REVERSIBLE LANES
ALONG MAJOR THOROUGHFARES

Final Technical Memorandum

2016

MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

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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 USDOT.

1) INTRODUCTION

Travel delays due to peak-period and peak-direction congestion affects the productivity and quality of life of nearly all travelers in Miami-Dade County. Adding roadway capacity to improve travel times is challenging due to high costs and environmental impacts associated with designing, constructing, and purchasing Right of Way (ROW) for new travel lanes and/or roadways. Therefore, ensuring optimal utilization of existing transportation assets is crucial. A reversible lane is a transportation system management technique that ensures a higher utilization of existing transportation assets while reducing the negative externalities associated with widening existing roadway facilities. The reversible lane system designates traffic flow in one direction during some period of time and reverses it to the opposing direction during some other period of time in order to serve the direction with greater travel demand. This reversal of traffic flow from one direction to another can take place along a single center lane, multiple center/inside lanes, shoulders, or the entire roadway. The direction of traffic flow can be adjusted at different times to adapt to changing traffic conditions. These conditions are most commonly based on demand associated with frequent and predictable unbalanced peak-period travel times such as on corridors that accommodate predominantly commuter traffic. The basic principle is to configure the lanes of a roadway, or the entire roadway, to provide additional directional capacity to match anticipated periodic unbalanced directional traffic demand. Reversible lanes allow transportation agencies to make better use of new or existing underutilized roadways by aligning the capacity with traffic demand.

General use mixed-traffic reversible lanes along arterial roadways typically operate in one of the following three (3) configurations:

1. Unidirectional (one-way) flow with the purpose to serve the major-flow direction during the respective peak demand time period by operating all lanes or the entire roadway in the peak direction (higher directional traffic volume). No lanes would be designated for the nonpeak direction (lower directional traffic volume). Typically, on many urban transportation corridors the heavy traffic demand reverses between the morning and afternoon peak periods and the reversible lanes are operated to serve the respective peak time period.

Figure 1: Unidirectional Reversible Roadway Concept

2. Bi-directional (two-way) flow with an unbalanced number of lanes where a paved median or a center Two-Way-Left-Turn Lane (TWLTL) is temporarily borrowed to increase motor vehicle capacity in the major-flow (higher directional traffic volume) direction. This configuration negates the need for providing additional travel lanes. This means that a majority of the lanes would be designated for the peak direction (higher directional traffic volume) and some lesser number of lanes would be designated for the nonpeak direction (lower directional traffic volume).

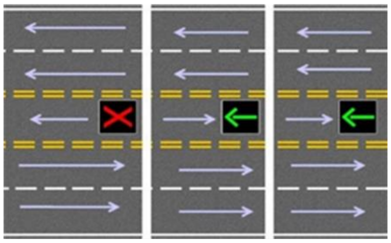


Figure 2: Bi-directional Center Reversible Lane Roadway Concept

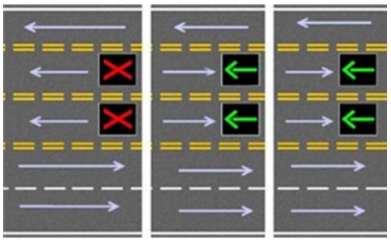


Figure 3: Bi-directional Multi Reversible Lanes Roadway Concept

3. Bi-directional (two-way) flow where the inner lanes of a divided roadway section are reversed in order to favor the peak direction (higher directional traffic volume) during each peak period. With this configuration, the inner lane would act as a contraflow lane in the peak direction (higher directional traffic volume) which may operate as a general use mixed-traffic lane (most common) or as a directional part time preferential lane (high occupancy vehicle (HOV) lane or transit only lane).

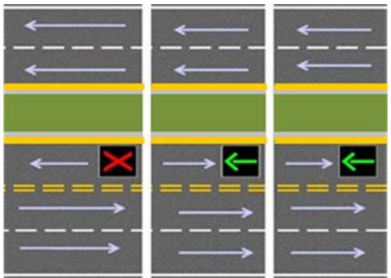


Figure 4: Bi-directional Single Inside Reversible Lane Roadway Concept

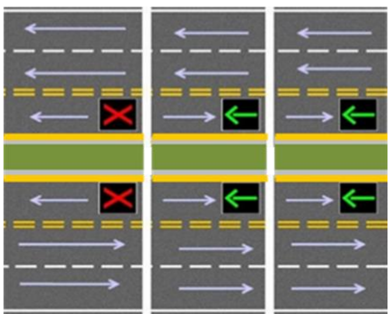


Figure 5: Bi-directional Dual Inside Reversible Lanes Roadway Concept

2) PROJECT NEED

Miami-Dade County is in need of possible solutions to the congestion problem associated with morning and afternoon peak travel periods. The purpose of this study is to evaluate the feasibility of implementing reversible lanes along major thoroughfares in Miami-Dade County, particularly during peak commute travel times with the intent of addressing traffic congestion in a cost-effective manner.

3) PROJECT OBJECTIVE

The objective of this study is to identify potential thoroughfares throughout Miami-Dade County where a reversible lane system can be successfully implemented and to evaluate the feasibility of implementing said system.

4) PROJECT BACKGROUND

In the past, four (4) studies regarding reversible lanes have been conducted for several roadways in Miami-Dade County. These four (4) studies are:

1. *Miami-Dade MPO Flagler Street Reversible Flow Study (Completed in 1992)*
2. *Miami-Dade MPO Special-Use Lanes Study (Completed in 2005)*
3. *NW 7th Avenue (SR 7/US-441) Reversible lane Control System Project Development and Environmental (PD&E) Study (Completed in 2007)*
4. *Miami-Dade MPO US-1 Reversible Flow Lane Study (Completed in 2007)*

Currently, only one corridor in Miami-Dade County has an operating reversible lanes system. This corridor is NW 199th Street. The reversible lanes system runs from SR 817/NW 27th Avenue on the west to SR 7/NW 2nd Avenue to the east and changes from two (2) center reversible lanes operation to one (1) center reversible lane operation east of the Florida's Turnpike. The difference between this reversible lane system and the ones proposed in the aforementioned studies (as well as this study) is that this system is only used to manage traffic on special events hosted in Sun Life Stadium as opposed to improve traffic congestion permanently or throughout the life-cycle of the project.

Figure 6: NW 199th Street Dual Center Reversible Lanes

Figure 7: NW 199th Street Single Center Reversible Lane

4.1) Miami-Dade MPO Flagler Street Reversible Flow Study (Completed in 1992)

In a similar study to this one, SR 968/West Flagler Street was recommended to be further analyzed for the implementation of a reversible lane system between SR 9/NW 27th Avenue and SR 826/Palmetto Expressway. The *Miami-Dade MPO Flagler Street Reversible Flow Study* provided the more in-depth planning analysis of the potential benefits and impacts of a reversible lane system on this segment of SR 968/West Flagler Street. This in-depth analysis comprised of an assessment of peak period operating conditions, a development of a preliminary operating plan, an analysis of benefits over impacts, and formulation of recommendations.

Numerous reversible flow scenarios were examined for this section of SR 968/West Flagler Street. In general, these scenarios were divided in two (2) categories:

a) The total reversal of the entire street during the peak periods.
b) The conversion of one or more lanes to reversible flow while maintaining two-way traffic operations.

Peak period traffic characteristics in the corridor indicated that the conversion of one lane to reversible flow operations would be the best scenario for SR 968/West Flagler Street. However, due to several characteristics of the street during the time of this analysis, it was determined that implementing reversible lanes on SR 968/West Flagler Street was not one of the better available methods to improve traffic flow.

The roadway characteristics that made SR 968/West Flagler Street unfit for reversible lane operations were:

a) The street did not have a high enough directional imbalance in traffic demand to generate enough benefits from the peak direction traffic that outweighed the impacts to the nonpeak direction traffic.
b) Low travel speed difference between the eastbound and westbound through traffic in the afternoon peak hour.
c) While traffic congestion during peak periods and at other times of the day was evident along the entire length of the corridor, the traffic congestion was a result from a select number of intersections rather than a multitude of locations between the SR 826/Palmetto Expressway and SR 9/NW 27th Avenue.

d) Access to adjacent residential neighborhoods had to be impacted by left-turn prohibitions along SR 968/West Flagler Street.
e) Increased north-south cross traffic demands, anticipated changes in traffic demand, and expected long range transit services suggested a better method for improving traffic flow were available.

4.2) Miami-Dade MPO Special-Use Lanes Study (Completed in 2005)

This study undertook a two (2) tier examination of freeway and major arterial facilities that had the potential to accommodate special use lanes which could be reversible lanes, HOV lanes, bus rapid transit lanes, or some mixture of the three (3).

The facilities selected for this study *(Miami-Dade MPO Special-Use Lanes Study)* were primarily major arterials that are section line roads that exhibited directionality or traffic flow that was heavily skewed in one direction at a particular time of the day. Generally, the directional facilities in the County are those that directly link with downtown. Three freeways were considered for special use lanes (I-95, SR 826/Palmetto Expressway and SR 836/Dolphin Expressway) which carry heavy volumes of peak period, peak directional trips. Roadways that had already incorporated major transit services or had a planned transit route were excluded.

The Tier 1 evaluation criteria used includes:

1. Number of lanes
   - At least five (5) in total
2. Peak hour level of service (LOS) in peak direction
   - LOS E or F
3. Peak hour directional split
   - 65% to 35%
4. Functional classification
   - State Principal Arterial or State Minor Arterial (i.e. apart from the selected few freeways)
5. Ease of conversion
   - Density of channelized turn bays, landscape medians, overpasses, columns, capacity limitations, and physical barriers
6. Corridor density
   - Population within a half-mile radius of the corridor, employment within a half-mile radius of the corridor, and number of bus routes
7. Origin/Destination
   - 2025 Person trip generation
8. Bus frequency
   - Number of peak hour buses

This evaluation reduced the potential candidates for special use lanes to six (6) arterial roadways plus the three (3) considered freeways. These corridors are:

1. I-95
2. SR 836/Dolphin Expressway
3. SR 826/Palmetto Expressway

4. SR 968/Flagler Street
5. US 1/Biscayne Boulevard
6. SR 9/NW 27th Avenue south of SR 112/Airport Expressway
7. SR 953/LeJeune Road
8. Douglas Road

The Tier II assessment of alternative examined future plans for each facility and determines if those plans have an impact on the availability of ROW for special use lanes or if the plans have progressed far enough to have a recommended use for that corridor. This tier also evaluated which type of special use lane could be implemented in the resulting corridors. Single reversible lanes on I-95, SR 836/Dolphin Expressway, SR 826/Palmetto Expressway, and Douglas Road were deemed not feasible. On the remaining corridors reversible lanes were deemed possible, however, in the final recommendations single reversible lane development for all corridors was not recommended and instead transit alternatives were given such as Bus Rapid Transit (BRT) and bus on shoulder lanes.

4.3) NW 7th Avenue (SR 7/US-441) Reversible lane Control System Project Development and Environmental (PD&E) Study (Completed in 2007)

Miami Dade County in coordination with Florida Department of Transportation (FDOT) initiated a Reversible Lane Control System Project Development and Environmental (PD&E) Study as a way to alleviate traffic congestion during the peak periods. The objectives of this PD&E Study are to increase roadway capacity, travel speeds as well decrease congestion and travel time along the SR 7/NW 7th Avenue Corridor from NW 5th/6th Street to NW 119th Street. This study evaluated access management issues, ingress and egress to and from local businesses along the corridor, and safety and control of pedestrian movements across a hypothetical reversible lanes system on SR 7/SW 7th Avenue. Additionally, the study evaluated the impact to adjacent roadways and communities in the immediate vicinity of the study area. Detailed analysis of the traffic and geometric conditions, including transition zones, were also evaluated.

This PD&E Study determined that the following characteristics made SR 7/SW 7th Avenue not feasible for reversible lane implementation.

a) The roadway segment between NW 6th Street and south of NW 20th Street did not have a significant skew in traffic demand in PM peak direction.
b) The roadway segment between NW 20th Street and NW 75th Street did not have a major to minor traffic ratio of 2:1 or greater at all segments, meaning a reversible lane operations was warranted in some segments but not through the entire roadway.
c) Connections to I-95 from SR 7 were located within 400 ft. of the study area which represented traffic operations and emergency relief operations issues.
d) Several school crossings, school bus stops, and school zones within the study area.
e) Adequacy of traffic transition at the two (2) ends of the study limits was an issue.
f) Additional need for operational improvements at key locations (i.e. reversible curve section) and critical intersections was also an issue.

4.4) Miami-Dade MPO US-1 Reversible Flow Lane Study (Completed in 2007)

The purpose of this planning study was to determine the impacts and benefits on safety and corridor LOS resulting from the potential addition of a reversible lane system on US 1/South Dixie Highway from SR 976/SW 40th Street to the beginning of I-95. US 1/South Dixie Highway experienced many conditions which made a reversible lane system seem feasible at the time. For example, the daily traffic volume ranged between 25,000 and 52,000 according to 2003/2005 FDOT traffic counts, the traffic carried by the roadway was 86% to 98% through traffic, US 1/South Dixie Highway had and has no similar parallel facilities, and the directional split averaged 60% to 40% which categorizes as significant directional disparity.

In total, four (4) alternatives for US 1/South Dixie Highway were developed and evaluated based on its then existing conditions. These alternatives included:

1. No Build Alternative
2. Alternative 2 comprised of a single center reversible lane estimated at $13.5 Million
3. Alternative 3 comprised of two (2) reversible lanes estimated at $20 Million
4. Alternative 4 comprised of two (2) reversible lanes and a center two-way left turn (TWLT) lane estimated at $20 Million

The proposed conditions pertaining to each alternative indicated that in general Alternative 2 provided a better LOS in comparison to the other alternatives. Vehicular speed along US 1/South Dixie Highway was expected to improve by approximately five (5) to six (6) miles per hour and travel delay to decrease by 67 seconds per cycle when comparing Alternative 2 with the No Build Alternative. Based on the information developed in this study, the implementation of a reversible flow lane system was determined feasible. Additionally, it was recommended that another study be performed to extend the reversible lane system limits further south possibly to SR 94/Kendall Drive.

5) PROJECT APPROACH

In an effort to determine best practices for implementing and operating reversible lanes and to obtain local stakeholder input, the assessment for selecting the most suitable thoroughfare for reversible lane implementation in Miami-Dade County was not performed without first completing a literature review analysis and multiple agency coordination meetings.

5.1) Agency Coordination

The coordination effort was carried out through the creation of a Study Advisory Committee (SAC). The SAC included the following agencies:

- Florida Department of Transportation (FDOT)
- Florida's Turnpike Enterprise (FTE)
- Miami-Dade County Transportation and Public Works Department
- Miami-Dade Expressway Authority (MDX)
- Miami-Dade Transit (MDT)

- Miami-Dade County Regulatory and Economic Resources (RER) Department

Coordination with SAC members established that:

a) This study should be based on finding mixed-traffic reversible lane solutions.
b) This study is not to have a specific transit component.
c) Roadways with capacity projects programmed within the Long Range Transportation Plan (LRTP) and Miami-Dade County MPO's Transportation Improvement Program (TIP) were to be excluded from further consideration.
d) This study should focus on corridors with heavy commuter utilization.
e) This study should focus on arterial and collectors only.
f) This study should provide two (2) potential corridors along which congestion problems can be easily addressed with the implementation of a reversible lane system.

A total of six (6) meetings were hosted as part of the coordination effort where the SAC and other municipalities and stakeholders were invited to participate and give necessary input. Additionally, a field visit was hosted. Study findings were presented to the Transportation Planning Council (TPC).

1. February 3rd, 2016 Study Advisory Committee Meeting
2. February 24th, 2016 Progress Meeting
3. March 17th, 2016 Progress Meeting
4. April 11th, 2016 Progress Meeting
5. April 29th, 2016 Field Visit
6. June 30th, 2016 Study Advisory Committee Meeting
7. August 1st, 2016 Study Advisory Committee Meeting
8. August 26th, 2016 TPC Meeting

5.2) Literature Review

This task comprised of working with the Metropolitan Planning Organization (MPO) Project Manager to identify corridors, nationwide, where reversible lanes are in place or in consideration and have relevance to the purpose of this study. Although not all the desired corridor information was available, the task consisted on collecting the following items:

- Limits
- Reversible segment length
- Speed limit
- Number of lanes
- Annual Average Daily Traffic (AADT)
- Lane-control (signals and signs)
- Roadway functional classification (e.g. arterial, limited-access, etc.)
- Vehicle restrictions (if any)
- Type and characteristics of reversible lane(s)

- Access management characteristics
- Land Use
- Lane configuration based on time
- Vehicle mix
- Enforcement mechanism
- Cost of implementation
- Initial results based on implementing agency's opinion or summary of any evaluation studies
- Level of physical protection available

The literature review was performed to incorporate relevant information from completed research and studies regarding reversible lanes and to understand how existing reversible lanes are operating in similar cities and/or metropolitan areas such as Miami-Dade County. To initiate this task, we referred to the Institute of Transportation Engineers (ITE) website which referred us to several relevant documents and studies on reversible lanes. One vital document to the development of our literary review included *Raj Kishore's Reversible Lanes: State of Implementation on a Global Level*. This document provided a list of active reversible lanes corridors from which we chose applicable corridors to relate to our study. Additionally, it provided reference to the Transportation Research Board report *NCHRP Synthesis 340* which provided key information on reversible lane characteristics, operational requirements, costs, and benefits for a more effective implementation process. **Table 1** offers a list of 14 roadways, along which reversible lanes have been successfully implemented; ten (10) of which are currently operating in the United States. Exhibits of these ten (10) nationwide reversible lane sample roadways have been included in **Appendix A**. In selecting these ten (10) corridors, only roadways classified as arterials or collectors were considered. Corridors having the right characteristics for an urban area were documented and their locations verified using satellite imagery and StreetView™ from Google™. In total, the literature review comprised of inspecting sixteen (16) documents and research materials, all listed in **Table 2**. This task reinforced previous knowledge of reversible lanes and provided further insight in the effective implementation of reversible lanes. Lessons learned have been listed below.

- Most reversible lane segments along arterial roads involve the use of a center Two-Way-Left-Turn Lane.
- On average, reversible lane(s) segments are 2 miles long.
- On average, reversible lane(s) segments have 5 to 7 lanes.
- Reversible lanes may comprise of a single lane, several lanes, or the entire roadway.
- Most, if not all, reversible lane segments along arterial roads serve as commuter routes from the suburbs to a Central Business District (CBD).
- Left turn prohibitions are commonly used to help avoid stops and reduce delays in through traffic.
- On-street parking can be limited to off-peak hours only.
- Additional investment in traffic control devices and enforcement is needed.
- Corridors with surrounding commercial land use are preferred over those with surrounding residential land use.
- Reversible lanes may be controlled by curb-mounted signs, overhead signs, lane-use control signals, pavement markings, and portable devices such as pedestals, tubes, and cones. Most installations in the United States are controlled with overhead changeable lane-use signals.

- Three basic methods have been employed for configuring the use of reversible lanes (ITE 1999):
    1. Reversal of flow in all lanes of a one-way facility,
    2. Reversal of flow in all lanes of a two-way facility, or
    3. Reversal of one or more lanes of a two-way facility.
- Reversible lanes are one of the most cost-effective methods for increasing directional capacity.
- Performed safety studies have concluded that reversible lanes do not contribute significantly to increased frequency or severity of accidents as suggested from empirical observation and anecdotal evidence.
- Reversible lane applications have been generally very well received by the public.
- Reversible lane systems have been developed and managed based primarily on experience, professional judgment, and empirical observation due to the limited amount of quantitative evaluations and research studies done on reversible lane performance, planning, design, operation, control, management, and enforcement.
- General configuration of reversible roadway segments can be divided into five zones:
    1. Zone 1: Approach Zone, where drivers need to be informed that a reversible roadway is ahead.
    2. Zone 2: Decision Zone, where drivers must move into or out of the lane(s) to become reversible. Due to the potential hazard of merging and weaving movements, this zone needs to be carefully designed.
    3. Zone 3: Reversed Zone, where reversible lanes are in operation. Adequate traffic control is needed to remind drivers about which lanes are open for use and avoid head-on collisions with opposing traffic in the adjacent lane.
    4. Zone 4: Transition Zone, where the change from reverse flow lanes back to normal roadway configuration occurs.
    5. Zone 5: Departure Zone, where traffic departs the reversible section and continues in normal flow configuration.
- Roadway capacity at the Transition Zones must be able to accommodate the increased volume resulting from the additional capacity of the lane reversal.
- The highest level of driver confusion exists in the termini Transition Zones and intermediate Approach and Departure Zones making them the most critical areas of a reversible lane operation.
- Enough time for vehicles to fully clear the reversible lane segment(s) should be provided before opposing traffic is permitted to use it.
- The criteria used by ITE to determine the need for reversible lanes is:
    1. Existing traffic demand should be greater than the capacity of the roadway.
    2. Traffic congestion should be both “periodic and predictable.”
    3. Ratio of major to minor traffic count should be of at least 2:1 (preferably 3:1), otherwise a new traffic problem could be caused on the minor flow roadways.
    4. Adequate entrance and exit capabilities to/from the reversible lane must be provided. Additionally, easy transition between the normal and reverse flow lanes must be provided. If not, reversible lanes could add bottlenecks and other traffic problems to the existing traffic congestion.

ITE also suggests other criteria that should be examined before the implementation of reversible lanes:

1. Completion of traffic studies that show the following results:
   - A lack of an adequate adjacent street that rules out the consideration of a one-way pair operation.
   - Side streets of five or more lanes with ratios of major to minor traffic flows of at least 2:1.
   - A high proportion of commuter-type traffic desiring to traverse the area without turns or stops.
2. Terminal conditions facilitating the full utilization of the additional lanes.
3. Ability to maintain a minimum of two lanes open to traffic in each direction to avoid forcing the nonpeak traffic flow direction to function near capacity, or creating serious congestion due to lack of storage for right- and left-turning traffic.
4. Adequate capacity must be maintained at both of the termini to avoid bottlenecks. Also, the transition from the normal operation to the reversible segment must be easy for drivers to navigate.
5. No other acceptable alternative improvement scenarios exist. Cost factors may be involved, such as right-of-way limitations that preclude widening an existing facility or constructing a parallel roadway on a separate right-of-way.

