road. This signalized driveway is located within the area were the T.F. Green Airport wishes to construct a new gateway entrance, which should be aligned with Montebello Road.
- **Post Road/Fresno Road –** One-way access from Post Road, primarily serving the monthly commuter lot entrance.
- **Post Road/Fullerton Road –** Unsignalized access restricting left-turns into/out of Fullerton Road.
- **Coronado Road/Imera Avenue –** Unsignalized full access driveway. Consideration should also be made for an actuated pedestrian signal, such as a HAWK of Rectangular Rapid Flashing Beacon (RRFB), as this intersection had been identified as a key pedestrian crossing.
- **Jefferson Boulevard/InterLink Facility –** Existing three-legged full access signalized driveway that can align with the proposed Leviton redevelopment.

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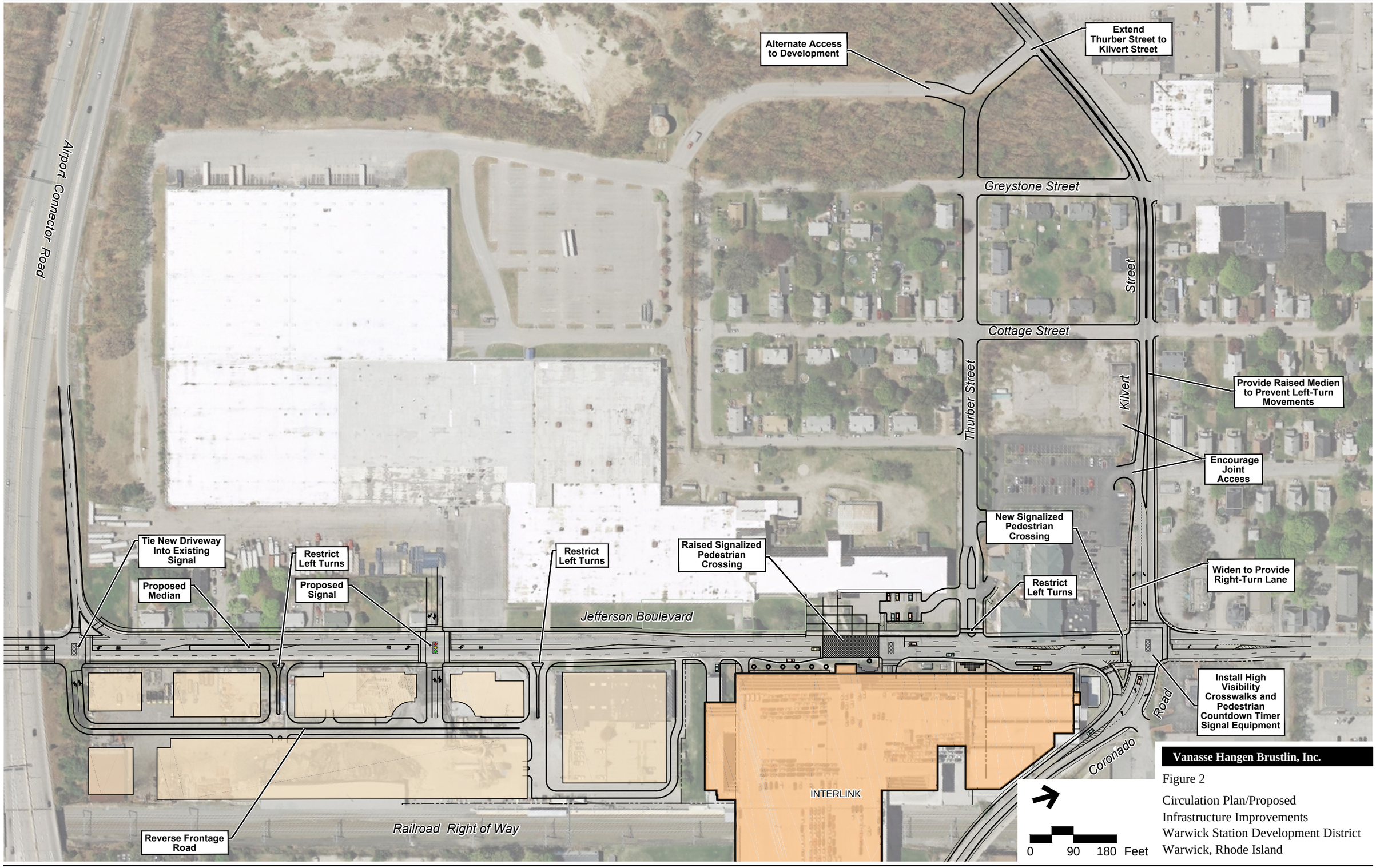

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Figure 2

Circulation Plan/Proposed Infrastructure Improvements
Warwick Station Development District
Warwick, Rhode Island

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Coronado Road

Actuated Pedestrian Crossing

Imera Avenue

Montebello Road

Fullerton Road

Fresno Road

SKYWALK

Alhambra Road

Kilvert Street

Proposed Widening

Post Road

WSDD "Gateway"

Proposed Signal

Restrict Left Turns

Monthly Commuter Entrance

0 50 100 Feet

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Figure 3

Circulation Plan/Proposed Infrastructure Improvements
Warwick Station Development District
Warwick, Rhode Island

Consideration should also be made for a wide pedestrian crossing, as this intersection had been identified as a key pedestrian crossing along Jefferson Boulevard.

- **Jefferson Boulevard/Proposed Site Drives** - Full access signalized driveway that will serve both the proposed redevelopment on the east side (800 Jefferson Boulevard) of Jefferson Boulevard and the west side (Leviton).
- **Jefferson Boulevard/Airport Connector On-Ramp –** Existing three-legged full access signalized driveway that can offer access to the proposed 800 Jefferson Boulevard redevelopment as the fourth leg.
- **Jefferson Boulevard/Thurber Street –** Unsignalized access restricting left-turns into/out of Thurber Street.
- **Kilvert Street/Alternate Access Site Drive –** Full access unsignalized driveway that will serve the proposed redevelopment on the west side of Jefferson Boulevard and offer an alternate connection to Interstate 95 via Metro Center Boulevard and Greenwich Avenue (Route 5). The alternate access can be provided via the existing Site Drive west of Graystone Street.
- **Kilvert Street/Hilton Garden Hills Hotel Driveway –** Existing unsignalized full access driveway that can offer joint access to the proposed property west of the hotel.
- **Other proposed driveways along Jefferson Boulevard –** Unsignalized access restricting left-turns into/out of the 800 Jefferson Boulevard and Leviton properties.
- **Cross-Access to Gateway District South –** When redeveloping the Gateway District South, strong consideration should be given to providing cross-access to the WSDD. By providing this access, vehicular traffic can use the Montebello Road signalized intersection to access Post Road and limit left-turning movements from the Gateway District South onto Post Road.

