Bus Rapid Transit (BRT)

Implementation Plan along Transit Corridors

HNTB in association with FTE

Prepared for: MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

Work Order # GPC V-18

April 2015

Bus Rapid Transit Implementation Plan

Prepared for the Miami-Dade County Metropolitan Planning Organization

Prepared by: HNTB in association with FTE

April 2015

The Miami-Dade MPO complies with the provisions of Title VI of the Civil Rights Act of 1964, which states: No person in the United States shall, on grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance. It is also the policy of the Miami-Dade MPO to comply with all of the requirements of the Americans with Disabilities Act. For materials in accessible format please call (305) 375-4507.

The preparation of this report has been financed in part from the U.S. Department of Transportation (USDOT) through the Federal Highway Administration (FHWA) and/or the Federal Transit Administration (FTA), the State Planning and Research Program (Section 505 of Title 23, U.S. Code) and Miami-Dade County, Florida. The contents of this report do not necessarily reflect the official views or policy of the U.S. Department of Transportation.

Table of Contents

List of Tables

List of Figures

Appendices

1.0 Introduction

Miami-Dade County is part of a heavily populated multi-county metropolitan area. The County encompasses approximately 2,500 square miles of land, and is the most populous county in the State of Florida. According to the US Census, as of 2014, Miami-Dade County was the eighth most populous county in the United States. As the population of Miami-Dade County continues to grow, so does the demand on the existing transportation system, which will require new and innovative investments, sustainable technologies, and collaborative strategies to curtail the rising cost of congestion.

1.1 Study Coordination

This project was headed by the Miami-Dade Metropolitan Planning Organization (MPO) and was supported by a study advisory committee made up of the representatives from the agencies listed in Table 1 below.

Table 1: List of SAC Members

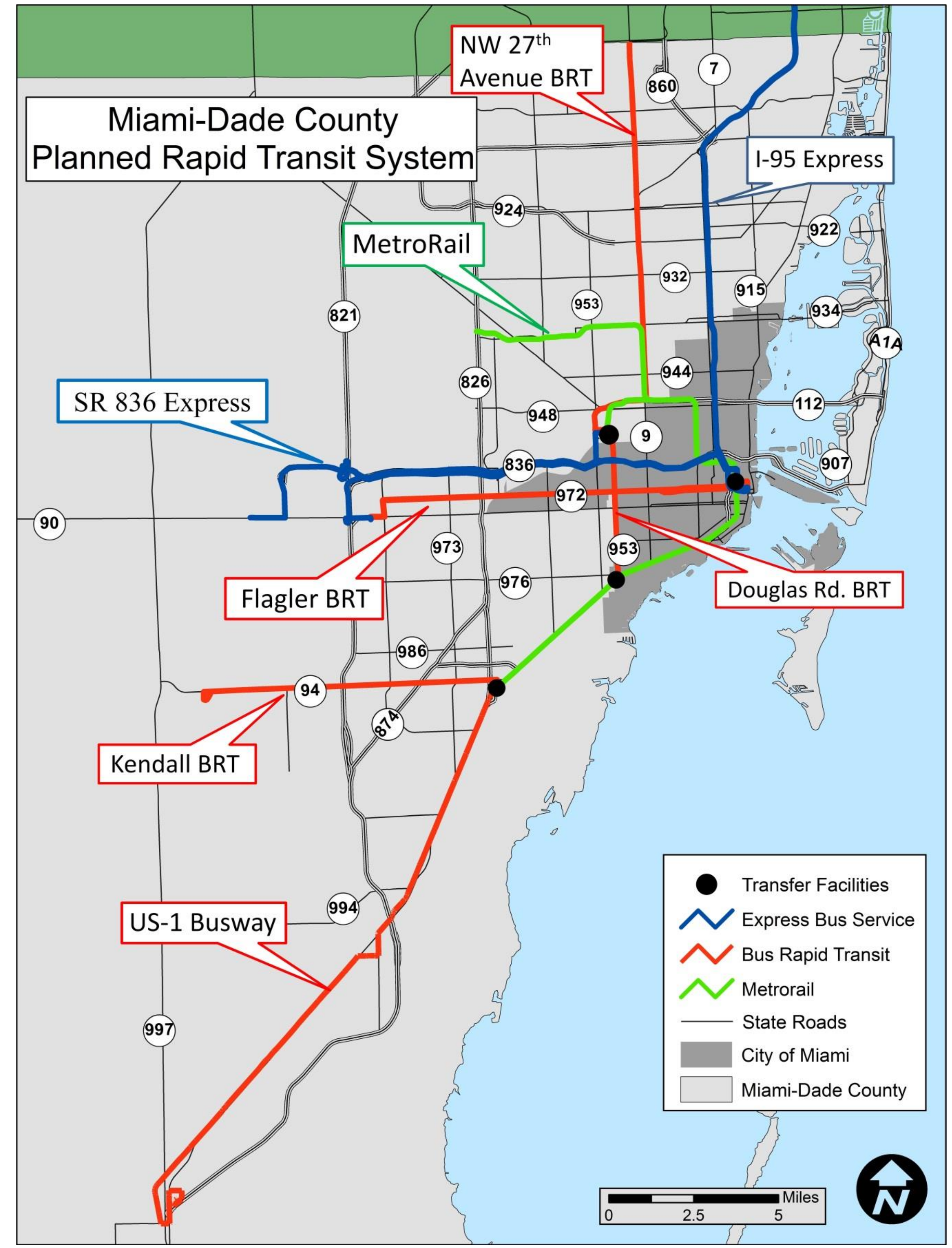
Miami-Dade Metropolitan Planning Organization (MPO)
Miami-Dade Public Works and Waste Management (PWWM)
Miami-Dade Transit (MDT)
Florida Department of Transportation (FDOT)
Citizen's Independent Transportation Trust (CITT)

1.2 Study Background

In 2002, the People's Transportation Plan (PTP) contemplated eight (8) corridors for implementing rapid transit services. These transit corridors include NW 27th Avenue/SR 9 (North Corridor), East-West Corridor (SR-836 and Flagler Street), Earlington Heights/Airport Connector, Baylink, Kendall Corridor, Northeast Corridor, Extension to Florida City, and Douglas Road Corridor. Currently, the Airport Connector (heavy rail) is the only corridor improvement constructed and in operation. However, construction, maintenance and operation of heavy rail systems are expensive and currently cost prohibitive in Miami-Dade County. Therefore, an alternative to develop Bus Rapid Transit (BRT) systems can be more cost effective while providing similar transit travel time savings.

Figure 1 details the rapid transit system in Miami-Dade County, which includes the existing Metrorail, I-95 Express, US -1 Bus lane, and the proposed BRT and Enhanced Bus Service (EBS) corridors. EBS service is similar to a limited-stop or MAX service that has lengthier stop spacing and more frequent service compared to the local fixed-route service. EBS often includes station and vehicle amenities that enhance the passenger experience while improving service speeds and reliability. Studies have previously been completed by the County for implementation of EBS along various corridors. It is important to note that the 'EBS' transit service depicted in Figure 1 along SR 836 is currently being implemented by MDT as an *Express Bus Service* (one seat ride) because there are no intermittent stops between the planned termini points. A Categorical Exclusion environmental document for the Express Bus Service was submitted to the Federal Transit Administration (FTA) for review and is pending approval.

Figure 1 – Miami-Dade County Planned Rapid Transit System



The objective of this study is to create a plan to implement BRT along four of the PTP transit corridors: the North Corridor, the East-West Corridor, the Kendall Corridor, and the Douglas Road Corridor, as shown in Figure 1. A more detailed definition and description of BRT service is provided in Section 3.0.

1.3 Miami-Dade County 2040 Long Range Transportation Plan (LRTP)

The newly adopted Long Range Transportation Plan (LRTP) for Miami-Dade County included funding for critical transportation elements for the four PTP corridors that are a part of this study. Projects that have funding scheduled within the next five years (before 2019) are also included in the Transportation Improvement Program (TIP) and are considered 'Priority I' projects. The LRTP has four levels of priority when scheduling funding for transportation projects, as well as a 'partially-funded' and 'no funding' list of projects. The table below details current project funding for each of the PTP corridors. Previous studies conducted for these corridors, and their recommendations, are explained further in the following section. All identified funding for EBS improvements are available for future BRT implementation.

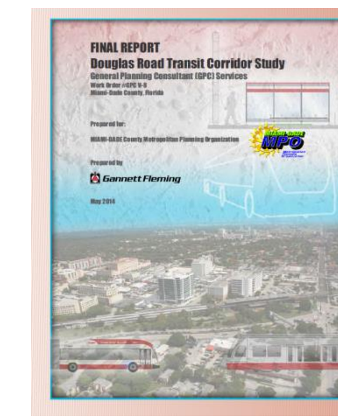
Table 2: LRTP Committed Funding

Project	Description	TIP Funding ($ Million)	Total Costs (YOE $ Mil.)
Priority I (TIP)			
East-West Corridor (Flagler) Enhanced Bus	Incremental improvement on PTP corridor between FIU and Downtown Miami	$2	$15.73
Kendall Park-and-Ride Facility	Park-and-Ride with 160 spaces at SW 127th Avenue	$0.74	
NW 215th Street Transit Terminal Facility	Park-and-Ride facility at NW 27th Avenue	$2.99	
North Corridor (NW 27th Avenue) Enhanced Bus	Enhanced Bus Service	$27	
SR-836 (Dolphin) Enhanced Bus	Enhanced Bus Service	$25	
SW 147th Avenue Park-and-Ride	Park-and-Ride facility at SW 8th Street	$9	
Priority II			
Dolphin Station Transit Terminal	Park-and-Ride facility at NW 12th Street		$31.43
Douglas Road Corridor Enhanced Bus	Incremental improvement on PTP corridor between US 1 and the MIC		$17.82
Kendall Corridor Enhanced Bus	Incremental improvement on PTP corridor between SW 162nd Avenue and Dadeland North	$6.61	$11.88
Unfunded			
Intermodal Terminal at SW 88th Street	Multi-modal terminal at the HEFT		$1.82

2.0 Previous Studies' Recommendations

The eight (8) aforementioned PTP transit corridors have been the subject of a number of planning studies over many years, including several recent plans advocating for the development of high-capacity bus service. A summary of the previous efforts completed by the Miami-Dade MPO, FDOT, and MDT with relevant recommendations for the four corridors that are the subject of this study are provided in the following sections.

2.1 Douglas Road Transit Corridor Study (2014)

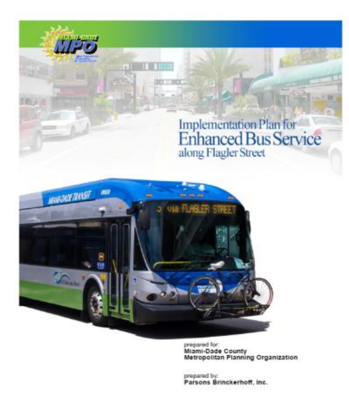


This study developed and evaluated feasible premium transit improvement options along the Douglas Road Corridor, extending at a minimum from the Miami Intermodal Center (MIC) to the Metrorail system in the vicinity of US-1 while connecting various major employment centers and transit generators. The study evaluated potential alignments between these two points as far west as SW 42nd Avenue and as far east as SW 27th Avenue. Different modes were considered such as an enhanced streetcar/trolley, light rail, rapid bus service, semi-exclusive bus lanes, and heavy rail/ Metrorail. The objectives for the study were to develop viable short-term, mid-term, and long-term transit plans that would be consistent with existing and future municipal and county goals, plans, and policies.

2.1.1 Study Recommendations

Five different alignments were evaluated as a part of this effort: 42nd Avenue, Ponce de Leon, 37th Avenue, 32nd Avenue, and 27th Avenue. Based on existing socio-economic data, transit ridership, roadway configurations, and traffic levels of service, the majority of the recommended outcomes for the evaluated alternatives and alignments suggested a rapid bus alternative to be the most feasible transit improvement, regardless of timeframe or alignment.

2.2 Enhanced Bus Service along Flagler Street (2014)



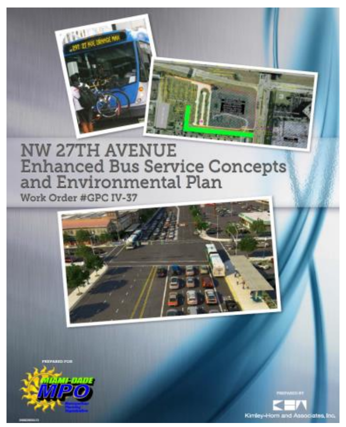
This study analyzed whether various enhanced bus service (EBS) improvements consisting of both changes to bus operations and the implementation of transit infrastructure (e.g. bus station and park-and-ride improvements) along Flagler Street are warranted and feasible.

The study examined previous plans in light of the existing transit and traffic along Flagler Street. Based on this analysis, the study provided short and medium-term recommendations for improvements to transit service and the development of new transit infrastructure along the corridor.

2.2.1 Study Recommendations

Several EBS operating plans were developed which entail transit service increases east of 79th Avenue and decreases west of 107th Avenue. The recommended changes in service levels were based on current ridership concentrations throughout the corridor. Complimentary infrastructure improvements were also recommended to improve the overall travel time such as exclusive bus lanes, queue jump lanes and transit signal priority at certain key intersections. Improved passenger amenities that enhance the transit user's experience in the corridor were also recommended such as real-time information and more attractive/visible signage at station/stop locations. Due to lack of available funding, improvements were recommended to be implemented incrementally, as warranted by ridership and congestion levels.

2.3 NW 27th Avenue/SR 9 Enhanced Bus Service Study (2012)



This study focused on steps to enhance transit service and increase transit ridership with the implementation of a rapid bus service while working toward the long term goal of implementing rail transit in the corridor. The corridor extends from the proposed park-and-ride lot near the County Line south to the MIC. Preliminary concepts were developed for the NW 215th Street terminal/park-and-ride, concepts and cost estimates were developed for the proposed EBS stations and operating plans, and a Categorical Exclusion environmental document was prepared. This document was approved by the FTA.

2.3.1 Study Recommendations

The study estimated the capital costs for the recommended EBS improvements to be approximately $28 million, which included eleven 60-foot articulated buses, the construction of the NW 215th Street transit terminal/park-and-ride facility, 22 total EBS stations, three queue jumps, and three bus bulbouts. The operating plan proposed replacing Route 297 (Orange MAX) with the EBS service, increasing the number of daily one-way trips from 79 to 117, which increased the annual operating costs by $1.1 million.

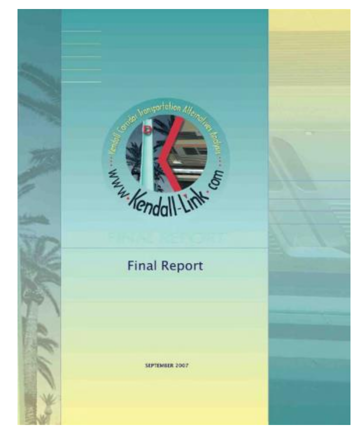
2.4 Near-Term Transportation Plan (2010)

This study was developed by the MPO as an effort to improve existing transportation services by recommending implementable projects along major corridors such as the North Corridor, the East-West Corridor, and other PTP corridors. The plan recommended projects that could be programmed and implemented incrementally within a 2-5 year time frame and was developed in close coordination with MDT, Miami-Dade Expressway Authority (MDX), FDOT, and other transportation agencies. The plan was consistent with the 2010 Transit Development Plan (TDP).

2.4.1 Study Recommendations

The focus of the plan was the development of an incremental approach for transit improvements. The initial step would streamline transit operations, lease/purchase properties for proposed park-and-ride lots and improve passenger amenities. Next steps included enhancing services by improving headways, potentially providing new express and feeder bus routes, and developing/supporting/ encouraging transit supportive land use around stations. Final steps included enhancing the roadside and roadway infrastructure such as installing queue jump lanes and transit signal priority, providing special use or dedicated lanes for buses, and equipping bus stations with off-board payment options, level-boarding platforms, and real-time information.

2.5 Kendall Link Alternative Analysis Study (2007)



The purpose of this study was to identify cost-effective, productive and affordable means to use transit capital investments and service improvements to strengthen mobility connections between the Kendall area and other key regional activity centers in Miami-Dade County and the region. These mobility improvements were identified as necessary to support existing travel demand, rapid population, employment and commercial growth occurring in the Kendall area, and to broaden and encourage transit ridership.

2.5.1 Study Recommendations

The study recommended a preferred rapid transit strategy comprised of BRT, Diesel Light Rail Transit (DLRT), and a Metrorail Extension. Several short-term transit improvements were planned for implementation within the study area. These small, incremental projects would begin to increase the level of transit service along Kendall Drive/SR 94 and set the stage for the larger investments proposed for the future. The ultimate service plan developed recommended daily service from 5am to midnight with 15-minute headways during peak hours and 30-minute headways during the off peak for all three modes. Depending on mode and travel speed, round trip times were estimated between 52 and 77 minutes.

The study developed ranges for each mode's capital costs and annual operations and maintenance costs depending on multiple alternatives:

- BRT: $4.6 - $6.5 million (O&M) and $250 - $408 million (Capital)
- DLRT: $5.2 - $12.2 million (O&M) and $222 - $418 million (Capital)

- Metrorail: $18.8 - $19.7 million (O&M) and $1,682 - $1,687 million (Capital)

However, none of the alternatives recommended are planned for construction at this time and several significant issues are yet to be resolved such as funding. A funding plan has not been developed for any of the proposed improvements. In summary, these four PTP corridors have been studied for various levels of transit service implementation with little success due mostly to funding constraints. The purpose of this study is to develop a BRT service that can be implemented in the immediate short term timeframe.

3.0 What is Bus Rapid Transit

3.1 BRT Defined

BRT is a form of transit that has generated interest around the world to help alleviate the adverse effects of traffic congestion and potentially contribute to economic growth. The FTA defines BRT as an enhanced bus system that the majority of the service operates in a separated right-of-way dedicated for transit use with substantial investment in a single route within a defined corridor or subarea, which includes features that emulate rail services such as defined stations, traffic signal priority, short headways, and other features. doing so, BRT operates at faster speeds, provides greater service reliability and increased customer convenience. It also utilizes a combination of advanced technologies, infrastructure, and operational investments that provide significantly better service than traditional bus service. The Institute for Transportation and Development Policy defines BRT as a high-quality bus-based transit system that delivers fast, comfortable, and cost-effective urban mobility through the provision of segregated right of way infrastructure, rapid and frequent operations, and excellence in marketing and customer service. BRT combines all of these qualities into a permanently integrated transit system with a quality image and uniquely identifiable brand.

BRT's flexibility derives from the fact that BRT vehicles (e.g., buses, specialized BRT vehicles) can travel anywhere there is pavement and the fact that BRT's basic service unit, a single vehicle, is relatively small compared to train-based rapid transit modes. A given BRT corridor may encompass route segments where vehicles operate in mixed traffic, exclusive bus lanes, or on a dedicated, fully grade-separated transitway with major stations. BRT is an integrated system that is designated to improve the speed, reliability, and identity of bus transit.

FTA Definition of Bus Rapid Transit:

An enhanced bus system that operates on bus lanes or other transitways in order to combine the flexibility of buses with the efficiency of rail.

Unlike other rapid transit modes where basic route alignment and station locations are constrained by right of way availability, BRT can be tailored to the unique origin and destination patterns of a given corridor's travel market. As the spatial nature of transit demand changes, BRT systems can adapt to these dynamic conditions.

3.2 BRT Elements

Many of the concepts at the heart of BRT have been in use for decades. However, there is uncertainty among elected officials and even some transit professionals about what BRT is and how it differs from conventional bus services and systems. Transit planners have strived for ways to enhance the speed and reliability of transit service in an attempt to encourage more usage with exclusive bus lanes, limited-stop/express services, and dedicated bus lanes. Most systems in the United States, as will be covered in Section 4.0, have some or all of the basic elements of a functioning BRT system such as dedicated right of ways, off-board fare collection, intelligent technology systems, and improved amenities in and around the transit station. But there are other elements that are critical for a successful BRT system. This section will briefly describe these elements in more detail.

3.2.1 Dedicated Right of way

A dedicated right of way is vital to ensuring that buses can move quickly and unimpeded past congestion. The physical separation from general purpose lanes gives the bus an operational advantage over vehicles while creating a psychological perception for motorists that BRT service is faster and more efficient than automobiles, especially during the peak hour. Physically separated bus lanes may be more difficult to build in areas with limited right of way. At a minimum, segments of dedicated lanes should be provided along the roadway, especially in the most heavily congested areas where it is harder to take a lane away from mixed traffic.

Dedicated lanes can be segregated from general purpose lanes with varying degrees of permeability such as delineators, electronic bollards, car traps, colorized pavement, etc. Keeping unauthorized vehicles out of bus lanes is a challenge, even for the most robustly separated lanes. Bus lanes with very high volumes of buses need fairly minimal enforcement. The most popular and cost-effective form of enforcement in the United States is cameras. These should ideally be installed on buses in order to ensure constant moving enforcement of bus lanes. A less effective, but still useful measure is to install stationary cameras along the corridor. In some designs, the bus stations themselves can act as a barrier. Some permeability is generally advised, as buses occasionally break down and block the bus lane or otherwise need to leave the corridor. Enforcing the use of these exclusive lanes is crucial to the operations of the BRT system.

The bus lane is best located where conflicts with other traffic can be minimized, especially from turning movements in mixed-traffic lanes. In most cases, a bus lane in the median of a roadway encounters fewer conflicts with turning vehicles than those closer to the curb due to alleys, parking, curb cuts, etc. The design of the bus lane should minimize the risk of delays caused by turning conflicts and curbside access.

3.2.2 Transit Stations

The main distinguishing features of a BRT system is a safe, comfortable, and enhanced station environment. One of the most important characteristics of a BRT station, in terms of time travel time savings, is platform-level boarding. Having the station platform level with the bus floor is one of the most important ways of reducing boarding and alighting times per passenger. Passengers climbing even relatively minor steps can mean significant delay, particularly for the elderly, disabled, or people with suitcases or strollers. The reduction or elimination of the vehicle-to-platform gap is also important to customer safety and comfort. There are a range of measures to minimize the gap between vehicle and station including guided bus lanes at stations, alignment markers, and intelligent motion-detection technology.

Enhanced stations are essential to attracting and maintaining ridership. Stations should be at least ten feet wide, be weather-protected (as appropriate to the local conditions), well-lit, transparent, and have security. A clear intention to create attractive stations is important to the image of the system and creates a sense of permanence and attractiveness that will attract not only riders but developers as well.

A high-quality BRT system should be easy to understand and to use. Real-time information at the stations is very important to passenger satisfaction, creating a positive overall experience, and helping passengers to understand the system. Real-time passenger information includes electronic panels, digital audio messaging, and/or dynamic information on handheld devices. These technologies are readily available and are often seen as a good way to pilot real-time information systems for the rest of the city's transit system. Static passenger information is also useful such as station and vehicle signage, network maps, route maps, local area maps, emergency indications, and other user information.

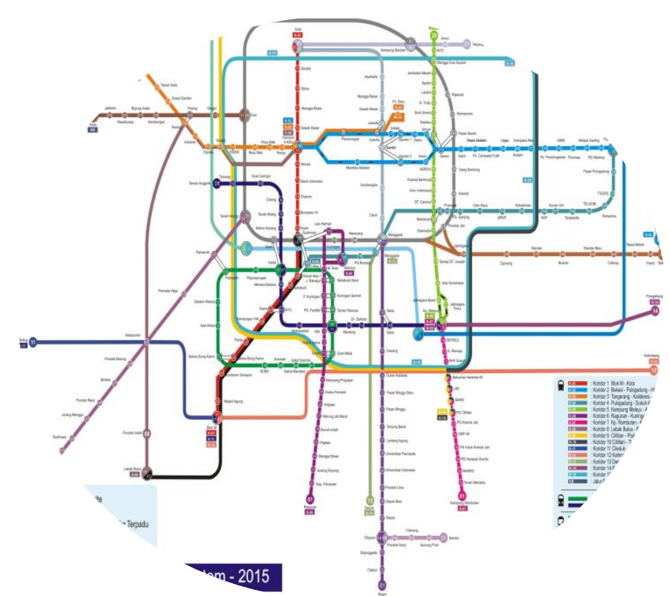
3.2.3 Transit Vehicles

The speed of boarding and alighting is also partially a function of the number of bus doors. Much like a subway in which a car has multiple wide doors, buses need the same to let higher volumes of people on and off the bus. One door or narrow doorways become bottlenecks that delay the bus. There are BRT vehicles that have two or even three doors that help improve travel times by expediting the boarding and alighting process.

Articulated buses are the preferred type of BRT vehicle because of more stringent service standards. Because demand for transit is generally lower in the United States, traditional buses may be used instead. However, it is very important that whatever size vehicle is used, that a concerted effort be placed on the branding of the vehicle. Articulated buses are more common with BRT service and generally act as a better branding tool for distinguishing the BRT service from conventional bus service. If the idea is to provide a high level of passenger convenience, to serve mid- to long-distance transit trips, and to attract choice riders, there needs to be available seats during commuting hours and this usually means use of a larger capacity bus. Currently, MDT is securing articulated vehicles for future premium services along their transit corridors.

Many newer models of transit vehicles are being equipped with smart technology that enhances the passenger experience and improves the quality and speed of the service. Providing Wi-Fi access can make the experience more comfortable and enjoyable for passengers. Other technologies such as automatic vehicle location (AVL) systems and intelligent transportation systems (ITS) help transit operators improve travel times and service reliability.

3.2.4 Operations and Service Planning



BRT corridors should be implemented where passenger demand is highest. A lack of available roadway capacity or right of way is typically an indication of a higher demand for travel and results in higher levels of congestion. BRT services should not avoid these corridors simply because taking away general purpose lanes result in reduced levels of service for automobiles. On the contrary, improved transit services can help to alleviate some of the congestion by attracting choice riders.

3.2.4.1 Route Structuring

BRT services can create an opportunity to modify route structures. In every BRT system design, the first questions to answer is which of the existing bus routes using the BRT corridor should be modified, which ones should be included in the new BRT operations, and which ones should be excluded. Currently, the trend when planning for a new BRT service is to upgrade a single existing bus route to a BRT service, and any other bus routes that were previously using that corridor are either re-routed or are allowed to use a limited part of the specialized BRT infrastructure.

Three of the four corridors that are a part of this study have both a local and a limited-stop service; Douglas Road being the only corridor with just a local service. As will be discussed later in this report, any future BRT service implemented would likely replace the existing limited-stop service. Because the proposed BRT service would provide frequent service, the local fixed-route service's frequency can be scaled back to save on overall corridor operation costs.

Station spacing is also important to the success of a BRT system. In urban areas like Miami-Dade County, the optimal distance between BRT station stops is a ¼ to a ½ mile. Beyond this, more time is imposed on customers walking to stations than is saved by higher bus speeds. Below this distance, bus speeds will be reduced by more than the time saved with shorter walking distances.

3.2.4.2 Frequency of Service

People do not want to have to wait to travel, especially when they can get in their car and go, even if once in their car they will be stuck in traffic. One barrier to getting people out of their cars and into public transportation is the ability to travel flexibly and on a whim. The best way to overcome this barrier is to provide frequent service. Increased service has a direct effect on operating costs, thus being a major concern for US transit agencies. Nevertheless, a high-quality transit service needs to be frequent. During the peak period, BRT frequencies should ideally be five minutes or less, and no more than every ten minutes. Off-peak BRT frequencies ideally should not exceed fifteen minutes.

In order to reasonably expect people to put aside their cars and take transit, they need to be guaranteed that if they make a trip, they will also be able to make the return trip. Thus, service needs to be offered throughout the day and well into the night. This seems to be understood, as most services that call themselves BRT in the U.S. operate at least until midnight. Weekend service is important as well if the system is to be seen as a viable alternative to owning a car.

BRT systems with ridership levels below 1,000 passengers per hour per direction (pphpd) during the peak hour are carrying fewer passengers than a normal mixed-traffic lane. Very low ridership can be an indication that a corridor was poorly selected. Almost all cities have corridors carrying at least 1,000 pphpd during the peak hour. Many cities, however, have corridors where transit demand is very low, even below this level. While including as many BRT features as possible would still bring benefits in these conditions, it is unlikely that such levels would justify the cost and dedicated right of way intrinsic to BRT.

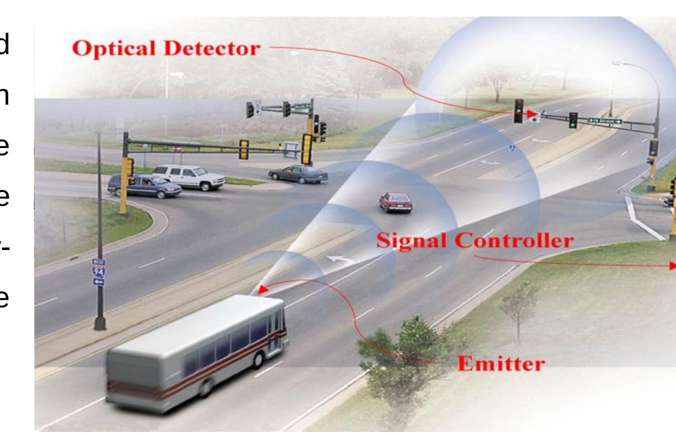
3.2.5 **Physical and Technological Improvements**

3.2.5.1 Off-board Fare Collection

Conventional bus systems require passengers to pay their fare on-board, before the bus departs. This slows the process significantly, particularly when there are large numbers of passengers boarding at a station. Boarding times per passenger under such conditions are upwards of five seconds per passenger, and in a standard BRT system, boarding times per passenger can be brought down to as little as one-third of a second. Collection of fares off-board before buses arrive significantly increases operational efficiency.

There are two basic approaches for off-board fare collection: turnstile-controlled, where passengers pass through a gate, turnstile, or checkpoint upon entering the station where their ticket is verified; and proof-of-payment, where passengers pay at a kiosk and collect a paper ticket that is then checked on board the vehicle by an inspector. Both approaches can significantly reduce delay. Turnstile-controlled is slightly preferred, but proof-of-payment systems on bus routes that extend beyond BRT corridors extend the benefits of time savings to those sections of the bus routes that lie beyond the BRT corridor. Smart card technology, similar to what MDT currently uses, can be used in conjunction with the off-board fare collection system so that boardings can be made faster.

3.2.5.2 Intersection Treatments



It is important to reduce the time buses spend at signalized intersections in a BRT corridor. Much of the focus has been on measures that extend a green signal by up to about five seconds if a sensor detects that a bus is approaching. These intelligent transportation systems (ITS) are important in low-frequency BRT systems because service reliability can be greatly improved.

Significantly more time can be saved by eliminating turns across a BRT system altogether. As a rule of thumb, on a BRT corridor, the majority of traffic signals should be two-phased, and only a few key intersections with high turning volumes should be three-phased, but never more than three phases. One of the benefits of a median-aligned bus lane is that it is easier to eliminate left turns across a median-aligned BRT system than it is to eliminate right-hand turns across a curb-aligned BRT system.

3.2.5.3 Real Time Signage

A key element of most BRT systems is the inclusion of Real-time arrival signage (RTAs). RTAs use the automated vehicle locator interface between the buses and dispatch control to provide real time information at the BRT station. These signs can be programmed to provide real time information for up to the next three buses. Obviously, the closer a vehicle is to the arrival location, the more accurate the estimation can be. Passengers find this technology to be extremely beneficial because it takes the "guesswork" out of using transit. Knowing exactly when to expect a delayed bus is much more conducive to transit ridership than not having such critical information. This technology can be deployed directly at the station through signage, as well as pushed out to the internet for access via smart phones or tablets.

3.2.5.4 Passing Lanes

In corridors where local transit and BRT services share the bus lane, passing lanes at stations are recommended. From a design perspective, local, limited, and express services can only coexist inside BRT bus lanes when there is a way for the limited and express services to pass the local. This only requires a passing lane at the station stops, instead of all along the entire corridor. Most of the newer BRT systems in Latin America and Asia include passing lanes due to the mix of transit service within the bus lane. However, in the U.S. transit demand is far lower than in many developing countries, therefore, it is harder to take an additional mixed-traffic lane and dedicate it to exclusive BRT infrastructure, especially with limited right of ways. Another design alternative is installing a pull-by in front of the BRT station where a local bus can move out of the way of an express bus if the driver sees one coming.

3.2.6 System Integration and Branding

3.2.6.1 System Branding

In order to distinguish BRT in the public's perception, it is important to brand the system as a different and better service than the local service. This requires a strong communications and marketing plan, as well as high quality branding that will touch all elements of the system, including communications, signage, maps, and most importantly the buses themselves. Most bus systems like MDT already have a brand identity. The challenge is to develop a BRT brand for service that meets the criteria referenced in this section.

3.2.6.2 Bicycle and Pedestrian Integration

BRT also provides an opportunity to improve the pedestrian environment as they reconstruct streets and station areas. As most transit trips begin or end with a walking trip, it is important that the pedestrian environment around transit stations be safe and attractive. A safe and attractive walking environment is also attractive to developers and businesses. All stations should include crosswalks or other amenities to ensure safe street crossings, and sidewalks in the nearby area should be sufficiently wide. Public art and landscaping should be added to enhance the pedestrian environment.

Often, a corridor chosen for BRT is selected for its high level of passenger demand. This is because the corridor is likely to include many desirable origins and destinations. Additionally, BRT routes are often designed on relatively straight paths, with a minimal number of turns. Because of this, a good BRT corridor shares many of the same characteristics of a good bicycle corridor. When a road is being reconstructed for BRT, there is an opportunity to redesign the entire street, including bicycle lanes. Bicycle parking infrastructure should also be provided at BRT stations. Secure bicycle parking at stations can help to encourage more bicycle use as well as acting as a marketing tool to attract potential transit users. BRT stations should also consider the use of shared bikes as a way to facilitate the last mile of access for BRT passengers.

3.3 Summary and Criteria of BRT Elements

The success of a BRT project hinges on its components, ideally with as many combined as possible. Ultimately, there are six criteria: the Bus lane, the transit stations, the vehicles, how the service is planned and operated, the physical improvements around the station and related development, and system branding and integration. This section elaborated on the elements that are essential to a fully-functioning BRT system, while Section 4 below provides examples of existing systems in the United States. These case studies highlight the diverse application of the BRT criteria and lessons learned from their implementation.

4.0 United States BRT Case Studies and Best Practices

4.1 Planning Background

Bus Rapid Transit was first implemented in Curitiba, Brazil in 1974, and has since become a global phenomenon. Since the turn of the century, major new BRT projects have opened in Africa, Australia, Asia, several cities in Europe, and dozens of cities in Latin America. BRT's popularity in the United States has grown exponentially in the past decade.

According to American Public Transportation Association (APTA), in 2008, transit ridership in the United States reached its highest level since the mid-1950s growing faster than population and vehicle miles travelled between 1995 and 2008. The flexibility and cost effectiveness of BRT make it an excellent choice for transit agencies facing both increasing demand for transit and increasingly constrained budgets. New BRT systems have opened over the last decade, with several new projects in the planning phases in cities such as San Francisco and Chicago.

The options available for designing a BRT system are so extensive that there is an infinite variety of integrated BRT systems. BRT's inherent flexibility means that no two BRT systems will look exactly the same within a given region, let alone between two different metropolitan areas. Cities that have already made the decision to invest in mass transit find BRT systems attractive for many reasons such as the flexibility of implementing the new BRT system, its relatively lower capital costs compared to other mass transit options, and the ability to operate on existing streets.

Fortunately, there are numerous successful BRT systems across the country and around the world that have provided experience and knowledge for implementing, operating, and maintaining BRT service. Most of these systems include a host of the crucial BRT elements that have helped to bring significant improvements to the quality of transit services, as referenced in Section 3.

The following section will discuss existing BRT systems, and their elements, in order to create an action plan for the implementation of BRT service along NW 27th Avenue/SR 9 (North Corridor), SR-836 and Flagler Street (East-West Corridors), Kendall Drive/SR 94, and Douglas Road.

4.2 Healthline BRT – Cleveland, Ohio

This project was created in response to the need for efficient transit service connecting the city's main employment and activity centers — downtown Cleveland, the major hospitals including the Cleveland Clinic, and University Hospital in University Circle. After decades of studying transit options, the city of Cleveland came to the consensus in 1995 that BRT would be the most cost-effective option to provide high-capacity transit service for the city.

Opening in 2008, the operational plan for the Healthline converted Route 6 (the bus route on Euclid Avenue – one of the most heavily used bus routes in the city, accounting for nearly ten percent of Cleveland's bus ridership) to new articulated BRT buses that operate mostly within newly-constructed segregated right of way. Other local bus routes use portions of the new BRT corridor, acting as feeder routes serving the BRT trunk line. Key characteristics of the Healthline include off-board fare collection, median-aligned dedicated bus-only lanes, level boarding platforms, interactive kiosks with real-time information at stations, and hybrid buses with multiple door boarding.

Before the system opened, average bus speeds in the corridor were only 9.3 mph. Together with all the bus routes serving the Euclid Avenue corridor, peak-hour headways averaged an interval of just over two minutes with average corridor speeds at 12.5 mph. Some of the speed increase resulted from the elimination of stops, which drew criticism from residents who complained about the elimination of stops and inconvenience resulting from the changes in routes. Nevertheless, the statistics are good. Daily ridership increased by sixty percent after the first two years of operation.

One major success of the system so far has been $4.3 billion in real estate investments along Euclid Avenue, one of the city's most historically significant corridors. The project's total budget was approximately $200 million, but only $50 million was allocated for buses and stations — the remainder was directed towards other corridor improvements such as roadway, utilities, new sidewalks, and street furniture. The cost of the bus lane itself was therefore about $7 million per mile. The FTA assisted by providing an $82.2 million New Starts grant. The naming rights of the line were also sold to help fund the system. The Cleveland Clinic and University Hospital jointly purchased the naming rights, naming it the HealthLine, which will provide the system with $6.75 million of additional funding, dedicated to maintenance, over the next 25 years. According to the National Transit Database, the total 2012 operating expenses were roughly $6.5 million with over 4.6 million annual passenger trips.

4.3 Emerald Express (EmX) – Eugene, Oregon

In the mid-1990s, Eugene, Oregon began looking to upgrade its bus system by improving travel times and overall transit service. Light rail was considered in the original plans, but it was eventually deemed too expensive.

Decision makers visited Curitiba's BRT system, which helped convince them that BRT would be the best option to address long-term transit issues in the region.

The Green Line opened in 2007 as a pilot project and operates on a four-mile stretch between Eugene and Springfield. Currently, the EmX system features many true BRT characteristics, such as dedicated bus lanes, off-board fare collection, and near-level boarding. Average speeds on the corridor have increased from approximately 11.5 mph to 15 mph, even though only 1.6 miles of the corridor is within a dedicated right of way. This upgrade in service led to an increase in daily ridership from 2,700 to 4,700. Eugene's BRT cost roughly $12 million per mile of dedicated trunk lines for the infrastructure, rolling stock, planning, and engineering. The FTA provided some Small Starts funding along with State funding. The success of the Green Line has inspired and justified system expansion.

EmX encountered several implementation barriers. First, system planners decided not to grant the right of way for a fully dedicated bus lane along the entire corridor, due to traffic concerns. Instead there is a mix of dedicated median bus lane and curbside bus lanes with signal priority. These same planners and engineers also worried about taking away or narrowing lanes, so instead of a wider bus lane that would allow for bus passing, the system was designed with one-way bus lanes, in which buses must wait for oncoming buses to pass before entering the lane. Finally, the system had to be designed around several clusters of trees because a local city ordinance prevented the removal of street trees over fifty years old. For this reason, the system's path does not follow a straight trajectory. Nonetheless, the system is mostly viewed as a success, despite some criticism for future corridors.

4.4 Metro Orange Line – Los Angeles, California

The Los Angeles County Metropolitan Transportation Authority (LACMTA) uses the term BRT to describe their MetroRapid system. MetroRapid is a network of fourteen bus lines with some transit priority improvements but with few elements associated with BRT. Other than some sections of Orange Line, little of the network has a dedicated bus lane, and all of the routes operate curbside. The main BRT characteristics are signal priority (a five second extended green phase) at select intersections, more frequent service than for conventional buses (ten minute intervals), the elimination of some stops, and the use of nicer, articulated buses with special red and silver branding. But because MetroRapid lacks other BRT system characteristics, it has failed to adequately demonstrate to the public the viability of BRT as an alternative to rail-based modes.

LACMTA opened its 14.2-mile Metro Orange Line to the public in October 2005 in the San Fernando Valley. The Orange Line is the best example of BRT in Los Angeles with features including an exclusive right of way, three-door buses, off-board fare collection, passenger information displays, and unique branding. It does not have at-level boarding. The Orange Line runs along an old railroad right of way from the Warner Center, the system's western terminus, to the Red Line subway in the east. Intervals during the peak hour are every ten minutes, and the system is currently carrying nearly 25,000 passengers a day. Travel time improvements are not available since there was no bus service along the corridor previously.

The system was expensive to build, $38.5 million per mile, because the tracks had to be removed, a new road had to be constructed, and sound barriers were required throughout the length of the corridor. Discussions about building a transit system in the east-west corridor of the San Fernando Valley date back to 1980 when Los Angeles County voters approved a half-cent sales tax increase to help fund transit systems in thirteen designated corridors.

Implementation was plagued by several problems. First, there was significant opposition from residents beginning in the 1980s that feared that transit infrastructure would be too noisy and would reduce property values. After over fifteen years of conflict, the community became convinced that improvements were necessary. The second problem was that, once operational, several high-profile crashes during the early stages of implementation led to LACMTA setting a reduced speed limit of 10 mph through intersections for Orange Line vehicles. Officials also chose to give signal priority to cross traffic instead of the bus lane. Together, this has led to a reduction in overall system speed from what would have been 25–30 mph, to an average of 18 mph in the peak period, similar to problems with Miami-Dade Transit's South Dade Bus lane.

4.5 MLK, Jr. East Bus lane – Pittsburgh, Pennsylvania

Pittsburgh unveiled its 4.3-mile South Bus lane in 1977, demonstrating the city's commitment to relieving urban traffic congestion and paving the way for BRT in the United States. After much success, the city's first full-fledged BRT system (the Martin Luther King, Jr. East Bus lane) began operations in 1983. Originally 6.8 miles in length, a 2.3-mile extension was

completed in 2003, providing the city's eastern suburbs with better access to the central business district. Pittsburgh's East Bus lane is an innovative and versatile BRT system, operating local, limited, and express services to accommodate the diverse travel patterns of local transit riders. Since first beginning service, the East Bus lane has optimized its operations to offer bus headways as low as two minutes and average speeds along the bus lane of approximately 30 mph. In addition, some suburban bus routes transfer from local roads onto the East Bus lane's designated bus lanes via connection ramps, facilitating convenient, transfer-free trips. This type of service plan enables the East Bus lane to be the main thoroughfare for about sixteen routes. Current daily ridership is approximately 25,000.

While Pittsburgh is the only true BRT system in the United States to employ a fully dedicated bus lane with limited stops and signal priority, it still lacks some of the more common elements of BRT. The East Bus lane lacks off-board fare collection, platform-level boarding, intelligent passenger information systems, and a common system brand. The buses also look very much like buses, rather than modern, sleek vehicles that signify a modern form of transit. Interestingly, it is some of these latter elements which other cities use to falsely brand their systems as BRT while Pittsburgh, which embraces the underlying fundamentals of BRT like a dedicated bus lane, fails to fully brand itself as such. Despite missing some important BRT elements, the total project cost was $183 million, at a cost of nearly $20 million per mile, which is reasonable considering the system operates along a dedicated bus lane. The dedicated bus lane was built along a former rail right of way, which helped lower the overall costs.

Pittsburgh is planning to expand its network to a full BRT system. For the first time, it is considering repurposing on-street lanes for BRT to connect to downtown Pittsburgh. The Port Authority (bus lane system operator) is looking to use this opportunity to begin incorporating some of the more commonly known features of BRT into its system.

4.6 Strip and Downtown Express (SDX) – Las Vegas, Nevada

The Metropolitan Area Express (MAX) was the first BRT-type service in Las Vegas. The MAX system featured several components of BRT, such as off-board fare collection, unique branding, specialized buses, and stations with at-level boarding in most places. Its 4.5 miles of dedicated lanes (out of 7.5 total miles) are curbside, which is shared with right-turning traffic, slowing speeds somewhat. The Strip & Downtown Express (SDX) line built on MAX's successes and raised the bar for BRT in Las Vegas. The SDX route is nine miles in length with 2.25 miles of central median-aligned dedicated right of way, left turn restrictions at many intersections, and operates between the Strip and downtown.

Prior to the SDX route, a double-decker bus called the "Deuce" carried over 32,000 passengers per day along the corridor. With the introduction of SDX, the Deuce continued to operate, using the BRT infrastructure for much of its route, but making more frequent stops, while the SDX served as the limited-stop service. Peak-hour headways on both the SDX and the Deuce are every twelve minutes for a combined average frequency of about six minutes. Daily ridership in the corridor today is 21,500 on the Deuce and 14,000 on the SDX, a 3,500 passenger increase on the corridor overall.

The SDX line's most significant deficiency is that the dedicated infrastructure does not continue onto the main part of the Strip, largely because the casino owners did not want to make it easier for their clientele to leave their casinos. The Regional Transportation Commission (RTC) had to fight to get permission to operate the buses along the Strip with attractive stations and other BRT elements. Unfortunately, the SDX incurs countless delays in the most congested and popular parts of Las Vegas, operating more or less like a normal bus route.

Nonetheless, the SDX line is a positive example that BRT can provide high-quality transit at a lower cost than rail. SDX is viewed as a political and operational success, in part because of the aggressive marketing campaign to gain public support. Las Vegas continues to expand its BRT system. Future lines, such as the Sahara Express, which broke ground in February 2011, will be operating along the curb.

4.7 Silver Line BRT – Boston, Massachusetts

In Boston, the Massachusetts Bay Transportation Authority (MBTA) has decided to brand modest, incremental bus improvements as BRT. In 2004, the Silver Line replaced a local bus service, reducing bus stops from 20 to 12, which improved travel times by as much as 25 percent. The line operates within a one mile stretch of exclusive right of way, which is almost entirely in an underground tunnel, while the remainder of the route operates in mixed traffic, on streets, or on highways. The Silverline has ten minute peak-hour headways, despite operating in mixed traffic or in standard curb-aligned bus lanes frequently plagued by double-parked vehicles and other obstacles. When approaching intersections where right turns are permitted, the bus lane functions as a right-turn only lane for vehicles. Bicycles are also permitted in the bus lane. In one short section, a contra-flow bus lane was added on a one-way arterial to improve the directness of route and reduce travel time.

Only the stations in the tunnel have off board fare collection, while other stations have traditional payment options. The curbside stations feature raised platforms and curb extensions for level boarding, real-time information, bicycle racks, and three-sided protective glass to help protect passengers from the weather. The vehicles feature GPS communication, three boarding doors, and text/audio announcements. The Silver Line also uses signal priority treatments at select intersections to improve travel times. There are no other BRT system features, leading to extensive community criticism that it is merely a bus.

The total Silver Line cost was $619 million (about $70 million per mile), which is skewed because $477 million of the total cost was for the one-mile long tunnel segment. The new system did lead to an increase of ridership by about 98 percent, some of this due to growth in South Boston. The Silver Line also acted as a catalyst for nearly 1,800 new/rehabilitated housing units and 128,000 sq. ft. of retail between 1997 (when the Silver Line was being planned) and 2004. All of this new development contributed to the transformation of the streetscape.

4.8 Fordham Rd BRT – New York City, New York

New York City's Department of Transportation and the MTA replaced the limited service on Fordham Road with a BRT-like service while continuing local services at slightly reduced frequencies. Intervals on the BRT route are between four and five minutes during the peak. The Fordham Road corridor has off-board fare collection and red-painted curb-aligned bus lanes, with signal priority (extended green phase) at a few key intersections. These measures increased average speeds and travel times by about eighteen percent, with off-board fare collection responsible for most of that.

New York City has installed five cameras to enforce the restriction of vehicles in the bus lanes. The exclusive lanes are only in effect during extended peak periods. Enforcement has been stepped up but violators in the bus lane remain frequent. Right-turning vehicles are permitted to turn from the bus lane, which, given the pedestrian crossing volumes, sometimes introduces delay. New York City has adopted an incremental phased-in approach, and plans to upgrade the corridor by adding nicer stations built on bus bulbouts. The introduction of bus bulbouts creates the possibility that new high-quality stations can be built with platforms level with the bus floor to provide for easier and faster boardings.

5.0 Existing Conditions of the Selected Corridors

The main lesson learned from case studies reviewed of BRT implementation in the U.S. is that no two corridors are necessarily alike. Corridor context and funding appear to be the main driving force for application of one or several BRT elements along the corridor. As indicated above, there are few examples of a true BRT with all six BRT criteria or elements implemented. Many BRT corridors are a mix of dedicated lanes in segments and in mixed traffic in other segments. There are also many instances of curbside dedicated lanes as well as median running dedicated lanes. Because corridor context is critical to determining BRT application, this section details existing transit and roadway conditions for the four BRT corridors being studied in this report.

5.1 NW 27th Avenue/SR 9

NW 27th Avenue/SR 9 is a state owned and maintained roadway and has been identified as a PTP corridor. There have been a number of previous MPO studies that included plans and concepts for a potential BRT service along NW 27th Avenue/SR 9 such as the Bus Rapid Transit Opportunities Study (2003), the Special Use Lane Study (2004), Short Term Transit Improvements Study (2009), and the Enhanced Bus Service Concepts Plan (2013). The proposed BRT corridor along NW 27th Avenue/SR 9 stretches from the proposed park and ride lot at NW 215th Street ultimately to the Miami Intermodal Center via SR 112 and NW 42nd Avenue (See Appendix A). All of the recommended BRT improvements are between the park and ride lot and SR 112.

Miami-Dade County's 2040 LRTP has allocated funding for transit service improvements along NW 27th Avenue/SR 9. It references a new transit terminal / park-and-ride lot at NW 215th Street ($2.9 million) and 'Enhanced Bus Service' improvements ($27 million – which plans to be funded via MDT system efficiencies). These two projects are considered priority I, meaning these projects are programmed to be implemented within the next five years. Because these projects are listed as priority I, they are also included in the most recent TIP. The LRTP also goes on to mention funding for 'Full BRT' with dedicated lanes from the MIC to the NW 215th Street park-and-ride ($291 million). This improvement is considered a priority IV project, which is planned between 2031 and 2040. There is also mention of a project converting the full BRT to heavy rail ($1.8 billion), which doesn't have any funding currently identified, and therefore is considered unfunded.

5.1.1 Existing Transit

There are two existing transit routes that provide service along NW 27th Avenue/SR 9, Routes 27 and 297. Route 297 is a limited-stop service while Route 27 provides local bus service. In addition, there are thirteen existing MDT bus routes that cross NW 27th Avenue/SR 9 that provide transfer opportunities. A park-and-ride lot is proposed at NW 215th Street and NW 27th Avenue/SR 9, and would be the northern terminal for a NW 27th BRT or EBS service. There are two existing park-and-ride lots within the corridor located at the NW 54th and NW 62nd Street Stations.

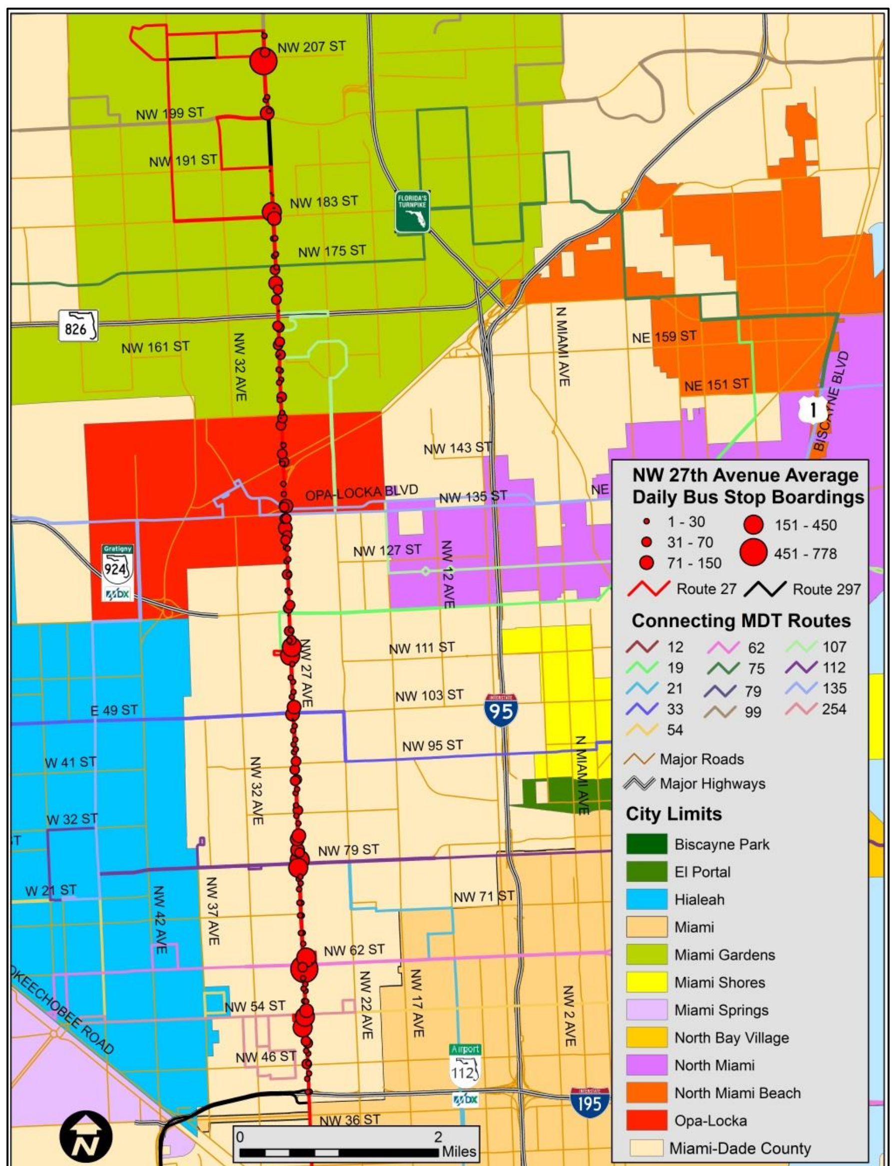
The existing characteristics for Routes 27 and 297 are listed in the table below. Note that the existing route lengths and average daily ridership are separated depending on if they are within the proposed BRT corridor. For example, roughly 54 percent of the average daily boardings for Route 27 occur within the proposed BRT corridor.

Table 3: NW 27th Avenue/SR 9 Existing Transit Service Characteristics

Route	Roundtrip Length (miles)	Length within BRT corridor	Travel Time (minutes)	Avg. Travel Speed (mph)	Average Daily Ridership	Avg. Daily Ridership within BRT corridor	Peak Hour Headways (minutes)	Service Hours
27	39.8	22	200	13	11,704	6,298	15	24
297	32.5	32.5	102	18.2	2,203	2,029	15	14

There are a total of 139 bus stops within the NW 27th Avenue/SR 9 BRT corridor limits, seen in Figure 2. Based on data from April 2014, the average number of boardings for all the stops is approximately 54 passengers per day. Stops with the highest boardings include NW 62nd, NW 207th, and NW 183rd Streets stops with 778, 681, and 443 average daily boardings respectively.

Figure 2 – NW 27th Avenue/SR 9 Transit Ridership



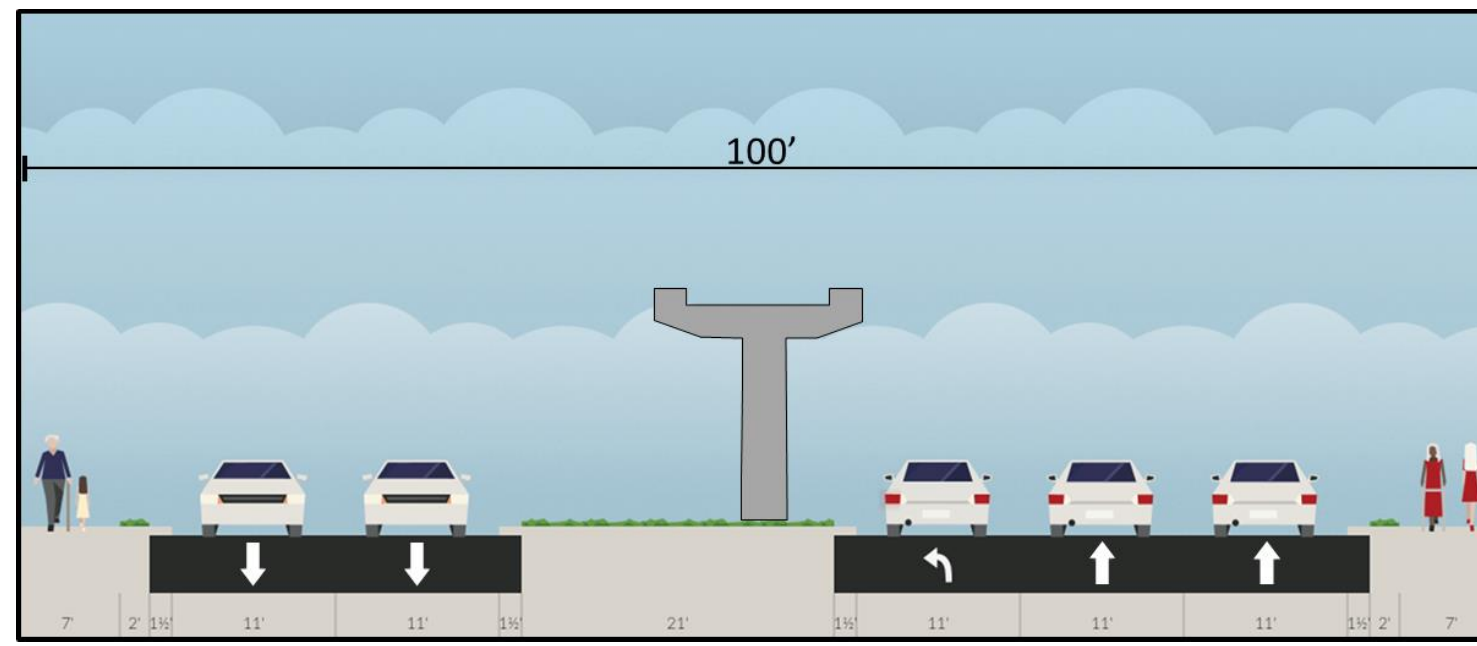
5.1.2 Existing Roadway Data

5.1.2.1 Typical Cross Sections

NW 27th Avenue/SR 9 has three distinct segments throughout the proposed BRT corridor: SR 112 to NW 79th Street, NW 79th Street to NW 103rd Street, and NW 103rd Street to NW 215th Street. The graphics in this section depict the typical cross sections for the three segments at mid-block locations. Note that the cross sections at intersections, and multiple mid-block locations, provide a left turn bay for turning vehicles.

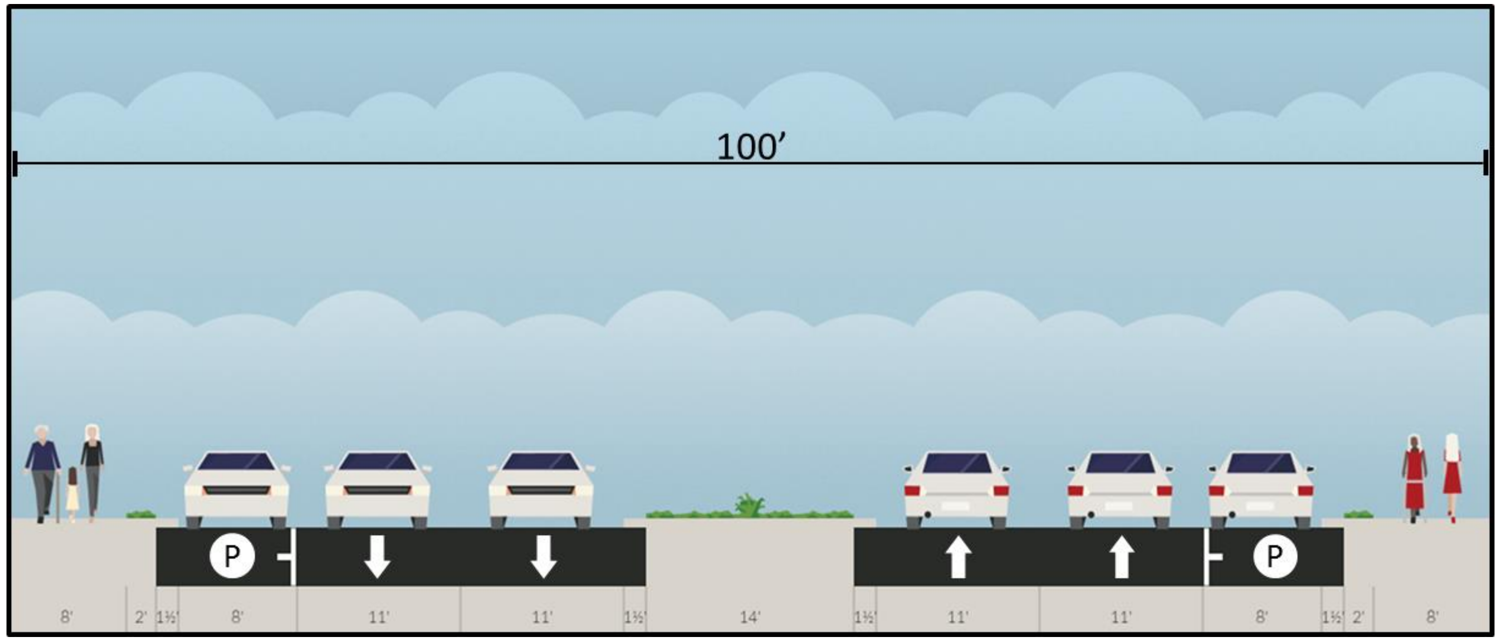
The southern-most segment (SR 112 to NW 79th Street) has two travel lanes in each direction. The Metrorail runs down the median while providing left turn bays at intersections and mid-block locations. There is no on-street parking, but this segment does feature 6-8' of sidewalks with a 1-2' grass buffer.

Figure 3 – NW 27th Avenue/SR 9 Typical Section (SR 112 to NW 79th Street)



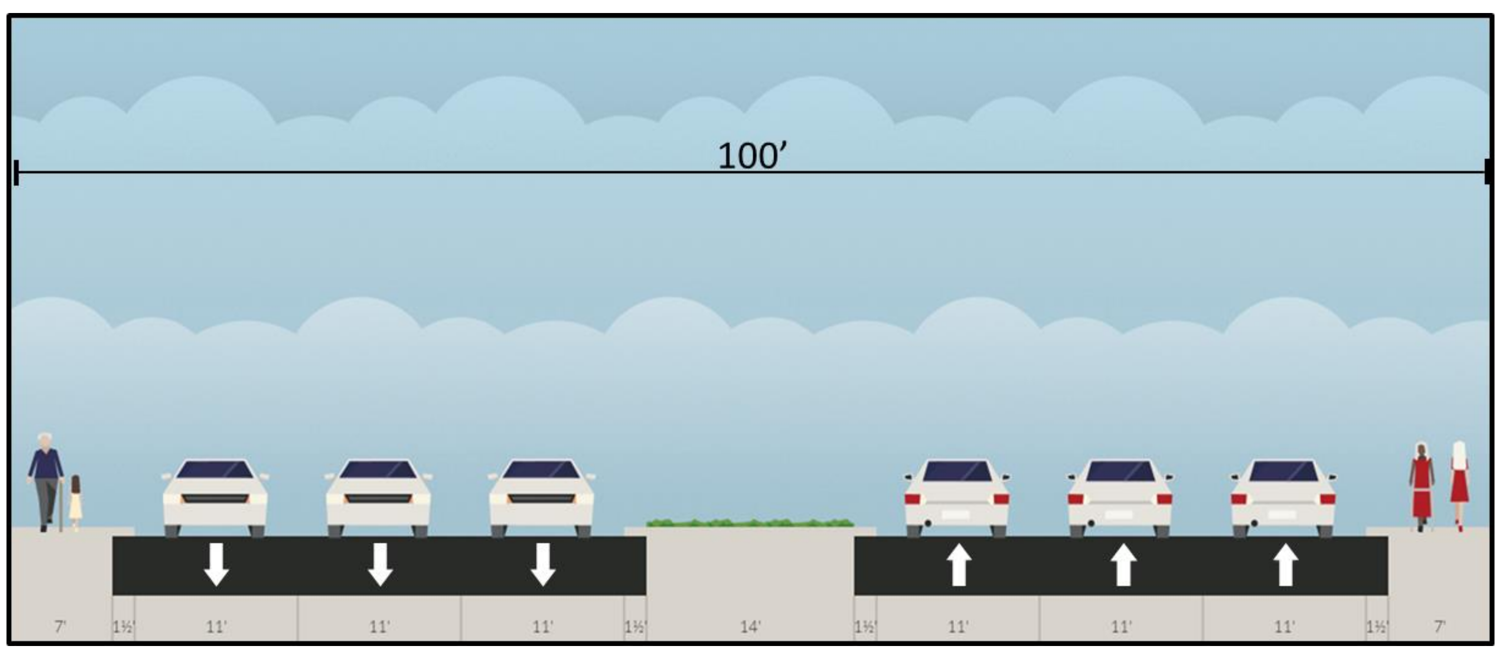
The middle segment (NW 79th Street to NW 103rd Street) also has two travel lanes in each direction. There is a 14' median that is fairly continuous with some left turn bays providing mid-block access. The key distinction in this segment is the on-street parking, which is provided on both sides of the road generally throughout. Sidewalk widths vary slightly between 6' to 8'.

Figure 4 – NW 27th Avenue/SR 9 Typical Section (NW 79th Street to NW 103rd Street)



The northern segment (NW 103rd Street to NW 215th Street) has three travel lanes in each direction, which is the key distinction of this segment. There is a fairly continuous 14’ median that provides mid-block access throughout. Sidewalk widths vary slightly between 6’ to 8’.

Figure 5 – NW 27th Avenue/SR 9 Typical Section (NW 103rd Street to NW 215th Street)



5.1.2.1 *Existing Roadway Characteristics*

The tables below detail the existing roadway characteristics such as Average Annual Daily Traffic (AADT), level of service (LOS), and right of way. The level of service was derived from the FDOT Generalized Level of Service Tables. The AADT are provided by FDOT and are from 2013.

Table 4: NW 27th Avenue/SR 9 Existing Roadway Characteristics

Limits	AADT	Lanes	Speed	LOS	Jurisdiction
NW 36 St to SR 112	34,500	6	35	D	State
SR 112 to NW 54 St	31,500	4	40	C	State
NW 54 St to NW 79 St	30,000	4	40	C	State
NW 79 St to NW 103 St	37,000	4	40	C	State
NW 103 St to NW 135 St	43,500	6	45	C	State
NW 135 St to NW 138 St	58,500	6	45	D	State
NW 138 St to SR 9	43,000	6	45	C	State
SR 9 to NW 151 St	35,000	6	35	D	State
NW 151 St to NW 167 St	48,000	6	45	C	State
NW 167 St to County Line	56,500	6	45	C	State

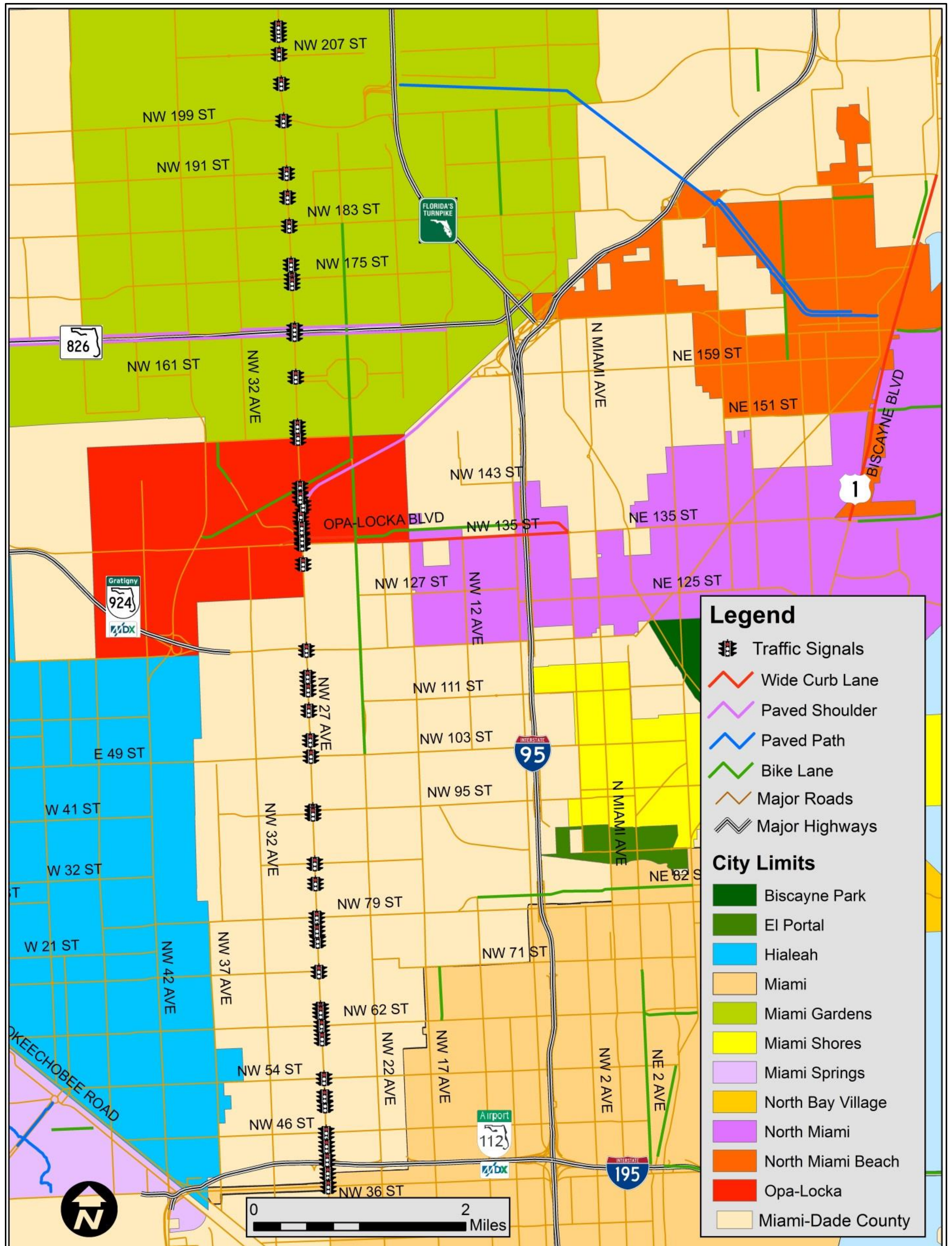
Table 5: NW 27th Avenue/SR 9 Existing Right of way

From	To	Total ROW (ft)
SR 112	79 St	100
79 St	106 St	100
106 St	108 St	100-130
108 St	117 St	130
117 St	119 St	111.75
119 St	135 St	100
135 St	Dunad Ave	100
Dunad Ave	151 St	100
151 St	163 St	100 , 175*
163 St	171 St	100
171 St	175 St	100, 135*
175 St	187 St	100
187 St	199 St	100
199 St	Snake Creek Canal	100-175
Snake Creek Canal	County Line	100

*Includes separator and the adjacent road

Figure 6 shows the locations for all of the signalized intersections and the nearby bicycle facilities. There are a total of 50 signalized intersections along the proposed NW 27th Avenue/SR 9 BRT corridor. There are no existing bicycle facilities along NW 27th Avenue/SR 9, although there are a few bicycle facilities that cross NW 27th Avenue/SR 9.

Figure 6 – NW 27th Avenue/SR 9 Signalized Intersections and Bicycle Facilities



5.1.3 Existing Land Use and Major Destinations

The majority of the existing land uses along the proposed BRT corridor are residential, both single family and multi-family residential. Higher density residential dwelling units are more common in the southern portion of the proposed BRT corridor, especially near the Metrorail. The Metrorail enters the corridor just south of NW 27th Street and is above the median along the entirety of the southern portion of the proposed BRT corridor.

One of the largest trip generators in the corridor is Miami-Dade Community College, whose campus is located at NW 112th Street. Sun Life Stadium is located just east of NW 27th Avenue/SR 9 near NW 207th Street, attracting a large number of trips during major sporting and entertainment events. There are strips of commercial and retail uses directly adjacent to NW 27th Avenue/SR 9, mostly at the intersections of major arterials.

5.2 West Flagler Street/SR 968

West Flagler Street/SR 968 is also a state owned and maintained roadway and a PTP corridor. There have been a number of previous MPO studies that included plans and concepts for a potential BRT service along West Flagler Street/SR 968 such as the Bus Rapid Transit Opportunities Study (2003), the Special Use Lane Study (2004), Short Term Transit Improvements Study (2009), and the Implementation Plan for Enhanced Bus Service along Flagler Street (2014). The recommended BRT corridor extends from the proposed transit terminal at FIU (SW 8th Street / SW 109th Avenue) to Government Center in downtown Miami via NW 107th Avenue (See Appendix D).

Miami-Dade County's 2040 LRTP has allocated funding for transit service improvements along West Flagler Street/SR 968. It references incremental enhanced bus service improvements between FIU and downtown ($15 million – which plans to be funded via MDT system efficiencies). This project is considered priority I, which means that these improvements are programmed to be implemented within the next five years and is also included in the most recent TIP. There is also mention of a project converting the full BRT to light rail ($336.7 million), which doesn't have any funding currently identified, and therefore is considered unfunded.

5.2.1 Existing Transit

There are two existing transit routes that provide service along West Flagler Street, Route 11 and Route 51. Route 51 is a limited-stop service while Route 11 provides local bus service. Route 11 has two route variations – the shorter alignment has a western terminal at the Mall of Americas at NW 79th Avenue, while the longer alignment has a western terminal at the FIU campus near SW 107th Avenue. In addition, there are twelve existing MDT bus routes that cross W Flagler Street that provide potential transfer opportunities. A park-and-ride lot is proposed at SW 109th Avenue and SW 8th Street on the FIU Campus, and will act as the western terminal for the proposed Flagler BRT service. There are no existing park-and-ride lots within the proposed BRT corridor.