Table 1: Existing Reversible Lane Segments

No.	Location	Roadway	Opening Year	Length (miles)	Speed Limit (mph)	No. of Lanes	AADT	Configuration	Other Information
1	Phoenix, Arizona	7th Ave.	1979	5.88	South of Missouri St. 35 mph North of Missouri St. 40 mph	6 Lanes	W McDowell Rd. to W MacKenzie Rd. 15,650 NB 14,180 SB W Bethany Home Rd. to Northern Ave. 7,890 NB 7,345 SB	Morning peak (6:00 AM to 9:00 AM): 3 NB lanes, 2 SB lanes, and a reversible center lane operating in the SB direction Afternoon peak (4:00 PM to 6:00 PM): 3 NB lanes, 2 SB lanes, and a reversible center lane operating in the NB direction All other times: 3 NB lanes, 2 SB lanes, and a reversible center lane operating as a Two-Way-Left-Turn-Lane (TWLTL)	• Reversible center lane with no physical separation • Overhead lane-use control signs • Commercial and residential land use • Left turns are prohibited at all arterial and most collector street intersections, but left-turns are allowed at other non-signalized streets and at driveways for access • No Parking allowed • Bus Route
2	Phoenix, Arizona	7th St.	1982	6.93	South of Missouri St. 35 mph North of Missouri St. 40 mph	6 Lanes	15,295 NB 14,495 SB	Morning peak (6:00 AM to 9:00 AM): 3 NB lanes, 2 SB lanes, and a reversible center lane operating in the SB direction Afternoon peak (4:00 PM to 6:00 PM): 3 NB lanes, 2 SB lanes, and a reversible center lane operating in the NB direction All other times: 3 NB lanes, 2 SB lanes, and a reversible center lane operating as a (TWLTL)	• Reversible center lane with no physical separation • Overhead lane-use control signs • Commercial and residential land use • Left turns are prohibited at all arterial and most collector street intersections, but left-turns are allowed at other non-signalized streets and at driveways for access • No Parking allowed • Bus Route
3	Lexington, Kentucky	Nicholasville Rd.	1979	2.16	40 mph	North of Southland Dr. 5 Lanes South of Southland Dr. 7 Lanes	New Circle Rd. (MP 2.412) to Southland Dr. (3.531) 38,500 Southland Dr. (3.531) to Waller Ave. (4.674) 45,900 Waller Ave. (4.674) to Virginia Ave. (5.162) 38,100	Morning peak (7:00 AM to 9:00 AM) and before UK Football Games: University of Kentucky Campus to Southland Drive: 4 NB lanes and 1 SB lane Southland Drive to New Circle Road: 5 NB lanes and 2 SB lane Afternoon peak(4:00 PM to 6:00 PM) and after UK Football Games: University of Kentucky Campus to Southland Drive: 1 NB lane and 4 SB lane Southland Drive to New Circle Road: 2 NB lanes and 5 SB lanes All other times: An equal number of lanes are dedicated to traffic in each direction and the center lane operates as a (TWLTL)	• Reversible center lane with no physical separation • Overhead lane-use control signals • Residential, Commercial, and Institutional land use • Left turns are allowed at signalized intersections during operation of the reversible lanes • Parking is not allowed • Bus Route
4	Silver Spring, Maryland	Colesville Rd.	Not Available	0.83	South of Spring St. 30 mph North of Spring St. 35 mph	6 Lanes	34,132	Morning peak (7:00 AM to 9:30 AM): 2 NB lanes and 4 SB lanes Afternoon peak (4:00 PM to 7:00 PM): 4 NB lanes and 2 SB lanes All other times: An equal number of lanes are dedicated to traffic in each direction	• Reversible center lane with no physical separation • Overhead lane-use control signals and signs • Commercial and residential land use • Left turns are restricted through the use of LED blank out signs and regular signs • No parking allowed during peak hours • Bicycle may use full lane • No cut through traffic allowed north of North Noyes Dr. • Bus Route
5	Omaha, Nebraska	Dodge St.	Not Available	3.10	35 mph	5 Lanes	38,230	Morning peak (5:50 AM to 9:00 AM): 2 EB lanes, 2 WB lanes, and a reversible center lane operating in the EB direction Afternoon peak (9:00 AM to 5:50 AM): 2 EB lanes, 2 WB lanes, and a reversible center lane operating in the WB direction	• Reversible center lane with no physical separation • Overhead lane-use control signals as well as signs along the side • Commercial and residential land use • Left turns are not allowed • Mug handles are located in specific intersections for left turn and U-turn maneuvers • No Parking allowed • Truck Route • Bus Route
6	Omaha, Nebraska	Farnam St.	1958	1.1	30 mph	2 Lanes	10,535	Morning peak (7:00 AM to 9:00 AM): 2 one-way EB lanes Afternoon peak (4:00 PM to 6:00 PM): 2 one-way WB lanes All other times: 1 lane in each direction	• Undivided 2 lane roadway operates as a one-way street during peak periods • Overhead lane-use control signals, and signs indicating directional flow • Residential land use, driveways along the entire segment • LED Blank Out signs mounted on mast arms may be used to restrict left turns at signalized intersections • No Parking allowed • No Trucks over 6 Tons and 650 ft. long allowed
7	Indianapolis, Indiana	Fall Creek Parkway North Dr.	Not Available	2.13	35 mph and 40 mph	South of E 38th St. 5 Lanes North of E 38th St. 7 Lanes	13,212	Morning peak: 2 NB lanes and 3 SB lanes Afternoon peak: 3 NB lanes and 2 SB lanes	• Reversible center lane with no physical separation • Overhead lane-use control signals • Residential and land use on the west side and Fall Creek on the east side • Left turns are restricted on signalized intersections • No Parking allowed • 11,000 lbs. weight limit • Lane configuration changes periodically to facilitate traffic flow during events at the Indiana State Fairgrounds

Table 1: Existing Reversible Lane Segments (Continued)

No.	Location	Roadway	Opening Year	Length (miles)	Speed Limit (mph)	No. of Lanes	AADT	Configuration	Other Information
8	Houston, Texas	West Alabama St.	Not Available	1.72	30 mph	3 Lanes	Not Available	Morning peak (6:00 AM to 10:00 AM): 2 EB lanes and 1 WB lanes Afternoon peak (3:00 PM to 7:00 PM): 1 EB lanes and 2 WB lanes All other times: 1 EB lane, 1 WB lane, and a (TWLTL)	• Reversible center lane with no physical separation • Overhead lane-use control signals • Commercial, residential, and institutional land use • Blank out signals at intersections restrict left turns • No Parking allowed • No Trucks over 2 axles • Bus Route
9	Montgomery, Alabama	Norman Bridge Rd.	Not Available	0.64	30 mph	3 Lanes	S of Burton Ave (MP 4.47) 18,820 S of Cloverdale Rd (MP 4.17) 13,870 S of Winthrop (MP 3.91) 14,380	Morning peak (7:00 AM – 9:00 AM) 2 NB lanes and 1 SB lanes Afternoon peak (4:00 PM – 6:00 PM) 1 NB lanes and 2 SB lanes All other times: 1 NB lane, 1 SB lane, and 1 TWLTL	• Reversible center lane with no physical separation • Overhead lane-use control signals over center lane • Commercial and residential land use • Left turns for minor-flow direction are not allowed at signalized intersections during peak hour
10	Santa Clara, California	Lafayette St.	Not Available	0.35	30 mph	3 Lanes	Not Available	Morning peak (6:00 AM – 9:30 AM) 2 NB lanes and 1 SB lanes Afternoon peak (2:30 PM – 7:00 PM) 1 NB lanes and 2 SB lanes All other times: 1 NB lane, 1 SB lane, and 1 TWLTL	• Reversible center lane with no physical separation • Overhead lane-use control signals over center lane • Residential land use • Left turns for minor-flow direction are not allowed at signalized intersections during peak hour • On-Street parking allowed • No Trucks over 3 Tons
11	San Juan, Puerto Rico	PR-2 Expressway	Not Available	1.86	Not Available	5 Lanes	Not Available	Not Available	• Reversible center lane with no physical separation • Overhead lane-use control signals for center lane
12	Calgary, Canada	Memorial Dr.	Not Available	0.54	30 mph	1 Lanes	Not Available	Afternoon peak (3:30 PM – 6:30 PM) 1 EB lane and 3 WB lanes All other times: 2 EB lanes and 2 WB lanes	• Divided roadway with reversible contraflow lane operating only in the afternoon on the eastbound direction • Overhead lane-use control signals as well as a median LED signal indicating when contraflow lane is open/closed • Commercial and residential land use • On-Street parking allowed by permit only
13	Bogota, Colombia	Carrera 7a Ave.	1971	4.20	Not Available	6 Lanes	Not Available	(1971) Afternoon peak (5:00 PM – 8:00 PM) NB operation of all lanes of Carrera 7, between 32nd St. and 92nd St. (1993) Afternoon peak (6:00 PM – 9:00 PM) NB operation (contraflow) of external lane of east carriageway, between 77th St. and 147th St. (1994) NB operation (contraflow) of left lane of west carriageway between 92nd St. and 103rd St. (1999) Afternoon peak (6:00 PM – 9:00 PM) SB contraflow from 6:00 PM to 9:00 PM changes to SB operation of all lanes of Carrera 7 (2014) Afternoon peak (5:00 PM – 8:00 PM) NB operation of all lanes of Carrera 7, between 36th St. and 92nd St. All other times Carrera 7 operates 3 lanes in each direction 6. Implementation of preferential lane for transit takes place (Future) Carrera 7 will operate 3 lanes in each direction the entire day	http://www.movilidadbogota.gov.co/?pag=1986 • Divided roadway with reversible lane operation • Enforced through the use of transit personnel

Table 2: Referenced Documents

No.	Document Name	Summary	Relevant Info
1	**IS A REVERSIBLE LANE SYSTEM SAFE?** BY W. MARTIN BRETHERTON JR and MAZ ELHAJ	This study reviewed and compared road operation and safety before and after the installation of Reversible Lane Systems (RLS) on US-78 as well as similar roads in Georgia.	The increase in accident rates and the significant increase in injury and fatality rates have made some engineers reluctant to propose reversible lane systems as an alternative solution to mitigate traffic congestion, even when all RLS warrants are met. The report concludes with the elimination of future reversible lanes in Gwinnett County, GA.
2	**NCHRP SYNTHESIS 340**	The goal of the synthesis was to document the historical development of reversible lanes; their application to address various needs; the lessons learned from prior implementation; the costs and benefits associated with their use; and various techniques and successful practices developed over their history.	Empirical observation and anecdotal evidence suggest that reversible lanes do not contribute significantly to increased frequency or severity of accidents. Most managing agencies have reported little change in accident frequency or severity. They also reported an overall very positive response from most drivers. Empirical evidence gained from past experience has shown that drivers readily adapt to reversible operations and the common belief is that once operations are under way in a reversible lane, the follow-the-leader nature of traffic should minimize head-on conflicts. Enforcement and incident management on many reversible segments can become problematic. Capacity within reversible operation transitions is critical; segment termini must adequately handle the added reversible lane capacity. Enforcement and incident management on reversible segments can become problematic.
3	**REVERSIBLE LANE OPERATION FOR ARTERIAL ROADWAYS - THE WASHINGTON, DC EXPERIENCE** BY SOUMYA DEY AND JIANMING MA	This paper discusses the operations of reversible lanes for arterial roadways in the District of Columbia. The operations of reversible lanes are evaluated using three different criteria: (1) utilization of existing infrastructure capacity (2) safety (3) land use/economic development impacts The discussion takes into account constraints inherent in a built-out urban environment and operational constraints imposed by external stakeholders. The paper discusses the status of continued operations of such facilities and draws some preliminary conclusions.	• Preliminary crash analysis and anecdotal evidence suggests that more crashes are associated with reversible lane operations as compared to nonreversible lane segments. • Reversible lanes may be confusing, especially for unfamiliar drivers, for turning movements, specifically left turns, from and to the side streets. • Reversible lanes are perceived as being commuter oriented, deemphasizing residents and communities. It is also less pedestrian friendly and not very conducive to economic revitalization since it focuses on “through traffic” rather than traffic destined “to” the community.
4	**REVERSIBLE LANE OPERATION FOR ARTERIAL ROADWAYS THE WASHINGTON, DC, USA EXPERIENCE** BY SOUMYA DEY, JIANMING MA, AND YUSUF ADEN	This paper discusses the operations of reversible lanes on arterial roadways in Washington, DC, USA. The operations of reversible lanes are evaluated using three different criteria: • Utilization of infrastructure capacity • Safety • Land use/economic development impacts The discussion takes into account constraints inherent in a built-out urban environment and operational constraints imposed by external stakeholders. The paper discusses the status of continued operations of such facilities and draws some preliminary conclusion.	• More crashes are associated with reversible operations vs. non-reversible. • Reversible lanes are perceived as being too commuter oriented vs. emphasizing the needs/wants of residents and their communities. • Reversible lanes are less pedestrian friendly, not very conducive to economic revitalization since it focuses on “through traffic” rather than traffic destined to the community.
5	**CITY OF CALGARY'S REVERSIBLE LANE CONTROL SYSTEMS** BY CHRIS DELANOY, TRAVIS GAEDE, YEATLAND WONG	This paper highlights a potential model for municipalities looking to find innovative ways to enhance transportation capacity on existing road facilities without undertaking costly or controversial road widening projects.	The Reversible Lane Control Systems (RLCS) project was completed with a total budget of $3.8 Million (all figures in 2009 dollars) for all components including the traffic control infrastructure, fiber optic network, and central control system. Typical unit costs for key system elements are roughly summarized as follows: • Traffic Control Gates: $20,000 (gate device and arm) plus $25,000 (foundation and custom protective concrete barrier) • Prismatic Message Signs: $20,000 (sign, controller and diamond-grade message printing) plus $3,000 (foundation and installation) • LED Traffic Signs: $3,000 to $5,000 • Lane Control Signals: $700, including mounting bracket, or about $18,000 per typical structure (foundation, pole trunk, mast arm, and 8 signal displays) • PTZ Cameras: $3,000 (camera) plus $8,000 (foundation and pole) • Control Cabinets: $40,000 The manual operation of the RLCS, in place since 2006, had had an annual cost of approximately $400,000, primarily in labor and material costs, for multiple detour crews to manage the traffic flow reversal transitions four times a day.
6	**REVERSIBLE LANE VALUE ENGINEERING PROPOSAL FOR WYTHE CREEK ROAD, HAMPTON AND POQUOSON VA** BY CLARK NEXSEN	This power point presentation reports potential cost saving by Cities of Hampton, VA and Poquoson, VA associated with reversal of Wythe Creek Road.	• Construction cost savings and ROW Savings in Hampton were estimated at $5,000,000 and $3,400,000 respectively. • Construction cost savings and ROW Savings in Poquoson were estimated at $100,000 and $400,000 respectively. • Reversible Lane Control Signs can be found in MUTCD Section 2B.26 Reversible Lane Control Signs (R3-9e through R3-9i).
7	**GRANT ROAD REVERSIBLE LANE TRAFFIC FLOW AND CRASH ANALYSIS WITH AN UPDATE OF THE BROADWAY REVERSIBLE LANE STUDY** BY TRANSCORE	This study, in Tucson, AZ, evaluates the traffic volume and crash impacts associated with the removal of the reversible traffic lane application from Grant Road between Stone Avenue on the west and Swan Road on the east. The secondary purpose of the study is to update the crash analysis that was conducted in an earlier study (*Crash Analysis of Reversible Lane Removal on Broadway Boulevard and 6th Street*, April 2004) to evaluate the impacts of removing the reversible lane on Broadway Boulevard between Euclid Avenue on the west and Country Club Road on the east.	The number of crashes and the crash rate declined since the reversible lane was discontinued. Motorists disregard for the left turn restriction was a factor in the incidence of crashes during the reversible lane operation.
8	**PLANNING AND OPERATIONAL PRACTICES FOR REVERSIBLE ROADWAYS** BY BRIAN WOLSHON AND LAURENCE LAMBERT II	This report focuses on several key findings of the **NCHRP SYNTHESIS 340** and presents an overview of planning, design and control principles that have been developed for reversible lanes. The goal is to bring these findings to a wider audience of traffic practitioners for their consideration. It also includes anecdotal information collected from interviews and reviews of field applications (past and present). Several examples are included in the report to illustrate the range of practices and to highlight locally adopted techniques that are particularly effective and/or innovative.	The majority of reversible lane applications reviewed were able to achieve their operational objectives with relatively low safety impacts and at surprisingly high levels of public understanding and acceptance. Agencies responsible for the design and management of the reviewed reversible lanes, generally regarded them as safe and efficient. Most managing agencies interviewed during the review reported little change in accident frequency or severity under reversible operation. It is believed that added capacity and uniform operation on reversible roadways actually contributed to improved safety conditions. This suggests that reversible operations may not be nearly as complicated, controversial, or dangerous as many agencies believe. Empirical evidence gained from prior experience suggested that drivers adapt to reversible flow quite readily.
9	**LEETSDALE DRIVE REVERSIBLE LANE DESIGN STUDY; DENVER, COLORADO** BY STEVE MARKOVETZ, DENNIS ROYER, ROBERT F. DORROH	The study evaluated the effectiveness of low-cost improvements such as transportation system management options (TSMO) in addition to a reversible lane along Leetsdale Drive to alleviate congestion and mitigate traffic in adjacent neighborhoods. Low-cost safety improvements also were identified.	A reversible lane will alleviate traffic congestion and will improve travel speeds along Leetsdale Drive. Certain collision patterns that are related to congestion at signalized intersections, such as right angle, turning, and rear end collisions, might be reduced by the capacity increase of the reversible lane. Four types of accident typically increase with application of reversible lanes (particularly if multiple reversible lanes instead of just one): • Left turns in front of traffic moving in the same direction • Left turns across traffic onto the facility • Left turning traffic being struck by oncoming through traffic • Left turning traffic being struck by approaching from behind Usually, any increase in accident numbers is followed by a reduction and then leveling of total accidents over time as drivers adjust to the reversible lane condition.

Table 2: Referenced Documents (Continued)

No.	Document Name	Summary	Relevant Info
10	**REVERSIBLE FLOW ON A SIX LANE URBAN ARTERIAL** BY JONATHAN E. UPCHURCH	The study analyses the characteristics of reversible flow along Union Avenue in Memphis, TN, in terms of traffic volume accommodated by the facility, capacity and Level of Service at each of the facility's 12 signalized intersections, amount/types accidents associated with the reversible nature of the facility.	• Reversible lane operation has a high potential to increase roadway capacity. • Left Turns should be prohibited during peak periods with internally illuminated overhead signs. • Consider improving pavement marking and use of reflectorized lane markers. • Distance between lane control markers and traffic signals should be adjusted so that confusion between the two can be avoided.
11	**REVERSIBLE LANE SYSTEMS: SYNTHESIS OF PRACTICE** BY BRIAN WOLSHON AND LAURENCE LAMBERT	This report summarizes and expands on the findings of the "Survey of Practice" section of the **NCHRP SYNTHESIS 340** project. It highlights the characteristics of several different types of reversible applications. The report focuses on the planning, design, control, and evaluation of reversible lanes. This report also includes several of the most significant findings of the survey portion of the **NCHRP SYNTHESIS** to acquaint readers with the challenges, practices, systems, and use philosophies of agencies that are currently (or have recently) employed reversible flow facilities. Discussions of the costs and benefits as well as any obtained knowledge from direct experience with such applications have been included.	• The majority of reversible lane applications have been able to achieve their operational objectives with relatively low safety impacts and with surprisingly high levels of public understanding and acceptance. Reversible operation has not been as complicated, controversial, and dangerous as most agencies originally believe. • The body of empirical evidence gained from past experience shows that drivers have adapted to reversible lane systems quite readily. • The empirical evidence suggests that operations of reversible lane systems were generally safe and efficient. • The most critical locations (and periods) for reversible operation are the transitions. The termini areas are particularly important from the perspectives of safety and operational efficiency.
12	**REVERSIBLE LANES: STATE OF IMPLEMENTATION ON A GLOBAL LEVEL** BY RAJ KISHORE	This report looked into the implementations of reversible lane systems across the world along with summarizing available literature on the reversible lanes studies done so far, including primary considerations needed when designing and implementing a reversible lane system. It also looked into the effectiveness of reversible lane systems and probable effects on safety and operational efficiency.	• Overhead signal is the lane control measure used in most of the implementations. • More than three-quarter of the documented implementations belong to North America. • Bridges and downtown street sections are major feasible location of reversible lane systems due to the benefits lane management provides versus the cost of implementation. • Reversible lane systems are fewer with length of sections greater than 3.1 miles. • Total number of lanes almost has no impact on implementing reversible lane systems. Almost 23 percent of all reversible lane systems have more than five travel lanes. Some studies shows that crashes associated with them reduced as years go by after implementation. Also, around 80 percent of crashes due to lane reversal are caused by unauthorized left turns. Other possible variables associated with crashes are found to be signage confusion, inadequate switch-in and switch-out length as well as lane departures.
13	**REVERSIBLE LANES IN UTAH – ADDING EFFICIENCY SAFELY** BY ALFRED A GUEBERT, DIEGO CARROLL, BRANDON WESTON, DAVE KINNECOM	This report describes a unique solution that was developed for the Utah DOT to improve the efficiency of a major east-west urban arterial using existing road infrastructure, while maintaining a shifting Two-Way-Left-Turn-Lane (TWLTL) while addressing the safety and operational challenges that arose from the design concept. The first part of the paper provides some basic concepts and some historic facts about reversible lanes and the second part provides a description of the unique features of the system that were put in place for this project.	Utah DOT uses the term "flex lane" to distinguish the application of reversible lanes along arterials from the freeway application that residents generally associated "reversible lane" with. To avoid confusion as drivers approached a signalized intersection, separation of the lane control signals and the traffic signals was set at approximately 300 feet or more. Temporal transition periods (i.e. the specific times needed to allow drivers to shift lanes safely when the system is transitioning from one lane configuration to another) includes a "warning" clearance interval (yellow "X"); an "all red" clearance interval (solid red "X") and then opening the lane for travel (green arrow) in the opposing direction. The timing of these intervals are dependent upon posted speed, length of the corridor (or in this case the distance between signalized intersections), and the cycle length of the traffic signal system on the corridor. Cameras at strategic points along the corridor also provide the operators in the traffic management center with a visual confirmation that the lanes are clear for transition. Changing lane configuration requires left turn lanes at the signalized intersections to change as well. Turning left across four lanes of oncoming traffic should require protected-only left turns. However, during off-peak and opposing peak periods, the left turn phase can be set up as protected-permitted. When the flex lane system shifts the lanes for the different periods of the day, the left turn lanes at signalized intersections also must shift. There is a need to clear the left turn lanes before transition so that the drivers are not trapped in a lane that has oncoming traffic. The signal layout at these intersections must now have a signal head over each of the five lanes that approaching drivers could be in. This requires the use of occasionally "dark" signal heads and a complex signal controller operation. Special blank-out lane designation signs are also provided next to each signal head to reinforce direction of travel and use for every lane.
14	**REVERSIBLE TRAFFIC LANES** BY MOBILITY INVESTMENT PRIORITIES	This article summarizes basic information regarding reversible lane systems that should be known before embarking in the planning, design, and implementation of said system. It summarizes application techniques and principles, issues, expected project timeframe, cost, and data needed.	• Proper communication and public participation are crucial to ensuring the success of a reversible lane strategy. • Treatment of the terminus requires particular care and attention. Common treatments extend across an intersection, requiring complex signals and signal timing strategies. • Locating a safe mid-block left turn across the favored travel direction may be difficult. • Impacted businesses may complaint. • Potential for crashes may increase depending on left turn demand, mid-block geometric conditions, and platooning of the favored traffic direction. • Reversible lane systems require approximately one year to design and implement. • In Phoenix, a 2009 proposal to add overhead beacons and lane-control signs to their existing reversible lane system was estimated to cost a total of $18.3 million.
15	**"EVALUATION OF REVERSIBLE LANES (NICHOLASVIILE ROAD; LEXINGTON, KY),"** **RESEARCH REPORT 549, KYP-79-87; HPR-PL-1(15), PART III B** BY KENNETH R. AGENT	The study involved an evaluation of reversible lanes as a method of increasing traffic flow. A unique feature of the system was allowing left turns during the period of reversible flow, which meant that the left-turn lanes had to be moved and the signal displays shifted during operation and without interrupting traffic flow. The evaluation involved a comparison of data taken before and after installation of the reversible lanes. Types of data included delays, volumes, accidents, speeds, traffic conflicts, fuel consumption, and environmental factors.	• The reversible-lane system was successful. • Delays were reduced substantially in the direction of peak traffic flow during both AM and PM operation. Delays in the off-peak direction, particularly during PM operation, increased. • An economic analysis based on current operating times showed a benefit-cost ratio of 6.90. • A one-year before-and-after analysis indicated no significant increase in accidents. • The analysis of the before and after volumes showed that reversible lanes generated trips in the peak direction and deterred trips in off-peak direction resulting in a substantial increase in the directional split. • For reversible lanes to operate effectively, the ratio of major to minor movements should be at least 2:1 (66%/33%) and preferably 3:1 (75%/25%). • The volumes were fairly constant before and after, except for the change which occurred during operation of the reversible lanes. • There was an overall reduction of almost two minutes in travel time for both directions during both peak periods. However, travel times in the off-peak direction showed increase significantly in the afternoon. • The overall reduction in stopped time was almost three minutes in the peak directions.