3.1.2 Circulation

Based on the above recommended access points identified and a general review of the proposed development plan as part of the WSDD Master Plan and projected future traffic operations, the following internal circulation is recommended**:**

- **Montebello Road –** Two-way travel connecting Post Road with the district and the proposed parking garage, as identified in the WSDD Master Plan.
- **Imera Street –** Two-way travel bisecting the district, connecting Montebello Road and Coronado Road.
- **Fresno Road –** One-way westbound travel, connecting Post Road to the monthly commuter garage.
- **Fullerton Road –** One-way eastbound travel, connecting the district to Post Road. This roadway could be abandoned in the future for potential redevelopment or it could become a service road for potential redevelopment.

The Circulation and Access Management Plan can be applied to the district with or without Fullerton Road in service.

3.1.3 Infrastructure Improvements

Based on the review of the roadway capacity analyses from the previously published studies and a general review of the projected future traffic operations, the following infrastructure improvements are recommended:

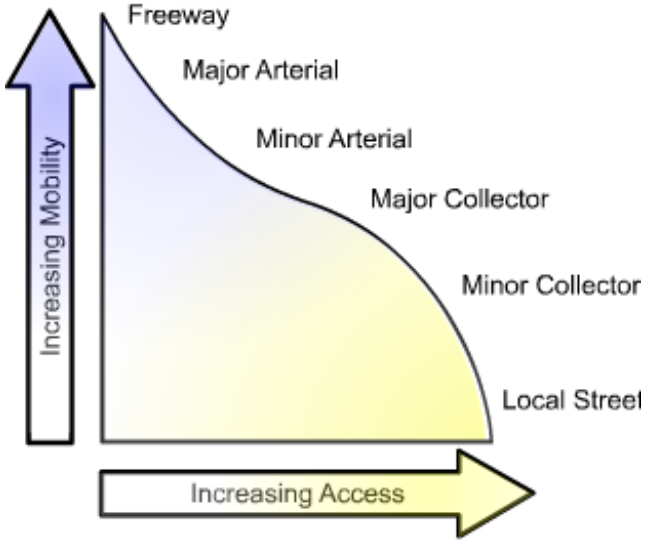
- **Post Road/Montebello Road –** Install a traffic signal and widen the Montebello Road approach to the intersection. Also, restripe the Post Road northbound approach to provide an exclusive left-turn lane. This signalized intersection has been analyzed and designed to include the T.F. Green Airport gateway entrance, which is proposed under the T.F. Green Airport Improvement Program.
- **Post Road/Coronado Road –** Upgrade the traffic signal and widen the Post Road southbound approach to the intersection to provide a right-turn lane. Also, widen Coronado Road to provide dual left-turn lanes and a right-turn lane. This intersection is in the Study & Development design stage in the state's TIP.
- **Post Road at the Airport Connector –** Provide an exclusive right-turn lane onto the Airport Connector along Post Road southbound.
- **Jefferson Boulevard, between the InterLink facility and the Airport Connector –** Widen Jefferson Boulevard to provide left-turn lanes at the proposed signalized intersections and also provide 5-foot shoulders to accommodate bike lanes. Reconstruct the intersection with the InterLink facility to provide a wide, raised crosswalk, as this is envisioned as a primary pedestrian connection between the propose redevelopment to the west and the InterLink.
- **Jefferson Boulevard at Coronado Road/Kilvert Street –** Install pedestrian facilities, including ADA ramps, a marked crosswalk, and pedestrian signals on the south leg of the intersection. Also, under existing conditions, the Kilvert Street eastbound approach operates with long delays during peak periods. Mitigation measures, such as an addition of a right-turn lane, were recommended as part of the 800 Jefferson Boulevard traffic impact and access study.
- **Kilvert Street at Alternate Access Site Drive –** Provide alternate access to the proposed redevelopment on the west side of Jefferson Boulevard. This can alleviate some of the traffic congestion along Jefferson Boulevard by offering an alternate access to Interstate 95 via Metro Center Boulevard and Greenwich Avenue (Route 5). The alternate access can be provided via the existing Site Drive west of Graystone Street. This intersection should be monitored after the property is redeveloped and fully operational to determine is this intersection meets warrants for signalization.
- **Kilvert Street –** Extend the sidewalks on both sides of the roadway within the extents of the WSDD. Also restrict left-turn movements along Kilvert Street

between Jefferson Boulevard and the proposed alternate access site drive. This can be done through intersection/driveway reconfiguration or through the installation of a raised median.

4

Access Management

Access management (management of points of access to adjacent land uses) is a useful strategy to preserve the character of a roadway and to ensure safe and efficient traffic operations along a corridor. Land use planning and transportation planning must be coordinated to ensure that a roadway is accessible, safe, and can provide adequate traffic operations now and in the future. Poor access management can cause deterioration in traffic operations and safety, and affect the viability of businesses that rely on an efficient access plan. Similarly, poor planning of land development increases conflicts between adjacent land uses and regional corridor operations.



This study adresses the challenges of integrating transportation, land use, and *context sensitive design*. Reaffirming land use tools are key to providing a successful Access Management Plan (the Plan) in a district that has the City of Warwick, local businesses, property owners, and the Rhode Island Department of Transportation as distinct stakeholders. The Plan that is developed will need to balance the needs of regional mobility while paying particular attention to the local needs. The collaboration of city officials and planners, and the developers, will need diverse options to develop the "best" possible solution for the corridor.

There are numerous driveway curb cuts, signalized intersections unsignalized driveways/intersections that exist along the WSDD roadways today. Most of the curb cuts serve as primary or secondary access to office or commercial uses.

Developed sections of the Post Road and Jefferson Boulevard corridors are congested today. Future development, and associated traffic demands, will add to the congestion and will need to be closely monitored/reviewed. The corridors have several large vacant parcels that have the potential to generate a significant amount of traffic and new access points within the WSDD. Therefore it is important to

establish a Plan now that can provide the necessary tools to implement access management techniques for parcels that are to be developed/redeveloped.

There are some areas along the two corridors where implementation of access management techniques will be more challenging. This is because, private infrastructure (driveways, parking, signage, utilities, etc.) in these areas has already been constructed immediately adjacent to the roadway's right-of-way. In these areas, efforts should be made to eliminate, consolidate, or restrict access for some of the properties and provide internal circulation between parcels and limit truck delivery access. This chapter discusses specific solutions that may be appropriate at various locations within the study area.

Access management solutions need to be retrofitted to the developed sections of the corridors and a Plan needs to be established for areas of future redevelopment. This Chapter provides an overview of potential transportation and land use strategies, and it provides a brief summary of techniques used by other agencies. Specifically, the next sections of this chapter cover the following items:

- A review of the Ten Principles of Access Management and how they relate to the WSDD.
- A summary of access management techniques, the access issues they would address, and how they could be applied to the WSDD.