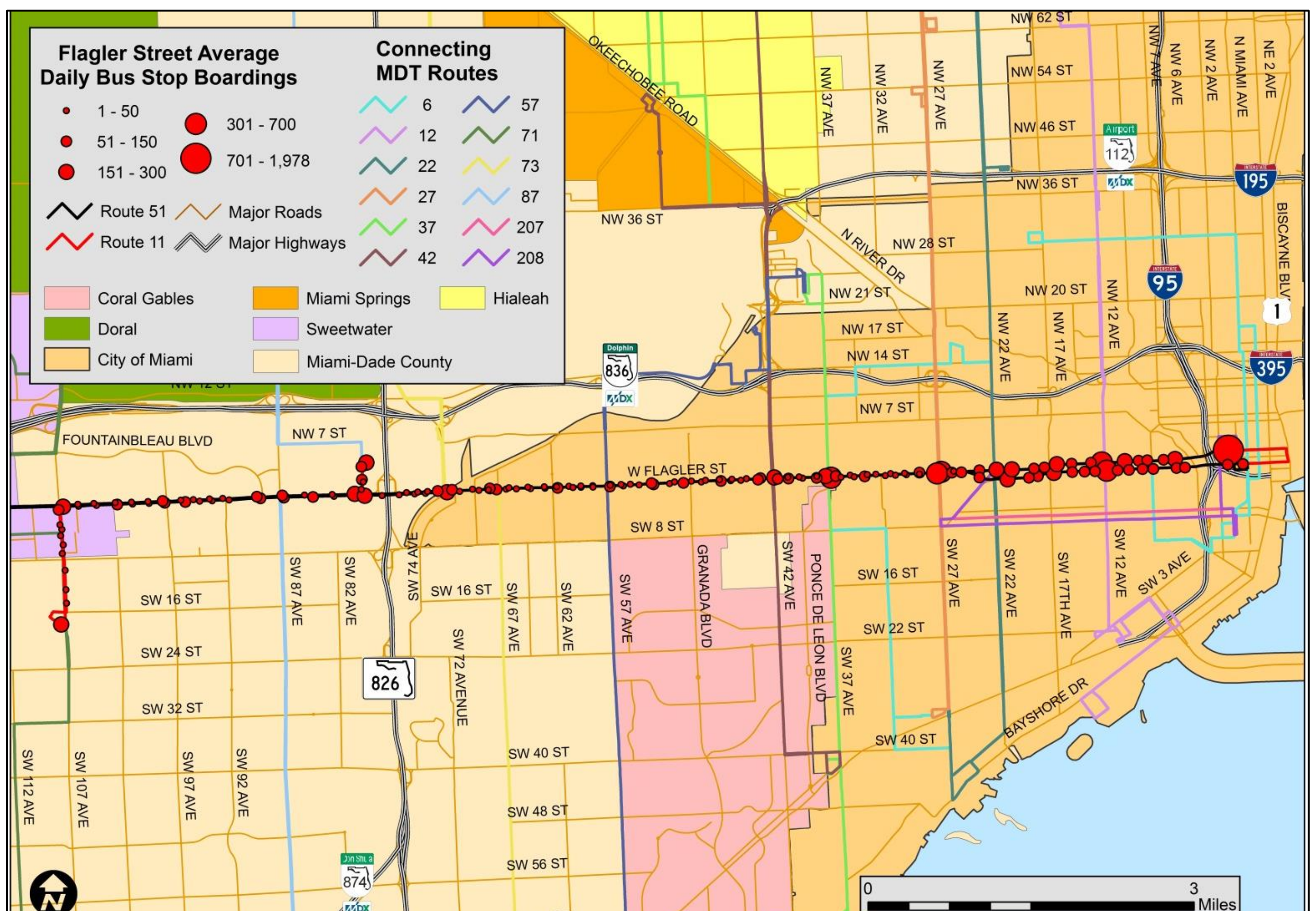
The existing characteristics for Routes 11 and 51 are listed in the table below. Because the BRT corridor nearly mimics Route 11 (long), nearly all of the average daily boardings occur within the proposed BRT corridor.

Table 6: West Flagler Street/SR 968 Existing Transit Service Characteristics

Route	Roundtrip Length (miles)	Length within BRT corridor	Travel Time (minutes)	Avg. Travel Speed (mph)	Average Daily Ridership	Avg. Daily Ridership within BRT corridor	Peak Hour Headways (minutes)	Service Hours
11 -short	16.8	15.5	130	8	12,210	11,825	15	24
11-long	25.5	25.5	210	8	12,210	11,825	15	24
51	34.7	25.5	190	11.6	3,424	2,500	10	15

There are a total of 156 bus stops within the proposed Flagler Street BRT corridor, which are displayed in Figure 7. The average number of boardings for all the stops is approximately 82 passengers per day, which is slightly skewed mostly due to the number of boardings at Government Center. Stops with the highest boardings include the Government Center, 12th Avenue, and 27th Avenue stops with 1,978, 629, and 451 average daily boardings respectively.

Figure 7 – West Flagler Street/SR 968 Transit Ridership



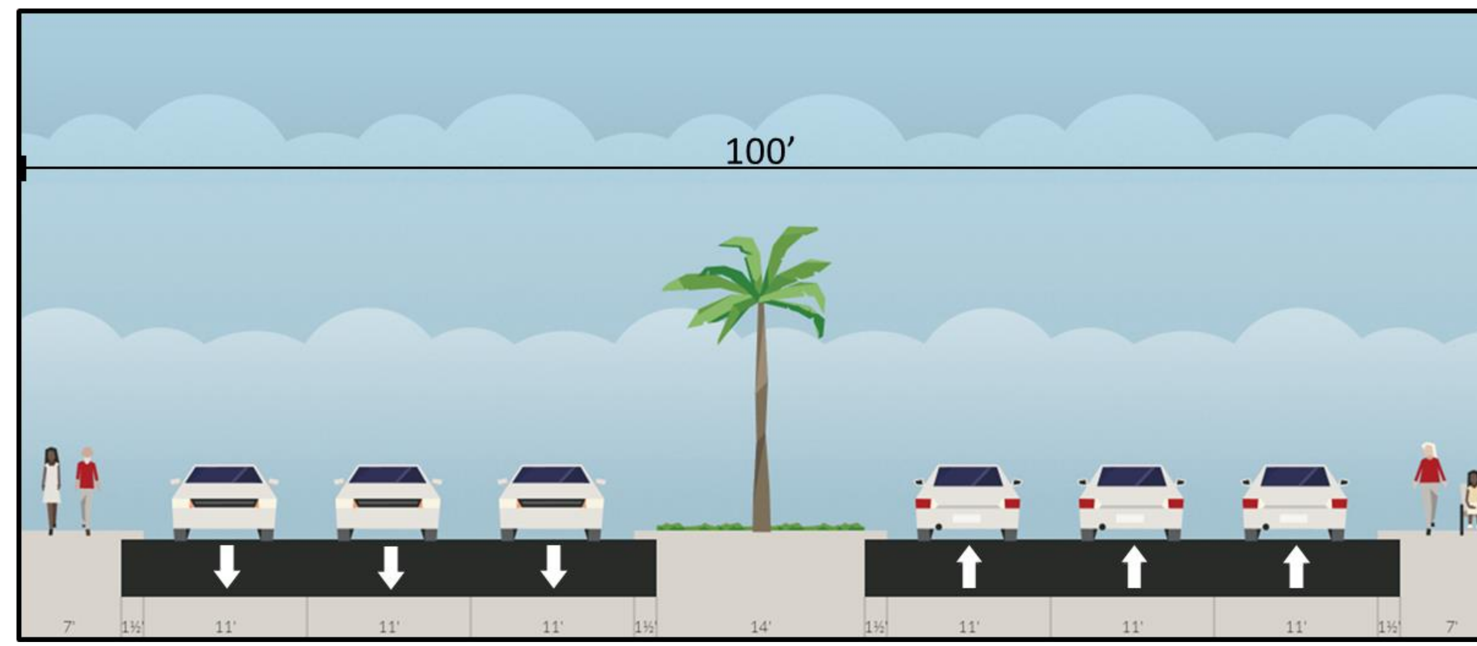
5.2.2 Existing Roadway Data

5.2.2.1 Typical Sections

Flagler Street has three distinct segments throughout the proposed BRT corridor: 107th Avenue to 72nd Avenue, 72nd Avenue to 24th Avenue, and 24th Avenue to I-95. The graphics in this section depict the typical cross sections for the three segments at mid-block locations. Note that the cross sections at intersections, and multiple mid-block locations, provide a left turn bay for turning vehicles.

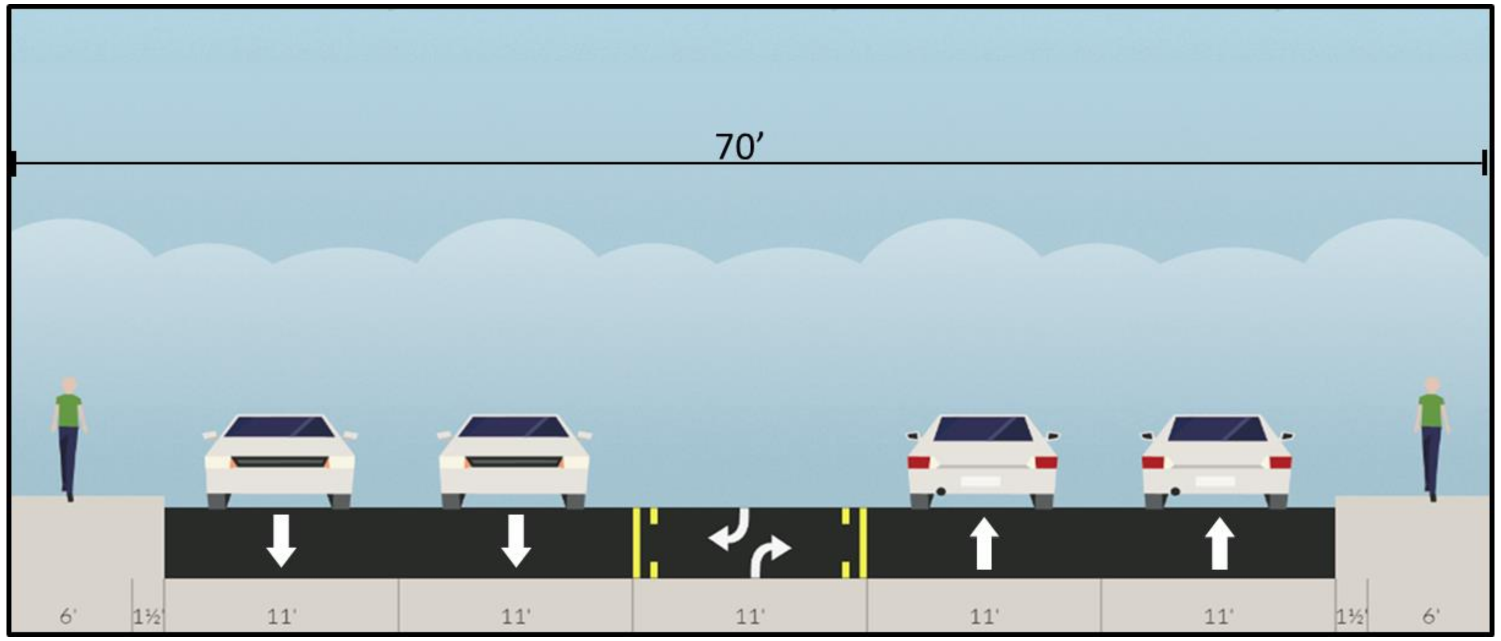
The western segment (107th Avenue to 72nd Avenue) has three travel lanes in each direction and features protected left turn lanes at signalized intersections. There is no on-street parking, but this segment does feature sidewalks that vary from 6' to 8' throughout with frequent business and driveway access.

Figure 8 – West Flagler Street/SR 968 Typical Section (107th Avenue – 72nd Avenue)



The middle segment (72nd Avenue to 24th Avenue) has two travel lanes in each direction with a dual left turn lane in the center and isolated islands for access control. There is also occasional on-street parking between 42nd Avenue and 30th Avenue. Sidewalks in the middle segment vary from 4' to-8' throughout.

Figure 9 – West Flager Street Typical Section (72nd Avenue – 24th Avenue)



The eastern segment (24th Avenue to I-95) features a one-way pair with SW 1st Street. Both streets vary in the number of travel lanes and right of way. W Flagler Street is only a one-way street from W 24th Avenue to W 12th Avenue. Between W 12th Avenue and the Miami River, W Flagler Street has three westbound travel lanes and one eastbound travel lane. On-street parking is on both sides of the road (for W Flagler Street and SW 1st Street) with generally wider sidewalks throughout.

Figure 10 – SW 1st Street Typical Section (SW 24th Avenue – SW 17th Avenue)

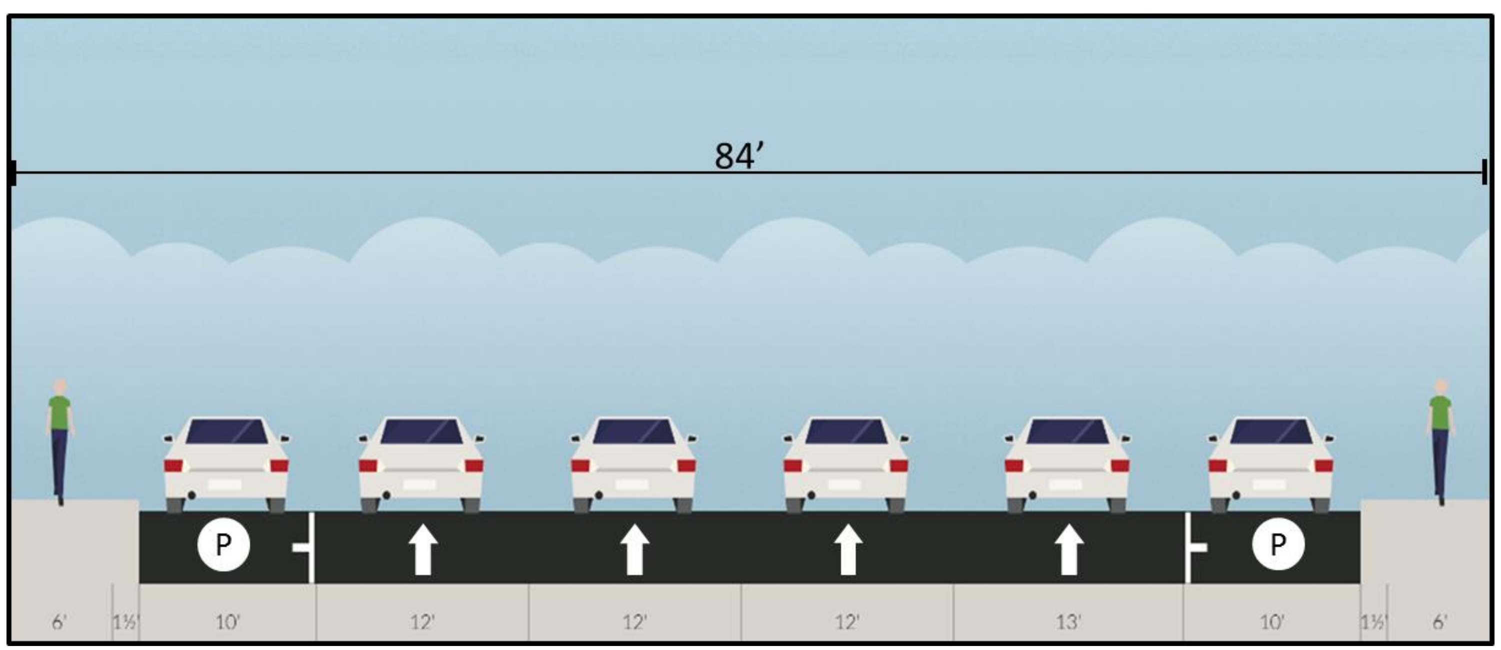


Figure 11 – SW 1st Street Typical Section (SW 17th Avenue – Miami River) and W Flagler Street Typical Section (24th Avenue – 12th Avenue)

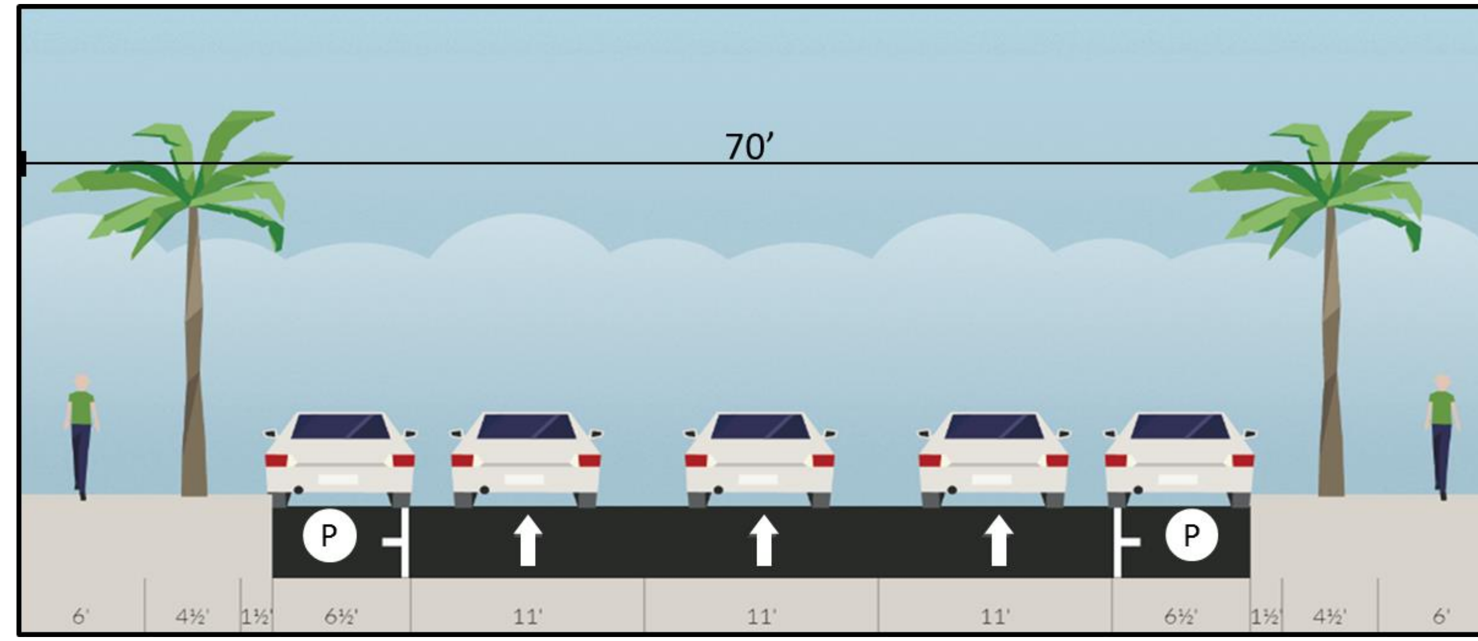
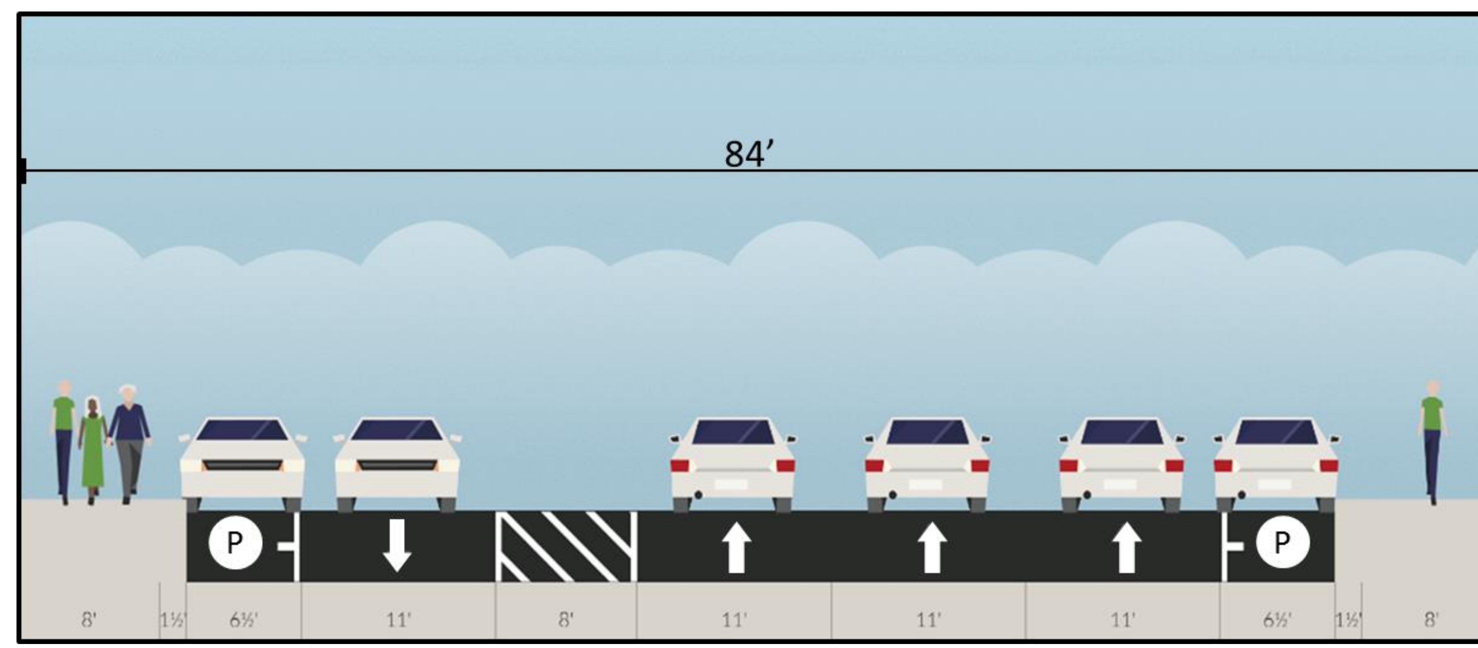


Figure 12 – West Flagler Street/SR 968 Typical Section (12th Avenue – Miami River)



5.2.2.2 Existing Roadway Characteristics

The tables below detail the existing roadway characteristics such as Average Annual Daily Traffic (AADT), level of service (LOS), and right of way within the proposed BRT corridor limits. The AADT are provided by FDOT and are from 2013.

Table 7: West Flagler Street/SR 968 Existing Roadway Characteristics

Limits	AADT	Lanes	Speed	LOS	Jurisdiction
West of 107 Ave to 107 Ave	25,500	6	40	C	State
107 Ave to 97 Ave	35,000	6	40	C	State
97 Ave to 87 Ave	48,500	6	40	C	State
87 Ave to 72 Ave	53,000	6	40	F	State
72 Ave to 42 Ave	33,000	4	40	C	State
42 Ave to 36 Ave	36,500	4	40	C	State
36 Ave to 27 Ave	32,500	4	40	C	State
27 Ave to 17 Ave	22,500	4	30	D	State
17 Ave to 8 Ave	14,500	3	30	D	State

Table 8: West Flagler Street Existing Right of way

Flagler Street		
From	**To**	**Total ROW (FT)**
107 Ave	102 Ave	95
102 Ave	93 Block	100
93 Block	92 Ave	115
92 Ave	87 Ave	105-135
87 Ave	82 Ave	100
82 Ave	78 Pl	100
78 Pl	77 Ave	130
77 Ave	76 Ave	130
76 Ave	Tamiami Canal Rd	97.5
Tamiami Canal Rd	CSX RR	81
CSX RR	FEC RR	85
FEC RR	60 Ct	70
60 Ct	60 Ave	85
60 Ave	43 Ave	70
43 Ave	42 Ave	85
42 Ave	40 Ave	70
40 Ave	37 Ave	85
37 Ave	27 Ave	70
27 Ave	24 Ave	70
24 Ave	22 Ave	70
22 Ave	17 Ave	65-70
17 Ave	12 Ave	70
12 Ave	10 Ave	80-90
10 Ave	6 Ave	70-90

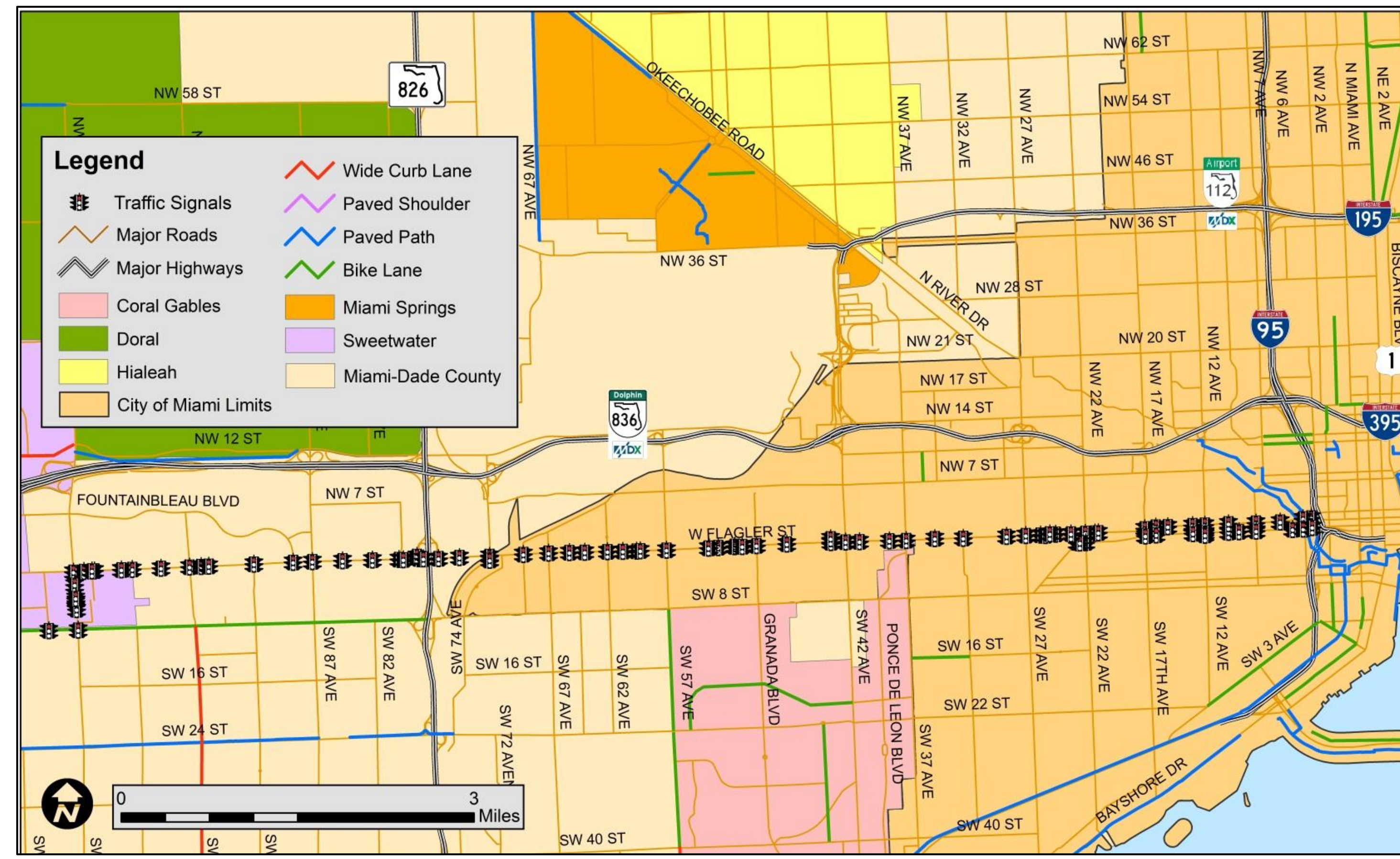
SW 1st Street		
From	**To**	**Total ROW**
17 Ave	12 Ave	60-70
12 Ave	6 Ave	55-70
6 Ave	2 Ave	55-72.50

There are a total of 84 signalized intersections along the proposed West Flagler BRT corridor, which includes the signals along SW 107th Avenue and SW 8th Street leading to the FIU bus terminal, as well as the signals along SW 1st Street. Not included in this count are the traffic signals east of the Miami River.

There are no existing bicycle facilities along West Flagler Street, although there are a few bicycle facilities that are nearby, such as the Miami River Greenway paths.

The figure below shows the locations of the signalized intersections and the nearby bicycle facilities.

Figure 13 – West Flagler Street/SR 968 Signalized Intersections



5.2.3   Existing Land Use and Major Destinations

The majority of the existing land uses directly adjacent to the proposed BRT corridor are commercial and retail uses. W Flagler Street also has a large amount of single family and multi-family residential uses that would be served by this proposed BRT service. The corridor is anchored on either end by two major destinations: Florida International University (FIU) on the western end and downtown Miami on the eastern end.

5.3 Kendall Drive/SR 94

Kendall Drive/SR 94 is a state owned and maintained roadway and is considered a PTP corridor. There have been a number of previous MPO studies that included plans and concepts for a potential BRT service along Kendall Drive/SR 94 such as the Kendall Drive/SR 94 Mobility Enhancement Study (2002), the Bus Rapid Transit Opportunities Study (2003), the Special Use Lane Study (2004), the Kendall-Link Alternative Analysis Study (2005), and the Short Term Transit Improvements Study (2009). The recommended BRT corridor extends from the existing park and ride / transit terminal at SW 162nd Avenue to the Dadeland South Metrorail Station (See Appendix G).

Miami-Dade County's 2040 LRTP has allocated funding for transit service improvements along Kendall Drive/SR 94. It references a park-and-ride lot with 160 spaces at SW 127th Avenue ($741,000) as a priority I project, which means that this park-and-ride lot is also in the most recent TIP. According to the latest Transit Development Plan (TDP), the park-and-ride lot at SW 127th Avenue is planned to be implemented by February 2017. The LRTP also mentions funding for incremental enhanced bus service improvements between SW 162nd Avenue and the Dadeland North Metrorail Station ($11.9 million – which plans to be funded via MDT system efficiencies).This improvement is considered a priority II project, which is planned between 2021 and 2025. There is also mention of a full BRT project for the Kendall Corridor ($286 million), which doesn't have any funding currently identified, and therefore is considered unfunded.

5.3.1 Existing Transit

There are two existing transit routes that provide service along Kendall Drive/SR 94, Route 88 and Route 288. Route 288 is a limited-stop service while Route 88 provides local bus service. In addition, there are four existing MDT bus routes that cross Kendall Drive/SR 94 that provide potential transfer opportunities. There are two existing park-and-ride lots within the proposed BRT corridor which are located at SW 162nd Avenue and SW 150th Avenue.

The existing characteristics for Routes 88 and 288 are listed in the table below. Because the BRT corridor nearly mimics both routes, nearly all of the average daily boardings occur within the proposed BRT corridor.

Table 9: Kendall Drive/SR 94 Existing Transit Service Characteristics

Route	Roundtrip Length (miles)	Length within BRT corridor	Travel Time (minutes)	Avg. Travel Speed (mph)	Average Daily Ridership	Avg. Daily Ridership within BRT corridor	Peak Hour Headways (minutes)	Service Hours
88	22.5	18	150	12	2,905	2,655	20	19
288	23.3	18	100	17.5	1,275	1,250	10	7

There are 92 bus stops within the proposed Kendall Drive/SR 94 BRT corridor, as seen in Figure 14. The average number of boardings for all the stops is about 42 passengers per day, which is skewed due to the boardings at the Dadeland South Metrorail Station. Stops with the most boardings include the Dadeland South Metrorail Station, SW 162nd Avenue, and SW 107th Avenue stops with 1,250; 230; and 212 average daily boardings, respectively.

Figure 14 – Kendall Drive/SR 94 Transit Ridership

5.3.2 Existing Roadway Data

5.3.2.1 Typical Sections

The typical section along, Kendall Drive/SR 94 varies slightly throughout the proposed BRT corridor. The entire corridor, except a segment in the middle, has three travel lanes in each direction. The middle segment has four travel lanes in each direction. There is a continuous 16' raised median throughout the entire corridor with left turn lanes at intersections and mid-block locations . Most of the section-line roads feature dual left-turn lanes, while all signalized intersections have protected left turns. There is no on-street parking anywhere along the corridor. Sidewalks vary throughout and typically range from 6'-8' in width.

The typical cross sections below depict the mid-block locations' for the outer segments and the intersection typical cross section for the middle segment.

Figure 15 – Kendall Drive/SR 94Typical Section
(SW 162nd Avenue – SW 127th Avenue; SW 124th Avenue – US-1)

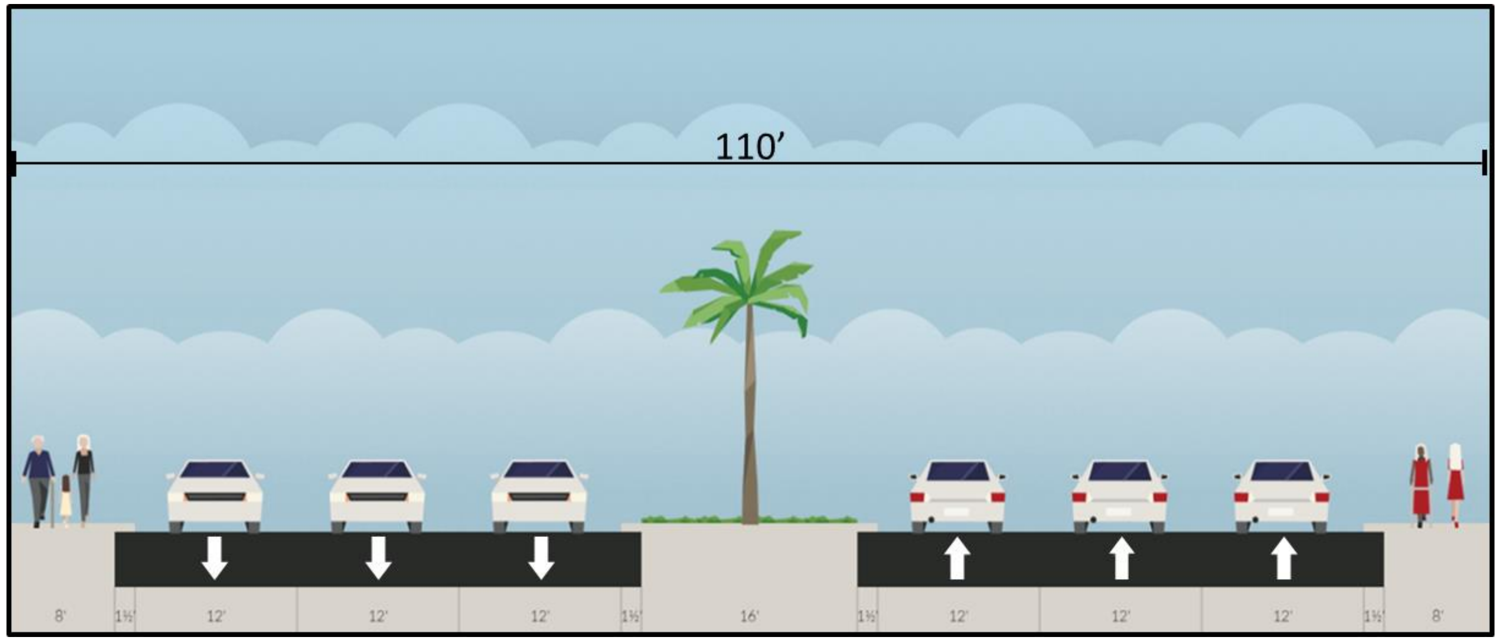
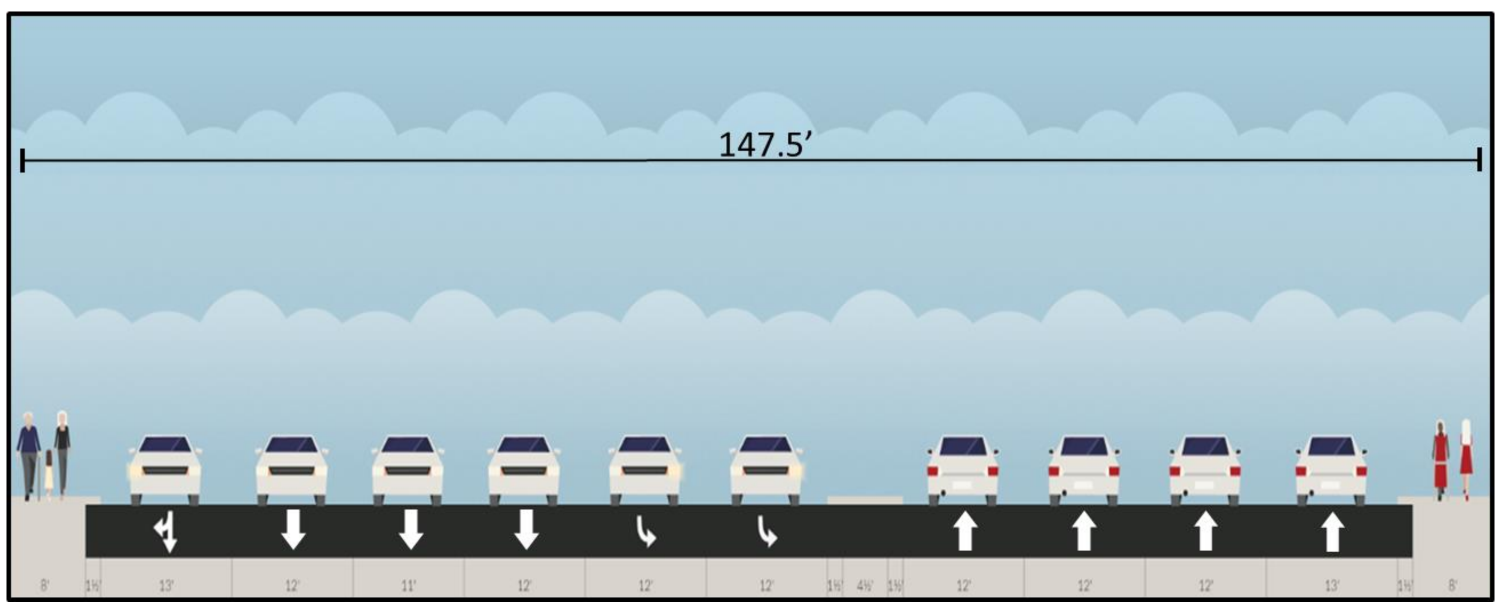


Figure 16 –Kendall Drive/SR 94 Typical Section (SW 127th Avenue – SW 124th Avenue)



5.3.2.2 Existing Roadway Characteristics

The tables below detail the existing roadway characteristics such as Average Annual Daily Traffic (AADT), level of service (LOS), and right of way. The level of service was derived from the FDOT Generalized Level of Service Tables. The AADT are provided by FDOT and are from 2013.

Table 10: Kendall Drive/SR 94 Existing Roadway Characteristics

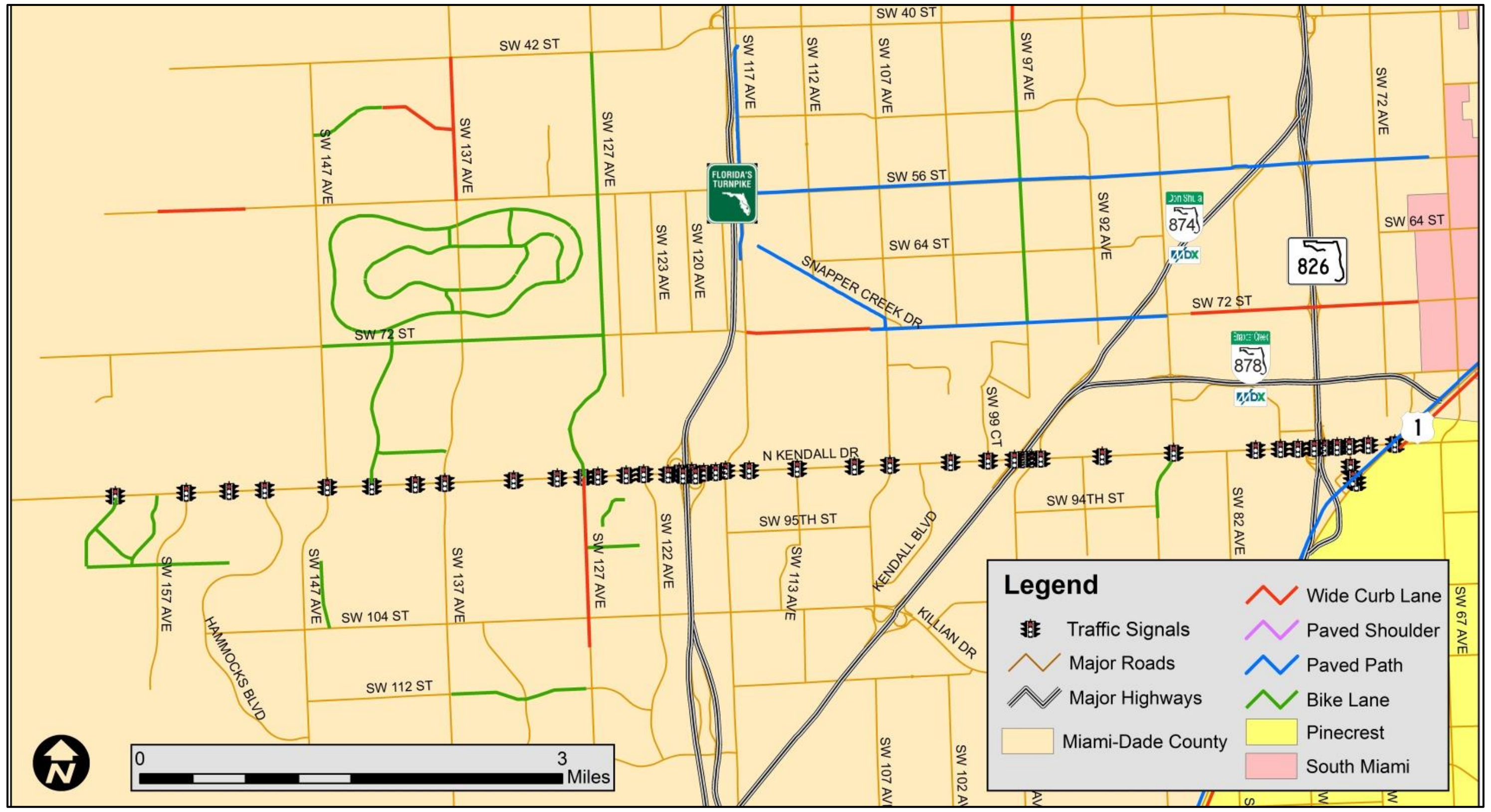
Limits	AADT	Lanes	Speed	LOS	Jurisdiction
SW 162 Ave to SW 157 Ave	39,000	6	45	C	State
SW 157 Ave to SW 147 Ave	53,500	6	45	C	State
SW 147 Ave to SW 137 Ave	72,500	6	45	F	State
SW 137 Ave to SW 127 Ave	82,000	8	45	F	State
SW 127 Ave to SW 110 Ave	64,500	6	45	F	State
SW 110 Ave to SW 103 Ave	60,500	6	45	F	State
SW 103 Ave to SW 91 Ave	49,665	6	45	F	State
SW 91 Ave to SW 87 Ave	52,000	6	45	F	State
SW 87 Ave to SW 79 Ave	59,000	6	45	F	State
SW 79 Ave to Dadeland Blvd	44,500	6	45	F	State

Table 11: Kendall Drive/SR 94 Existing Right of way

From	To	Total ROW (ft)
Krome	SW 139 Ave	110
SW 139 Ave	Canal	136.5
Canal	SW 127 Ave	110
SW 127 Ave	SW 125 Ave	147.5
SW 125 Ave	SW 124 Ave	136.5
SW 124 Ave	West of HEFT	140.82
East of HEFT	SW 117 Ave	110
SW 117 Ave	SW 103 Ave	110
SW 103 Ave	SW 101 Ave	145
SW 101 Ave	SW 94 Ave	110
SW 94 Ave	SW 87th Ave	130
SW 87th Ave	West of SR 826	105
East of SR 826	SW 72 Ave	106

There are a total of 44 signalized intersections along the proposed Kendall Drive/SR 94 BRT corridor, including along Dadeland Boulevard. There are no existing bicycle facilities along Kendall Drive/SR 94, although there are a few bicycle facilities that are nearby or cross Kendall Drive/SR 94. Figure 17 shows the locations for the signalized intersections and the nearby bicycle facilities.

Figure 17 – Kendall Drive/SR 94 Signalized Intersections



5.3.3 Existing Land Use and Major Destinations

The majority of the existing land uses within the proposed BRT corridor are residential with nodes of commercial uses at the major intersections, with higher densities of both residential and commercial uses in the eastern portions of the corridor. There are also some vacant or underutilized properties within the corridor, more prevalent in the western portions. This corridor has four intersecting, major highways (the Turnpike, SR 874, SR 826, and US 1) that have clusters of dense commercial and residential uses. The Dadeland area near SR 826 and US1 (where the Metrorail terminates) is located at the eastern end of the proposed BRT corridor.

5.4 Douglas Road

Douglas Road is the only County owned and maintained roadway of the four corridors in this study. It has also been identified as a PTP corridor. There have been a number of previous MPO studies that included plans and concepts for a potential BRT service along Douglas Road such as the Bus Rapid Transit Opportunities Study (2003), Short Term Transit Improvements Study (2009), and the Douglas Road Transit Corridor Study (2013). The recommended BRT corridor extends from the Coconut Grove Metrorail Station to the MIC (See Appendix J).

Miami-Dade County's 2040 LRTP has allocated funding for transit service improvements along Douglas Road. It references incremental 'Enhanced Bus Service' improvements ($17.8 million – which plans to be funded via MDT system efficiencies). These improvements are considered a priority II project, meaning implementation is planned between 2021 and 2025. The LRTP also goes on to mention funding for 'Full BRT' with dedicated lanes from the MIC to US 1 ($166.4 million). This improvement is considered a 'partially-funded' project, because a portion of the funding has been set aside.

5.4.1 Existing Transit

Route 37 provides local bus service and is the only existing transit route along Douglas Road. In addition, there are nine existing MDT bus routes that cross Douglas Road that provide potential transfer opportunities. There are no existing or proposed park-and-ride lots within the BRT corridor.

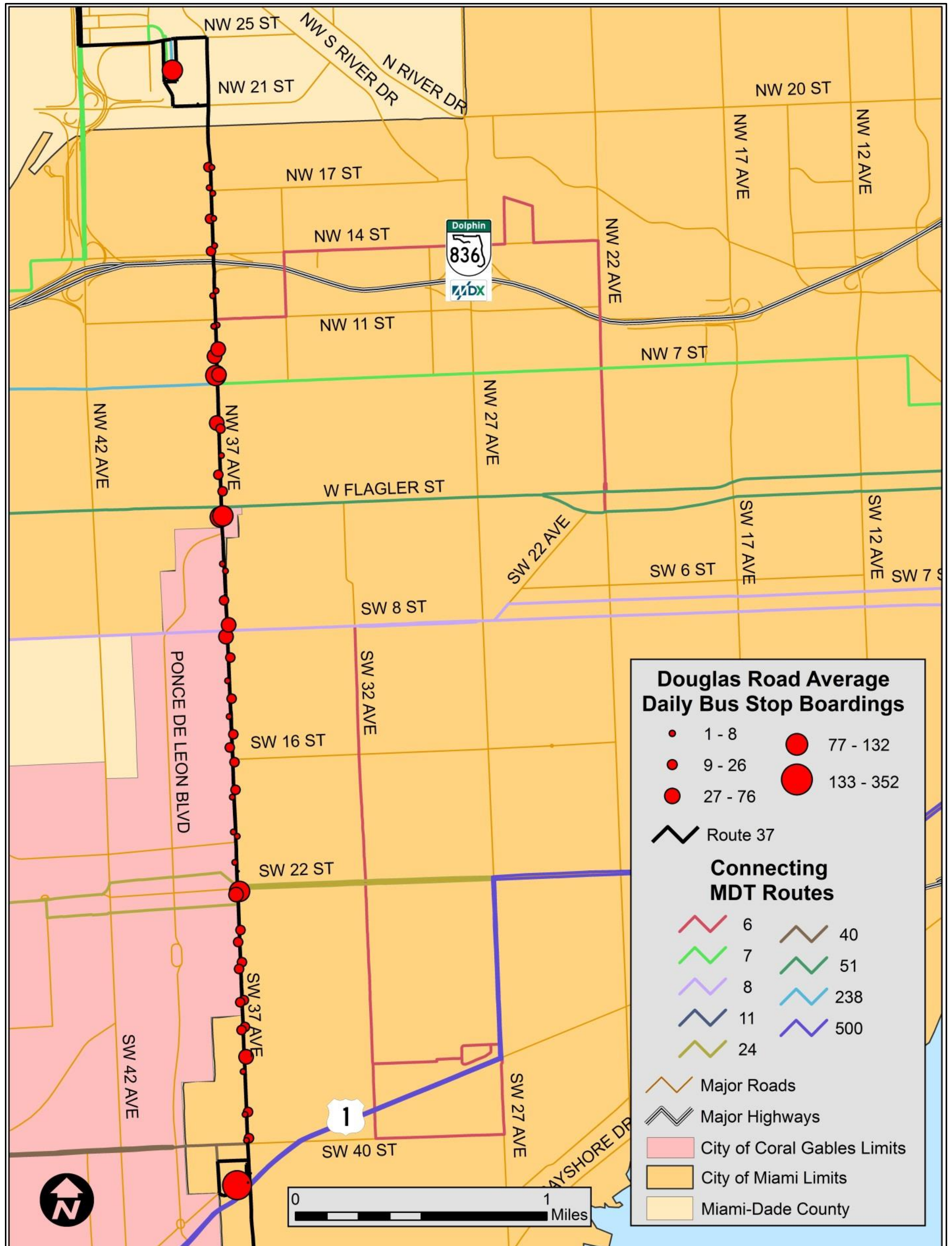
The existing characteristics for Route 37 are listed in the table below. Note that the proposed BRT corridor is only a fraction of the existing alignment, but nearly half of the existing ridership boards within the proposed BRT corridor.

Table 12: Douglas Road Existing Transit Service Characteristics

Route	Roundtrip Length (miles)	Length within BRT corridor	Travel Time (minutes)	Avg. Travel Speed (mph)	Average Daily Ridership	Avg. Daily Ridership within BRT corridor	Peak Hour Headways (minutes)	Service Hours
37	40.1	8.8	300	8	4,174	1,941	30	19

There are a total of 63 bus stops within the proposed Douglas Road BRT corridor, which are displayed in Figure 18. The average number of boardings for all the stops is approximately 30 passengers per day. Stops with the highest boardings include the Douglas Road Metrorail Station, the MIC, and W Flagler Street stops with 352, 132, and 124 average daily boardings respectively.

Figure 18 – Douglas Road Transit Ridership

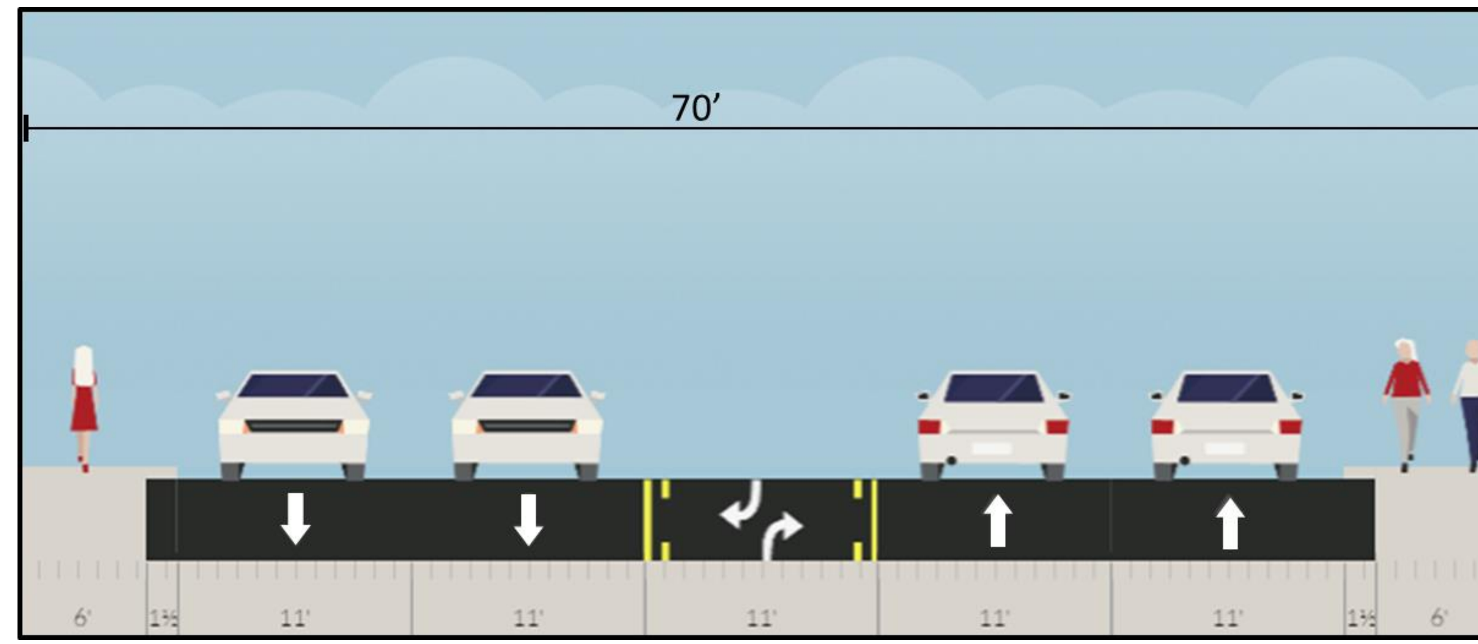


5.4.2 Existing Roadway Data

5.4.2.1 Typical Sections

In terms of the existing typical section, there is little to no variation along the proposed BRT corridor. There are two travel lanes in each direction with a continuous left-turn lane throughout. There are very frequent curb cuts to serve commercial and residential land uses. The sidewalks are generally set back from the curb in the residential areas and range from 5' to-8' throughout the corridor. Figure 19 depicts the mid-block location for the proposed BRT corridor. Note left turn lanes are provided at intersections

Figure 19 –Douglas Road Typical Section (NW 25th Street – US-1)



5.4.2.2 Existing Roadway Characteristics

Table 13 details the existing roadway characteristics such as Average Annual Daily Traffic (AADT), level of service (LOS), and right of way. The AADT are provided by FDOT and are from 2013.

Table 13: Douglas Road Existing Roadway Characteristics

Limits	AADT	Lanes	Speed	LOS	Jurisdiction
US 1 to SW 8 St	15,600	4	40	C	Non-State
SW 8 St to SR 836	17,200	4	40	C	Non-State
SR 836 to NW 21 St	19,500	4	40	C	Non-State

Table 14: Douglas Road Existing Right of way

From	To	Total ROW (ft)
NW 25 St	US-1	70

There are 25 signalized intersections along the proposed Douglas Road BRT corridor, including along NW 25th Street near the MIC. There are no existing bicycle facilities along Douglas Road, although there are a few bicycle facilities that are nearby or cross Douglas Road such as the M-Path near US-1. Figure 20 shows the locations for all of these signalized intersections and the nearby bicycle facilities.

Figure 20 – Douglas Road Signalized Intersections

5.4.3 Existing Land Use and Major Destinations

Besides the clusters of commercial land uses at NW 7th , West Flagler, SW 8th, and SW 22nd Streets, the majority of the existing land uses within the proposed BRT corridor are residential. The areas with the higher residential densities are southern segments of the corridor. This corridor is parallel to Ponce de Leon Boulevard and within Coral Gables, which is a major destination in Miami-Dade County dominated by a large cluster of commercial land uses. The northern termini of the proposed corridor is the Miami Intermodal Center, with several intermixed modes of travel including other bus routes, the Metrorail, Tri-Rail, Amtrak, and Greyhound. The southern termini of the proposed corridor is the Coconut Grove Metrorail Station.

6.0 Bus Rapid Transit Bus lane Alignment Design Options

The cumulative impact of packaging multiple BRT elements together is the key to a fully integrated rapid transit system. As was covered in Section 3.2, there are essential BRT elements that make up the BRT service. All of these elements should be carefully considered to be incorporated into Miami-Dade County's future BRT system depending on corridor context and funding availability.

Many bus lane alignment designs were considered as a part of this study, which included transit station locations and other roadway infrastructure improvements. These options were presented to the Study Advisory Committee for their input and comments in order to craft the proposed recommendations for each corridor. This section is meant to illustrate the many design options that were considered and ultimately used for the recommended BRT plan in Section 7.

Two general types of bus lanes were considered as a part of this study: median/left lane alignment and curbside alignment. The median alignment was combined with the left lane alignment because they share many characteristics, such as station placement, left-turning vehicle considerations, and impacts to traffic flow during construction/implementation. The median alignment featured different designs based on station design and location within the bus lane.

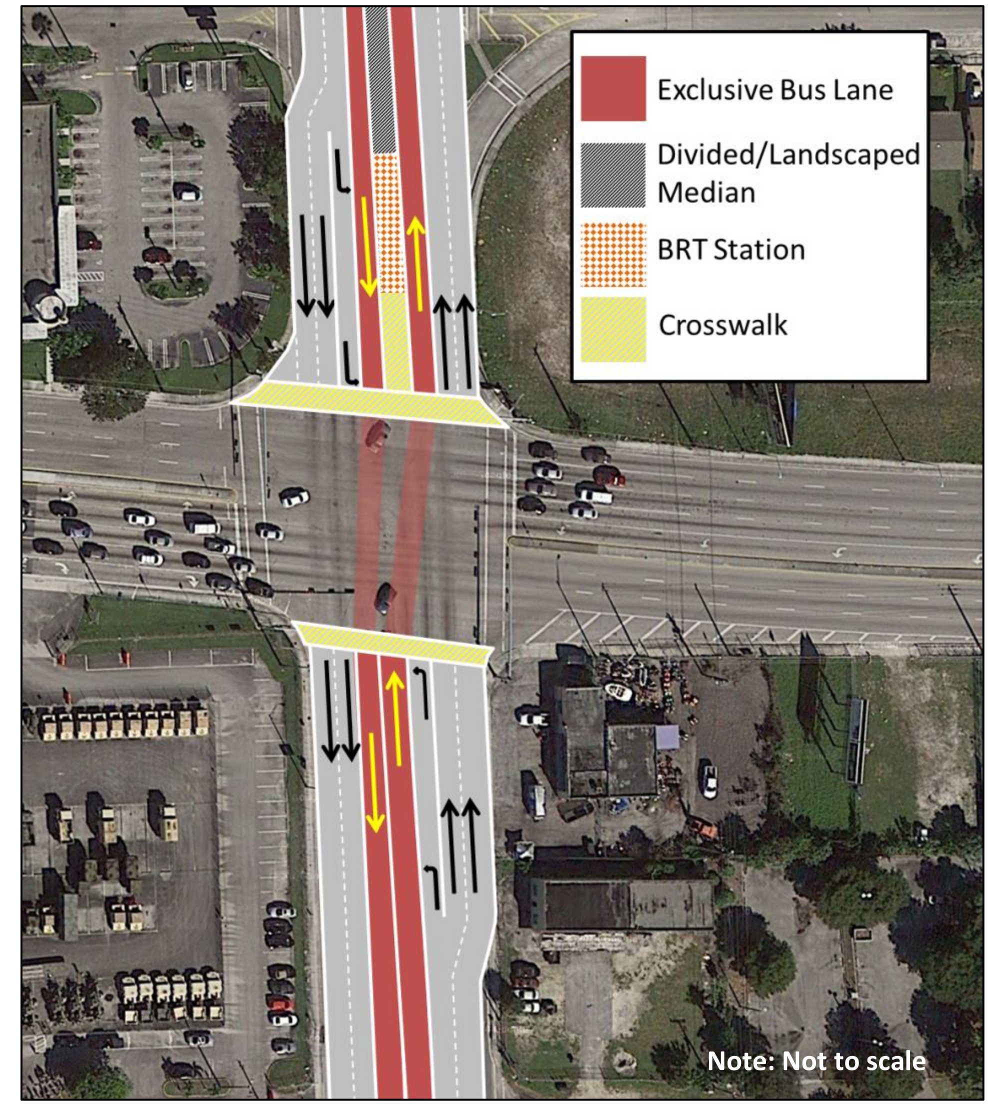
A reversible lane bus lane option was also originally considered, but was not further analyzed because of operational and logistical constraints, as well as from lessons learned from other systems (EmX in Eugene, Oregon). The reversible lane is typically used only for the BRT vehicle in the peak direction, while the trip in the off-peak direction uses mixed-traffic lanes. Because of this condition, the off-peak direction vehicle would rarely be able to maintain its headways resulting in an overall unreliable service. Therefore, reversible lanes were not considered for potential alignments for bus lanes in this study.

6.1.1 Median Bus Lanes with Center Platforms

This design option features a dedicated bus lane in each direction located either within the median or by repurposing the existing left lane. This design offers a transit station that is shared by each direction of travel. The transit station is set back slightly from the intersection to allow for buses to stage without blocking the intersection, and has a curb extension from the crosswalk to the transit station.

The transit vehicles would be required to have left-side doors for boarding because of the station locations. The bus lane is also located on the inside of the left turn bay. As a result, the alignment across the intersection is skewed for the transit vehicles, and in addition, the left turning vehicles would be turning in front of the bus lane. These left turning vehicles would require a separate phase in the signal cycle to avoid conflicts with the BRT vehicles, thus adding to the total cycle time and the time vehicles spend at the intersection. For congested corridors, stations in the median are located in the middle of traffic and can be uncomfortable for passengers due to the weather/pavement heat and isolates passengers from accessing any retail or services quickly without crossing the street.

Figure 21 – Median Bus lane Alignment Option #1

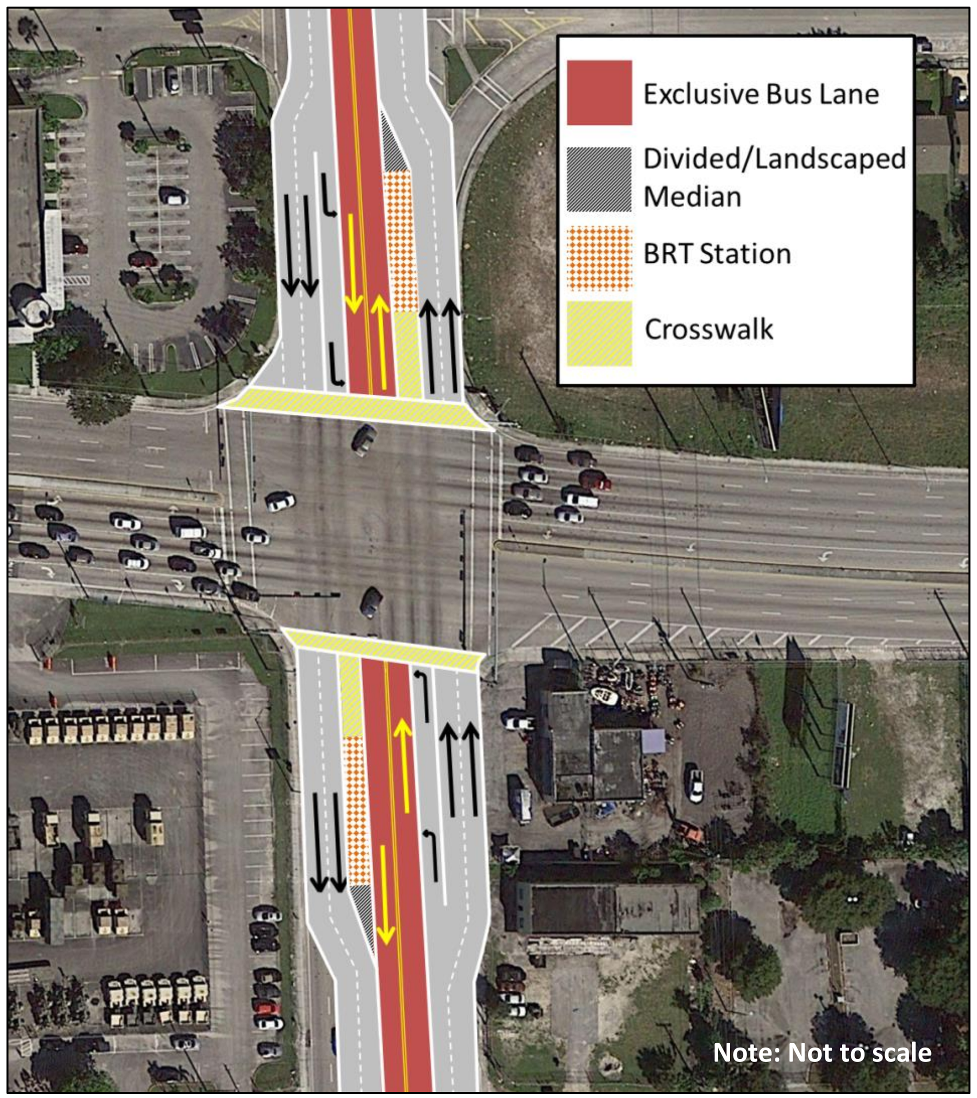


6.1.2 Median Bus Lanes with Side Platforms

This design option also features a dedicated bus lane in each direction located either within the median or by repurposing the existing left lane. The key difference in this option, as compared to the previous median-running option, is the location of the transit station. Not only does each direction of travel get its own transit station in Option #2, but the stations are located on the right side of the bus lane, thereby allowing traditional right-door boarding vehicles to be used. The alignment of the bus lanes across the intersection is not skewed, giving Option #2 another advantage over Option #1. These transit stations are located on the far-side of the intersection and feature crosswalks leading in and out of the station area. Costs associated with stations are higher with this option because two individual stations are needed. This option poses the same inconveniences on passengers by making them wait in the median as the previous median-running option.

The design and operational issues associated with the left-turning vehicles is still an issue with Option #2. A separate phase in the signal cycle would still be required to avoid conflicts between automobiles and BRT vehicles, which adds time to the total cycle length and the time vehicles spend at the intersection.

Figure 22 – Median Bus lane Alignment Option #2

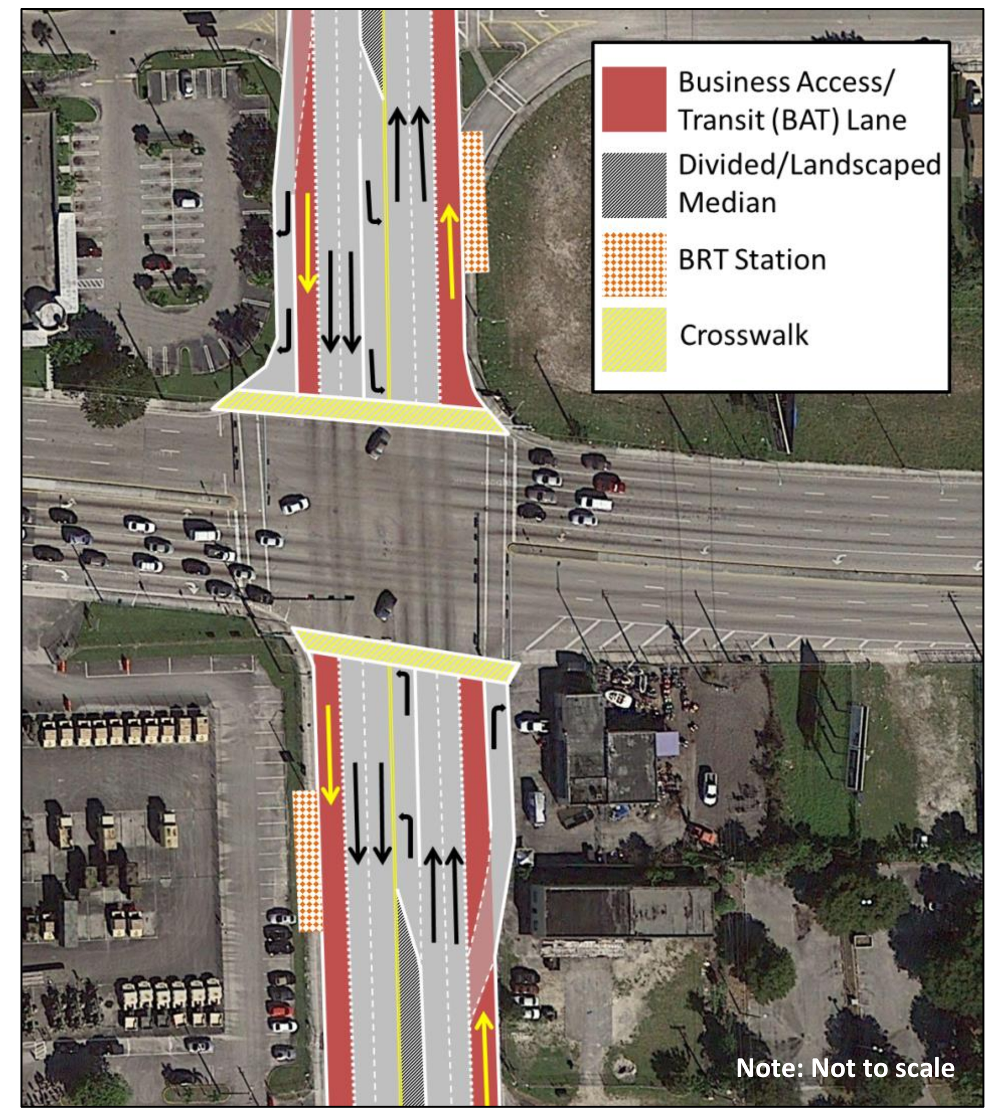


6.1.3 Curbside Bus lane

Curbside bus lanes are the most common form of BRT bus lane alignment in the United States, mostly due to lower implementation costs and right of way impacts. Keeping the BRT vehicle in the curbside lane avoids any conflicts with left-turning vehicles, albeit creating conflicts with right-turning vehicles. Curbside BRT bus lanes are not always exclusive only to buses – they also allow for business access and right-turning vehicles. By allowing right-turning vehicles to use the bus lane, average travel speeds are typically slower than median bus lanes, which is the biggest point of criticism.

Transit stations can be accommodated along the sidewalk or on curb extension (bulbouts), which are typically more familiar and comfortable for passengers as compared to stations in the median. Special consideration needs to be given to the pedestrian facilities in and around these curbside BRT stations to ensure access for all users. In most designs, transit stations are a minimum of ten feet wide, which happens to be wider than most existing sidewalks. Therefore, additional space is needed to provide access around stations for pedestrians. Although this creates issues in terms of right of way availability, curbside bus lane alignments generally require less right of way at station locations than median bus lane alignments.

Figure 23 – Curbside Bus lane Alignment



The tables below briefly describe the pros and cons associated with curbside and median aligned bus lanes.

Table 15: Bus Lane Alignment Pros and Cons

Median-running BRT	
PROs	**CONs**
Faster running speeds due to fewer vehicular conflicts	Major conflicts with left and median access
Local bus service will not impact BRT operations	Requires special signal phasing at intersections
Facilitates variation in platform height	Requires more right of way - minimum of two bus lanes and space for platform
Facilitates closed fare collection areas	Most designs require vehicles with doors on the left side
Does not impact right turning vehicles	Alignment across intersection often skewed
Does not impact bicycles	Passengers required to access platform located in the middle of the street
Breaks up wide streets and makes pedestrian crossings easier and safer	Florida Administrative Codes limits bus shelters to a height of 10 feet and prohibits placing them in the medians

Curbside-running BRT	
PROs	**CONs**
Allows full mid-block business access	More difficult to provide closed fare collection
Does not impact left turns at intersections	Higher platform height impacts the sidewalk area for pedestrians
All bus operations occur in the same lane - easier for riders	Limited running speeds because of right turning vehicles
Requires less right-of-way	Requires special consideration for bicycles
Allows for standard door locations	Special passing consideration required if local bus uses same running way as BRT
Alignment does not cause lane shifts or deflections	Can be difficult enforcing the bus-exclusivity of the lane
Passengers remain on the curb	

7.0 Bus Rapid Transit Plans and Recommendations

Based on case studies and corridor context information, this section details the recommended BRT designs for each of the four corridors. This includes proposed bus lane alignment, station locations, and other physical and technological considerations. Corridor-level aerials with proposed BRT alignments for each corridor are included in Appendices A, D, G, and J. Intersection-level aerials with BRT station configurations are included in Appendices B, E, H, and I. Detailed design concepts, and before and after renderings of select portions of the corridors, are included in Appendices C, F, I, and L. Recommended concepts were based on various considerations including vehicular level of service, roadway geometry, and right of way constraints.

<u>For alignment</u>: Curbside BRT is recommended for all four corridors, which in most cases is accommodated by repurposing the existing curbside lane from a general travel lane to a transit only lane. Curbside lanes can provide benefits to all the bus routes using the bus lanes. There are a few segments of various corridors where the transit only lanes require expanding the right of way, but this is uncommon and will be pointed out in more detail within the following subsections. The transit only lanes are meant for transit vehicles and for any right-turning vehicles, whether the vehicle is accessing a driveway or at an intersection. Enforcing the proper use of this lane will be pivotal to the success of any BRT by ensuring that higher average speeds are maintained.

<u>For stations</u>: The station platforms that are recommended for all four corridors measure 180' long and 10' wide. Considering that three of the four corridors will have a local and BRT service, the dimensions allow two buses to easily stage and pick up passengers. The stations will also be wide enough for passengers to move around each other and comfortably wait for the bus. These stations will at a minimum feature unique branding, comfortable seating, adequate lighting, real-time information signage, off-board payment capabilities, and are ADA-compliant. The length of the platform may vary depending on existing buildings or streets that limit the size.

Each station is proposed at the far-side location of signalized intersections and is directly against the curb, making boarding and alighting nearly level with the platform. Concrete pads will be required at each station where buses will be stopping to accommodate the weight of the vehicles as to not put excessive stress on the existing roadway. Most of the existing sidewalks where these stations are proposed are less than ten feet wide, meaning that the stations would extend over the existing right of way and encroach upon existing sidewalk width. Therefore, additional right of way will be required for the platforms at most station locations and associated sidewalk improvements. Additional sidewalks would have to be a minimum of five feet wide to meet ADA standards. Specific right of way needs for corridor stations will be further discussed in this section as well as in Section 8.

Table 16 shows the basic elements of two BRT design concepts for the four corridors. The first is a concept for typical arterial BRT deployment based on several recent U.S. applications. The second represents an enhanced investment level, "Gold Standard Rating", representing a significant upgrade compared to the more typical application seen around the country, based on recommendations from the Institute for Transportation and Development Policy's "*The BRT Standard*". The intent is to define a range of investments in both capital and operating dollars to guide future implementation decisions. The costs associated with each of these options are laid out in detail in Section 8.

Table 16: Miami Dade County BRT Deployment Options

BRT Element	Option 1 – Typical BRT Deployment	Option 2 – Enhanced BRT Deployment
Stations	All stations developed with shelters, markers, furnishings, etc.	More extensive station development; custom shelter, upgraded furnishings, etc.
Transit centers	None	Assume one at each terminus with accommodations for bus interface, kiss and ride and enhanced pedestrian access.
Access improvements	Necessary access improvements at all stations; ADA compliance.	Pedestrian overpass at key stations; enhanced pedestrian crosswalk protection at other stations.
Real-Time Arrival (RTA) Signs	RTA signs at all stations.	RTA signs at all stations. Full monitors at key stations.
Roadway	Bus pads and new curbing at all stations.	Assume full depth reconstruction of transit lane to improve ride quality. Colored pavement application (embedded color) to enhance BRT guideway visibility.
Priority lanes/queue jumps	Conversion of existing general traffic lane to dedicated transit lane with minor surface improvements.	Conversion of existing general traffic lane to dedicated transit lane with substantial surface improvements. Allowance for queue jumps or special intersection treatment at major intersections.
Signal Priority	TSP at select intersections. Assumes basic infrastructure in place – controllers, communications, etc.	TSP along the entire corridor length. Assumes basic infrastructure in place – controllers, communications, etc.
Vehicles	New articulated vehicles.	New articulated vehicles.
Corridor improvements	None, improvements limited at station areas.	Corridor branding, linear landscaping allowance, new sidewalks, etc. Project art at 1%.
Headways	5 - minute BRT service;30-minute local service. (More frequent headways can be provided with additional routes using the bus lane)	5 - minute BRT service;30-minute local service. (More frequent headways can be provided with additional routes using the bus lane)
Span	19.5 hours minimum, 7 days per week.	21 hours minimum, 7 days per week.