Table 2: Referenced Documents (Continued)

No.	Document Name	Summary	Relevant Info
16	**PERCEIVED COSTS AND BENEFITS OF REVERSIBLE LANES IN PHOENIX, ARIZONA** BY AARON GOLUB	This paper summarizes the results of a public opinion survey carried out by The Phoenix City Council to understand public sentiments in regards to the reversible lanes along 7th Street and 7th Avenue. The survey addresses the following questions: 1. What are the costs of the lanes? 2. What are the benefits of the lanes? 3. What should be done with them? Full results have been published separately. This study was to be joined with an engineering assessment of the lanes' operation and safety as well as an evaluation of the various options regarding the lanes, carried out by the City of Phoenix Street Transportation Department.	• The study showed that the crash rate of 7th Avenue and 7th Street during reverse lane times was not significantly different from similar streets in the area, thus countering the popular sentiment that they were unsafe. • The engineering assessment showed that the lanes were fairly effective at carrying their share of traffic and that the impact of removing the lanes on travel times would have been significant.

5.3) Data Collection and Screening Process

5.3.A) Data Collection

The data collection effort began by retrieving volume data from over 1,000 traffic count stations throughout Miami-Dade County. These stations were evaluated based on data availability for the last two (2) years. However, it is important to note that lack of consistency among count stations regarding type of station (i.e. volume stations and classification station) resulted in data being available for three (3) consecutive days as well as for a single day. The types of stations that were polled include:

- Volume Stations
- Vehicle Classification Count Station
- Telemetered Traffic Monitoring Sites (TTMS)
- Portable Traffic Monitoring Sites (PTMS) Vehicle Classification Station
- Portable Traffic Monitoring Sites (PTMS) Volume Count Station
- 24-Hour Classification Station
- 48-Hour Classification Station

5.3.B) Tier One: Preliminary Screening

As part of the preliminary screening's primary criteria, each station's directional distribution was evaluated and scrutinized for a consistent minimum split of 65%-35% between 6:00 AM and 10:00 AM and between 3:00 PM and 7:00 PM. **Figure 8** shows corridors conforming to the 65%-35% directional split during, both, the AM and PM peak periods. It is important to note that temporal and spatial continuity were considered within the directional distribution analysis. The temporal directional distribution was measured during the four (4) and five (5) most critical hours of the AM and PM peaks, respectively, to better indicate what percentage of the AM and PM peak periods met the directional split. Spatial continuity was measured based on the number of successive segments that met the selected temporal directional distribution were preferred. Since the 65%-35% split failed to produce enough candidates with an ideal temporal frequency and spatial continuity of the directional distribution, SAC members agreed on screening countywide corridors with a more balanced minimum split of 60%-40% and an extended afternoon peak-hour period (3:00 PM to 8:00 PM) to allow for a wider corridor sample for the potential implementation of a reversible lane system. **Figure 9** shows all corridors having a 65%-35% and 60%-40% directional split during both the AM and PM peak periods.

Following the directional distribution analysis, a secondary set of criteria was used to screen roadways based on:

- Length (two (2) miles or longer were preferred),
- Targeted market (connectivity to the CBD a higher order roadway was preferred),
- Number of through jurisdiction (single jurisdiction sections were preferred), and
- Functional classification (SAC members had previously decided on arterial and collectors only).

As seen in **Figures 8** and **9** limited access facilities were excluded. Results from this preliminary screening resulted in the following roadways being considered for an in-depth screening process:

1. NE 6th Avenue
2. NW 7th Avenue
3. NW 7th Street
4. NW 25th Street
5. NW 32nd Avenue
6. NW 36th Street
7. SW 40th Street
8. SW 104th Street
9. SW 152nd Avenue
10. SW 184th Street
11. NW 87th Avenue

Additionally US-1/Dixie Highway, SW 8th Street, SW 88th Street, NW 114th Avenue were selected by the SAC to advance to the in-depth screening as suggested by the SAC. These roadways are highlighted in **Figure 10**.

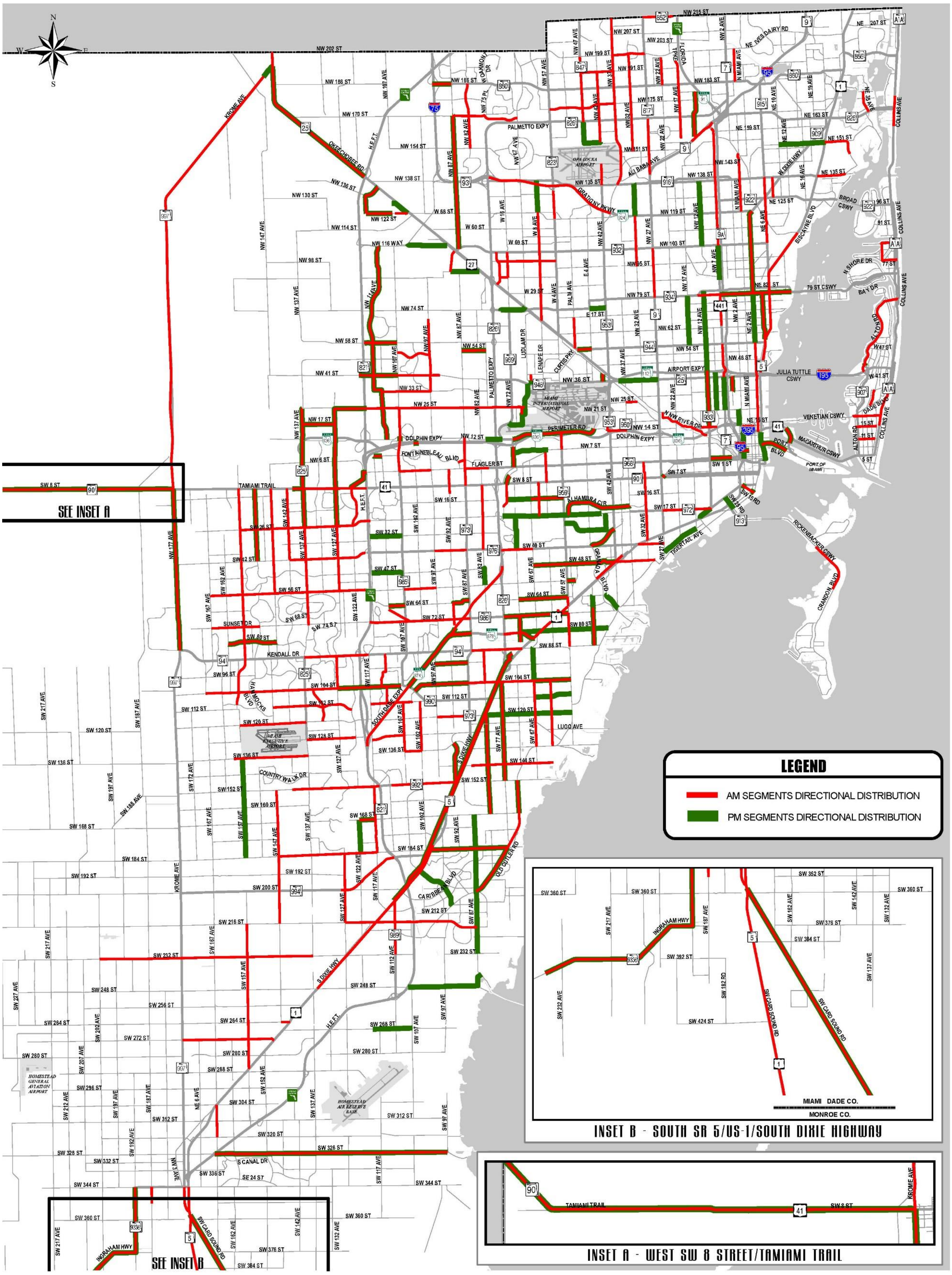


Figure 8: 65% - 35% Directional Distribution Map

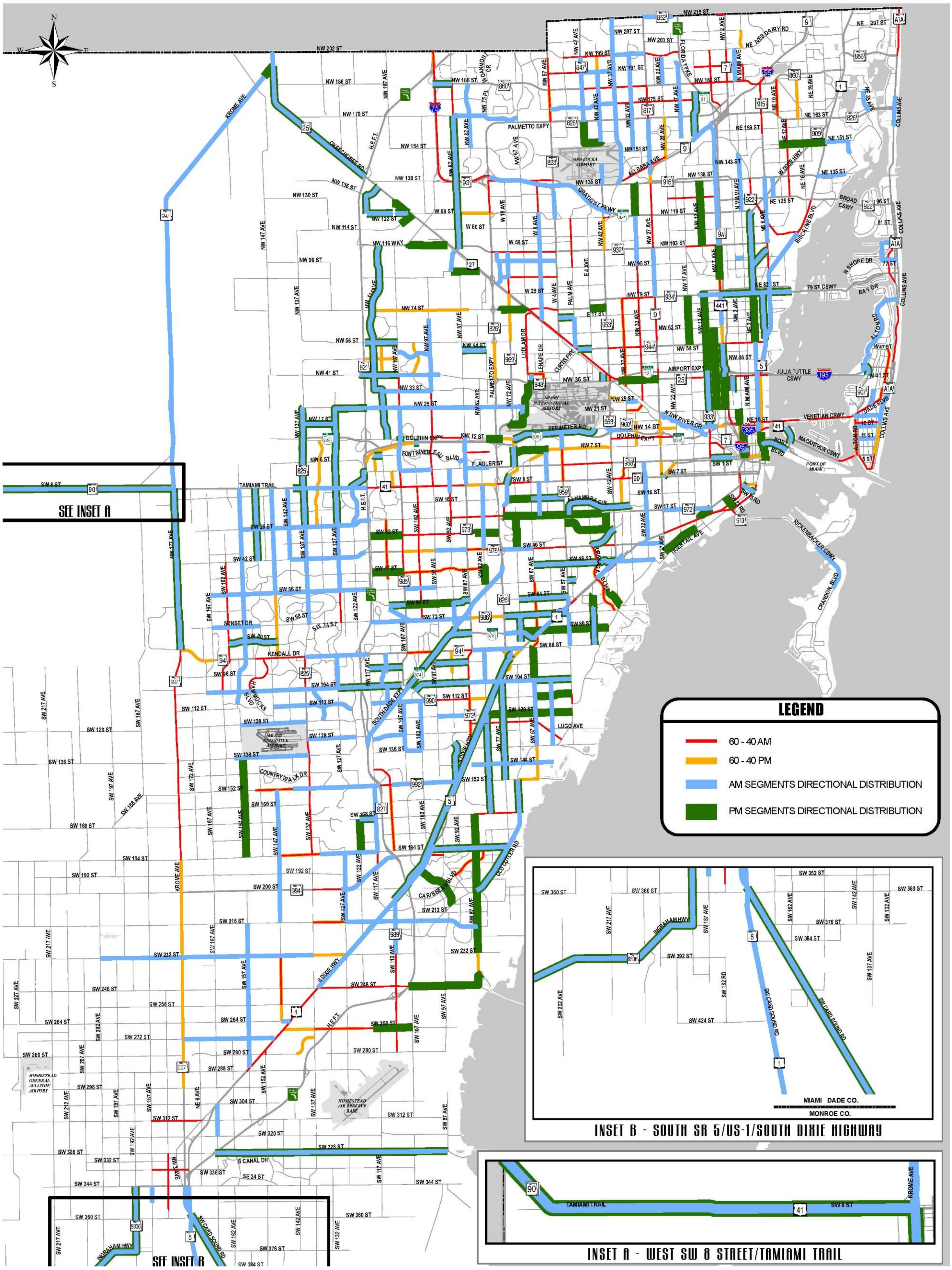


Figure 9: 60% - 40% Directional Distribution Map

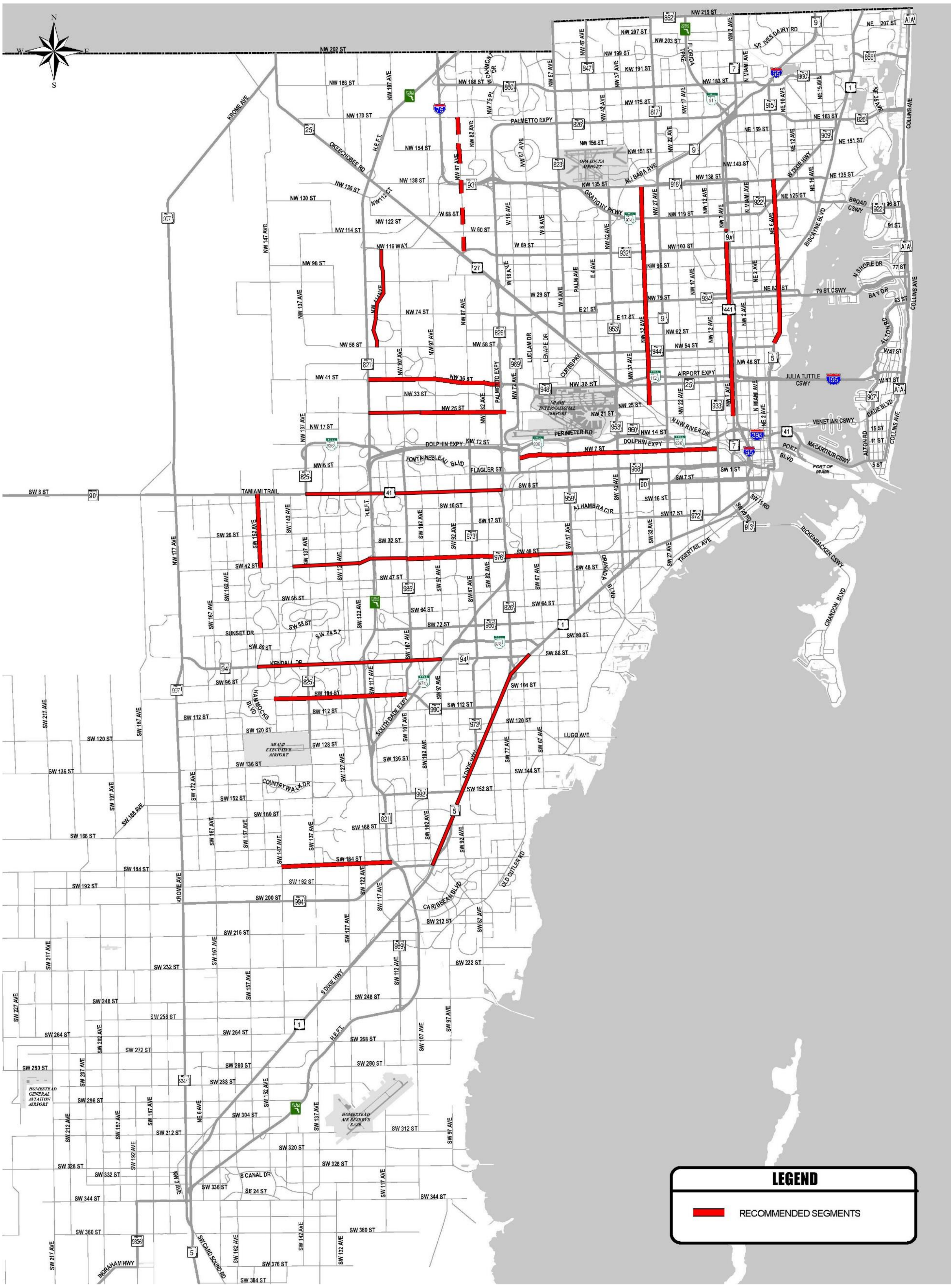


Figure 10: Recommended Corridors from the Preliminary Process

5.3.C) Field Visit

Following the results from the preliminary screening process, field visits to some of the recommended corridors were scheduled on April 29th, 2016 to better understand corridor characteristics and driver behavior.

SW 104TH Street:

SW 104th Street from SR 874 to SW 147th Avenue is a 40 mph speed limit, 6 lane divided corridor mostly abutted by residential land use (single family) with very few driveways throughout. Miami Dade College-Kendall Campus is located between SW 113th Place and SW 108th Avenue near the eastern termini. Implementing a reversible lane in this corridor may prove difficult due to this corridor being a truck route, a transit route (MDT Routes 104 and 204), having a landscaped median, and a dual left turn lane at the intersection with SW 117th Avenue.

Figure 11: SW 104th Street

SW 184th Street

SW 184th Street from the Homestead Extension of the Florida Turnpike (HEFT) to SW 147th Avenue is a five (5) Lane undivided roadway with a speed limit of 40 mph. This thoroughfare is ideal for reversible lane implementation, however, it is mostly abutted by residential land use (single family) with a high number of driveways between SW 127th Avenue and the HEFT which could pose a problem in the operation of a reversible lane.

Figure 12: SW 18TH Street

NW 7th Street

NW 7th Street from NW 57th Avenue to NW 12th Avenue is a 40 mph (posted speed) corridor mostly abutted by commercial land use. The eastern terminus at NW 12th Avenue provides access to/from eastbound SR 836/Dolphin Expressway (NW 17th Ave has SR 836/Dolphin Expressway access to/from the west). The corridor has a paved median/TWLTL from NW 57th Avenue to NW 42nd Avenue after which it alternates between paved median/TWLTL and curbside on-street parking. Traffic separators from NW 57th Avenue to NW 42nd Avenue, two (2) reduced speed School Zones, and six (6) midblock pedestrian crossings could pose a problem for a reversible lane implementation. Additionally, the corridor is served by MDT Routes 7, 238, and the City of Miami trolley. Fire Stations are also present east of NW 42nd Avenue and east of NW 12th Avenue.

Figure 13: NW 7th Street

NW 32nd Avenue

NW 32nd Avenue from NW 36th Street to NW 119th Street is a 40 mph (posted speed) roadway that has an ideal uniform 5-lane typical section from NW 36th Street to NW 103rd Street. The corridor is mostly abutted by residential land use and is served by garbage pick-up, mail delivery, and transit (MDT Route 32) routes. Given NW 32nd Avenue's proximity to industrial land use, it serves as a truck route. A reduced speed along a School Zone from NW 50th Street to NW 52nd Street and some segments of 35 mph speed limits may indicate there is a speed problem along this corridor. The corridor crosses the Florida East Coast Railroad at approximately NW 75th Street and is divided by a raised median north of NW 103rd Street.

Figure 14: NW 32nd Avenue

5.3.D) Tier Two: In-depth Screening

Following field visits to the recommended corridors from the preliminary screening process, an in-depth screening was carried out with a couple of recommendations from the SAC. For expedited implementation, minimized complexity, and reduced reconstruction, the ideal roadway geometry for reversible lane implementation would consist of a cross section having 5 lanes with the center lane functioning as a Two-Way-Left-Turn Lane (TWLTL) or a paved median (see **Figure 15** and **Figure 16**). These typical sections would allow a corridor to maintain two (2) lanes open in the off-peak direction while adding capacity to the peak direction by operating the reversible lane on the center lane. This follows the ITE recommendation of maintaining a minimum of two lanes open to traffic in each direction to avoid forcing the minor-flow direction to function near its capacity, or creating serious congestion due to lack of storage for right- and left-turning traffic. Additionally, after lane reversal, a 5 lane corridor (center TWLTL or paved median) would have the same directional capacity as the chosen minimum directional distribution volume for this study (60%-40%); see **Figure 17**. The number of lanes of each Miami-Dade County corridor is shown in **Figure 18**.