4.1 Transportation Strategies

Typically corridors that have been extensively developed may never meet access management standards or requirements, and the potential to implement retrofit solutions may either limited and/or expensive. This is why it is important that the City implement policies relative to access management before the corridors experience major development. In areas where there has already been development, policies need to be adopted to avoid further degradation of the corridor. The City must develop and adopt procedures/ordinances that require future developments or modifications to existing developments to implement improvements that address traffic and access issues in the context of an overall Plan and not focus attention to project specific impacts and solutions. In this section, the ten principles of access management will be reviewed and evaluated in relation to the WSDD. Following this evaluation, a set of strategies have been identified that may be applicable to study area roadways.

4.1.1 Ten Principles of Access Management

This following presents an overview of the Ten Principles of Access Management, which have been developed by the Transportation Research Board (TRB). The goal of this effort is to provide an overview of the issues and challenges associated with access management in order to apply the relevant techniques specifically to the WSDD corridors.

1. Provide a Specialized Roadway System: Design and manage roadways according to the primary functions they serve.

   Applicability to WSDD: The Post Road corridor is classified as a principal arterial roadway, which means that through traffic mobility is considered a priority. For the most part, the corridor is currently operating in this manner; however, there are some locations along the corridor where there are many access points, which implies an emphasis of access over mobility.

   The Jefferson Boulevard corridor is classified as an urban minor arterial, which means that it offers a lower level of traffic mobility as a Principal Arterial and distributes travel to geographic areas smaller than those identified with a higher level system such as Post Road. Jefferson Boulevard currently provides access to/from the Airport Connector and I-95 to the industrial facilities located along Jefferson Boulevard.

   Coronado Road is classified as a urban collector roadway, which means that it provides both land access service and traffic circulation within residential neighborhoods, commercial, and industrial areas. All of the other roadways within the WSDD are classified as local roadways, which serve primarily to provide direct access to abutting land and access to the higher order systems.

2. Limit Direct Access to Major Roadways: Direct property access is more compatible with local and collector roadways.

   Applicability to WSDD: As mentioned in Principle #1 above, the Post Road and Jefferson Boulevard corridors are both arterial roadways promoting regional and local mobility to varying degrees of effectiveness. All access points along both corridors provide full turning access for vehicles, which creates numerous vehicle conflicts and negatively impacts mobility. Providing direct property access to the corridor results in it operating more as a local or collector roadway.

3. Promote Intersection Hierarchy: A functional classification system is important to promote access from one classification of roadway to another.

Applicability to WSDD: Under this principle, the following roadway hierarchy would be most desired.

A. *Arterial Roadways: A major roadway intended primarily to serve through traffic, and where access is carefully controlled. This type of roadway is intended to serve moderate to high volumes of traffic.*
B. *Collector Roadways: Road intended to move traffic from local roads to secondary arterials.*
C. *Local Roadway: A roadway with the primary function of providing access to adjacent properties and to roadways of a higher functional classification.*

As indicated above, access is most desired from either a collector or local roadway. The lack of these two roadways along the study area corridors limits the ability to reduce vehicle conflicts by promoting parcel connections with adjacent streets.

Note: The definitions of roadway types were obtained from the Access Management Manual prepared by the Transportation Board (TRB) in 2003.

4. Locate Signals to Favor Through Movements: Poor signal placement may lead to delays while uniform spacing enhances the ability to coordinate traffic signals and ensure continuous movement of traffic.

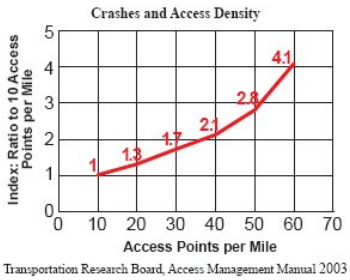
Applicability to WSDD: Within the WSDD, existing traffic signals are adequately spaced. As part of future development, new traffic signals should be strategically located to maintain the movement of traffic.

5. Preserve the Functional Area of Intersections: Driveways for properties too close to intersections can cause conflicts that impair the function of the intersection.

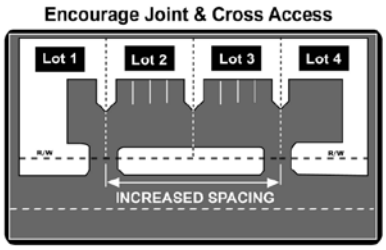
Applicability to WSDD: There are a few driveways in close proximity of major intersections in the WSDD.

6. Limit the Number of Conflict Points: Limiting the number and type of conflicts between vehicles, vehicles and pedestrians, and vehicles and bicyclists will reduce the likelihood that drivers will make mistakes that result in collisions.

Applicability to WSDD: There are numerous access points (full access driveways and intersections) along the study area corridors, with all of these driveways providing full access for vehicles. As noted in the chart to the left, the number of access points increases the likelihood of collisions, as more driveways introduce more conflict points.



Transportation Research Board, Access Management Manual 2003



7. Separate Conflict Areas: Increasing driveway spacing provides drivers with the ability to address one set of potential conflicts before addressing another. As travel speeds increases along a corridor, so should the driveway spacing.

   Applicability to WSDD: It is desirable that the Post Road corridor should have driveways spaced every 460 feet (see the Access Management Techniques section). The spacing along the Jefferson Boulevard corridor should have driveway spacing every 370 feet. However, both corridors have sections where the driveway spacing is less than 200 feet. Therefore, both corridors currently have areas that do not meet the requirements of its functional classification.

8. Remove Turning Vehicles from Through Traffic Lanes: Accommodate left-turns to the extent possible.

   Applicability to WSDD: Most of the key intersections along the Post Road and Jefferson Boulevard corridors provide designated left-turn lanes. There is also a continuous two-way left-turn lane on the Post Road corridor. There are currently no accommodations for left-turn movements at any of the unsignalized intersections/driveways along Jefferson Boulevard. Provisions for left-turn storage will improve the operation and safety of a corridor and should be considered.

   If feasible, roundabouts along the corridors could remove stopped turning vehicles from the through lanes and the occurrence of unexpected stopped vehicles within the roadway is greatly reduced. However, due to the limited available right-of-way along the WSDD corridors, roundabouts may not be the most economically feasible choice for access management.

9. Use Raised Medians to Manage Left-Turn Movements: Providing a raised median allows for managing locations where left-turns are warranted and aesthetic landscaping at locations where left-turns need to be prohibited.

   Applicability to WSDD: A median is not currently present along either corridor. In order to accommodate a raised median, and maintain access to existing businesses, widening and relocation of utilities and signs could be required at some locations. In addition, u-turns would need to be provided at critical intersections and accommodations for large trucks would need to be provided.

10. Provide a Supporting Street and Circulation System: Well-planned, interconnected, commercial developments with shared driveways are desired.