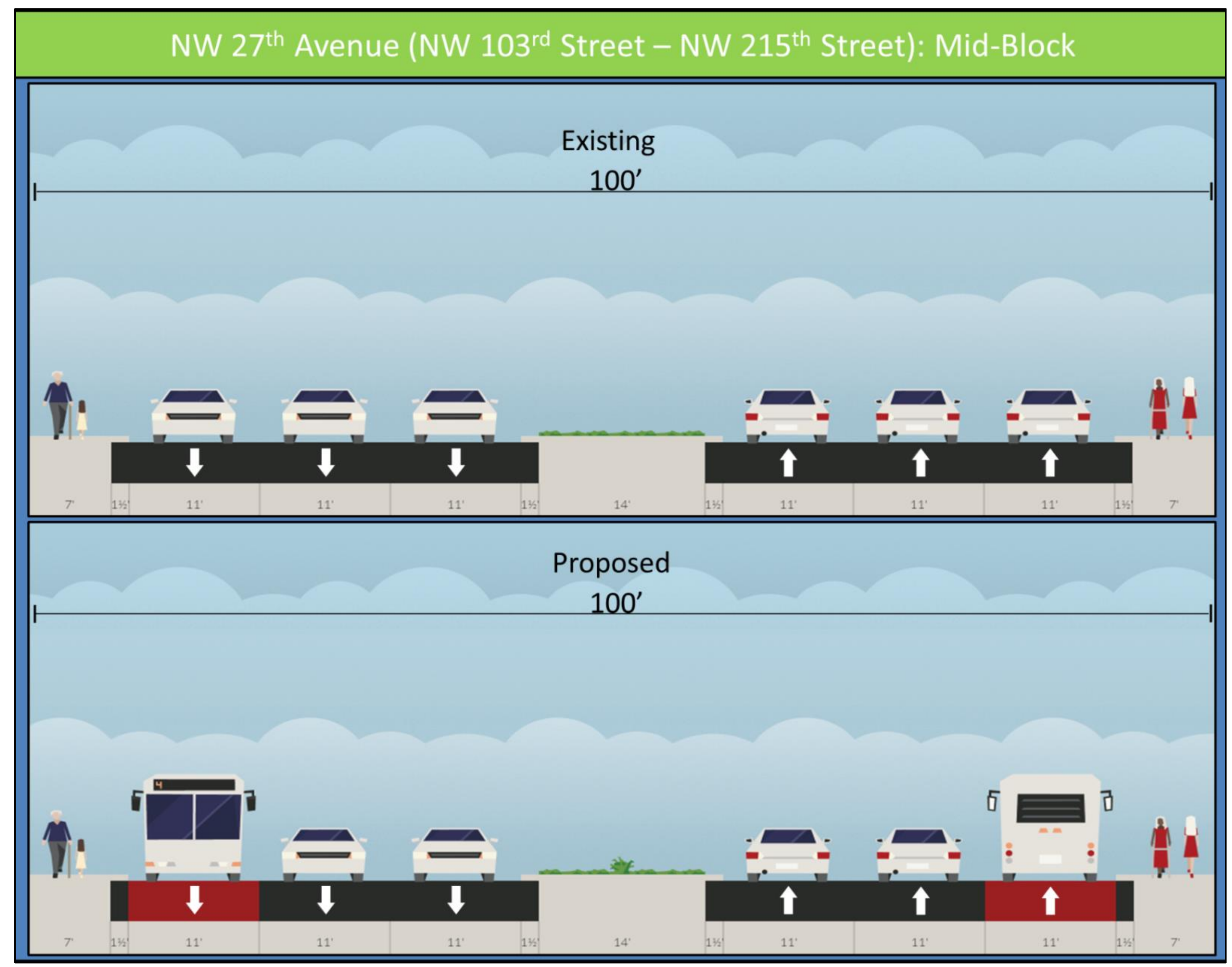
Level of service methodology: A simplified planning-level analysis for the level of service (LOS) was completed, but a more detailed analysis will likely be required in the subsequent phases of this study. In order to project future levels of service when repurposing the existing curbside lane, a 12 percent decrease in the remaining general purpose lanes volumes was assumed, in order to represent a reduction in volumes due to the right turning vehicles, while also assuming a 5 percent increase in transit service volumes (vehicles per hour) in the transit only lane due to less vehicular friction. Although it is true that friction would be removed from the through movement on the roadway, the overall capacity would remain constrained by the intersections. Projected volumes and associated levels of service were then derived from the FDOT Generalized Levels of Service Tables. LOS can be improved with new auxiliary right turn lanes and other mitigation measures, which will also be studied in more detail in subsequent phases of this study.

7.1.1 Bus lane Alignment Considerations (NW 27th Avenue/SR 9)

As mentioned earlier, NW 27th Avenue/SR 9 has three distinct segments throughout the proposed BRT corridor: SR 112 to NW 79th Street, NW 79th Street to NW 103rd Street, and NW 103rd Street to NW 215th Street. Designing a curbside bus lane throughout this corridor required careful planning mainly due to the variation in right of way. Corridor-level aerials with the proposed BRT alignment can be found in Appendix A.

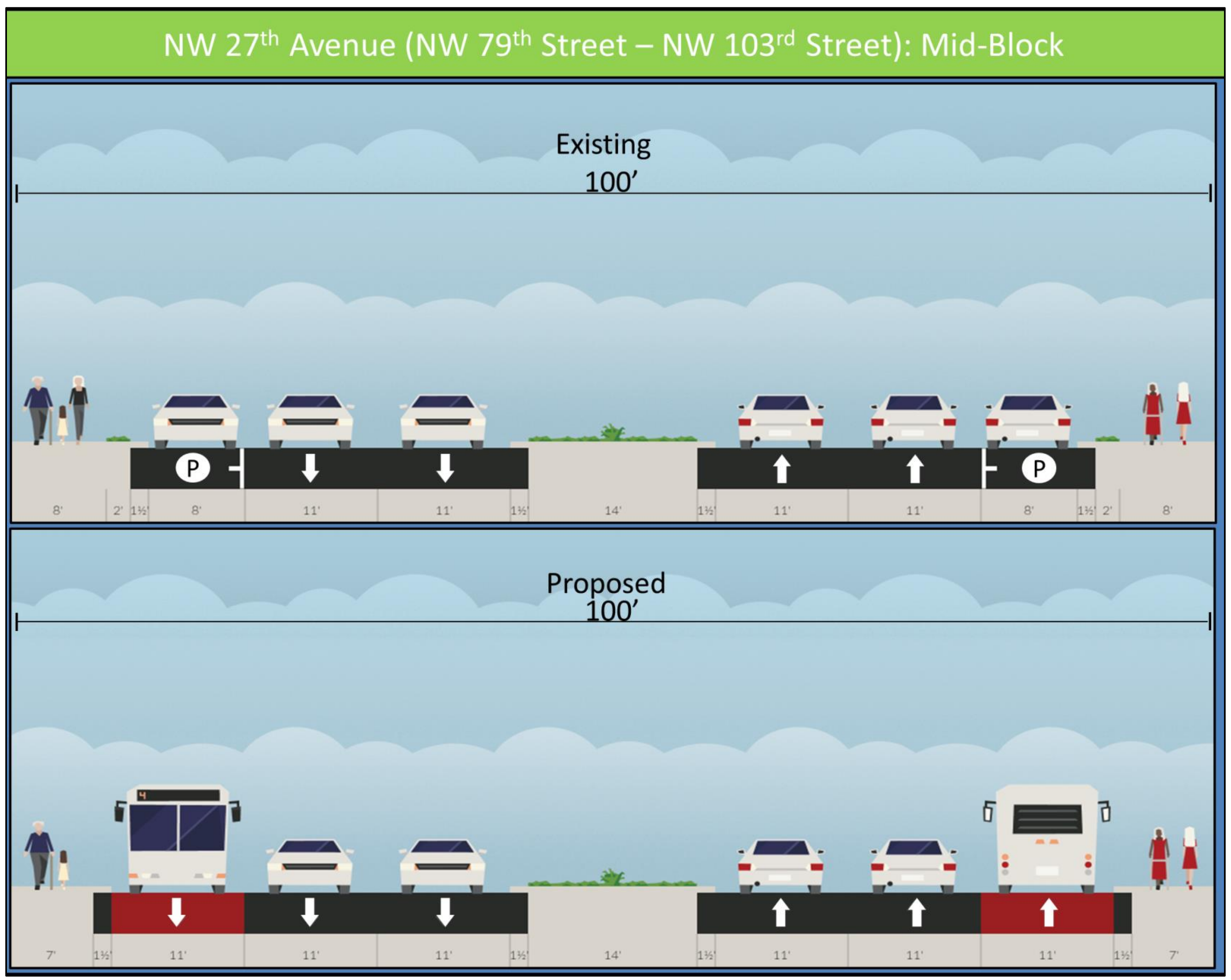
The northern segment (NW 215th Street to NW 103rd Street) has three travel lanes in each direction, which makes repurposing the curbside lane less detrimental to the movement of vehicles as compared to other parts of the corridor. The existing and proposed typical sections for the northern segment are illustrated in Figure 24. No additional right of way is needed to accommodate the transit only lane, however, right of way will be required for most of the transit stations along the corridor.

Figure 24 – NW 27th Avenue/SR 9: Northern Segment



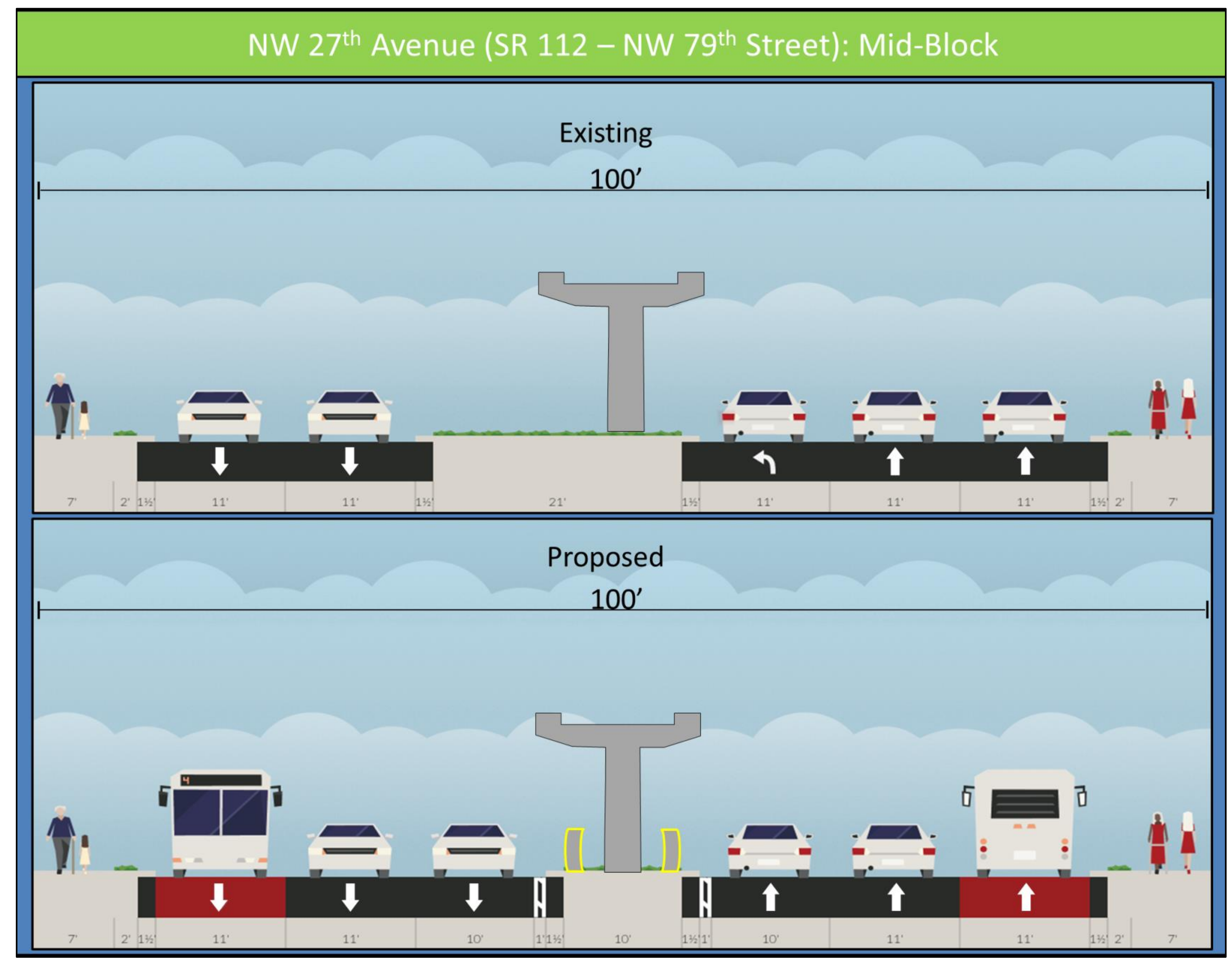
The middle segment (NW 103rd Street to NW 79th Street) has two general purpose lanes in each direction with on-street parking provided on both sides of the road. This segment also has a fairly wide median that varies, but is generally 14' wide. It is recommended that the existing on-street parking be repurposed to accommodate the transit only lane. Because the existing on-street parking is only eight feet wide, additional existing right of way must be repurposed. Portions of the median can be restriped or reconstructed so that the general purpose lanes can be shifted to allow for an 11' curbside transit only lane. Another option would be to reconstruct the existing sidewalk and adjacent buffer to accommodate the curbside transit only lane as illustrated in Figure 25 any drainage impacts?. No additional right of way will need to be acquired to accommodate the transit only lane in this segment.

Figure 25 – NW 27th Avenue/SR 9: Middle Segment



Similar median accommodations must be made for the southern-most segment. The southern-most segment (NW 79th Street to SR 112) also has two travel lanes in each direction. The major difference between this segment and the middle segment is the Metrorail structure in the median and no on-street parking lanes. The elevated Metrorail runs down the median while providing left turn bays at intersections and mid-block locations. The recommendation is to repurpose the curbside lane in each direction for the transit only lane. To accommodate two general purpose lanes and a transit only lane, portions of the existing median must be reconstructed to accommodate a new, 11' lane, as illustrated in Figure 26.what happens at the intersections? By taking the underutilized portions of the existing median, no additional right of way will need to be acquired to accommodate the proposed transit only lane.

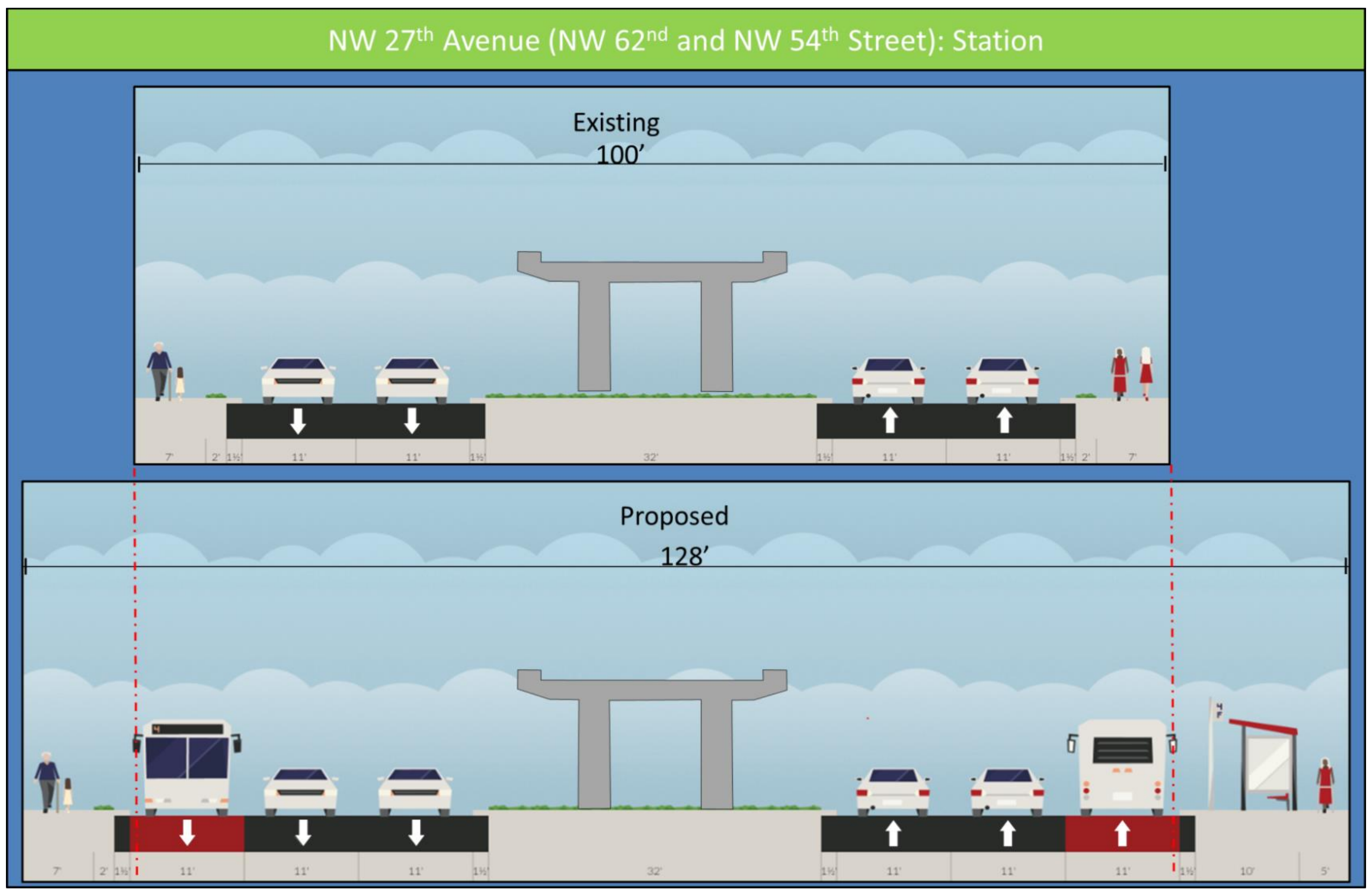
Figure 26 – NW 27th Avenue/SR 9: Southern Segment



Special design considerations are necessary along this segment at the Brownsville (NW 54th Street) and Martin Luther King Jr. (NW 62nd Street) Metrorail Stations. The available median space at these locations is constrained due to the elevated stations and supporting infrastructure. Unlike other parts of this southern segment, additional space cannot be repurposed from the median because of the additional columns supporting the Metrorail stations. Therefore, additional right of way must be acquired in this section to accommodate the transit only lane. MDT owns most of the right of way near the Metrorail stations, thereby assuring the possibility of accommodating necessary additional travel lanes and BRT station stops within existing public right of way.

Figure 27 below details the existing and proposed typical sections at these locations.

Figure 27 – NW 27th Avenue/SR 9: Southern Segment at the Metrorail Stations



7.1.2 Future Level of Service

In the case of NW 27th Avenue/SR 9, there are only a few segments where the levels of service would be noticeably impacted as depicted in Table 17. The most significant impact to vehicle traffic levels of service occur in the northern segment of the corridor. Repurposing an existing general purpose lane to a transit only lane reduces the overall daily volume of traffic by limiting the capacity of the roadway for *vehicles,* not people. However, the movement of people in a BRT corridor will increase due to the additional bus carrying capacity and frequency of transit in the corridor. Based on April 2014 ridership, Routes 27 and 297 carried an average of 13,907 daily riders collectively, of which 8,327 daily riders boarded within the proposed BRT corridor. Based on experience from other US BRT systems, ridership gains can range from 30 percent to 80 percent or more. A growth projection of 50 percent would result in an average daily ridership of over 12,000 just within the proposed BRT corridor.

Table 17: NW 27th Avenue/SR 9 Future Levels of Service

NW 27th Avenue								
Count Location	Lanes	Speed Limit	Existing LOS	Existing AADT	Daily transit volumes*	Adjusted AADT **	General Purpose Lanes	Adjusted LOS
200' N of SR 112	6	35	D	34500	215	30200	4	D
200' N of NW 54 St	4	40	C	31500	215	27500	4	C
100' S of NW 79 St	4	40	C	30000	216	26200	4	C
100' S of NW 103 St	4	40	C	33500	216	29300	4	C
100' N of NW 103 St	6	45	C	37000	216	32400	4	C
100' N of NW 135 St	6	45	C	43500	217	38100	4	C
100' N of NW 138 St	6	45	D	58500	217	51300	4	F
200' N of SR 9	6	45	C	43000	217	37600	4	C
100' S of NW 151 St	6	35	D	35000	217	30600	4	D
100' N of NW 167 St	6	45	C	48000	285	42000	4	F
400' S of Broward County Line	6	45	C	56500	129	49600	4	F
Broward County Line	6	45	C	56000	97	49200	4	F

* - Source: Miami-Dade Transit's bus schedules
** - Adjusted AADT reflects a 12% reduction for right turn volumes that will be removed from the general purpose lane onto the BRT lane. The daily transit volumes were also reduced as they are removed from the general purpose lanes.

7.1.3 BRT Stations

There are a total of 38 proposed stations at 20 different locations. There are two stations per intersection except for the two locations at existing Metrorail Stations – NW 54th Street (Brownsville Station) and NW 62nd Street (Martin Luther King, Jr. Station). The proposed NW 54th Street and NW 62nd Street BRT stations have park and ride lots on the west and east side of NW 27th Avenue/SR 9 respectively, and therefore only justify a BRT station on one side. Four total stations will feature platforms shorter than 180' in order to not block existing driveways:

- Northbound at the NW 175th Street station (120'),
- Southbound at the NW 95th Street station (160'),
- Northbound at the NW 87th Street station (160'), and;
- Northbound at the NW 79th Street station (120').

Intersection-level aerials with the proposed BRT stations are located in Appendix B.

Right of way will be required at nearly all stations to accommodate the wide platforms and sidewalks around the stations. There are a few proposed BRT stations along NW 27th Avenue/SR 9 that will not require additional right of way to accommodate the wide platform and new sidewalk:

- Northbound stations at NW 207th, NW 199th, NW 191st, NW 160th, NW 151st, and NW 119th Streets, and;
- Southbound stations at NW 113th and NW 175th Streets.

Due to the existing Metrorail stations and structures in the median, the northbound station at NW 54th Street and southbound station at NW 62nd Street with require approximately 14' of right of way beyond the back of sidewalk. This property is owned by MDT. All other proposed BRT stations along NW 27th Avenue/SR 9 will require a minimum of eight feet beyond the existing right of way along the extent of each station. Figures 28 and 29 depict the typical sections at intersections with BRT stations.

Figure 28 – NW 27th Avenue/SR 9: Middle Segment at the Station / Intersection

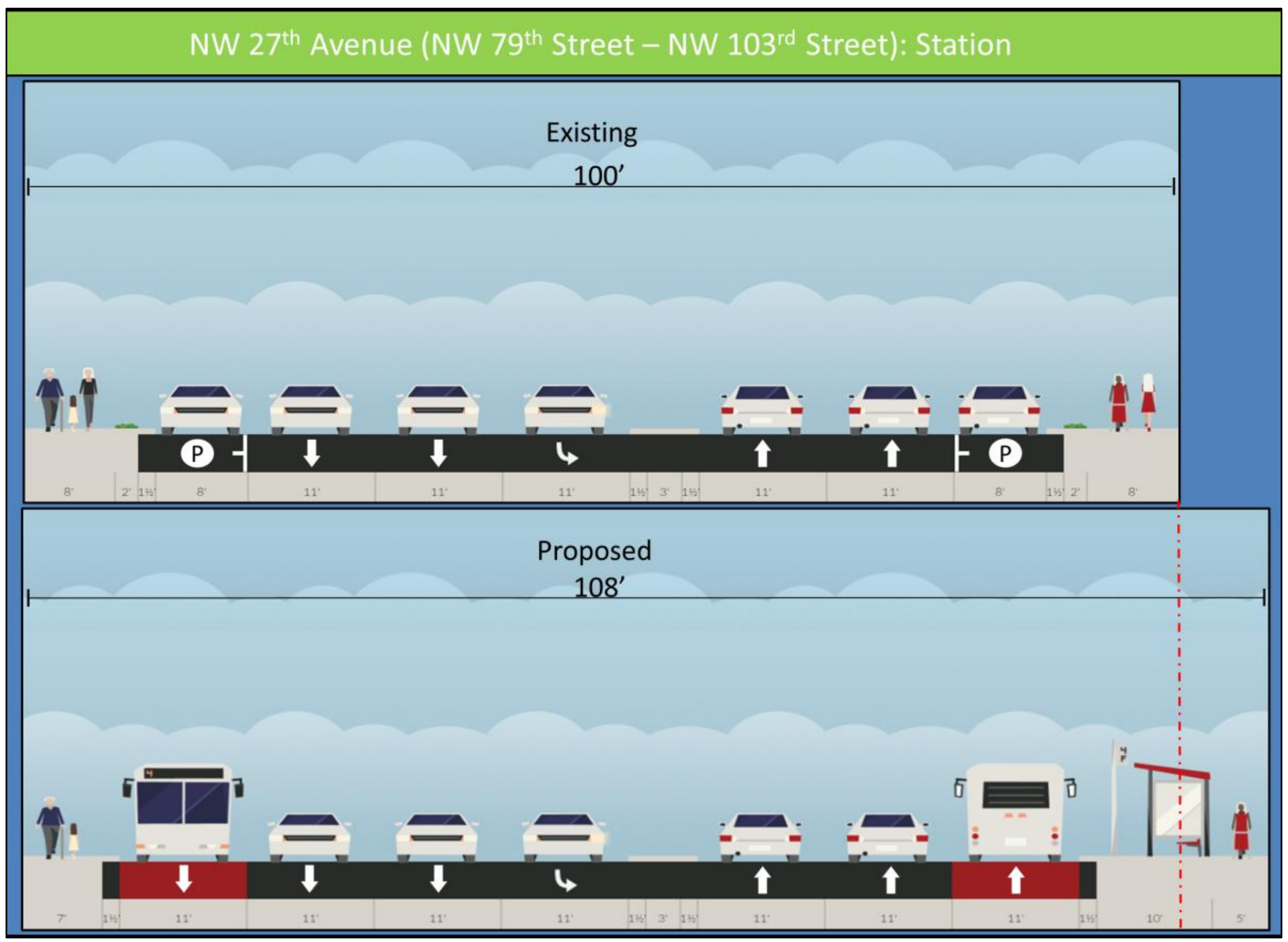
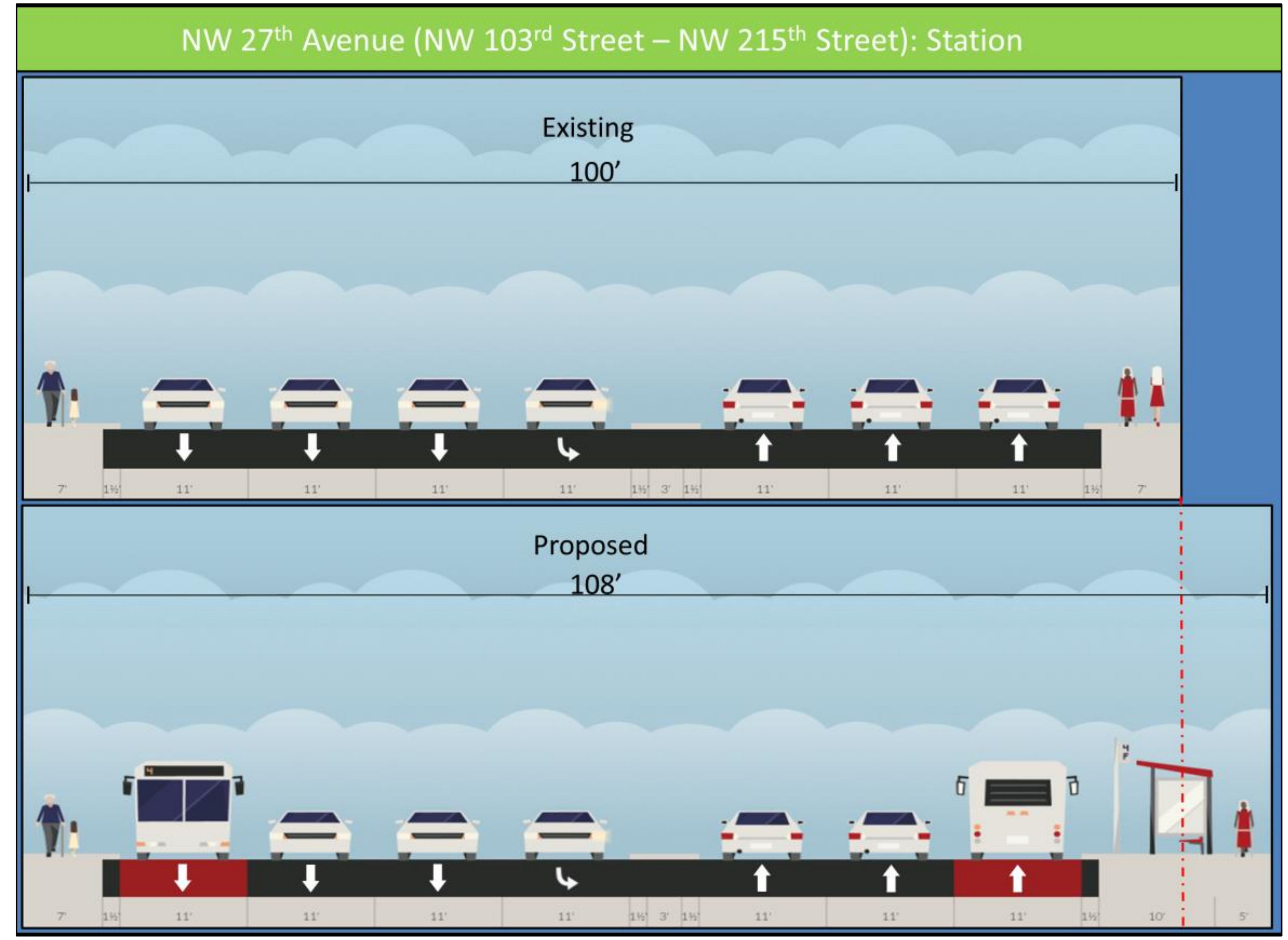


Figure 29 – NW 27th Avenue/SR 9: Northern Segment at the Station / Intersection



A detailed description of each BRT station's right of way needs and the parcels impacted can be found in Section 8.

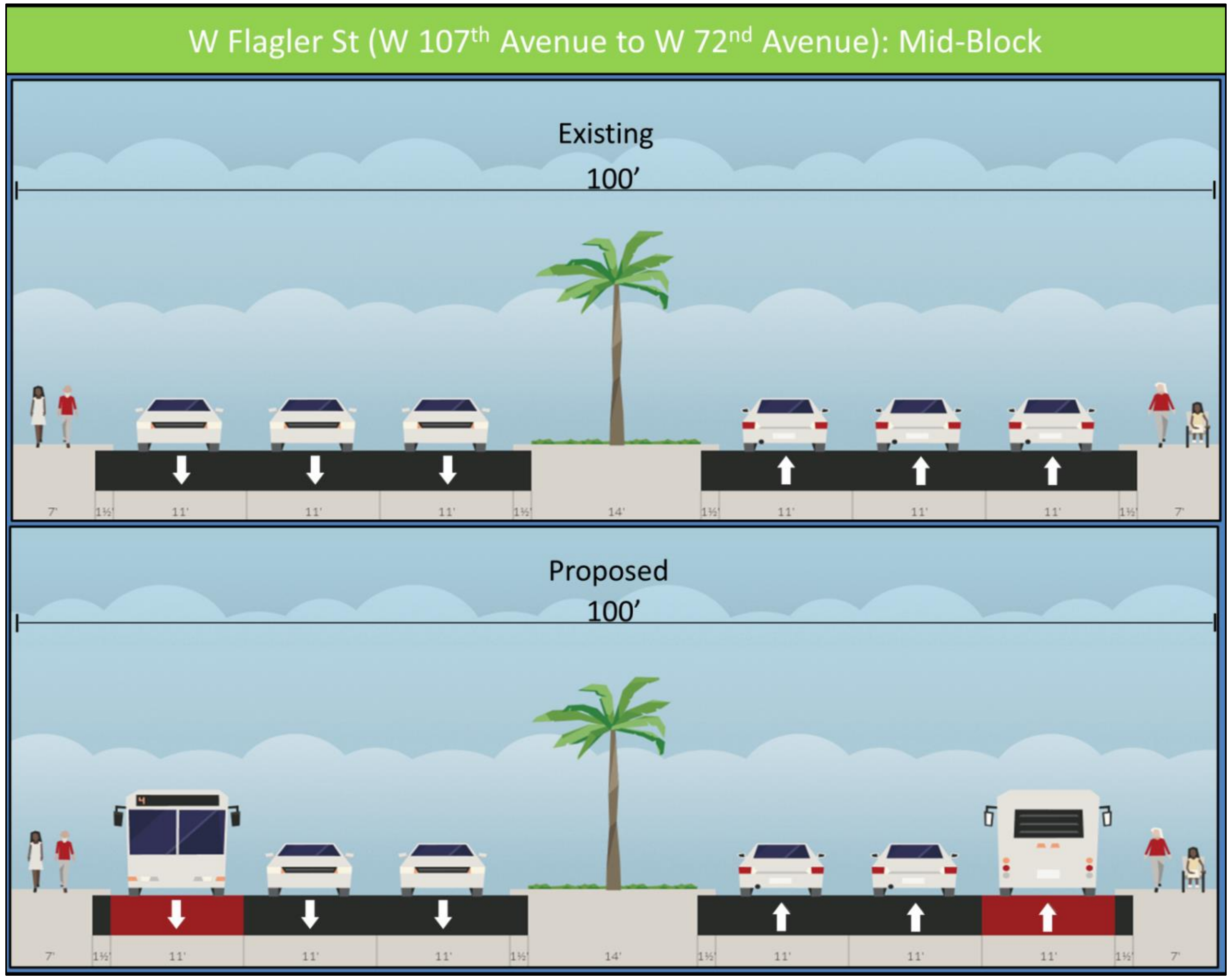
7.2 West Flagler Street/SR 968

7.2.1 Bus lane Alignment Considerations

Flagler Street also has three distinct segments throughout the proposed BRT corridor: 107th Avenue to 72nd Avenue, 72nd Avenue to 24th Avenue, and 24th Avenue to I-95. Curbside BRT is recommended throughout Flagler Street from the transit center at Florida International University (SW 8th Street / SW 109th Avenue) to downtown Miami. Corridor-level aerials with the proposed BRT alignments can be found in Appendix D.

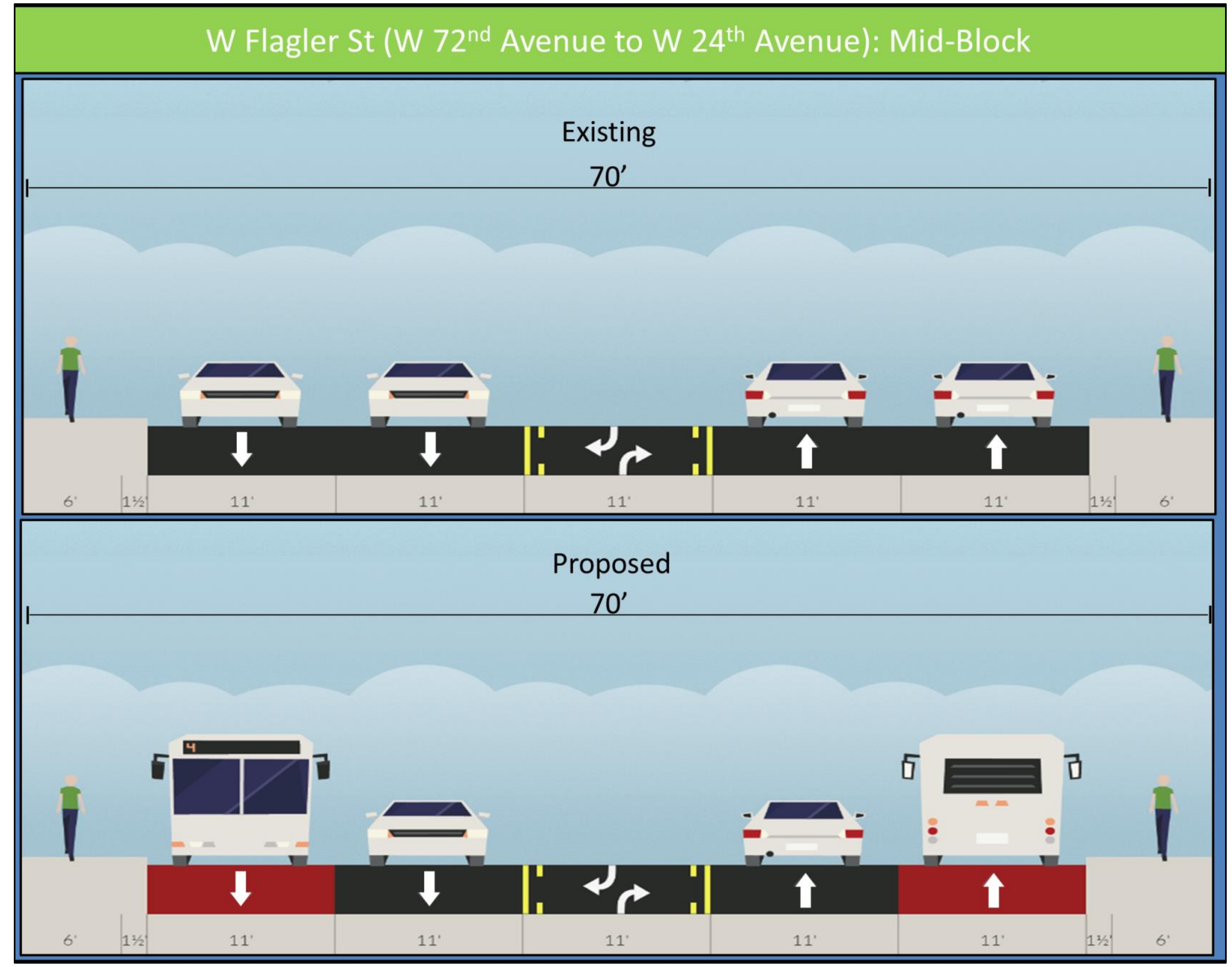
The western segment (107th Avenue to 72nd Avenue) has three travel lanes in each direction with protected left turn lanes at signalized intersections. Because there are three existing general purpose lanes, repurposing the curbside lane has less of an adverse impact on the movement of vehicles than other parts of the corridor, as depicted in Figure 30. Therefore, no additional right of way is needed to accommodate the transit only lane.

Figure 30 – W Flagler Street: Western Segment



The middle segment (72nd Avenue to 24th Avenue) has two general purpose lanes in each direction with a continuous left turn in the center and isolated islands for access control. There is also occasional on-street parking between 42nd Avenue and 30th Avenue. It is recommended that the curbside lane be repurposed for a transit only lane, leaving only one general purpose lane in each direction. No additional right of way will need to be acquired to accommodate the transit only lane as depicted in Figure 31.

Figure 31 – West Flagler Street/SR 968: Middle Segment



The eastern segment (24th Avenue to I-95) features one-way pairs with SW 1st Street and W Flagler Street. SW 1st Street features eastbound lanes only, while W Flagler Street features only westbound lanes between NW 24th Avenue and NW 12th Avenue. W Flagler has three westbound lanes and one eastbound lane between NW 12th Avenue and just west of the Miami River. Both streets vary in the number of travel lanes and right of way, but generally both have three general purpose lanes with on-street parking on both sides of the roadway with smaller portions of this segment featuring four travel lanes. Regardless of the number of lanes, the curbside lane is proposed as a transit only lane, as illustrated in Figure 32.

Figure 32 – SW 1st Street: NW 17th Avenue to Miami River

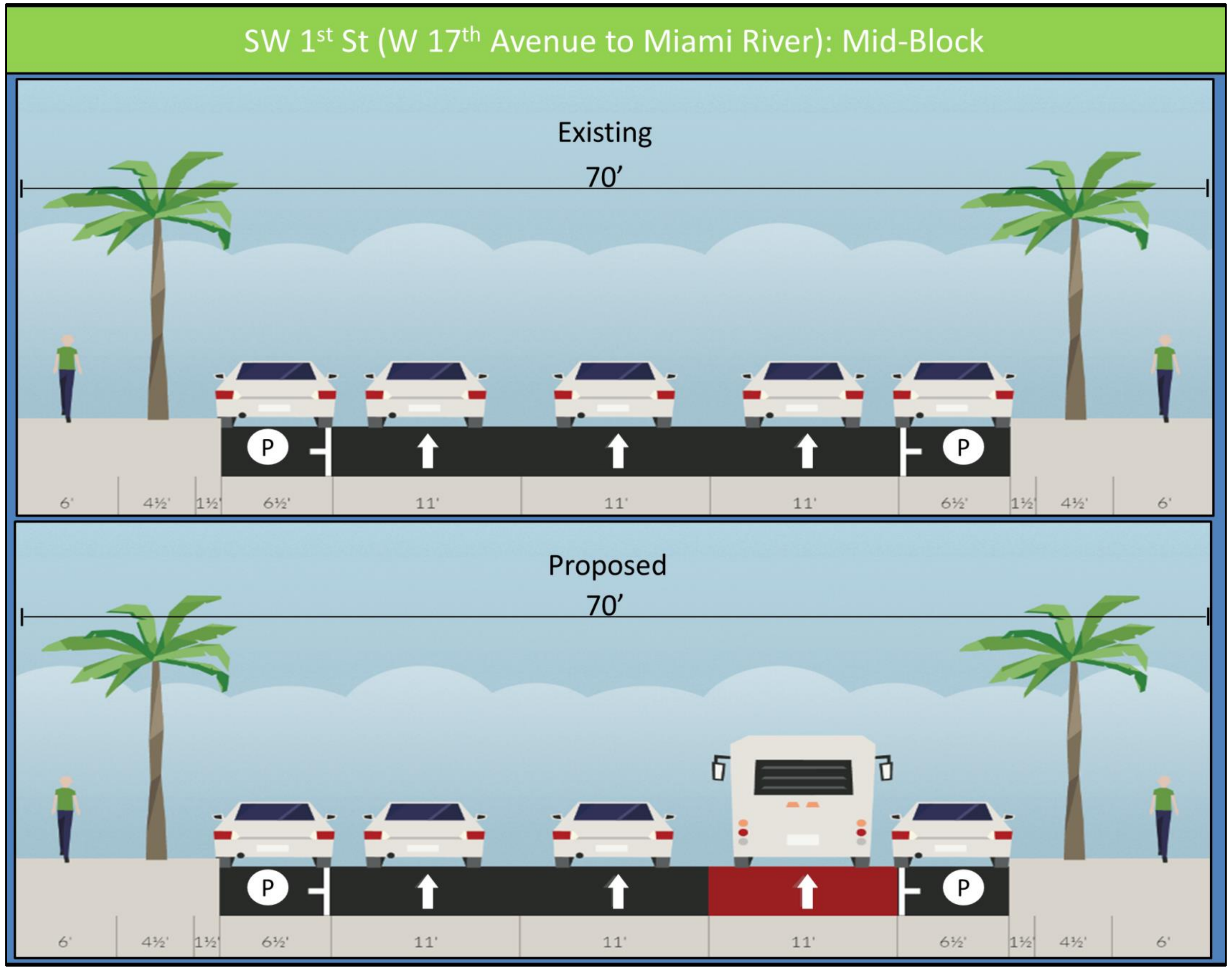
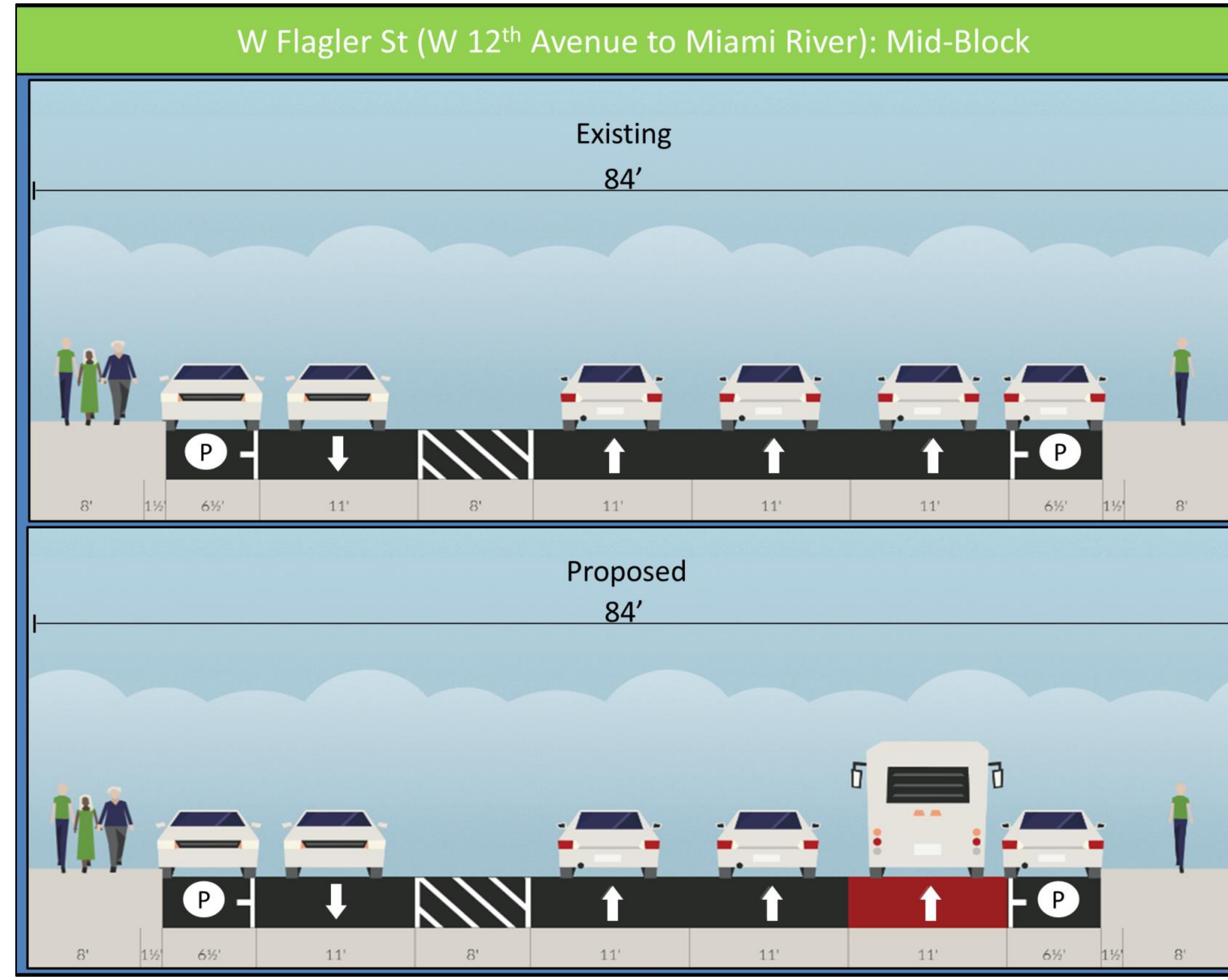


Figure 33 – W Flagler Street: NW 12th Avenue to Miami River



There is a portion of West Flagler Street/SR 968 between the Miami River and 12th Avenue that has three westbound general purpose lanes and one eastbound lane. In this section, only a westbound BRT service is proposed, requiring a transit only lane on the northern side of the roadway, as illustrated in Figure 33. The existing on-street parking is left intact except for locations with proposed BRT transit stations. At these locations, on-street parking is removed so that transit vehicles can directly serve passengers from the curbside platform.

7.2.2 Future Level of Service

The future levels of service, as illustrated in Table 18, were calculated assuming the repurposing of the existing curbside lane with the right turn volumes coming from this lane. As expected, the middle portions of the corridor from 42nd Avenue to 7th Avenue would experience the biggest impact to the levels of service when the curbside lane is repurposed for the transit only lane. By repurposing the curbside lane, the general purpose lanes in each direction are reduced from two to one, reducing the vehicular capacity of the roadway by nearly 50%. However, taking a closer look at the existing and projected AADTs for this corridor, the roadway is estimated to carry approximately 4,000 less vehicles per day, which is nowhere near the 50% reduction assumed from repurposing one lane. These 4,000 fewer vehicles can be compensated for with improved transit service and higher ridership, potentially resulting in more people moving through the corridor than without the BRT service. Routes 11 and 51 currently average 15,634 daily riders collectively, of which 14,325 board within the proposed BRT corridor. Again assuming a 50 percent increase in ridership due to higher levels of service with a uniquely branded system would yield in nearly 22,000 average daily riders within the corridor.

Table 18: W Flagler Street Future Levels of Service

W Flagler Street								
Count Location	Lanes	Speed Limit	Existing LOS	Existing AADT	Daily transit volumes*	Adjusted AADT **	General Purpose Lanes	Adjusted LOS
200' W of NW 107 Avenue	6	40	C	25500	153	22300	4	C
200' W of NW 97 Avenue	6	40	C	35000	185	30600	4	C
200' W of NW 87 Avenue	6	40	C	43000	185	37700	4	C
200' E of NW 87 Avenue	6	40	C	48500	234	42500	4	F
400' W of NW 72 Avenue	4	40	F	53000	329	46400	2	F
200' E of NW 72 Avenue	4	40	F	47000	384	41000	2	F
350' W of NW 42 Avenue	4	40	C	33000	271	28800	2	F
70' W of NW 36 Avenue	4	40	C	36500	271	31900	2	F
400' W of NW 27 Avenue	4	40	C	32500	271	28400	2	F
200' W of NW 17 Avenue	3	30	D	22500	340	19500	3	D
200' W of NW 8 Avenue ***	3	30	D	14500	340	12500	3	C

* - Source: Miami-Dade Transit's bus schedules
** - Adjusted AADT reflects a 12% reduction for right turn volumes that will be removed from the general purpose lane onto the BRT lane. The daily transit volumes were also reduced as they are removed from the general purpose lanes.
*** - LOS calculated as a 3-lane one-way roadway

7.2.3 **BRT Stations**

There are a total of 28 proposed stations at 14 intersections from the western terminus to 27th Avenue. After this point, the one-way pair begins with SW 1st Street, where there are eight individual stations (four eastbound stations on SW 1st Street and four westbound stations on W Flagler Street). Fourteen total stations will feature platforms shorter than 180’ in order to not block existing driveways:

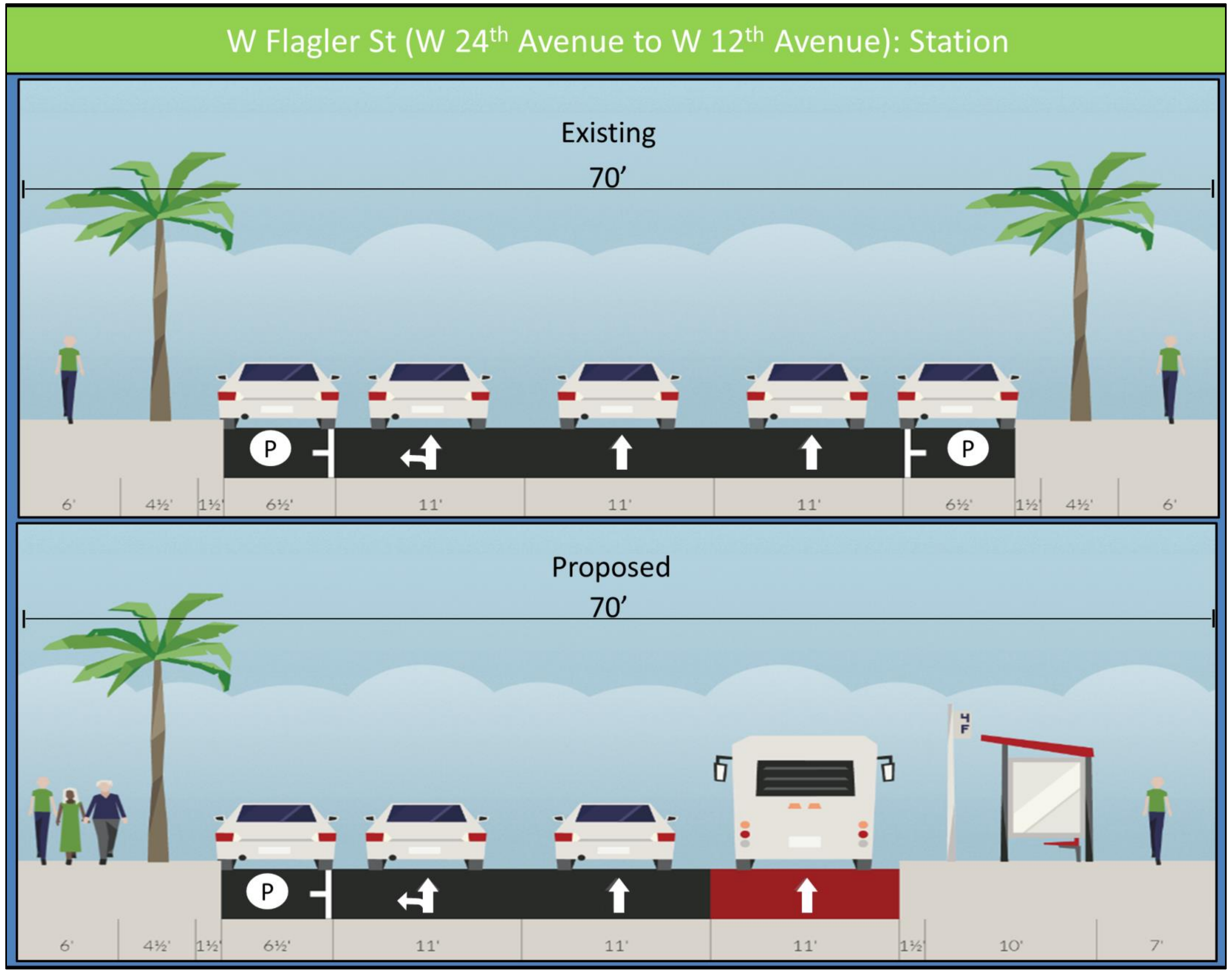
- Eastbound at 97th Avenue station (140’),
- East and westbound at 71st Avenue stations (120’ each),
- Eastbound at 67th Avenue station (120’),
- Westbound at 57th Avenue station (120’),
- East and westbound at 49th Avenue stations (120’ each),
- East and westbound at 42nd Avenue stations (120’ each),
- Eastbound at 37th Avenue station (140’),
- Eastbound at 32nd Avenue station (160’),
- Eastbound at 27th Avenue station (120’),
- Eastbound at SW 22nd Avenue station (120’), and;
- Westbound 17th Avenue station (120’).

Intersection-level aerials with the proposed BRT stations can be found in Appendix E. A detailed description of each station’s right of way needs and the parcels impacted are found in Section 8.

Right of way will be required at nearly all stations to accommodate wider platforms and sidewalks around the stations. Stations that will not require right of way include:

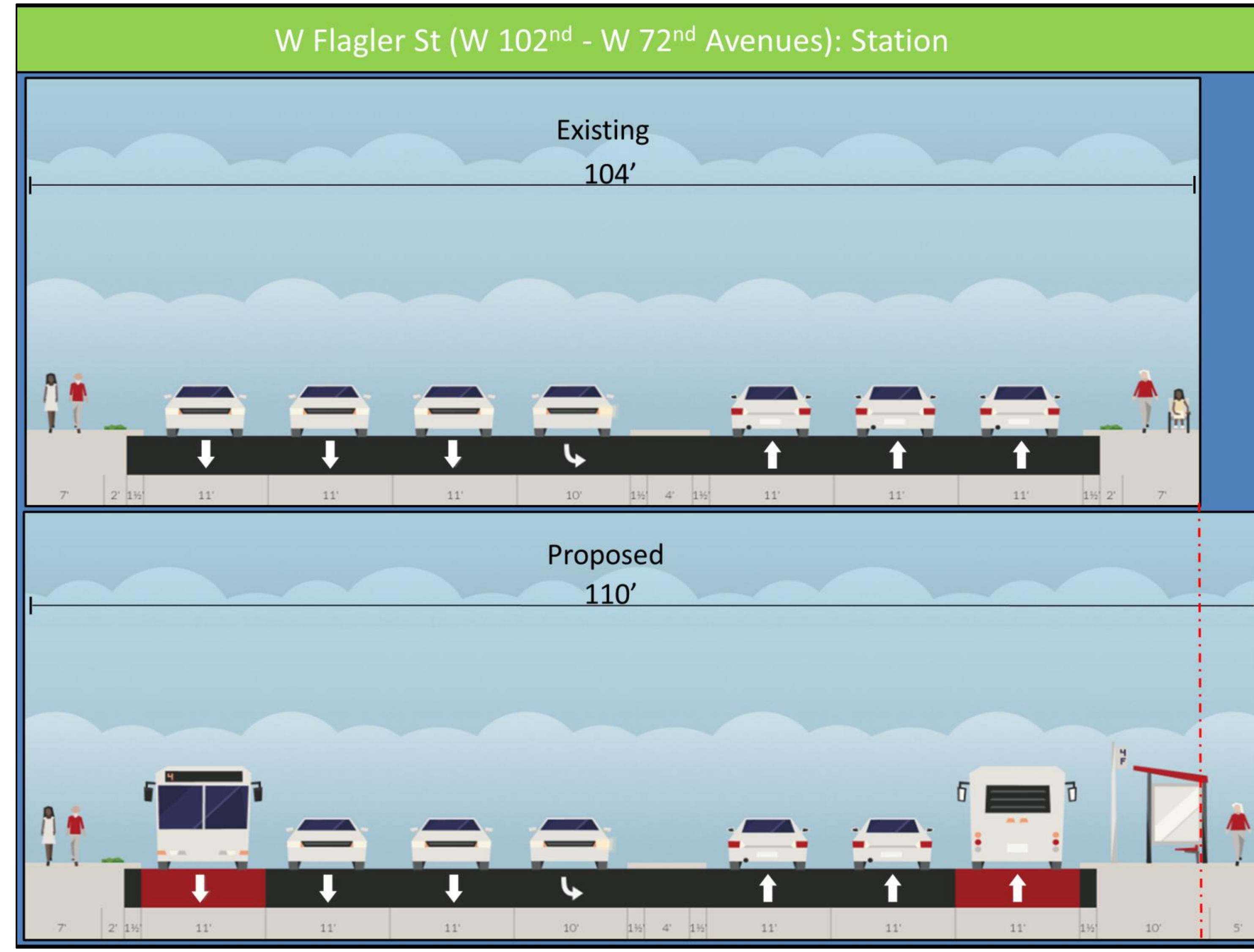
- Westbound 92nd Avenue,
- Westbound 37th Avenue westbound, and;
- All the BRT stations at 22nd Avenue and further east (along the one-way portions of W Flagler Street and SW 1st Street). These stations will use the existing on-street parking and parts of the wide existing sidewalk to accommodate the platform, as depicted in Figure 34.

Figure 34 – W Flagler Street: Eastern Segment at the Station / Intersection



Right of way requirements for the proposed BRT stations, whether in the western or middle segments, will require anywhere from six to nine feet of additional right of way, as depicted in Figure 35.

Figure 35 – W Flagler Street: Western Segment at the Station / Intersection



7.3 Kendall Drive/SR 94

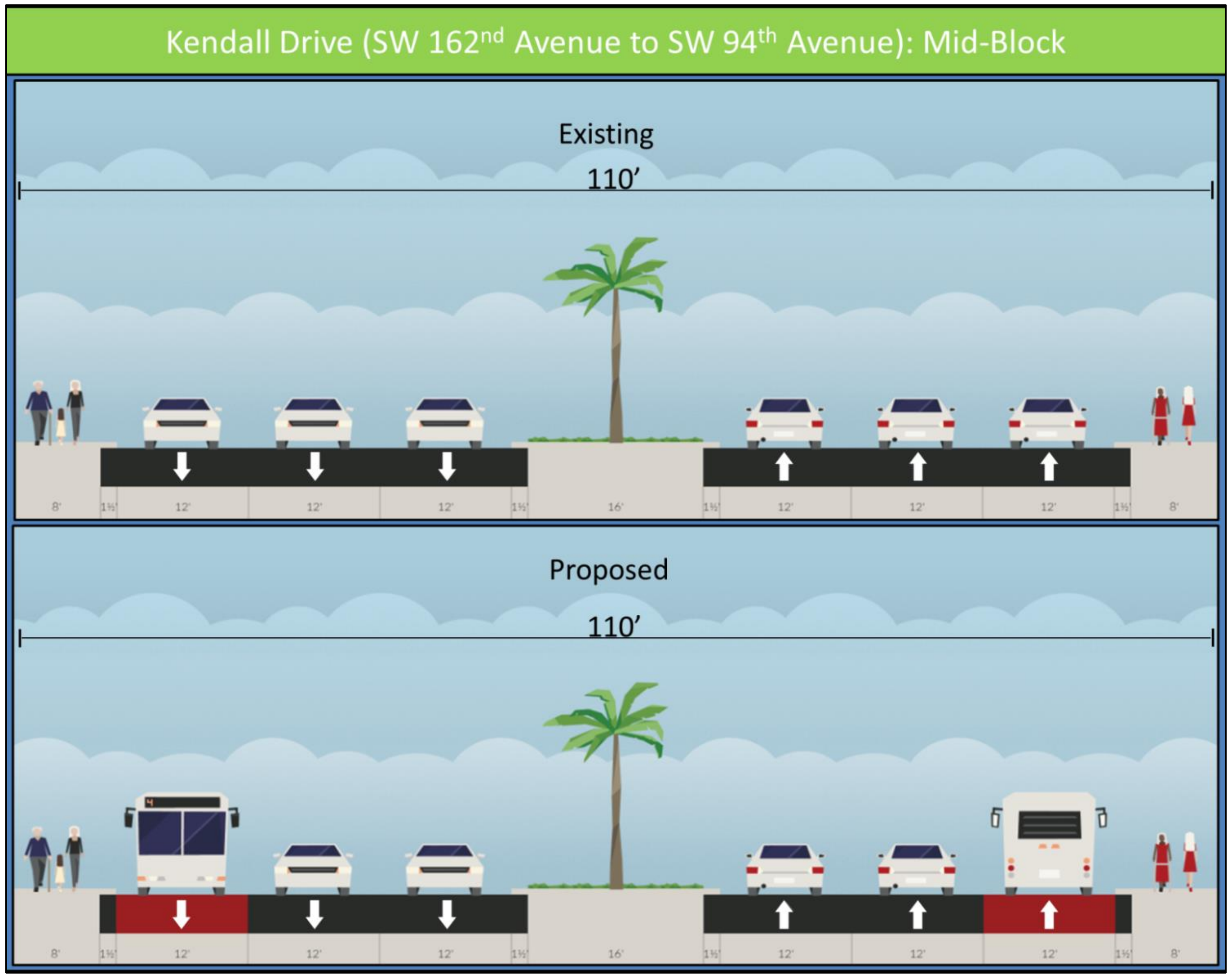
7.3.1 Bus lane Alignment Considerations

Kendall Drive/SR 94's typical sections slightly vary throughout the proposed BRT corridor. The entire corridor, except a segment in the middle, has three travel lanes in each direction. The middle segment, near SW 127th Avenue, has four travel lanes in each direction. There is also a local access road on the north side of the roadway between SW 101st and SW 104th Avenues as well as between SW 88th and SW 93rd Avenues. Curbside BRT is recommended throughout Kendall Drive/SR 94 from the existing park-and-ride lot at SW 162nd Avenue to the

Dadeland South Metrorail Station. Corridor-level aerials with the proposed BRT alignments can be found in Appendix G.

Figure 36 illustrates the proposed typical section after implementing the transit only lanes. No additional right of way is needed to accommodate the transit only lane. The difference between the western and eastern portions of the corridor is that the western portion has 12' lanes while the rest of the corridor features 11' lanes.

Figure 36 – Kendall Drive/SR 94 Typical Section



7.3.2 Future Level of Service

Because there are three existing general purpose lanes, repurposing the curbside lane typically would not have an adverse impact on the movement of vehicles. As depicted in Table 19, the majority of the corridor (east of SW 137th Avenue) already has failing levels of service. The alternative would be to widen Kendall Drive/SR 94 to accommodate a new transit lane. Routes 88 and 288 currently average 4,180 daily riders throughout the corridor. Assuming a 50 percent increase in the number of riders due to the improved service, Kendall Drive would serve over 6,000 daily riders.

A capital cost estimate for new BRT lanes was developed during the Kendall Link previous study with a range of $250 million to $408 million, which was deemed cost prohibitive for the County.

Table 19: Kendall Drive/SR 94 Future Levels of Service

Kendall Drive								
Count Location	Lanes	Speed Limit	Existing LOS	Existing AADT	Daily transit volumes*	Adjusted AADT **	General Purpose Lanes	Adjusted LOS
200' W of SW 157 Avenue	6	45	C	39000	230	34100	4	C
200' W of SW 147 Avenue	6	45	C	53500	202	46900	4	F
200' E of SW 137 Avenue	6	45	F	72500	154	63700	4	F
200' E of SW 127 Avenue	8	45	F	82000	154	72000	6	F
200' E of SW 110 Avenue	6	45	F	64500	154	56600	4	F
200' E of SW 103 Avenue	6	45	F	60500	154	53100	4	F
150' W of SW 91 Avenue	6	45	F	49665	133	43600	4	F
200' W of SW 87 Avenue	6	45	F	52000	133	45600	4	F
200' E of SW 79 Avenue	6	45	F	59000	182	51800	4	F
200' W of Dadeland Boulevard	6	45	F	44500	182	39000	4	F

* - Source: Miami-Dade Transit's bus schedules
** - Adjusted AADT reflects a 12% reduction for right turn volumes that will be removed from the general purpose lane onto the BRT lane. The daily transit volumes were also reduced as they are removed from the general purpose lanes.

7.3.3 BRT Stations

There are a total of 32 proposed stations at 16 intersections throughout the corridor. Only two total stations will feature platforms shorter than 180' in order to not block existing driveways: the westbound SW 157th Avenue station (160') and the westbound SW 122nd Avenue station (160'). Intersection-level aerials with the proposed BRT stations can be found in Appendix H. A detailed description of each station's right of way needs and the parcels impacted are found in Section 8 as well as Appendix M.

As was mentioned earlier in this section, right of way will be needed at nearly all stations to accommodate wide platforms and sidewalks around the stations except for:

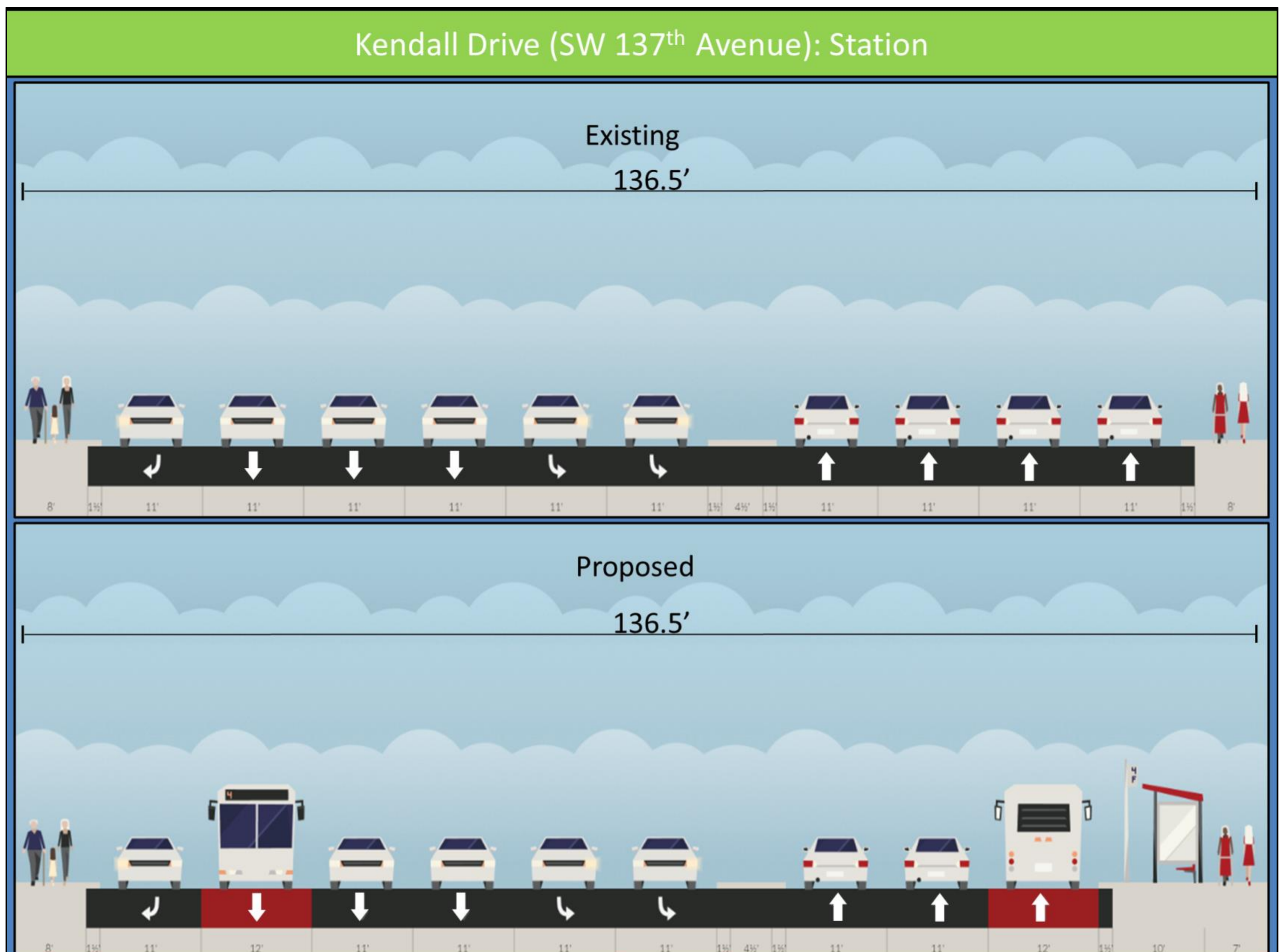
The following proposed BRT stations will not require additional right of way to accommodate the wide platforms and new sidewalk:

- Westbound SW 137th,

- Westbound SW 102nd,
- Westbound SW 90th,
- Westbound SW 87th Avenue, and;
- Eastbound SW 137th Avenue

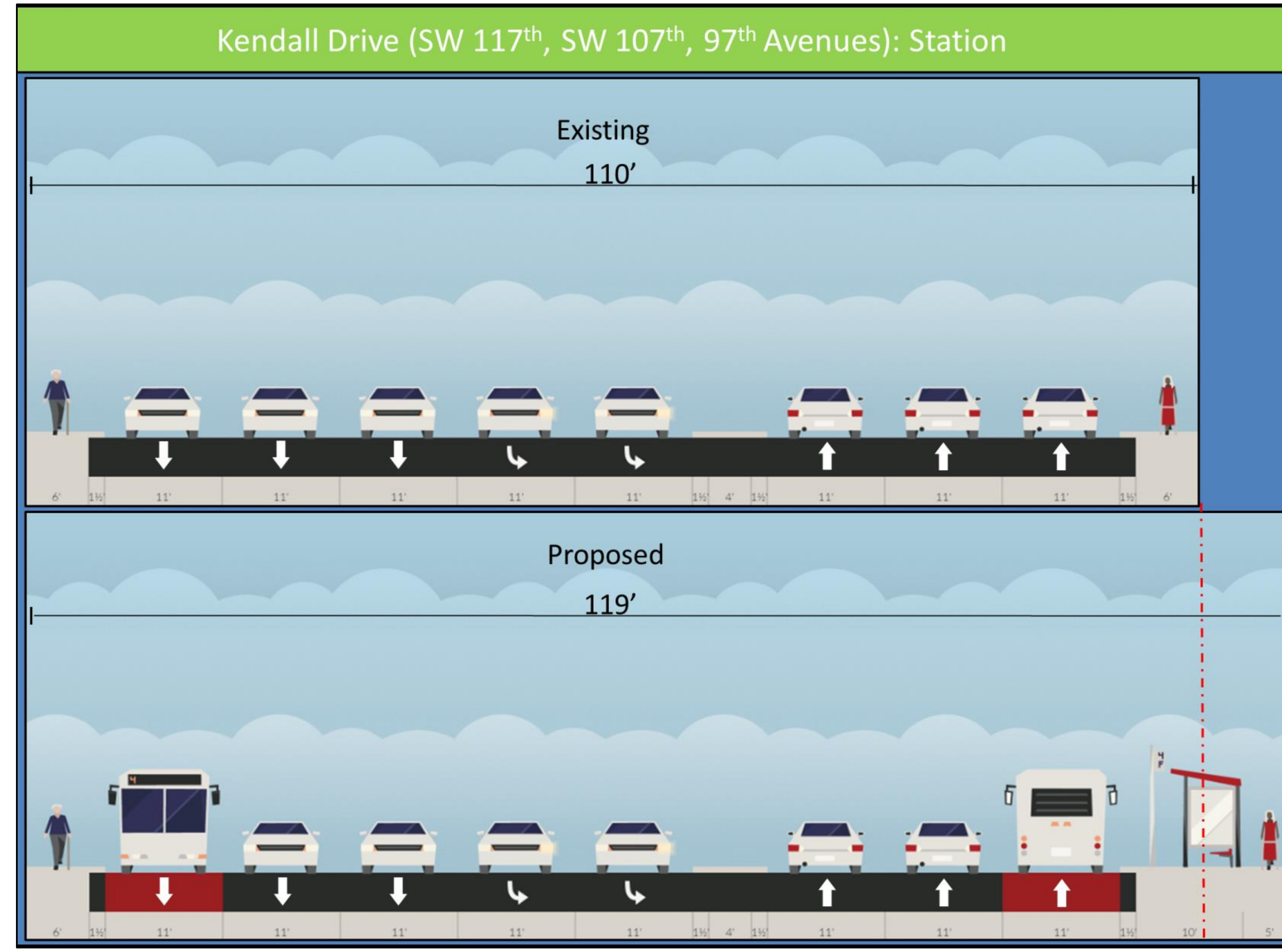
The access road on the northern side of Kendall Drive/SR 94 provides the additional right of way for a majority of these stations. The SW 137th Avenue stations will not require additional right of way because of the consolidation of travel lanes as seen in Figure 37. There are four existing westbound general purpose lanes which will be converted to two general purpose lanes and a bus lane. The right of way from the curbside lane will be used for the transit station. This is the only station in the corridor that goes from four general purpose lanes to two.

Figure 37 – Kendall Drive/SR 94 Typical Section at SW 137th Avenue proposed BRT station



Proposed BRT stations will require anywhere from seven to nine feet of additional right of way, as seen in Figure 38.