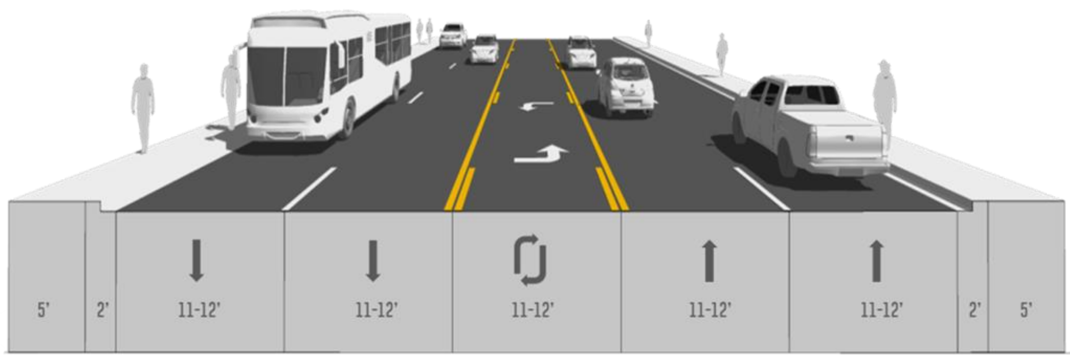


Figure 15: Typical Section of a Roadway with Center TWLTL

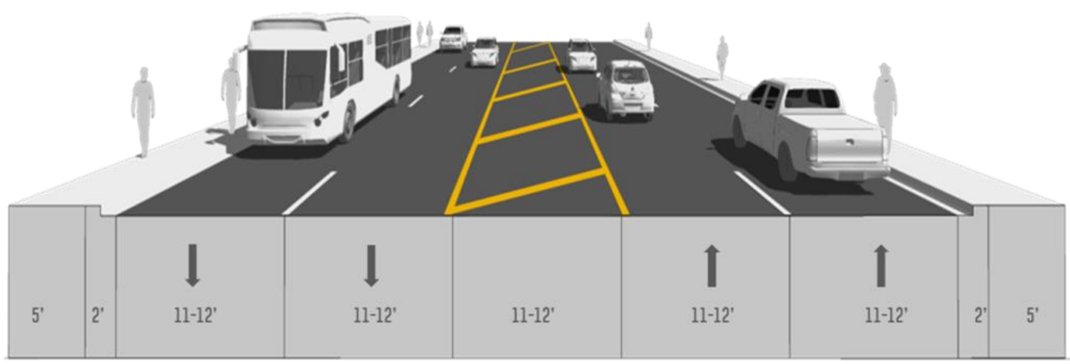


Figure 16: Typical Section of a Roadway with Paved Median

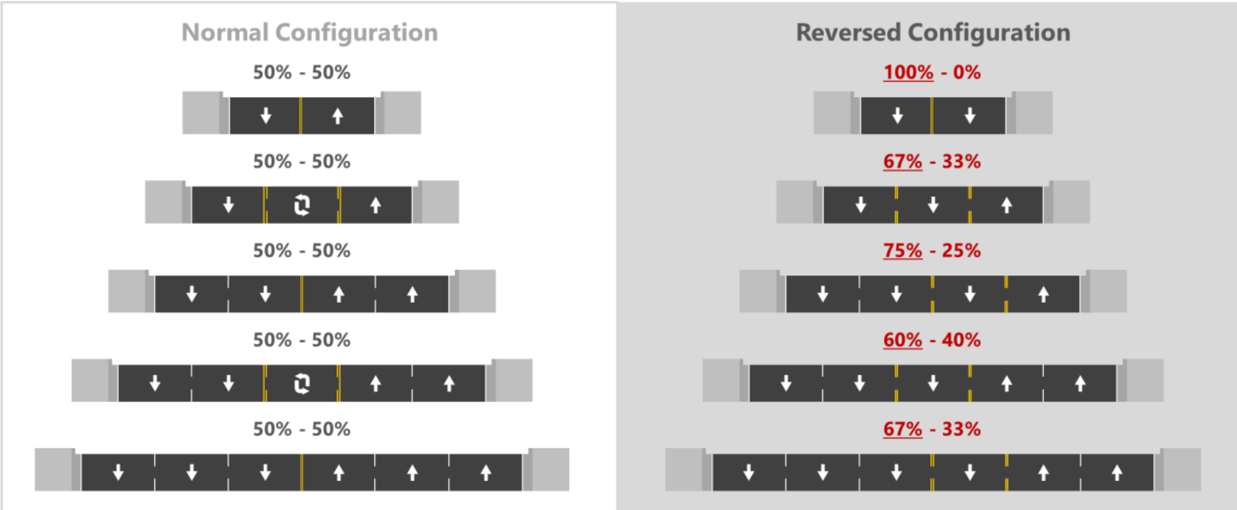


Figure 17: Shift in Directional Capacity with Reversible Lanes

Additionally, reconstruction/capacity projects programmed in the LRTP and Miami-Dade County MPO's TIP were excluded from further consideration, and roadways with raised medians, as opposed to paved medians or two-way-left-turn lanes, were screened as undesirable due the high cost and complexity of reconstruction. **Figures 19** and **20** depict roadway segments with programmed capacity improvements and roadway median type, respectively.

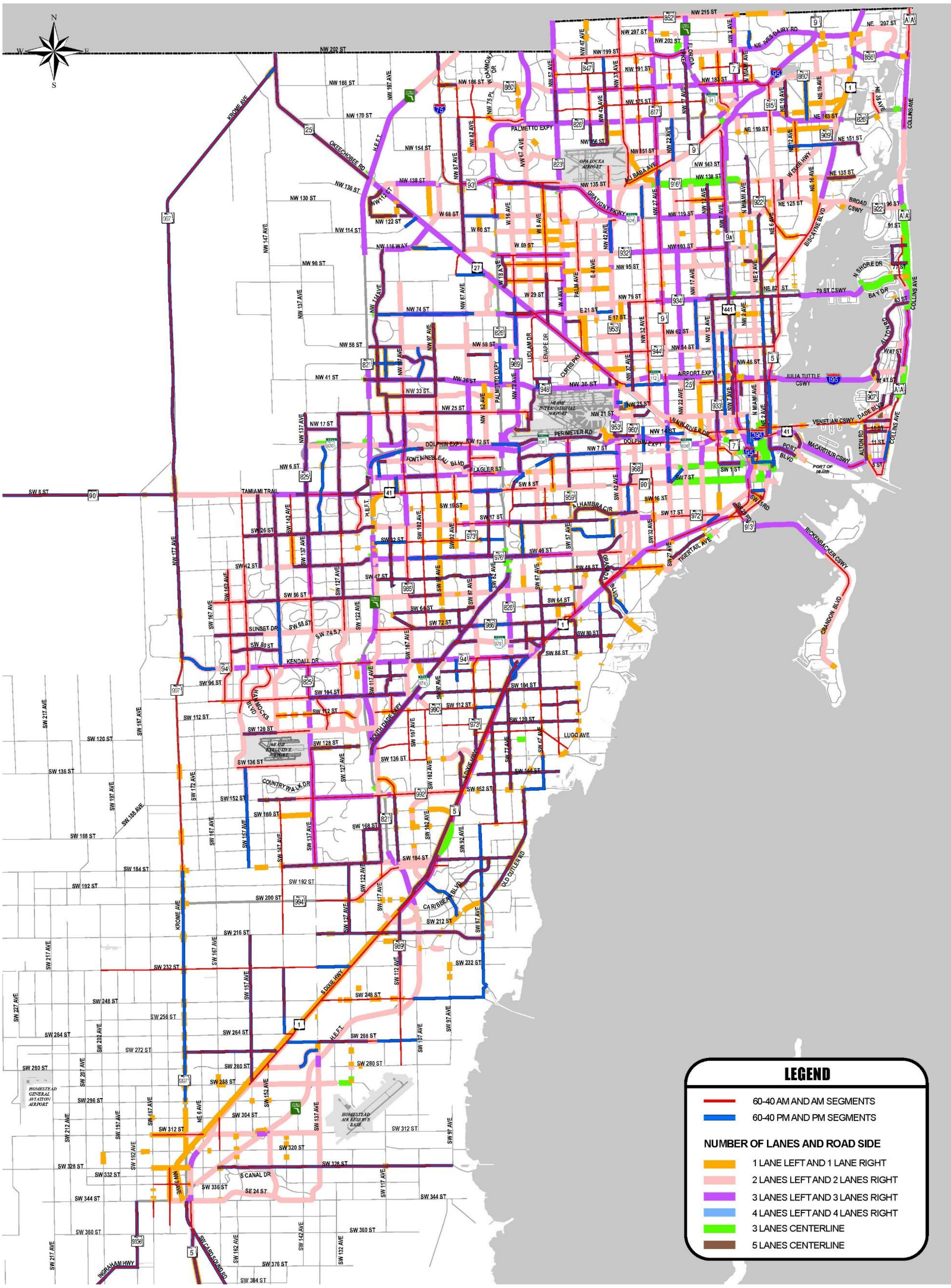


Figure 18: Miami-Dade Count Roadways by Number of Lanes

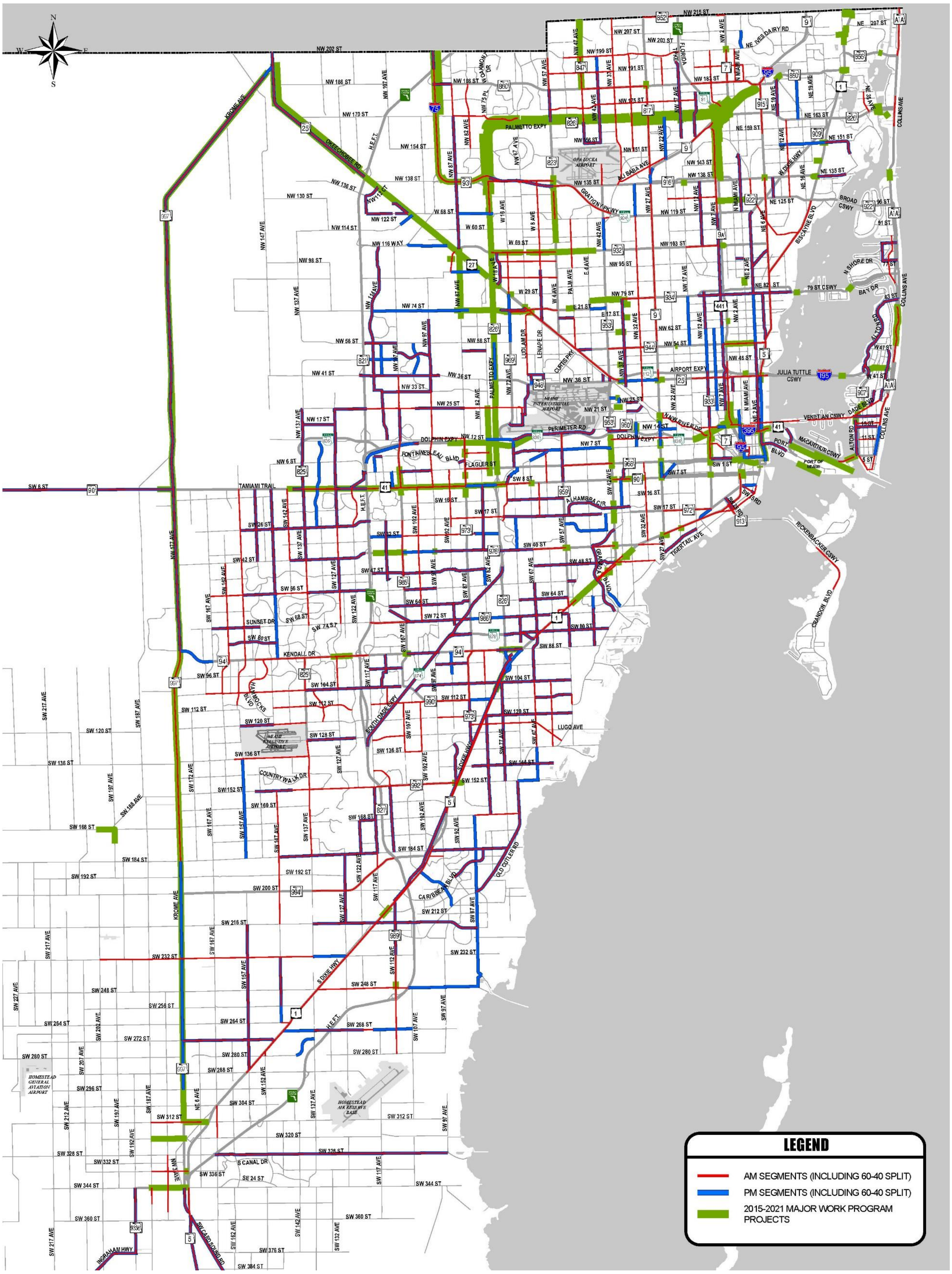


Figure 19: Major Work Program Projects

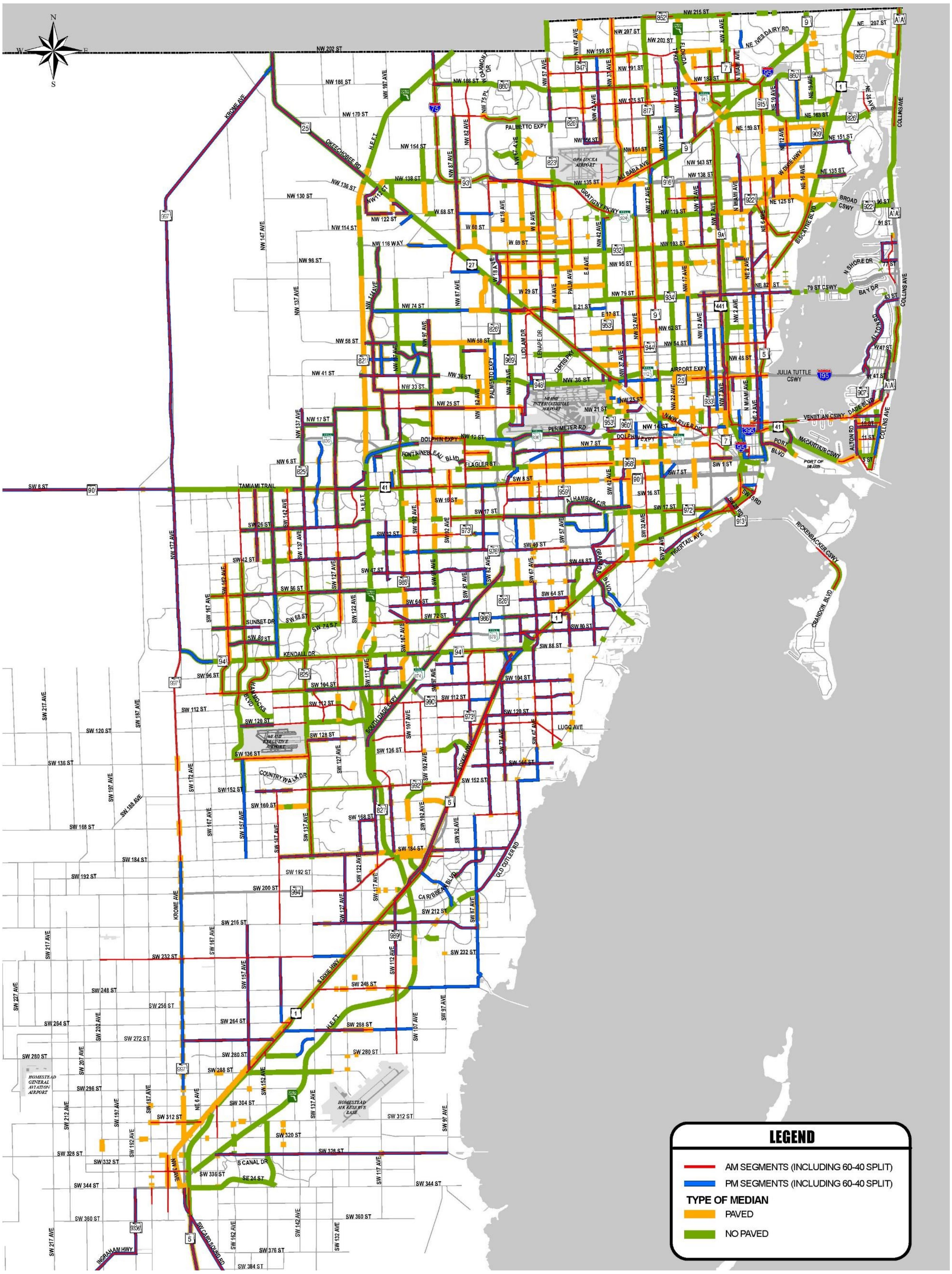


Figure 20: Miami-Dade County Roadways by Median Type

Other considerations during the in-depth screening process included preference for high daily traffic volume, low truck percentage, commercial land use surrounding the corridor, corridors with few (or no) transit routes, few signalized intersections, few (or no) school zones, lowest generic capital cost, and shorter implementation timeframe. Additional criteria including on-street parking, mid-block pedestrian crossings, railroad crossings, and issues with access management policies were considered but were not included in the matrix. The generic cost criterion was based on a per mile capital cost of $1.3 million for corridors with a raised median and $0.8 million for corridors with a paved median. This criteria, as well as the primary and secondary criteria in Tier One, were used to develop a comparative evaluation matrix to rank the recommended corridors that resulted from Tier One. **Table 3** shows the scoring system used for the comparative matrix. **Table 4** shows the comparative matrix with the resulting corridor ranking.

Table 3: Scoring Criteria

Criteria	Levels	Points
Average Directional Distribution	65% - 35%	3
	60% - 40%	2
	Less than 60% - 40%	1
Temporal frequency of 60%-40% operation during the AM and PM peak period	100% - 75%	3
	75% - 50%	2
	50% - 0%	1
Jurisdictions along the corridor	Single	2
	Multi	1
Daily Traffic Volume	60000 – 100000	10
	30000 – 60000	7
	0 – 30,000	4
Truck Traffic	Less than 10%	3
	More than 10%	1
Median	Paved	5
	Raised	1
Number of Lanes	5 lanes or more than 6 lanes	5
	6	4
	4	3
	3	2
	2	1
Adjacent Land Use	Commercial	2
	Residential	0
Number of Traffic Signals	Less than 10	2
	More than 10	0
School Zones along the corridor	No	2
	Yes	1
Transit Routes	0 - 1	2
	2 or more	1
Market Character	Urban	5
	Sub-urban	0
Traffic Pattern Impacts	Low	3
	Med	2
	High	1
Implementation Cost	$5 Million or less	5
	More than $5 Million	0

Table 4: Comparative Matrix

Jurisdiction Initiative	SECTION NUMBER	LOCAL NAME	BMP	From	EMP	To	Length	Station	Daily Volume	Truck %	60%-40% Average DD AM		AM DD (4 hours)	60%-40% Average DD PM		PM DD (5 hrs)	Median	#lanes	Primary Land Use	Transit	Signals	School Zones	Market	Traffic Impacts	Implementation & Cost (Million)	Criteria	Pros	Cons
Single	87000424	NW 7 Street	1.000	NW 62 Avenue	1.475	NW 57 Avenue	0.475	1	26260	3	66.1%	33.9%	75%	34.2%	65.8%	80%	No	5	Commercial	1	2	No	Urban	Low	Short	45	• Ideal typical cross-section between NW 63 Avenue to NW 12 Avenue • Commercial area • Parallel to SR 836 • Single jurisdiction •Cost of Implementation per mile low	• Some intersections have raised medians • Although the segment is primary commercial there are some residential units • Pedestrian crossings mid-block • School zone • Parking affected
Single	87049500	NW 7 Street	1.475	NW 57 Avenue	2.990	NW 42 Avenue	1.515	2	37890	3	52.9%	47.1%	0%	44.8%	55.2%	0%	No	5	Commercial	1	5	No	Urban	Low	Short	37		
Single	87580500	NW 7 Street	0.000	NW 42 Avenue	1.537	NW 27 Avenue	1.537	3	35970	3	52.1%	47.9%	0%	44.4%	55.6%	0%	No	5	Commercial	1	6	Yes	Urban	Low	Short	36		
Single	87580501	NW 7 Street	0.000	NW 27 Avenue	1.525	NW 12 Avenue	1.525	4	26980	3	60.8%	39.2%	75%	38.5%	61.5%	60%	No	5	Commercial	1	6	Yes	Urban	Low	Short	41		
Single		NW 7 Street	0.000	NW 62 Avenue	5.552	NW 12 Avenue	5.052		31775	3	58.0%	42.0%	38%	40.5%	59.5%	35%	No	5	Commercial	1	19	Yes	Urban	Low	Short + $5 Million	44.75		
Single	87000178	NW 32 Avenue	0.910	SR 112	1.666	NW 54 Street	0.756	5	23110	12	44.9%	55.1%	0%	61.5%	38.5%	80%	No	5	Residential	1	4	Yes	Urban	Low	Short	35	• Ideal typical section • North-south corridor parallel to I-95 • Cost of Implementation per mile low	• Median at the northern side of the corridor • RXR • Residential houses along the corridor • Truck traffic
Single	87000208	NW 32 Avenue	0.000	NW 54 Street	1.528	NW 79 Street	1.528	6	21067	12	49.6%	50.4%	0%	61.0%	39.0%	80%	No	5	Residential	1	5	Yes	Urban	Low	Short	35		
Single	87000209	NW 32 Avenue	0.000	NW 79 Street	1.558	NW 103 Street	1.558	7	24569	12	38.2%	61.8%	100%	62.3%	37.7%	80%	No	5	Residential	1	4	No	Urban	Low	Short	39		
Single	87000208	NW 32 Avenue	0.000	NW 103 Street	1.019	Gragtigny Prkwy	1.019	8	27320	12	40.0%	60.0%	75%	60.0%	40.0%	80%	Yes	4	Commercial	1	6	No	Urban	Low	Short	37		
Single		NW 32 Avenue	0.000	SR112	4.861	Gragtigny Prkwy	4.861		24017	12	43.2%	55.8%	44%	61.2%	38.8%	80%	Yes	4	Residential	1	19	Yes	Urban	Low	Short + $4.9 Million	41.5		
Multi	87000029	NW 25 Street	0.000	HEFT	1.498	NW 102 Avenue	1.498	878110	23500	*	60.7%	39.3%	50%	50.0%	50.0%	0%	No	5	Commercial	1	3	No	Urban	Low	Short	36	• Ideal typical section between HEFT and 87 Avenue • No school zones • Cost of Implementation per mile low	• Heavy truck traffic • Raised median from 87 Avenue to SR 826 • DD during the PM peak appers not to be adequate
Multi	87000184	NW 25 Street	0.000	NW 102 Street	1.530	NW 87 Avenue	1.530	877025	31000	15.8	65.4%	34.6%	100%	41.2%	58.8%	40%	No	5	Commercial	1	3	No	Urban	High	Short	38		
Multi	87000184	NW 25 Street	1.530	NW 87 Avenue	2.530	SR 826	1.000	877026	29000	17.9	63.6%	36.4%	75%	47.9%	52.1%	0%	Yes	6	Commercial	1	4	No	Urban	High	Short	32		
Multi		NW 25 Street	0.000	HEFT	4.028	SR 826	4.028		27833	16.85	63.2%	36.8%	75%	46.4%	53.6%	13%	Yes	5	Commercial	1	10	No	Urban	Med	Short + $4.1 Million	40.3		
Single	87000964	SW 152 Avenue	0.000	SW 40 Street	2.229	SW 8 Street	2.229	878691	12600	5.8	67.5%	32.5%	75%	32.6%	67.4%	100%	No	5	Residential	1	3	Yes	Sub-urban	Low	Short + $2.3 Million	40.0	• Ideal typical section • Good Directional Distribution • Cost of implementation per mile low	• Sub-urban segment, limited market
Single	87000555	NW 114 Avenue	2.244	NW 36 Street	6.320	NW 106 Street	4.076	878584	12300	7.3	77.2%	22.8%	100%	28.5%	71.5%	100%	Yes	4	Residential	1	7	Yes	Urban	Med	Short + $4.1 Million	40.0	• Portion of the segment between NW 36 Street and NW 58 Street presents the ideal typical cross-section • Cost of Implementation low	• Residential area • Raised median north of NW 58 Street • Traffic patterns could be affected by widening of NW 74 Street
Single	87140000	NW 7 Avenue	2.054	NW 20 Street	3.075	NW 36 Street	1.021	875005	23500	4.2	37.6%	62.4%	75%	66.4%	33.6%	100%	No	5	Commercial	2	5	No	Urban	Med	Long	42.00	• Ideal typical section • North-south corridor parallel to I-95 • Cost of Implementation per mile low	• New raised median segments • Complete street project by FDOT • Overall cost high • A previus study of reversible lanes was rejected.
Single	87140000	NW 7 Avenue	3.075	NW 36 Street	4.126	NW 54 Street	1.051	879030	22000	2.6	37.5%	62.5%	75%	64.5%	35.5%	80%	No	5	Commercial	2	2	No	Urban	Med	Long	41.00		
Single	87140000	NW 7 Avenue	4.126	NW 54 Street	4.695	NW 62 Street	0.569	875141	25500	5.1	41.2%	58.8%	25%	62.3%	37.7%	80%	No	5	Commercial	2	2	No	Urban	Med	Long	38.00		
Single	87140000	NW 7 Avenue	4.695	NW 62 Street	5.649	NW 79 Street	0.954	875144	24500	3	34.2%	65.8%	75%	61.2%	38.8%	60%	No	5	Commercial	2	8	No	Urban	Med	Long	41.00		
Single	87140000	NW 7 Avenue	5.649	NW 79 Street	6.112	NW 85 Road	0.463	870529	32000	3.3	37.1%	62.9%	75%	59.3%	40.7%	60%	No	5	Commercial	2	2	No	Urban	Med	Long	39.00		
Single	87140000	NW 7 Avenue	6.112	NW 85 Road	7.171	NW 103 Street	1.059	870235	32500	5.1	38.3%	61.7%	75%	67.2%	32.8%	100%	No	5	Commercial	2	3	No	Urban	Med	Long	42.00		
Single	87140000	NW 7 Avenue	7.171	NW 103 Street	8.171	NW 119 Street	1.000	875014	32500	5.1	32.8%	67.2%	100%	60.5%	39.5%	40%	No	5	Commercial	2	3	No	Urban	Med	Long	40.00		
Single	87140000	NW 7 Avenue	8.171	NW 119 Street	9.172	NW 135 Street	1.001	870128	37500	5.1	29.9%	70.1%	100%	54.5%	45.5%	0%	Yes	6	Commercial	2	3	No	Urban	Med	Long	36.00		
Single	87140000	NW 7 Avenue	9.172	NW 135 Street	10.812	Golden Glades	1.640	870436	27000	4.9	33.1%	66.9%	100%	49.2%	50.8%	0%	Yes	6	Commercial	2	5	No	Urban	Med	Long	36.00		
Single		NW 7 Avenue	0.000	NW 20 Street	8.758	Golden Glades	8.758		28556	4.27	35.7%	64.3%	78%	60.6%	39.4%	58%	Yes	6	Commercial	2	33	No	Urban	Med	Long + $8.7 Million	39.4		
Multi	87000417	NW 36 Street	0.000	HEFT	1.187	NW 107 Avenue	1.187	877081	44000	7.2	67.9%	32.1%	100%	36.0%	64.0%	100%	Yes	6	Commercial	2	1	No	Urban	Med	Low	40	• City of Doral most congested corridor • No school zone • Few signals per mile	• Recenet Traffic data not completely available between 87 Avenue and SR 826 • Heavy volume intersection at 87 Avenue Cost of Implementation per mile high
Multi	87000429	NW 36 Street	0.000	NW 107 Avenue	0.500	NW 102 Avenue	0.500	878196	44000	10.2	66.5%	33.5%	75%	38.5%	61.5%	80%	Yes	6	Residential	2	1	No	Urban	Med	Low	38		
Multi	87000181	NW 36 Street	0.000	NW 102 Avenue	0.808	NW 93 Court	0.808	877022	48500	5.2	69.1%	30.9%	100%	39.9%	60.1%	80%	Yes	6	Residential	2	2	No	Urban	Med	Low	38		
Multi	87673501	NW 36 Street	0.000	NW 93 Court	1.586	SR 826	1.586	878359	44000	*	*	*	*	*	*	*	Yes	6	Commercial	2	4	No	Urban	High	Low	38		
Multi		NW 36 Street	0.000	HEFT	4.081	SR 826	4.081		45125	7.53	67.8%	32.2%	92%	38.1%	61.9%	87%	Yes	6	Commercial	2	8	No	Urban	Med	Long + $6.6 Million	38.5		
Multi	87000030	NW 87 Avenue	0	Okeechobee Blvd	4.12	NW 169 Street	4.12	878112	10200	2.6	80.0%	20.0%	100.0%	32.8%	67.2%	80.0%	Yes	5	Residential	0	8	No	Sub-urban	Low	Short + $3.5 Million	38.0	• Ideal typical section • Cost of Implementation per mile Low	• Segment traffic not defined as several projects like the American Dream can change vehicular patterns and needs