    Applicability to WSDD: The WSDD corridors are currently operating with parcels that access the roadways with individual access driveways, and in some cases, parcels have multiple access points. This principle supports the construction of collector roadways

and local streets so that parcels can access the arterials in a fashion so that shared access driveways and interconnecting driveways can be provided.

4.1.2 Access Management Techniques

There are several access management techniques that can be used to better manage or minimize traffic movements (or conflicts). This section reviews techniques that could be applied to the study area roadways so that the overall traffic capacity within the WSDD roadway system can be preserved and/or enhanced to support future development. Some of these techniques can also be applied to manage entering and exiting traffic from land uses more efficiently; however, such techniques will require full support and cooperation from the owners of the affected parcels.

Table 4-1 presents an access management matrix that correlates access concerns to access management techniques.

Table 4-1 Access Management Matrix

Access Techniques	Access Issues									
	Limit Turning Movement Conflicts	Separate Turning Movement Conflicts	Auxiliary (Turn) Lanes	Left-turns Exiting a Site	Left-turns Entering a Site	Pedestrian Access/Safety	Bicycle Access/Safety	Roadway Operations	Excessive Driveways	Driveway Operations
Roadway Treatments										
Continuous Two-Way Left-Turn Lane (TWLTL)			X		X			X		
Center Raised Median	X			X	X	X		X	X	X
Shoulder Lane Treatments		X					X	X		
Secondary Roadways										
Frontage/Service Roads	X	X						X	X	
Reverse Frontage Roads	X	X				X		X	X	
Controlled Access										
Traffic Signal Spacing		X		X	X	X	X	X		X
Driveway Design Standards										
Closure								X	X	X
Spacing, corner clearances	X	X		X	X	X	X	X	X	X
Joint and Cross Access	X	X		X	X	X	X	X	X	X
Sight Distances		X		X				X		X
Throat Length		X		X	X			X		X
Pedestrian Facilities										
Crosswalk Treatments		X				X	X	X		
New Pedestrian Crossings						X	X	X		
Public Transit										
Bus Stop Location		X				X		X		
Turning Restrictions										
Restrict Turn Movements	X			X	X	X	X	X		X

In many cases the access management techniques listed above are not likely to be applied to the district as stand-alone alternatives, as they may not be effective on a smaller scale. Additionally, some of these measures may need to be considered as part of land use regulations (ordinance or new zoning) to increase their acceptability as part of new development proposals.

Roadway Treatments

Roadway treatments can be used to improve safety, access and capacity along a particular segment of roadway or along a corridor as a whole. The following provides a short summary and breakdown of advantages and disadvantages for each treatment.

Continuous Two-Way Left-Turn Lane (TWLTL)

This treatment can improve capacity and traffic flow along a corridor by removing left-turn traffic from the mainline. Currently, the Post Road corridor already includes a TWLTL within the WSDD. Implementation of this alternative is not as desirable as other treatments; however, there may be intermediate term applications along the Jefferson Boulevard corridor where this treatment may be considered. Application of a TWLTL is commonly used in developed areas with a high frequency of low volume driveways such as strip commercial developments. This often results in motorists exiting driveways and using the TWLTL as a refuge or acceleration lane. This treatment typically loses its efficiency when roadway daily traffic volumes are over 24,000 vehicles per day.[1]

Aside from separating the mainline left-turning traffic from the through movements, the safety and efficiency of this treatment is contingent primarily on driveway location, spacing and volume. Driveways on opposite sides of a roadway where this treatment is applied should be located such that opposing left-turn movements on the mainline can be completed by a vehicle without having to occupy the same portion of the TWLTL. Furthermore, driveways should be spaced adequately such that vehicles making left-turns from a property do not conflict with vehicles at adjacent driveways.

Advantages

- Removes left-turn movements from main line travel lane which could result in an increase in vehicle safety when compared to a roadway with no TWLTL.
- Increases capacity compared to an undivided roadway.
- Reduces delay compared with undivided roadways

Disadvantages

- Efficiency of TWLTL is compromised when traffic volumes reach 24,000 vehicles per day.
- Lane can be used as a passing lane.
- Doesn't restrict turn movements, and full access is permitted from driveways.

[1] Access Management Manual, Transportation Research Board of the National Academies, 2003

- Accommodates strip development along major roadways with frequent access points, which can lead to safety issues if driveway spacing is inadequate.
- Longer pedestrian crossings with no refuge area.
- Overlapping left-turn movements.

Roundabouts

A roundabout is a type of circular intersection with yield control of entering traffic, islands on the approaches, and appropriate roadway curvature to reduce vehicle speeds. Roundabouts can provide a level of flexibility for driveways and other access points at and near intersections and along corridors. Along the WSDD corridors of Post Road and Jefferson Boulevard, roundabouts with median islands may be considered as part of an access management strategy.

Advantages

- Shown to improve safety, with reductions of 35% of all crashes and 76% of injury crashes.
- Reduce congestion, pollution and fuel use by offering fewer stops and hard acceleration and less time idling.
- Eliminates left-turning movements at intersections and between roundabouts if two roundabouts are located in close proximity (see "Dog-Bone" configuration in next section)
- Driveways on opposite sides of the roadway can be located closer together.
- Reduces lengths of pedestrian crossings and establishes pedestrian refuge areas.
- Creates an opportunity to establish a "gateway" to an urban center.

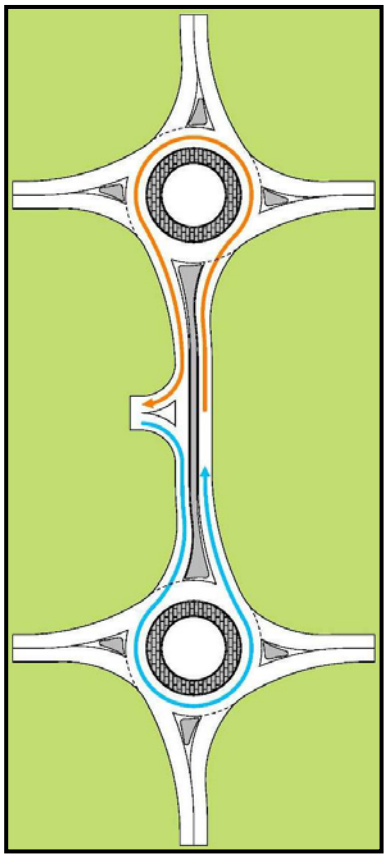
Disadvantages

- Requires higher costs and right-of-way compared to a traditional intersection. To accommodate the projected traffic volumes along the WSDD corridors, two-lane roundabouts would likely be required at the major intersections. Significant right-of-way takings would be required along Post Road and Jefferson Boulevard if roundabouts are considered.