Figure 38 –Proposed Kendall Drive/SR 94 BRT Station Typical Section



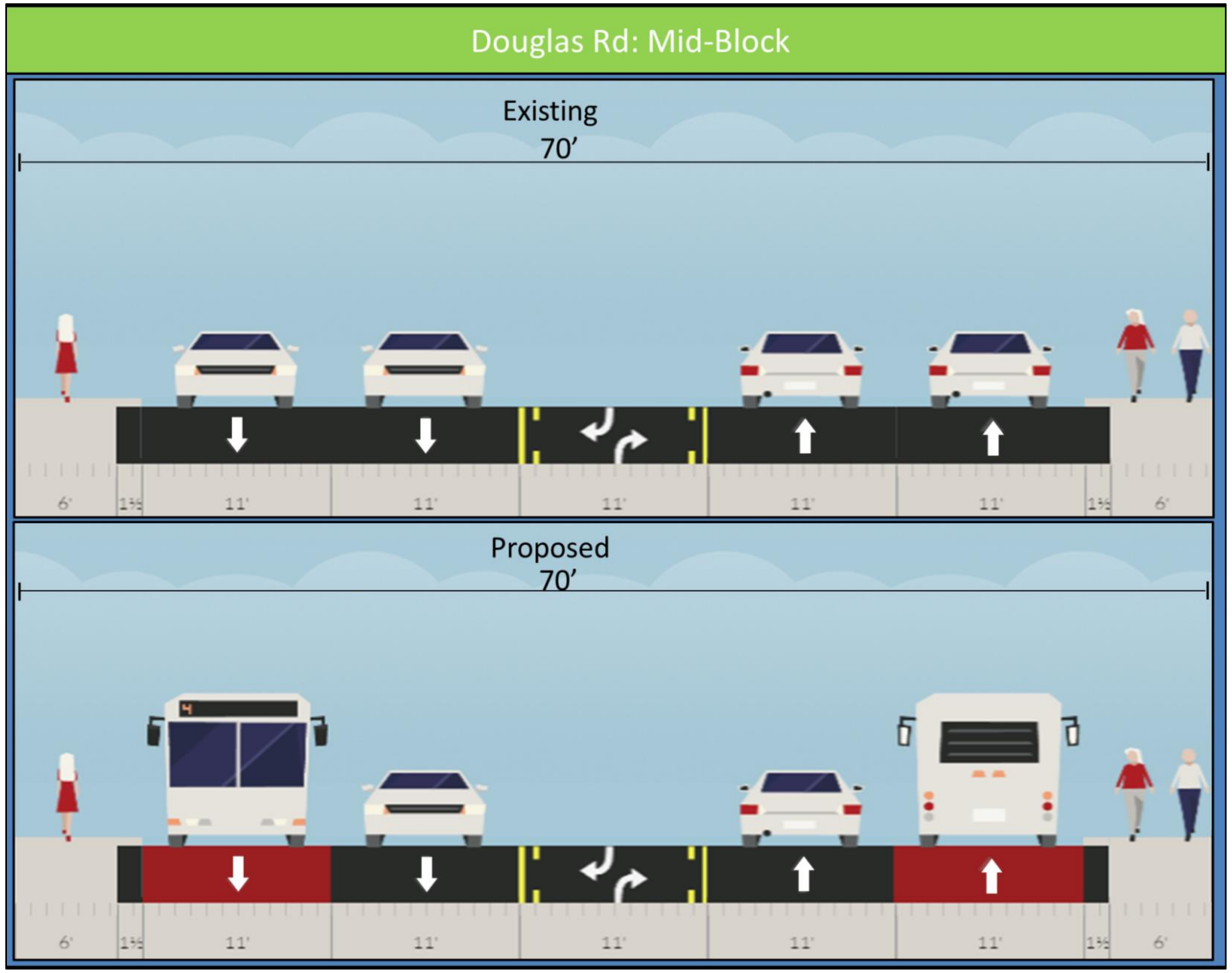
7.4 Douglas Road

7.4.1 Bus lane Alignment Considerations

There is little to no variation in the typical section along the proposed Douglas Road BRT corridor. There are two travel lanes in each direction with a continuous left-turn lane throughout. Curbside BRT is recommended throughout Douglas Road from the MIC to the Douglas Road Metrorail Station. Corridor-level aerials with the proposed BRT alignments can be found in Appendix J.

Figure 39 illustrates the proposed typical section after implementing the transit only lanes. No additional right of way is needed to accommodate the transit only lane.

Figure 39 – Douglas Road Typical Section



7.4.2 Future Level of Service

Repurposing the curbside lane in each direction would reduce the total number of general purpose lanes from four to two. Because Douglas Road has a relatively low AADT as compared to the other four corridors, repurposing one lane for a transit only lane has minimal negative impact to vehicular movements. As Table 20 shows, the existing levels of service are not affected except for the portion of Douglas Road north of SR-836.

Table 20: Douglas Road Future Levels of Service

Douglas Road								
Count Location	Lanes	Speed Limit	Existing LOS	Existing AADT	Daily transit volumes*	Adjusted AADT **	General Purpose Lanes	Adjusted LOS
200' N of US-1	4	40	C	15600	67	13700	2	C
200' S of SW 8 Street	4	40	C	17200	87	15100	2	C
500' N of SR-836	4	40	C	19500	100	17100	2	D

* - Source: Miami-Dade Transit's bus schedules

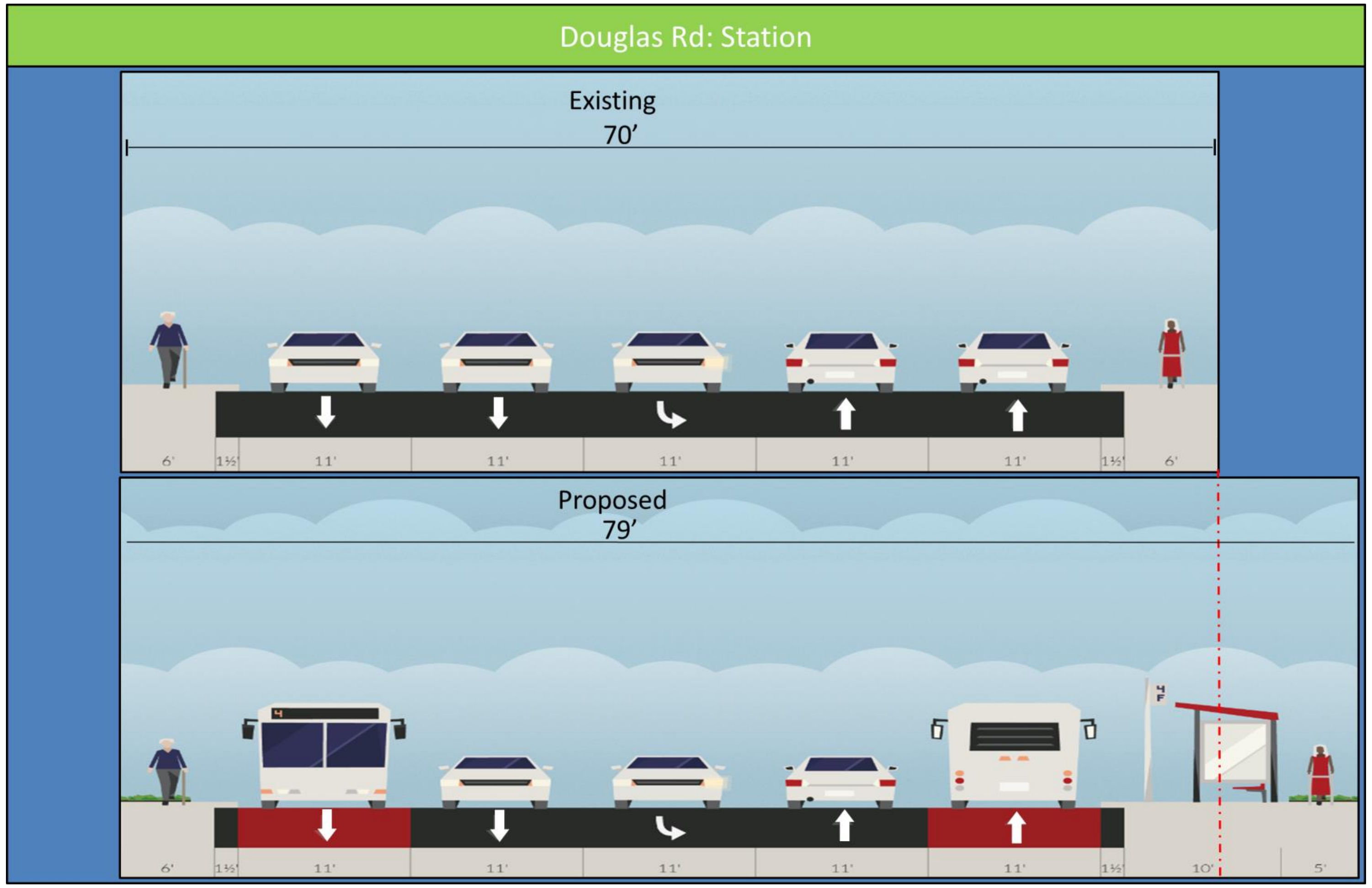
** - Adjusted AADT reflects a 12% reduction for right turn volumes that will be removed from the general purpose lane onto the BRT lane. The daily transit volumes were also reduced as they are removed from the general purpose lanes.

7.4.3 BRT Stations

There are a total of 14 proposed stations at seven intersections throughout the corridor. Only two stations will feature platforms shorter than 180' in order to not block existing driveways: the northbound station at W Flagler Street (160') and the southbound station at W Flagler Street (120'). Intersection-level aerials with the proposed BRT stations can be found in Appendix K. A detailed description of each station's right of way needs and the parcels impacted are found in Section 8.

Approximately nine feet of right of way will be needed at every proposed station to accommodate wider platforms and sidewalks as seen in Figure 40.

Figure 40 – Douglas Road Typical Section at proposed BRT station



8.0 Implementation and Action Plan

The purpose of this section is to define the BRT capital and operational costs accounting for the range of elements and service when implementing a BRT system along the four selected corridors of this study. Potential funding sources and next steps for implementation are also identified. Costs considerations included are the capital, operations, and right of way costs, with the latter category being the only constant cost despite the levels of investment selected.

As depicted in Table 16 in Section 7, two different deployment strategies were analyzed (a low and a high), for development of capital and operations costs. These strategies will be further explained in the following sections.

8.1 Capital Investments

The major elements associated with capital costs include the BRT stations, roadway and intersection improvements, vehicles, and ITS costs.

8.1.1 BRT Stations

The basic elements of a BRT station must provide a certain level of comfort for passengers and can accommodate all users. The BRT stations must also be uniquely branded so they are easily identifiable from the standard local bus stops. A typical deployment for a BRT station should include at a minimum a wide platform, an adequate shelter, station marker, and basic furnishings – trash receptacle, bench, pedestrian-scale lighting, a bicycle rack, and a real-time informational panel. Improving the pedestrian network around the station will need to be a priority in order to improve local connectivity as well as to comply with ADA requirements. Local sitework such as demolition, curb construction, and associated earthwork is likely necessary for the construction of each station.

An enhanced level of investment for stations would focus on improved furnishings, custom shelters, and security monitors at key stations. The pedestrian crossings would be enhanced with pedestrian overpasses at major intersections. These enhancements will contribute to higher capital costs, but could result in increased levels of ridership.

8.1.2 Roadway and Intersections

There are certain basic roadway improvements that are necessary to deploy a BRT system. A minimum level of investment includes signage for the corridor, special pavement markings, minor surface repair, and bus pads for each station. In order to enforce the exclusivity of the transit only lane, proper signage and pavement markings are needed, as well as proper public education and outreach. The types of minor surface repair likely needed would include fixing potholes and other impediments in the repurposed curbside lane that ultimately would improve the "ride" and comfort for passengers. Because heavier buses would be used along the corridor with frequent stops, each station would require a bus pad that would be able to accommodate the weight of the BRT vehicles better than the typical pavement, thus reducing the level of roadway damage caused by the buses.

An enhanced level of investment would include completing a full depth reconstruction of the transit lane and using a special pavement color to enhance the BRT guideway's visibility. The cost difference between these two levels of investment can be significant.

8.1.3 Vehicles

New articulated vehicles are recommended for either level of BRT investment. These vehicles need to be branded apart from the local bus service. These vehicles will offer low floors to improve the ease of boarding and alighting and will contribute to faster travel times. The vehicles will also come equipped with the proper technology to communicate with any proposed ITS system such as transit signal priority, AVL/CAD systems, onboard informational systems, and potential (digital) advertisement capabilities that would help to off-set some of the operational costs.

8.1.4 Intelligent Transportation Systems

Utilizing ITS drastically improves the reliability, speed, and perception of any transit system including BRT. A typical or minimum level of BRT investment would include transit signal priority (TSP) at select intersections along the corridor. Another critical technological element for even a minimum level of BRT investment is off-board fare collection. Requiring passengers to purchase tickets at the station prior to boarding helps to reduce dwell time, or the time spent for passengers boarding and alighting. This would require ticket vending machines as well.

An enhanced level of BRT investment would include TSP along the entire corridor to ensure the optimum travel speeds with fewest delays at intersections. Full-monitor LED screens could also be included at stations displaying the real-time information of bus arrivals that would enhance the overall experience for passengers. Providing TSP along the entire corridor instead of at select intersections can nearly double the costs.

All vehicles, despite level of investment, should come equipped with the most advanced technology such as TSP communication capabilities and automatic vehicle locators (AVL). These AVLs play a crucial role for the real time signage technology employed at each station as previously mentioned. All BRT vehicles should also be outfitted with cameras to help enforce the proper usage of the bus lane. Enforcing the proper use of the bus lane is important to guaranteeing reliable travel speeds for the buses. Drivers improperly using the bus lane will be documented and ticketed. Installing cameras along the corridor further help to enforce the proper use of the bus lane, but are only recommended in the enhanced level of investment.

8.2 Transit Operational Characteristics

8.2.1 Service Schedule

As previously stated, it is vitally important that the BRT operating plan provide frequent service that operates from early morning to late night. Two different service spans were recommended to offer a range of operational costs. A minimum level of investment should offer frequent, weekly service from 5 am to 12:30 am. Headways would be set at 15 minutes throughout Saturdays, Sundays, and holidays, while the headways during the weekdays would vary throughout the day, as seen in Table 21.

Table 21: Minimum Recommended BRT Service Plan

Operating Schedule						
Weekdays						
Time Span	5-6 am	6-9 am	9am-4pm	4-7pm	7-8 pm	8-12:30am
Headways	10 min	5 min	10 min	5 min	10 min	15 min
Buses/Hr	6	12	6	12	6	4
Hours	1	3	7	3	1	4.5
Satuday/Sundays and Holidays						
Time Span	5am -12:30am					
Headways	15					
Buses/Hr	4					
Daily Hours	**19.5**					

An enhanced service plan would offer more service by starting at 4 am instead of 5 am and would operate until 1 am instead of 12:30 am, thus offering a total of 21 total daily service hours. Offering these extended hours results in an approximate six percent increase in operations and maintenance costs. This enhanced operating schedule and accompanying headways are detailed in the table below.

Table 22: Enhanced BRT Service Plan

Operating Schedule						
Weekdays						
Time Span	4-6 am	6-9 am	9am-4pm	4-7pm	7-8 pm	8-1am
Headways	10 min	5 min	10 min	5 min	10 min	15 min
Buses/Hr	6	12	6	12	6	4
Hours	2	3	7	3	1	5
Satuday/Sundays and Holidays						
Time Span	4am -1am					
Headways	15					
Buses/Hr	4					
Daily Hours	**21**					

8.2.2 Vehicles Required

The number of buses needed is a function of travel time, route length, and headway. Each corridor differs in the travel time and length, despite offering the same level of BRT service. Therefore, the same number of vehicles would be needed for both the low and high cost estimates. The highest number of buses would be needed during peak hour service. It is also standard practice to have spare vehicles on hand in the event of breakdowns or other unforeseen accidents in the amount of 20 percent of the total number of vehicles. Table 23 calculates the number of vehicles that would be required, including spares, for each of the proposed BRT corridors.

Table 23: BRT Vehicles Required

	Vehicles Required				
Corridor	Roundtrip Length (miles)	Roundtrip Travel Time (minutes)	Buses Needed	20% spares	Total Buses
NW 27th Avenue	27.8	132	28	5.6	34
W Flagler Street	25.8	121	25	5	30
Kendall Drive	18	79	16	3.2	20
Douglas Road	8.8	40	8	1.6	10

8.2.3 Other Operational Considerations

Three of the four corridors have both an existing local and MAX (express) service, the exception being the Douglas Road corridor. It is recommended that proposed BRT service along the corridors replace the existing MAX service and that the level of service for the local be reduced. In the case of Douglas Road, the local service would be reduced with the addition of the BRT service. For all four corridors, it is recommended that the local service continue to serve the existing bus stops, but with a daily frequency of thirty minutes despite time of day. The cost savings from this reduction in service will be applied to off-set the BRT implementation costs.

Stop spacing is also an important consideration along these corridors, balancing the need for higher vehicle speeds with the distance required for passengers to walk on average. Stop placement for each stop and each corridor is context-sensitive, but for new BRT service it is recommended that they be spaced between ¼ and a ½ mile. This spacing is typically between the local service stop distance (< ¼ mile) and express stop spacing (> ½ mile). Each stop recommended for the four corridors takes into account existing bus stop locations, major land uses, and other roadway characteristics.

8.3 Right of Way Needs

As mentioned previously, right of way will need to be acquired at most of the station locations for all four corridors with some exceptions. The right of way is needed to accommodate wide platforms as well as reconstructing the sidewalk adjacent to the station to accommodate passing pedestrians and comply with ADA requirements. Based on a preliminary desktop GIS analysis, 149 parcels will be impacted throughout the four corridors, as illustrated in the summary table below. The NW 27thAvenue corridor estimate for required right of way assumes no additional requirements at the proposed BRT stations at the NW 54th and NW 62nd Streets since the property is already owned by MDT.

Table 24: BRT Vehicles Required

Preliminary Right of Way Needs		
Corridor	Total ROW Needed (sq ft)	Parcels Impacted
NW 27th Avenue	~42,000	39
Douglas Road	~26,000	19
W Flagler Street	~38,000	49
Kendall Drive	~43,000	42

A more detailed list of each station's right of way needs for each corridor can be found in Appendix M.

8.4 Cost Estimates

The cost estimates developed are based on the costs from similar, recently implemented BRT projects from across the country. These estimates include roadway, stations, facilities, branding, property acquisition, ITS, vehicles, contingency, design services, as well as the operation and maintenance costs. The "low" estimate includes the typical or minimum level of BRT deployment as referenced previously, while the "high" estimate includes all the elements from the enhanced BRT deployment. The cost per mile for the low end estimate ranges from $4.6 to $7.6 million while the high end estimate ranges from $12.5 to $15.7 million per mile.

Also included is the existing operation and maintenance cost for the MAX service, which is depicted to highlight the potential savings of replacing BRT with the MAX service along applicable corridors. It is recommended that the proposed BRT service replace the existing MAX services, reallocating these MAX dollars to fund the operations and maintenance cost of the proposed BRT service. It should be noted that the proposed NW 27th Avenue/SR 9 BRT corridor from NW 215th Street to SR 112 is just over 11 miles, whereas the roundtrip distance used to calculate operation and maintenance costs considered the entire route from NW 215th Street to the MIC, totaling almost 28 miles. Capital costs, such as roadway improvements, were only developed for to the portion of the corridor north of SR 112 (proposed BRT corridor).

The tables below show the summary costs for each proposed BRT corridor. A more detailed breakdown of the low and high end estimates for each corridor can be found in Appendix N.

Table 25: NW 27th Avenue/SR 9 Cost Estimate

NW 27th Avenue (11.2 mile corridor)		Low		High
Roadway	$	4,303,000	$	37,526,000
Stations	$	6,897,000	$	13,607,000
Facilities	$	3,200,000	$	3,200,000
Corridor Branding	$	-	$	18,256,000
Property Acquisition	$	420,000	$	420,000
ITS	$	4,020,000	$	6,720,000
Vehicles	$	34,000,000	$	34,000,000
Contingencies	$	7,294,000	$	19,472,000
Design Services	$	4,605,000	$	19,827,000
Total Capital Costs	**$**	**64,739,000**	**$**	**153,028,000**
Cost per Mile	**$**	**5,780,268**	**$**	**13,663,214**
Annual Revenue Hours		49,612		52,576
Cost per Revenue Hour	$	133.26	$	133.26
Existing MAX O&M Cost	*$*	*1,142,000*	*$*	*1,142,000*
Total Annual O&M Costs	**$**	**6,611,322**	**$**	**7,006,224**

Table 26: W Flagler Street Cost Estimate

Flagler (12.9 mile corridor)		Low		High
Roadway	$	4,646,000	$	43,803,000
Stations	$	6,534,000	$	14,074,000
Facilities	$	5,000,000	$	5,000,000
Corridor Branding	$	-	$	21,027,000
Property Acquisition	$	374,000	$	374,000
ITS	$	5,640,000	$	10,040,000
Vehicles	$	30,000,000	$	30,000,000
20% Contingency	$	7,551,000	$	21,976,000
Design Services	$	5,455,000	$	23,486,000
Total Capital Costs	**$**	**59,745,000**	**$**	**169,780,000**
Cost per Mile	**$**	**4,631,395**	**$**	**13,161,240**
Annual Revenue Hours		45,328		48,035
Cost per Revenue Hour	$	133.26	$	133.26
Existing MAX O&M Cost	*$*	*2,074,000*	*$*	*2,074,000*
Total Annual O&M Costs	**$**	**6,040,344**	**$**	**6,401,141**

Table 27: Kendall Drive/SR 94 Cost Estimate

Kendall Drive (9 mile corridor)		Low		High
Roadway	$	3,517,000	$	30,867,000
Stations	$	5,808,000	$	13,008,000
Facilities	$	19,100,000	$	19,100,000
Corridor Branding	$	-	$	14,670,000
Property Acquisition	$	423,000	$	423,000
ITS	$	2,680,000	$	4,280,000
Vehicles	$	20,000,000	$	20,000,000
20% Contingency	$	8,432,000	$	18,597,000
Design Services	$	7,776,000	$	20,481,000
Total Capital Costs	**$**	**59,960,000**	**$**	**141,426,000**
Cost per Mile	**$**	**6,662,222**	**$**	**15,714,000**
Annual Revenue Hours		29,083		31,545
Cost per Revenue Hour	$	133.26	$	133.26
Existing MAX O&M Cost	*$*	*952,000*	*$*	*952,000*
Total Annual O&M Costs	**$**	**3,875,587**	**$**	**4,203,735**

Table 28: Douglas Road Cost Estimate

Douglas Rd (4.4 mile corridor)		Low		High
Roadway	$	1,654,000	$	14,517,000
Stations	$	2,541,000	$	5,211,000
Facilities	$	-	$	-
Corridor Branding	$	-	$	7,172,000
Property Acquisition	$	255,000	$	255,000
ITS	$	1,760,000	$	3,260,000
Vehicles	$	10,000,000	$	10,000,000
20% Contingency	$	2,318,000	$	7,159,000
Design Services	$	1,489,000	$	7,540,000
Total Capital Costs	**$**	**18,528,000**	**$**	**55,114,000**
Cost per Mile	**$**	**4,210,909**	**$**	**12,525,909**
Annual Revenue Hours		15,109		16,012
Cost per Revenue Hour	$	133.26	$	133.26
Total Annual O&M Costs	**$**	**2,013,448**	**$**	**2,133,714**

The difference between the low and high estimates is significant, however, the major advantage of BRT is that priority elements to achieve a BRT in a corridor can be identified and implemented incrementally as funding is available. It is recommended that, at a minimum, the elements included as a part of the "low" estimate be implemented with the goal of improving the BRT system with enhanced amenities, technologies, and overall service.

8.5 Potential Funding Sources

There are a number of Federal and State Discretionary Grant programs, as well as innovative financing programs and partnerships that can and should be explored as a means of implementing the recommended BRT systems within the four corridors.

The use of federal funding for BRT in the United States has increased since 2005, when the Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) expanded eligibility for major capital projects under FTA's Capital Investment Grant Program to include corridor-based bus projects. This funding continued in TEA-21 and MAP-21, the subsequent federal grant programs. Elements of BRT projects can also be funded through Federal Discretionary Programs such as Section 5309, which offers New, Small, and Very Small Start grants under the Capital Investment Grant Program.

Small starts projects can receive up to $75 million in funding for projects that have total costs under $250 million. These projects usually require significant local and state funding commitments in order to be competitive for the New Starts or Small Starts funding at the national level. The New Starts program process is typically a 2-3 year process and is highly prescriptive and highly competitive. TIGER grants can also be considered for BRT funding, but these funds are also highly competitive. It must be mentioned that TIGER funds are only available when Congress appropriates funds in an authorization bill and that funding requests far exceed the amount appropriated. The upper limit for TIGER grant awards is typically $20 million.

Over the next five fiscal years, the Miami-Dade TIP has budgeted over $7 billion for projects in the County. A major funding source included in the TIP for both transit and general transportation enhancements is the revenue raised from the one-half cent sales tax from the PTP. Over the next five fiscal years, approximately $125,572,000 from the PTP will be used to fund transportation improvements in Miami-Dade County, which represents approximately 1.7% of the overall TIP Five Year Work Program Budget. PTP funds are eligible for many of the improvements required to implement BRT service.

As outlined in Table 2 in Section 1, funding has already been allocated for transit improvements for NW 27th Avenue/SR 9, Kendall Drive/SR 94, and W Flagler Street/SR 968. The TIP includes $12 million for Flagler Street, just over $15 million for Kendall Drive/SR 94, and nearly $24 million for the NW 27th Avenue/SR 9 corridor. The 2040 LRTP also has funding scheduled for all four corridors. Transit-related improvements such as bus shelters and other capital costs involving transit upgrades can generally be funded with MDT monies. The 2015 TIP has allocated nearly $886 million to MDT for funding projects along the People's Transportation Plan (PTP) corridors. These dollars can be reprogrammed on improvements to the transit service, modifying or replacing transit vehicles, improvements to transit stations or facilities, safety and security enhancements, conducting planning and design studies, parking accommodations, and any signage improvements needed for ultimate BRT implementation. This shift in funding from current obligations to implementation of BRT along these corridors would have to go through the required MPO amendment process.

Improvements recommended along state-maintained facilities such as NW 27th Avenue/SR 9, W Flagler Street/SR 968, and Kendall Drive/SR 94 can be funded by the FDOT, and county-maintained facilities such as Douglas Road by the Public Works and Waste Management Department (PWWM). Over $4 billion dollars are programmed for FDOT to use on major highways, intermodal projects, bicycle/pedestrian corridors, public transit, freight, rail, planning efforts, and other miscellaneous projects over the next five years. Secondary road funding out of the 2014 TIP amounts to over $75 million, which are funds dedicated for use by PWWM.

Other eligible funding sources include the National Highway System (NHS), the Strategic Intermodal System (SIS), and the State Transit Block Grant. The first two sources can be used if the proposed transit service improves a NHS route and the regional traffic. Similarly, SIS funds can be used for transit projects that are within designated SIS corridors, especially since the SIS system has recently placed emphasis on transit corridor that connect major hubs of regional activity.

Special taxing schemes such as tax increment financing (TIFs), business improvement districts, (BIDs), and special assessment districts can also be developed to help fund transit services and investments locally. Special assessment districts (SADs) like TIFs, are a type of public financing tool that captures increases in appreciated property values resulting from public investments in infrastructure, transit, and transportation. A SAD is a geographic area in which property owners agree to pay an assessment to fund a proposed improvement or service from which they expect to benefit directly. SADs are more direct and less risky. By increasing the property tax rate, they capture a guaranteed portion of current property value in addition to a portion of future increases in property value. TIFs usually require a designation of blight, but SADs do not. The SAD consists of only those properties which are designated as having received a specific and unique "benefit" from the public improvement. In general, the "benefit" must result directly, uniquely and specifically from the public project. For example, when premium transit service is implemented, nearby land often increases in value. Therefore the properties that have improved accessibility and mobility once certain public investments and improvements are programmed and completed would be likely contributors to a SAD, TIF, or BID.

Since the adoption of MAP-21, several transportation enhancements activities were eliminated or revised and recast as transportation alternatives. The Transportation Enhancements Program was consolidated into the Transportation Alternatives Program (TAP), which provides funding for numerous improvements including the provision of facilities for pedestrians and bicycles. Bicycle, pedestrian, and landscaping enhancements for the four corridors can be funded through the Federal TAP.

The Florida State Infrastructure Bank (SIB) Loan program is one source for financing recommended BRT projects. The SIB is a revolving loan and credit enhancement program consisting of two separate accounts and is used to leverage funds to improve project feasibility. The SIB can provide loans and other assistance to projects eligible for assistance under federal and state law. The SIB cannot provide assistance in the form of a grant. The federally-funded account is capitalized by federal money matched with state money as required by law under the TEA-21. Projects must be included in the adopted comprehensive plans of the applicable MPOs and must conform to all federal and state laws, rules and standards.

Another source of funding for transit investments are Private-Public Partnerships (P3s). Although not a direct funding source, P3s provide a way for projects to move forward and acquire required financing. Many P3s involve development partners that take advantage of the improved transit service or other public service as an incentive to invest within the corridor. The private sector typically up fronts the money to be paid by the local or state entity at a later date. Early involvement of the private sector can bring creativity, efficiency, and capital to address complex transportation problems facing State and local governments. However, P3s have only been used on one transit project in the U.S. (commuter rail in Denver, CO) and they still require local funding commitments to implement.

The Transportation Infrastructure Finance and Innovation Act (TIFIA) program provides Federal credit assistance in the form of direct loans, loan guarantees, and standby lines of credit to finance surface transportation projects of national and regional significance. TIFIA credit assistance provides improved access to capital markets, flexible repayment terms, and potentially more favorable interest rates than can be found in private capital markets for similar instruments. TIFIA can help advance qualified, large-scale projects that otherwise might be delayed or deferred because of size, complexity, or uncertainty over the timing of revenues.

Many surface transportation projects are eligible for TIFIA assistance. Each dollar of Federal funds can provide up to $10 in TIFIA credit assistance - and leverage $30 in transportation infrastructure investment. With this kind of leverage, major agencies such as the FDOT and the County may be able to pool their resources to increase the bonding capacity from the TIFIA program. If multiple agencies were able to contribute $10 million a year for the next 15 years, upwards of $400 million could be bonded for the use along these proposed BRT corridors.

8.6 Next Steps Moving Forward

Numerous studies and plans have been completed regarding the implementation of BRT within Miami-Dade County. In order to move these projects forward, political census among the MPO Governing Board must be coordinated so that funding for the various PTP corridors is prioritized.

The timeframe associated with the implementation of any BRT service can range from over a year to five or more years depending on the complexity of the project, current political climate, and the type and amount of funding used. The implementation process can be accelerated with the coordination of these major agencies, perhaps with the help of inter-agency agreements as necessary.

The next steps that need to be taken to move these projects forward will be to amend the existing LRTP and TIP so that the programmed funding can be repurposed. Existing funds for Enhanced Bus Projects (EBS) can be immediately refocused for these BRT efforts. Once agreement is reached on priorities and programmed funding, the selected projects can be moved forward to the Project Development phases such as NEPA and / or the PD&E process as necessary.

There are some issues that will need to be addressed as a part of any subsequent phase of this study, most of which have cost implications that need to be considered. Some of these issues include:

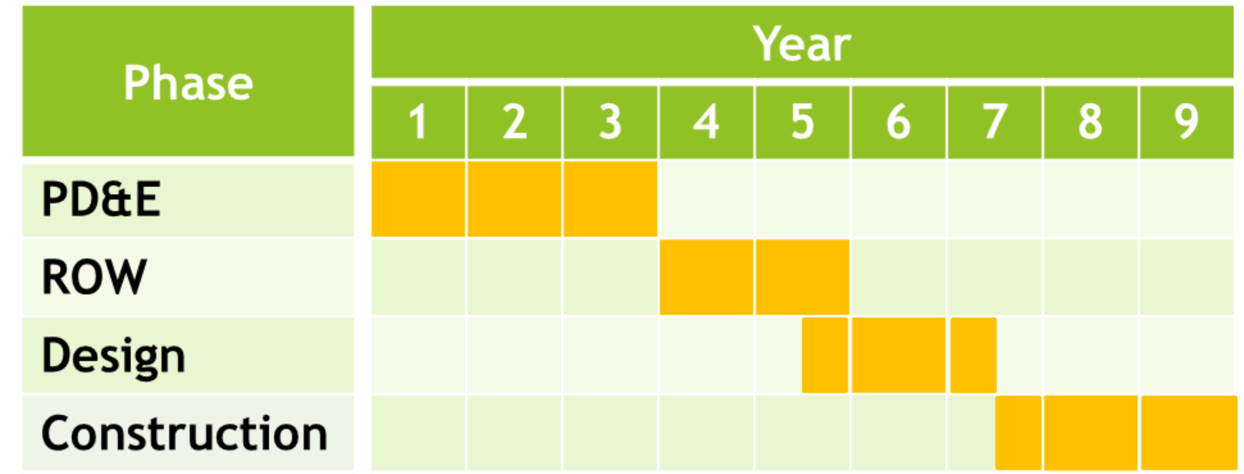
- Any modifications to the existing connecting bus routes
- Coordination with MDX and the Turnpike Enterprise as it relates to vehicular access and traffic impacts that will likely occur at their interchanges on several of these corridors
- Driveway access management modifications particularly at isolated corner properties where stations are being proposed
- Pedestrian and bicycle access facilities to and from the BRT stations
- Lane enforcement means, methods, devices, personnel, responsible agencies, etc.
- Need for surveillance and service patrols to keep BRT lanes clear from incidents
- Land use and parking policies near BRT stations

- On-street parking and loading zone modifications, especially along W Flagler Street and SW 1st Street

- Transit vehicle delay from movable bridge openings, at-grade railroad crossings, and reduced speed school zones

The implementation schedule for project development and construction for these corridors is likely to range from four to eight years, depending again on funding, political will / support, and physical constraints. The project development portion of the implementation process can take anywhere from two to four years. Critical elements for each corridor during this phase will include the preliminary design, a detailed traffic impact study, completing an environmental document complying with the NEPA process, a final design, and right of way acquisition. Because each corridor has its own unique characteristics, opportunities, and constraints, this time frame will vary. Not included in each of the corridor's cost estimate is the PD&E process and associated cost, which can add anywhere from $1 to $3 million to the total implementation cost. The construction phase of the implementation schedule can also take anywhere from two to four years depending on the length of the corridor, number of stations, and associated infrastructure needs. Table 29 summarizes a typical implementation schedule and time frame for a BRT system. Note that this process can be sped along by combining tasks such as right of way acquisition and design as well as by expediting the PD&E process.

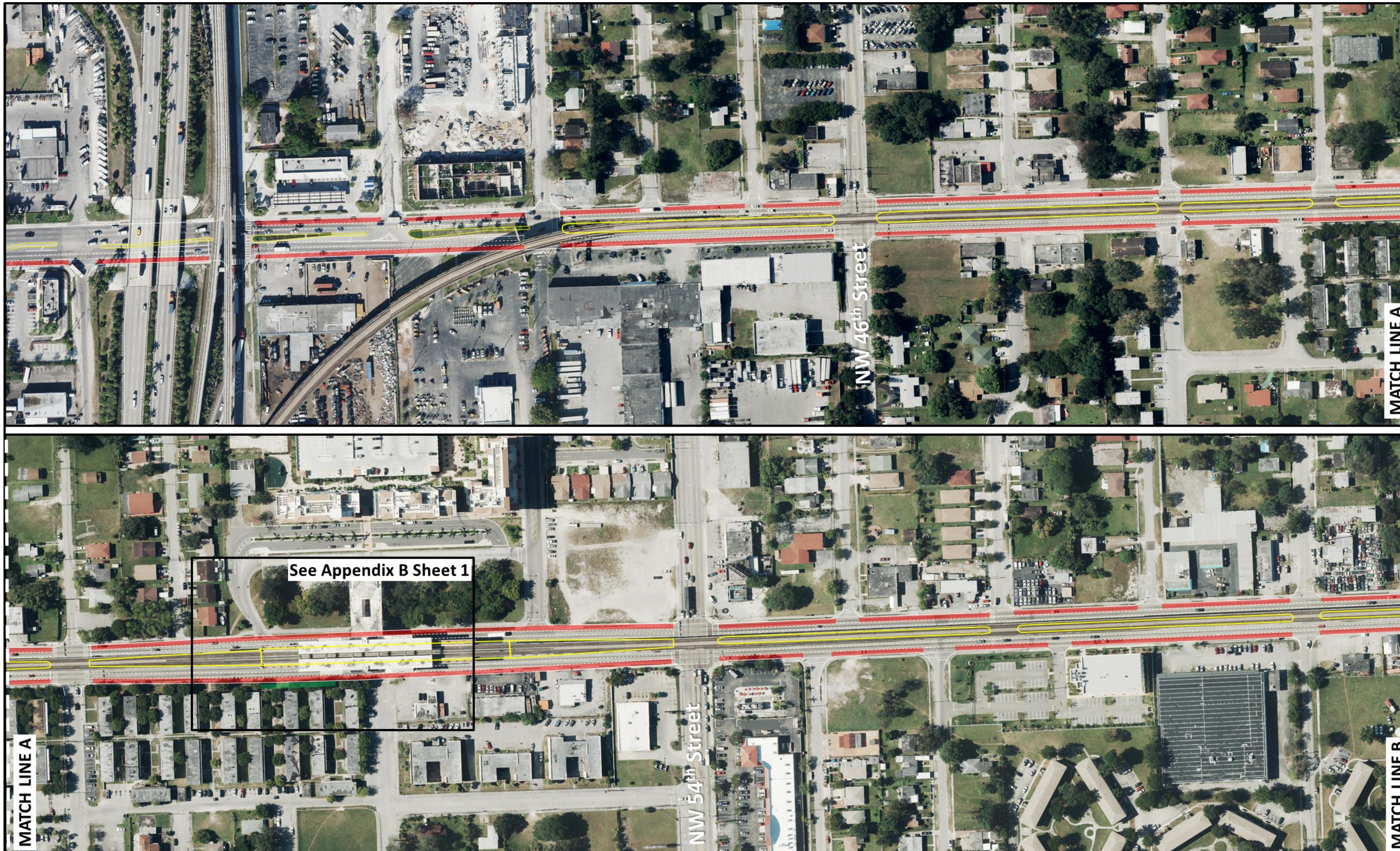
Table 29: Typical Implementation Schedule for a BRT System



The public and stakeholder involvement element of the implementation process cannot be overstated, seeing that implementing a BRT system boils down to being a local decision. It is vitally important that community residents, leaders, and elected officials are active and engaged throughout the implementation process to help shape the project and ultimately bring the proposed BRT service to fruition.

Appendix A – Corridor-Level Aerials with proposed BRT Alignment

NW 27th Avenue Corridor-Level Aerial (from SR 112 to NW 59th Street)



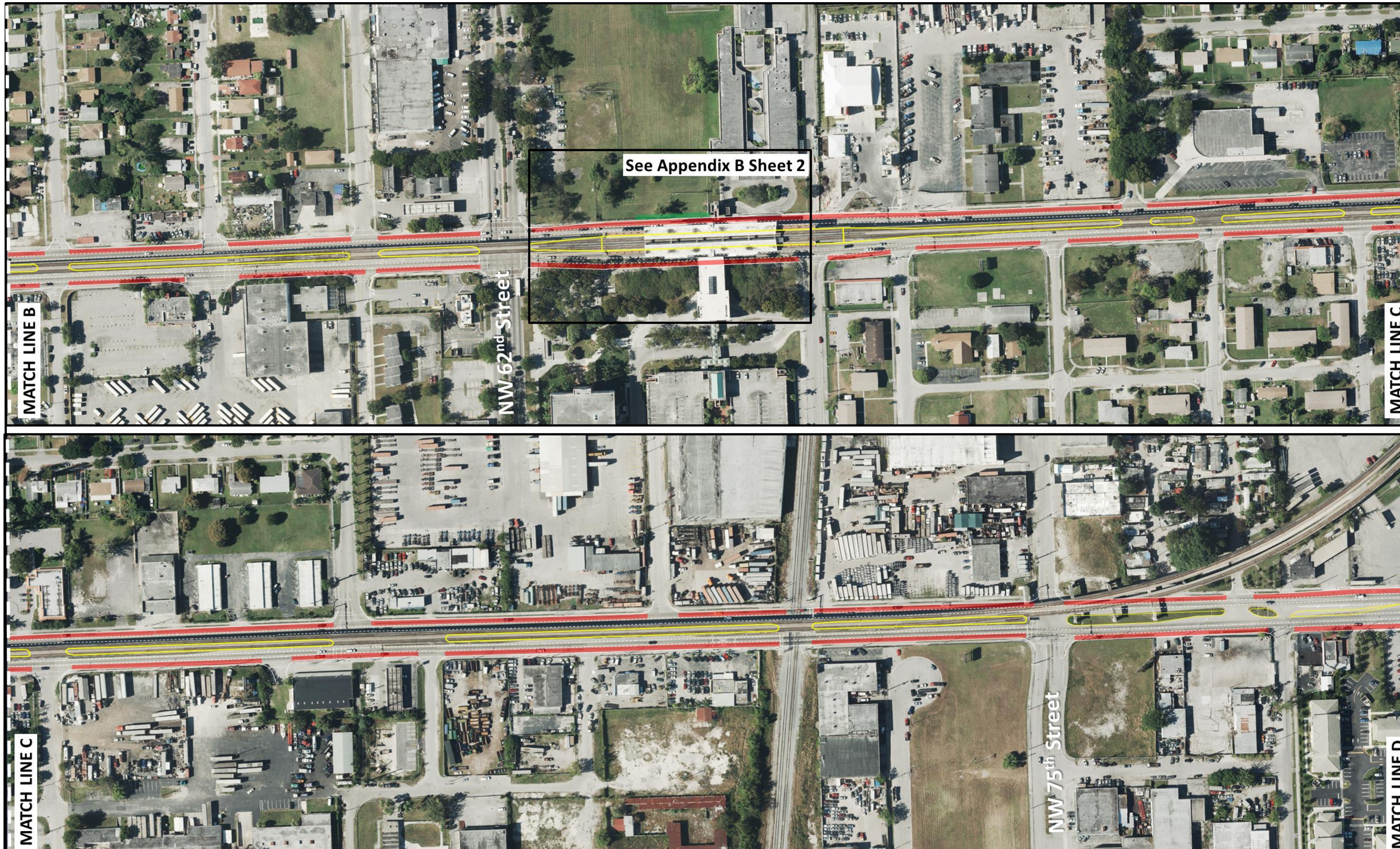
NW 27th Avenue BRT

HNTB

Sheet 1 of 10

0 125 250 500 Feet

NW 27th Avenue Corridor-Level Aerial (from NW 59th Street to NW 78th Street)



MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

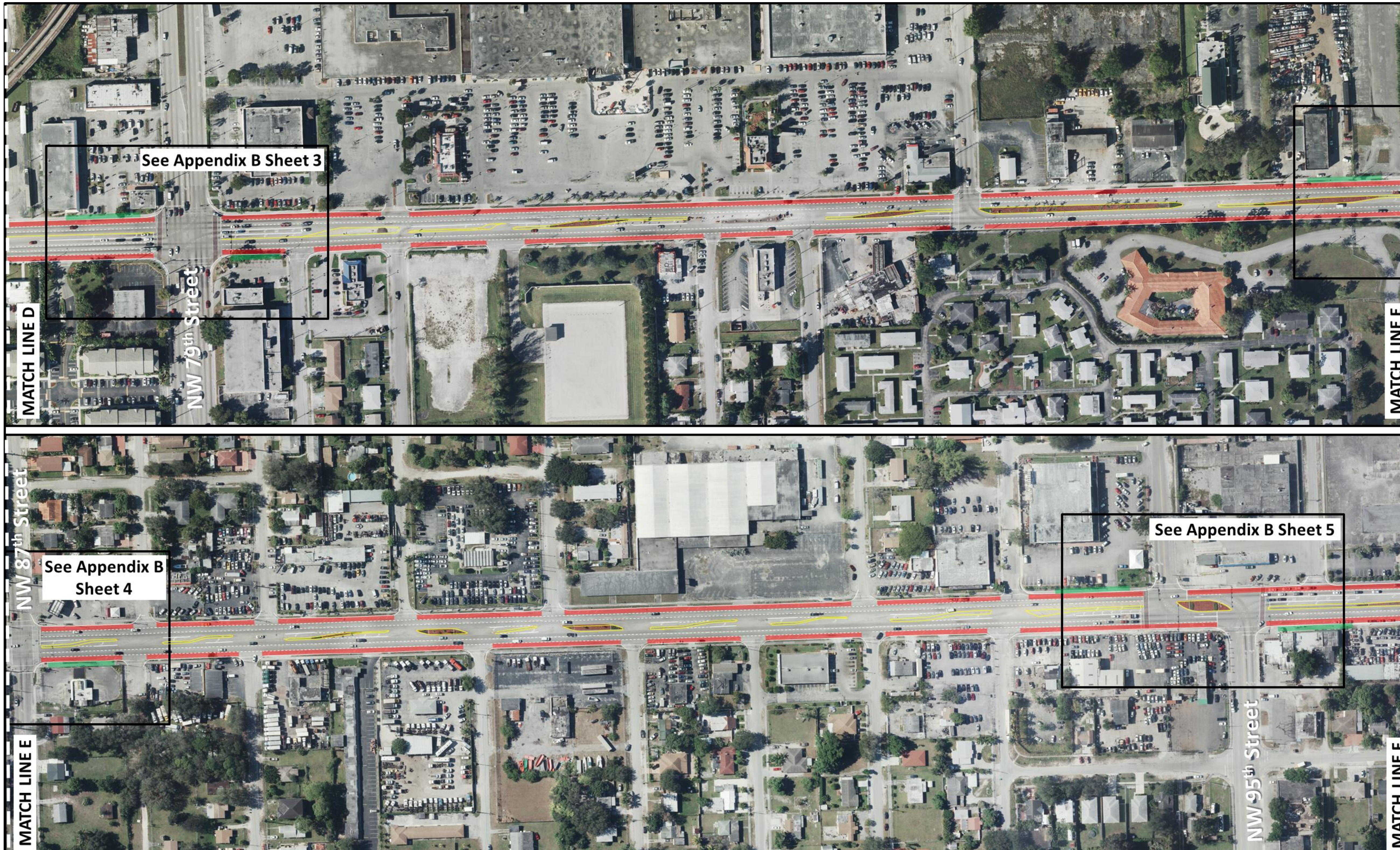
NW 27th Avenue BRT

HNTB

Sheet 2 of 10

0 125 250 500 Feet

NW 27th Avenue Corridor-Level Aerial (from NW 78th Street to NW 96th Street)



MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

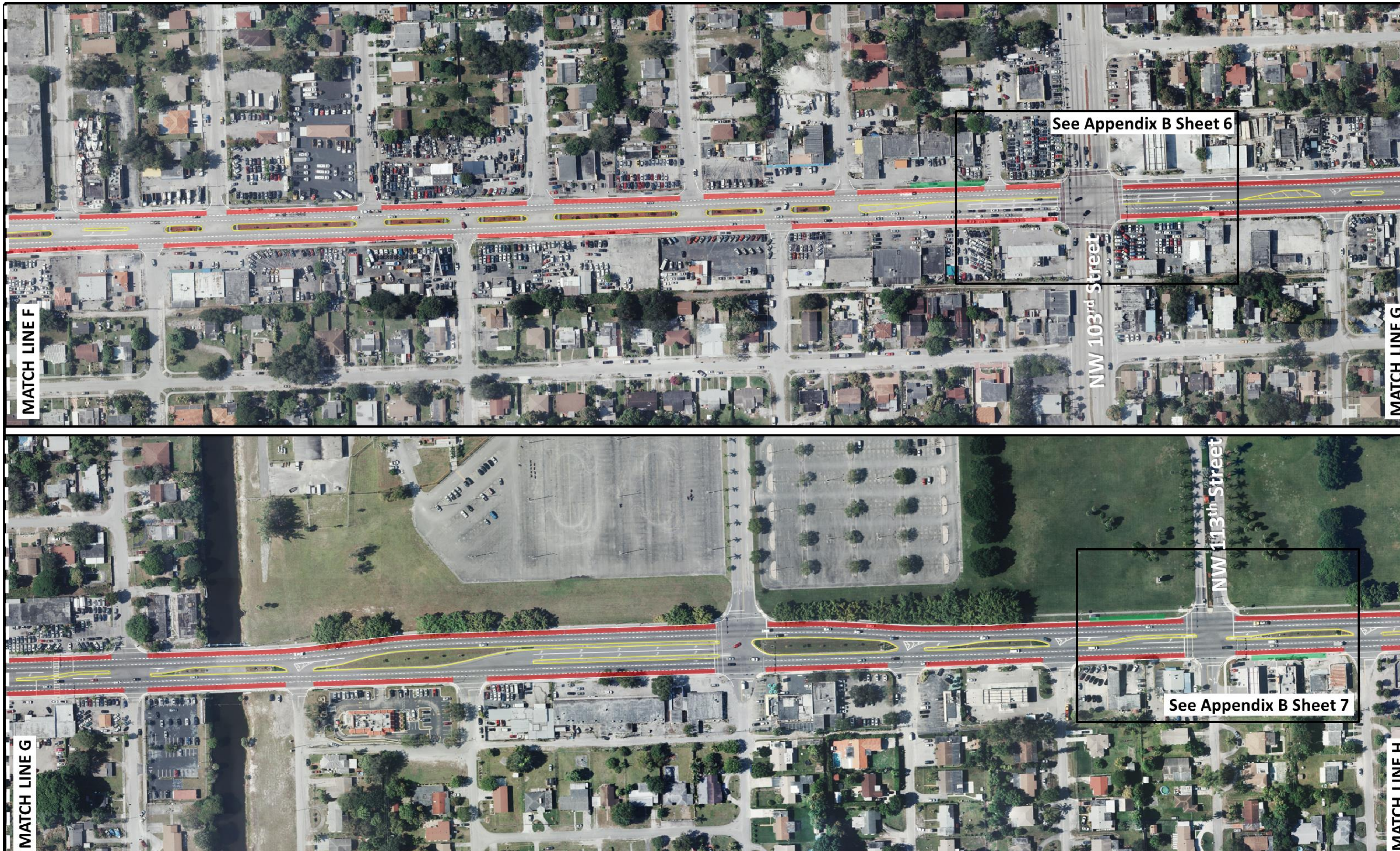
NW 27th Avenue BRT

HNTB

Sheet 3 of 10

0 125 250 500 Feet

NW 27th Avenue Corridor-Level Aerial (from NW 96th Street to NW 114th Street)



MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

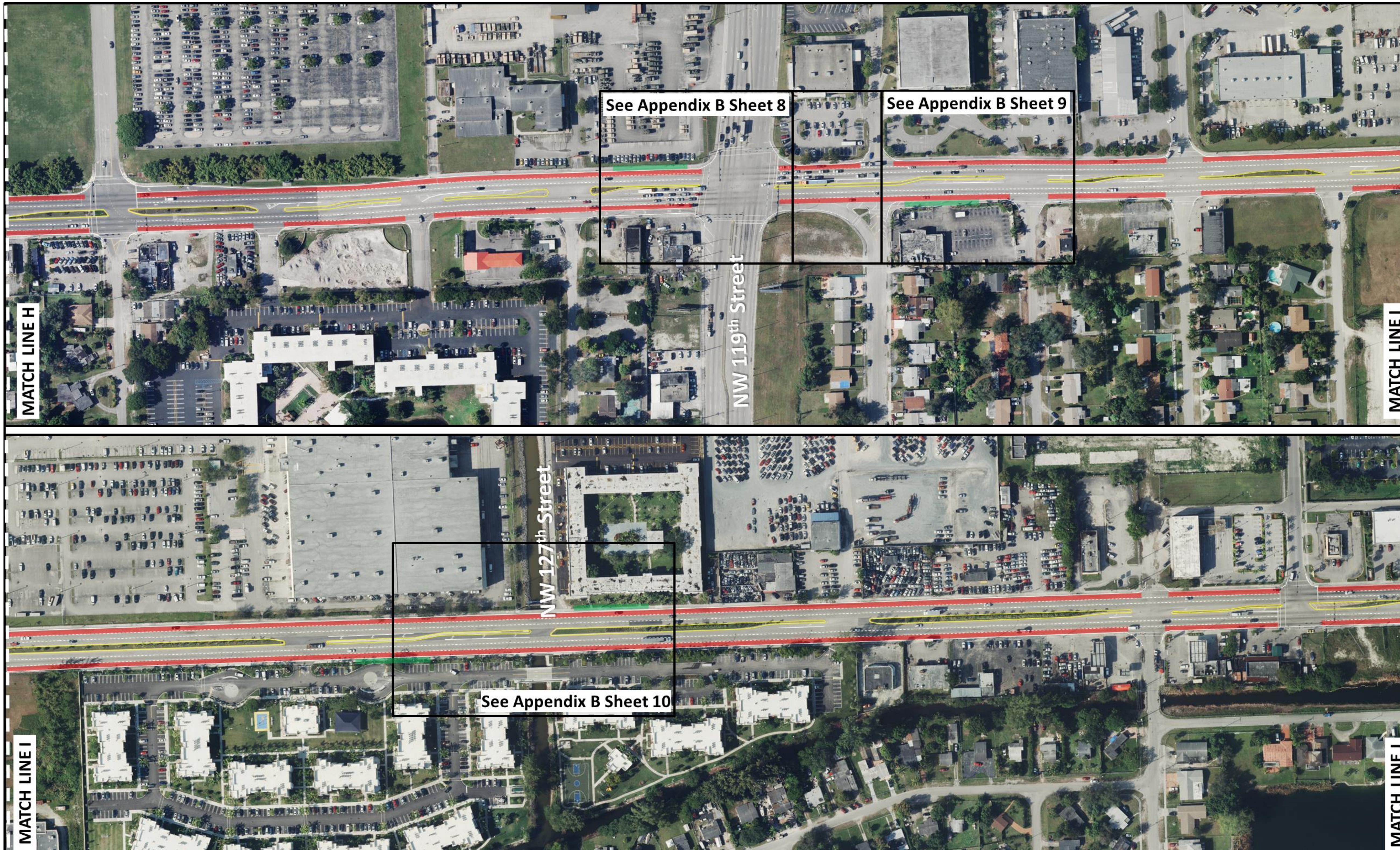
NW 27th Avenue BRT

HNTB

Sheet 4 of 10

0 125 250 500 Feet

NW 27th Avenue Corridor-Level Aerial (from NW 114th Street to NW 135th Street)



NW 27th Avenue BRT

HNTB

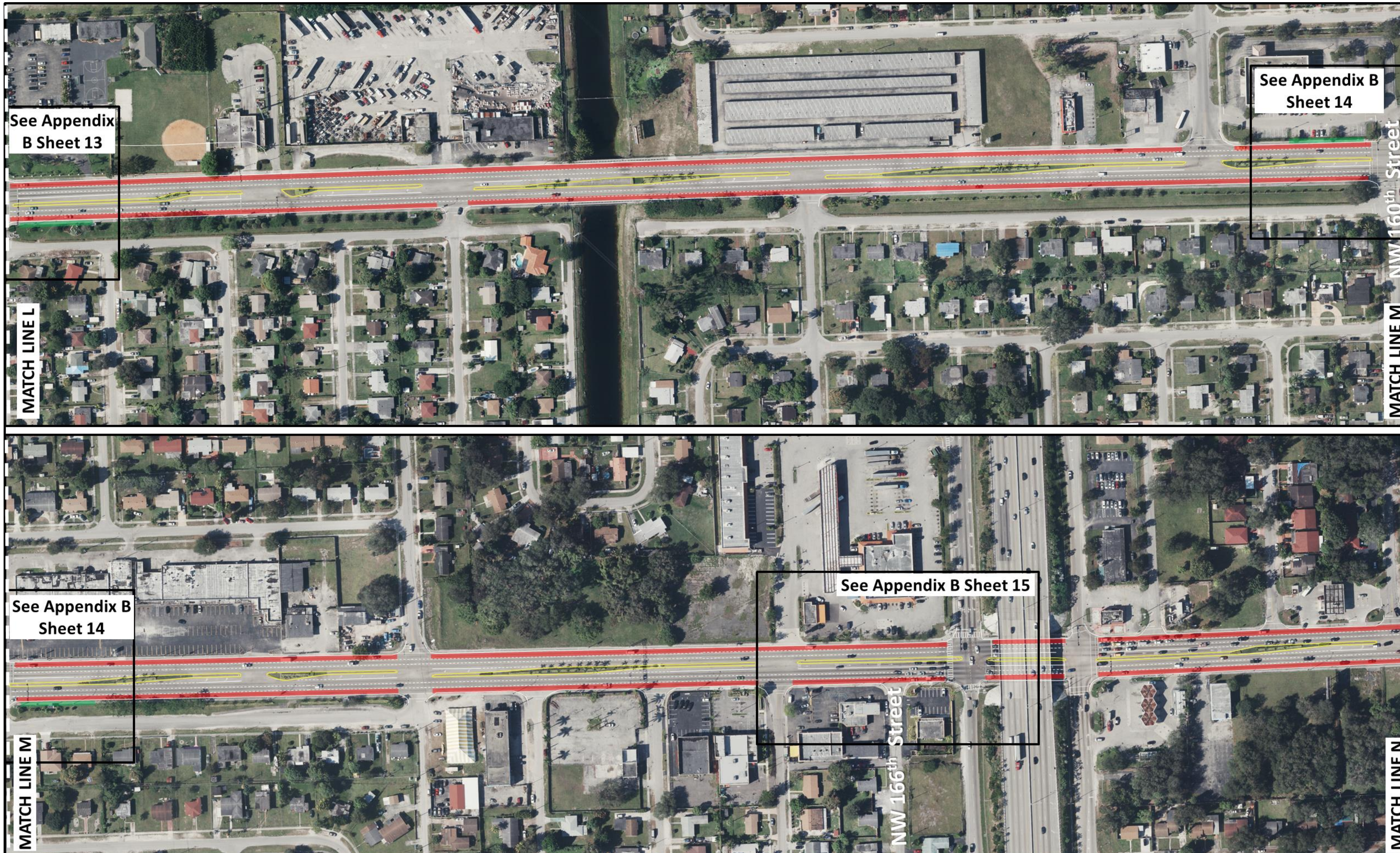
Sheet 5 of 10

0 125 250 500 Feet

NW 27th Avenue Corridor-Level Aerial (from NW 135th Street to NW 151st Street)

0 125 250 500 Feet

NW 27th Avenue Corridor-Level Aerial (from NW 151st Street to NW 170th Street)



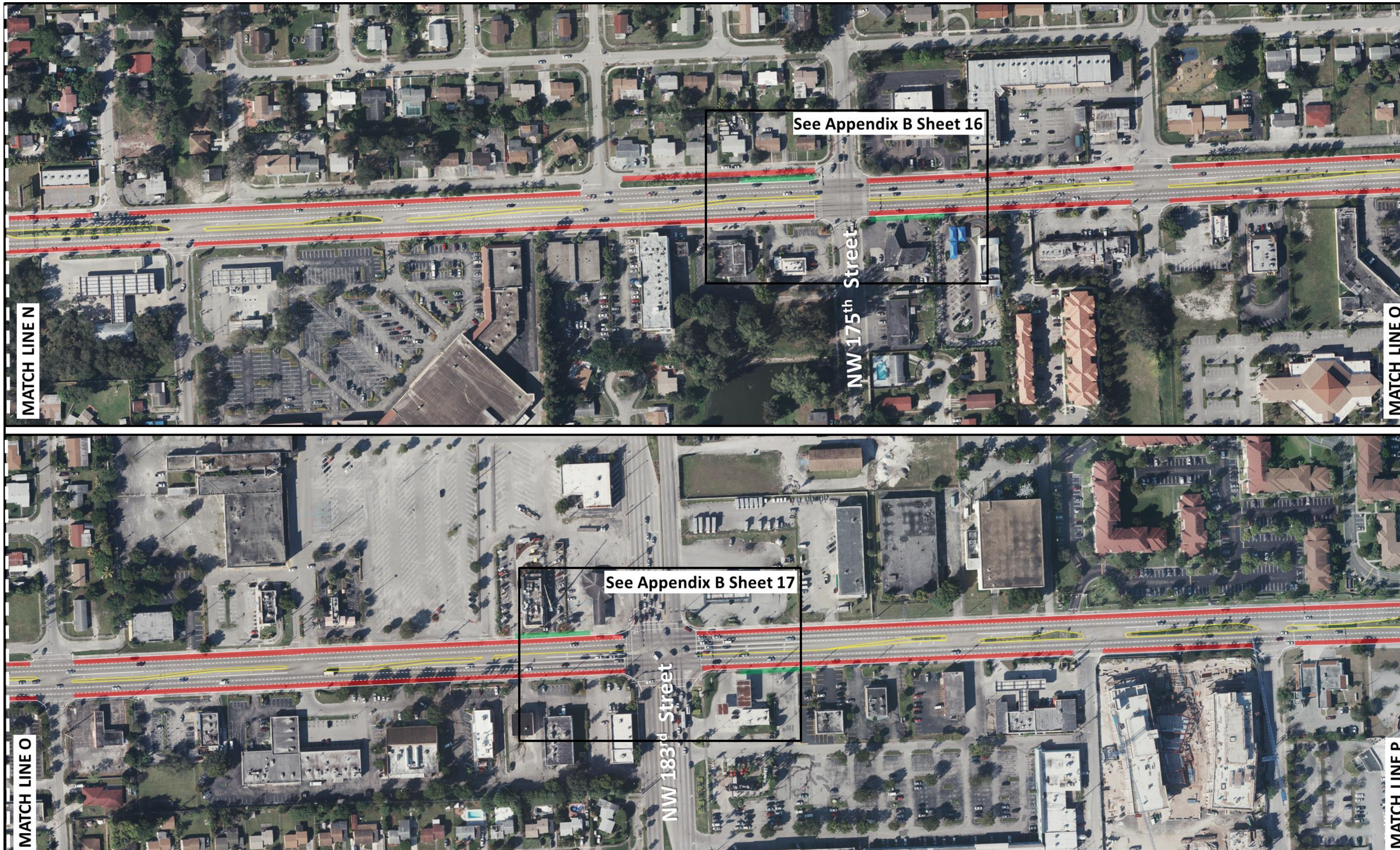
NW 27th Avenue BRT

HNTB

Sheet 7 of 10

0 125 250 500 Feet

NW 27th Avenue Corridor-Level Aerial (from NW 170th Street to NW 188th Street)



MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

NW 27th Avenue BRT

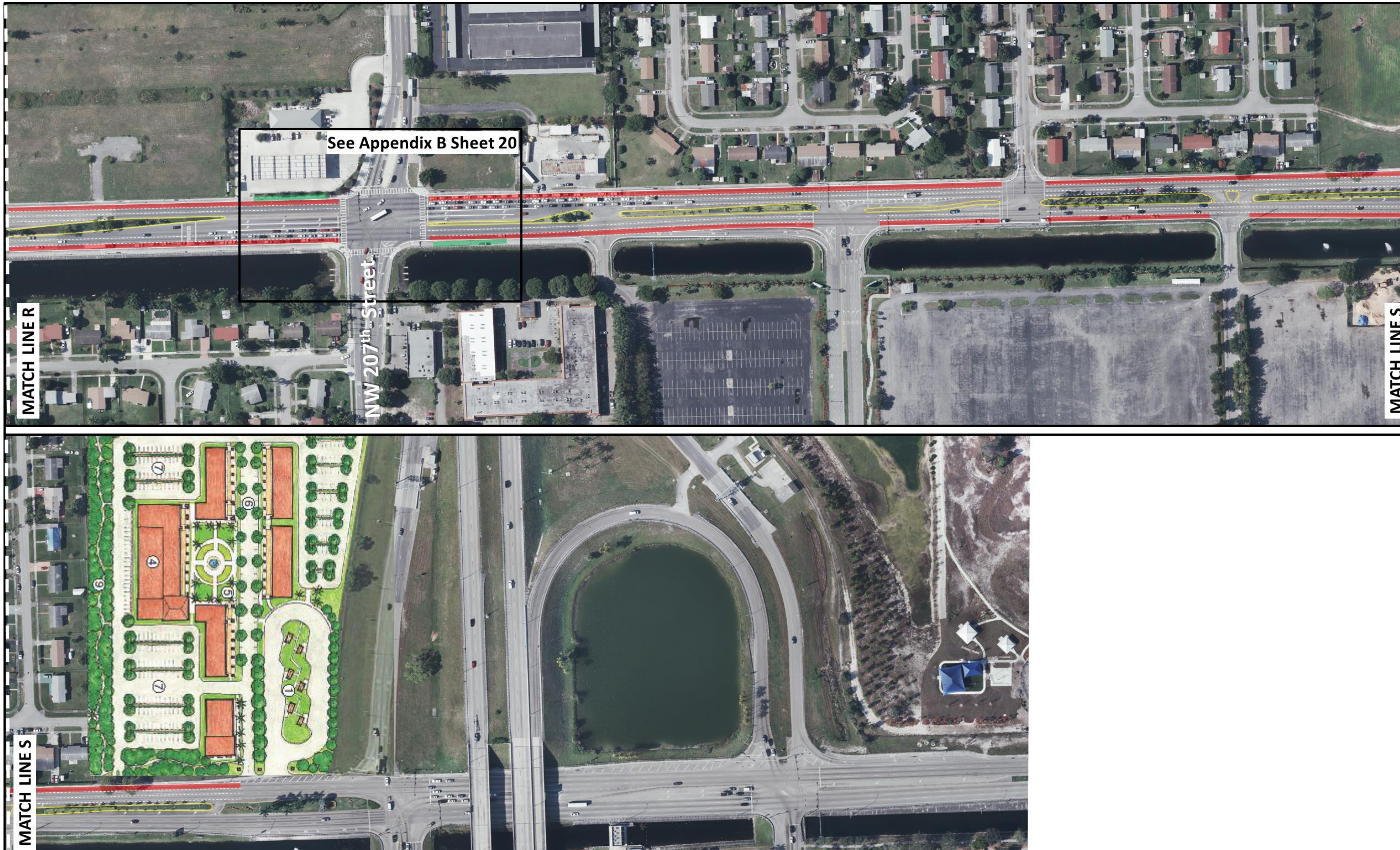
HNTB

0 125 250 500 Feet

NW 27th Avenue Corridor-Level Aerial (from NW 188th Street to NW 203rd Street)

MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION | NW 27th Avenue BRT | HNTB | Sheet 9 of 10 | 0 125 250 500 Feet

NW 27th Avenue Corridor-Level Aerial (from NW 203rd Street to NW 215th Street)

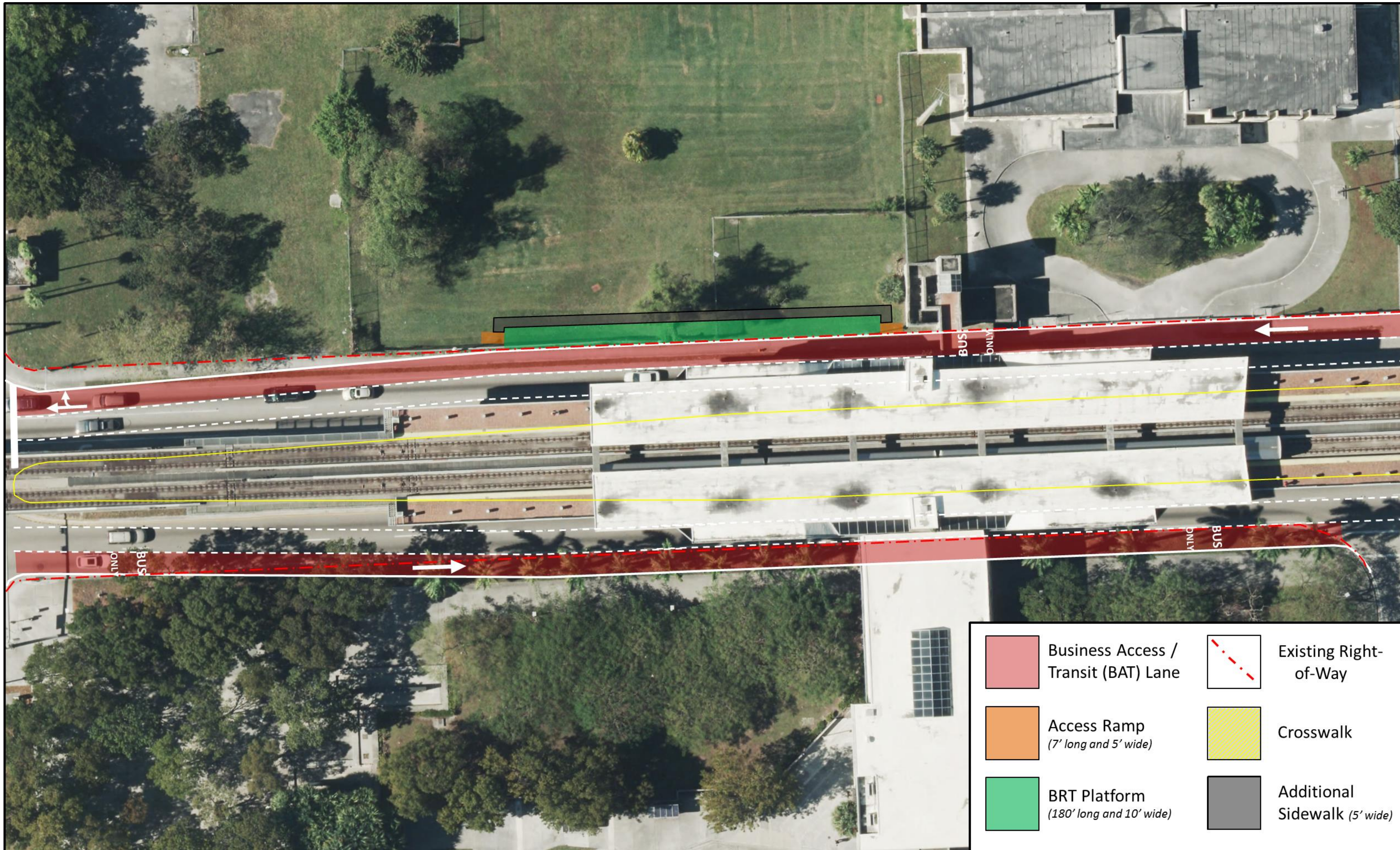


NW 27th Avenue BRT

HNTB

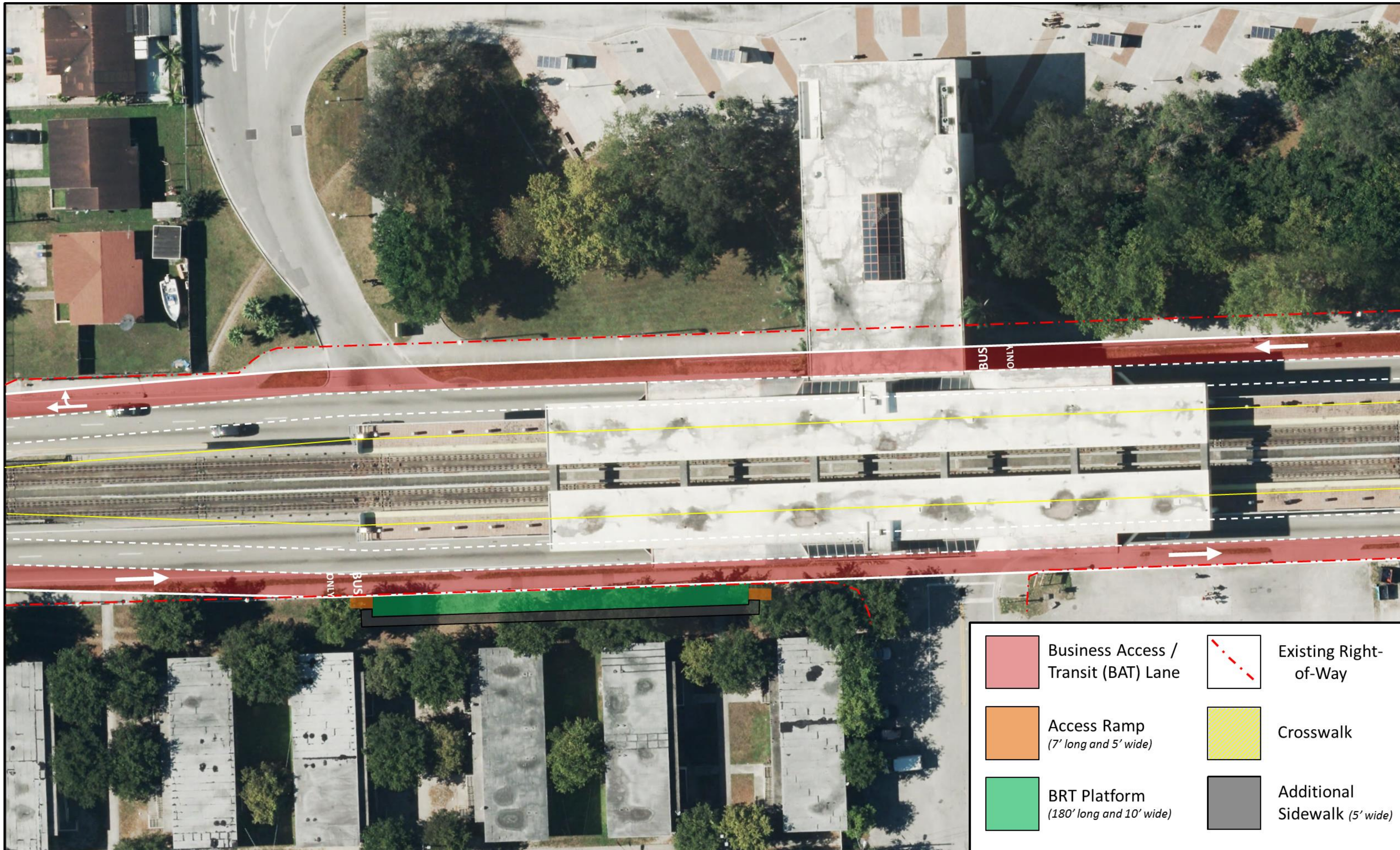
Sheet 10 of 10

Appendix B – Transit Station-Level Aerials with proposed BRT Concepts



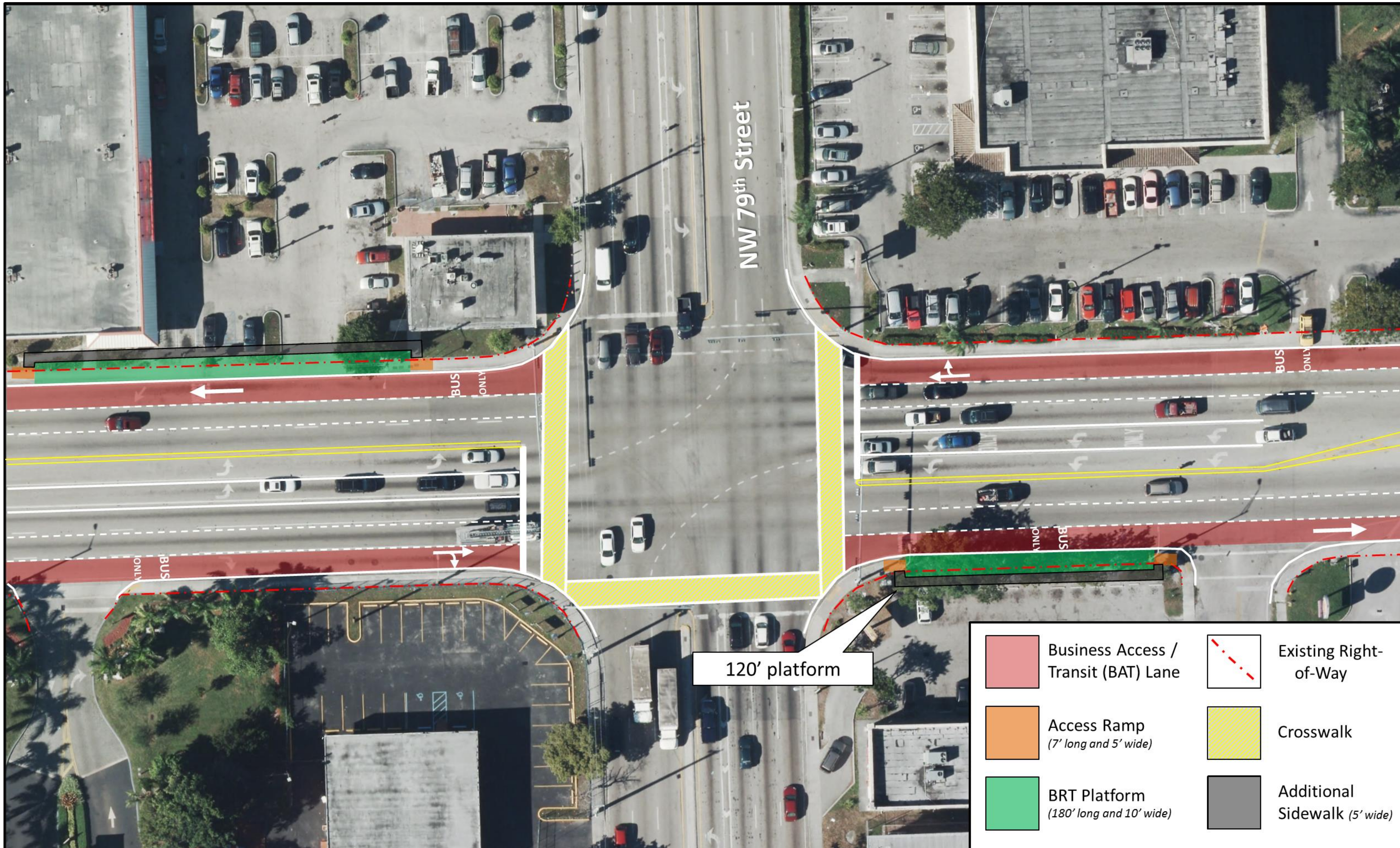
NW 27th Avenue BRT at NW 62nd Street Station