Table 4: Comparative Matrix (Continued)

Single	87001000	Kendall Drive	2.436	SW 152 Avenue	3.962	SW 137 Avenue	1.526	871080	47000	4	63.8%	36.1%	75%	43.6%	56.4%	0%	Yes	6	Commercial	2	7	No	Urban	High	High	36		
Single	87001000	Kendall Drive	3.962	SW 137 Avenue	4.954	SW 127 Avenue	0.992	870060	70500	5.6	63.2%	36.8%	50%	42.6%	57.4%	0%	Yes	8	Commercial	2	3	No	Urban	High	High	38		
Single	87001000	Kendall Drive	4.954	SW 127 Avenue	5.951	SW 117 Avenue	0.997	870062	71500	4	72.2%	27.8%	100%	44.4%	55.6%	0%	Yes	6	Commercial	2	7	No	Urban	High	High	39		
Single	87001000	Kendall Drive	5.951	SW 117 Avenue	7.128	SW 107 Avenue	1.177	870592	60500	4.6	61.3%	38.7%	25%	43.0%	57.0%	0%	Yes	6	Commercial	2	3	No	Urban	High	High	36		
Single	87001000	Kendall Drive	7.128	SW 107 Avenue	8.136	SW 97 Avenue	1.008	870064	69500	3	62.8%	37.2%	50%	37.0%	63.0%	100%	Yes	6	Commercial	2	4	No	Urban	High	High	40		
Single		Kendall Drive	0.000	SW 152 Avenue	5.700	SW 97 Avenue	5.700		63800	4.24	64.7%	35.3%	60%	42.1%	57.9%	20%	Yes	6	Commercial	2	24	No	Urban	High	Long + $9.3 Million	37.8	• Very high demand segment	• RXR • Raised Median • Access Management policy • Premium Transit Corridor under study • Cost of Implementation High
Single	87034000	NE 6 Avenue	0.000	Biscayne Blvd	0.940	NE 103 Street	0.940	871009	9300	2.5	39.3%	60.7%	50%	54.0%	46.0%	20%	No	5	Residential	2	5	No	Urban	Med	low	33		
Single	87034000	NE 6 Avenue	0.940	NW 103 Street	2.343	NE 125 Street	1.403	871010	17200	2.3	31.9%	68.1%	75%	54.9%	45.1%	0%	Yes	4	Residential	2	4	Yes	Urban	Med	low	30		
Single	87034000	NE 6 Avenue	2.343	NE 125 Street	2.975	NE 135 Street	0.632	872539	16300	2.8	32.3%	67.7%	100%	53.7%	46.3%	0%	No	5	Residential	2	5	No	Urban	Med	low	35		
Single		NW 6 Avenue	0.000	Biscayne Blvd	2.975	NW 135 Street	2.975		14267	2.55	34.5%	65.5%	75%	54.2%	45.8%	7%	No	5	Residential	2	14	Yes	Urban	Med	Short + $3.0 Million	37.7	• Ideal typical section • Cost of Implementation per mile Low	• RXR • Raised median along the segment • DD during the PM peak appears not to be adequate
Single	87000477	SW 104 Street	0	SW 147 Avenue	0.997	SW 137 Avenue	0.997	878220	28000	3.0	75.4%	24.6%	100.0%	44.2%	55.8%	25.0%	Yes	4	Residential	2	2	No	Urban	Med	High	33		
Single	87000066	SW 104 Street	0	SW 137 Avenue	1.011	SW 127 Avenue	1.011	878125	43500	3.0	76.5%	23.5%	100.0%	38.5%	61.5%	100.0%	Yes	4	Residential	2	3	No	Urban	Med	High	38		
Single	87000066	SW 104 Street	1.011	SW 127 Avenue	2.942	SR 874	1.931	878126	61000	3.0	71.7%	28.3%	100.0%	33.9%	66.1%	100.0%	Yes	4	Residential	2	7	No	Urban	Med	High	41		
Single		SW 104 Street	0	SW 147 Avenue	2.942	SR 874	2.942		35750	3.0	76.0%	24.1%	100.0%	41.4%	58.7%	62.5%	Yes	4	Residential	2	12	No	Urban	Med	High + $ 5.1 Million	37.3	• Connectivity to two expressways	• Residential Area • Four lane section road with lanscaping median • Cost of implementatiion High
Single	87000225	SW 184 Street	0.000	SW 147 Avenue	1.256	SW 134 Avenue	1.256	878170	18100	3.4	60.3%	39.7%	50%	46.0%	54.0%	0%	No	4	Residential	1	3	No	Sub-urban	Low	Short	28		
Single	87000084	SW 184 Street	0.000	SW 134 Avenue	1.774	SW 117 Avenue	1.774	877009	33000	4.4	68.5%	31.5%	100%	39.9%	60.1%	80%	No	4	Residential	1	4	No	Sub-urban	Low	Short	35		
Single		SW 184 Street	0.000	SW 147 Avenue	3.030	SW 117 Avenue	3.030		25550	3.9	64%	36%	75%	43.0%	57.1%	40%	No	4	Residential	1	7	No	Sub-urban	Low	Long + $3.1 Million	36.5	• Few intersections • Cost of Implementation per mile Low	• Sub-urban segment • Residential area
Single	87120000	SW 8 Street	4.010	SW 137 Avenue	5.028	SW 127 Avenue	1.018	870088	43500	5.9	65.8%	34.2%	100%	42.8%	57.2%	0%	Yes	6	Commercial	2	3	No	Urban	High	High	37		
Single	87120000	SW 8 Street	5.028	SW 127 Avenue	5.991	HEFT	0.963	872561	55000	5.9	68.6%	31.4%	100%	41.9%	58.1%	40%	Yes	8	Commercial	2	2	No	Urban	High	High	38		
Single	87120000	SW 8 Street	5.991	HEFT	7.045	SW 107 Avenue	1.054	870090	55000	3.8	64.6%	35.4%	100%	53.5%	46.5%	0%	Yes	6	Commercial	2	4	No	Urban	High	High	36		
Single	87120000	SW 8 Street	7.045	SW 107 Avenue	9.056	SW 87 Avenue	2.011	870589	57000	6.6	63.4%	36.6%	50%	46.2%	53.8%	0%	Yes	8	Commercial	2	6	No	Urban	High	High	36		
Single	87120000	SW 8 Street	9.056	SW 87 Avenue	10.021	SR 826	0.965	870092	69000	3.8	57.5%	42.5%	25%	38.7%	61.3%	0%	Yes	6	Commercial	2	3	No	Urban	High	High	36		
Single		SW 8 Street	0.000	SW 137 Avenue	6.011	SR 826	6.011		55900	5.20	64.0%	36.0%	75%	44.6%	55.4%	8%	Yes	8	Commercial	2	18	No	Urban	High	Long + $9.8 Million	36.6	• Very high demand segment	• DD during the PM peak appears not to be adequate • Raised Median • Access Management policy • Corridor under study by FDOT with multi-modal goals. • Cost of Implementation High
Multi	87000139	SW 40 Street	0.000	SW 142 Avenue	2.391	HEFT	2.391	877017	34000	3.1	69.7%	30.3%	100%	37.4%	62.6%	80%	Yes	4	Commercial	2	7	No	Urban	High	High	36		
Multi	87044000	SW 40 Street	0.000	HEFT	1.142	SW 107 Avenue	1.142	870072	52000	3.9	60.3%	39.7%	25%	46.0%	54.0%	0%	Yes	6	Commercial	2	5	No	Urban	High	High	33		
Multi	87044000	SW 40 Street	1.142	SW 107 Avenue	2.151	SW 97 Avenue	1.009	870074	54500	5.3	58.7%	41.3%	25%	38.7%	61.3%	80%	Yes	6	Commercial	2	4	Yes	Urban	High	High	34		
Multi	87044000	SW 40 Street	2.151	SW 97 Avenue	3.144	SW 87 Avenue	0.993	870076	54500	5.3	67.2%	32.8%	75%	38.6%	61.4%	80%	Yes	6	Commercial	2	2	No	Urban	High	High	39		
Multi	87044000	SW 40 Street	3.144	SW 87 Avenue	4.223	SR 826	1.079	870078	72000	5.3	61.6%	38.4%	50%	38.9%	61.1%	80%	Yes	6	Commercial	2	6	No	Urban	High	High	39		
Multi	87044000	SW 40 Street	4.223	SR 826	5.200	SW 67 Avenue	0.977	871050	70500	4.4	70.0%	30.0%	100%	40.5%	59.5%	40%	Yes	6	Commercial	2	3	No	Urban	High	High	38		
Multi	87044000	SW 40 Street	5.200	SW 67 Avenue	6.219	SW 57 Avenue	1.019	870080	51500	5.3	64.4%	35.6%	75%	42.2%	57.8%	20%	Yes	6	Commercial	2	2	No	Urban	High	High	35		
Multi		SW 40 Street	0.000	SW 142 Avenue	6.219	SW 57 Avenue	6.219		55571	5	65%	35%	64%	40.3%	59.7%	54.3%	Yes	6	Commercial	2	29	Yes	Urban	High	Long + $10.5 Million	36.3	• Connectivity to two expressways • Very high traffic demand • Most segment can be considered commercial	• Congested intersections such as 107 & 87 Avenue could pose difficulty for reversed flows • Raised Median • Access Management policy • Multi-jurisdiction coordination • Corridor under study by FDOT with multi-modal goals • Cost of Implementation High
Multi	87020000	US-1	12.014	SW 112 Avenue	14.139	SW 183 Street	2.125	870346	53500	6	71.3%	28.7%	100%	42.4%	57.6%	0%	Yes	6	Commercial	2	4	No	Urban	High	High	36		
Multi	87020000	US-1 NB/SB	14.139	SW 183 Street	15.265	US-1 Split	1.126	872563	59000	5.2																		
Multi	87020000	US-1	15.265	US-1 Split	17.387	SW 136 Street	2.122	870332	65500	5.2	72.4%	27.6%	100%	42.9%	57.1%	0%	Yes	6	Commercial	2	7	No	Urban	High	High	38		
Multi	87020000	US-1	17.387	SW 136 Street	19.071	SW 112 Street	1.684	870014	79000	2.6	66.8%	33.2%	75%	43.3%	56.7%	0%	Yes	6	Commercial	2	6	No	Urban	High	High	38		
Multi	87020000	US-1	19.071	SW 112 Street	20.042	SR 826	0.971	870110	91500	5.2	65.1%	34.9%	75%	39.4%	60.6%	40%	Yes	6	Commercial	2	1	No	Urban	High	High	39		
Multi	87030000	US-1	0.000	SR 826	0.840	Kendall Drive	0.840	872532	48000	5.3	54.8%	45.2%	25%	40.9%	59.1%	40%	Yes	6	Commercial	2	5	No	Urban	High	High	32		
Multi	87030000	US-1	0.840	Kendall Drive	1.284	SR 878	0.444	870163	52000	3.7	54.7%	45.3%	25%	38.8%	61.2%	80%	Yes	6	Commercial	2	2	No	Urban	High	High	33		
Multi		US-1	0.000	SW 112 Avenue	9.312	SR 878	9.312		64071	4.74	64.2%	35.8%	67%	41.3%	58.7%	27%	Yes	6	Commercial	2	25	No	Urban	High	Long + $15.2 Million	36.0	• Very high demand segment	• Raised Median • Access Management policy • Multi-jurisdiction coordination • Corridor under study by FDOT with multi-modal goals • Cost of Implementation High

6) STUDY RESULTS

Based on the Comparative Matrix two (2) corridors ranked highest out of the fifteen (15) corridors resulting from Tier One. These two (2) corridors are NW 7th Street and NW 32nd Avenue. Even though these two (2) corridors scored the highest, meaning they are the most suitable thoroughfares for implementation of a reversible lane system, they both present challenges moving forward. These challenges pertain to the characteristics of each corridor as described in more detail on **Pages 24** and **25**.

NW 7th Street

- AM peak spatial directional distribution
- AM peak temporal directional distribution
- PM peak spatial directional distribution
- PM peak temporal directional distribution
- Number of reduced speed School Zones

NW 32nd Avenue

- AM peak spatial directional distribution
- AM peak temporal directional distribution
- PM peak spatial directional distribution
- Percent of truck traffic
- Number of reduced speed School Zones
- Surrounding land use

The existing conditions for NW 7th Street and NW 32nd Street are depicted in **figures 21** and **22**, respectively, within the analyzed limits (i.e. from NW 57th Avenue to NW 12th Avenue for NW 7th Street and from NW 36th Street to NW 119th Street for NW 32nd Avenue).

Figure 21: NW 7th Street Existing Conditions

Figure 22: NW 7th Street Existing Conditions

6.1) Corridor Visualization

As part of this study both resulting corridors were visualized to graphically illustrate how a reversible lane system would look in their corresponding environments. This effort was done based on design criteria obtained during the literature review process and field visits. The design criteria used is as follows:

a) Static Signs
   - One (1) overhead mounted panels at each termini to inform drivers reversible lane will end
   - One (1) single post ground mounted on each direction every 2,000 feet to inform drivers of center lane restriction period

Figure 23: Reversible Lanes Static Signs

b) Dynamic Message Signs (DMS)
   - One (1) sign at each termini to inform drivers reversible lane is ahead

Figure 24: Digital Message Sign (DMS)

c) Lane Use/Blank Out Signals
   - Three (3) signal heads in each direction every 1,000 feet to signal the lane use status (open, close, transition, TWLTL)

Figure 25: Lane Use/Blank Out Signals

d) Closed Circuit Television (CCTV) Cameras
   - One (1) on each direction every mile to monitor traffic, lane use signals, and DMSs

Figure 26: Close Circuit Television (CCTV) Camera

e) Bluetooth Traffic Detection Device
   - One (1) per midblock (between signalized intersections) to monitor traffic congestion and travel times

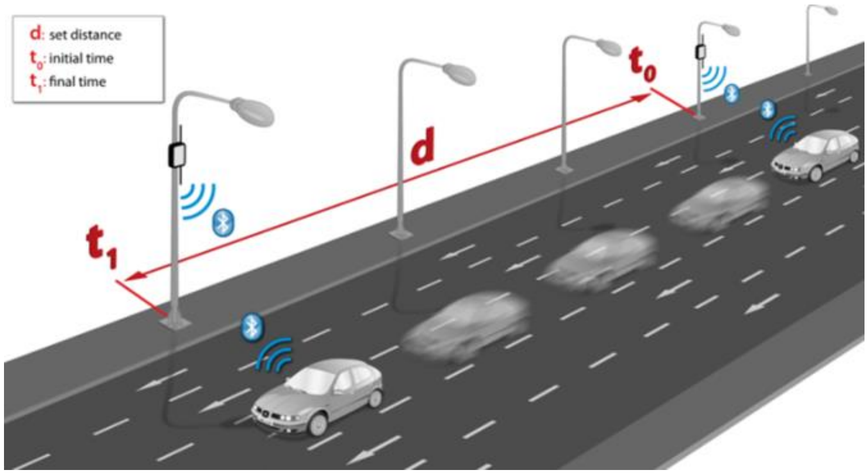


Figure 27: Bluetooth Travel Time Detection System

f) Microwave Vehicle Detection
   - Three (3) per mile to monitor vehicular volumes

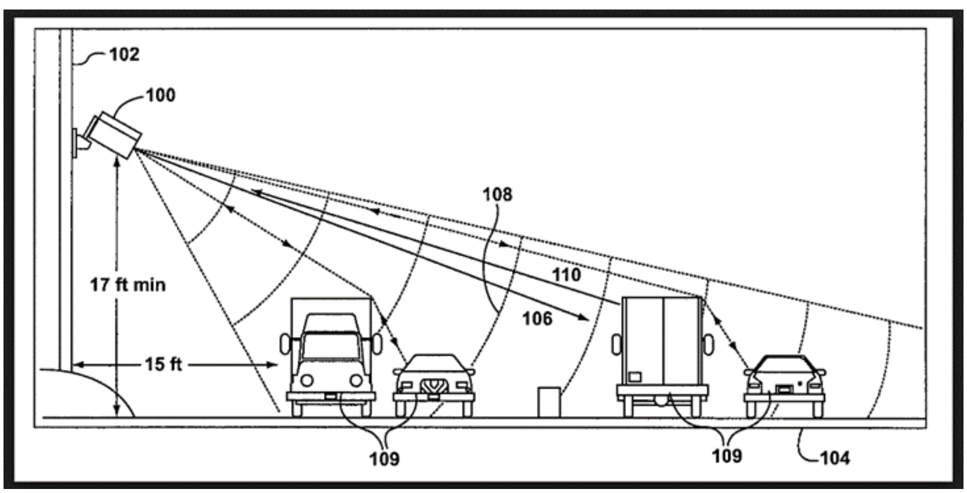


Figure 28: Microwave Volume Monitoring System

Figures 29 through **32** show the resulting corridor visualization and amount of design items needed for NW 7th Street and NW 32nd Avenue, respectively, as well as quantify all affected existing features.