Center Raised Median

Non-traversable raised medians can provide improved access control, capacity and safety along a corridor. Implementation of a raised median limits the majority of private driveways to right-in/right-out operation thus reducing the number of vehicle conflict points and the amount of information that motorists have to process before and during a movement. However, turn-around locations (or u-turns) also need to be constructed at critical intersections to allow vehicles access to properties on both sides of the roadway. If feasible, roundabouts along the corridors can remove stopped turning vehicles from the through lanes and the occurrence of

unexpected stopped vehicles within the roadway is greatly reduced. This creates a "Dog-Bone" configuration, in which all left-turning movements can be removed between adjacent roundabouts.



A center raised median may be considered along the Post Road and Jefferson Boulevard corridors, especially if traffic volumes increase substantially in the future with planned development. Research has concluded that raised medians reduce crash rates by approximately 30-percent over a roadway that has a TWLTL[2]. Research has found that raised medians are increasingly safer than roadways with a TWLTL when volumes exceed 24,000 to 28,000 vehicles per day.

Advantages

- Improves safety through reduced vehicle conflicts by separating opposing movements.
- Driveways on opposite sides of the roadway can be located closer together.
- Reduces length of pedestrian crossings and establishes a pedestrian refuge area.
- Improves traffic mobility by removing delay caused by left-turning vehicles (left-turns came be made at strategically located intersections).
- Has the potential to reduce the number of crashes (compared to roadway with no median).

Disadvantages

- Restricts driveway movements to a right-turn in and out only.
- Requires u-turns to be accommodated at intersections, which could require additional right-of-way to accommodate movements.
- Could require roadway widening and impacts to adjacent businesses.
- Perceived impact of loss of business by adjacent uses; however, if roundabouts are implemented there have been studies that show that adjacent businesses are not impacted.

Shoulder Treatments

Shoulder widths can have a significant impact on mobility and vehicle safety. As currently configured, the Post Road and Jefferson Boulevard corridors have 1-2 foot shoulders which do not meet current design standards at several locations. Wider shoulders become more critical when coupled with conditions such as a raised median.

[2] Gluck, J., H.S. Levinson, and V. Stover, *NCHRP Report 420: Impacts of Access Management Techniques.* TRB, National Research Council, Washington, D.C.; 1999.

The RIDOT Highway Design Manual provides a summary of shoulder widths that are recommended to accommodate various functions. It is a design requirement that the latest RIDOT standards be followed on projects within their jurisdiction. While RIDOT makes the final determination with regard to the required shoulder width for any location, it is recommended that the minimum offset to a curbed median of two feet and a minimum paved shoulder of four feet be considered.

Secondary Roadways

The following section reviews secondary roadway treatments that could be considered with the district. A secondary roadway typically parallels an arterial roadway and is used to limit direct access to the arterial by adjacent parcels. The goal of these treatments would be to reduce the number of access points directly to the major corridor through the creation of other roadways.

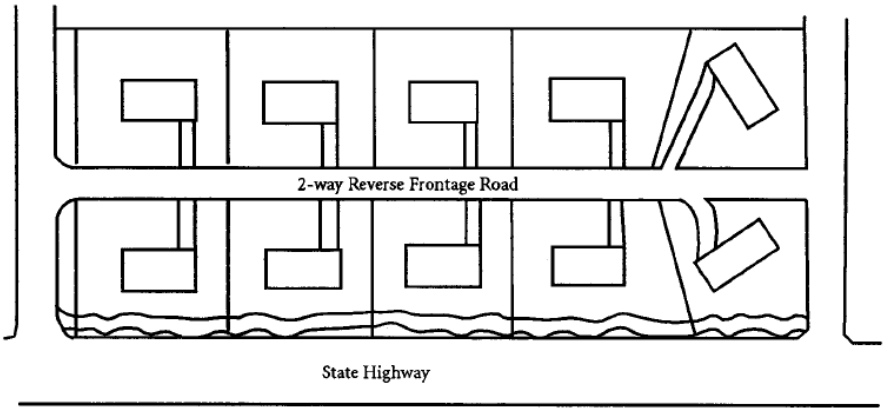
Frontage Roads

Frontage roads are constructed to run parallel to the corridor along the frontage of several adjacent parcels and between the roadway right-of-way and the front building setback. These roadways provide interconnectivity between the parcels and shared access/egress points. Construction of a frontage road would usually occur prior to, or as parcels are developed, and the actual roadway may be located on private property.

Due to the limited right-of-way and relatively small size of the WSDD, these have limited applicability in the district.

Reverse Frontage Roads

Reverse frontage roads, also referred to as service roads, are somewhat similar to a frontage road. However, the primary difference is that they typically run along the rear of adjacent parcels. This allows for access on both sides of the reverse frontage roadway and can provide opportunities for parcels to be subdivided or to provide access for land-locked parcels, thus providing additional development opportunities.



It is preferred to implement reverse frontage roads instead of frontage roads where feasible because of the greater distance between the main road and the reverse frontage road when compared to regular frontage roads. This increased distance provides longer stacking for vehicles and reduces the possibility of operational issues that could impact the mainline traffic. The following lists some advantages and disadvantages for reverse frontage roads.

Advantages

- Improves safety through reduced traffic conflicts on major arterials.
- Improves mobility by consolidating arterial access points.
- Businesses are still visible from the major roadway (businesses can be located closer to the street and more visible than implementation of a frontage road).
- Provides interconnectivity between land uses.
- Provides opportunities for additional development on both sides of the roadway.

Disadvantages

- Operational and safety problems can occur if the distance between the reverse frontage road and crossroad is inadequate (the lots in the WSDD are deep enough so that this should not be an issue).
- Can be costly if property acquisition is needed for implementation.
- Can require easements between property owners.
- Restricts driveway movements to a specific location.
- Could require additional signage or wayfinding signs to guide patrons to businesses.

Controlled Access

Traffic signals can be used to provide control for specific movements at key locations and to properties that generate a significant amount of traffic. Currently there are three traffic signals located along the Post Road corridor and four traffic signals located the Jefferson Boulevard corridor in the study area that can create gaps in through traffic both upstream and downstream from the signal location, which results in reduced delays for vehicles exiting the unsignalized driveways. The following provides a limited discussion about traffic signals justifications and their spacing.

Traffic Signal Spacing

While a signalized intersection or driveway provides controlled access to a driveway or intersection, traffic signals should not be installed unless specific thresholds are met. Typically the advantages need to outweigh the disadvantages, so to provide

some consistency on their installation, a series of warrants must be reviewed to define minimum conditions under which a traffic signal may be appropriate. These warrants, which are defined in the FHWA document, the Manual on Uniform Traffic Control Devices (MUTCD), include a review of traffic volumes, pedestrian volumes, progression of traffic movements, and crash experience.