HNTB



NW 27th Avenue BRT at NW 54th Street Station

HNTB

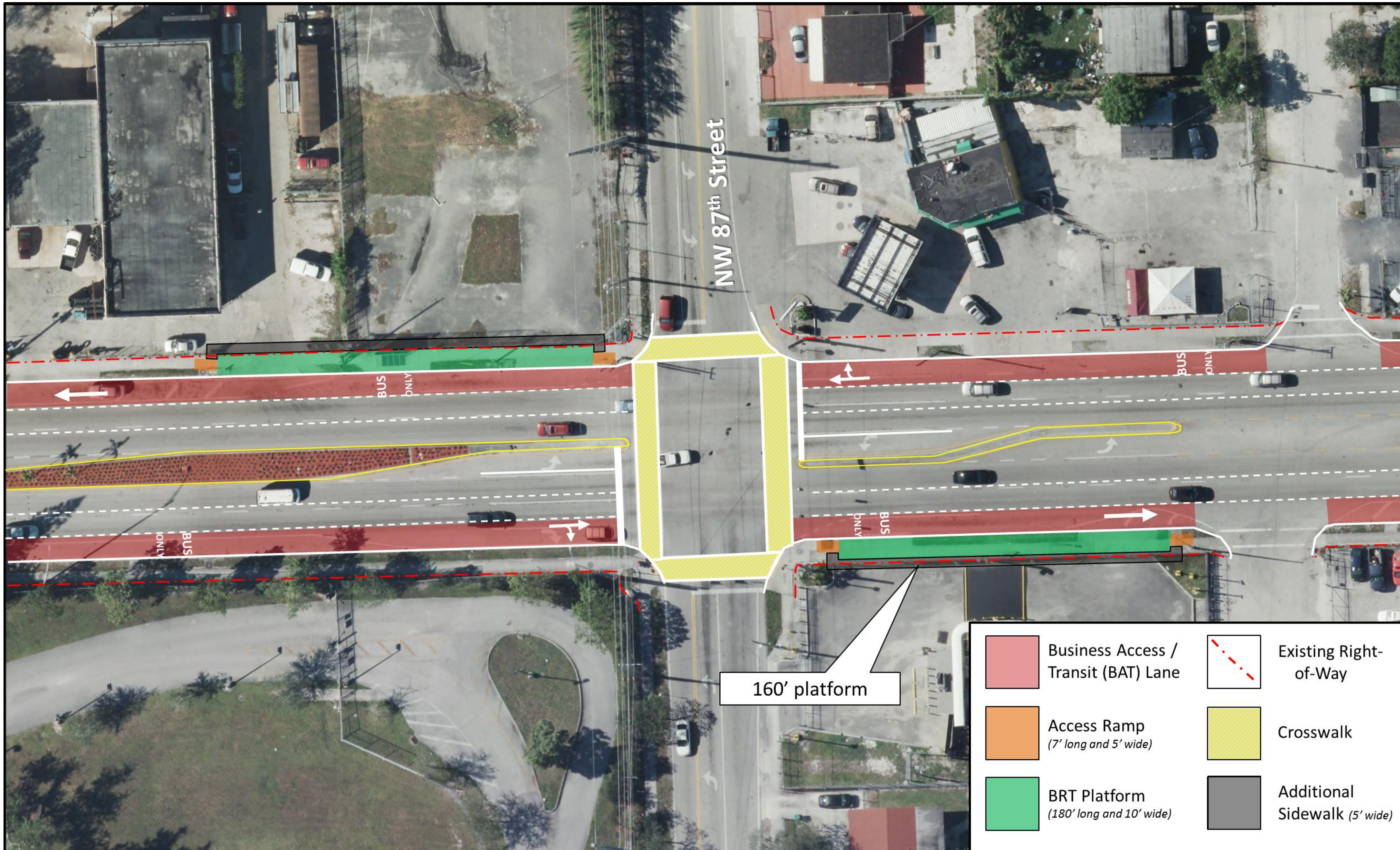


MPO MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

NW 27th Avenue BRT at NW 79th Street Station

HNTB

0 25 50 100 Feet



NW 27th Avenue BRT at NW 87th Street Station

HNTB

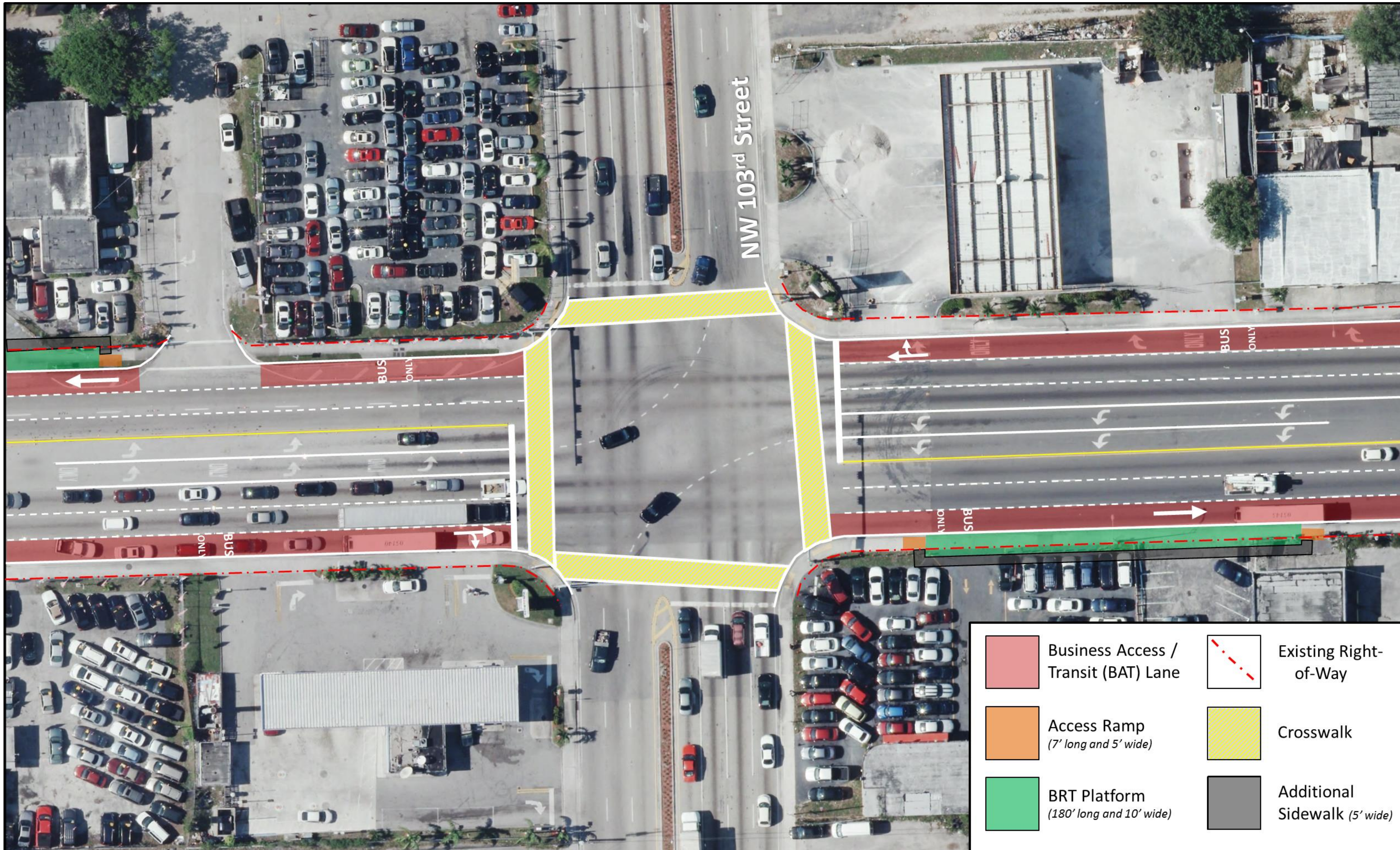
0 25 50 100 Feet

NW 27th Avenue BRT at NW 95th Street Station

HNTB

Sheet 5 of 20

0 25 50 100 Feet

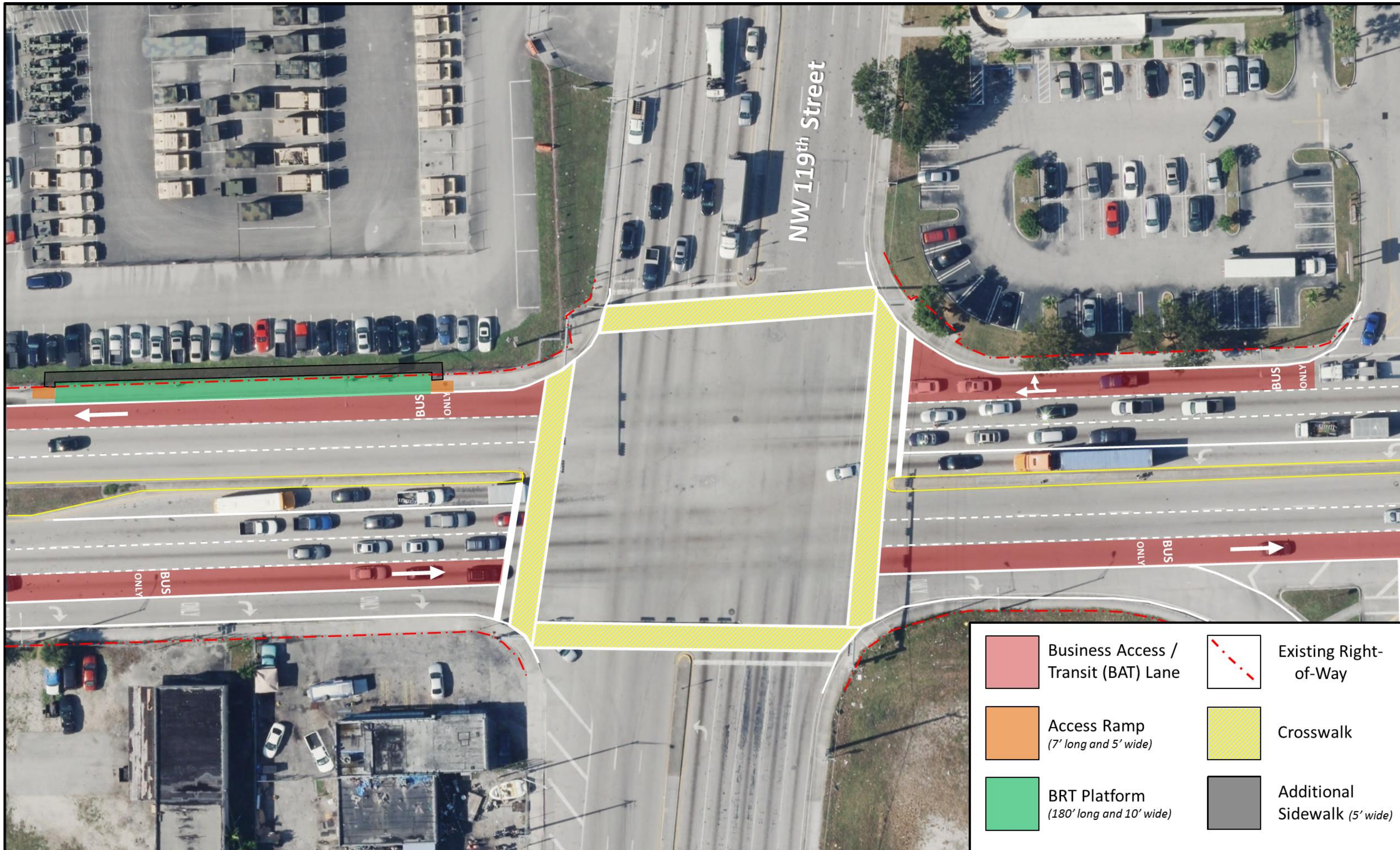


NW 27th Avenue BRT at NW 103rd Street Station HNTB Sheet 6 of 20

0 25 50 100 Feet

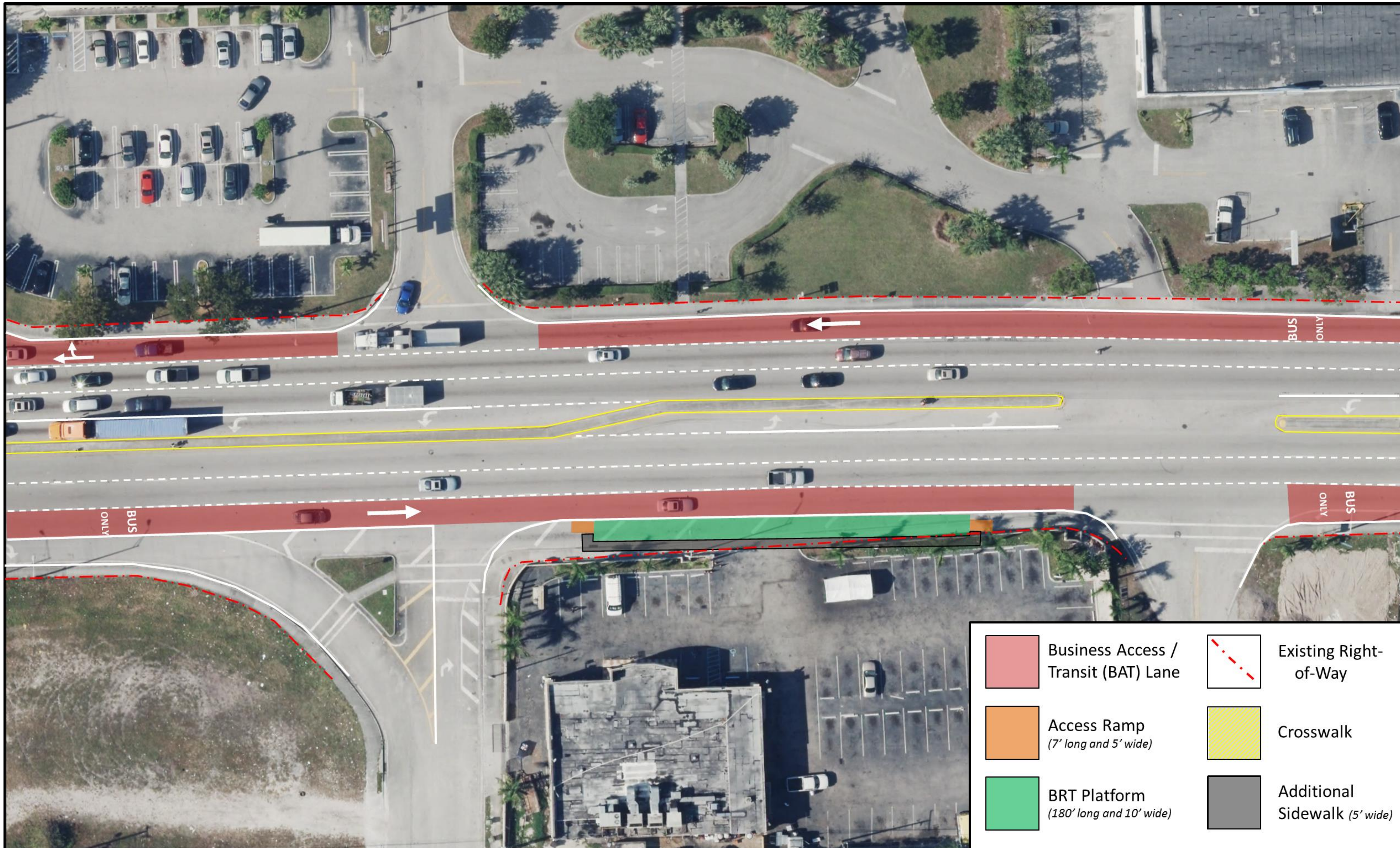
NW 27th Avenue BRT at NW 113th Street Station

HNTB



NW 27th Avenue BRT at NW 119th Street (SB) Station HNTB

0 25 50 100 Feet



NW 27th Avenue BRT at NW 119th Street (NB) Station

HNTB

Sheet 9 of 20

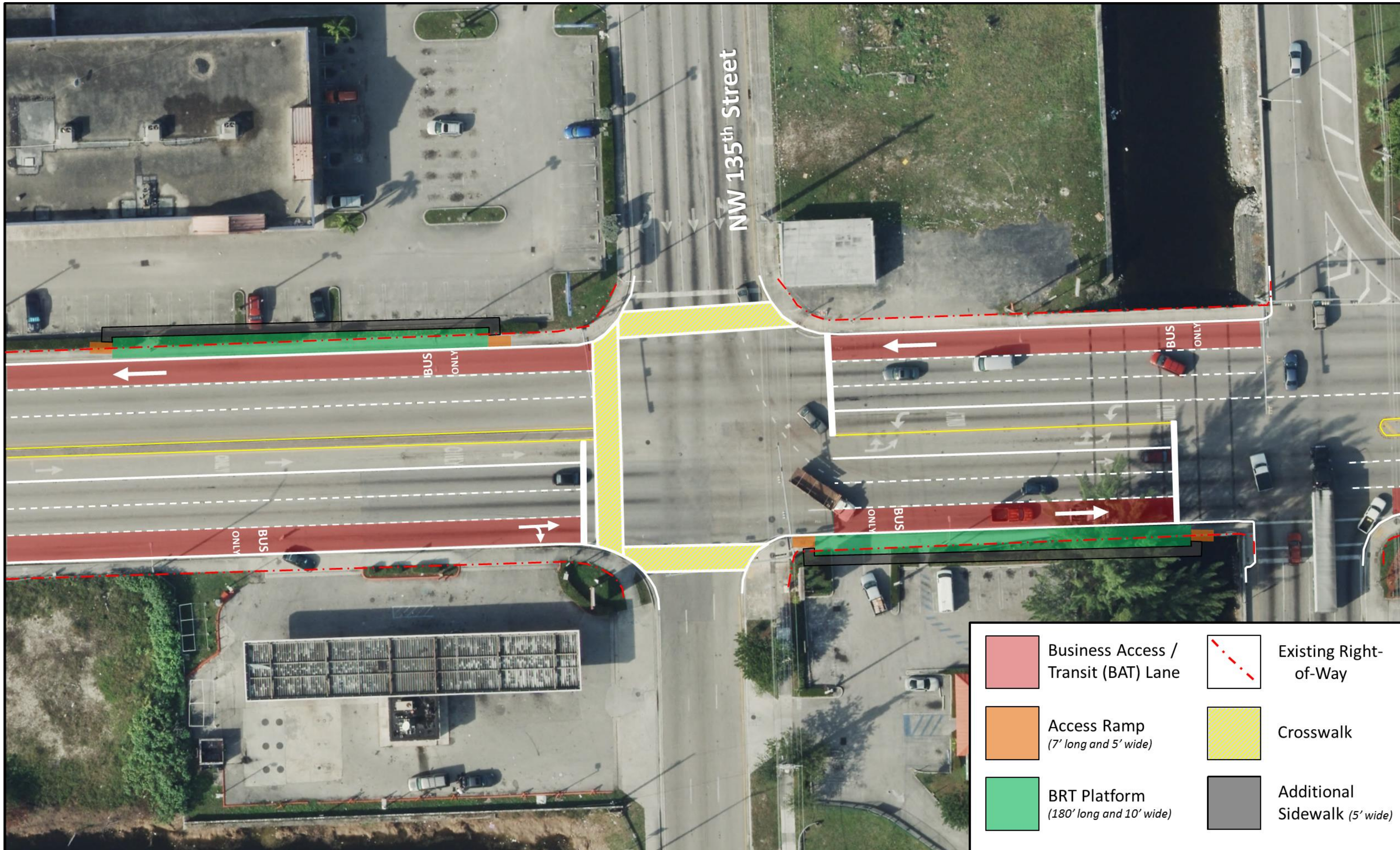
0 25 50 100 Feet

NW 27th Avenue BRT at NW 127th Street Station

HNTB

Sheet 10 of 20

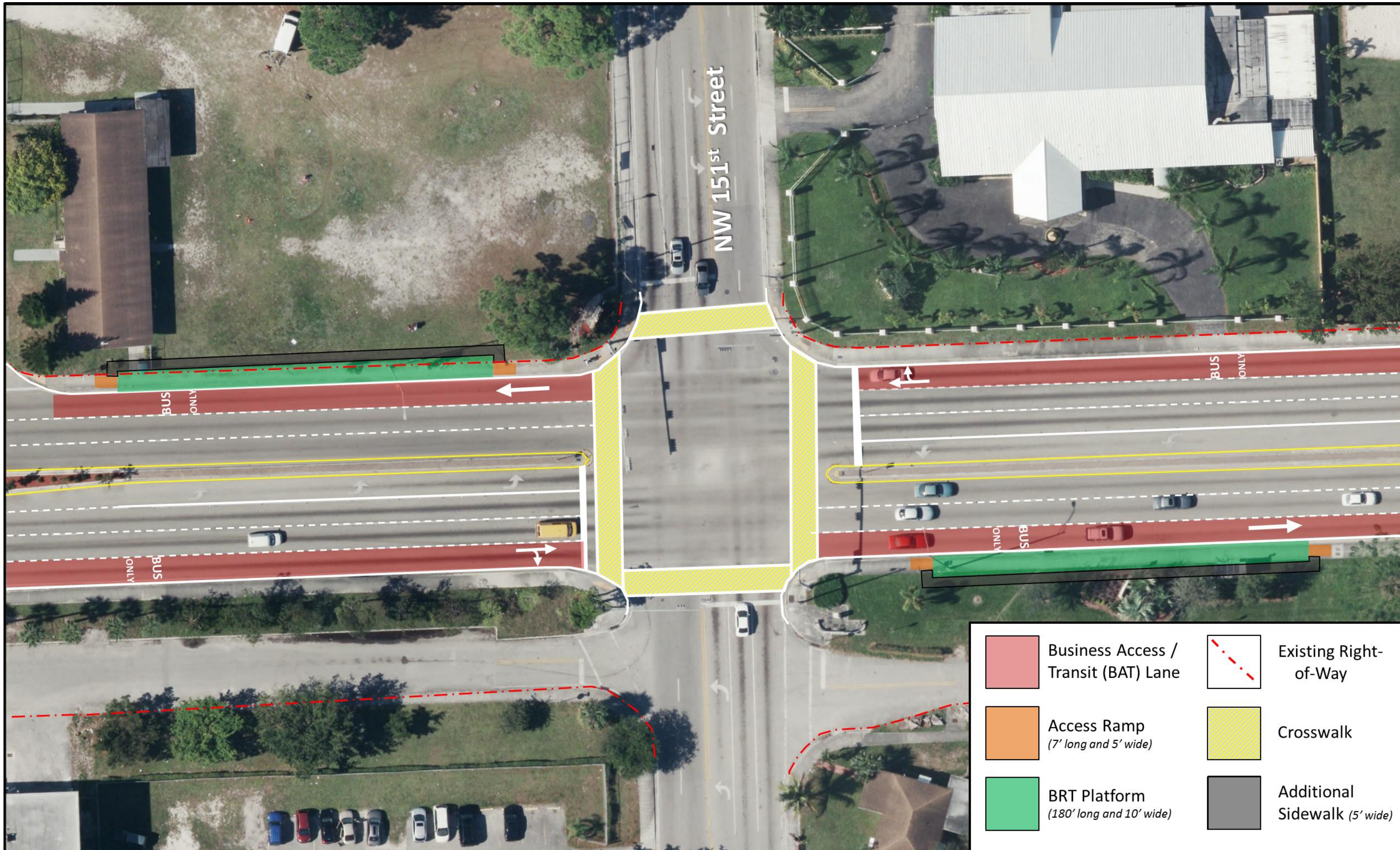
0 25 50 100 Feet



NW 27th Avenue BRT at NW 135th Street Station HNTB Sheet 11 of 20

0 25 50 100 Feet

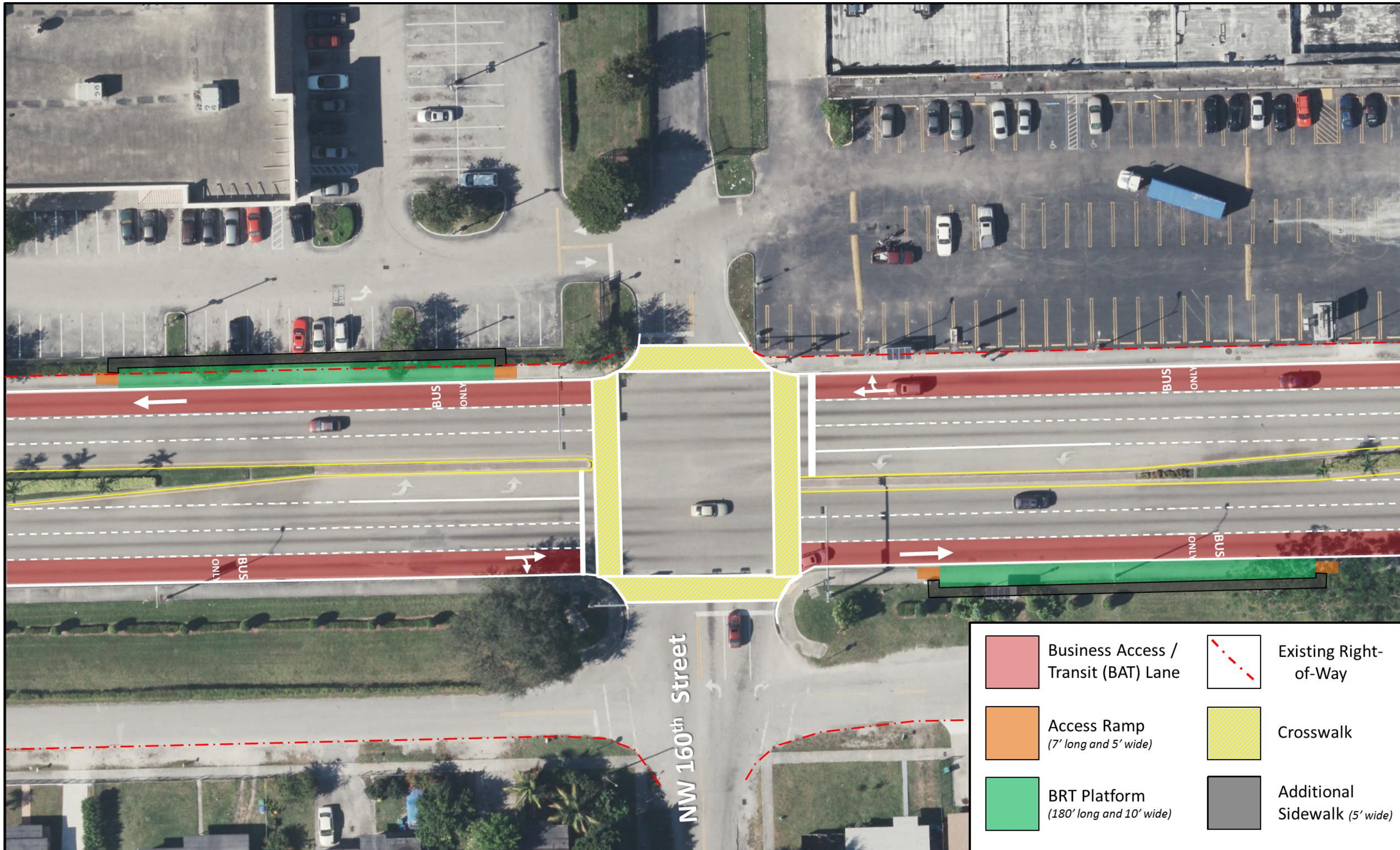
MPO MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION | NW 27th Avenue BRT at Sesame Street Station | HNTB | Sheet 12 of 20



NW 27th Avenue BRT at NW 151st Street Station

HNTB

Sheet 13 of 20

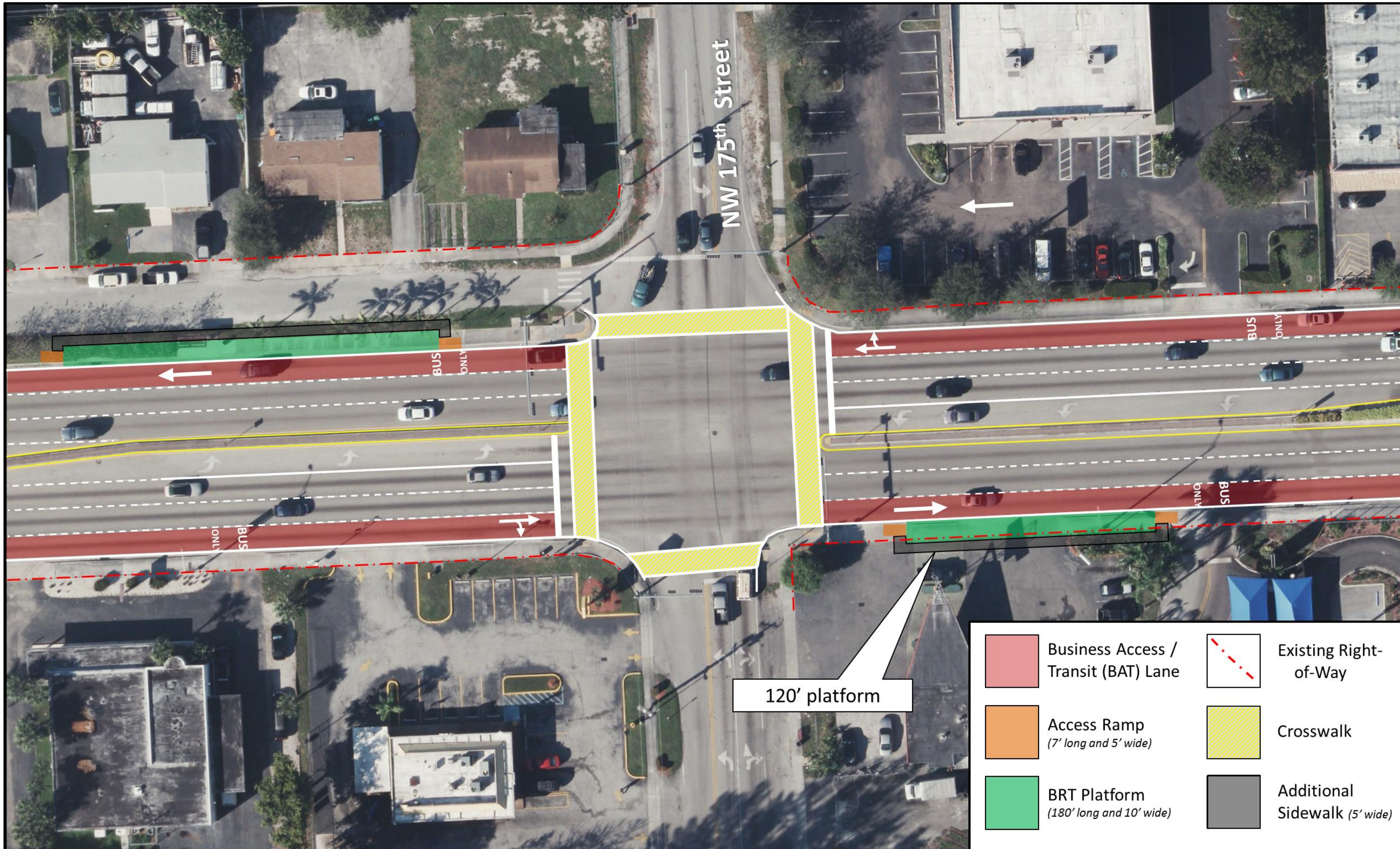


NW 27th Avenue BRT at NW 160th Street Station

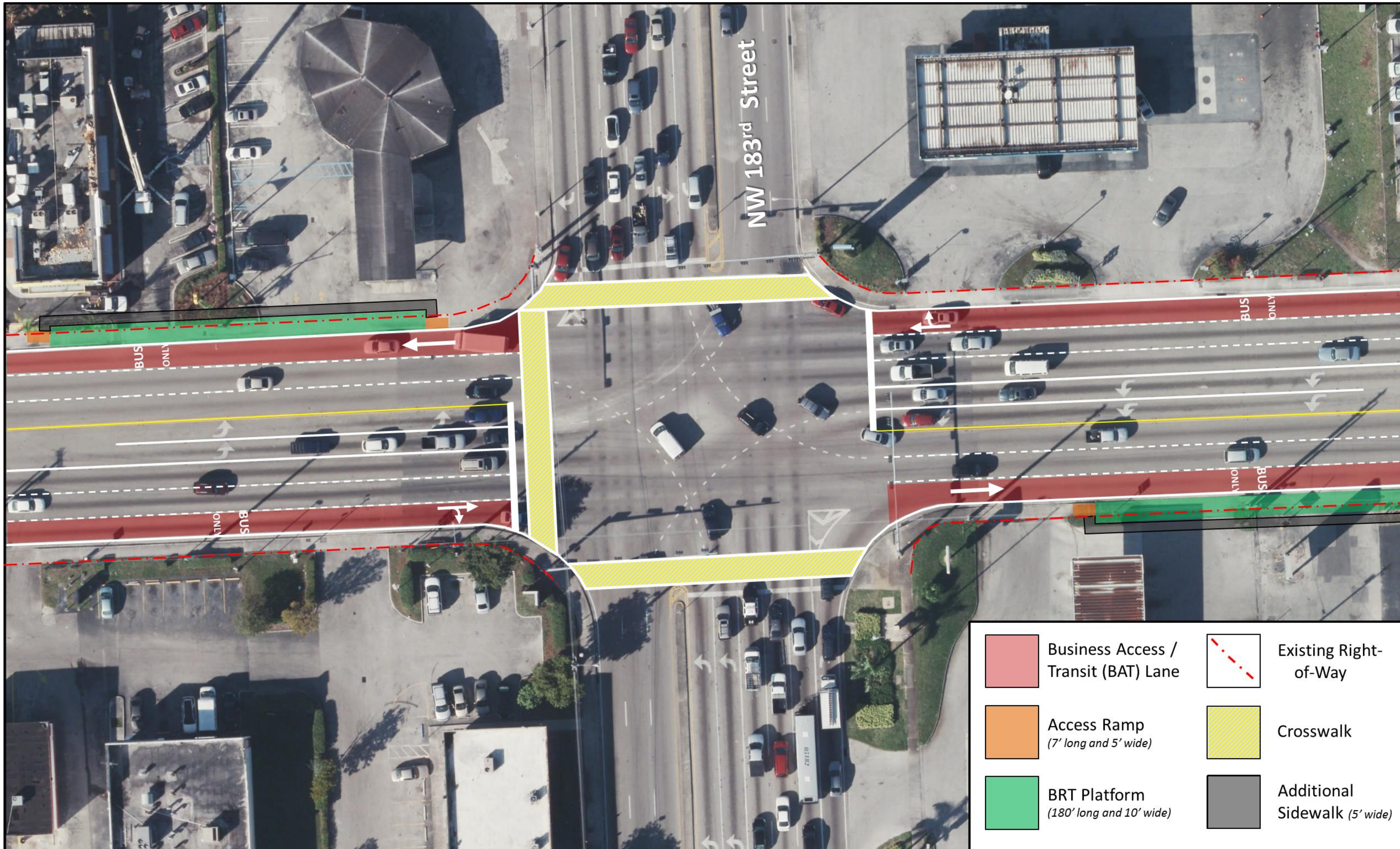
HNTB

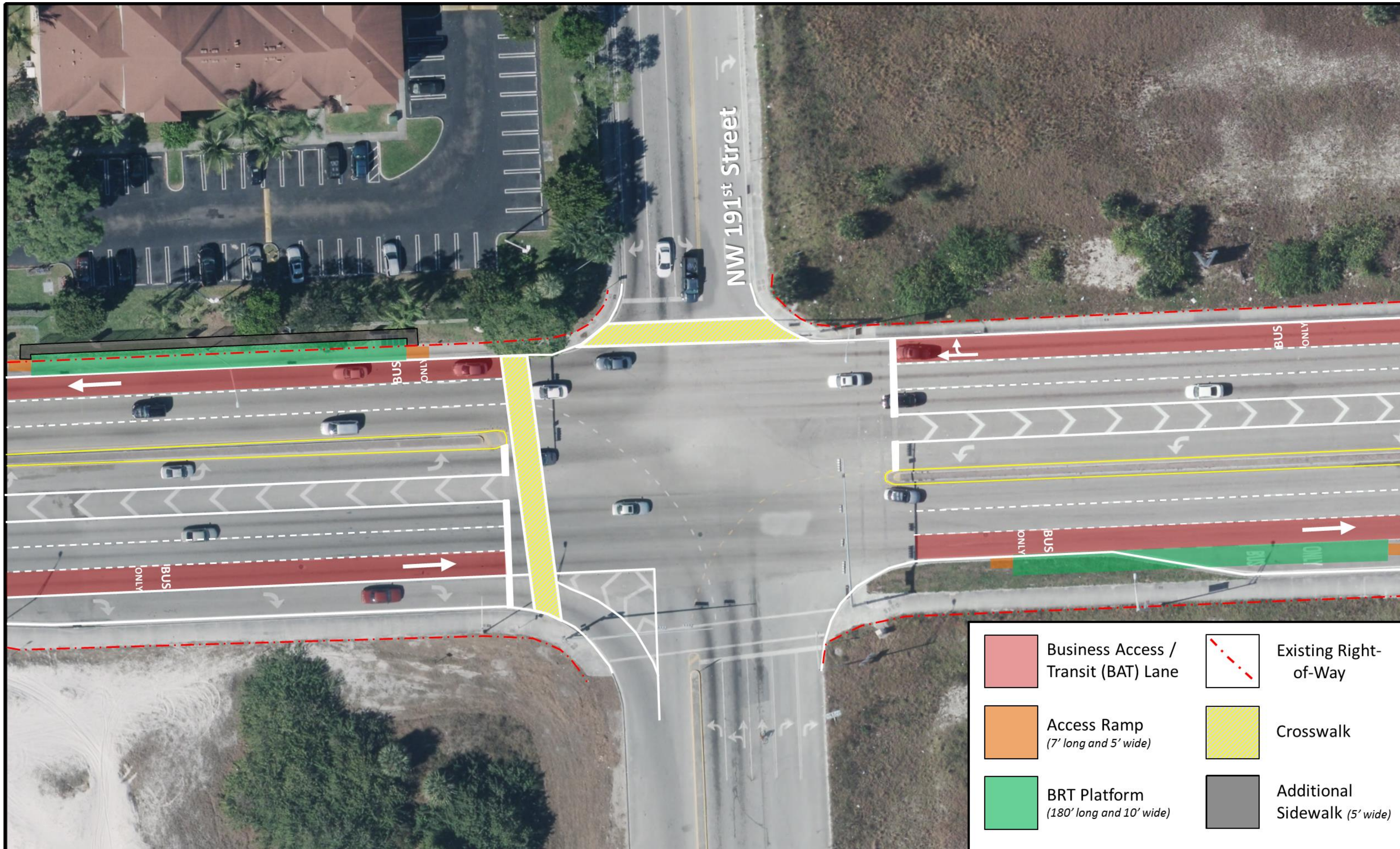
Sheet 14 of 20

NW 27th Avenue BRT at NW 166th Street Station HNTB | Sheet 15 of 20 | 0 25 50 100 Feet



NW 27th Avenue BRT at NW 175th Street Station HNTB


NW 183rd Street
BUS ONLY
BUS ONLY
BUS ONLY
BUS ONLY
Business Access / Transit (BAT) Lane
Existing Right-of-Way
Access Ramp (7' long and 5' wide)
Crosswalk
BRT Platform (180' long and 10' wide)
Additional Sidewalk (5' wide)
0 25 50 100 Feet



NW 27th Avenue BRT at NW 191st Street Station

HNTB

Sheet 18 of 20

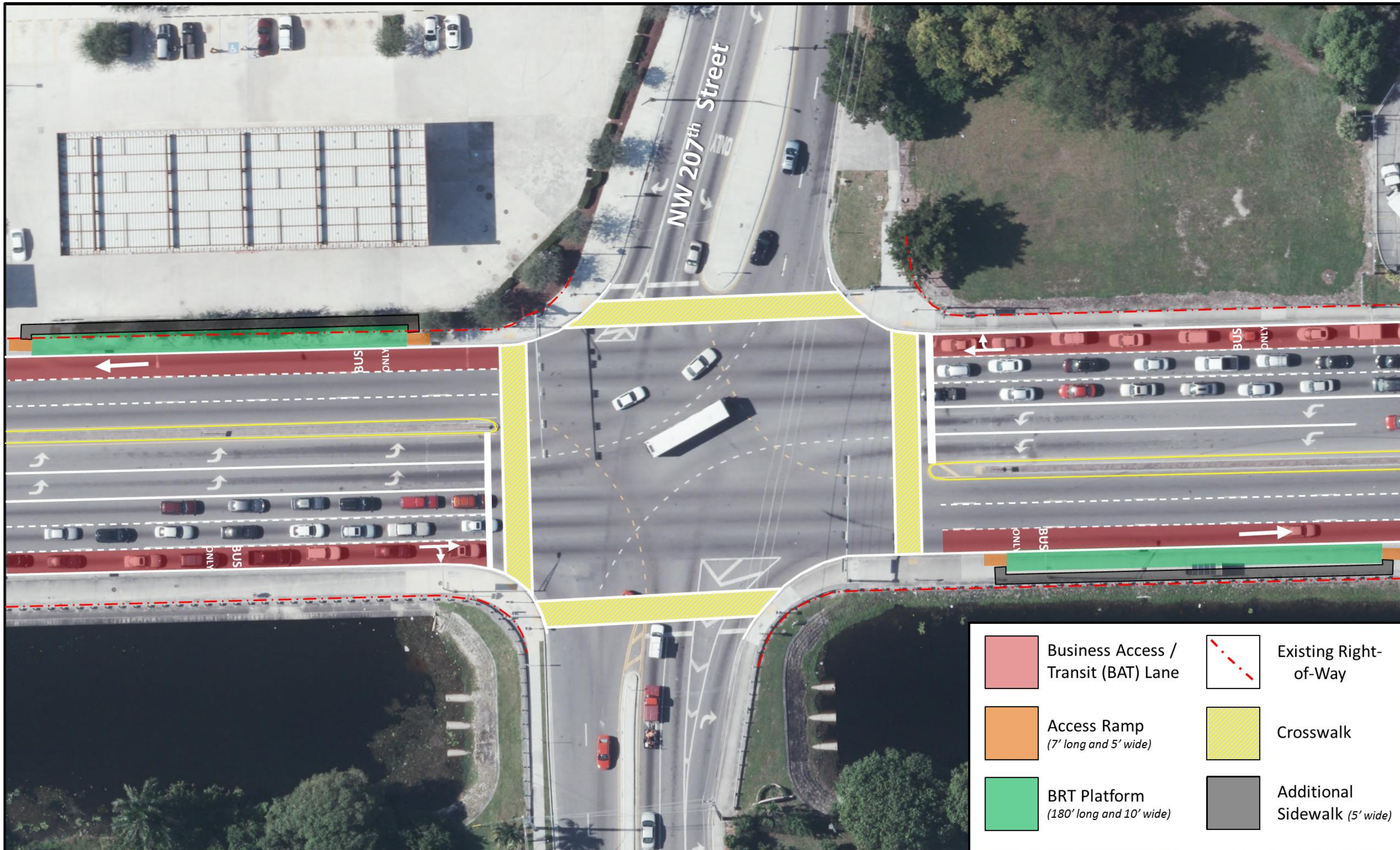
0 25 50 100 Feet

NW 27th Avenue BRT at NW 199th Street Station

HNTB

Sheet 19 of 20

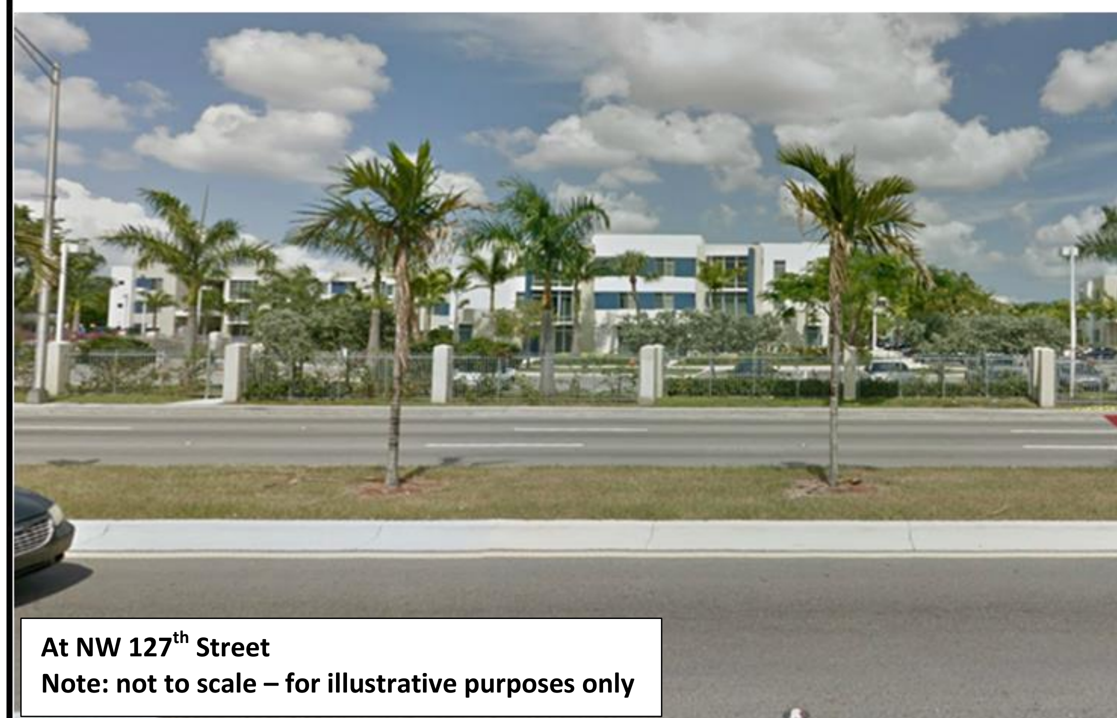
0 25 50 100 Feet



NW 27th Avenue BRT at NW 207th Street Station HNTB | Sheet 20 of 20 | 0 25 50 100 Feet

Appendix C – Before and After Renderings

Just south of Sesame Street
Note: not to scale – for illustrative purposes only

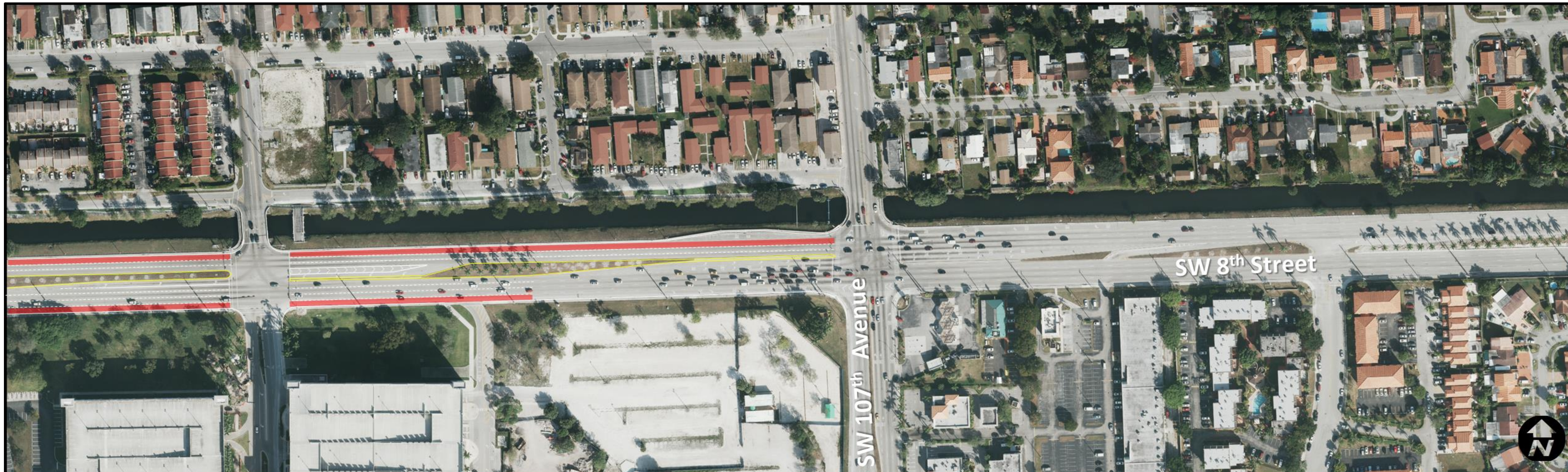


At NW 127th Street
Note: not to scale – for illustrative purposes only

NW 27th Avenue Before and After Renderings | HNTB | Sheet 2 of 2

Appendix D – Corridor-Level Aerials with proposed BRT Alignment

W Flagler Street Corridor-Level Aerial (from SW 8th Street/SW 109th Avenue to W Flagler Street/107th Avenue)

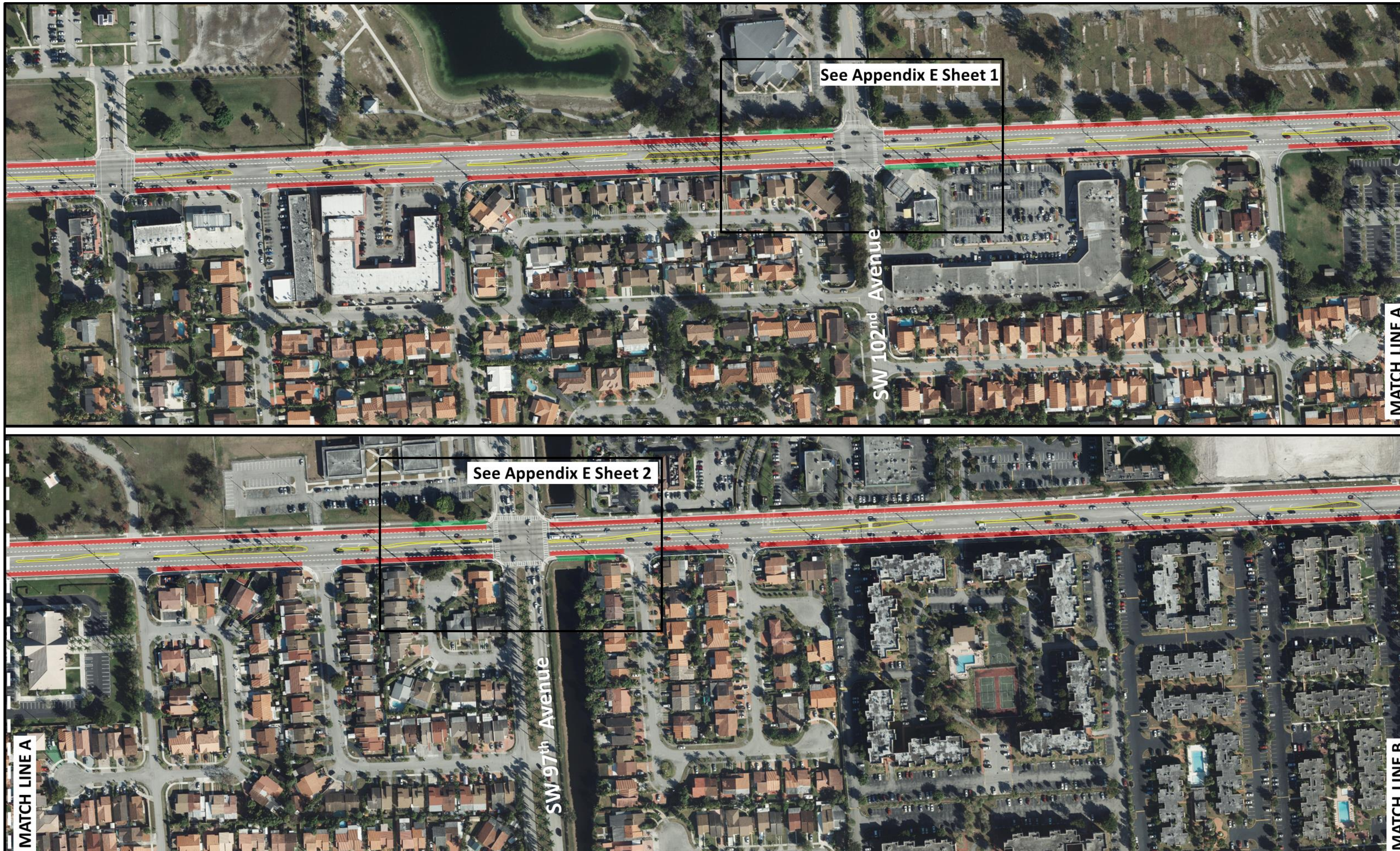


W. Flagler Street BRT

HNTB

Sheet 1 of 9

W Flagler Street Corridor-Level Aerial (from 107th Avenue to 93rd Avenue)



MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

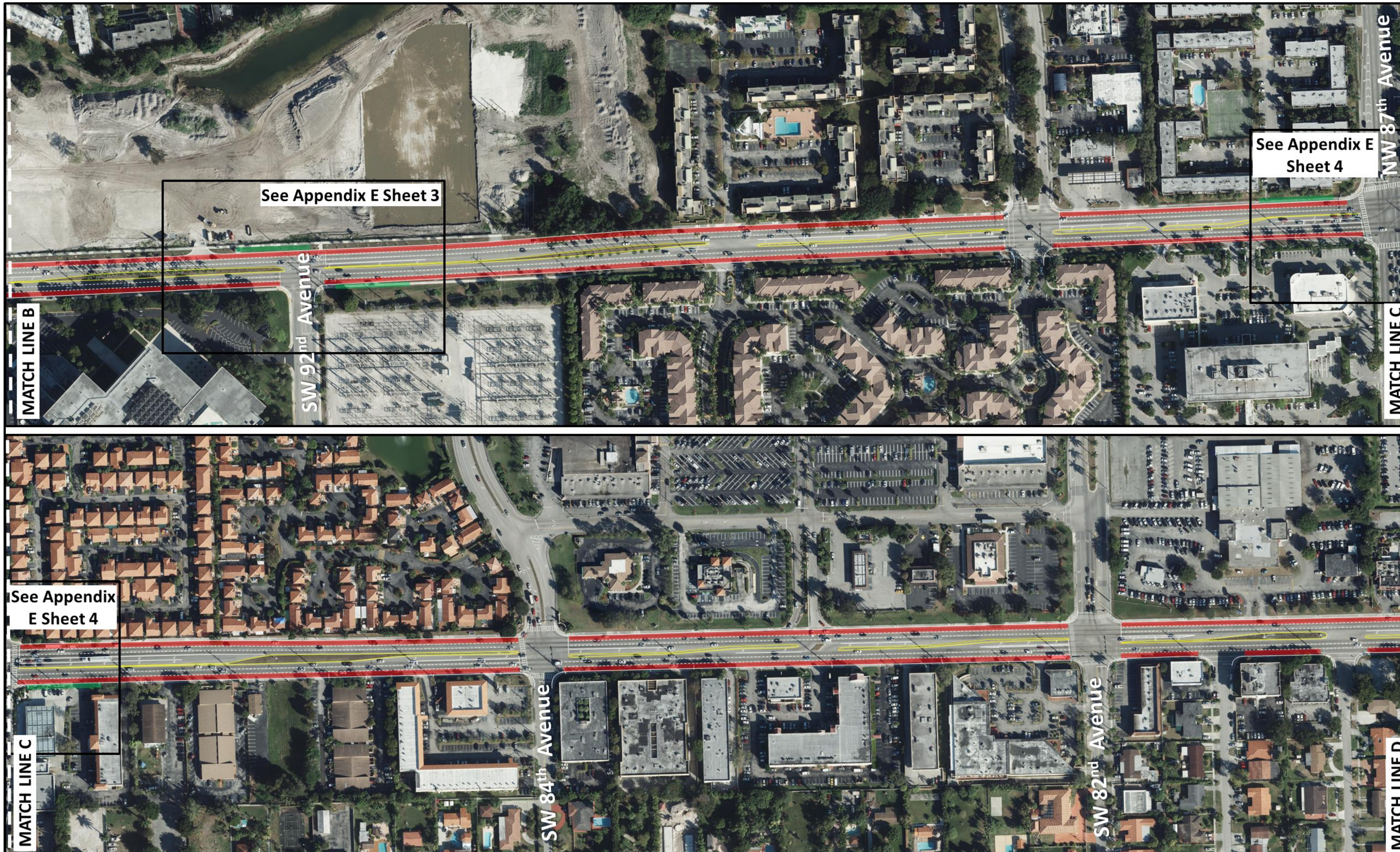
W. Flagler Street BRT

HNTB

Sheet 2 of 9

0 125 250 500 Feet

W Flagler Street Corridor-Level Aerial (from 93rd Avenue to 80th Avenue)



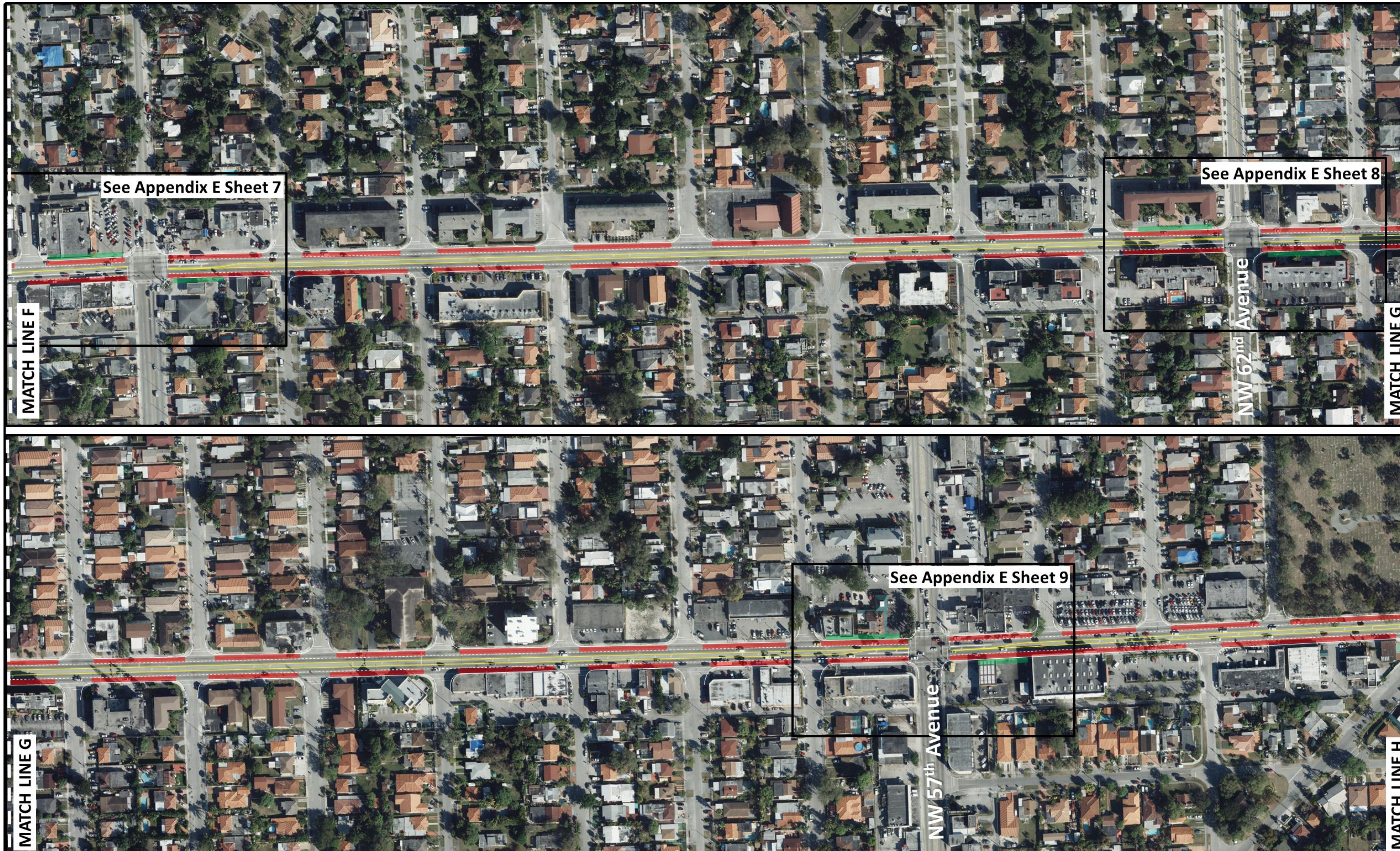
W. Flagler Street BRT

HNTB

Sheet 3 of 9

W Flagler Street Corridor-Level Aerial (from 80th Avenue to 67th Avenue)

W Flagler Street Corridor-Level Aerial (from 67th Avenue to 54th Avenue)

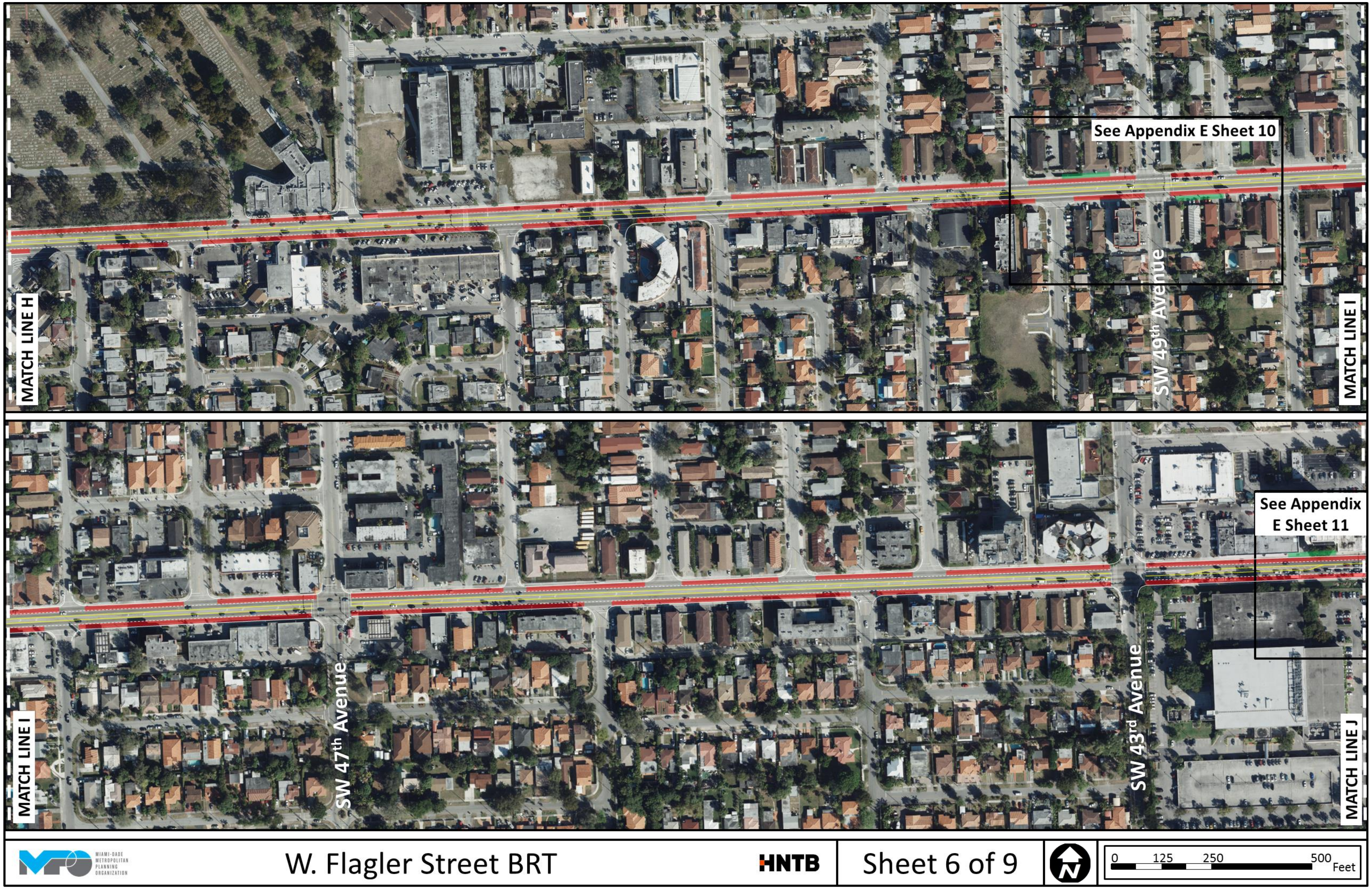


W. Flagler Street BRT

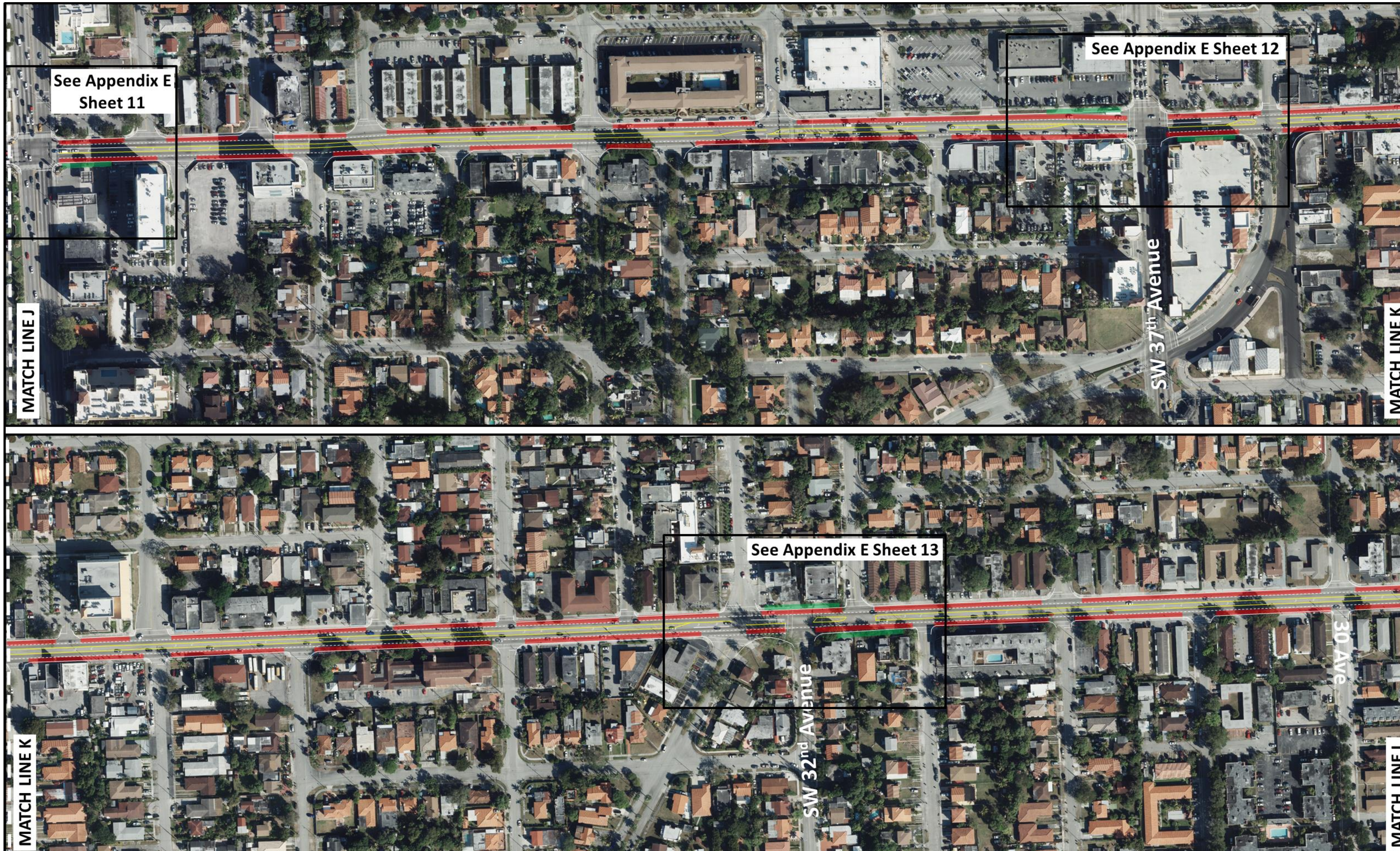
HNTB

0 125 250 500 Feet

W Flagler Street Corridor-Level Aerial (from 54th Avenue to 43rd Avenue)



W Flagler Street Corridor-Level Aerial (from 43rd Avenue to 30th Avenue)

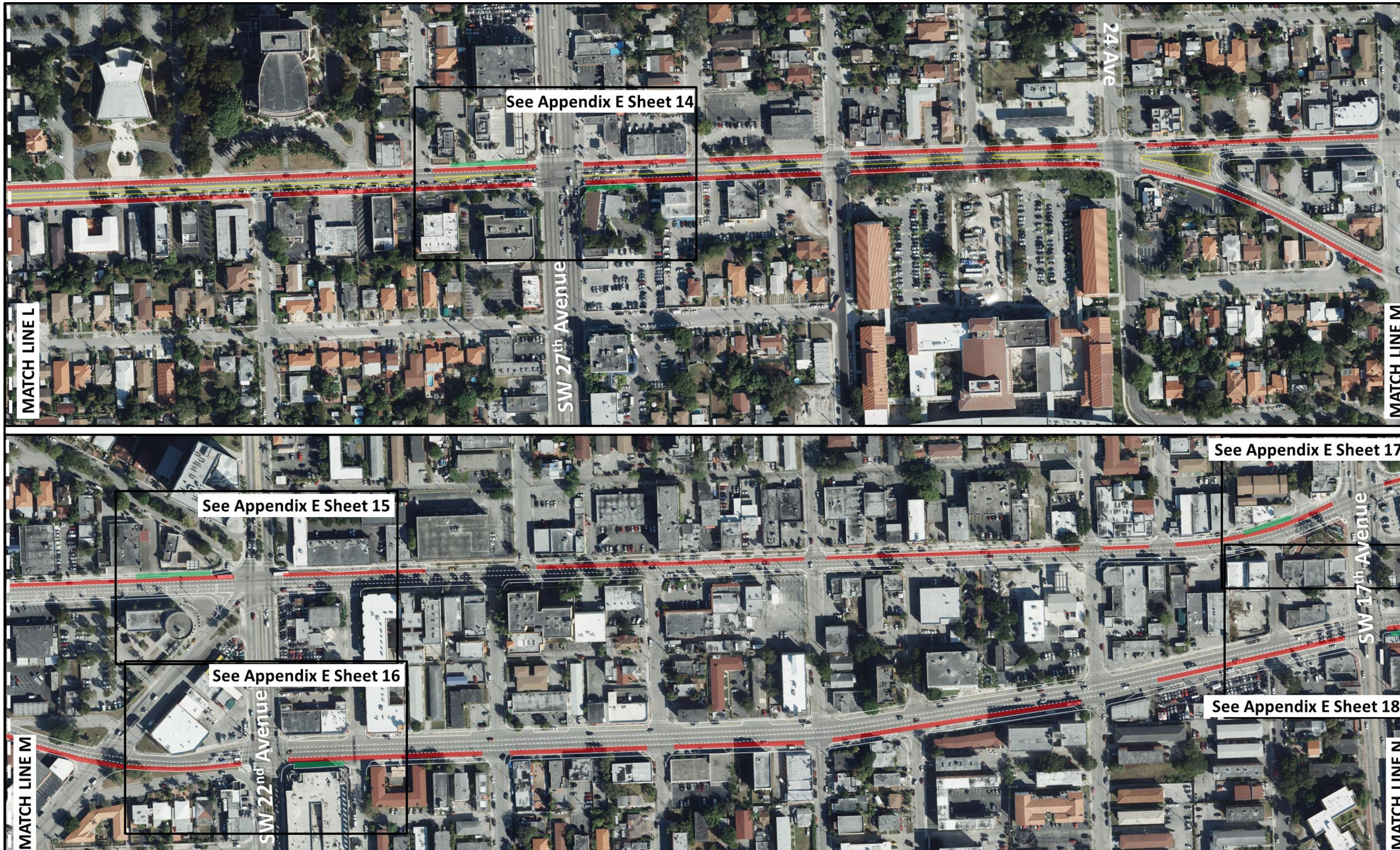


MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

W. Flagler Street BRT

HNTB

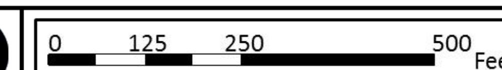
W Flagler Street Corridor-Level Aerial (from 30th Avenue to 17th Avenue)