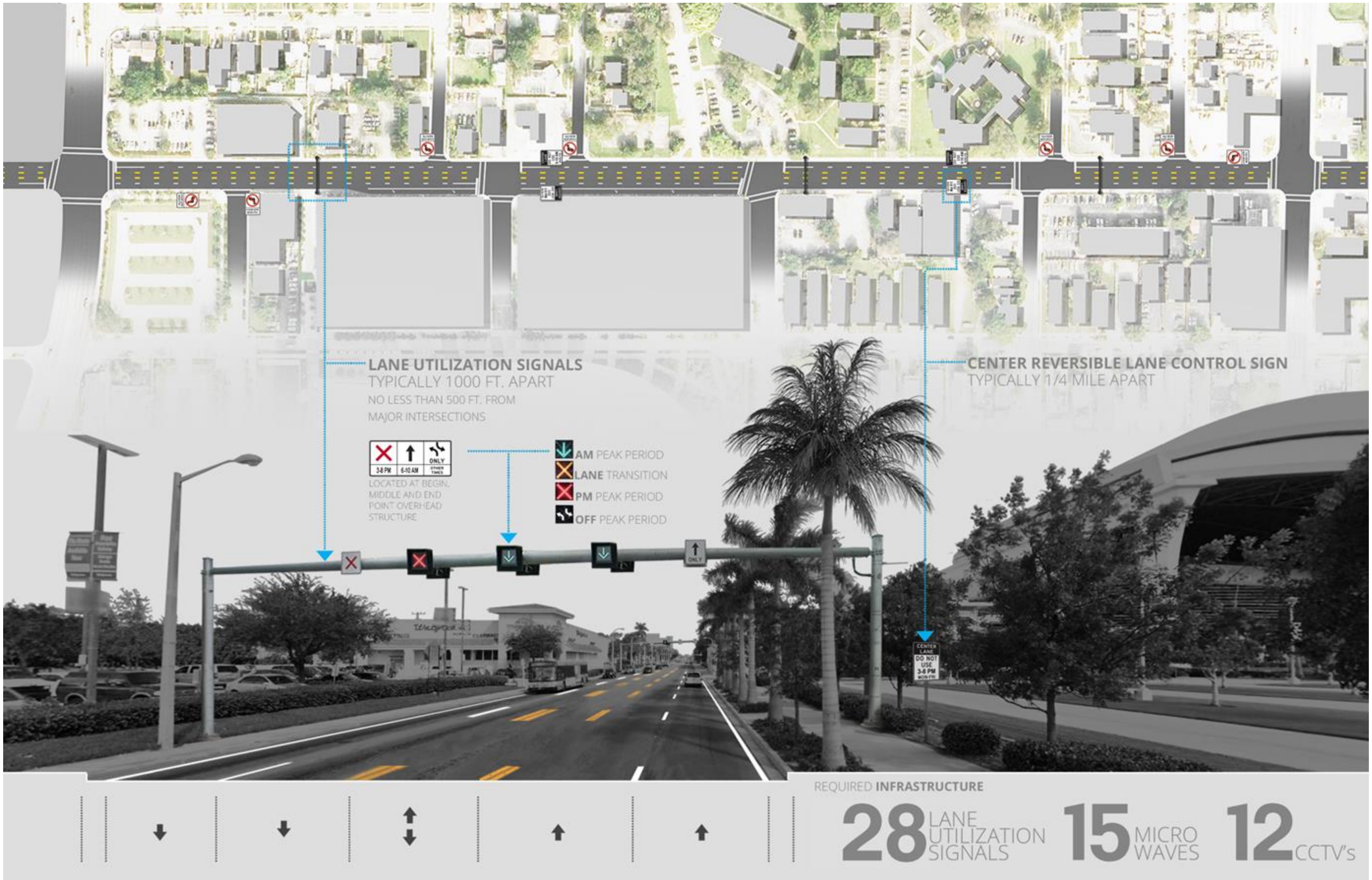


Figure 29: Visualization of the NW 7th Street Reversible Lane System

Figure 30: Detail and Cost of the NW 7th Street Reversible Lane System

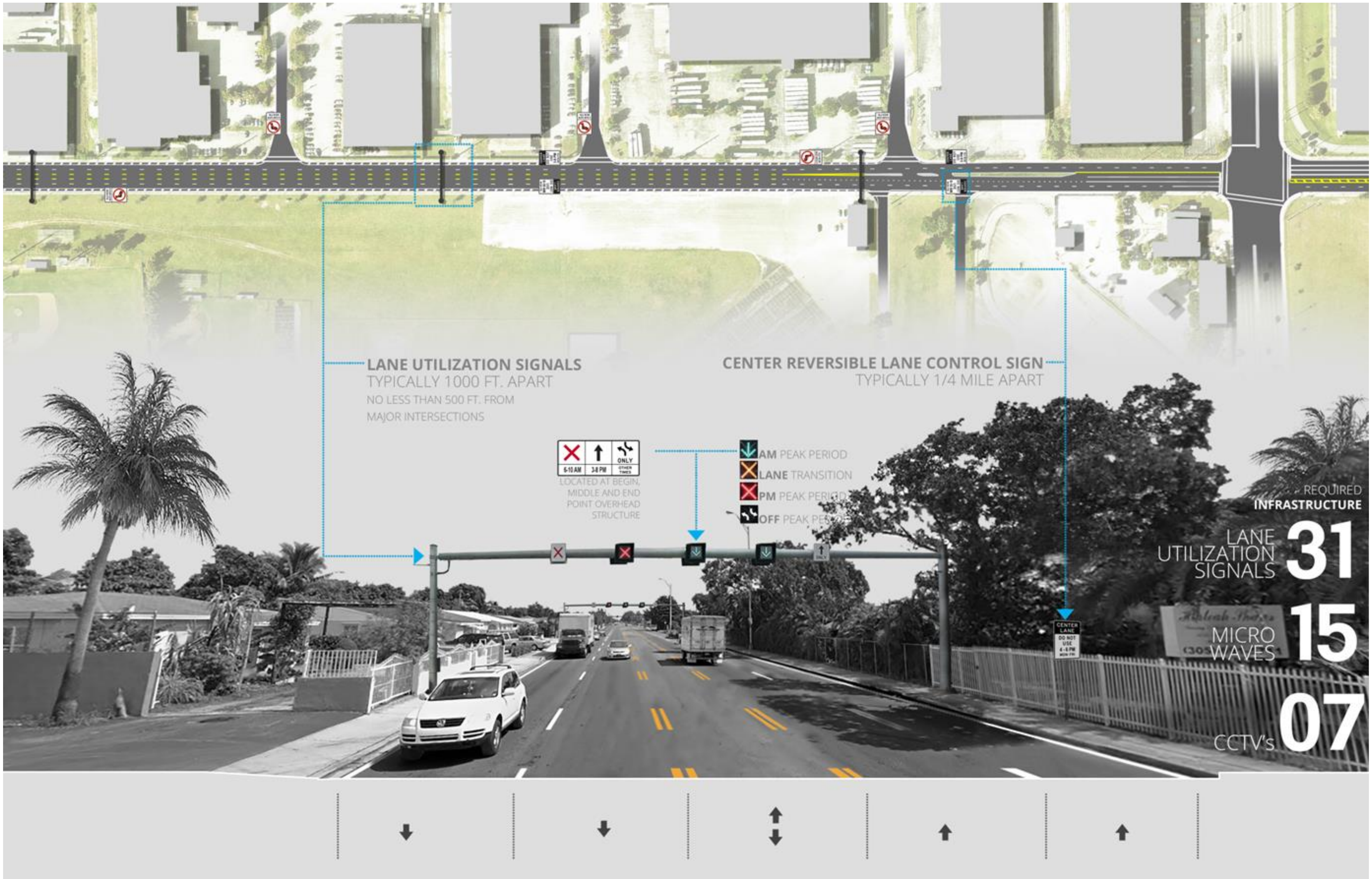


Figure 31: Visualization of the NW 32nd Street Reversible Lane System

Figure 32: Detail and Cost of the NW 32nd Street Reversible Lane System

6.2) Capital and Operating & Maintenance Cost Estimate

Based on the corridor visualization and amount of needed design elements a capital cost estimate and operating & maintenance (O&M) cost estimate for both thoroughfares was created. These cost estimates are based on FDOT District Six historical pay item costs and the cost for existing signal modification came from Miami-Dade County Transportation and Public Works Department. **Tables 5** and **6** show the cost estimates for both NW 7th Street and NW 32nd Avenue.

Table 5: Cost Estimate for the NW 7th Street Reversible Lane System

NW 7th Street (4.5 miles)				
Description	**Units**	**Quantity**	**Capital Costs**	**Annual O&M Costs**
Median Removal	Acres	0.14	$1,526	-
Pavement	Square Yards	161,568	$1,300,723	-
Striping	Gross Miles	18	$69,655	-
Signing	Assembly	28	$30,186	-
Existing Signal Modification	Each	19	$475,000	-
Dynamic Message Signs	Each	2	$390,514	$4,650
Lane Use/Blank Out Signals	Each	168	$2,626,301	$52,920
CCTV Cameras	Each	12	$485,900	$62,268
Bluetooth Vehicle Detection	Each	18	$669,712	$16,578
Microwave Vehicle Detection	Each	14	$611,887	$28,158
Electrical Service Points	Each	5	$29,720	-
Electrical Wiring/Conduits/Fiber Optic	Linear Feet	24,235	$670,588	$31,675
			$7,361,712	**$196,250**

Table 6: Cost Estimate for the NW 32nd Avenue Reversible Lane System

NW 32nd Avenue (5.0 miles)				
Description	**Units**	**Quantity**	**Capital Costs**	**Annual O&M Costs**
Median Removal	Acres	1.36	$14,436	-
Pavement	Square Yards	178,816	$1,636,331	-
Striping	Gross Miles	20	$77,091	-
Signing	Assembly	30	$32,167	-
Existing Signal Modification	Each	19	$475,000	-
Dynamic Message Signs	Each	2	$390,514	$4,650
Lane Use/Blank Out Signals	Each	156	$2,438,708	$49,140
CCTV Cameras	Each	13	$526,391	$67,457
Bluetooth Vehicle Detection	Each	18	$669,712	$16,578
Microwave Vehicle Detection	Each	16	$699,299	$32,81
Electrical Service Points	Each	6	$35,664	-
Electrical Wiring/Conduits/Fiber Optic	Linear Feet	26,822	$742,176	$35,057
			$7,737,490	**$205,063**

6.3) Next Steps

In order to successfully implement reversible lanes along NW 7th Street and NW 32nd Avenue, a Project Development and Environmental (PD&E) Study will have to be carried out by the Miami-Dade County Department of Transportation and Public Works. This would require:

- A refinement of the preliminary conceptual alternatives
- A detailed traffic operations analysis study
- A detailed multimodal safety study
- A detailed adjacent property access impact analysis
- An analysis of expressway accessibility
- An analysis of social and environmental impacts
- A compatibility analysis with special events at Marlins Park
- And community and stakeholder engagement

Additionally, apart from the design items discussed previously, the physical implementation will include:

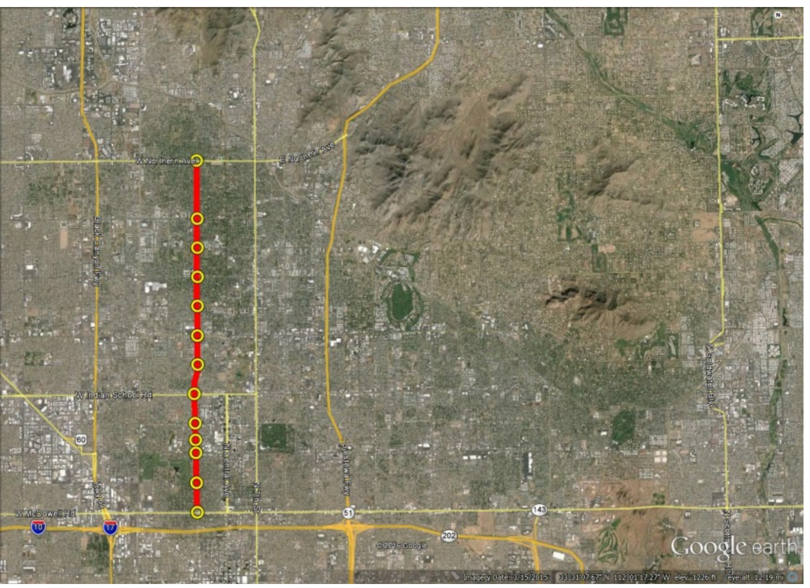
- Milling and resurfacing existing asphalt pavement,
- Minor reconstruction of existing medians and traffic separators,
- Installation of new pavement markings and signing,
- Installation of new intelligent transportation systems (ITS) and traffic control devices, and
- Utility coordination and potential relocation.

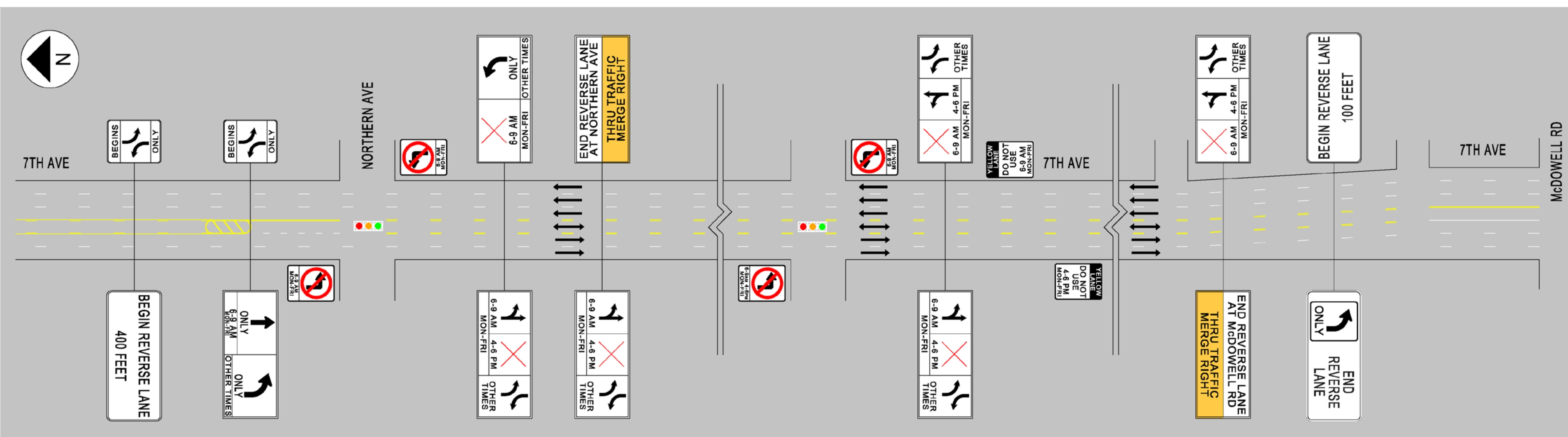
Appendix A:

Sample of Nationwide Roadways with Reversible Lane System

Phoenix, AZ

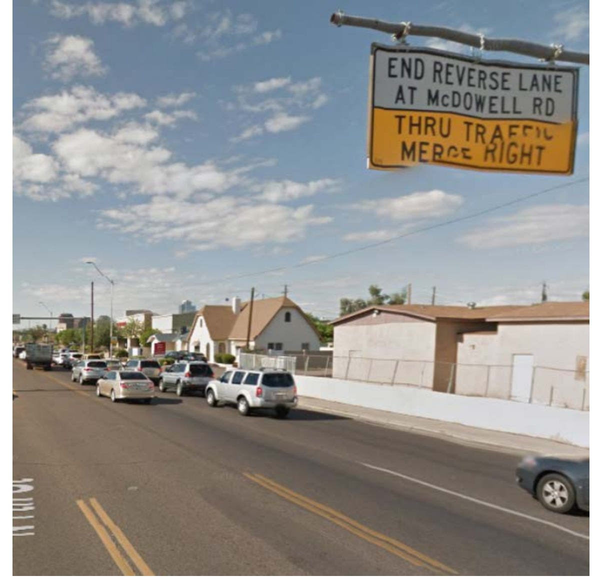
- 7th Avenue between McDowell Road and Northern Avenue
- Length: 5.88 miles
- Speed Limit: 35 mph/40mph South/North of Missouri Avenue
- Number of Lanes: 6 lanes
- Access Management: No median
- Land Use: Mostly residential with some commercial areas
- Configuration:
  - Morning peak (6:00 AM – 9:00 AM): 3 NB lanes, 2 SB lanes, and a SB reversible center lane
  - Afternoon peak (4:00 PM to 6:00 PM): 3 NB lanes, 2 SB lanes, and a NB reversible center lane
  - All other times: 3 NB lanes, 2 SB lanes, and the center lane operating as a TWLTL
- Left turns are prohibited during peak hours
- No parking allowed
- Bus route

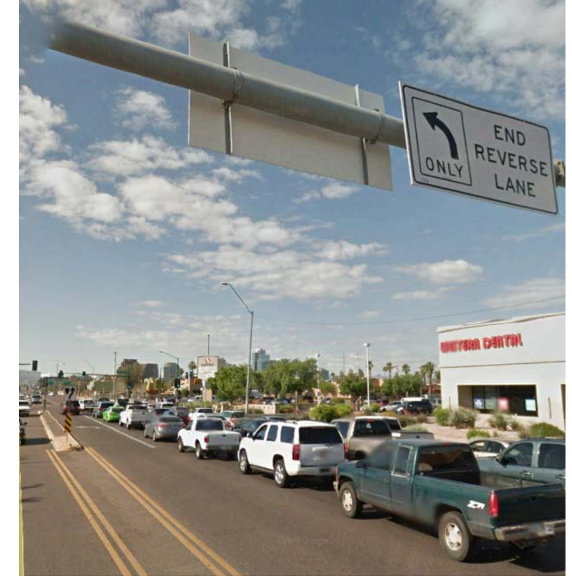


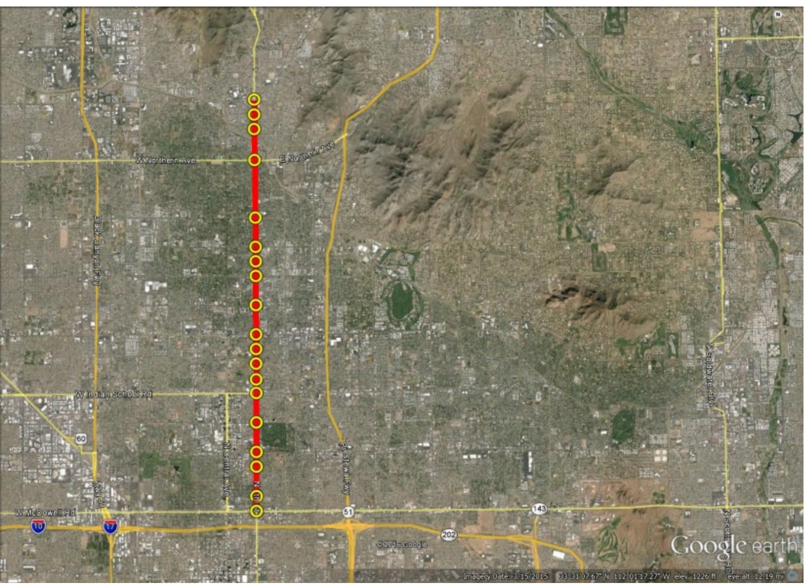


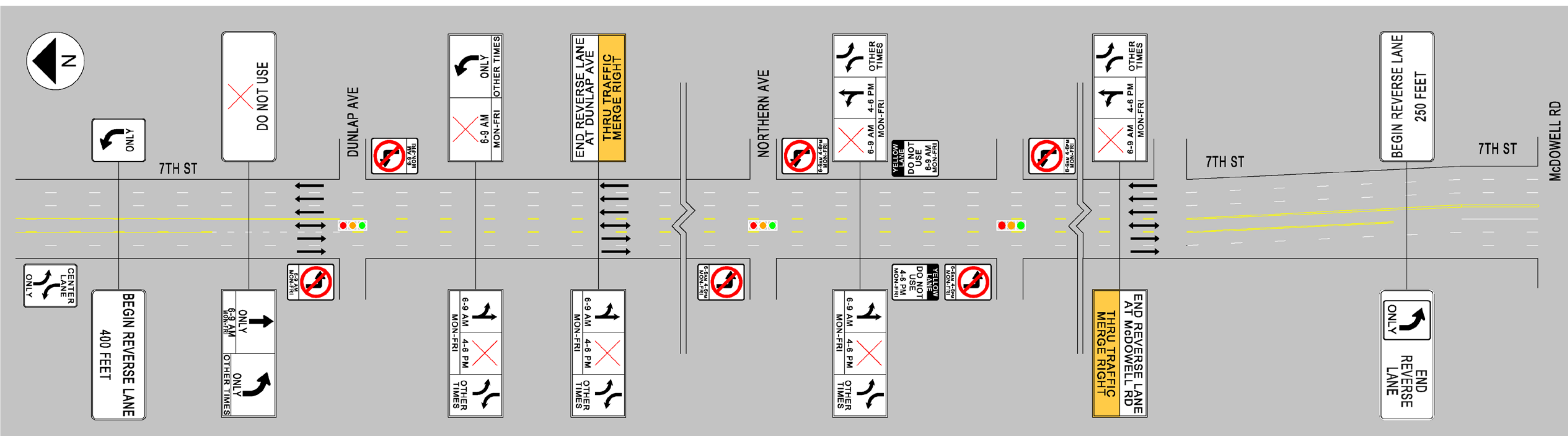
Phoenix, AZ

- 7th Street between McDowell Road and Cave Creek Road/Dunlap Avenue
- Length: 6.93miles
- Speed Limit: 35 mph/40mph South/North of Missouri Avenue
- Number of Lanes: 6 lanes
- Access Management: No median
- Land Use: Mostly residential with some commercial areas
- Configuration:
  - Morning peak (6:00 AM – 9:00 AM): 3 NB lanes, 2 SB lanes, and a SB reversible center lane
  - Afternoon peak (4:00 PM to 6:00 PM): 3 NB lanes, 2 SB lanes, and a NB reversible center lane
  - All other times: 3 NB lanes, 2 SB lanes, and the center lane operating as a TWLTL
- Left turns are prohibited during peak hours at 12 signalized intersections.
- No parking allowed
- Bus route