However, even if warrant thresholds were met, the installation of a traffic signal would still need to be approved by the RIDOT and the State Traffic Commission. In order to preserve the mobility of the corridors, traffic signals need to be spaced so that a vehicle can travel at a reasonable speed. The optimal spacing for traffic signals typically depends on the cycle length and the posted speed limit. Shorter cycle lengths and lower speeds enable closer spaced traffic signals. Uniform spacing is desirable for traffic progression at optimal levels. Table 4-2 illustrates traffic signal spacing standards that should be considered along the corridors. However, further engineering assessment should be used rather than just the information in the table below. Within the WSDD, the spacing listed in the table below is not feasible. However, it is recommended that the distance between existing and proposed signals be maximized to promote optimal progression along the corridors. Also, whenever possible, full access driveways on opposite sides of the road, where signalization is justified, should be located across from each other.

Table 4-2 Signalized Intersection Spacing

Cycle Length (Seconds)	Operating Speed (mph)				
	30	35	40	45	50
60	1,320	1,540	1,760	1,980	2,200
70	1,540	1,800	2,050	2,310	2,560
80	1,760	2,050	2,350	2,640	2,930
90	1,980	2,310	2,640	2,970	3,300
100	2,200	2,570	2,930	3,300	3,670

Source: NCHRP Report 348, Access Management Guidelines for Activity Centers, Table 7-2, page 59.

Driveway Design Standards

While driveways should be designed (width, radii, etc.) to accommodate the most appropriate design vehicle, the following section reviews critical driveway design standards that could improve access and circulation within the WSDD and along Post Road and Jefferson Boulevard. It should be noted that some of the existing characteristics of the developed sections of the district such as driveway spacing, parcel size, etc., may not meet minimum standards. Effort should be made to improve the existing deficiencies; however, if and when a parcel is developed and/or redeveloped, the design standards should be adhered to such that the future

roadway network will not be further encumbered by additional deficiencies. The following specific criteria are discussed in this section.

Driveway Spacing

When driveways (or intersections) are located and spaced properly, vehicle safety and mobility for the corridor can be enhanced. Providing adequate spacing between driveways allows for safer turning movements in and out of driveways. Longer distances between driveways also provide safer travel for bicycles and pedestrians by providing fewer conflicts. Eliminating or reducing driveway offsets (driveways located on opposite sides of the roadway) should be considered if the corridor is left undivided. As a roadway's functional classification level increases, spacing standards become more stringent and driveways are required to be spaced further apart. Typically two different standards are created, including: (i) standards for an undivided roadway, and (ii) standards for a divided roadway, or a roadway with a median. Tables 4-3 and 4-4 provide recommended spacing for each scenario.

Minimum Spacing Between Opposite Side Driveways: It is desired to have driveways aligned with driveways directly on the opposite side of the roadway. If this is not possible, it is then desired to have driveways offset by an appropriate distance, as summarized in Table 4-3. These distances are measured from centerline of the proposed driveway to the centerline of the driveway on the opposite side of the roadway. The redevelopment along Jefferson Boulevard may enable the desirable spacing between driveways; however, these spacing standards may not be possible along some developed sections of the Post Road corridor.

Table 4-3 Driveway Spacing – Opposite Side of Roadway (Undivided)

Posted Speed	Required Minimum Driveway Spacing
30 mph	370 feet
35 mph	460 feet
40 mph	530 feet
45 mph	670 feet
50 mph	780 feet

Source: NCHRP Report 348, Access Management Guidelines for Activity Centers, Table 7-8 page 63.
Note: The posted speed limit is 35 mph on the Post Road corridor and 25 mph on the Jefferson Boulevard corridor.

Minimum Spacing between Adjacent Driveways: For driveways on the same side of the street, the required minimum driveway spacing summarized in Table 4-4 should be measured from the centerline of the proposed driveway to the centerline of the adjacent driveway. This spacing is more applicable for a corridor that is divided and movements consist primarily of a right-turns in and/or out only. The measurements in Table 4-4 are based on the acceleration rate of a vehicle exiting a driveway, and the deceleration rate of a vehicle approaching the driveway that the vehicle just exited. The redevelopment along Jefferson Boulevard may enable the desirable spacing

between driveways, however, these spacing standards may not be possible along some sections of the Post Road corridor.

Table 4-4 Driveway Spacing – Same Side of Roadway (Median)

Posted Speed	Minimum Driveway Spacing
30 mph	185 feet
35 mph	245 feet
40 mph	300 feet
45 mph	350 feet
50+ mph	450 feet

Source: TRB, Access Management Manual, Table 9-7, page 152.
Note: The posted speed limit is 35 mph on the Post Road corridor and 25 mph on the Jefferson Boulevard corridor.

Corner Clearances

Corner clearances are the distances between an intersection and the nearest driveway. Typically corner clearances would need to meet or exceed the driveway spacing requirements. Additionally, driveways should not be located within the functional area of the intersection. If a driveway is located within the functional area, it should be restricted to right-turn in/out, right-turn in, or right-turn out only operations.

Joint and Cross Access

Some developed sections of the Post Road corridor have a high density of access points. Consolidating access points through joint and cross access provisions provides a unified property access and circulation system between two parcels. Implementing either joint or cross access can provide many advantages to the corridor. This technique can also be done within the WSDD street network and between the WSDD and the Gateway District South.

Advantages

- Reduces the number of individual access points.
- Increases access spacing.
- Provides customer convenience for circulation between properties.
- Landscaping increases along the properties frontage.
- May improve circulation and parking layout.

Disadvantages

- Properties cannot be forced to implement this technique, and must redevelop for this technique to apply.

- Closure or sharing of driveways can be contentious and involve legal agreements for liability.
- Local and State officials must be on same page for effective implementation.

Sight Distance

Sight distance is one of the most important considerations in the placement of driveways, as it provides the maximum safety for the general public and provides access for the property owner. Both vertical and horizontal alignment of the roadway, as well as obstructions such as parked vehicles, buildings and vegetation, can limit sight distance. The following provides a summary of stopping sight distance and intersection stop distance criteria.

- *Stopping sight distance:* is the length of roadway ahead visible to a driver and ensures that drivers have sufficient visibility to anticipate and avoid collisions before reaching a stationary object in the roadway.
- *Intersection sight distance:* is the view a driver has from the side street (a site driveway, for example) of approaching traffic. The desirable values for intersection sight distance are such that the major-street traffic would not have to substantially reduce its speed when the driver exits the side street and into the main flow of traffic.

Required sight distances are typically determined using the 85th percentile speed of a roadway. Sight distance requirements based on speed are summarized below in Table 4-5. For driveway design, AASHTO[3] recommends that the stopping sight values be met at a minimum with intersection sight distance values desirable.