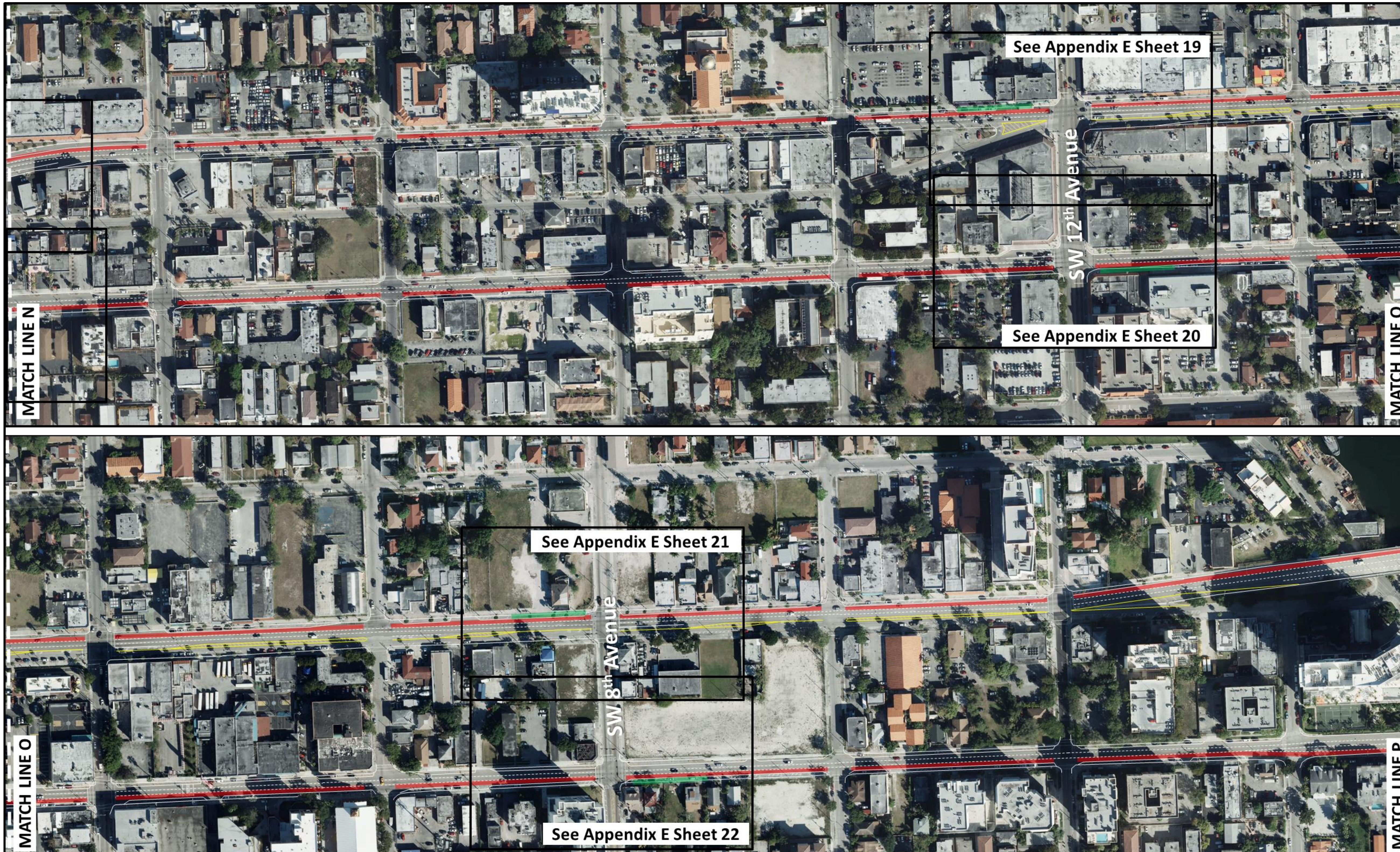
W. Flagler Street BRT

HNTB

Sheet 8 of 9



W Flagler Street Corridor-Level Aerial (from 17th Avenue to the Miami River)

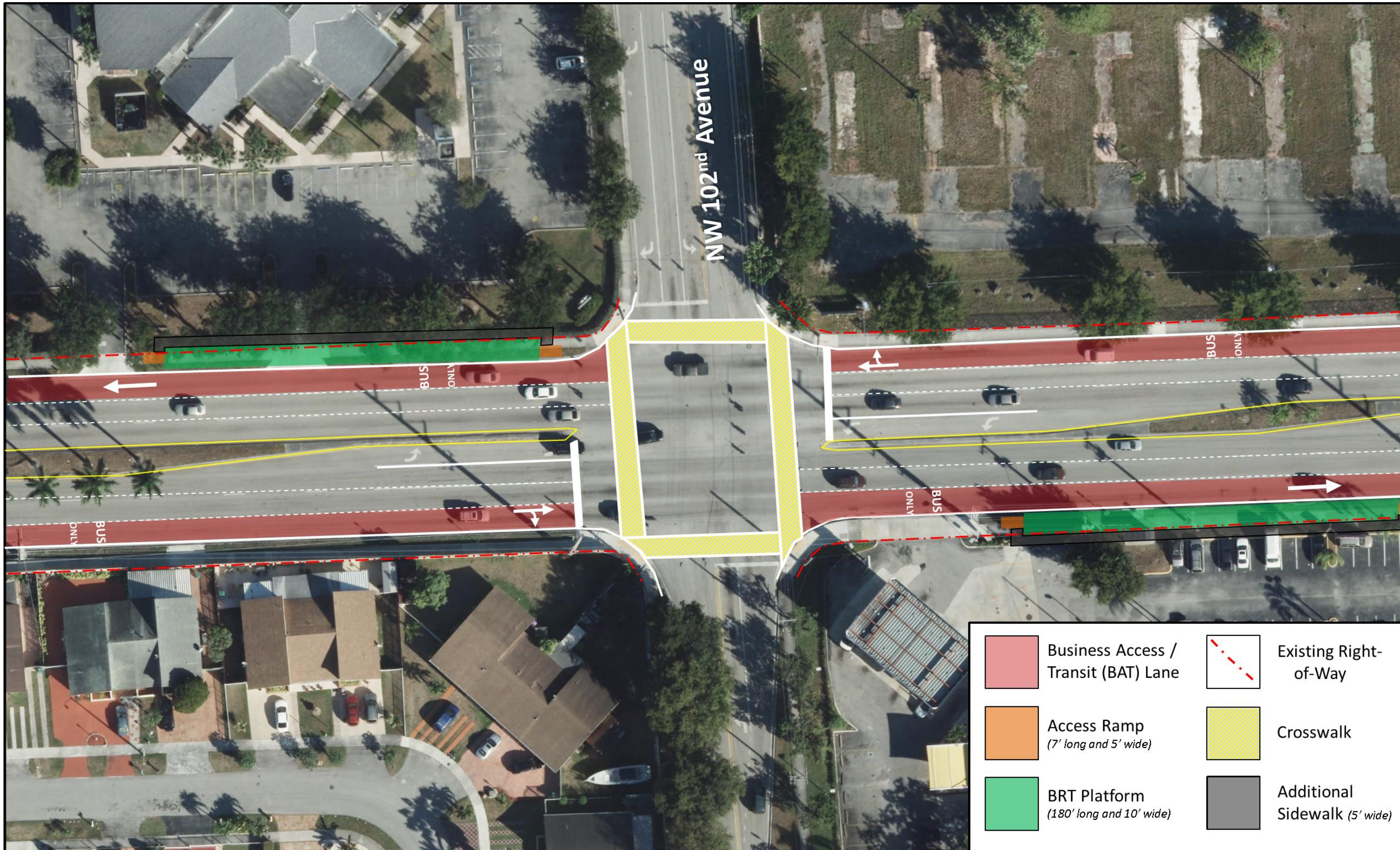


W. Flagler Street BRT

HNTB

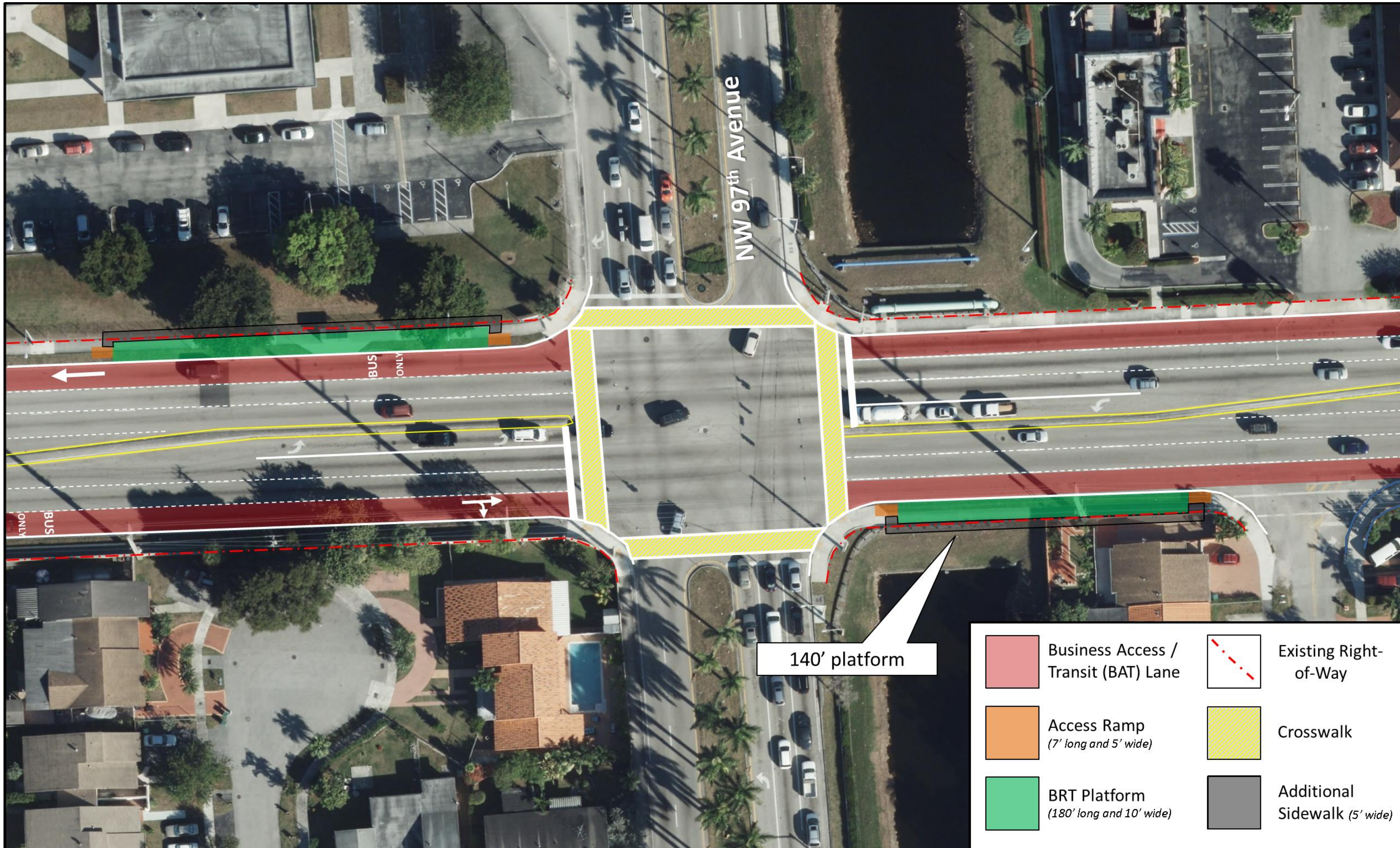
0 125 250 500 Feet

Appendix E - Transit Station-Level Aerials with proposed BRT Concepts



W Flagler BRT at W 102nd Avenue Station

HNTB

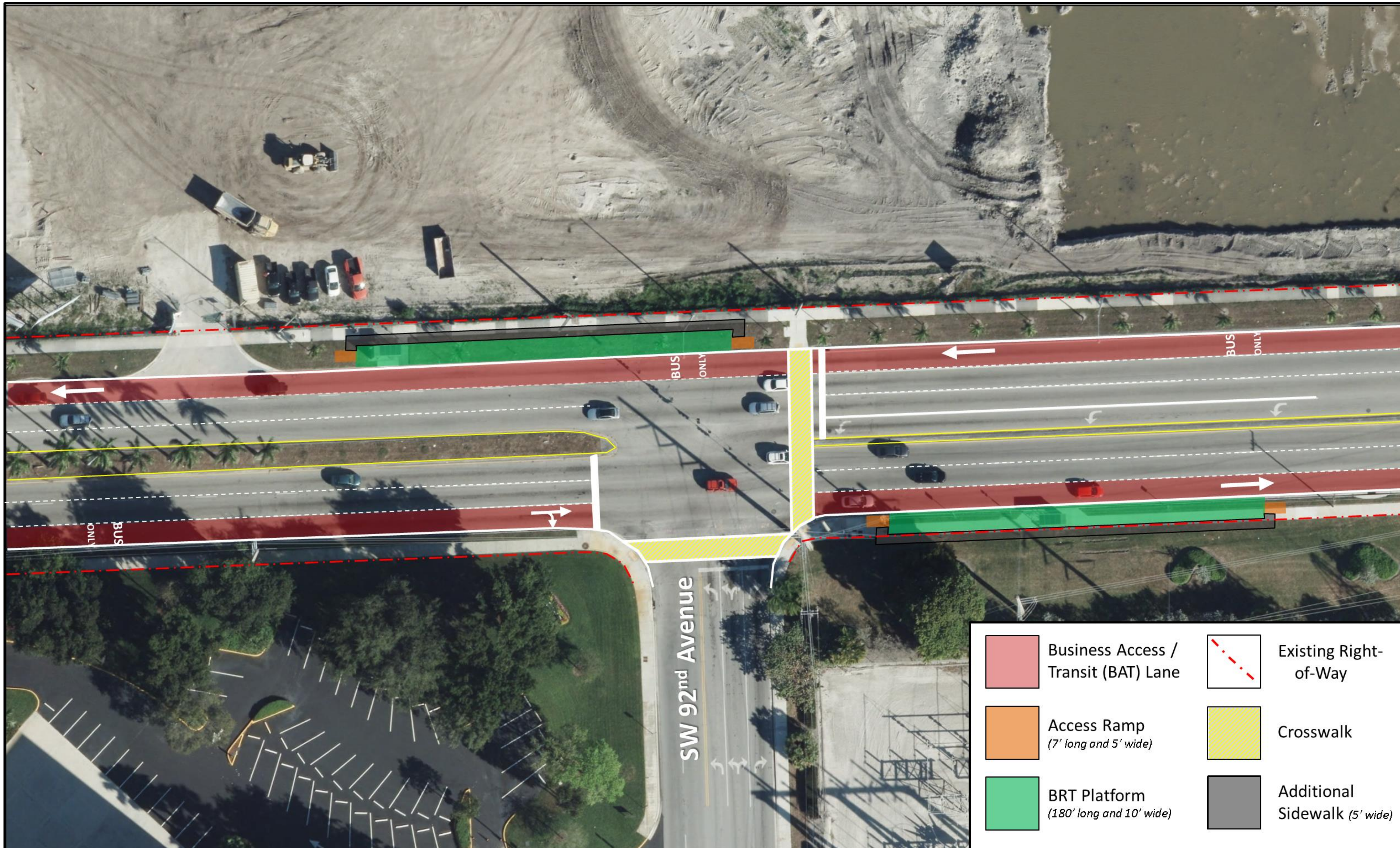


W Flagler BRT at W 97th Avenue Station

HNTB

Sheet 2 of 22

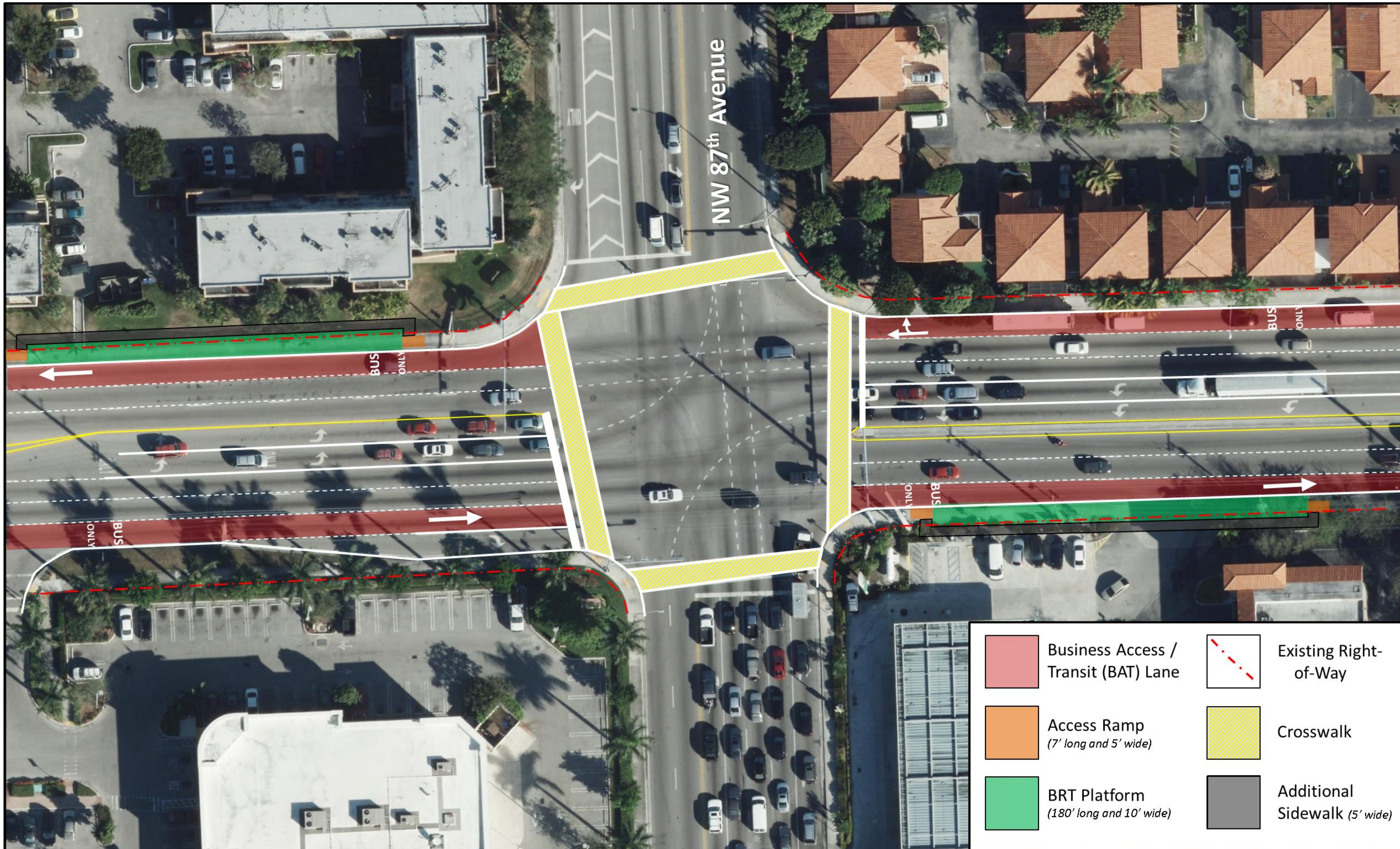
0 25 50 100 Feet



W Flagler BRT at W 92nd Avenue Station

HNTB

0 25 50 100 Feet



W Flagler BRT at W 87th Avenue Station

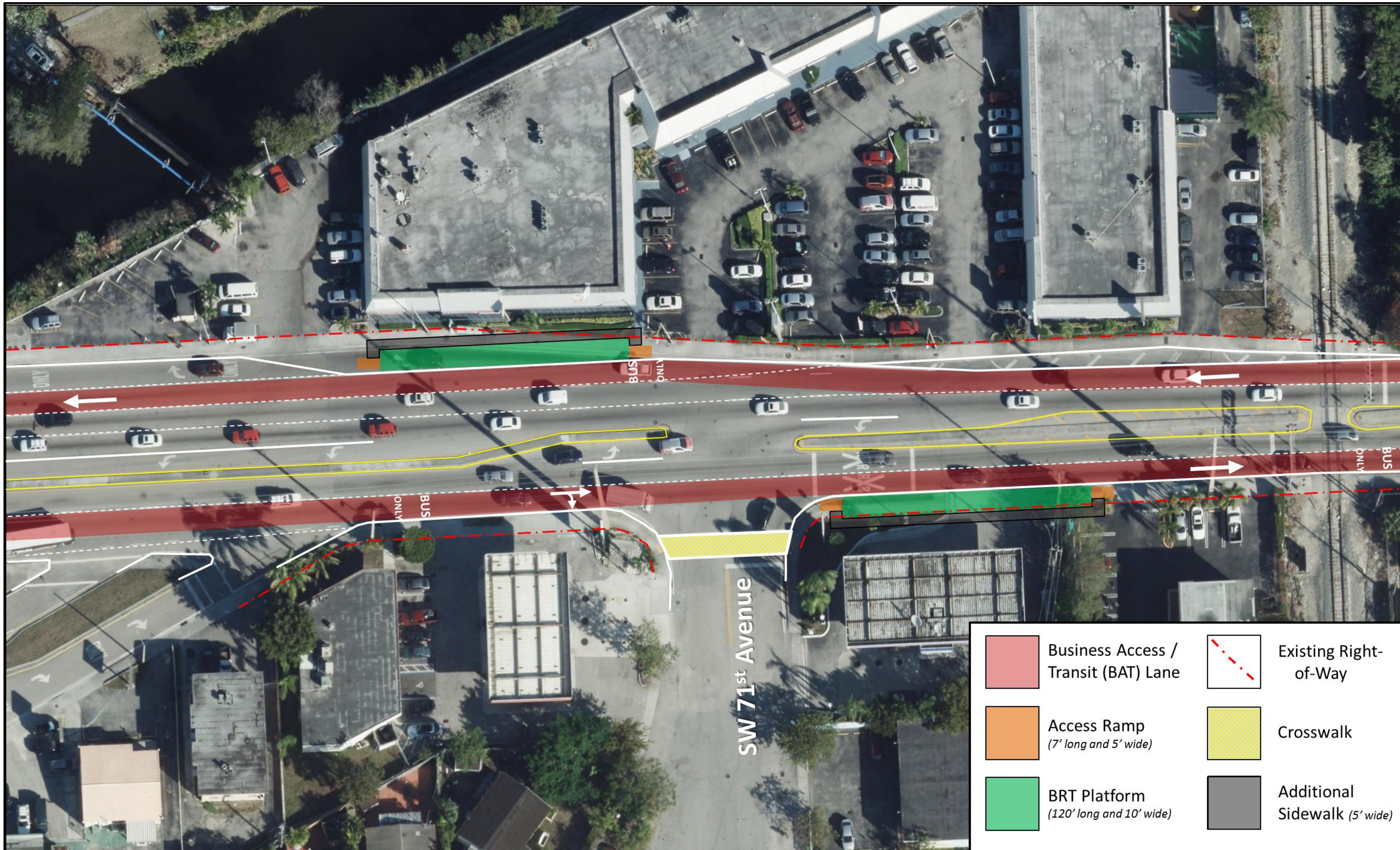
HNTB

0 25 50 100 Feet

W Flagler BRT at W 79th Avenue Station

HNTB

Sheet 5 of 22



MPO MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

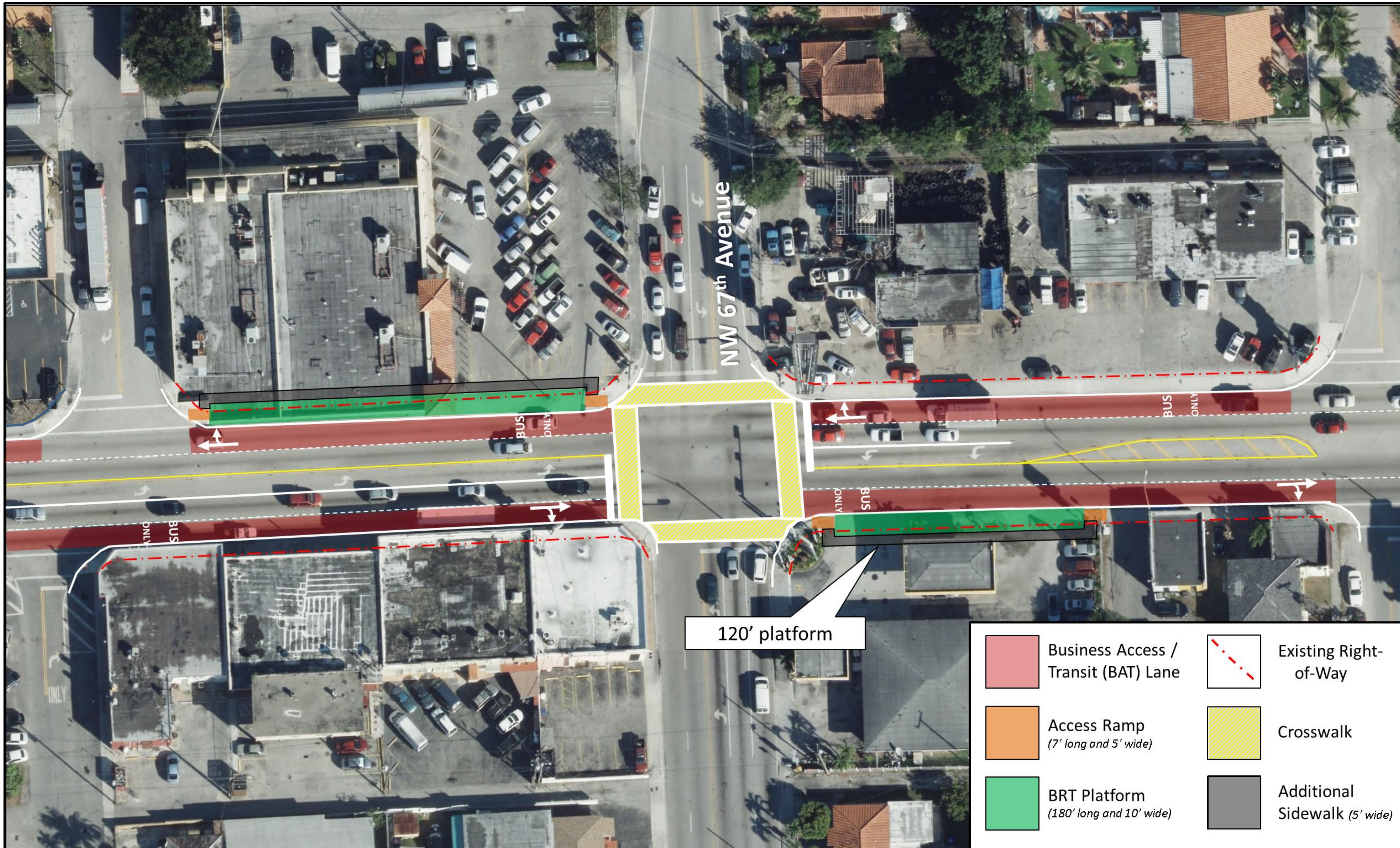
W Flagler BRT at W 71st Avenue Station

HNTB

Sheet 6 of 22

N

0 25 50 100 Feet



W Flagler BRT at W 67th Avenue Station

HNTB

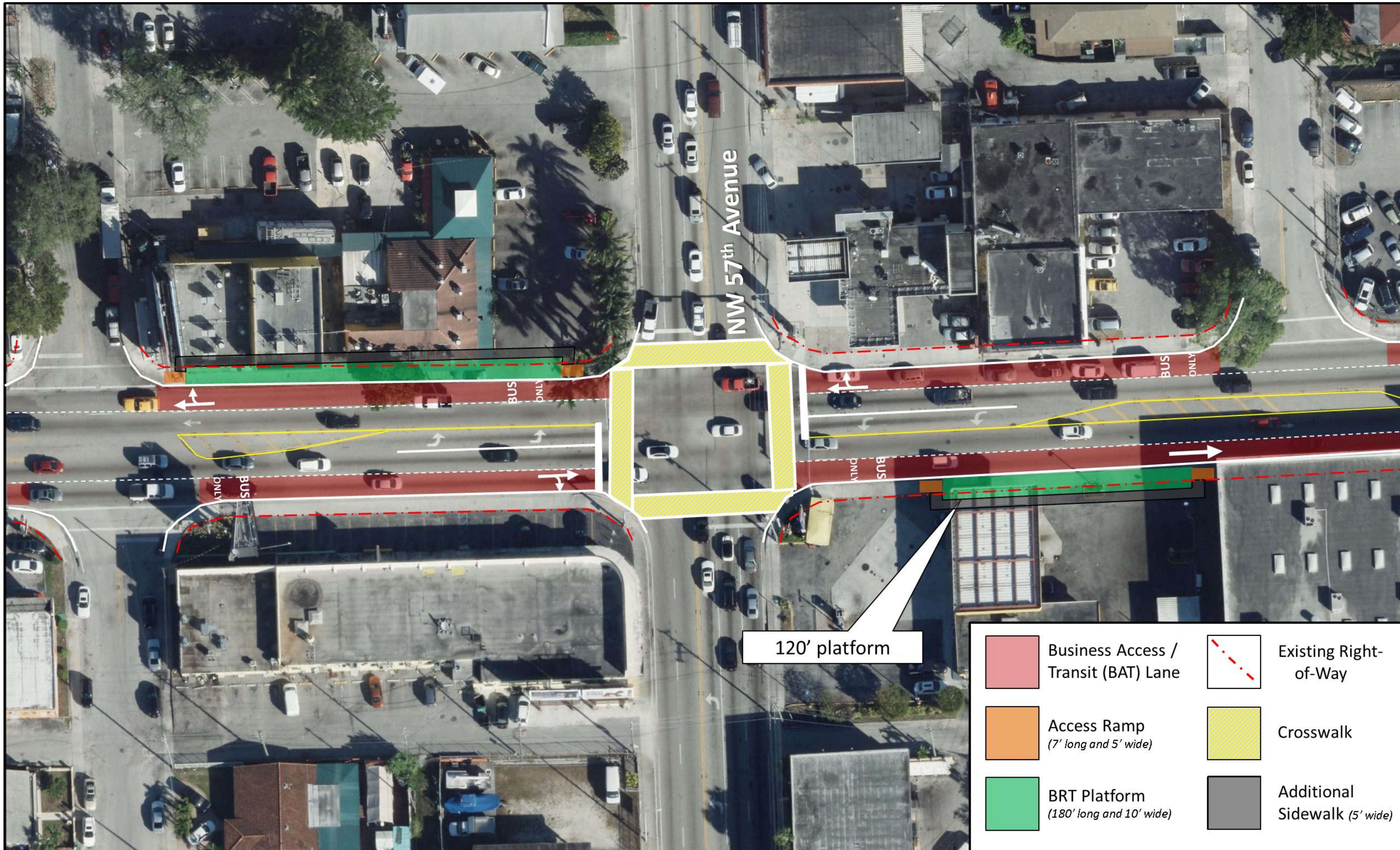
0 25 50 100 Feet

W Flagler BRT at W 62nd Avenue Station

HNTB

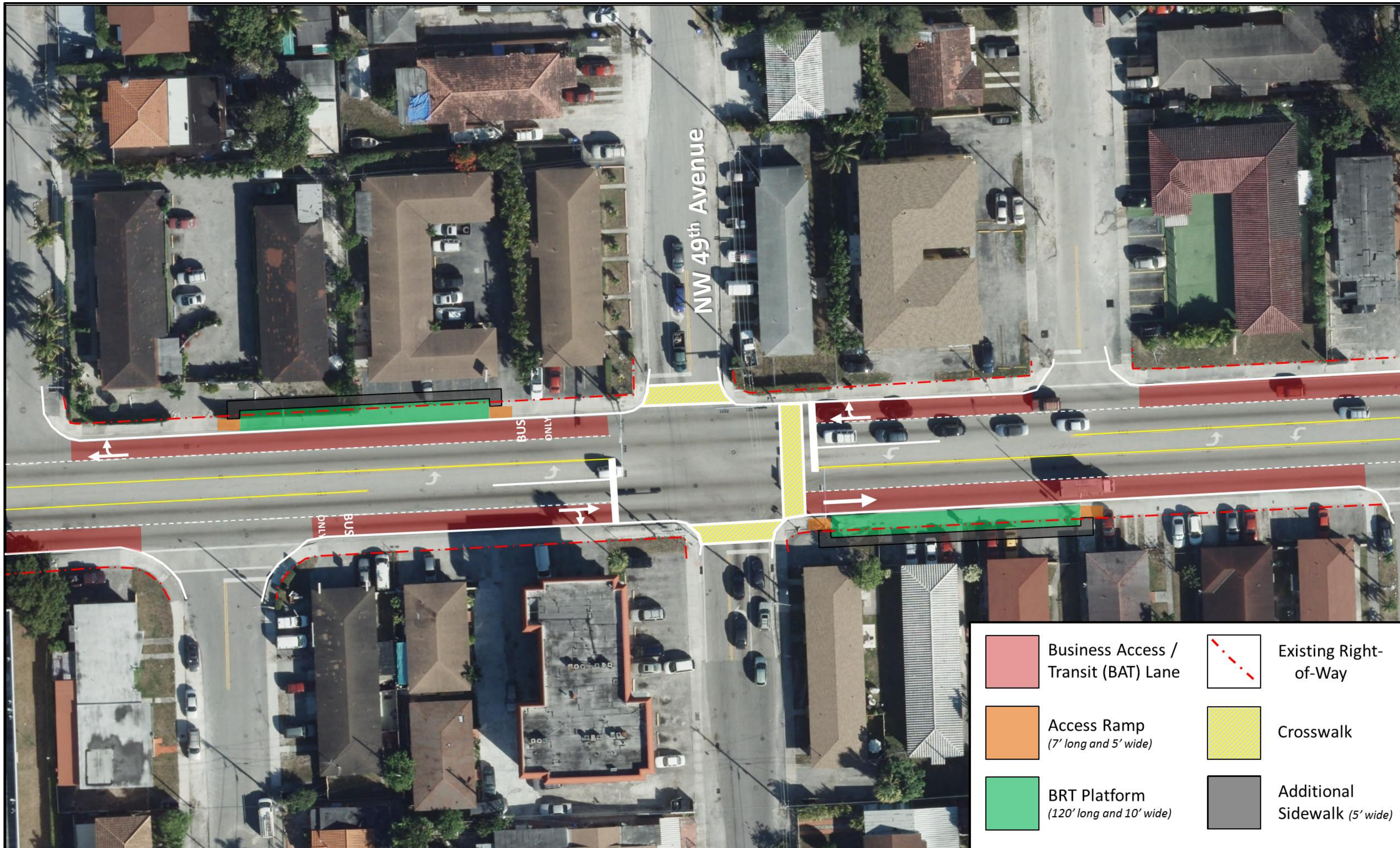
Sheet 8 of 22

0 25 50 100 Feet



W Flagler BRT at W 57th Avenue Station

HNTB

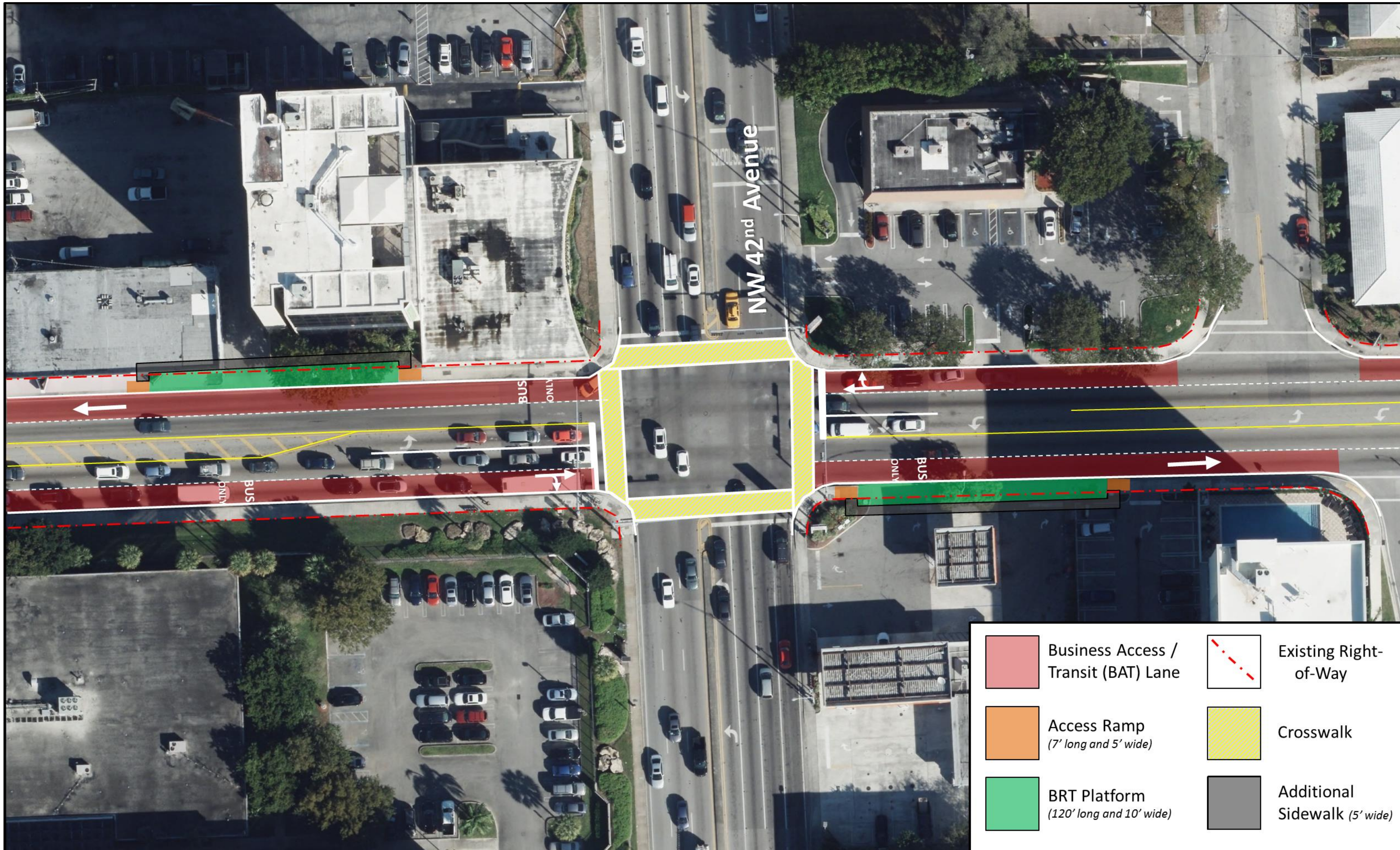


W Flagler BRT at W 49th Avenue Station

HNTB

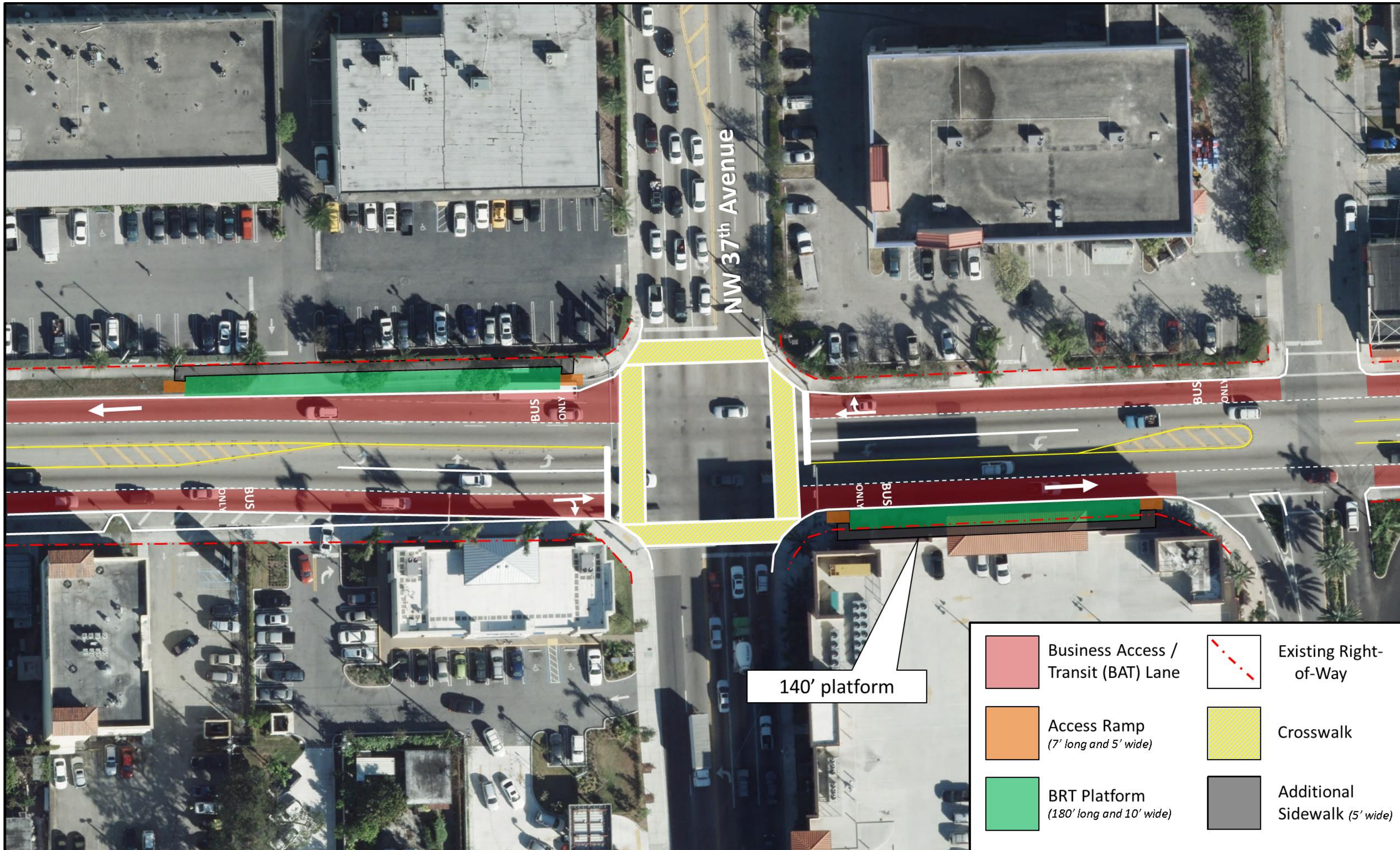
Sheet 10 of 22

0 25 50 100 Feet



W Flagler BRT at W 42nd Avenue Station

HNTB

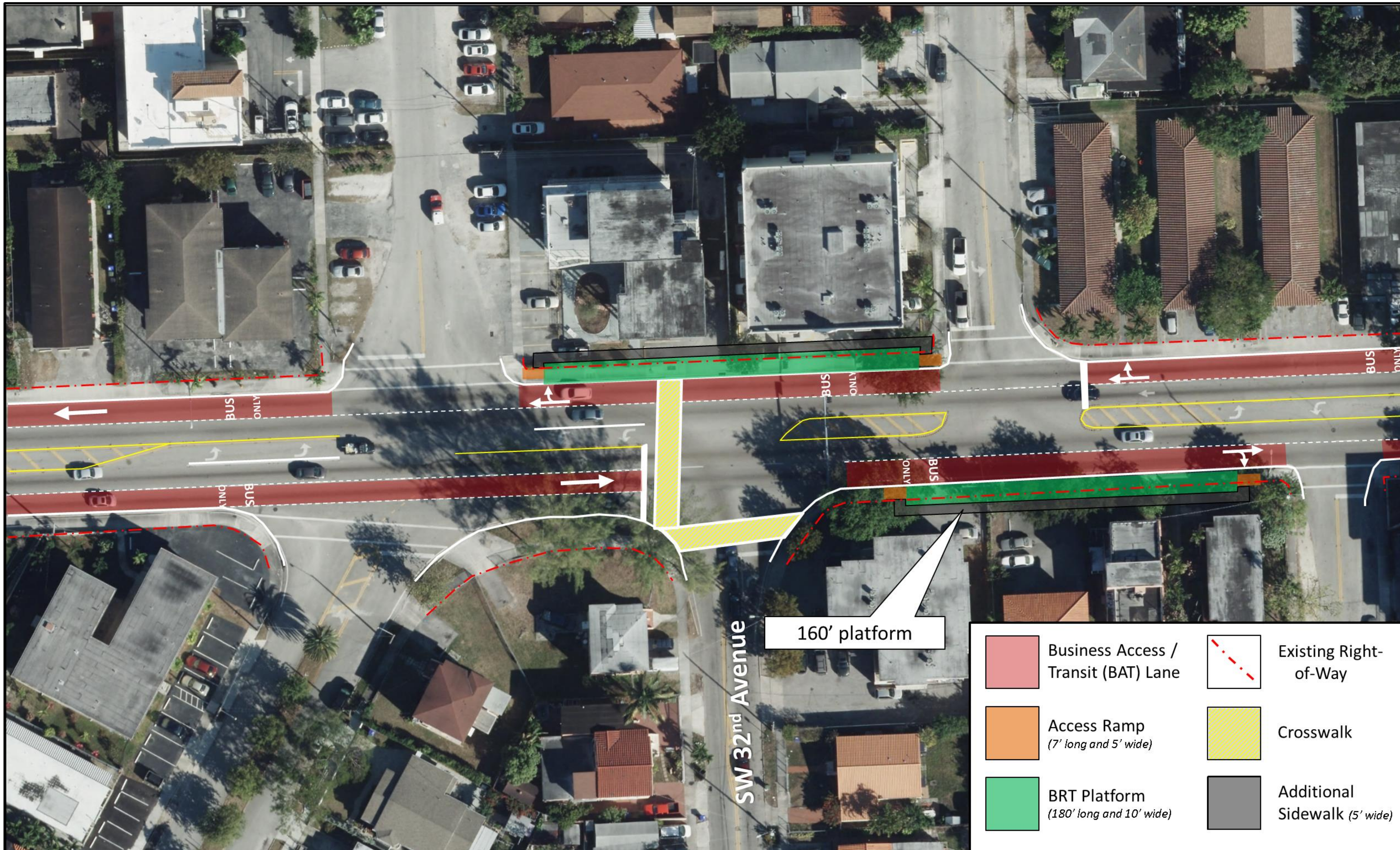


W Flagler BRT at W 37th Avenue Station

HNTB

Sheet 12 of 22

0 25 50 100 Feet

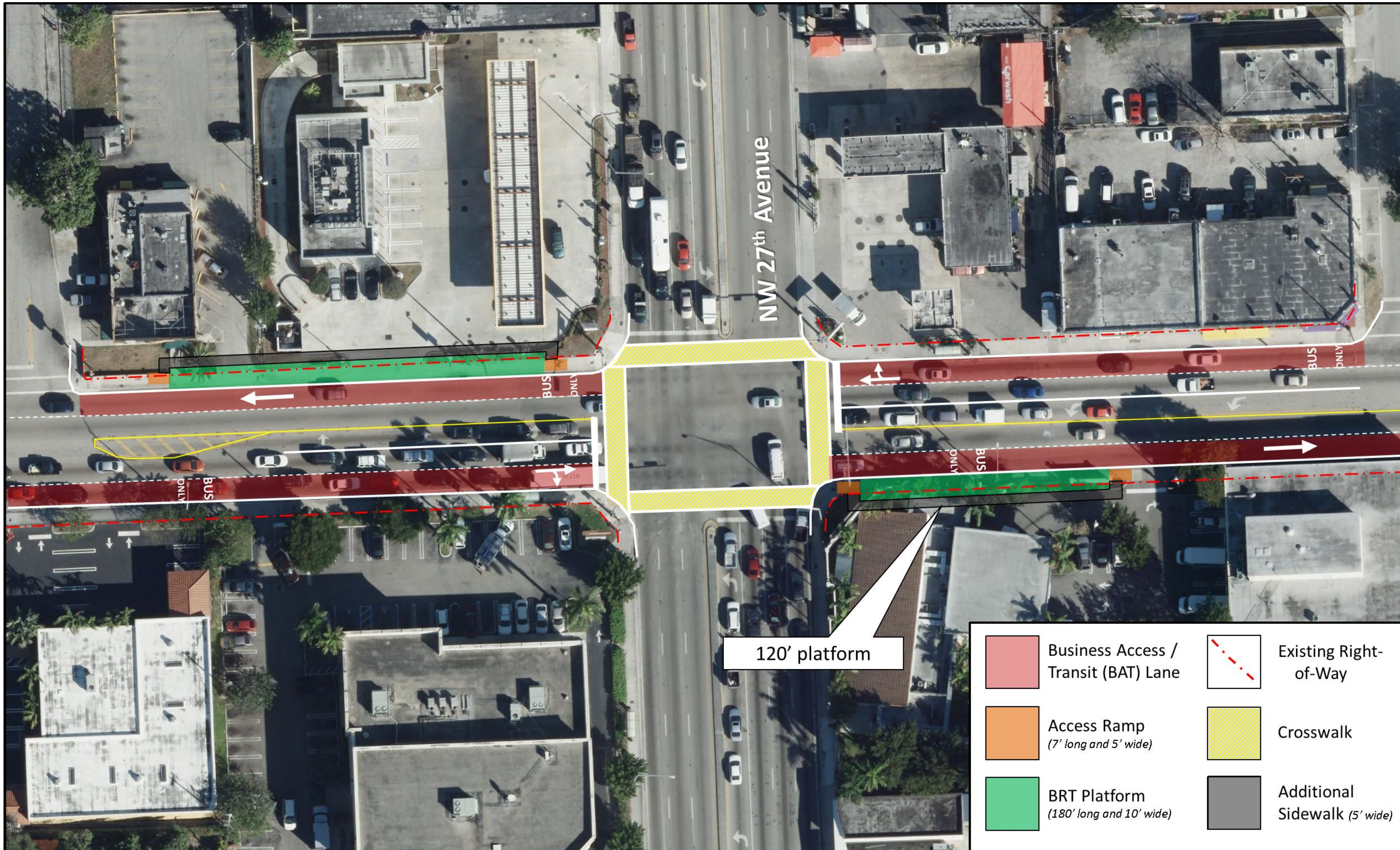


W Flagler BRT at W 32nd Avenue Station

HNTB

Sheet 13 of 22

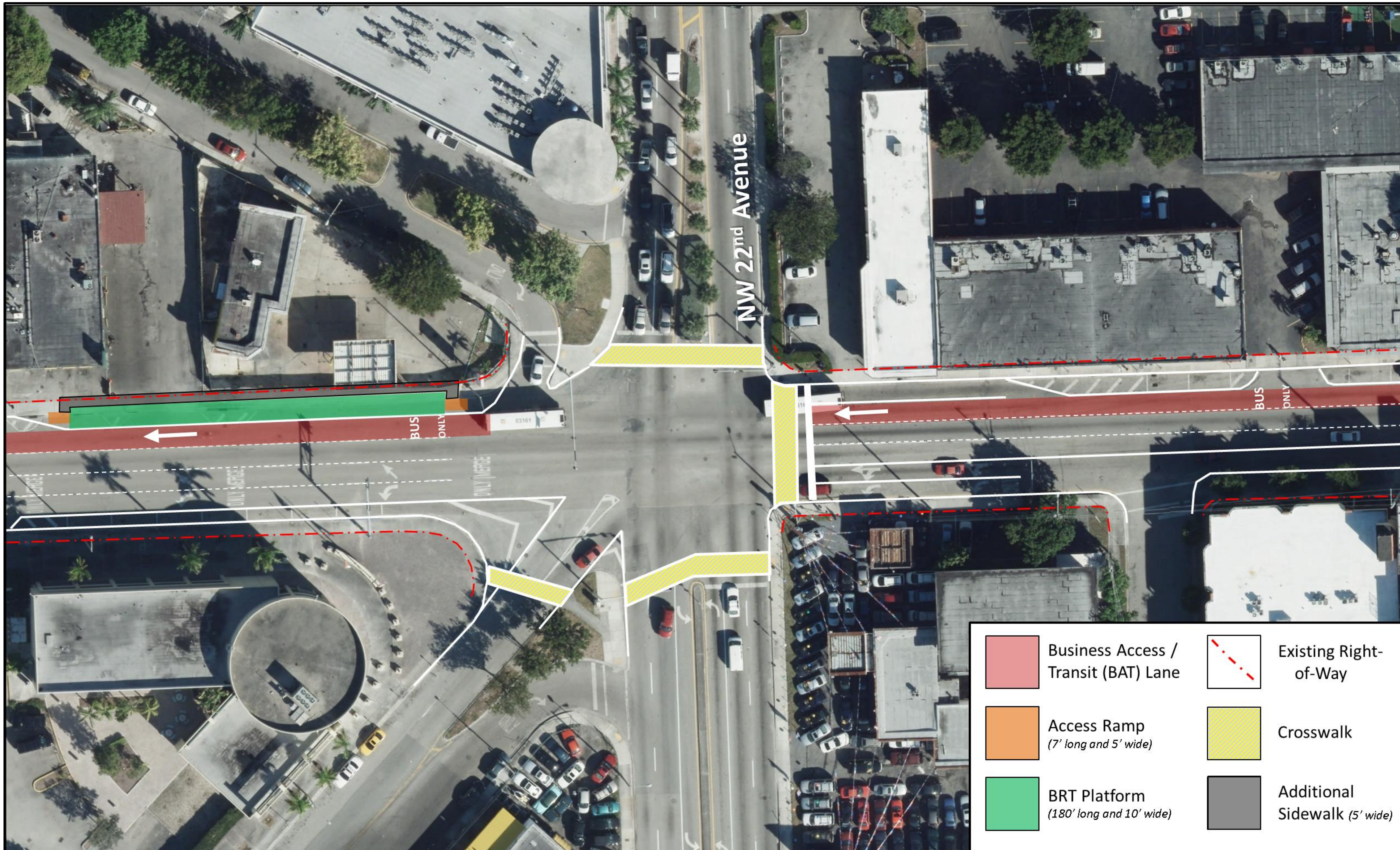
0 25 50 100 Feet



W Flagler BRT at W 27th Avenue Station

HNTB

Sheet 14 of 22



W Flagler BRT at W 22nd Avenue Station

HNTB

W Flagler BRT at SW 1st St / SW 22nd Ave Station

HNTB

Sheet 16 of 22

0 25 50 100 Feet

W Flagler BRT at W 17th Avenue Station

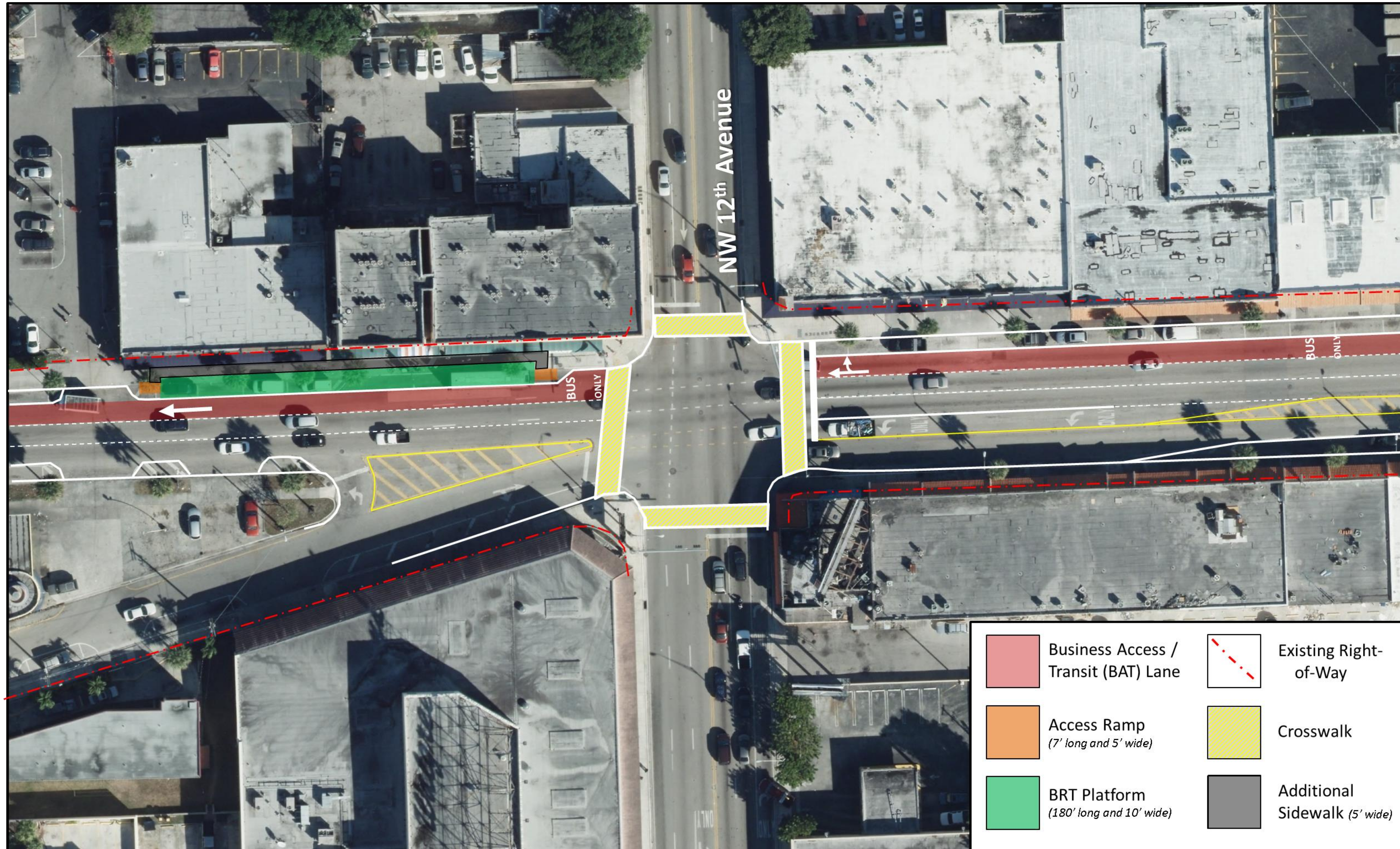
HNTB

Sheet 17 of 22

0 25 50 100 Feet

W Flagler BRT at SW 1st St / SW 17th Ave Station

HNTB

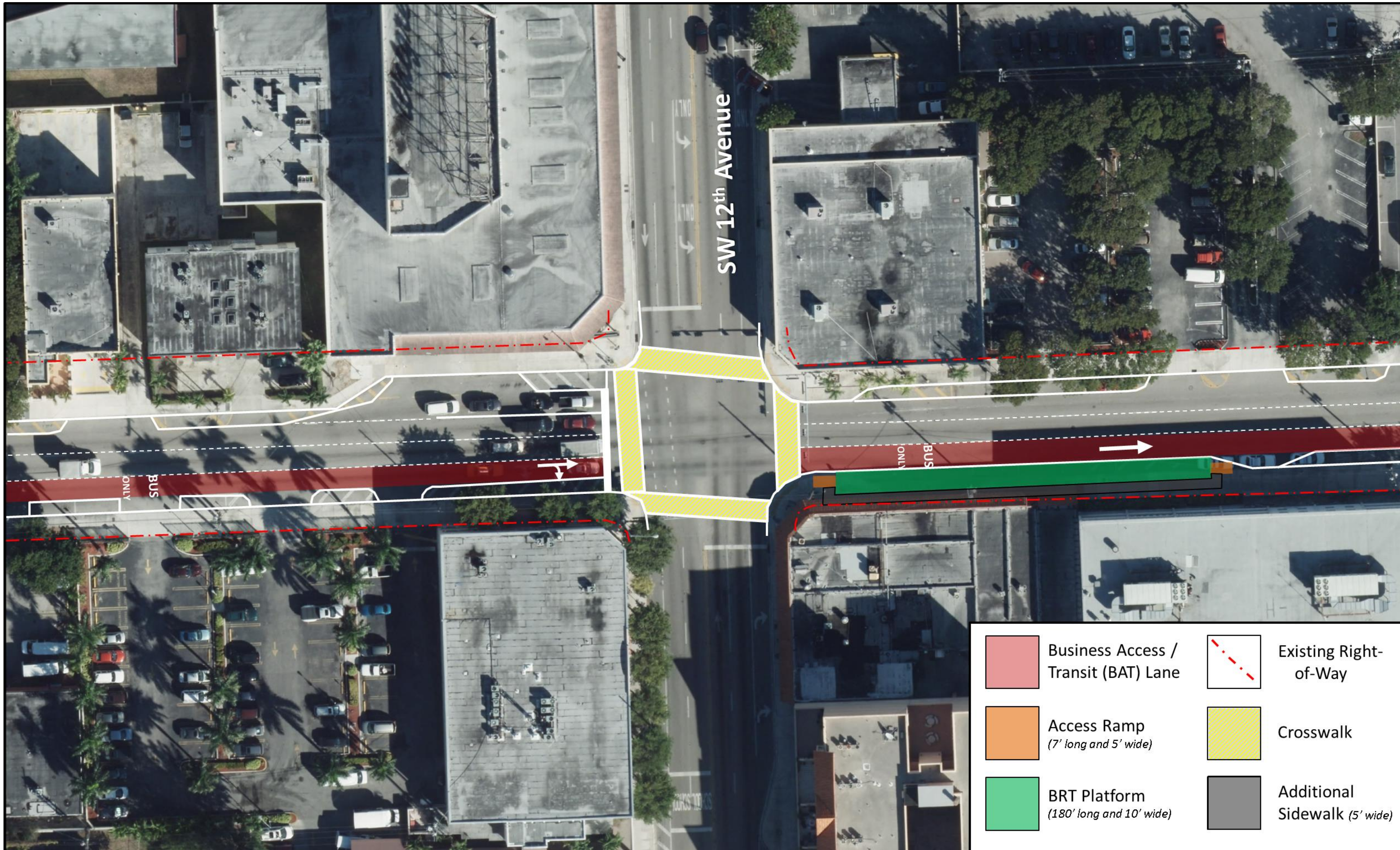


W Flagler BRT at W 12th Avenue Station

HNTB

Sheet 19 of 22

0 25 50 100 Feet



W Flagler BRT at SW 1st St / SW 12th Ave Station

HNTB

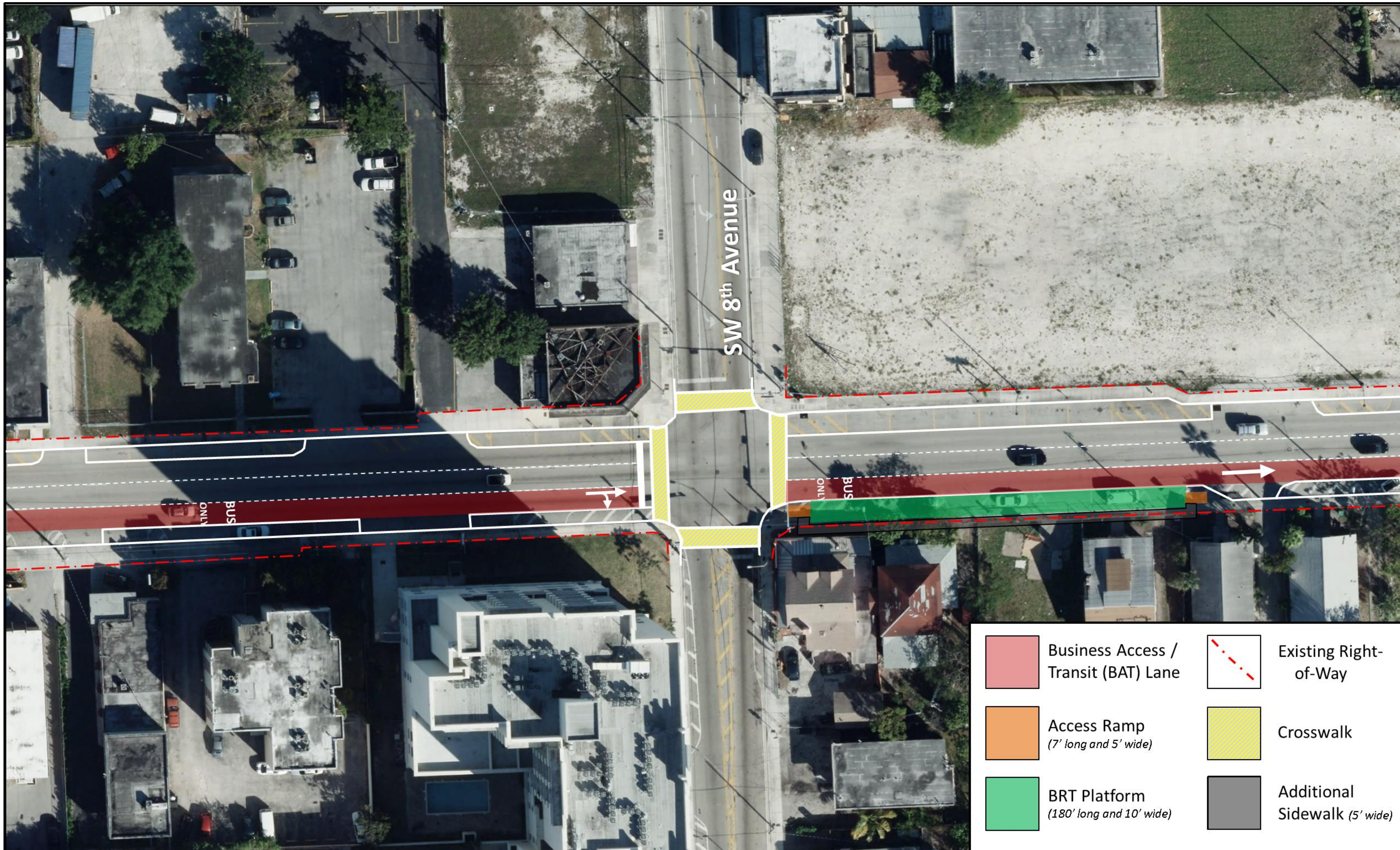
0 25 50 100 Feet

W Flagler BRT at W 8th Avenue Station

HNTB

Sheet 21 of 22

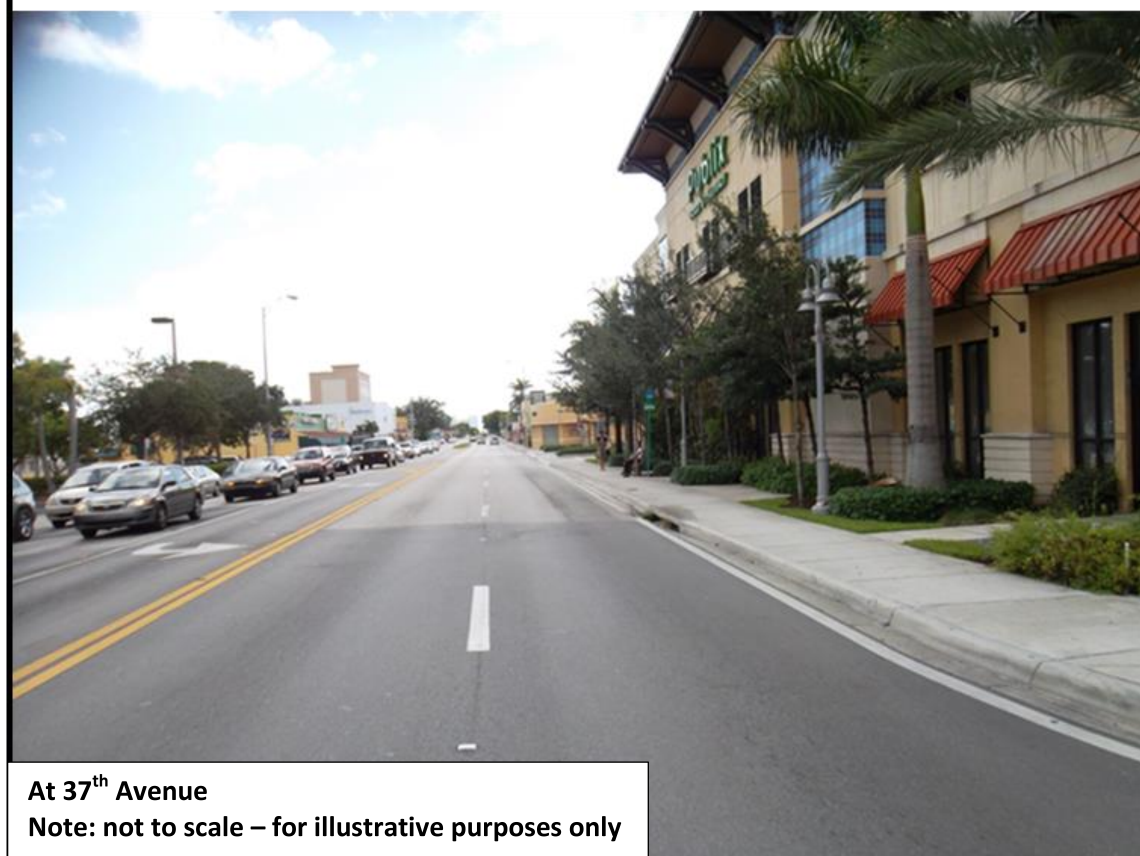
0 25 50 100 Feet



W Flagler BRT at SW 1st St / SW 8th Ave Station

HNTB

Appendix F – Before and After Renderings



At 37th Avenue
Note: not to scale – for illustrative purposes only

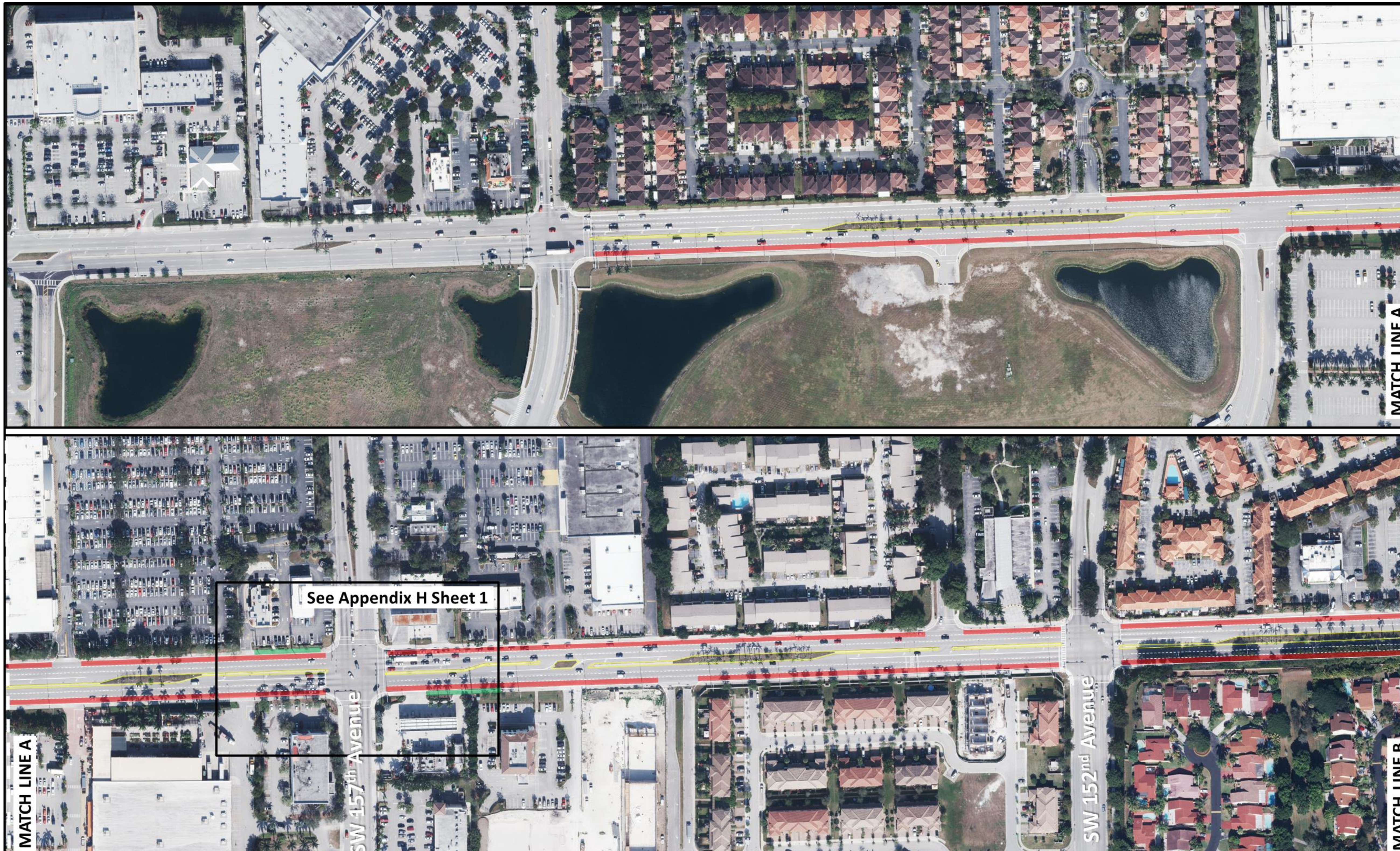
W Flagler Street Before and After Renderings | HNTB | Sheet 1 of 2

W Flagler Street Before and After Renderings

HNTB

Appendix G – Corridor-Level Aerials with proposed BRT Alignment

Kendall Drive Corridor-Level Aerial (from SW 162nd Avenue to SW 151st Avenue)



MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

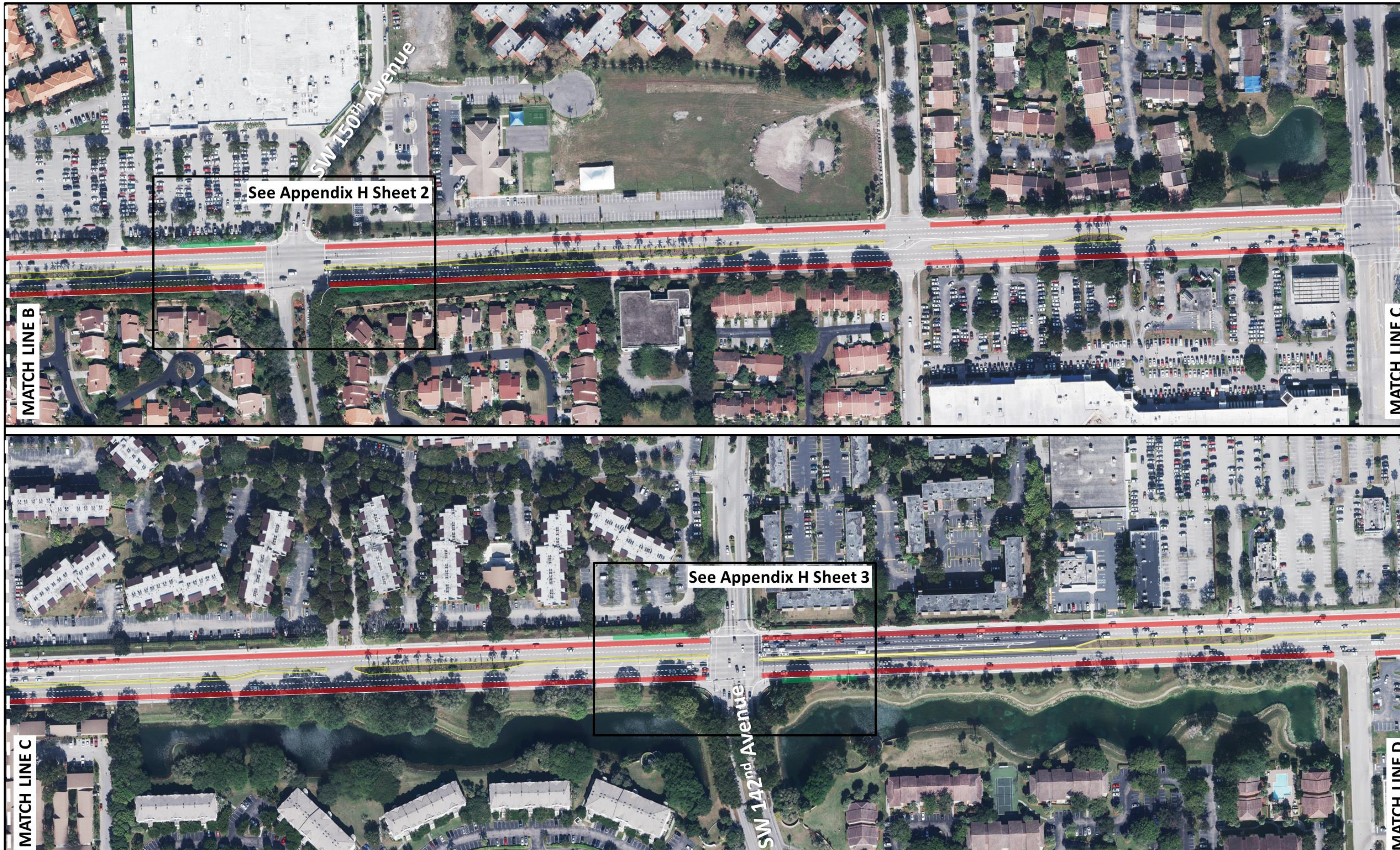
Kendall Drive BRT

HNTB

Sheet 1 of 8

0 125 250 500 Feet

Kendall Drive Corridor-Level Aerial (from SW 151st Avenue to SW 140th Avenue)