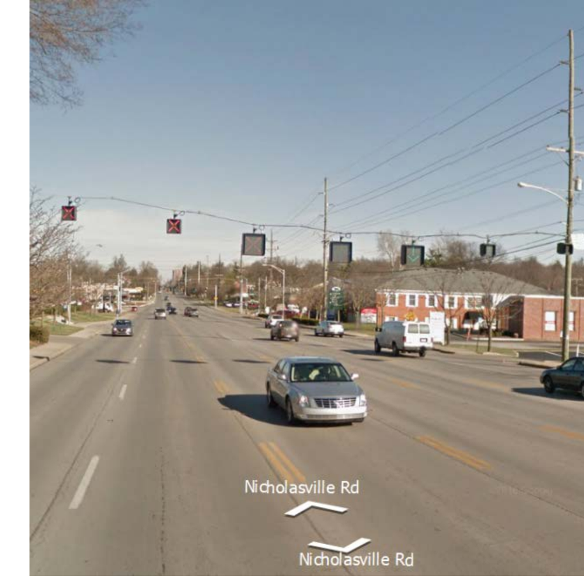


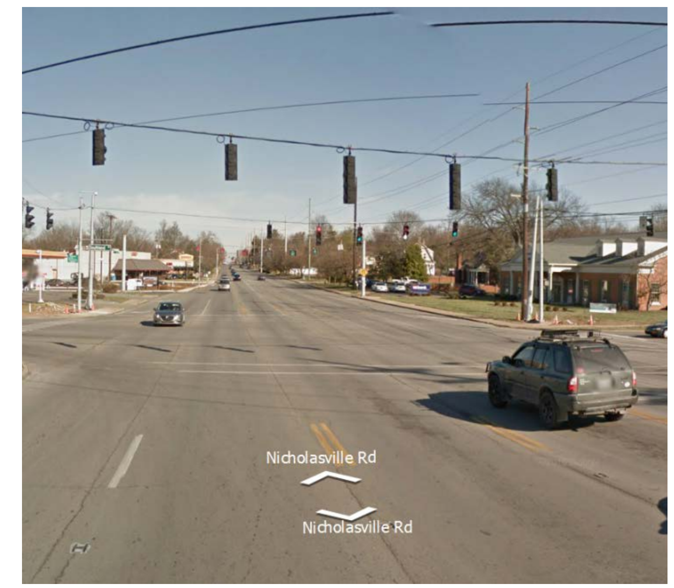


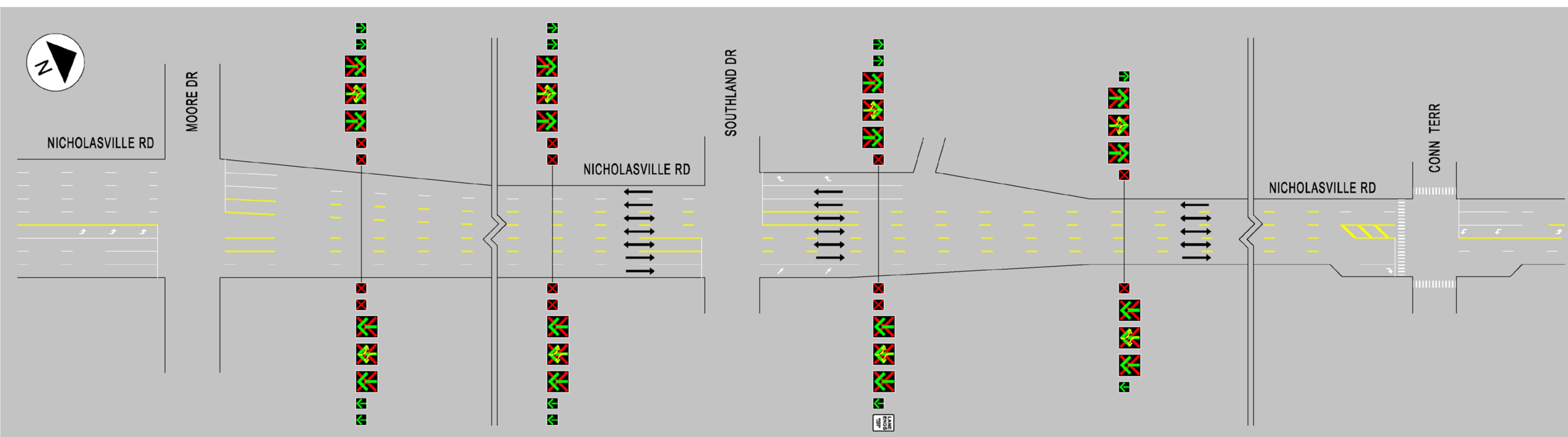


Lexington, KY

- Nicholasville Road (U.S. Highway 27) between Moore Drive and Rose Street
- Length: 2.16 miles
- Speed Limit: 40 mph
- Number of Lanes: 5 lanes north and 7 lanes south of Southland Dr.
- Access Management: No median
- Land Use: Residential, Commercial, and Institutional
- Configuration:
  - Morning peak/before Football Games: UK Campus to Southland Dr.: 4 NB lanes, 1 SB lane
    Southland Dr. to New Circle Rd: 5 NB lanes, 2 SB lane
  - Afternoon peak/after Football Games: UK Campus to Southland Dr.: 1 NB lane, 4 SB lane
    Southland Dr. to New Circle Rd.: 2 NB lanes, 5 SB lanes
  - All other times: UK Campus to Southland Dr.: 2 NB lane, 2 SB lane, 1 TWLTL
    Southland Dr. to New Circle Rd: 3 NB lanes, 3 SB lanes, 1 TWLTL
- Bus route
- Snow emergency route

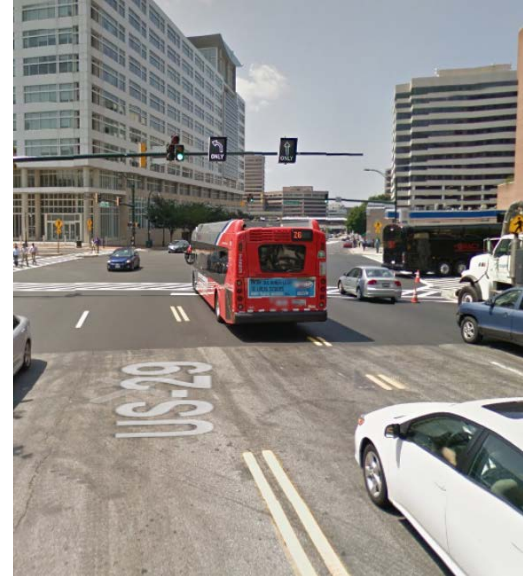


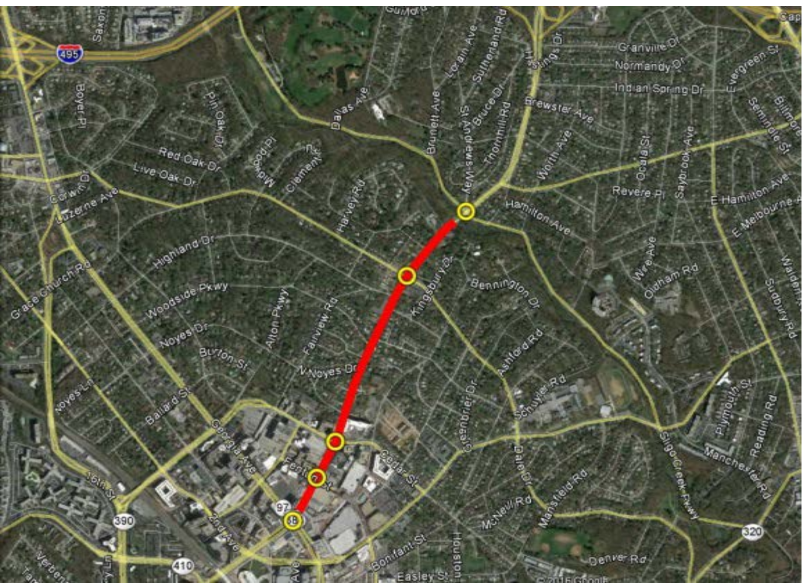


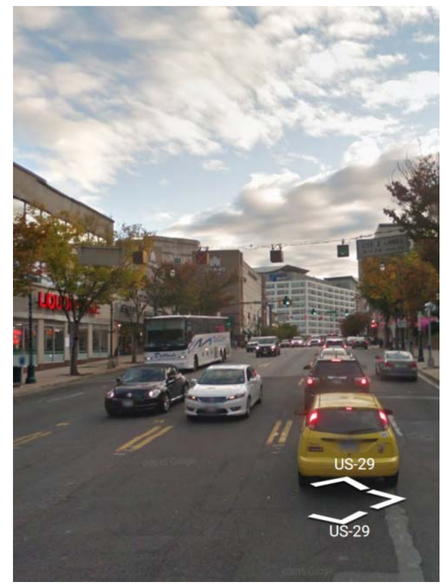


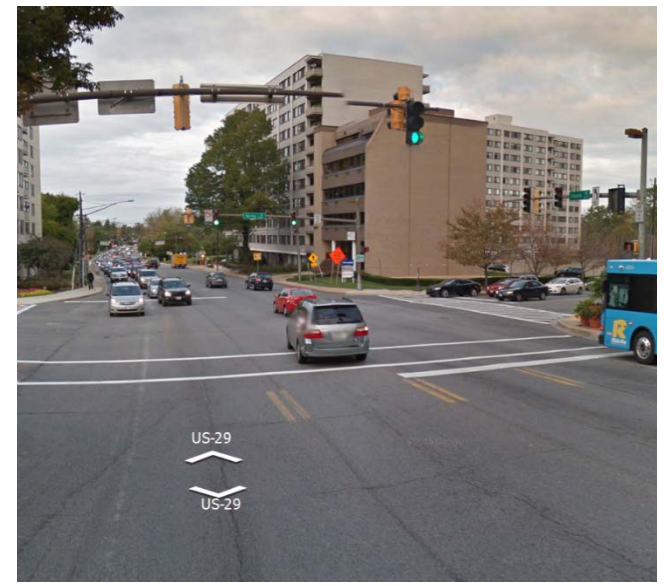
Silver Spring, MD

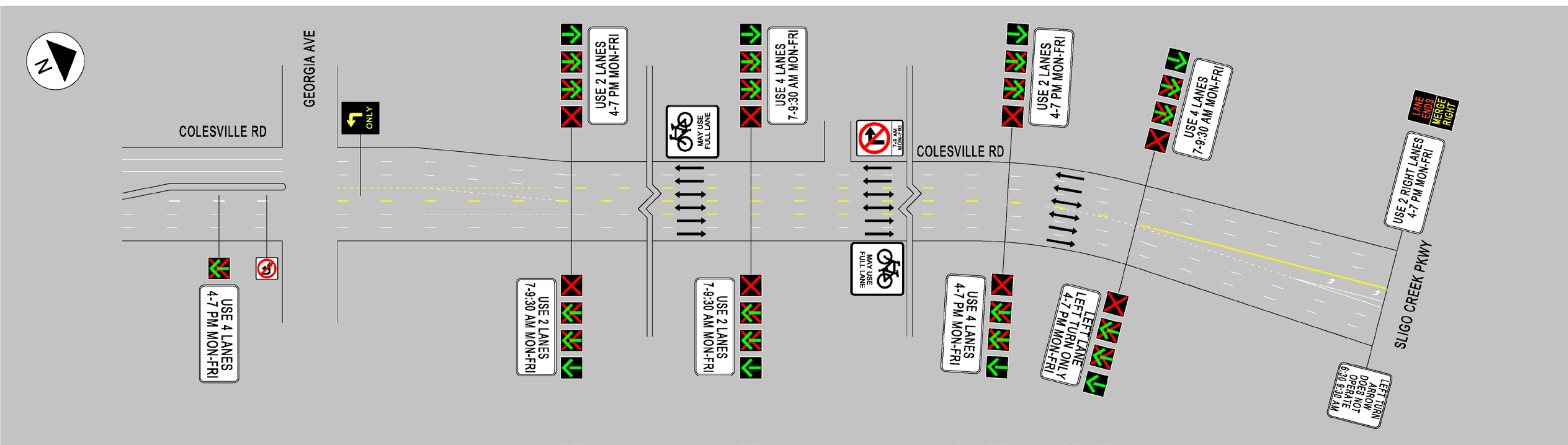
- Colesville Road between Georgia Avenue and Sligo Creek Parkway
- Length: 0.83
- Speed Limit: 30 mph/35mph South/North of Spring Street
- Number of Lanes: 6 lanes
- Access Management: No median
- Land Use: Commercial and residential
- Configuration:
  - Morning peak: 2 NB lanes and 4 SB lanes
  - Afternoon peak: 4 NB lanes and 2 SB lanes
  - All other times: 3 NB lanes and 3 SB lanes
- No parking allowed during peak hours
- Bus Route
- Bicycle may use full lane





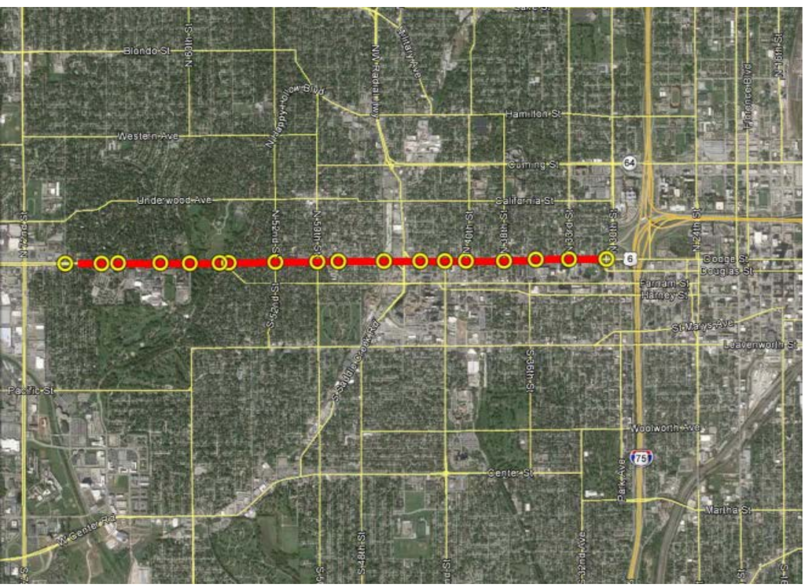


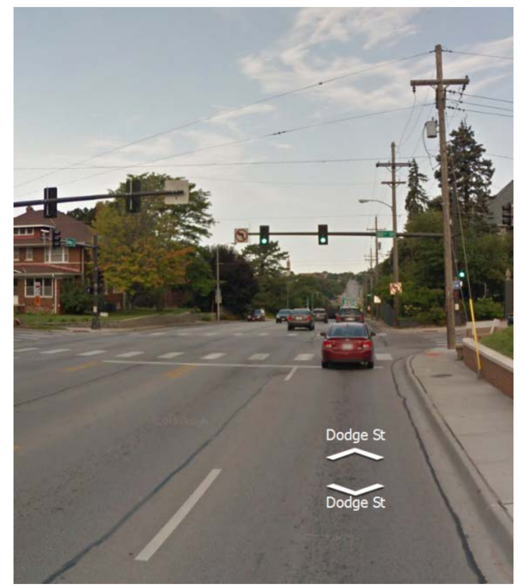


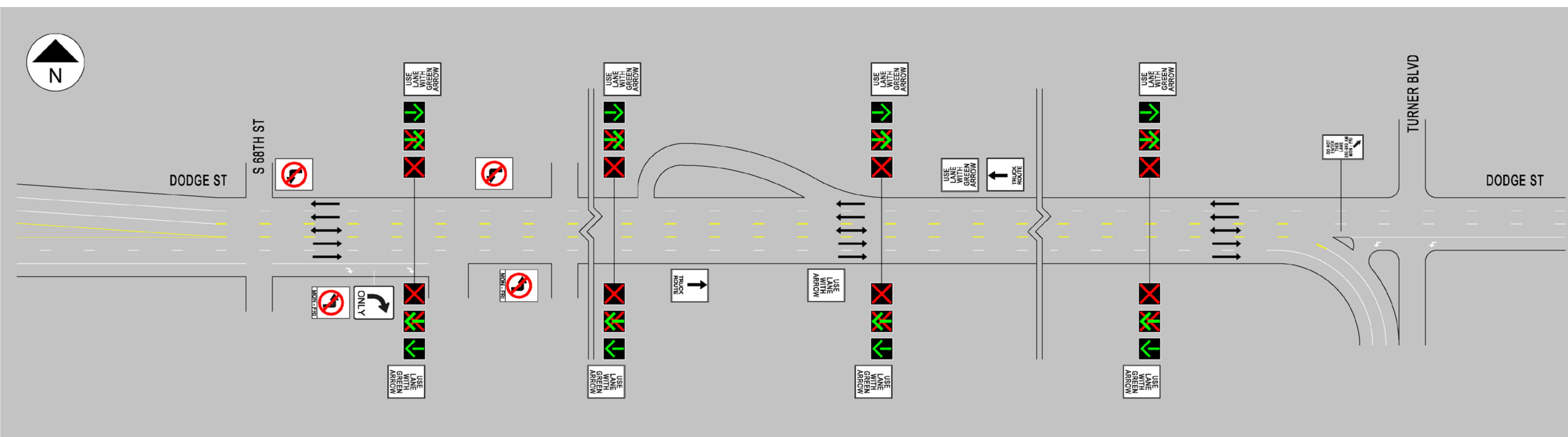


Omaha, NE

- Dodge Street between Turner Boulevard and 68th Street
- Length: 3.10 miles
- Speed Limit: 35 mph
- Number of Lanes: 5 lanes
- Access Management: No median
- Land Use: Commercial and residential
- Configuration:
  - Morning peak (5:50 AM – 9:00 AM): 2 EB lanes, 2 WB lanes, and an EB reversible center lane
  - Afternoon peak (9:00 AM to 5:50 AM): 2 EB lanes, 2 WB lanes, and a WB reversible center lane
- No left turns allowed
- Mug handles are located in specific intersections for left turn and U-turn maneuvers
- No Parking allowed
- Truck Route
- Bus Route



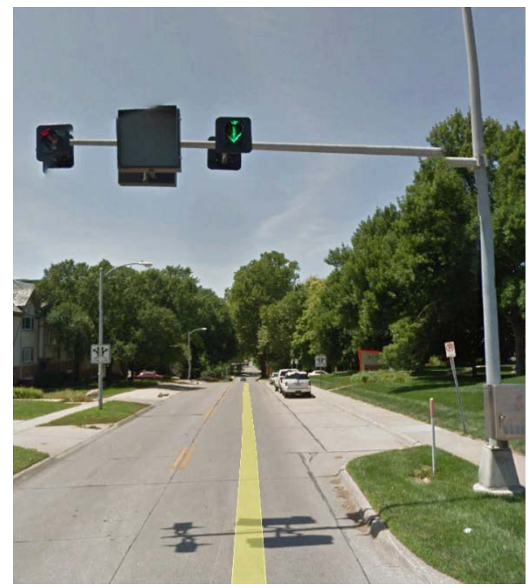
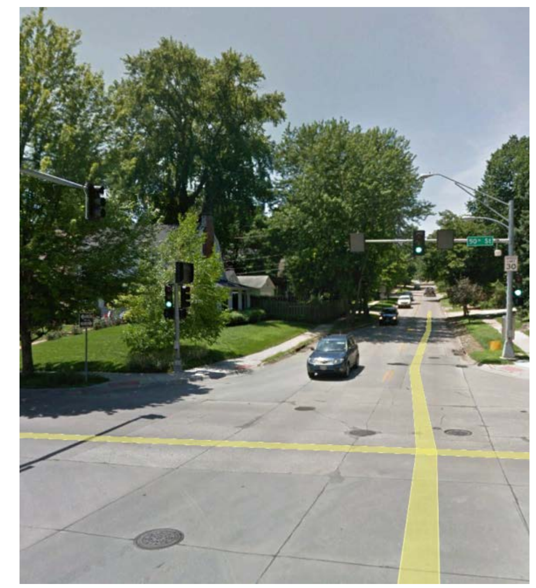


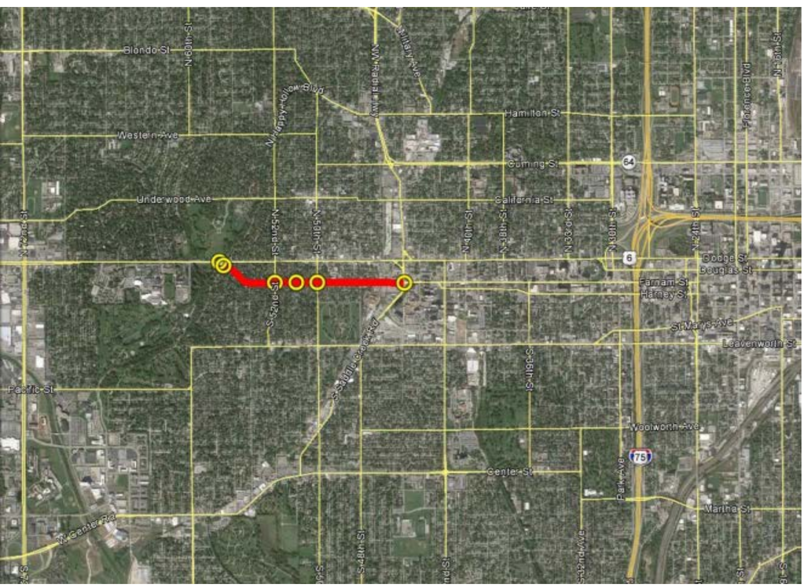
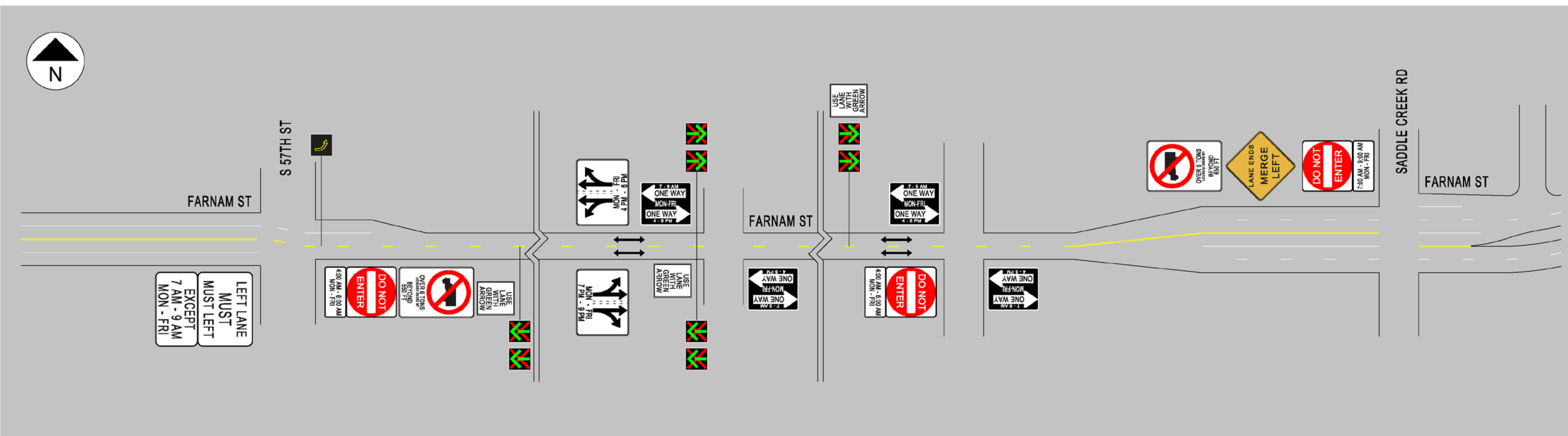


Omaha, NE

- Farnam Street between Saddle Creek Road and 57th Street
- Length: 1.1 miles
- Speed Limit: 30 mph
- Number of Lanes: 2 lanes (lanes marked with lane-use control signals and LED signs)
- Access Management: No median
- Land Use: Residential
- Configuration
  - Morning peak (7:00 AM - 9:00 AM): 2 one-way EB lanes
  - Afternoon peak (4:00 PM – 6:00 PM): 2 one-way WB lanes
  - All other times: 1 lane in each direction
- LED Blank Out signs mounted on mast arms may be used to restrict left turns at signalized intersections
- No Parking allowed
- No Trucks over 6 Tons and 650 ft. long allowed