Table 4-5 Sight Distance Analysis Summary

Design speed (mph)	Stopping Sight Distance (feet)	Intersection Sight Distance (feet)
25	155	280
30	200	335
35	250	390
40	305	445
45	360	500
50	425	555
55	495	610

Source: Based on guidelines established in A Policy on the Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials [AASHTO], 2004.
Note: The posted speed limit is 35 mph on the Post Road corridor and 25 mph on the Jefferson Boulevard corridor.

[3] A Policy on the Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials [AASHTO], 2004

Driveway Throat Length

Drive throat length is the distance parallel to the centerline of the driveway from the first on-site location where a driver can make a right-turn or a left-turn onto the "on-site circulation roadway" to the edge of roadway at the major corridor; which is typically the curb or roadway gutter line. Creating a driveway throat length is important for safe and efficient access to and from the corridor. A sufficient throat length enables drivers to clear the intersection at the corridor before encountering on-site circulation. When a vehicle conflict occurs on-site, it can result in poor traffic operation on the corridor and in the vicinity of the intersection.

Entering and exiting traffic should generally be separated with a solid yellow line. For driveways where parcels generate less than 50 peak hour vehicles in both the entering and exiting directions, the throat length should be able to accommodate at least two passenger cars, or a minimum of 60 feet depending on the types of vehicles entering and exiting.

For driveways that generate more than 50 peak hour vehicles, the driveway throat length should be assessed in greater detail through the preparation of a traffic study and site plan for a particular parcel. In these cases, the calculated 95th percentile queue length may need to be accommodated. Left and right-turn lanes can be considered for driveway that are expected to generate significantly more traffic.

Pedestrian Connections

Special consideration should be given to improve pedestrian connectivity across the Post Road and Jefferson Boulevard corridors at signalized intersections and between parcels. The corridors have sidewalks on both sides of the roadways but there are limited opportunities to cross the corridors. While there may not be a need to install these treatments now, the need for pedestrian crossings may be more relevant in the future, and therefore should be considered if there is any future roadway or intersection improvement projects or when parcels are developed/redeveloped.

Pedestrian circulation within the parcels should also be carefully reviewed as part of development proposals.

Public Transit

Bus service is provided within the WSDD by the Rhode Island Public Transit Authority (RIPTA). Scheduled stops off the corridor are currently provided at T.F. Green Airport and at the InterLink Facility. It is recommended that bus stops be provided within the WSDD, either along the local streets or with the creation of a bus

turnout along Post Road. Jefferson Boulevard currently has a bus turnout adjacent to the InterLink facility.

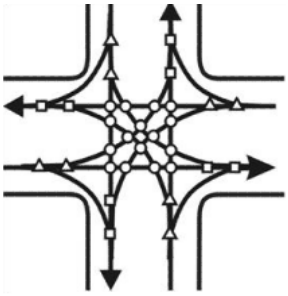
Turning Restrictions

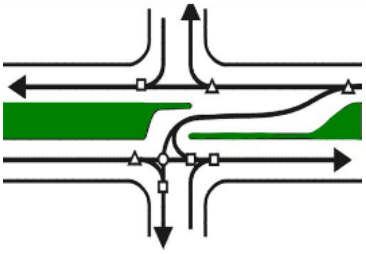
Turning restrictions limit movements at access points or driveways. By restricting movements, vehicle conflicts along a corridor can be significantly reduced. The left-turn movement to and from an access point is typically the most critical movement and has the most conflicts on a corridor. The following types of driveways with restricted movements could be considered:

- Prohibit all left-turn movements at a driveway.
- Channelized right-turns in and out, right-turn in only, right-turn out only driveways.
- Provide entrance or exit only driveways.

The restriction of turning movements at driveways can improve safety conditions and corridor operations; however, these restrictions can be difficult to enforce unless physical barriers like a raised medians or raised channelizing islands are incorporated into the corridor or driveway.

4.1.3 Retrofitting a Corridor





In areas of the WSDD corridors, existing development limits the ability to implement full scale access management techniques previously listed that are more conducive to new development areas.

Most retrofit actions limit the number of conflict points, separate conflict areas, and remove turning lanes from the through lanes. The following is a brief listing of various retrofit techniques:

- Provide right-turn lanes.
- Provide left-turn lanes.
- Provide two way left-turn lane (TWLTL).
- Install a median.
- Close median openings.
- Install a frontage road.
- Install or modify traffic signals.
- Widen driveways and improve vehicle queue area.
- Consolidate driveways.
- Relocate or reorient access.
- Close driveways.

- Redesign internal road and parking system.
- Remove signals and install roundabouts.

The characteristics of the WSDD corridors are such that implementation of many of these techniques could be accomplished in conjunction with further development along the corridors.

4.2 Applicable Access Management for the WSDD

The following section provides an overview of the access management techniques that should be considered for the roadways within the WSDD. The recommendations described in this section build upon information from previous chapters including existing corridor safety and driveway access issues, existing and future intersection operations, land development and redevelopment opportunities, and the application of transportation access management strategies.

Post Road

Post Road, a principal arterial roadway, provides regional access to the district from Interstate 95 via Route 37 and the Airport Connector, and local access from Warwick, Cranston, and East Greenwich. The following types of access management techniques should be considered:

- ***Continuous Two-Way-Left-Turn-Lane (TWLTL) -*** Post Road currently has a TWLTL adjacent to the district.
- ***Restrict Turn Movements*** - Prohibit all left-turn movements at all WSDD unsignalized driveways and roadways to Post Road (with the exception of Fresno Road). This can be accomplished through a center raised median or with signage and enforcement. A center raised median combined with roundabouts on both ends of the corridor can create a "Dog-Bone" configuration in which all left-turning movements can be removed between adjacent roundabouts while maintaining access to unsignalized driveways and roadways.
- ***Traffic Signal Spacing*** - Provide a signalized full access intersection at the Montebello Road intersection. The proposed T.F. Green Airport Gateway entrance should be located as the forth leg of the proposed intersection.
- ***Provide Left-Turn/Right-Turn Lanes*** – Provide a left-turn lane at the new signalized intersection with Montebello Road. Provide a right-turn lane on the southbound approach to the Coronado Road intersection. Also extend the right-turn lane at the Post Road/Airport Connector intersection.