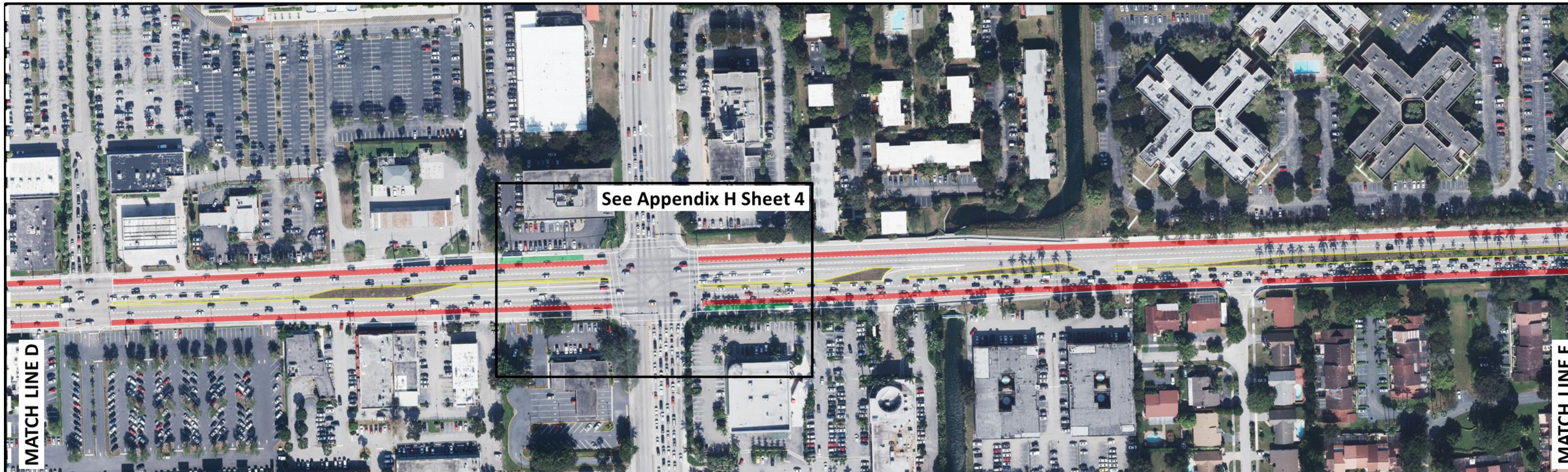
Kendall Drive BRT

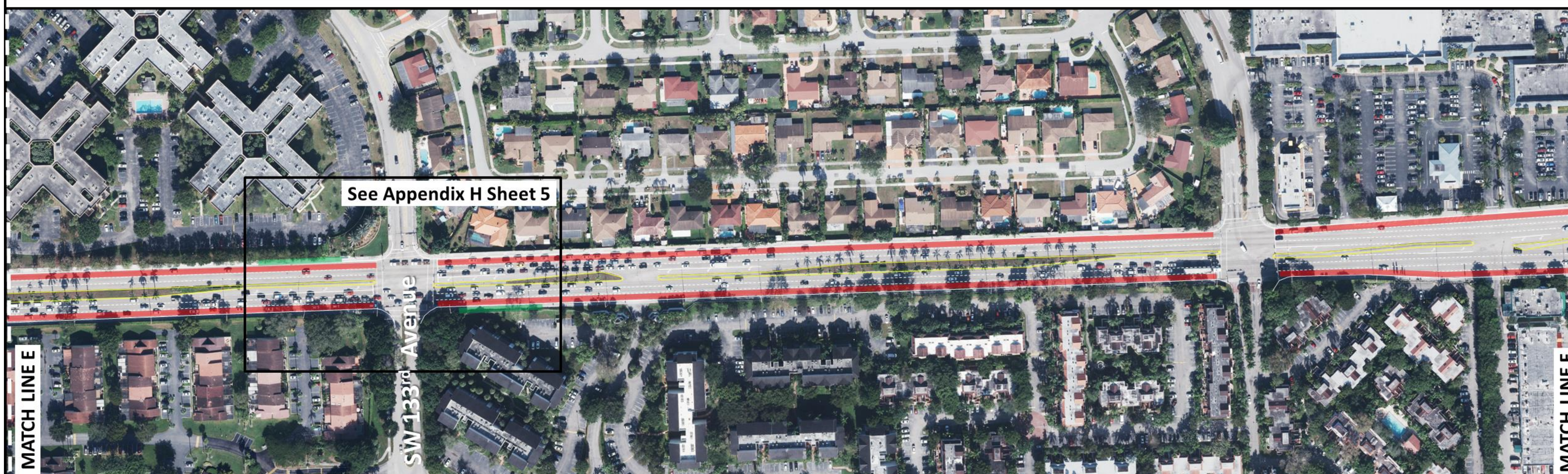
HNTB

Sheet 2 of 8

0 125 250 500 Feet

Kendall Drive Corridor-Level Aerial (from SW 140th Avenue to SW 128th Avenue)





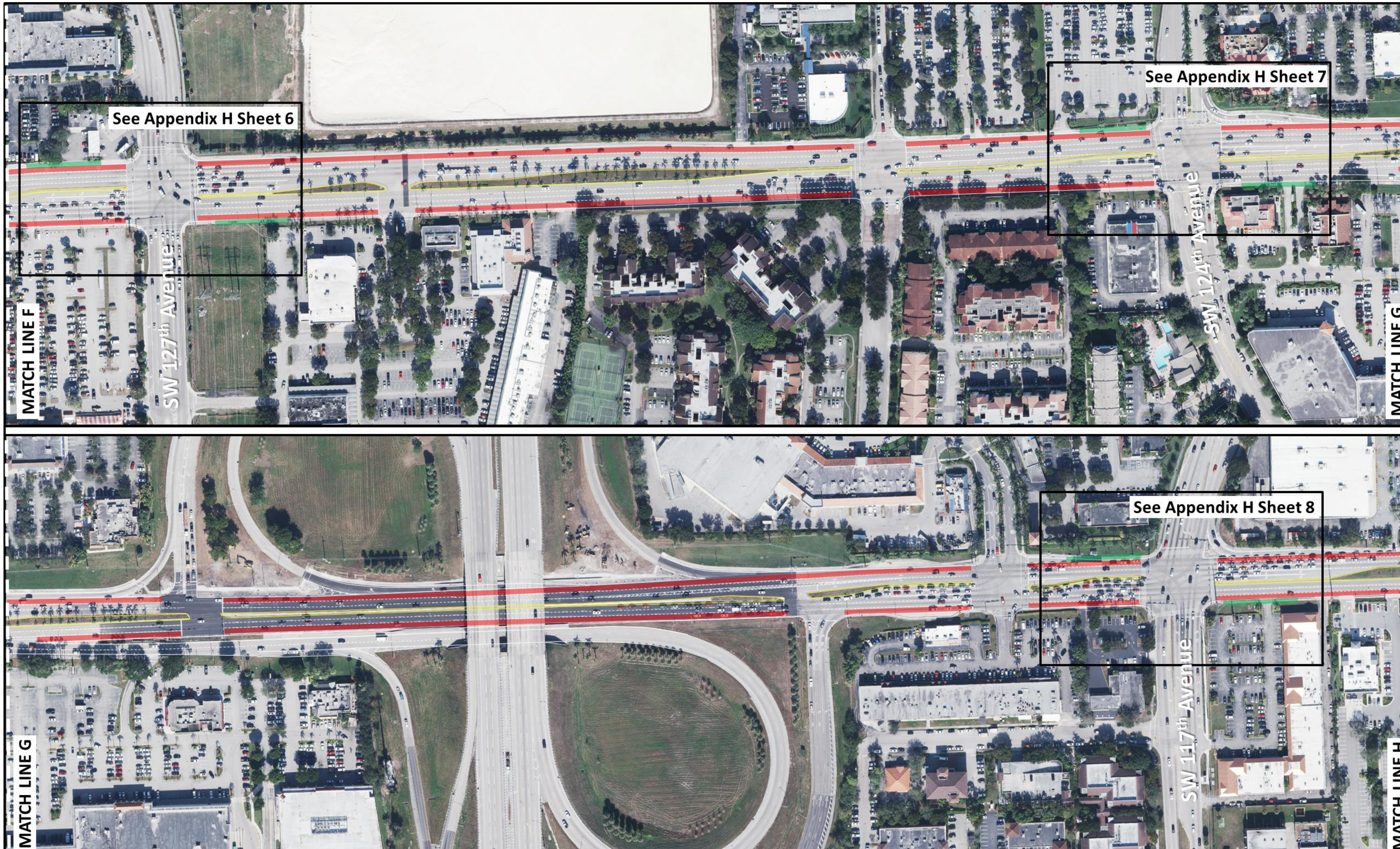
Kendall Drive BRT

HNTB

Sheet 3 of 8

0 125 250 500 Feet

Kendall Drive Corridor-Level Aerial (from SW 128th Avenue to SW 117th Avenue)



MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

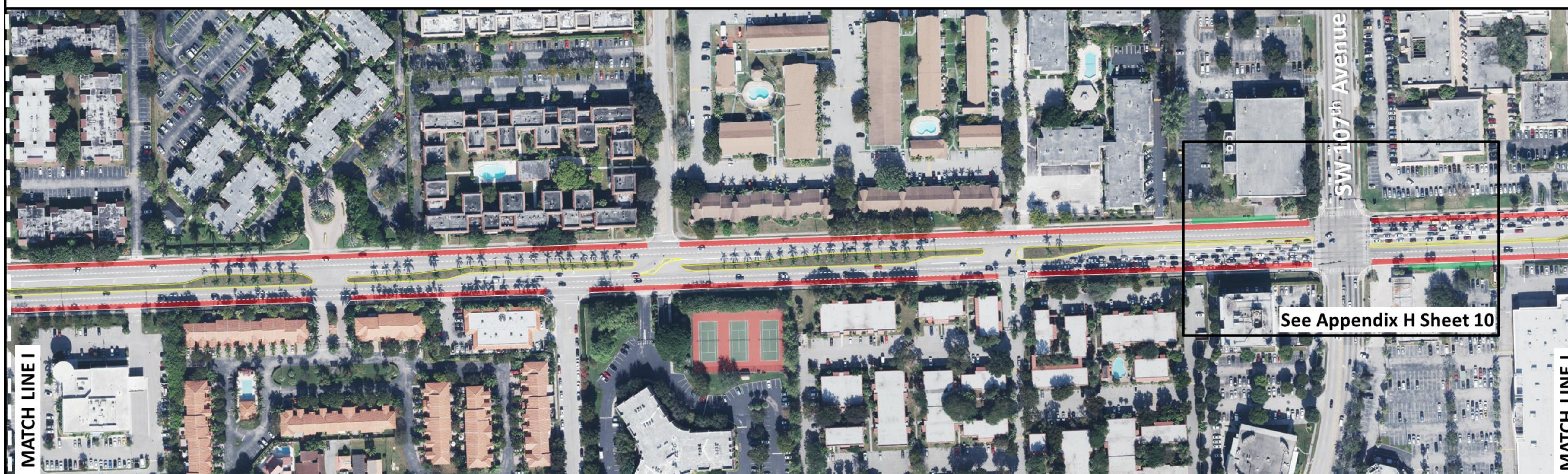
Kendall Drive BRT

HNTB

Sheet 4 of 8

0 125 250 500 Feet

Kendall Drive Corridor-Level Aerial (from SW 117th Avenue to SW 106th Avenue)



MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

Kendall Drive BRT

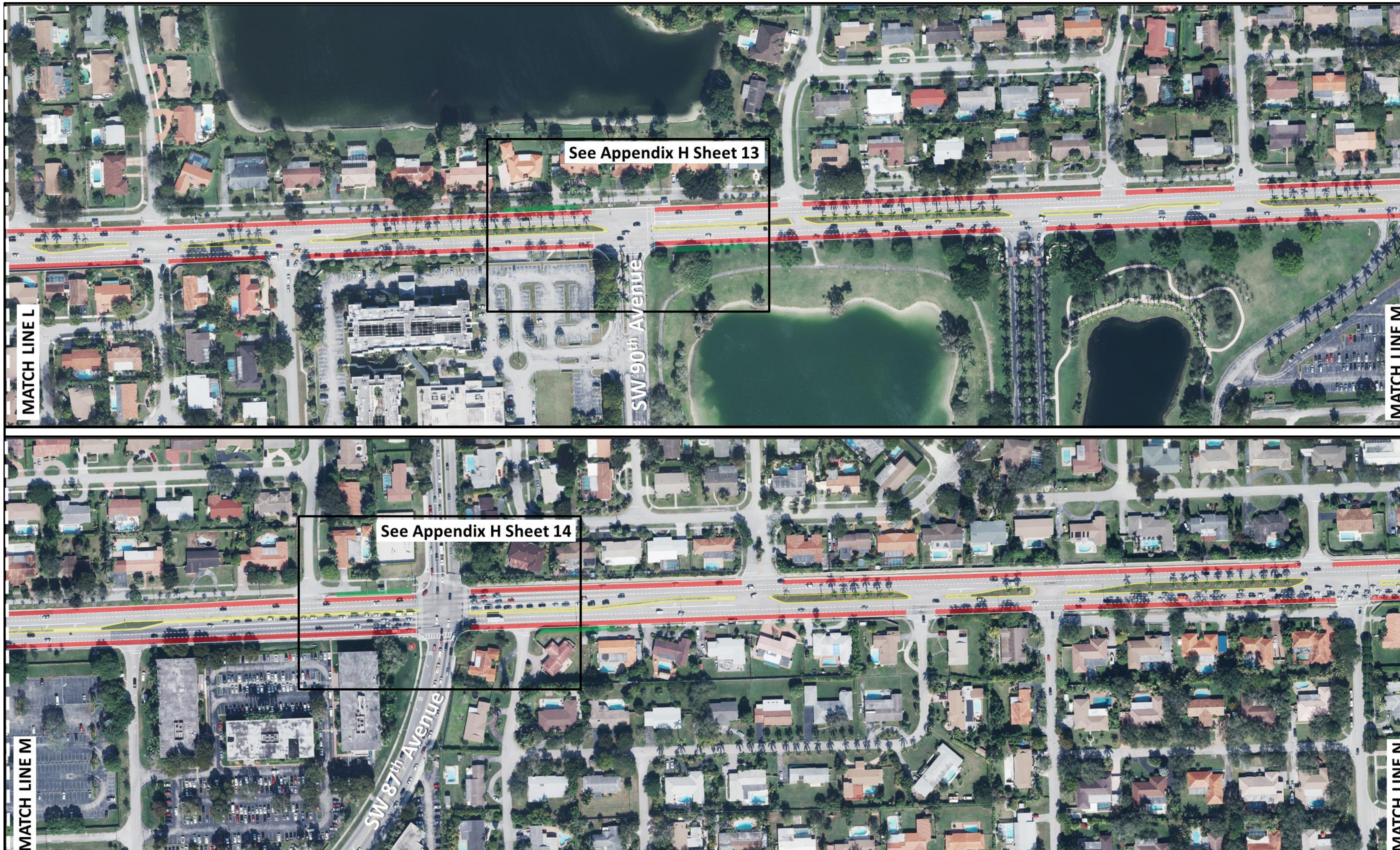
HNTB

0 125 250 500 Feet

Kendall Drive Corridor-Level Aerial (from SW 106th Avenue to SW 94th Avenue)

0 125 250 500 Feet

Kendall Drive Corridor-Level Aerial (from SW 94th Avenue to SW 83rd Avenue)



MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

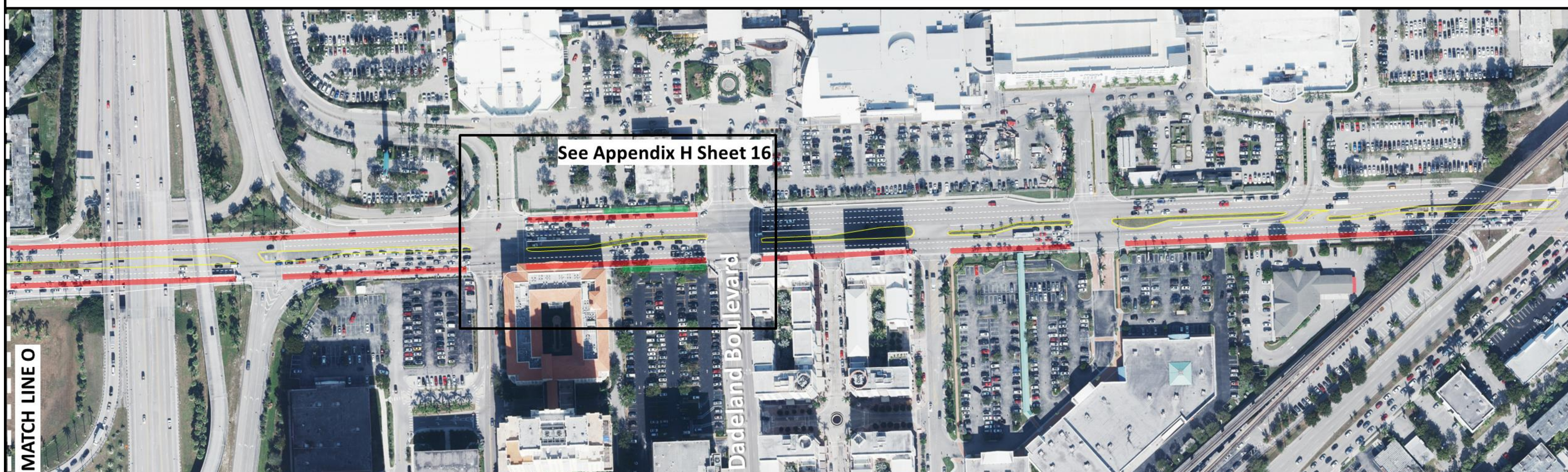
Kendall Drive BRT

HNTB

Sheet 7 of 8

0 125 250 500 Feet

Kendall Drive Corridor-Level Aerial (from SW 83rd Avenue to US 1)



Kendall Drive BRT

HNTB

Sheet 8 of 8

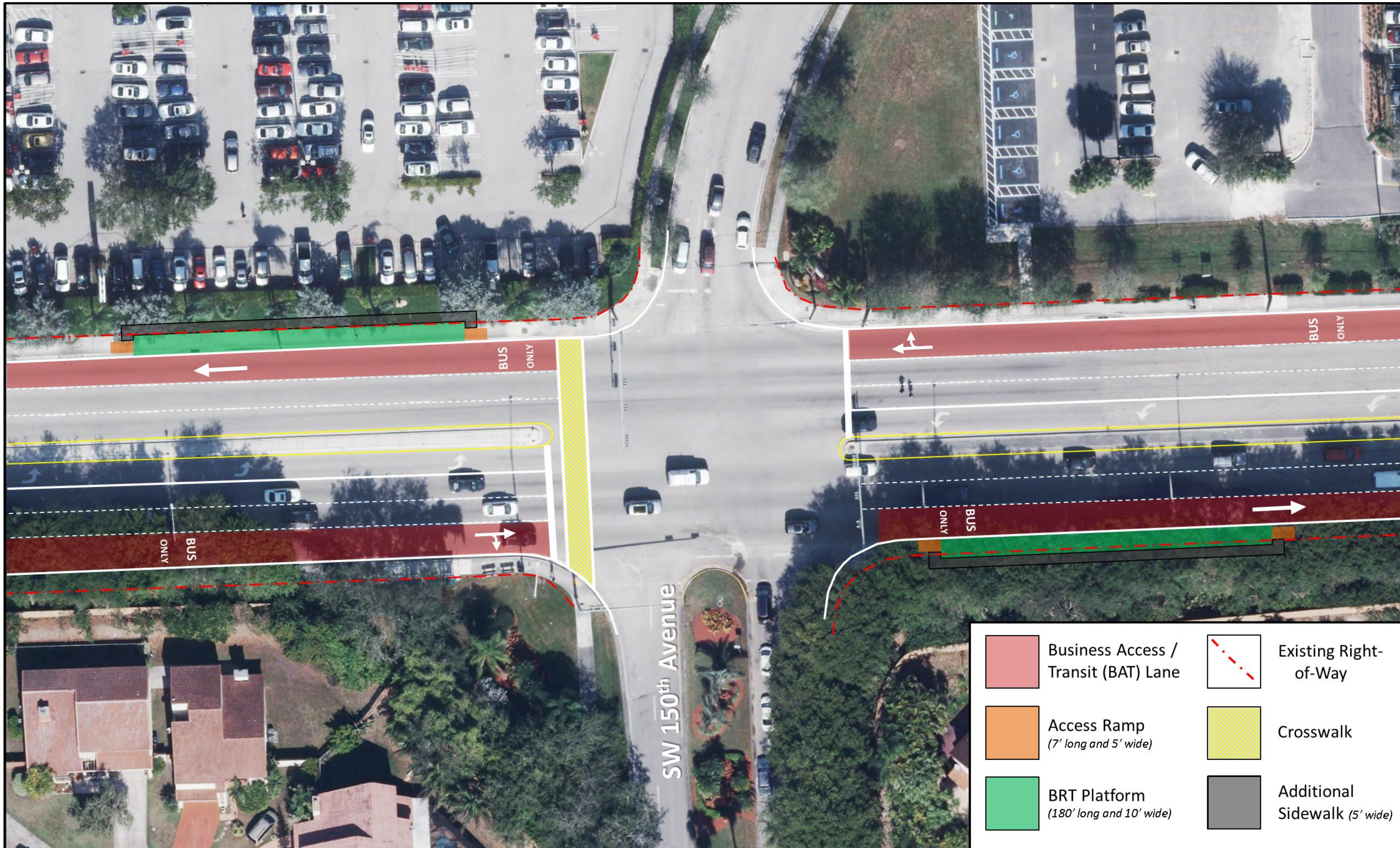
0 125 250 500 Feet

Appendix H – Transit Station-Level Aerials with proposed BRT Concepts

Kendall Drive BRT at SW 157th Avenue Station

HNTB

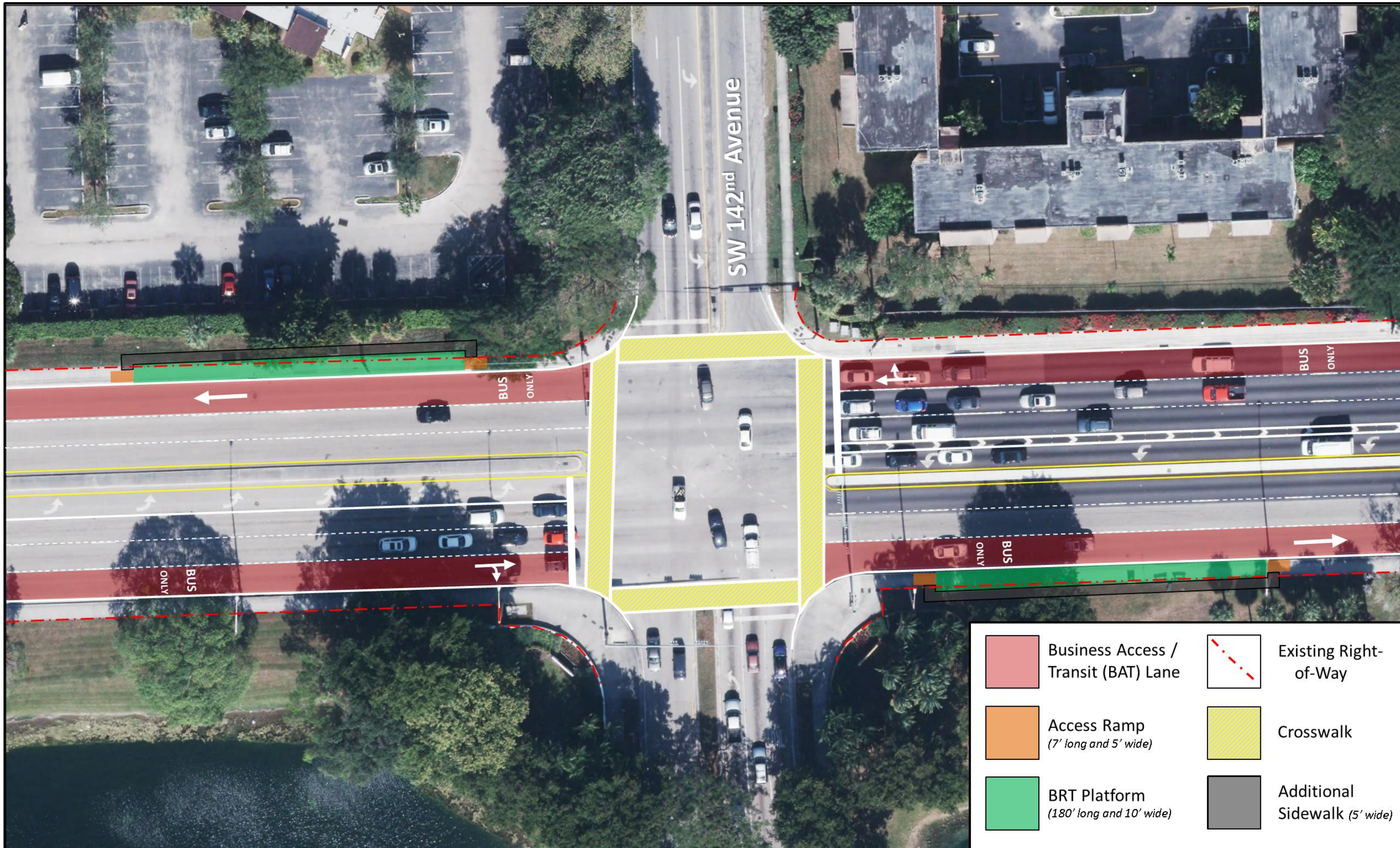
Sheet 1 of 16



Kendall Drive BRT at SW 150th Avenue Station

HNTB

Sheet 2 of 16



Business Access / Transit (BAT) Lane

Access Ramp (7' long and 5' wide)

BRT Platform (180' long and 10' wide)

Existing Right-of-Way

Crosswalk

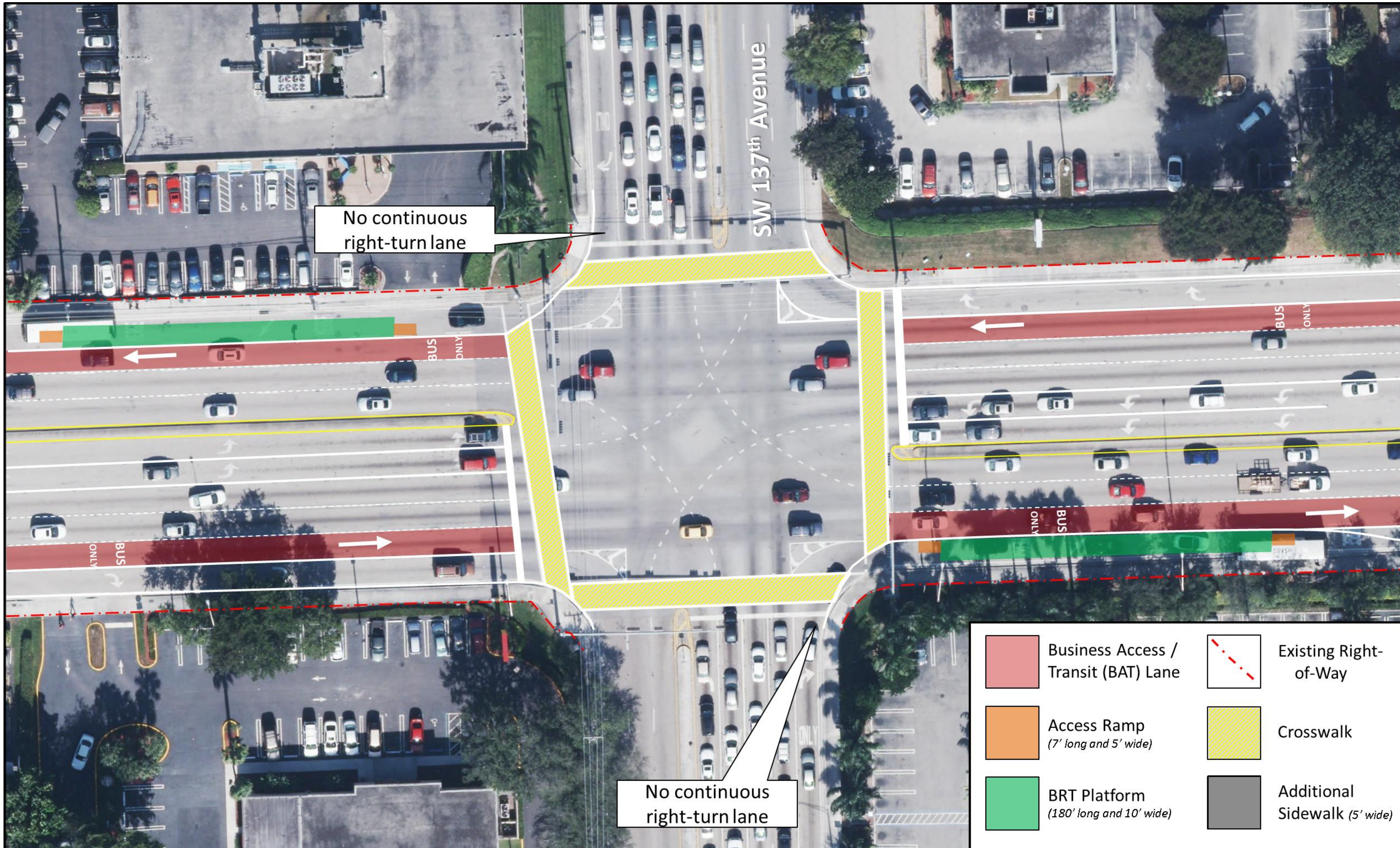
Additional Sidewalk (5' wide)

Kendall Drive BRT at SW 142nd Avenue Station

HNTB

Sheet 3 of 16

0 25 50 100 Feet

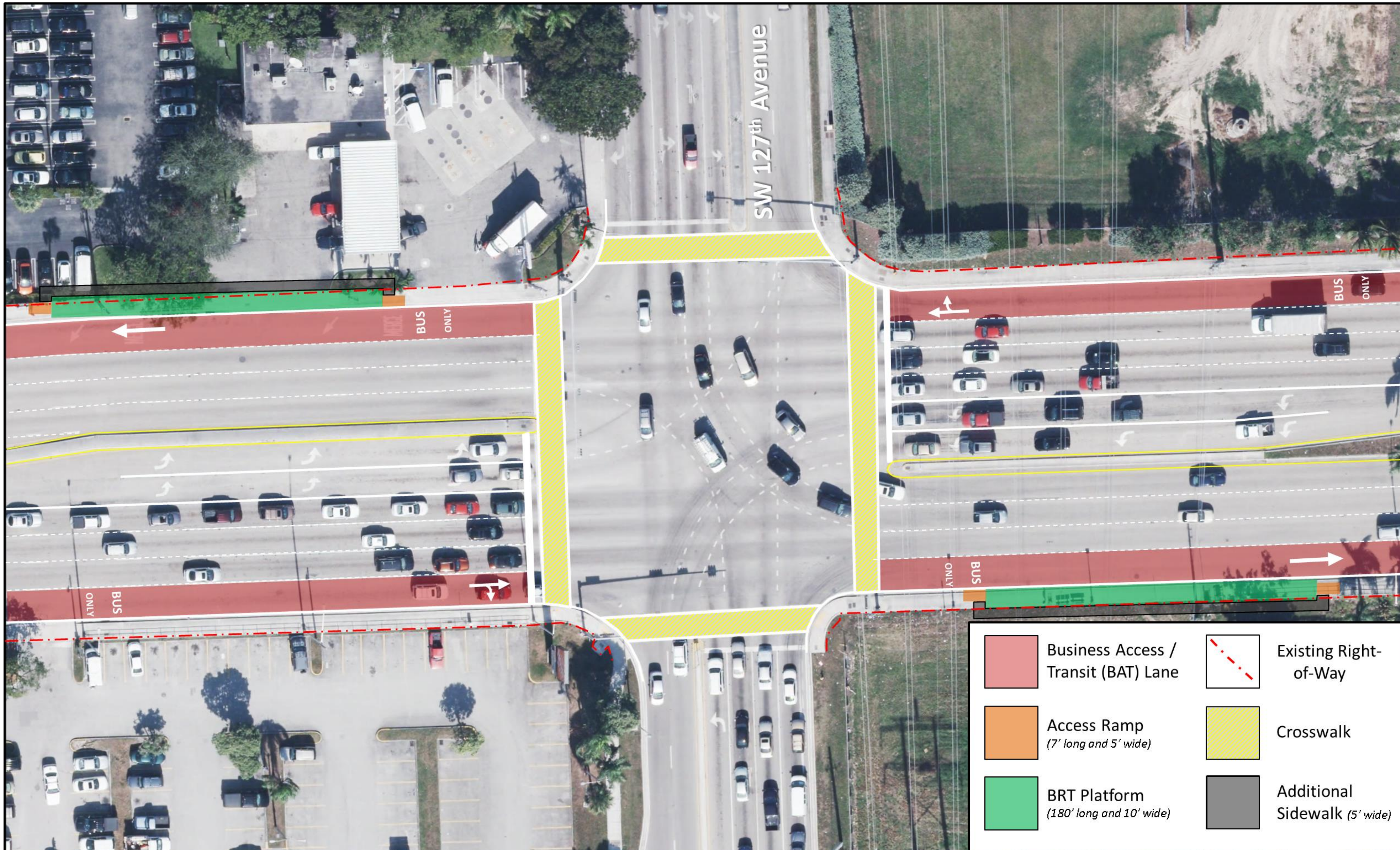


Kendall Drive BRT at SW 137th Avenue Station

HNTB

Kendall Drive BRT at SW 133rd Avenue Station

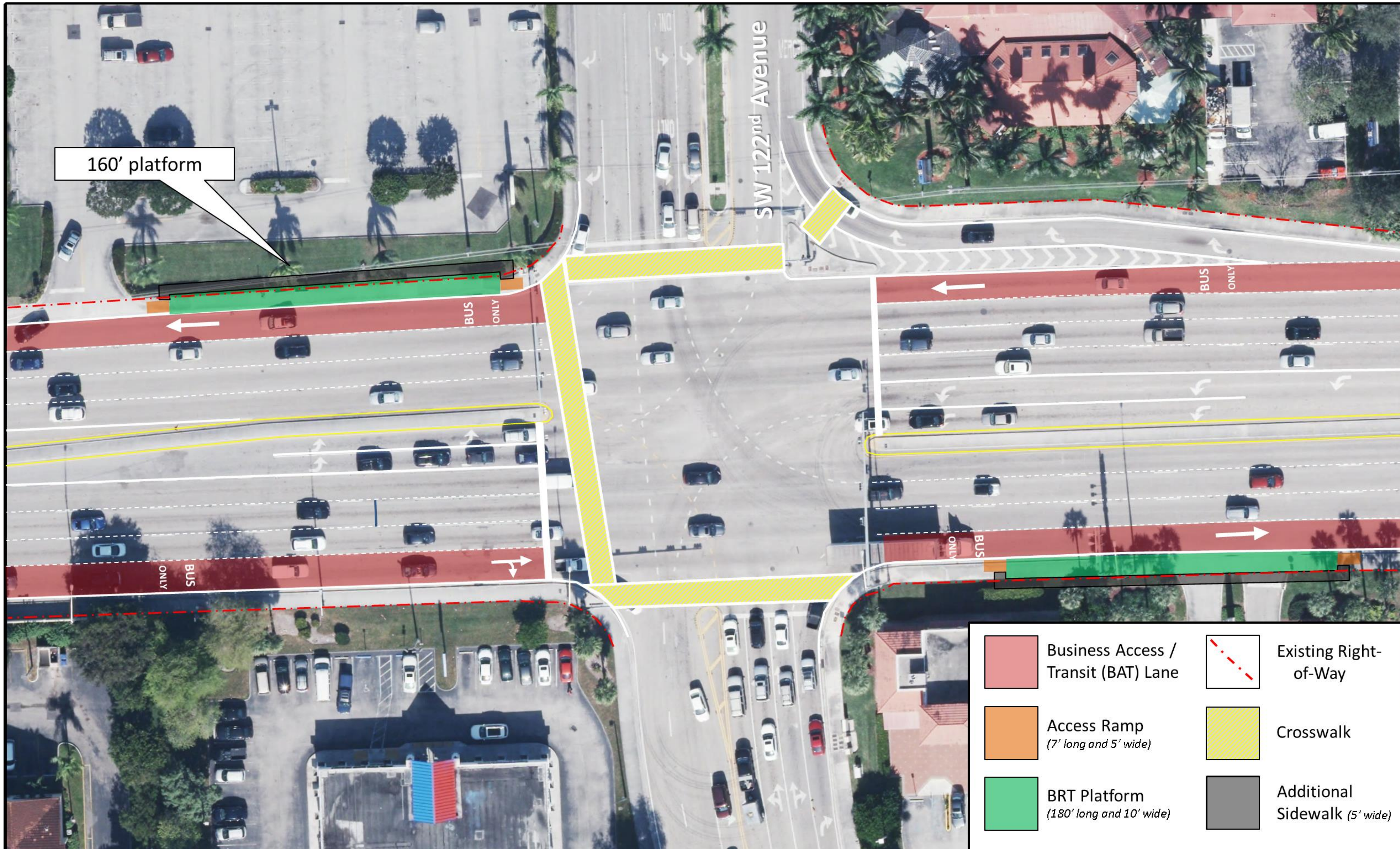
HNTB



Kendall Drive BRT at SW 127th Avenue Station

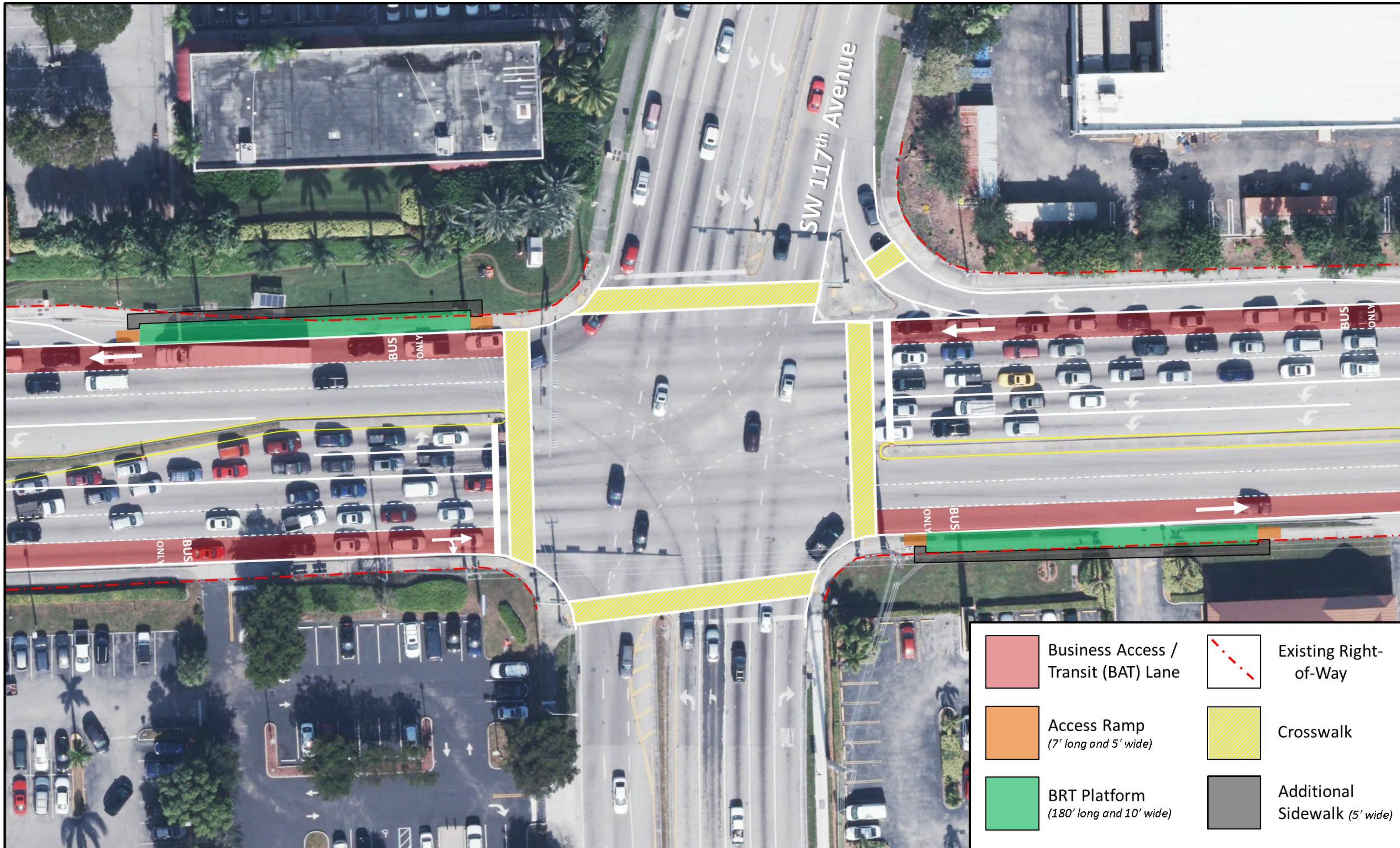
HNTB

Sheet 6 of 16



Kendall Drive BRT at SW 122nd Avenue Station

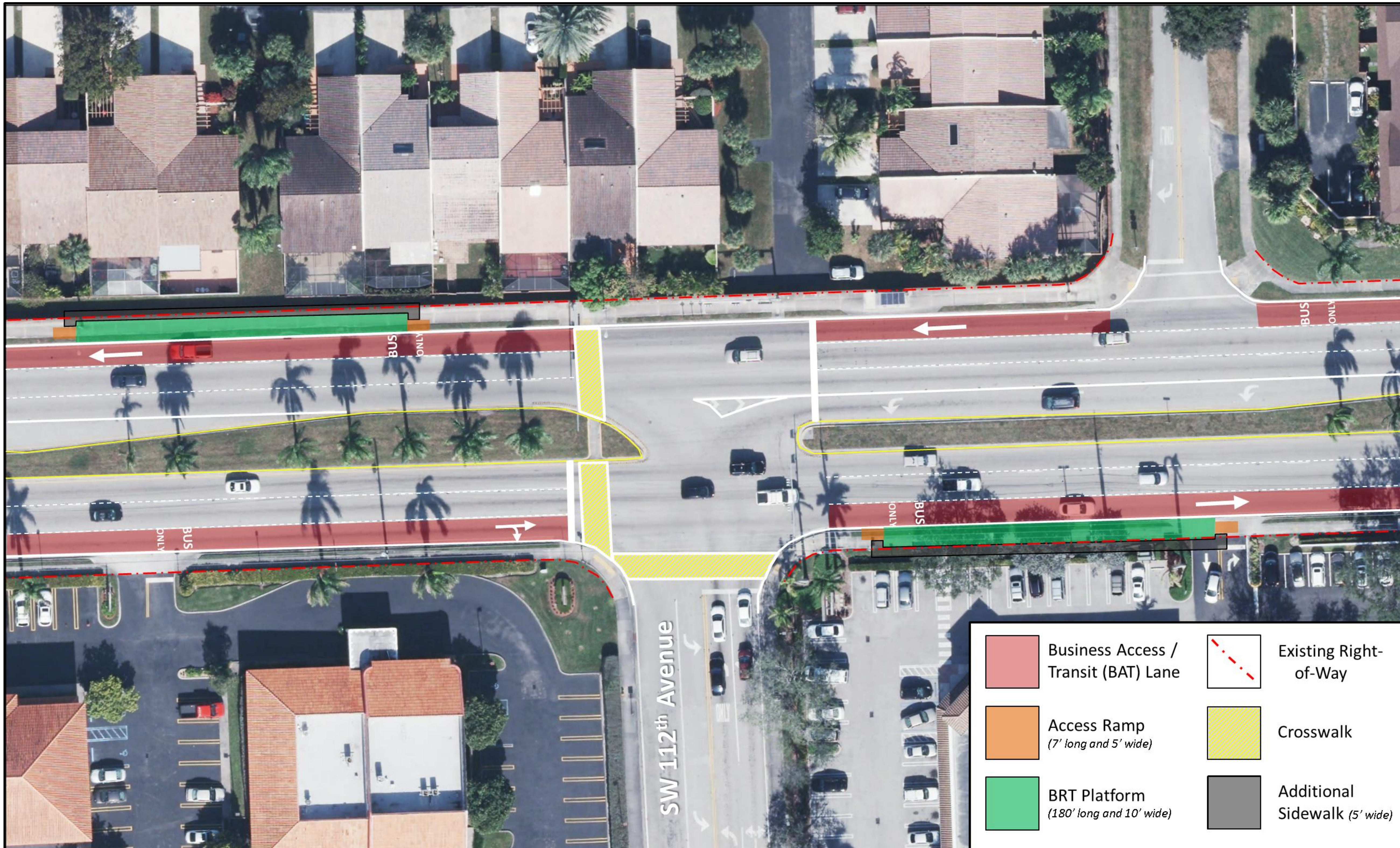
HNTB



Kendall Drive BRT at SW 117th Avenue Station

HNTB

0 25 50 100 Feet



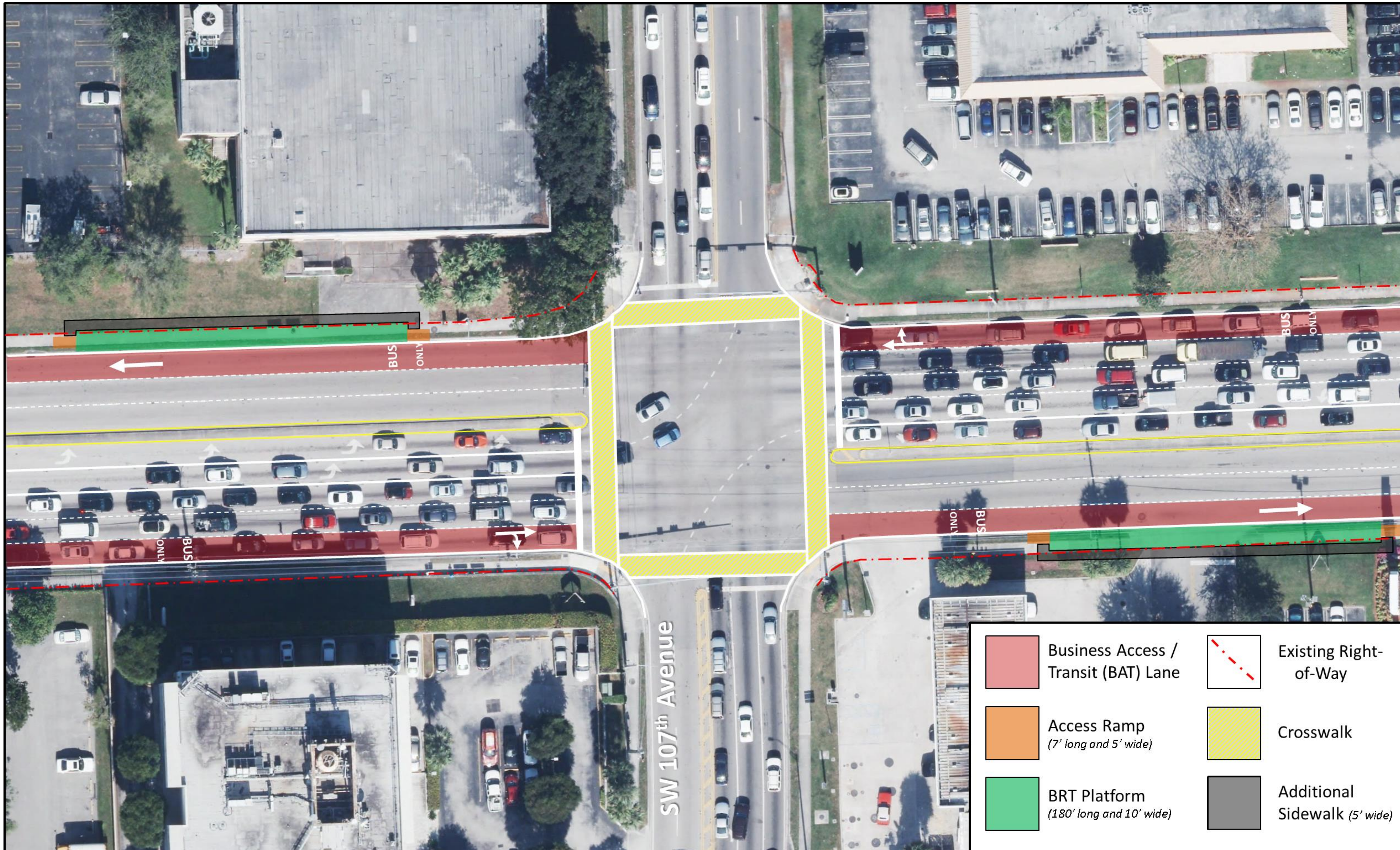
MPO MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

Kendall Drive BRT at SW 112th Avenue

HNTB

Sheet 9 of 16

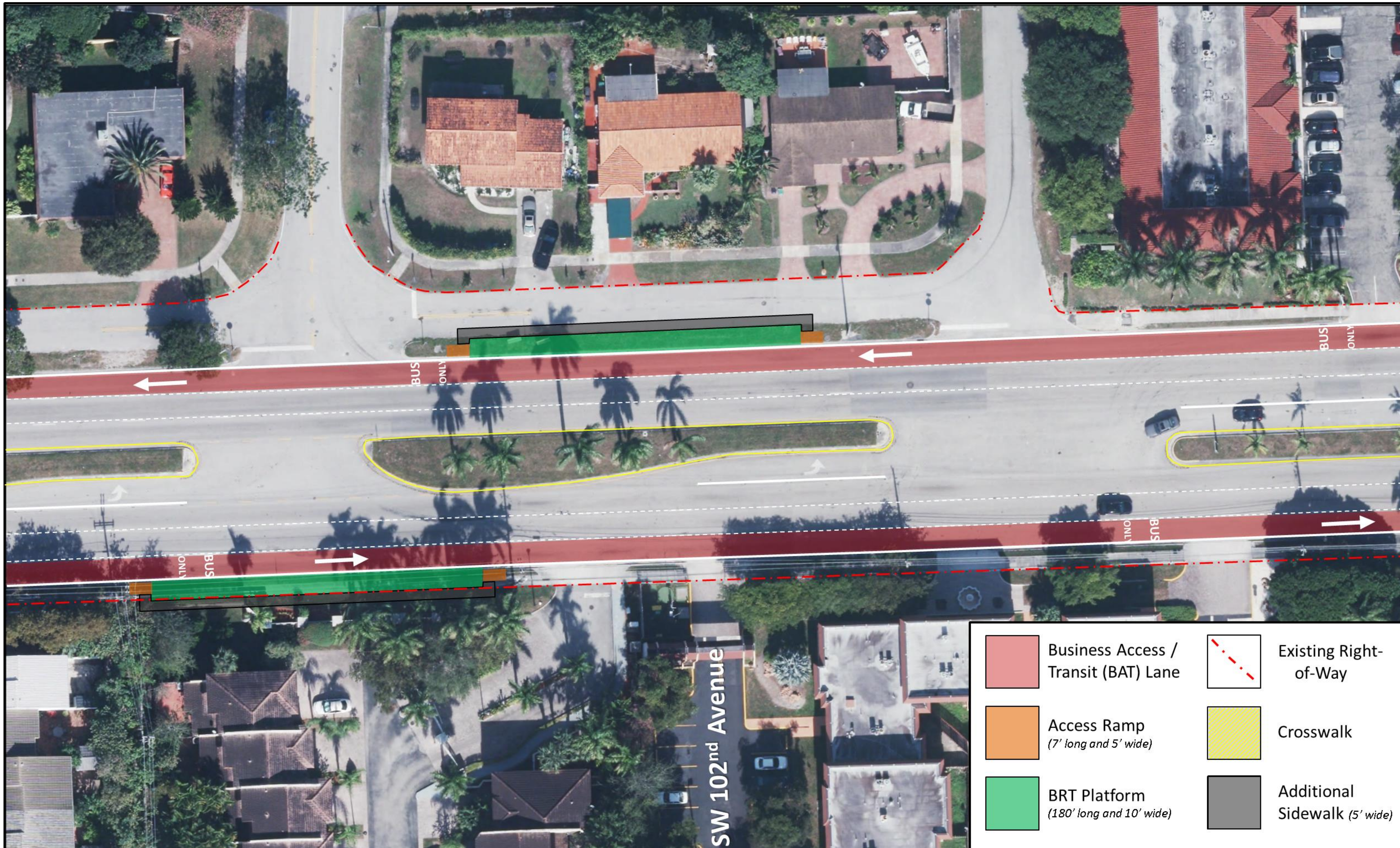
0 25 50 100 Feet



Kendall Drive BRT at SW 107th Avenue Station

HNTB

0 25 50 100 Feet



Kendall Drive BRT at SW 102nd Avenue Station

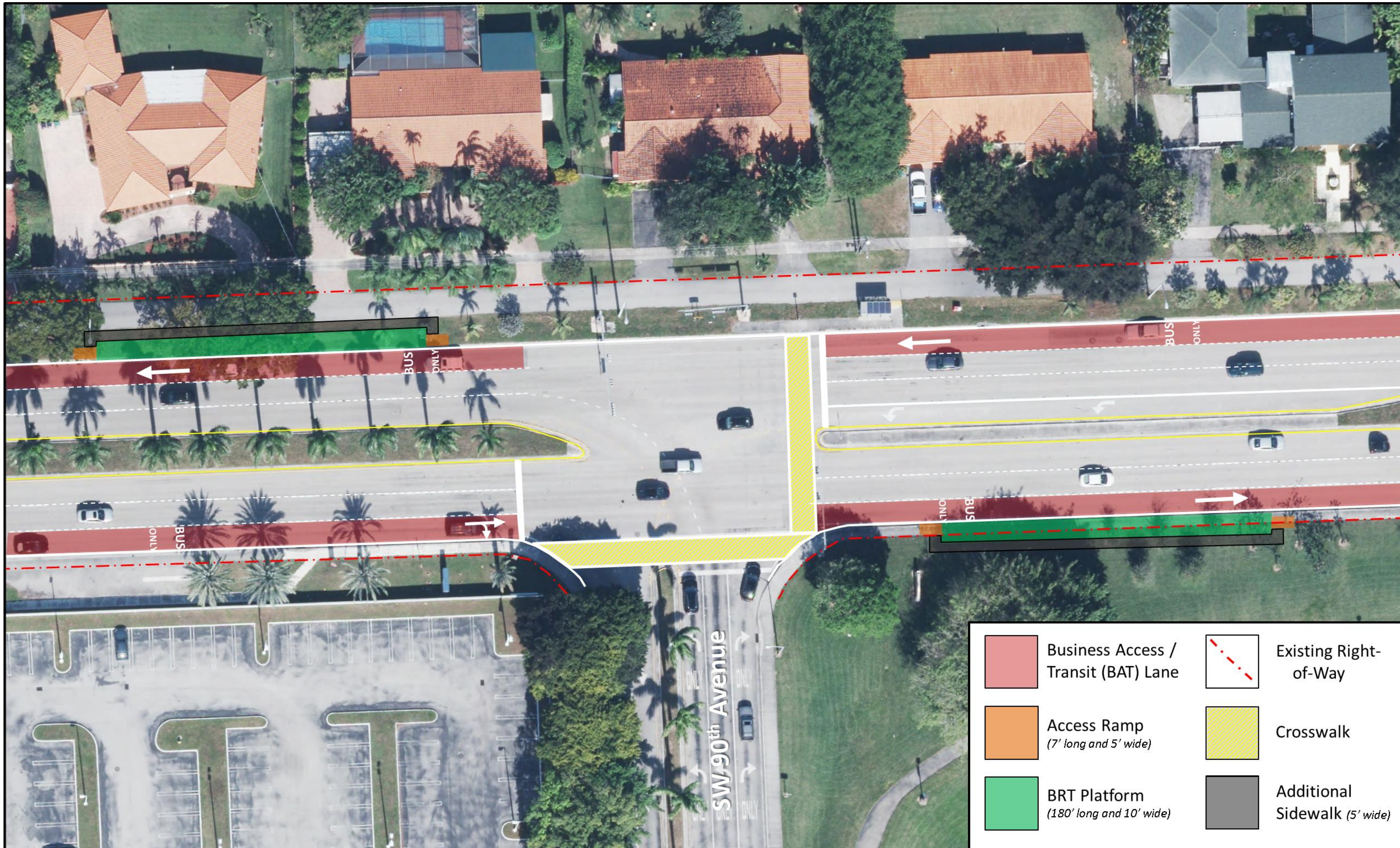
HNTB

0 25 50 100 Feet

Kendall Drive BRT at SW 97th Avenue Station

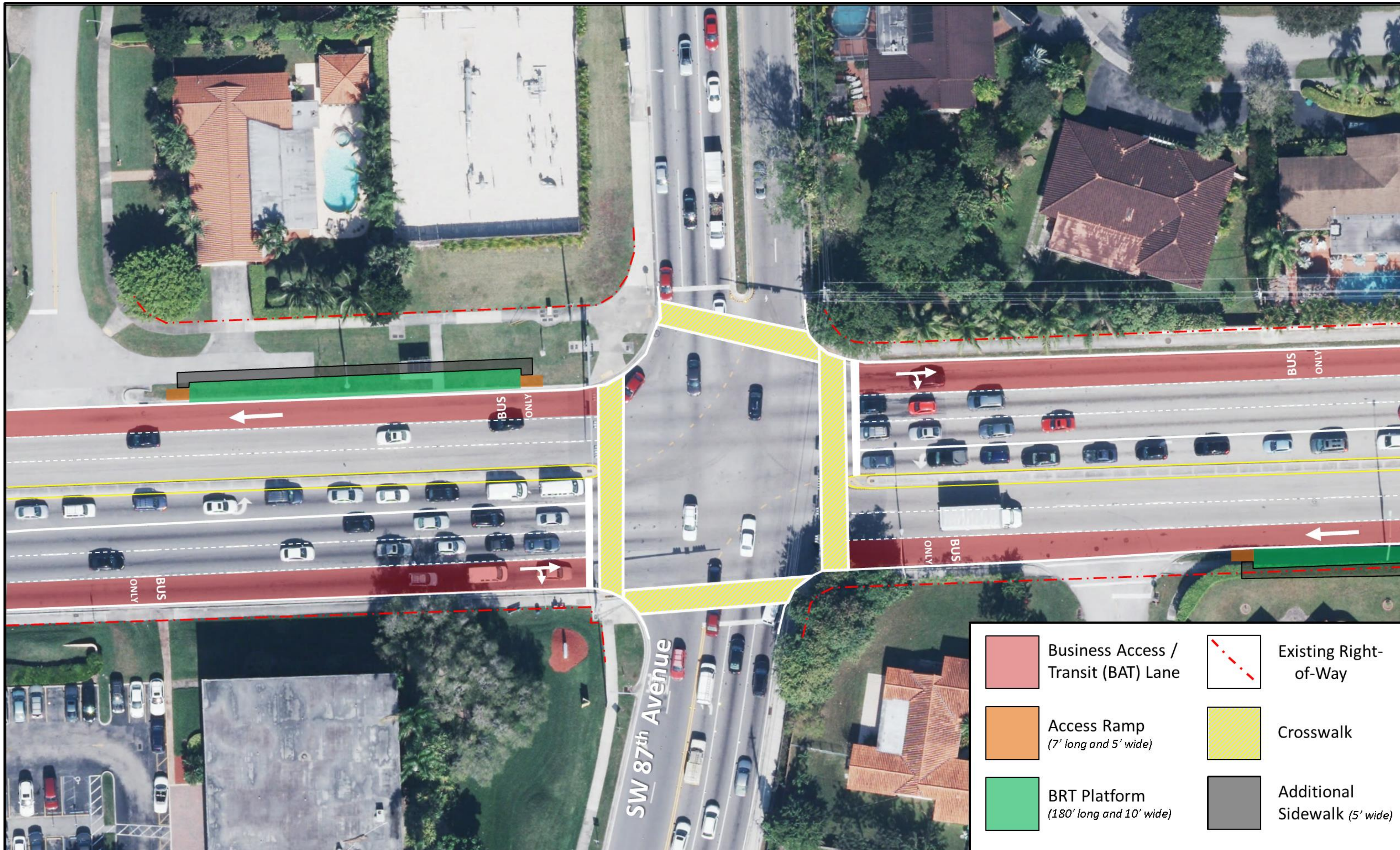
HNTB

0 25 50 100 Feet



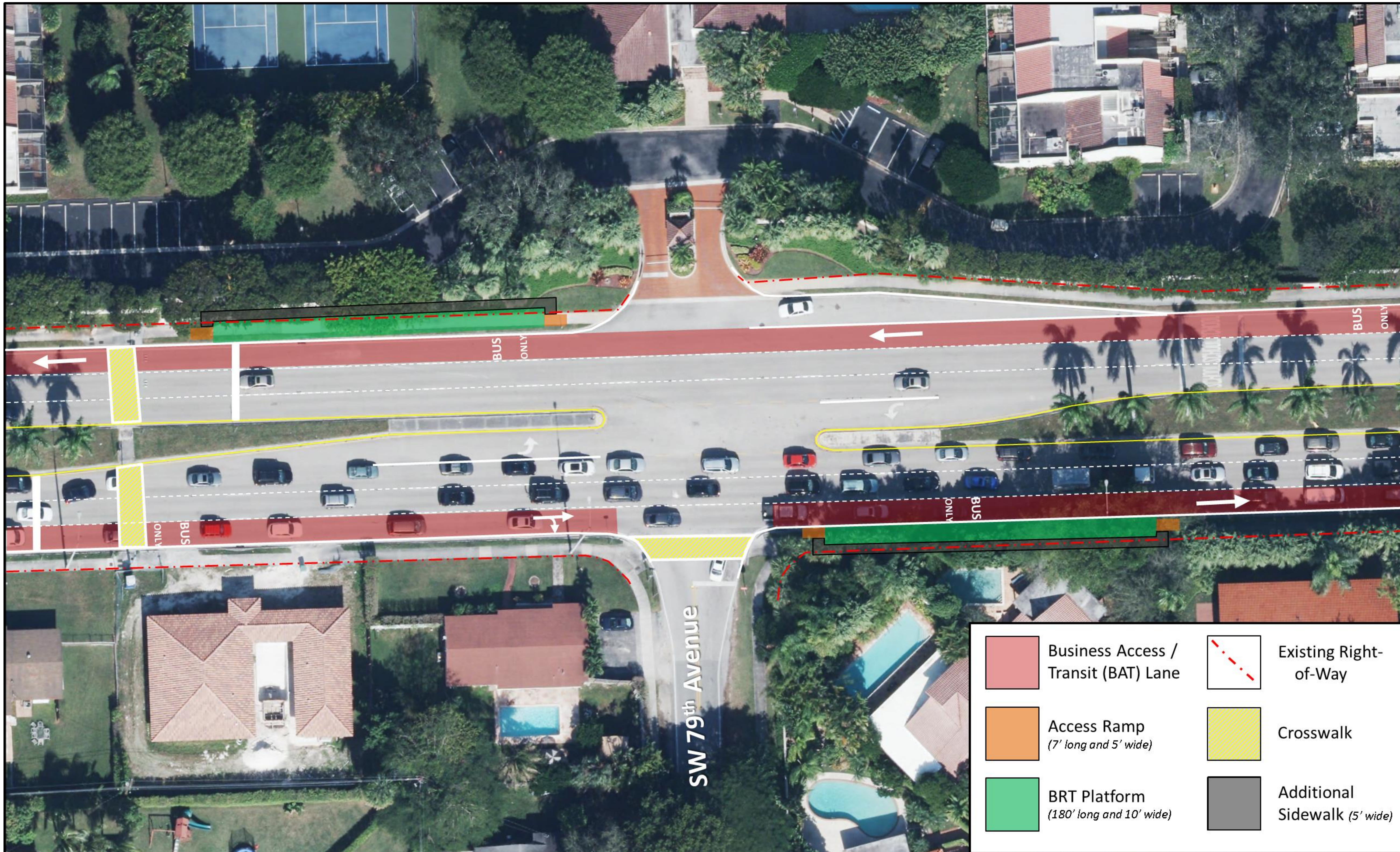
Kendall Drive BRT at the Baptist Hospital Station

HNTB



Kendall Drive BRT at SW 87th Avenue Station

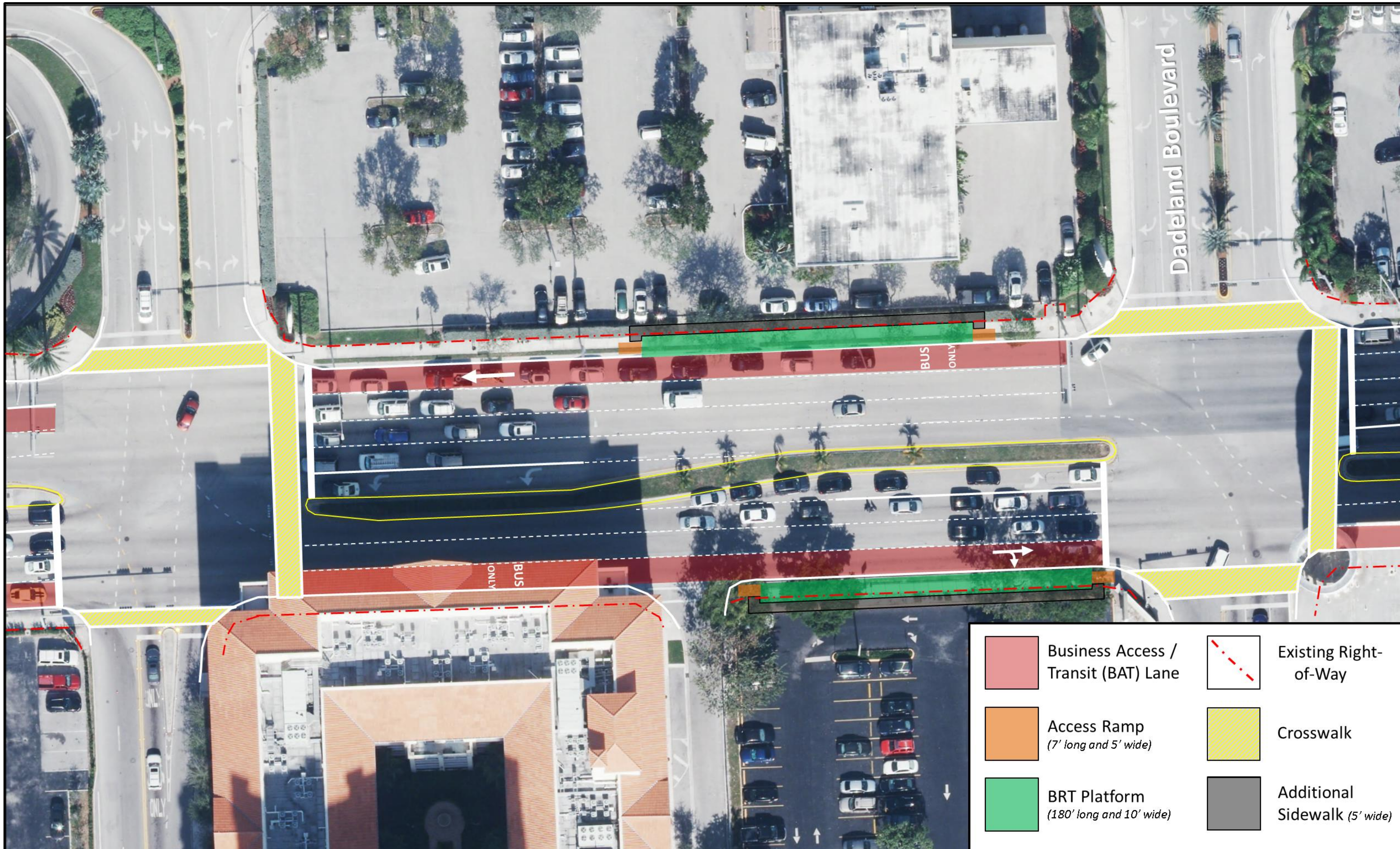
HNTB



Kendall Drive BRT at SW 79th Avenue Station

HNTB

0 25 50 100 Feet



Kendall Drive BRT at Dadeland Boulevard Station

HNTB

Sheet 16 of 16

0 25 50 100 Feet

Appendix I – Before and After Renderings

At SW 122th Avenue
Note: not to scale – for illustrative purposes only

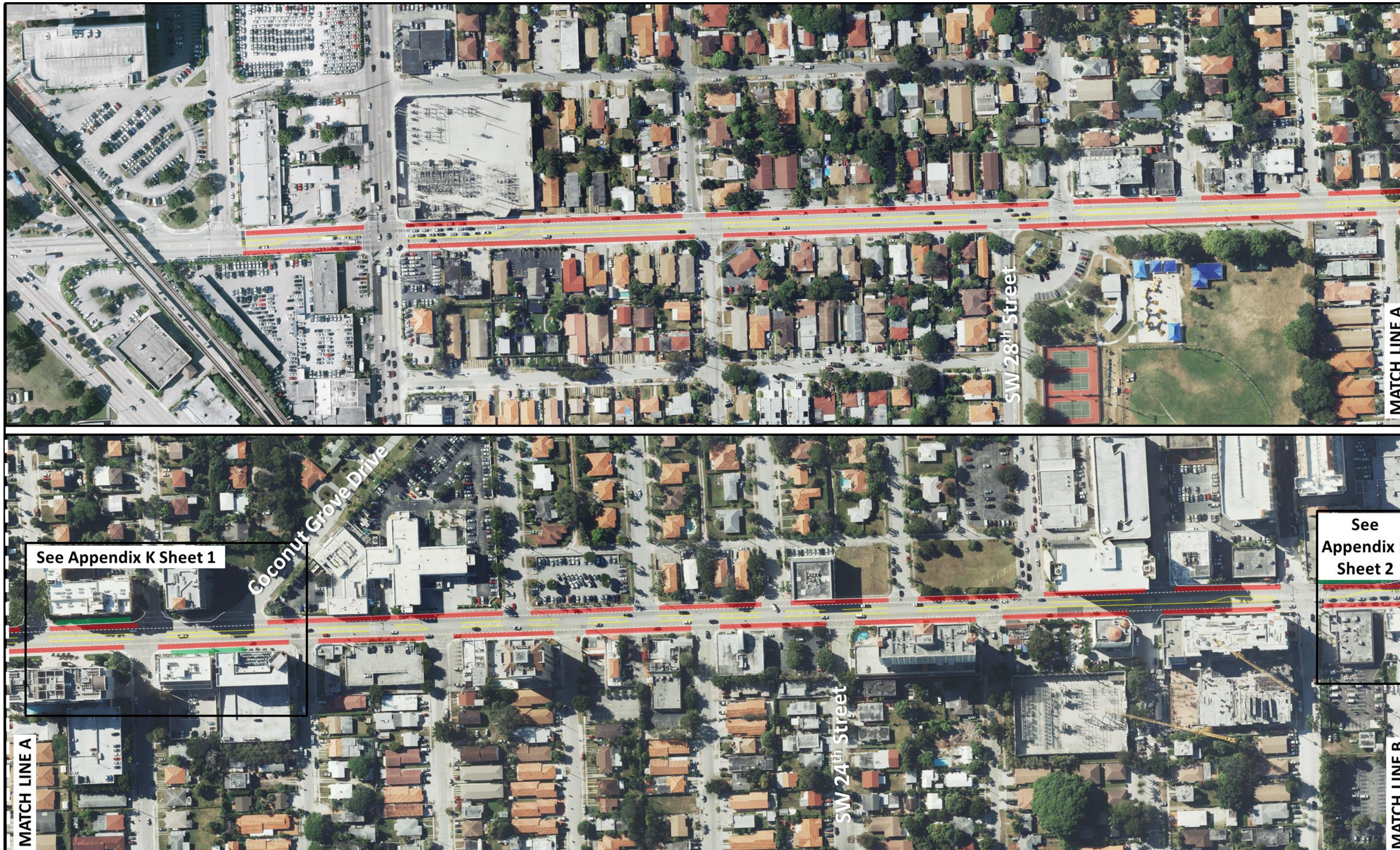
Kendall Drive Before and After Renderings HNTB | Sheet 1 of 2

At SW 122th Avenue
Note: not to scale – for illustrative purposes only

Kendall Drive Before and After Renderings | HNTB | Sheet 2 of 2

Appendix J – Corridor-Level Aerials with proposed BRT Alignment

Douglas Road Corridor-Level Aerial (from US 1 to SW 24th Street)



MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

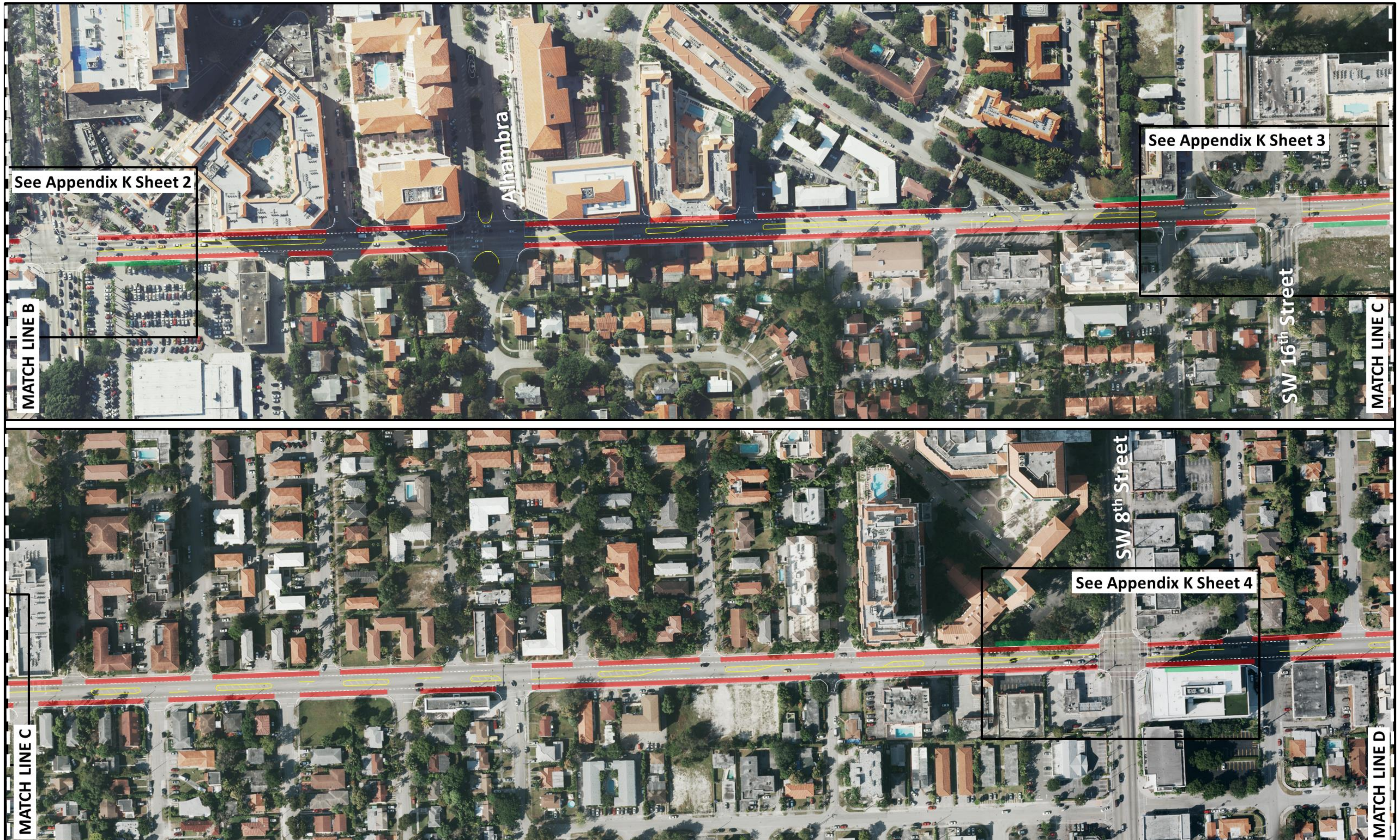
Douglas Road BRT

HNTB

Sheet 1 of 4

0 125 250 500 Feet

Douglas Road Corridor-Level Aerial (from SW 24th Street to SW 8th Street)



MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

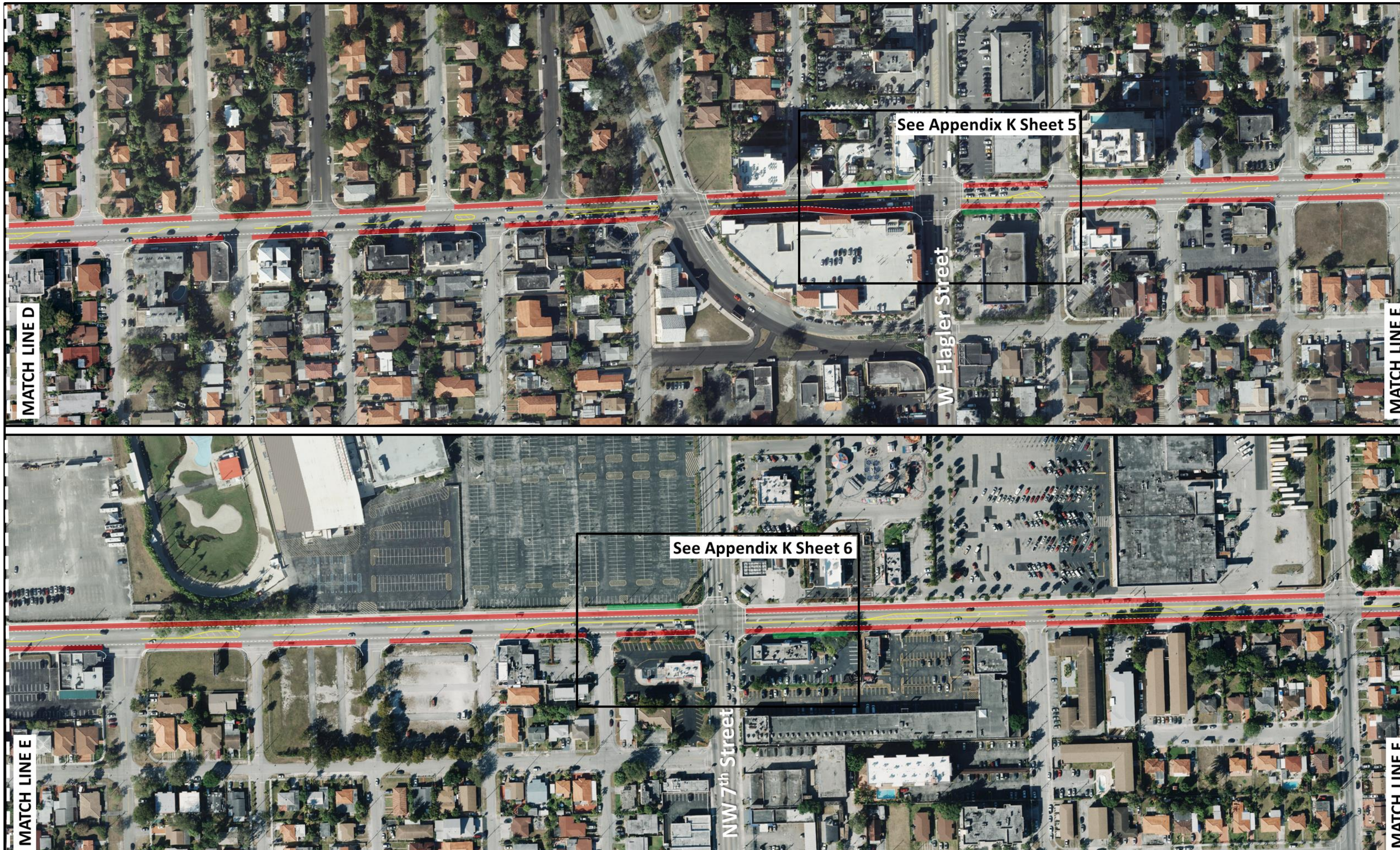
Douglas Road BRT

HNTB

Sheet 2 of 4

0 125 250 500 Feet

Douglas Road Corridor-Level Aerial (from SW 8th Street to NW 14th Street)

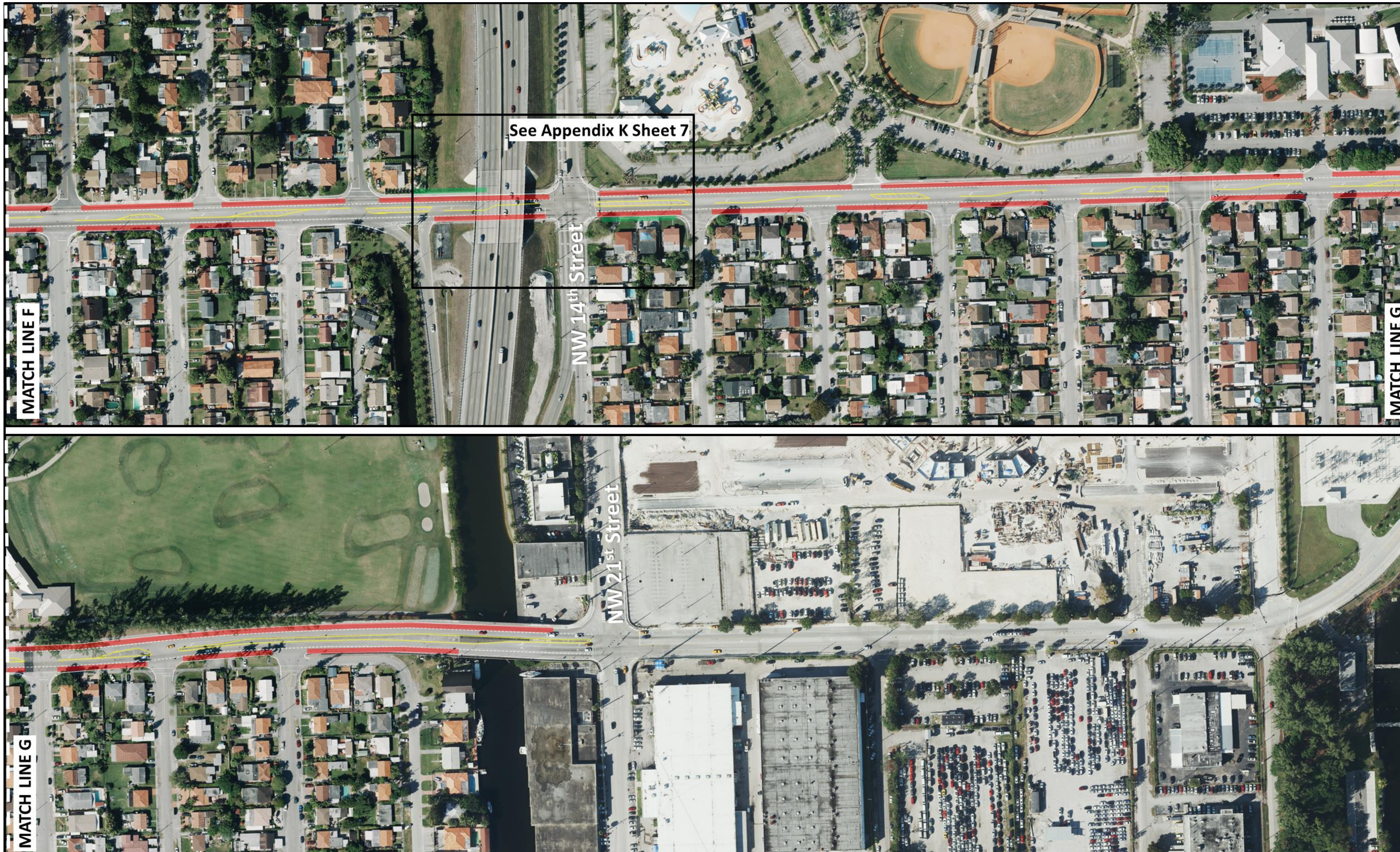


Douglas Road BRT

Sheet 3 of 4

0 125 250 500 Feet

Douglas Road Corridor-Level Aerial (from NW 14th Street to the Miami Intermodal Center)



MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

Douglas Road BRT

HNTB

Sheet 4 of 4

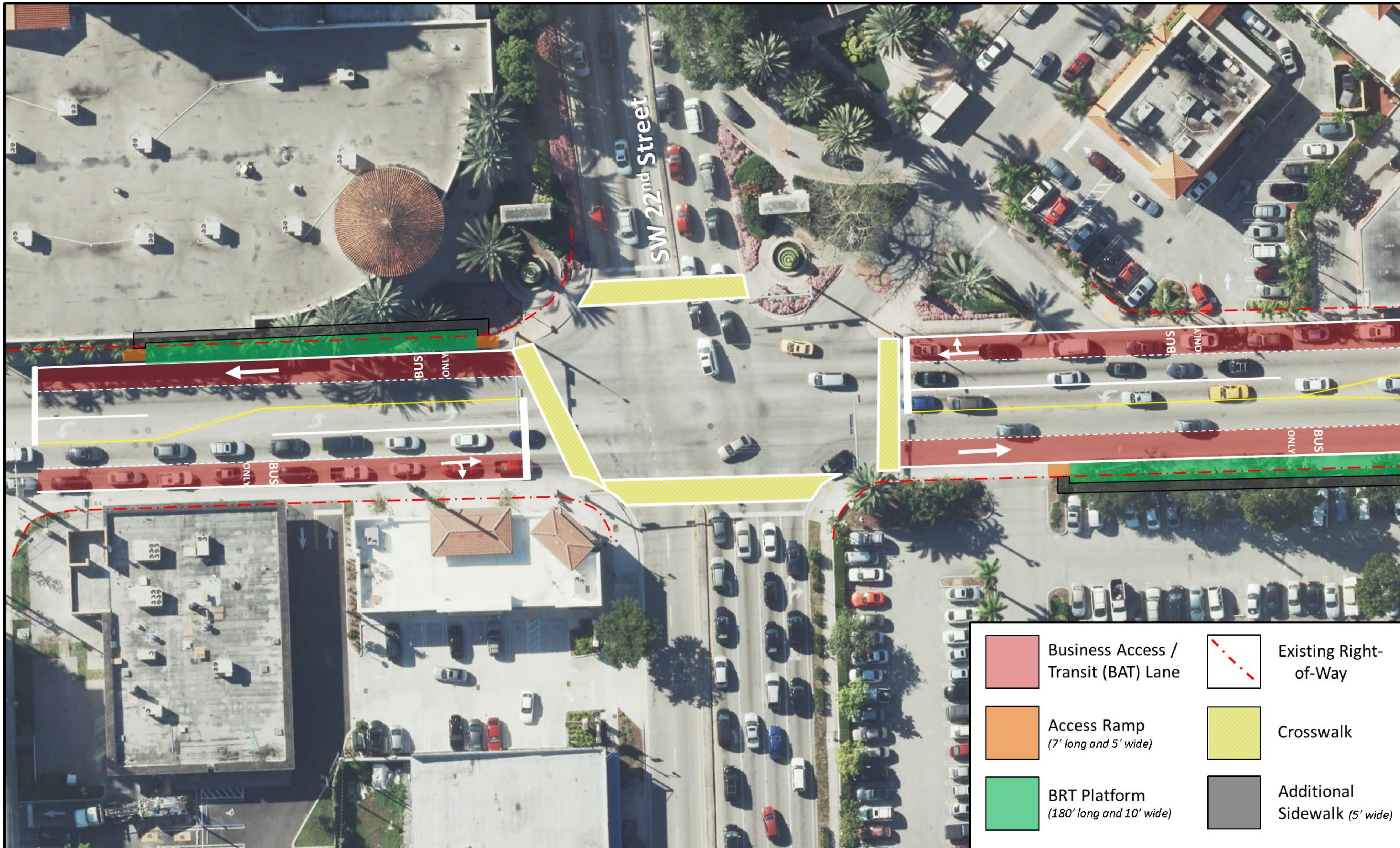
0 125 250 500 Feet

Appendix K – Transit Station-Level Aerials with proposed BRT Concepts

Douglas Road BRT at Coconut Grove Drive Station

Sheet 1 of 7

0 25 50 100 Feet

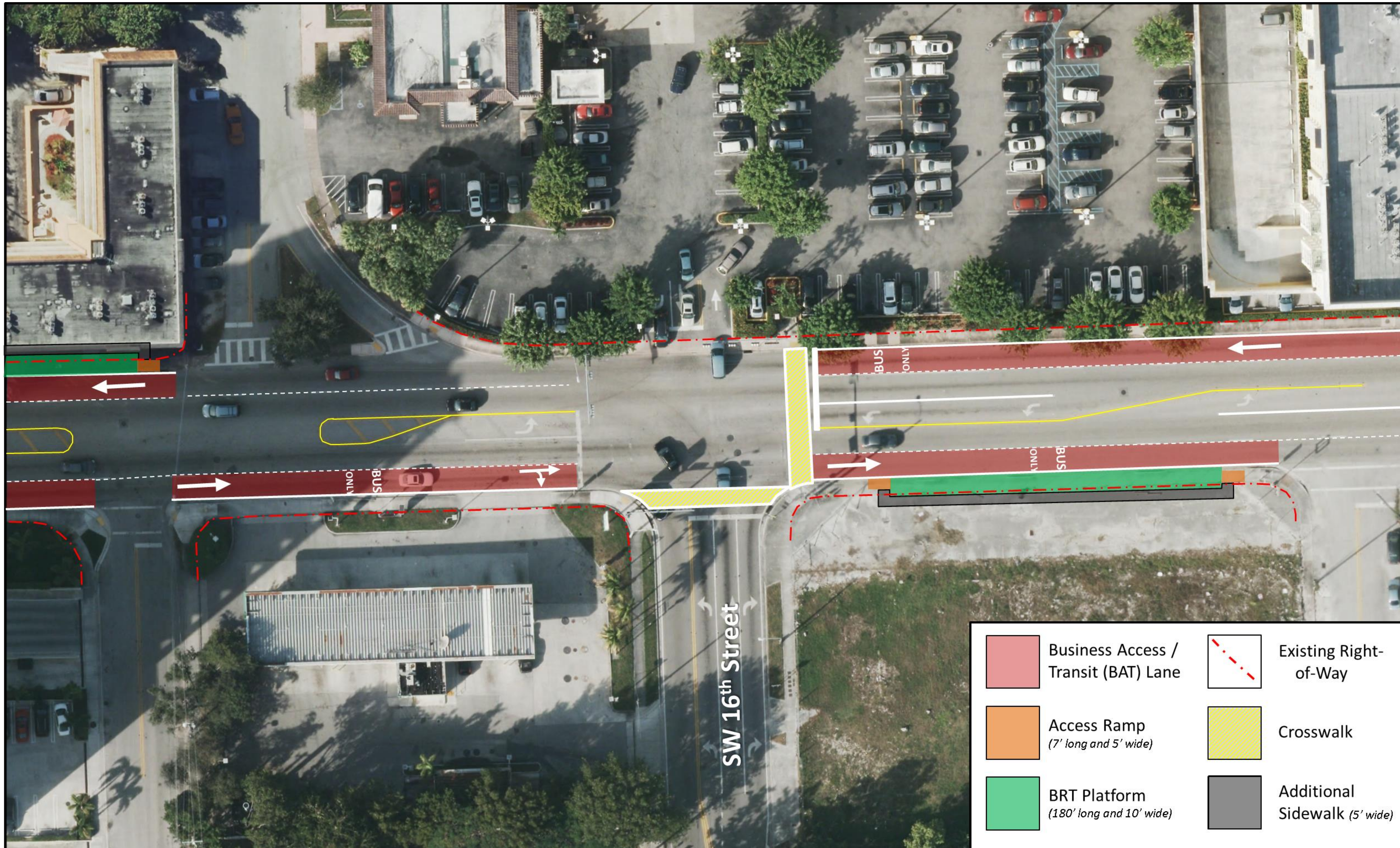


Douglas Road BRT at SW 22nd Street Station

HNTB

Sheet 2 of 7

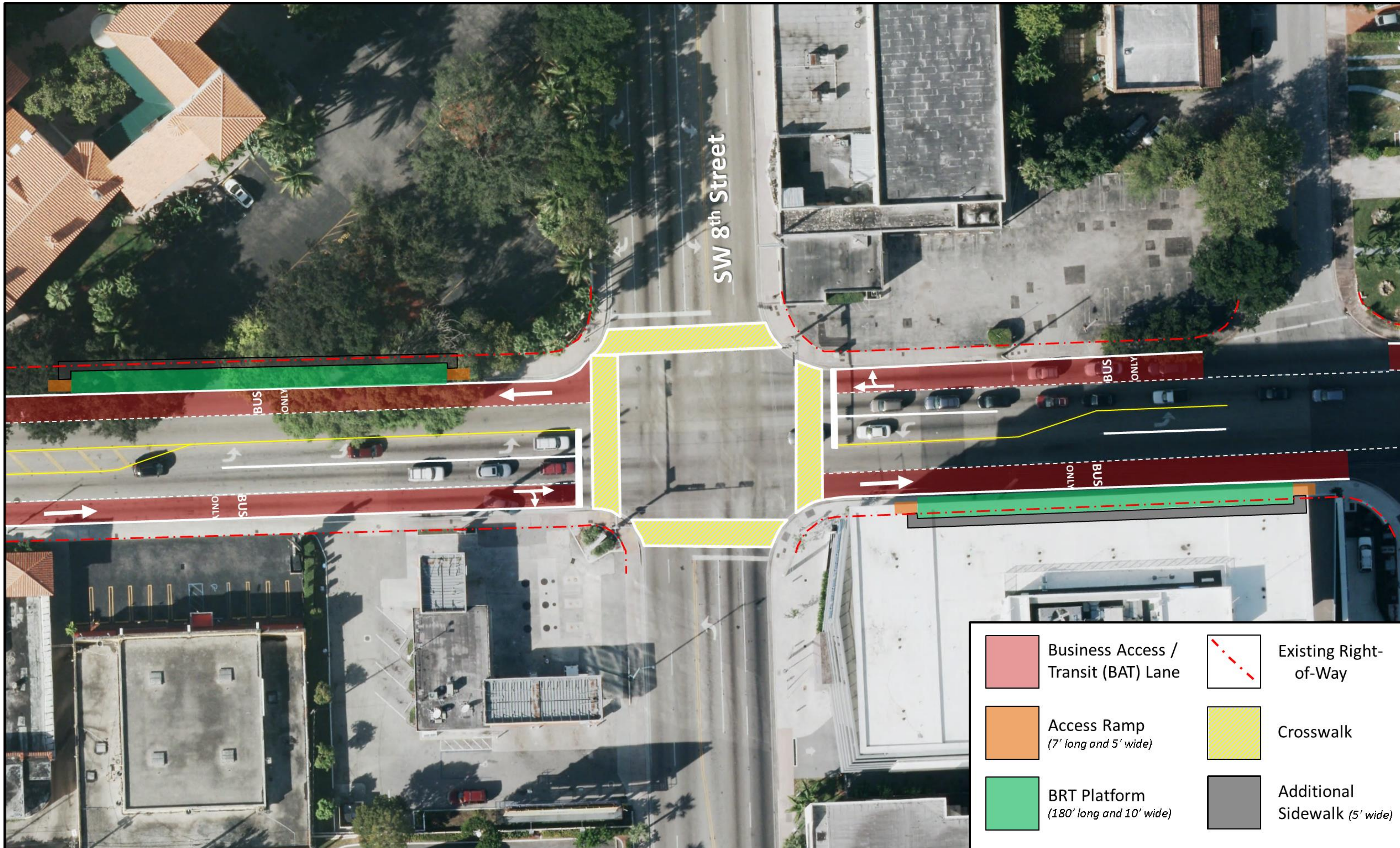
0 25 50 100 Feet



Douglas Road BRT at SW 16th Street Station

Sheet 3 of 7

0 25 50 100 Feet

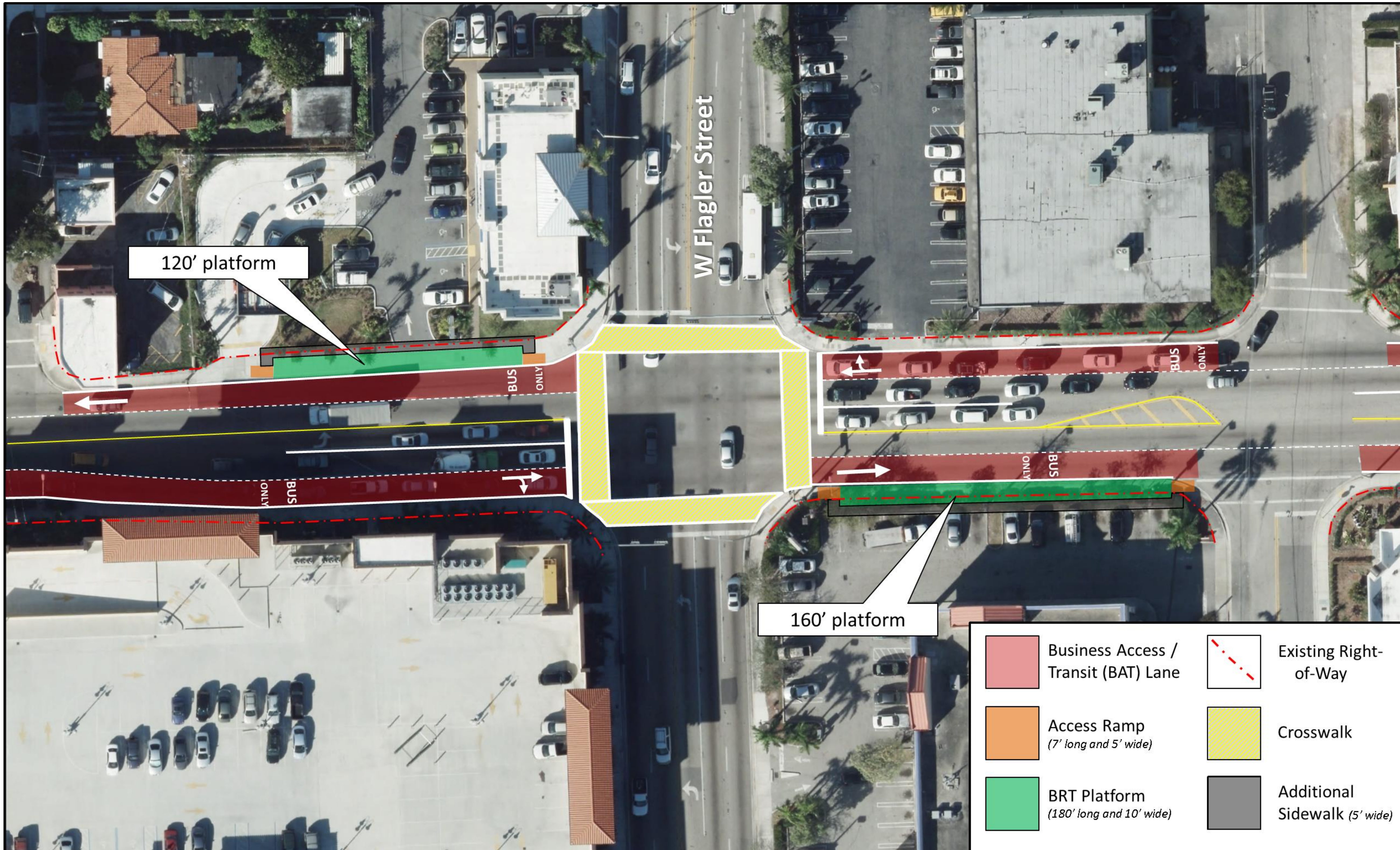


Douglas Road BRT at SW 8th Street Station

HNTB

Sheet 4 of 7

0 25 50 100 Feet

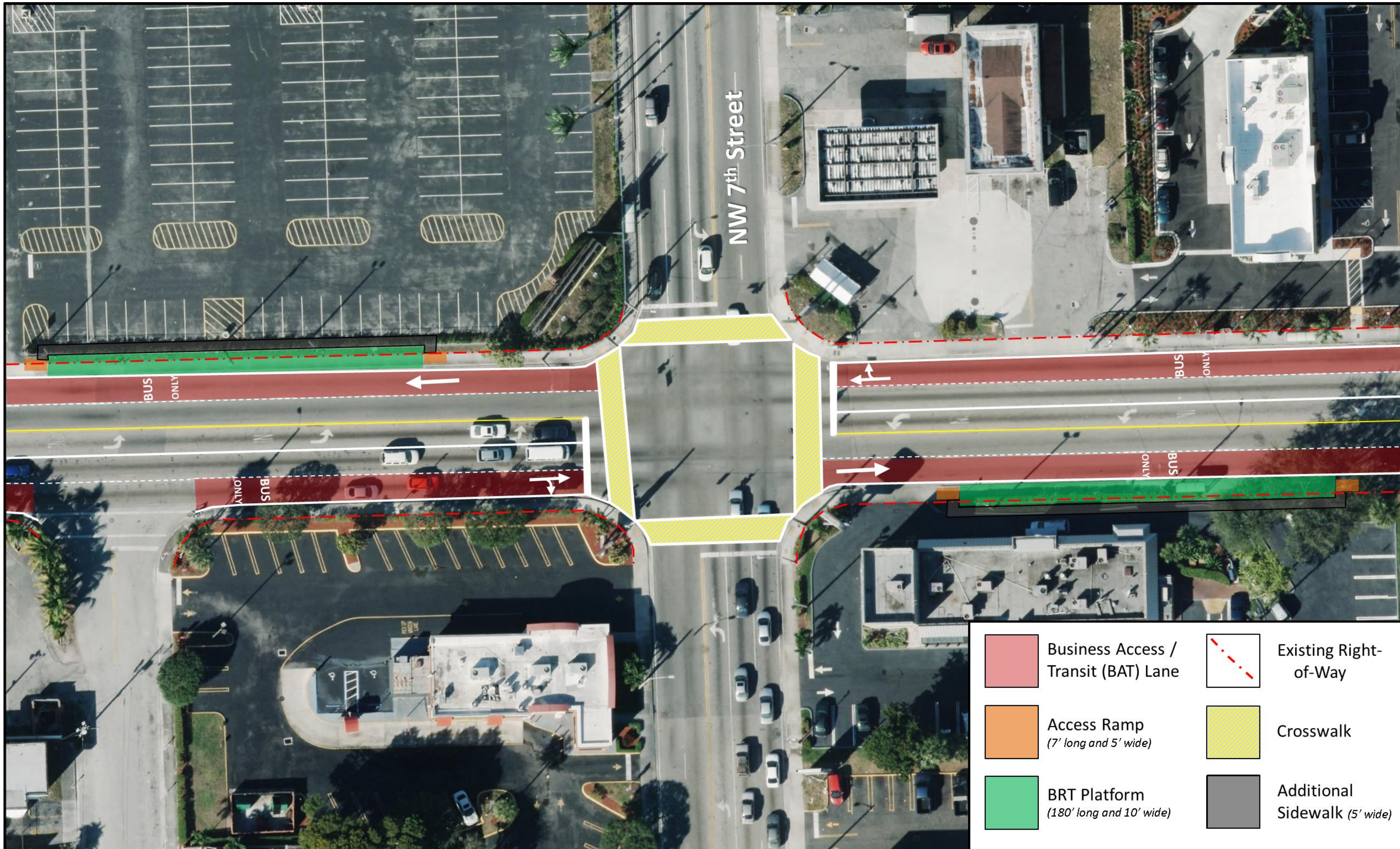


Douglas Road BRT at W Flagler Street Station

HNTB

Sheet 5 of 7

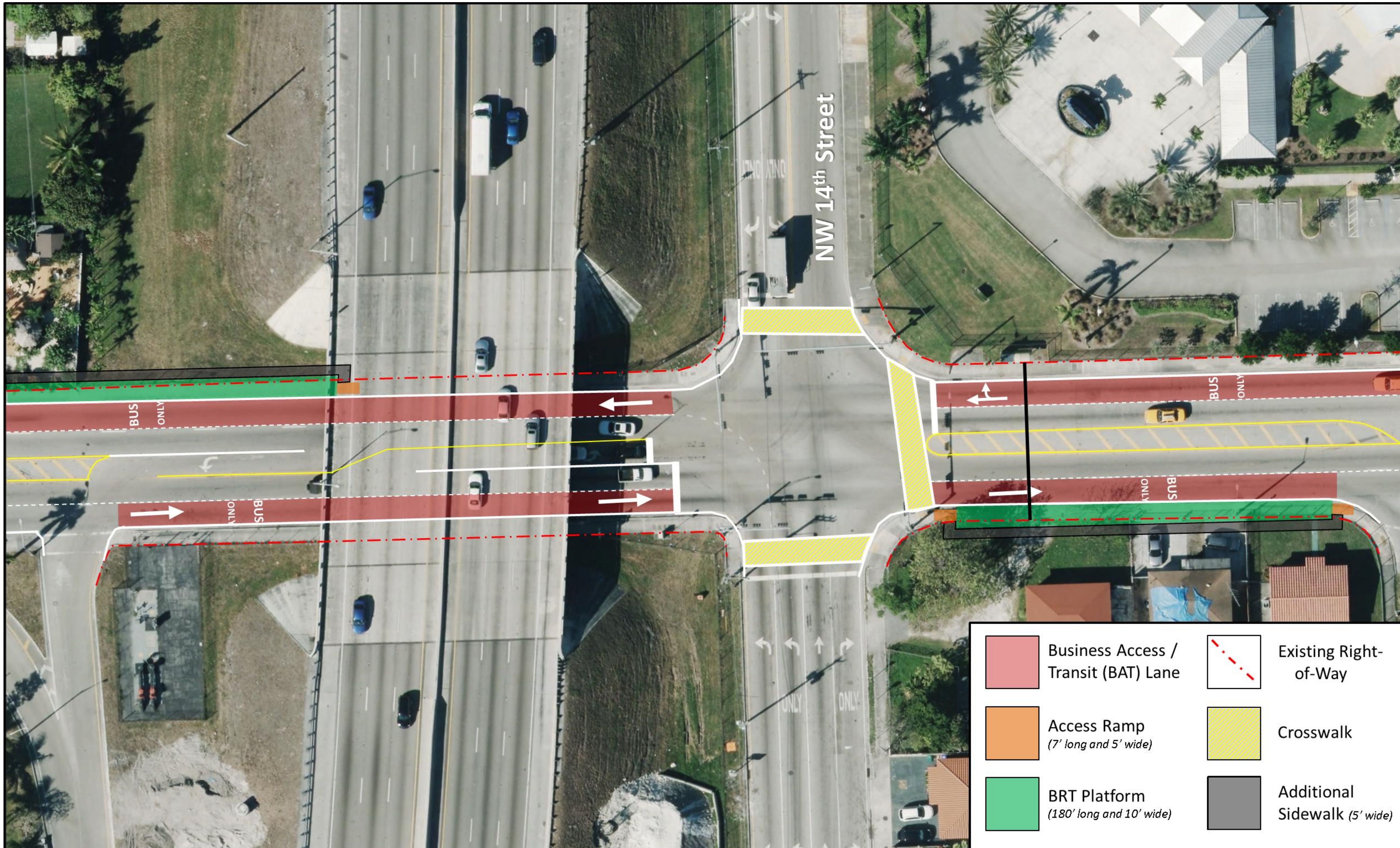
0 25 50 100 Feet



Douglas Road BRT at NW 7th Street Station

HNTB

0 25 50 100 Feet



Douglas Road BRT at NW 14th Street Station

HNTB

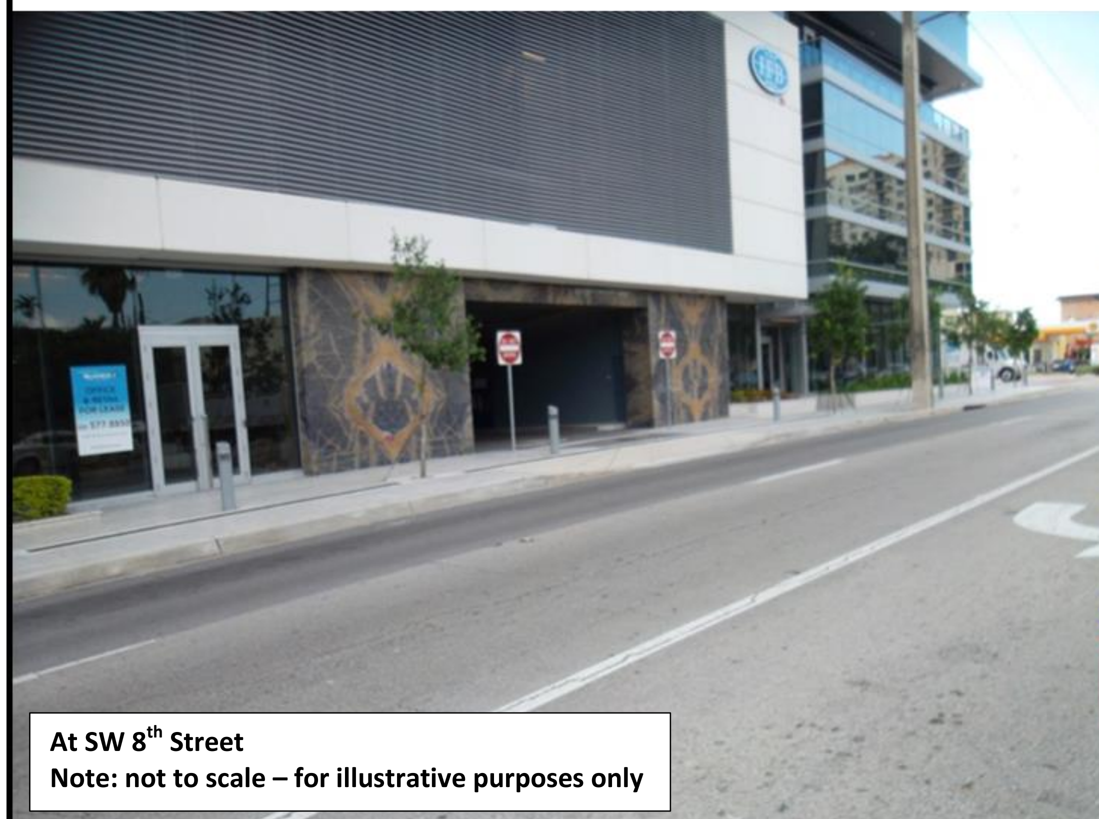
Sheet 7 of 7

0 25 50 100 Feet

Appendix L – Before and After Renderings

At SW 8th Street
Note: not to scale – for illustrative purposes only

MPO Douglas Road Before and After Renderings	HNTB	Sheet 1 of 2	



At SW 8th Street
Note: not to scale – for illustrative purposes only

Douglas Road Before and After Renderings

Appendix M

NW 27th Ave					
Location	Dimension	R/W needed (sq. ft.)	Parcels Impacted	R/W from	Notes
NW 207th St	208' x 8'	1,664	1	Gas Station	Northbound station will not require any additional R/W
NW 199th St	208' x 8'	1,664	2	Gas Station	Northbound station will not require any additional R/W
NW 191st St	208' x 8'	1,664	2	Multi-family Residential	Northbound station will not require any additional R/W
NW 183rd St	2 * (208' x 8')	3,328	4	Commercial parking lot/ parcel	Northbound station will block one of Gas Station's driveway access
NW 175th St**	148' x 8'	1,184	1	Commercial parking lot/ parcel	Northbound station will block one of corner parcel's driveway access; southbound station will not require any additional R/W
NW 166th St	2 * (208' x 8')	3,328	2	Commercial parking lot/ parcel	Northbound station is nearside
NW 160th St	208' x 8'	1,664	1	Commercial parking lot/ parcel	Northbound station will not require any additional R/W
NW 151st St	208' x 8'	1,664	1	Residential/ Open Space	Northbound station will not require any additional R/W
Sesame St	2 * (208' x 8')	3,328	4	Commercial parking lot/ parcel	Southbound station will block one of the commercial parcel's driveway access
NW 135th St	2 * (208' x 8')	3,328	2	Commercial parking lot/ parcel	Northbound station takes up entire block length at intersection and blocks access to commercial parcel
NW 127th St	2 * (208' x 8')	3,328	2	Multi-family Residential	
NW 119th St	208' x 8'	1,664	2	Commercial parking lot/ parcel	Northbound station is 300' north of NW 119th intersection, will not require additional R/W, and blocks access to commercial parcel
NW 113th St	208' x 8'	1,664	2	Commercial parking lot/ parcel	Southbound station will not require additional R/W; northbound station partially blocks access to gas station
NW 103rd St	2 * (208' x 8')	3,328	3	Commercial parking lot/ parcel	Both northbound and southbound stations restrict driveway access for local commercial parcels
NW 95th St**	(208' x 8') + (188' x 8)	3,168	4	Commercial parking lot/ parcel	Northbound station may require removing existing buildings
NW 87th St**	(208' x 8') + (188' x 8)	3,168	4	Commercial parking lot/ parcel	Northbound station extends the entire block length; southbound station partially blocks access to the adjacent commercial parcel
NW 79th St**	(208' x 8') + (148' x 8')	2,848	2	Commercial parking lot/ parcel	Northbound station extends the entire block length; southbound station blocks access to the adjacent commercial strip
NW 62nd St	[(.5 x 400 x 14) + (14	28,674	1	around Metrorail Station	Northbound station is not included - park-and-ride instead; R/W needed belongs to MDT
NW 54th St	[(.5 x 400 x 14) + (14	28,674	1	around Metrorail Station	Southbound station is not included - park-and-ride instead; R/W needed belongs to MDT

** Shorter platform lengths due to existing driveways or block lengths

W Flagler Street					
Location	Dimension	R/W needed (sq. ft.)	Parcels Impacted	R/W from	Notes
W 107th Ave					
W 102nd Ave	2 * (208' x 6')	2496	3	Commercial parking lots/ parcels	
W 97th Ave**	(208' x 6') + (168' x 6')	2256	3	Commercial parking lots and residential parcels	Eastbound station extends the entire block length
W 92nd Ave	208' x 6'	1248	2	Commercial parcel/ open space	Westbound station doesn't require additional R/W
W 87th Ave	2 * (208' x 6')	2496	3	Residential parcel/ gas station	Eastbound station blocks access to gas station from W. Flagler St.
W 79th Ave	2 * (208' x 6')	2496	2	Commercial parking lots/ parcels	Westbound station blocks access to commercial parcel; eastbound station extends the entire block length
W 71st Ave**	2 * (148' x 9')	2664	4	Commercial parcel/ gas station	Westbound station doesn't require additional R/W; Eastbound station blocks access to gas station from W. Flagler St.
W 67th Ave**	(208' x 9') + (148' x 9')	3204	2	Commercial parcel/ gas station	Westbound station blocks access to commercial parcel from W. Flagler St.; eastbound station blocks access to gas station from W. Flagler St.
W 62nd Ave	2 * (208' x 9')	3744	2	Multi-family residential parcels	Both stations blocks access to existing multi-family residential buildings
W 57th Ave**	(208' x 9') + (148' x 9')	3204	5	Commercial parcel/ gas station	Westbound station blocks access to commercial parcel; eastbound station blocks access to one of the gas station's driveways
W 49th Ave**	2 * (148' x 9')	2664	7	Multi-family residential parcels	Both stations blocks access to existing multi-family residential buildings
W 42nd Ave**	2 * (148' x 9')	2664	4	Commercial parcel/ gas station	Westbound station requires a portion of commercial building removed; eastbound station blocks both driveways to existing gas station from W. Flagler St.
W 37th Ave**	168' x 9'	1512	4	Commercial parking lots/ parcels	Westbound station blocks access to a commercial strip's driveway and will not require additional R/W
W 32nd Ave**	(208' x 9') + (188' x 9')	3564	5	Multi-family residential parcels	Both stations blocks access to existing multi-family residential buildings
W 27th Ave**	(208' x 9') + (148' x 9')	3204	3	Commercial parcel/ gas station	Westbound station blocks access to a commercial parcel and a gas station from W. Flagler St.
W 22nd Ave	-	-	-	-	One-way section; minimal R/W needed if any
W 22nd Ave / SW 1st St**	-	-	-	-	One-way section; station extends the entire block length; no additional R/W needed
W 17th Ave**	-	-	-	-	One-way section; no additional R/W needed
W 17th Ave / SW 1st St	-	-	-	-	One-way section; no additional R/W needed
W 12th Ave	-	-	-	-	One-way section; no additional R/W needed
W 12th Ave / SW 1st St	-	-	-	-	One-way section; no additional R/W needed
W 8th Ave	-	-	-	-	No additional R/W needed
W 8th Ave / SW 1st St	-	-	-	-	One-way section; minimal R/W needed if any

** Shorter platform lengths due to existing driveways or block lengths

Kendall Drive					
Location	Dimension	R/W needed (sq. ft.)	Parcels Impacted	R/W from	Notes
SW 157th Ave**	(188' x 7') + (208' x 7')	2,722	4	Commercial parking lots/ parcels	Eastbound station will block one of Gas Station's driveway access
SW 150th Ave	2 * (208' x 7')	2,912	2	Commercial parking lots/ parcels and residential parcels	
SW 142nd Ave	2 * (208' x 7')	2,912	2	Residential/ Open Space	
SW 137th Ave	-	-	-	-	Stations fit within the existing R/W
SW 133rd Ave	2 * (208' x 7')	2,912	2	Residential/ Open Space	
SW 127th Ave	2 * (208' x 6')	2,496	3	Commercial parking lots/ parcels	
SW 122nd Ave**	(188' x 7.5') + (208' x 7.5')	2,970	4	Commercial parking lots/ parcels	Eastbound station will block a driveway access to commercial strip
SW 117th Ave	2 * (208' x 9')	3,744	2	Commercial parking lots/ parcels	More ROW needed to purchase outside shop to allow for different access to shopping mall
SW 112th Ave	2 * (208' x 7')	2,912	9	Commercial parking lots/ parcels and residential parcels	Eastbound station will block a driveway access to commercial strip
SW 107th Ave	2 * (208' x 9')	3,744	3	Commercial parking lots/ parcels	Eastbound station will block one of Gas Station's driveway access
SW 102nd Ave	208' x 7'	1,456	1	Residential/ Open Space	Westbound station doesn't require additional R/W due to access road
SW 97th Ave	2 * (208' x 9')	3,744	2	Commercial parking lots/ parcels and residential parcels	
SW 90th Ave	208' x 9'	1,872	1	Open Space/ Baptist Hospital	Westbound station doesn't require additional R/W due to access road
SW 87th Ave	208' x 9'	1,872	2	Residential/ Open Space	Westbound station doesn't require additional R/W due to access road
SW 79th Ave	2 * (208' x 8.5')	3,536	3	Residential/ Open Space	
Dadeland Blvd	2 * (208' x 6')	2,496	2	Commercial parking lots/ parcels	Eastbound station is nearside

** Shorter platform lengths due to existing driveways or block lengths

Douglas Rd					
Location	Dimension	R/W needed (sq. ft.)	Parcels Impacted	R/W from	Notes
NW 14th St	2 * (208' x 9')	3,744	4	Under expressway; residential parcels	Southbound station approximately 275' south from NW 14th Street intersection
NW 7th St	2 * (208' x 9')	3,744	3	Commercial parking lots/ parcels	Northbound station will impact existing commercial parcel (drive through Wendy's)
W Flagler St**	(148' x 9') + (188' x 9')	3,024	2	Commercial parking lots/ parcels	Northbound station extends the entire block length; southbound station blocks one of the adjacent commercial parcel's driveway
SW 8th St	2 * (208' x 9')	3,744	2	Commercial parking lots/ parcels	Northbound station blocks the entrance/exit from the underground parking garage
SW 16th St	2 * (208' x 9')	3,744	3	Vacant parcel / residential building	
SW 22nd St	2 * (208' x 9')	3,744	2	Commercial parking lots/ parcels	Southbound station takes up nearly all of the block length, splitting two signalized intersection
Coconut Grove Drive	2 * (208' x 9')	3,744	3	Residential Buildings / residential parcels	Northbound station blocks the entrance/exit from the underground parking garage

** Shorter platform lengths due to existing driveways or block lengths

Appendix N

NW 27th AVENUE - LOW END COST ESTIMATE

Capital Costs

Roadway - Convert existing general traffic lane to transit lane					
Items	Unit	Unit Cost	Quantity		Total
Signage	mile	8,000	11.2	$	89,600
Pavement Markings	mile	35,000	11.2	$	392,000
Minor surface improvements	mile	205,525	11.2	$	2,301,880
Bus Pads	each	40,000	36	$	1,440,000
			Total	**$**	**4,223,480**
Stations and Sitework					
Items	Unit	Unit Cost	Quantity		Total
Shelter/Marker	each	80,000	36	$	2,880,000
Platform	each	9,000	36	$	324,000
Trash Receptacle	each	2,000	36	$	72,000
Bench	each	2,000	36	$	72,000
Landscaping	total	10,000	36	$	360,000
Lighting	total	10,000	36	$	360,000
Informational Panel	each	30,000	36	$	1,080,000
Demolition, clearing, earthwork, etc.	total	12,000	36	$	432,000
Site utility relocation	total	10,000	36	$	360,000
Pedestrian/Bicycle Accomodation	total	15,000	36	$	540,000
Bicycle Rack	each	1,500	36	$	54,000
			Total	**$**	**6,534,000**
Park & Ride Lots					
NW 215th Street Park-and-Ride Lot**	total	$3,200,000	1		$3,200,000
Property Acquisition					
Required ROW for stations	square ft	10	41,984	$	419,840
Intelligent Transportation Systems					
Items	Unit	Unit Cost	Quantity		Total
Transit Signal Priority	each	100,000	25	$	2,500,000
Real-Time Signage	each	20,000	36	$	720,000
Fare Collection and Support Systems	each	20,000	36	$	720,000
			Total	**$**	**3,940,000**
			Construction Subtotal	$	17,897,480
Vehicles - Articulated BRT					
Items	Unit	Unit Cost	Quantity		Total
Buses (including 20% spares)	each	1,000,000	34	$	34,000,000
Construction, Property and Vehicles Subtotal				$	52,317,320
Construction Contingency		20%		$	3,579,496
Property Acquisition Contingency		50%		$	209,920
Vehicle Contingency		10%		$	3,400,000
			Subtotal	$	59,506,736
Design and Professional Services (25% of Construction Costs)		25%		$	4,474,370
TOTAL COST				**$**	**63,981,106**
Cost per mile				$	5,712,599

** funding is programmed in the 2015 TIP

O&M Costs

Weekdays	252	
Daily one way trips		144
Roundtrip mileage		27.8
Speed		14
Cycle Time (min)		132
Cycle time (hrs)		2.2
Daily Veh. Rev. Hrs.		158.4
Annual Veh. Rev. Hrs.		39,917
Cost per Veh. Rev. hr.		$133.26
	$	5,319,313
Saturdays	52	
Daily one way trips		78
Roundtrip mileage		27.8
Speed		14
Cycle Time (min)		132
Cycle time (hrs)		2.2
Daily Veh. Rev. Hrs.		85.8
Annual Veh. Rev. Hrs.		4461.6
Cost per Veh. Rev. hr.		$133.26
	$	594,553
Sundays/Holidays	61	
Daily one way trips		78
Roundtrip mileage		27.8
Speed		14
Cycle Time (Min)		132
Cycle time (hrs)		2.2
Daily Veh. Rev. Hrs.		85.8
Annual Veh. Rev. Hrs.		5233.8
Cost per Veh. Rev. hr.		$133.26
	$	697,456
ANNUAL O&M COSTS	**$**	**6,611,322**

NW 27th AVENUE - HIGH END COST ESTIMATE

Capital Costs

Roadway - Convert existing general traffic lane to transit lane				
Items	Unit	Unit Cost	Quantity	Total
Signage	mile	8,000	11.2	$ 89,600
Pavement Markings	mile	35,000	11.2	$ 392,000
Full-depth roadway reconstruction	mile	3,000,000	11.2	$ 33,600,000
Colored Pavement	mile	120,000	11.2	$ 1,344,000
Special Intersection Treatment	each	300,000	6	$ 1,800,000
			Total	**$ 37,225,600**
Stations and Sitework				
Items	Unit	Unit Cost	Quantity	Total
Custom designed shelter/marker	each	165,000	36	$ 5,940,000
Platform	each	9,000	36	$ 324,000
Trash Receptacle	each	2,000	36	$ 72,000
Bench	each	2,000	36	$ 72,000
Landscaping	total	10,000	36	$ 360,000
Lighting	total	10,000	36	$ 360,000
Informational Panel	each	30,000	36	$ 1,080,000
Demolition, clearing, earthwork, etc.	total	12,000	36	$ 432,000
Site utility relocation	total	10,000	36	$ 360,000
Pedestrian/Bicycle Accomodation	total	15,000	36	$ 540,000
Pedestrian Overpass at key high-volume stations	each	500,000	6	$ 3,000,000
Enhanced pedestrian crosswalk protection	each	80,000	6	$ 480,000
Bicycle Rack	each	1,500	36	$ 54,000
			Total	**$ 13,074,000**
Corridor Branding Enhancements				
Enhanced Landscaping	mile	530,000	11.2	$ 5,936,000
Enhanced Lighting	mile	1,050,000	11.2	$ 11,760,000
Enhanced Art	mile	50,000	11.2	$ 560,000
			Total	**$ 18,256,000**
Park & Ride Lots				
NW 215th Street Park-and-Ride Lot**	total	$3,200,000	1	$3,200,000
Property Acquisition				
Required ROW for stations	square ft	10	41,984	$ 419,840
Intelligent Transportation Systems				
Items	Unit	Unit Cost	Quantity	Total
Transit Signal Priority	each	100,000	50	$ 5,000,000
Real-Time Signage	each	20,000	36	$ 720,000
Full-monitor LED System at key stations	each	20,000	10	$ 200,000
Fare Collection and Support Systems	each	20,000	36	$ 720,000
			Total	**$ 6,640,000**
			Construction Subtotal	$ 78,395,600
Vehicles - Articulated BRT				
Items	Unit	Unit Cost	Quantity	Total
Buses (including 20% spares)	each	1,000,000	34	$ 34,000,000
Construction, Property and Vehicles Subtotal				$ 112,815,440
Construction Contingency		20%		$ 15,679,120
Property Acquisition Contingency		50%		$ 209,920
Vehicle Contingency		10%		$ 3,400,000
			Subtotal	$ 132,104,480
Design and Professional Services (25% of Construction Costs)		25%		$ 19,598,900
TOTAL COST				**$ 151,703,380**
Cost per mile				$ 13,544,945

** funding is programmed in the 2015 TIP

O&M Costs

Weekdays	252	
Daily one way trips		152
Roundtrip mileage		27.8
Speed		14
Cycle Time (min)		132
Cycle time (hrs)		2.2
Daily Veh. Rev. Hrs.		167.2
Annual Veh. Rev. Hrs.		42,134
Cost per Veh. Rev. hr.		$133.26
		$ 5,614,830
Saturdays	52	
Daily one way trips		84
Roundtrip mileage		27.8
Speed		14
Cycle Time (min)		132
Cycle time (hrs)		2.2
Daily Veh. Rev. Hrs.		92.4
Annual Veh. Rev. Hrs.		4804.8
Cost per Veh. Rev. hr.		$133.26
		$ 640,288
Sundays/Holidays	61	
Daily one way trips		84
Roundtrip mileage		27.8
Speed		14
Cycle Time (Min)		132
Cycle time (hrs)		2.2
Daily Veh. Rev. Hrs.		92.4
Annual Veh. Rev. Hrs.		5636.4
Cost per Veh. Rev. hr.		$133.26
		$ 751,107
ANNUAL O&M COSTS		**$ 7,006,224**

W FLAGLER STREET - LOW END COST ESTIMATE

Capital Costs

Roadway - Convert existing general traffic lane to transit lane					
Items	Unit	Unit Cost	Quantity		Total
Signage	mile	8,000	12.9	$	103,200
Pavement Markings	mile	35,000	12.9	$	451,500
Minor surface improvements	mile	205,525	12.9	$	2,651,273
Bus Pads	each	40,000	36	$	1,440,000
			Total	**$**	**4,645,973**
Stations and Sitework					
Items	Unit	Unit Cost	Quantity		Total
Shelter/Marker	each	80,000	36	$	2,880,000
Platform	each	9,000	36	$	324,000
Trash Receptacle	each	2,000	36	$	72,000
Bench	each	2,000	36	$	72,000
Landscaping	total	10,000	36	$	360,000
Lighting	total	10,000	36	$	360,000
Informational Panel	each	30,000	36	$	1,080,000
Demolition, clearing, earthwork, etc.	total	12,000	36	$	432,000
Site utility relocation	total	10,000	36	$	360,000
Pedestrian/Bicycle Accomodation	total	15,000	36	$	540,000
Bicycle Rack	each	1,500	36	$	54,000
			Total	**$**	**6,534,000**
Park & Ride Lots					
FIU Panther Station at SW 8th Street / SW 109th Avenue**	total	$5,000,000	1		$5,000,000
Property Acquisition					
Required ROW for stations	square ft	10	37,416	$	374,160
Intelligent Transportation Systems					
Items	Unit	Unit Cost	Quantity		Total
Transit Signal Priority	each	100,000	42	$	4,200,000
Real-Time Signage	each	20,000	36	$	720,000
Fare Collection and Support Systems	each	20,000	36	$	720,000
Total				**$**	**5,640,000**
			Construction Subtotal	$	21,819,973
Vehicles - Articulated BRT					
Items	Unit	Unit Cost	Quantity		Total
Buses (including 20% spares)	each	1,000,000	30	$	30,000,000
Construction, Property and Vehicles Subtotal				$	52,194,133
Construction Contingency		20%		$	4,363,995
Property Acquisition Contingency		50%		$	187,080
Vehicle Contingency		10%		$	3,000,000
			Subtotal	$	59,745,207
Design and Professional Services (25% of Construction Costs)		25%		$	5,454,993
TOTAL COST				**$**	**65,200,200**
Cost per mile				$	5,054,279

**cost comes from SW 147th Ave PnR. Could not find Panther Station cost estimate

O&M Costs

Weekdays	252	
Daily one way trips		144
Roundtrip mileage		25.8
Speed		14
Cycle Time (min)		121
Cycle time (hrs)		2.01
Daily Veh. Rev. Hrs.		144.72
Annual Veh. Rev. Hrs.		36,469
Cost per Veh. Rev. hr.		$133.26
	$	4,859,918
Saturdays	52	
Daily one way trips		78
Roundtrip mileage		25.8
Speed		14
Cycle Time (min)		121
Cycle time (hrs)		2.01
Daily Veh. Rev. Hrs.		78.39
Annual Veh. Rev. Hrs.		4076.28
Cost per Veh. Rev. hr.		$133.26
	$	543,205
Sundays/Holidays	61	
Daily one way trips		78
Roundtrip mileage		25.8
Speed		14
Cycle Time (Min)		121
Cycle time (hrs)		2.01
Daily Veh. Rev. Hrs.		78.39
Annual Veh. Rev. Hrs.		4781.79
Cost per Veh. Rev. hr.		$133.26
	$	637,221
ANNUAL O&M COSTS	**$**	**6,040,344**

W FLAGLER STREET - HIGH END COST ESTIMATE

Capital Costs

Items	Unit	Unit Cost	Quantity	Total
Roadway - Convert existing general traffic lane to transit lane				
Items	Unit	Unit Cost	Quantity	Total
Signage	mile	8,000	12.9	$ 103,200
Pavement Markings	mile	35,000	12.9	$ 451,500
Full-depth roadway reconstruction	mile	3,000,000	12.9	$ 38,700,000
Colored Pavement	mile	120,000	12.9	$ 1,548,000
Special Intersection Treatment	each	300,000	10	$ 3,000,000
			Total	**$ 43,802,700**
Stations and Sitework				
Items	Unit	Unit Cost	Quantity	Total
Custom designed shelter/marker	each	165,000	36	$ 5,940,000
Platform	each	9,000	36	$ 324,000
Trash Receptacle	each	2,000	36	$ 72,000
Bench	each	2,000	36	$ 72,000
Landscaping	total	10,000	36	$ 360,000
Lighting	total	10,000	36	$ 360,000
Informational Panel	each	30,000	36	$ 1,080,000
Demolition, clearing, earthwork, etc.	total	12,000	36	$ 432,000
Site utility relocation	total	10,000	36	$ 360,000
Pedestrian/Bicycle Accomodation	total	15,000	36	$ 540,000
Pedestrian Overpass at key high-volume stations	each	500,000	8	$ 4,000,000
Enhanced pedestrian crosswalk protection	each	80,000	6	$ 480,000
Bicycle Rack	each	1,500	36	$ 54,000
			Total	**$ 14,074,000**
Corridor Branding Enhancements				
Enhanced Landscaping	mile	530,000	12.9	$ 6,837,000
Enhanced Lighting	mile	1,050,000	12.9	$ 13,545,000
Enhanced Art	mile	50,000	12.9	$ 645,000
			Total	**$ 21,027,000**
Park & Ride Lots				
FIU Panther Station at SW 8th Street / SW 109th Avenue**	total	$5,000,000	1	$5,000,000
Property Acquisition				
Required ROW for stations	square ft	10	37,416	$ 374,160
Intelligent Transportation Systems				
Items	Unit	Unit Cost	Quantity	Total
Transit Signal Priority	each	100,000	84	$ 8,400,000
Real-Time Signage	each	20,000	36	$ 720,000
Full-monitor LED System at key stations	each	20,000	10	$ 200,000
Fare Collection and Support Systems	each	20,000	36	$ 720,000
			Total	**$ 10,040,000**
			Construction Subtotal	$ 93,943,700
Vehicles - Articulated BRT				
Items	Unit	Unit Cost	Quantity	Total
Buses (including 20% spares)	each	1,000,000	30	$ 30,000,000
Construction, Property and Vehicles Subtotal				$ 124,317,860
Construction Contingency		20%		$ 18,788,740
Property Acquisition Contingency		50%		$ 187,080
Vehicle Contingency		10%		$ 3,000,000
			Subtotal	$ 146,293,680
Design and Professional Services (25% of Construction Costs)		25%		$ 23,485,925
TOTAL COST				**$ 169,779,605**
Cost per mile				$ 13,161,210

** funding is programmed in the 2015 TIP

O&M Costs

Weekdays	252	
Daily one way trips		152
Roundtrip mileage		25.8
Speed		14
Cycle Time (min)		121
Cycle time (hrs)		2.01
Daily Veh. Rev. Hrs.		152.76
Annual Veh. Rev. Hrs.		38,496
Cost per Veh. Rev. hr.		$133.26
		$ 5,129,913
Saturdays	52	
Daily one way trips		84
Roundtrip mileage		25.8
Speed		14
Cycle Time (min)		121
Cycle time (hrs)		2.01
Daily Veh. Rev. Hrs.		84.42
Annual Veh. Rev. Hrs.		4389.84
Cost per Veh. Rev. hr.		$133.26
		$ 584,990
Sundays/Holidays	61	
Daily one way trips		84
Roundtrip mileage		25.8
Speed		14
Cycle Time (Min)		121
Cycle time (hrs)		2.01
Daily Veh. Rev. Hrs.		84.42
Annual Veh. Rev. Hrs.		5149.62
Cost per Veh. Rev. hr.		$133.26
		$ 686,238
ANNUAL O&M COSTS		**$ 6,401,141**

KENDALL DRIVE - LOW END COST ESTIMATE

Capital Costs

Items	Unit	Unit Cost	Quantity		Total
Roadway - Convert existing general traffic lane to transit lane					
Signage	mile	8,000	9	$	72,000
Pavement Markings	mile	35,000	9	$	315,000
Minor surface improvements	mile	205,525	9	$	1,849,725
Bus Pads	each	40,000	32	$	1,280,000
			Total	**$**	**3,516,725**
Stations and Sitework					
Shelter/Marker	each	80,000	32	$	2,560,000
Platform	each	9,000	32	$	288,000
Trash Receptacle	each	2,000	32	$	64,000
Bench	each	2,000	32	$	64,000
Landscaping	total	10,000	32	$	320,000
Lighting	total	10,000	32	$	320,000
Informational Panel	each	30,000	32	$	960,000
Demolition, clearing, earthwork, etc.	total	12,000	32	$	384,000
Site utility relocation	total	10,000	32	$	320,000
Pedestrian/Bicycle Accomodation	total	15,000	32	$	480,000
Bicycle Rack	each	1,500	32	$	48,000
			Total	**$**	**5,808,000**
Park & Ride Lots					
SW 127th Avenue Park-and-Ride Lot**	total	$6,600,000	1		$6,600,000
SW 162nd Avenue Park-and-Ride Improvements	total	$12,500,000	1		$12,500,000
			Total	**$**	**19,100,000**
Property Acquisition					
Required ROW for stations	square ft	10	42,300	$	423,000
Intelligent Transportation Systems					
Items	Unit	Unit Cost	Quantity		Total
Transit Signal Priority	each	100,000	14	$	1,400,000
Real-Time Signage	each	20,000	32	$	640,000
Fare Collection and Support Systems	each	20,000	32	$	640,000
Total				**$**	**2,680,000**
			Construction Subtotal	$	31,104,725
Vehicles - Articulated BRT					
Items	Unit	Unit Cost	Quantity		Total
Buses (including 20% spares)	each	1,000,000	20	$	20,000,000
Construction, Property and Vehicles Subtotal				$	51,527,725
Construction Contingency		20%		$	6,220,945
Property Acquisition Contingency		50%		$	211,500
Vehicle Contingency		10%		$	2,000,000
			Subtotal	$	59,960,170
Design and Professional Services (25% of Construction Costs)		25%		$	7,776,181
TOTAL COST				**$**	**67,736,351**
Cost per mile				$	7,526,261

** funding is programmed in the 2015 TIP

O&M Costs

Weekdays	252	
Daily one way trips		144
Roundtrip mileage		18
Speed		15
Cycle Time (min)		79.2
Cycle time (hrs)		1.32
Daily Veh. Rev. Hrs.		95.04
Annual Veh. Rev. Hrs.		23,950
Cost per Veh. Rev. hr.		$133.26
	$	3,191,588
Saturdays	52	
Daily one way trips		78
Roundtrip mileage		18
Speed		15
Cycle Time (min)		79.2
Cycle time (hrs)		1.32
Daily Veh. Rev. Hrs.		51.48
Annual Veh. Rev. Hrs.		2676.96
Cost per Veh. Rev. hr.		$133.26
	$	356,732
Sundays/Holidays	61	
Daily one way trips		78
Roundtrip mileage		18
Speed		15
Cycle Time (Min)		79.2
Cycle time (hrs)		1.32
Daily Veh. Rev. Hrs.		40.26
Annual Veh. Rev. Hrs.		2455.86
Cost per Veh. Rev. hr.		$133.26
	$	327,268
ANNUAL O&M COSTS	**$**	**3,875,587**

KENDALL DRIVE HIGH END COST ESTIMATE

Capital Costs

Items	Unit	Unit Cost	Quantity	Total
Roadway - Convert existing general traffic lane to transit lane				
Items	Unit	Unit Cost	Quantity	Total
Signage	mile	8,000	9	$ 72,000
Pavement Markings	mile	35,000	9	$ 315,000
Full-depth roadway reconstruction	mile	3,000,000	9	$ 27,000,000
Colored Pavement	mile	120,000	9	$ 1,080,000
Special Intersection Treatment	each	300,000	8	$ 2,400,000
			Total	**$ 30,867,000**
Stations and Sitework				
Items	Unit	Unit Cost	Quantity	Total
Custom designed shelter/marker	each	165,000	32	$ 5,280,000
Platform	each	9,000	32	$ 288,000
Trash Receptacle	each	2,000	32	$ 64,000
Bench	each	2,000	32	$ 64,000
Landscaping	total	10,000	32	$ 320,000
Lighting	total	10,000	32	$ 320,000
Informational Panel	each	30,000	32	$ 960,000
Demolition, clearing, earthwork, etc.	total	12,000	32	$ 384,000
Site utility relocation	total	10,000	32	$ 320,000
Pedestrian/Bicycle Accomodation	total	15,000	32	$ 480,000
Pedestrian Overpass at key high-volume stations	each	500,000	8	$ 4,000,000
Enhanced pedestrian crosswalk protection	each	80,000	6	$ 480,000
Bicycle Rack	each	1,500	32	$ 48,000
			Total	**$ 13,008,000**
Corridor Branding Enhancements				
Enhanced Landscaping	mile	530,000	9	$ 4,770,000
Enhanced Lighting	mile	1,050,000	9	$ 9,450,000
Enhanced Art	mile	50,000	9	$ 450,000
			Total	**$ 14,670,000**
Park & Ride Lots				
SW 127th Avenue Park-and-Ride Lot**	total	$6,600,000	1	$6,600,000
SW 162nd Avenue Park-and-Ride Improvements	total	$12,500,000	1	$12,500,000
			Total	**$ 19,100,000**
Property Acquisition				
Required ROW for stations	square ft	10	42,300	$ 423,000
Intelligent Transportation Systems				
Items	Unit	Unit Cost	Quantity	Total
Transit Signal Priority	each	100,000	28	$ 2,800,000
Real-Time Signage	each	20,000	32	$ 640,000
Full-monitor LED System at key stations	each	20,000	10	$ 200,000
Fare Collection and Support Systems	each	20,000	32	$ 640,000
			Total	**$ 4,280,000**
			Construction Subtotal	$ 81,925,000
Vehicles - Articulated BRT				
Items	Unit	Unit Cost	Quantity	Total
Buses (including 20% spares)	each	1,000,000	20	$ 20,000,000
Construction, Property and Vehicles Subtotal				$ 102,348,000
Construction Contingency		20%		$ 16,385,000
Property Acquisition Contingency		50%		$ 211,500
Vehicle Contingency		10%		$ 2,000,000
			Subtotal	$ 120,944,500
Design and Professional Services (25% of Construction Costs)		25%		$ 20,481,250
TOTAL COST				**$ 141,425,750**
Cost per mile				$ 15,713,972

** funding is programmed in the 2015 TIP

O&M Costs

Weekdays	252	
Daily one way trips		152
Roundtrip mileage		18
Speed		15
Cycle Time (min)		79.2
Cycle time (hrs)		1.32
Daily Veh. Rev. Hrs.		100.32
Annual Veh. Rev. Hrs.		25,281
Cost per Veh. Rev. hr.		$133.26
		$ 3,368,898
Saturdays	52	
Daily one way trips		84
Roundtrip mileage		18
Speed		15
Cycle Time (min)		79.2
Cycle time (hrs)		1.32
Daily Veh. Rev. Hrs.		55.44
Annual Veh. Rev. Hrs.		2882.88
Cost per Veh. Rev. hr.		$133.26
		$ 384,173
Sundays/Holidays	61	
Daily one way trips		84
Roundtrip mileage		18
Speed		15
Cycle Time (Min)		79.2
Cycle time (hrs)		1.32
Daily Veh. Rev. Hrs.		55.44
Annual Veh. Rev. Hrs.		3381.84
Cost per Veh. Rev. hr.		$133.26
		$ 450,664
ANNUAL O&M COSTS		**$ 4,203,735**

DOUGLAS ROAD LOW END COST ESTIMATE

Capital Costs

Items	Unit	Unit Cost	Quantity		Total
Roadway - Convert existing general traffic lane to transit lane					
Items	Unit	Unit Cost	Quantity		Total
Signage	mile	8,000	4.4	$	35,200
Pavement Markings	mile	35,000	4.4	$	154,000
Minor surface improvements	mile	205,525	4.4	$	904,310
Bus Pads	each	40,000	14	$	560,000
			Total	**$**	**1,653,510**
Stations and Sitework					
Items	Unit	Unit Cost	Quantity		Total
Shelter/Marker	each	80,000	14	$	1,120,000
Platform	each	9,000	14	$	126,000
Trash Receptacle	each	2,000	14	$	28,000
Bench	each	2,000	14	$	28,000
Landscaping	total	10,000	14	$	140,000
Lighting	total	10,000	14	$	140,000
Informational Panel	each	30,000	14	$	420,000
Demolition, clearing, earthwork, etc.	total	12,000	14	$	168,000
Site utility relocation	total	10,000	14	$	140,000
Pedestrian/Bicycle Accomodation	total	15,000	14	$	210,000
Bicycle Rack	each	1,500	14	$	21,000
			Total	**$**	**2,541,000**
Property Acquisition					
Required ROW for stations	square ft	10	25,488	$	254,880
Intelligent Transportation Systems					
Items	Unit	Unit Cost	Quantity		Total
Transit Signal Priority	each	100,000	12	$	1,200,000
Real-Time Signage	each	20,000	14	$	280,000
Fare Collection and Support Systems	each	20,000	14	$	280,000
Total				**$**	**1,760,000**
			Construction Subtotal	$	5,954,510
Vehicles - Articulated BRT					
Items	Unit	Unit Cost	Quantity		Total
Buses (including 20% spares)	each	1,000,000	10	$	10,000,000
Construction, Property and Vehicles Subtotal				$	16,209,390
Construction Contingency		20%		$	1,190,902
Property Acquisition Contingency		50%		$	127,440
Vehicle Contingency		10%		$	1,000,000
			Subtotal	$	18,527,732
Design and Professional Services (25% of Construction Costs)		25%		$	1,488,628
TOTAL COST				**$**	**20,016,360**
Cost per mile				$	4,549,173

** funding is programmed in the 2015 TIP

O&M Costs

Weekdays	252	
Daily one way trips		144
Roundtrip mileage		8.8
Speed		15
Cycle Time (min)		39.6
Cycle time (hrs)		0.67
Daily Veh. Rev. Hrs.		48.24
Annual Veh. Rev. Hrs.		12,156
Cost per Veh. Rev. hr.		$133.26
	$	1,619,973
Saturdays	52	
Daily one way trips		78
Roundtrip mileage		8.8
Speed		15
Cycle Time (min)		39.6
Cycle time (hrs)		0.67
Daily Veh. Rev. Hrs.		26.13
Annual Veh. Rev. Hrs.		1358.76
Cost per Veh. Rev. hr.		$133.26
	$	181,068
Sundays/Holidays	61	
Daily one way trips		78
Roundtrip mileage		8.8
Speed		15
Cycle Time (Min)		39.6
Cycle time (hrs)		0.67
Daily Veh. Rev. Hrs.		26.13
Annual Veh. Rev. Hrs.		1593.93
Cost per Veh. Rev. hr.		$133.26
	$	212,407
ANNUAL O&M COSTS	**$**	**2,013,448**

DOUGLAS ROAD HIGH END COST ESTIMATE

Capital Costs

Roadway - Convert existing general traffic lane to transit lane					
Items	Unit	Unit Cost	Quantity		Total
Signage	mile	8,000	4.4	$	35,200
Pavement Markings	mile	35,000	4.4	$	154,000
Full-depth roadway reconstruction	mile	3,000,000	4.4	$	13,200,000
Colored Pavement	mile	120,000	4.4	$	528,000
Special Intersection Treatment	each	300,000	2	$	600,000
			Total	**$**	**14,517,200**
Stations and Sitework					
Items	Unit	Unit Cost	Quantity		Total
Custom designed shelter/marker	each	165,000	14	$	2,310,000
Platform	each	9,000	14	$	126,000
Trash Receptacle	each	2,000	14	$	28,000
Bench	each	2,000	14	$	28,000
Landscaping	total	10,000	14	$	140,000
Lighting	total	10,000	14	$	140,000
Informational Panel	each	30,000	14	$	420,000
Demolition, clearing, earthwork, etc.	total	12,000	14	$	168,000
Site utility relocation	total	10,000	14	$	140,000
Pedestrian/Bicycle Accomodation	total	15,000	14	$	210,000
Pedestrian Overpass at key high-volume stations	each	500,000	2	$	1,000,000
Enhanced pedestrian crosswalk protection	each	80,000	6	$	480,000
Bicycle Rack	each	1,500	14	$	21,000
			Total	**$**	**5,211,000**
Corridor Branding Enhancements					
Enhanced Landscaping	mile	530,000	4.4	$	2,332,000
Enhanced Lighting	mile	1,050,000	4.4	$	4,620,000
Enhanced Art	mile	50,000	4.4	$	220,000
			Total	**$**	**7,172,000**
Property Acquisition					
Required ROW for stations	square ft	10	25,488	$	254,880
Intelligent Transportation Systems					
Items	Unit	Unit Cost	Quantity		Total
Transit Signal Priority	each	100,000	25	$	2,500,000
Real-Time Signage	each	20,000	14	$	280,000
Full-monitor LED System at key stations	each	20,000	10	$	200,000
Fare Collection and Support Systems	each	20,000	14	$	280,000
			Total	**$**	**3,260,000**
			Construction Subtotal	$	30,160,200
Vehicles - Articulated BRT					
Items	Unit	Unit Cost	Quantity		Total
Buses (including 20% spares)	each	1,000,000	10	$	10,000,000
Construction, Property and Vehicles Subtotal				$	40,415,080
Construction Contingency		20%		$	6,032,040
Property Acquisition Contingency		50%		$	127,440
Vehicle Contingency		10%		$	1,000,000
			Subtotal	$	47,574,560
Design and Professional Services (25% of Construction Costs)		25%		$	7,540,050
TOTAL COST				**$**	**55,114,610**
Cost per mile				$	12,526,048

O&M Costs

Weekdays	252		
Daily one way trips			152
Roundtrip mileage			8.8
Speed			15
Cycle Time (min)			39.6
Cycle time (hrs)			0.67
Daily Veh. Rev. Hrs.			50.92
Annual Veh. Rev. Hrs.			12,832
Cost per Veh. Rev. hr.			$133.26
		$	1,709,971
Saturdays	52		
Daily one way trips			84
Roundtrip mileage			8.8
Speed			15
Cycle Time (min)			39.6
Cycle time (hrs)			0.67
Daily Veh. Rev. Hrs.			28.14
Annual Veh. Rev. Hrs.			1463.28
Cost per Veh. Rev. hr.			$133.26
		$	194,997
Sundays/Holidays	61		
Daily one way trips			84
Roundtrip mileage			8.8
Speed			15
Cycle Time (Min)			39.6
Cycle time (hrs)			0.67
Daily Veh. Rev. Hrs.			28.14
Annual Veh. Rev. Hrs.			1716.54
Cost per Veh. Rev. hr.			$133.26
		$	228,746
ANNUAL O&M COSTS		**$**	**2,133,714**