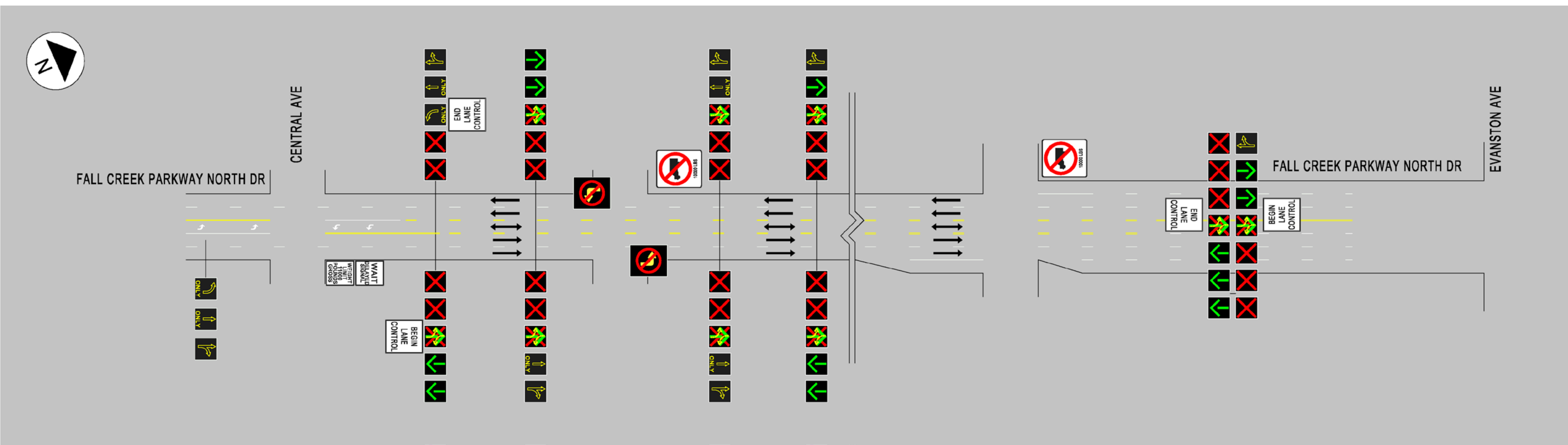


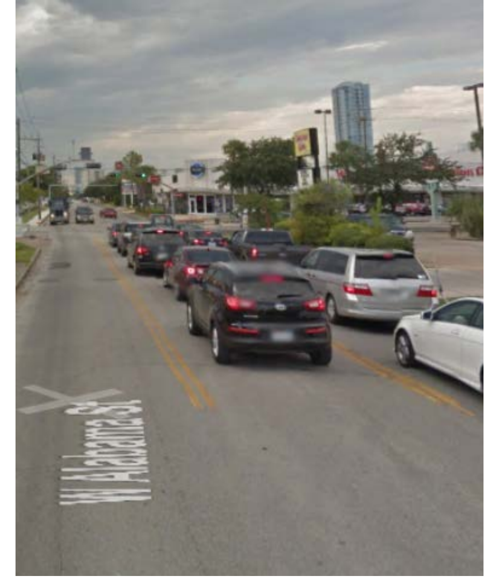
Indianapolis, IN

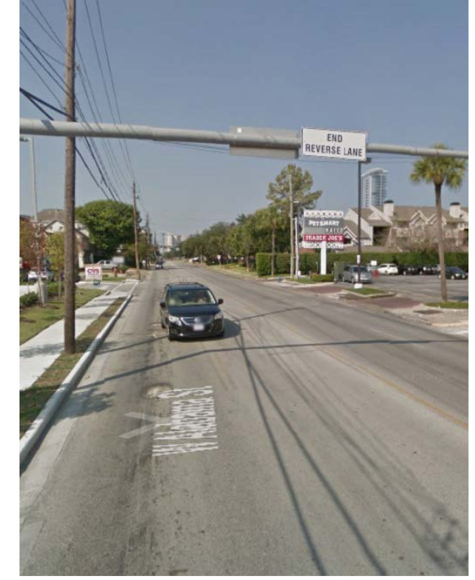
- Fall Creek Parkway North Drive between Central Avenue and Evanston Avenue
- Length: 2.13 miles
- Speed Limit: 35 mph/40 mph
- Number of Lanes: 5 lanes (7 in some sections)
- Access Management: No median
- Land Use: Residential and green area
- Configuration:
  - Morning peak: 2 NB lanes and 3 SB lanes
  - Afternoon peak: 3 NB lanes and 2 SB lanes
- Left turns are restricted on signalized intersections
- No Parking allowed
- 11,000 lbs. weight limit
- Lane configuration changes periodically to facilitate traffic flow during events at the Indiana State Fairgrounds

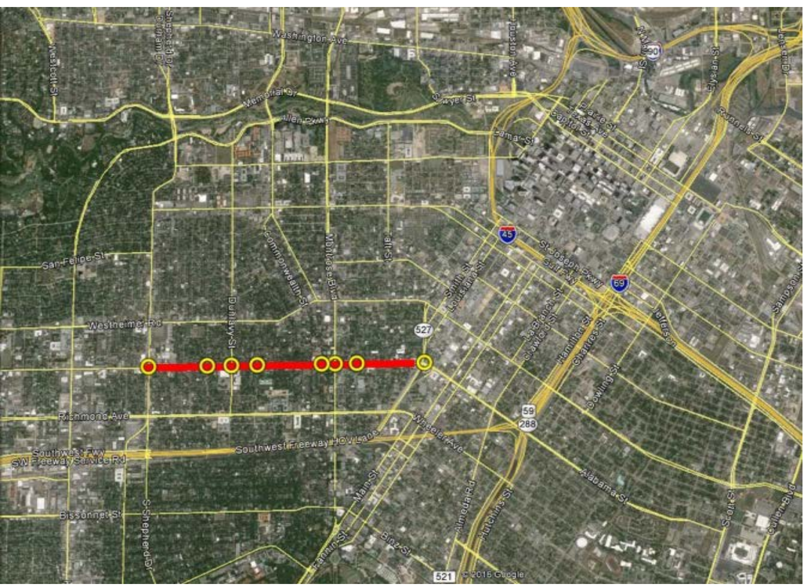


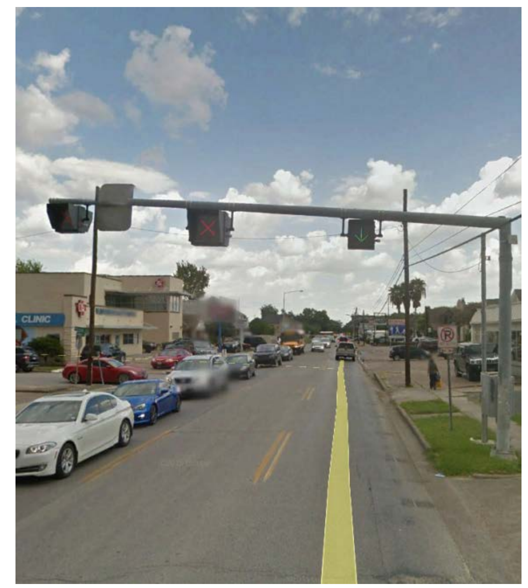
Houston, TX

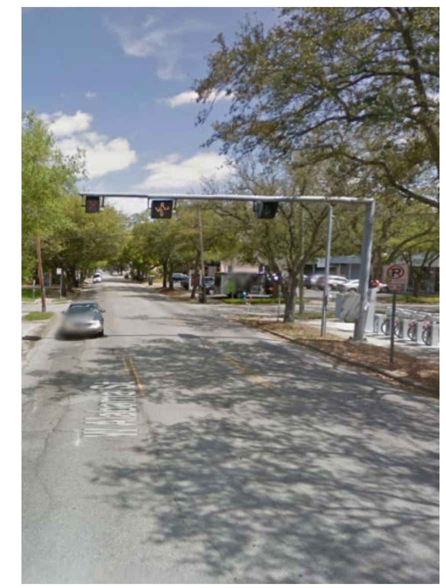
- West Alabama Street
- Length: 1.72 miles
- Speed Limit: 30 mph
- Number of Lanes: 3 lanes
- Access Management: No median
- Land Use: Residential
- Configuration:
  - Morning peak: 2 EB lanes and 1 WB lanes
  - Afternoon peak: 1 EB lanes and 2 WB lanes
  - All other times: 1 EB lane, 1 WB lane, and a (TWLTL)
- No parking allowed
- No Trucks over 2 axles allowed
- Bus Route

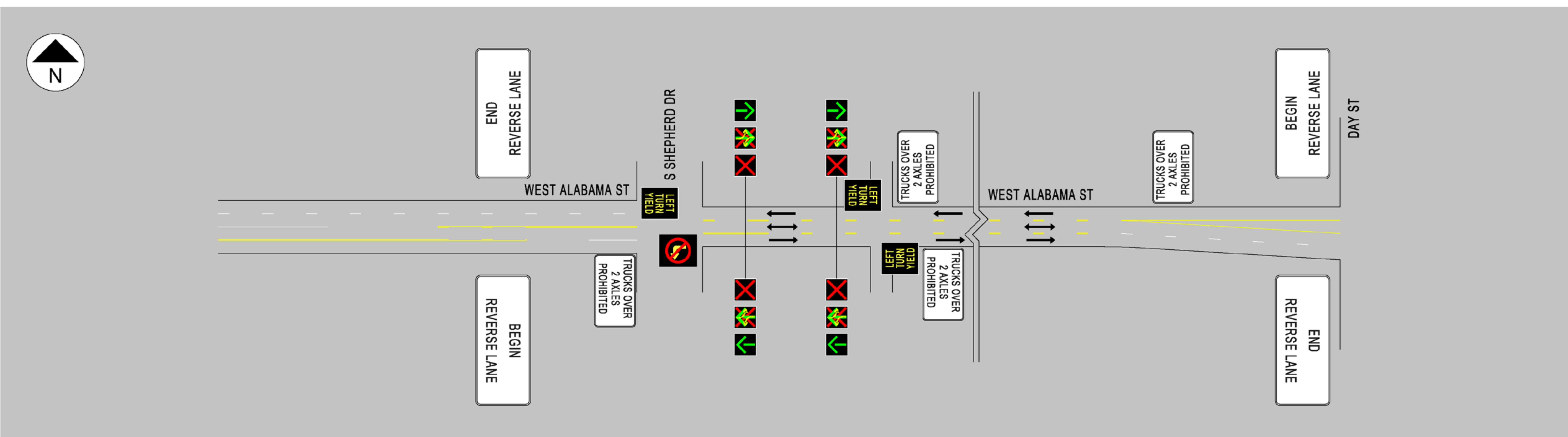






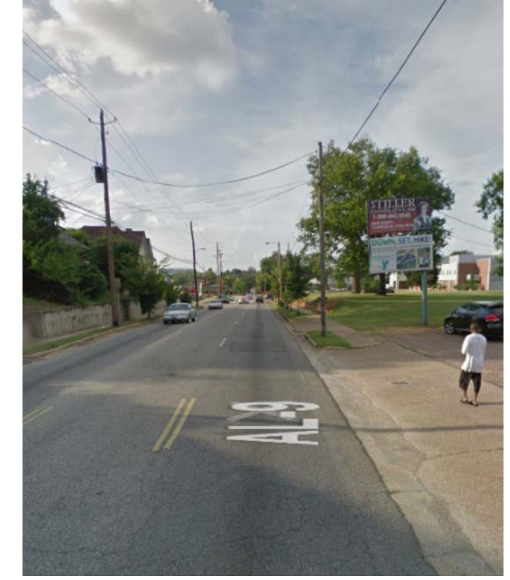


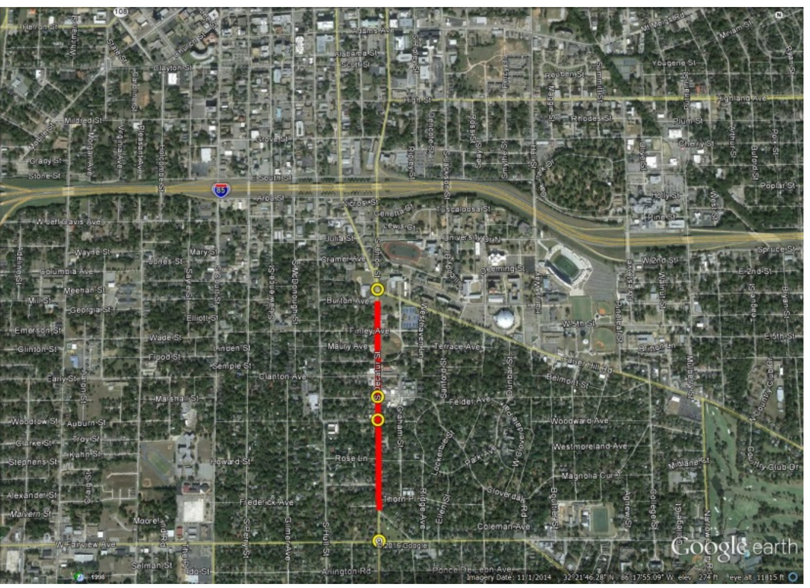


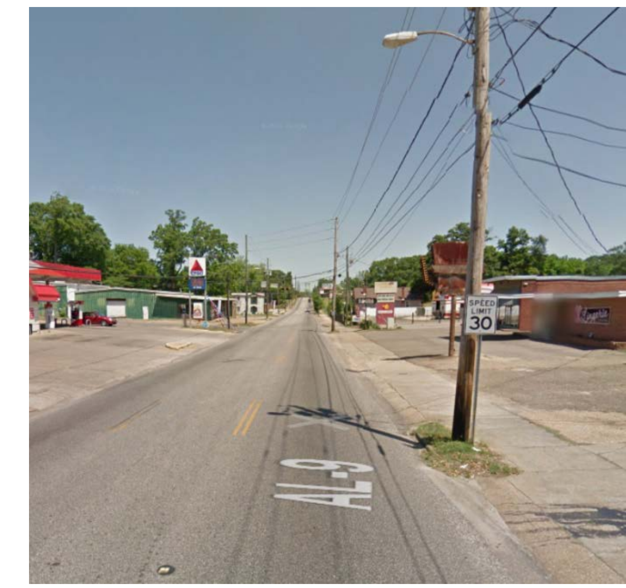


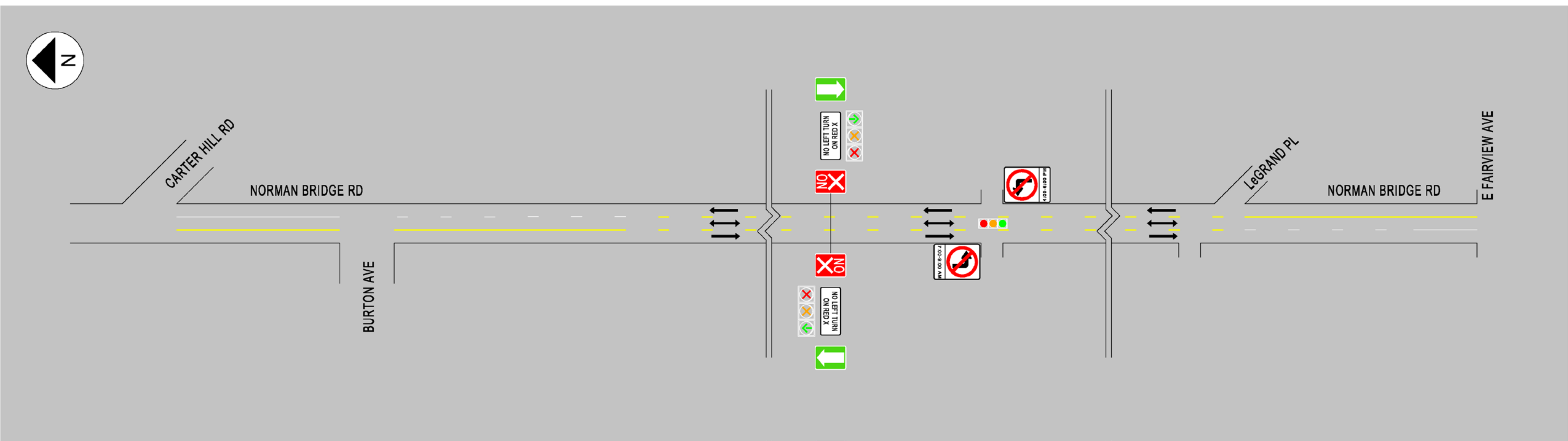
Montgomery, AL

- Norman Bridge Road between LeGrand Place and Burton Street
- Length: 0.64 miles
- Speed Limit: 30 mph
- Number of Lanes: 3 lanes
- Access Management: No median
- Land Use: Commercial and residential
- Configuration:
  - Morning peak (7:00 AM – 9:00 AM): 2 NB lanes and 1 SB lanes
  - Afternoon peak (4:00 PM – 6:00 PM): 1 NB lanes and 2 SB lanes
  - All other times: 1 NB lane, 1 SB lane, and 1 TWLTL
- Left turns for minor-flow direction are not allowed at signalized intersections during peak hour



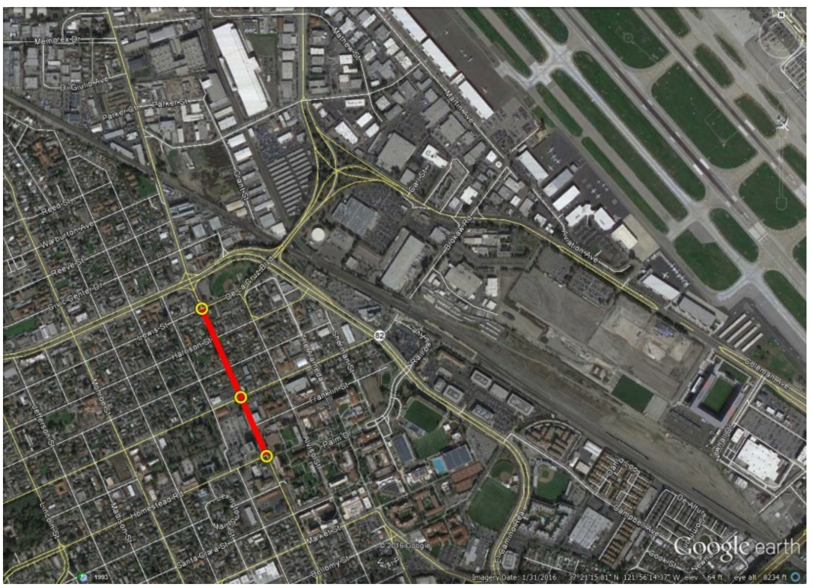


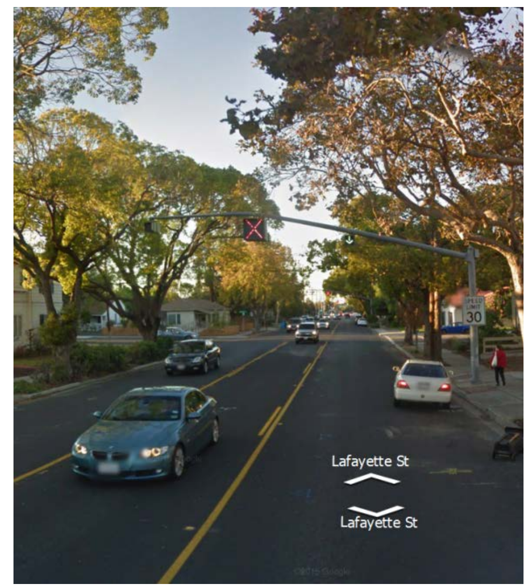


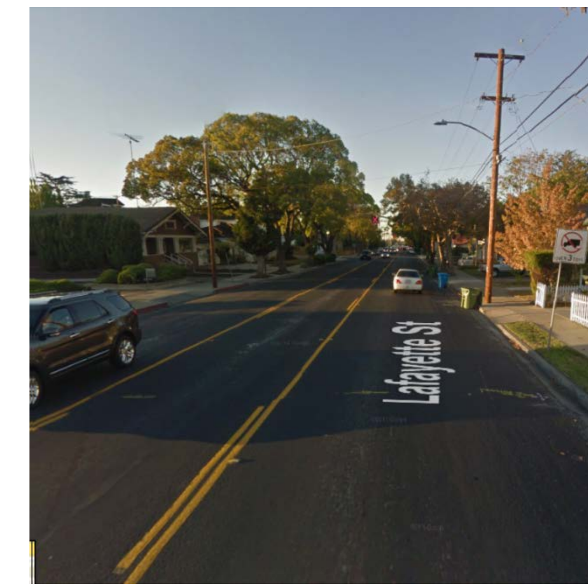


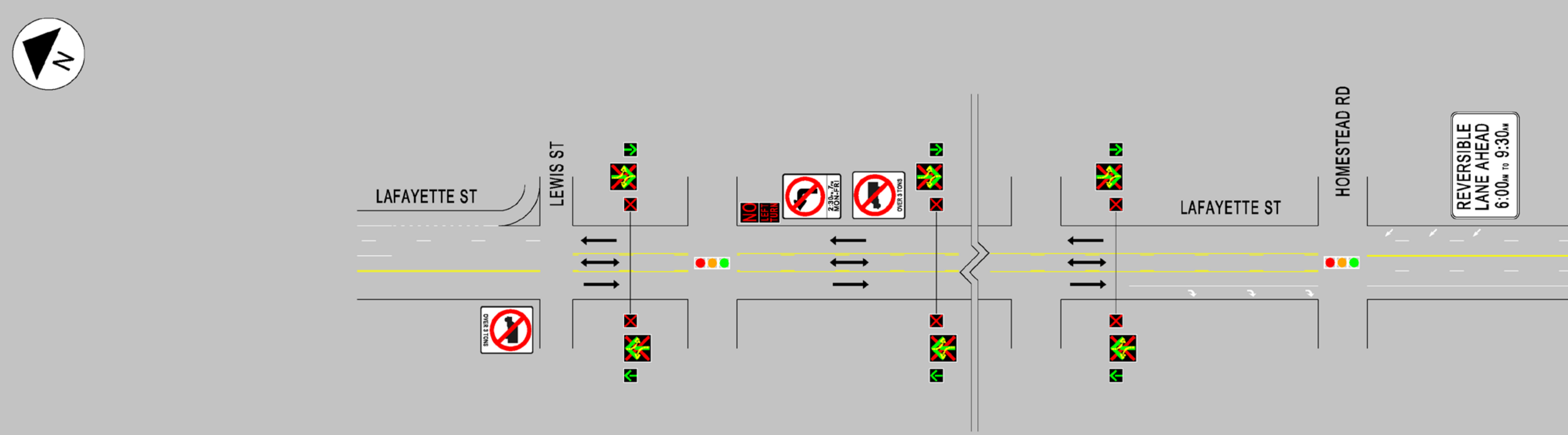
Santa Clara, CA

- Lafayette Street between Homestead Road and Lewis Street
- Length 0.35
- Speed Limit: 30 mph
- Number of Lanes: 3 lanes
- Access Management: No median
- Land Use: Residential
- Configuration:
  - Morning peak (6:00 AM – 9:30 AM): 2 NB lanes and 1 SB lanes
  - Afternoon peak (2:30 PM – 7:00 PM): 1 NB lanes and 2 SB lanes
  - All other times: 1 NB lane, 1 SB lane, and 1 TWLTL
- Left turns for minor-flow direction are not allowed at signalized intersections during peak hour
- On-Street parking allowed
- No trucks over 3 tons allowed









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