- ***Roundabouts –*** If funding allows, consideration should be given for the installation of roundabouts in lieu of traffic signals where feasible. Two-lane roundabouts are likely to be required based on the projected traffic volumes along Post Road, which would require significant right-of-way takings

Jefferson Boulevard

Jefferson Boulevard, an urban minor arterial roadway, provides regional access to the district from Interstate 95 via the Airport Connector and local access from Warwick. The following types of access management techniques should be considered:

- ***Continuous Two-Way-Left-Turn-Lane (TWLTL) -*** Restripe Jefferson Boulevard to provide a TWLTL. RIDOT has recently completed a feasibility study to implement a "Road Diet" to include a TWLTL along Jefferson Boulevard. With the current traffic volumes, a TWLTL is feasible along Jefferson Boulevard adjacent to the WSDD. However, with the increase in traffic volumes from the proposed development within the WSDD, the TWLTL is not feasible.
- ***Restrict Turn Movements*** - Prohibit all left-turn movements at all WSDD unsignalized driveways and roadways to Jefferson Boulevard. This can be accomplished with signage and enforcement or through a center raised median or. A center raised median combined with roundabouts on both ends of the corridor can create a "Dog-Bone" configuration in which all left-turning movements can be removed between adjacent roundabouts while maintaining access to unsignalized driveways and roadways.
- ***Traffic Signal Spacing*** - Provide a signalized full access intersection, servicing developments on both the east and west sides of Jefferson Boulevard, approximately half-way between the existing traffic signals at the InterLink facility and the Airport Connector On-Ramp. Also provide additional signalized access to the property on the east side of Jefferson Boulevard by constructing a fourth leg to the Airport Connector On-Ramp intersection.
- ***Provide Left-Turn/Right-Turn Lanes –*** Provide left-turn lanes at the new signalized intersection for the developments on the east and west sides of Jefferson Boulevard. Also provide a right-turn lane from Kilvert Street eastbound onto Jefferson Boulevard.
- ***New Pedestrian Crossings –*** Provide a wide, raised pedestrian crossing at the InterLink entrance across from the Elizabeth Mill. This area is envisioned to be a primary pedestrian crossing once the district is developed.
- ***Enhanced Pedestrian Crossings -*** Provide an additional signalized crossing on the south leg of the intersection with Jefferson Boulevard that enables pedestrians to cross from the properties on the north and southwest corners of the intersection to the InterLink. Also enhance all of the existing crossings with the installation of high visibility crosswalks and pedestrian countdown timer

signal heads. Additional improvements include extending the sidewalks on both sides of Kilvert Street within the extents of the WSDD.

- ***Roundabouts*** – If funding allows, consideration should be given for the installation of roundabouts in lieu of traffic signals where feasible. Two-lane roundabouts are likely to be required based on the projected traffic volumes along Jefferson Boulevard, which would require significant right-of-way takings

Coronado Road

Coronado Road, an urban collector roadway, is one of only three roadways in the area that offer a cross connection between the east and west sides of the railroad tracks. The following types of access management techniques should be considered:

- ***New Pedestrian Crossings –*** Provide an actuated pedestrian traffic signal at the intersection with Imera Avenue. Provide an additional signalized crossing on the south leg of the intersection with Jefferson Boulevard.
- ***Provide Left-Turn/Right-Turn Lanes*** – Provide dual left-turn lanes and a right-turn lane at the intersection with Post Road.

Kilvert Street

Kilvert Street, an urban collector roadway, provides an alternate connection from the WSDD and Interstate 95 via Metro Center Boulevard and Greenwich Avenue (Route 5). The following types of access management techniques should be considered:

- ***New Pedestrian Crossings –***Provide an additional signalized crossing on the south leg of the intersection with Jefferson Boulevard. Also extend the sidewalks on both sides of Kilvert Street within the extents of the WSDD.
- ***Install Traffic Signal*** – The intersection that provides alternate access to the development of the west side of Jefferson Boulevard should be monitored after the property is redeveloped and fully operational to determine if this intersection meets warrants for signalization.
- ***Restrict Turn Movements*** - Prohibit all left-turn movements at WSDD unsignalized driveways and roadways to Kilvert Street between Jefferson Boulevard and the proposed alternate access site drive.
- ***Encourage Joint Access*** – Joint access should be considered along the south side of Kilvert Street, between the existing Hilton Garden Hills Hotel driveway and the proposed development west of the hotel.

Thurber Street

Thurber Street, a local roadway, provides access to the hotel on the southwest corner and an undeveloped parcel to Jefferson Boulevard. The following types of access management techniques should be considered:

- ***New Pedestrian Crossings –*** Extend the sidewalks on both sides of the roadway WSDD.
- ***Reverse Frontage Road*** – Provide access to all the properties along the south side of Kilvert Street on Thurber Street.
- ***Driveway Design Standards*** – All driveway design standards previously mentioned should be considered when properties along Thurber Street are redeveloped.

Montebello Road

Montebello Road, a local roadway within the WSDD, is envisioned as being the major access point to the WSDD along Post Road. The following types of access management techniques should be considered:

- ***New Pedestrian Crossings –*** Provide a pedestrian traffic signal at the proposed intersection with Post Road.
- ***Provide Left-Turn/Right-Turn Lanes*** – Provide a left-turn lane on Post Road and a right-turn lane on Montebello Road at the intersection with Post Road.
- ***Driveway Design Standards*** – All driveway design standards previously mentioned should be considered when properties along Montebello Road are redeveloped.
- ***Bus Stop Location*** – A bus stop should be provided within the WSDD along one of the internal roadways.
- ***Encourage Joint Access*** – When redeveloping the Gateway District South, strong consideration should be given to providing cross-access to the WSDD. By providing this access, vehicular traffic can use the Montebello Road signalized intersection to access Post Road and limit left-turning movements from the Gateway District South onto Post Road.

Fullerton Road

Fullerton Road, a local roadway within the WSDD, is envisioned as being a one-way eastbound roadway, providing access to Post Road southbound. Also, this roadway could be abandoned in the future for potential redevelopment or it could become a service road for potential redevelopment. The Circulation and Access Management Plan can be applied to the district with or without Fullerton Road in service. The

following types of access management techniques should be considered if the road remains in service:

- ***Driveway Design Standards*** – All driveway design standards previously mentioned should be considered when properties along Fullerton Road are redeveloped.
- ***Bus Stop Location*** – a bus stop should be provided within the WSDD along one of the internal roadways.

Fresno Road

Fresno Road, a local roadway within the WSDD, is envisioned as being a one-way westbound roadway, providing access from Post Road to the InterLink Monthly Commuter entrance. The following types of access management techniques should be considered:

- ***Driveway Design Standards*** – All driveway design standards previously mentioned should be considered when properties along Fresno Road are redeveloped.

Imera Avenue

Imera Avenue, a local roadway within the WSDD, is envisioned as being the north-south spine of the WSDD, providing access between Montebello Road and Coronado Road and to Vanderbilt Road to the north. The following types of access management techniques should be considered:

- ***Reverse Frontage Road*** – Provide access to all the properties between Montebello Road and Post Road on Imera Avenue.
- ***Driveway Design Standards*** – All driveway design standards previously mentioned should be considered when properties along Imera Avenue are redeveloped.

In addition to the above mentioned roadways, within the developments on the east and west sides of Jefferson Boulevard, the developer and the City should consider the ***Driveway Design Standards*** and ***Reverse Frontage Roadways*** when designing the internal circulation roadways for such properties.

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