

# 47th Street Complete Street Plan

WESTWOOD | ROELAND PARK | UNIFIED GOVERNMENT | MARC

FEBRUARY 2018



# Acknowledgements

## Project Partners

City of Westwood  
City of Roeland Park  
Unified Government of Wyandotte County and Kansas City, Kansas  
Mid-America Regional Council

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# I. Executive Summary

## Project Area

The 47th Street Complete Street Plan is primarily focused on 47th Street from Rainbow Boulevard in the east to Mission Road in the west. The project also encompasses improvements to Belinder Road between 47th Street and Shawnee Mission Parkway. Finally, connections between Rainbow Boulevard and State Line Road are studied, generally between 46th Avenue and 48th Street.

## Project Partners

This project is led by the City of Westwood in partnership with the City of Roeland Park and the Unified Government of Wyandotte County and Kansas City, Kansas.

This project is made possible through a “Planning Sustainable Places” grant provided through the Mid-America Regional Council.

Guidance and oversight of this project has been provided throughout the process by the 47th and Mission Road Committee.

## Project Goals

Building off of the ongoing work of the 47th and Mission Road Committee and the recent planning efforts with the Rosedale Master Plan and Westwood Master Plan, the 47th Street Complete Street Plan explores ways to enhance the walkability, bikeability, and livability of the 47th Street Corridor.

Specifically, this project explores whether a reconfiguration of travel lanes on 47th Street can help to support various community goals for the corridor, and includes traffic studies to evaluate the feasibility of potential design options.

This project is also looking at improvements to connecting areas, including pedestrian and bicycle amenities on Belinder Road and connections between Rainbow Boulevard and State Line Road.

## Planning Background

The 47th Street Complete Street Plan builds on nearly two decades of work in the 47th Street corridor. Beginning in 2000, community partners have planned for and invested in strategic improvements to 47th Street with the goal of enhancing the livability and vitality of the area. Most recently, both the Rosedale Master Plan and Westwood Master Plan identify identify potential improvements to 47th Street, including options for a “road diet” that reconfigures travel lanes on 47th Street to create a more comfortable and inviting street that accommodates all types of users.

## Community Walk and Talk - Sep. 2017

Previous planning efforts highlight some common themes for improvements to the 47th Street corridor. Many of these themes were also front and center during the September 2017 Walk and Talk event where community members shared their first hand impressions and experiences. Community members walked and experienced the corridor first hand, and shared with each other their concerns and aspirations for 47th Street.

## Open House - Jan. 2018

A public open house provided community members a chance to review and discuss potential improvements to the 47th Street area. Residents, business owners, and visitors identified their priorities for the corridor and evaluated the benefits and tradeoffs of various design decisions. The recommendations of this plan are shaped by the community preferences identified at the open house and related online survey.

## Priorities and Concerns

For public meeting participants, accommodating all modes and users was the highest priority for any improvements to 47th Street. Most people also identified the need for a safe and inviting street, improved pedestrian crossings, and increased safety for cyclists as top priorities. Concerns about traffic speed, traffic operations, and parking were less important to participants overall.



## Street Design Features

Most public meeting participants identified bicycle facilities, improved sidewalks, crosswalk safety features, and street trees and landscaping as design features they would like to see in the 47th Street corridor. Parking, medians, and curb extensions rated at the bottom of preferred design features, desired by fewer than one in five participants.

## Is a Road Diet Feasible on 47th Street?

47th Street has fewer than 10,000 average daily trips making it an excellent road diet candidate.

Side streets along 47th are relatively low traffic. Busy cross streets (Mission and Rainbow) are signalized to manage turn movements.

Because 47th Street is two lanes west of Mission and stops at Rainbow, there are no problematic lane transitions to worry about.

## Traffic Summary

The quality of traffic operation can be defined through level-of-service (LOS) which consists of assignments of 'A' for free-flowing conditions through 'F' for congested conditions. The existing traffic operations of 47th Street are all acceptable with LOS at or below LOS C. As an alternative to the existing roadway design, a road diet conversion from four-lanes to three-lanes is appropriate for 47th Street. There is no significant change in LOS for the intersection under the road diet alternative design compared to existing operations. Implementing a road diet would have the benefits of reduced conflict points for left-turning movements, a shorter distance for pedestrians and bicyclists to cross vehicle traffic, increased mobility for bicyclists, and more buffered space between vehicles and pedestrians on sidewalks.

## Recommendations - 47th Street Near Term

- Complete a "road diet" on 47th Street, reconfiguring from a four-lane section to a three-lane section.
- Begin with a (mostly) striping project that works within existing curb lines.
- Reallocate new space within curb lanes to buffered bike lanes.
- Provide a dedicated space for cyclists, reduce the crossing distance for pedestrians, and improve the turn radius for trucks by maintaining bike lanes through the 47th Street / Mission intersection with no dedicated right turn lane from westbound 47th Street to northbound Mission Road.
- Enhance the 47th Street / Belinder Road crossing with four-way continental striping, signage demonstrated to encourage driver compliance, turn queue boxes for bikes, and a pedestrian refuge on the west side.
- Add a mid-block crossing near Walmart with a pedestrian refuge island that maintains all turn movements, and move the existing bus stop east of the Walmart driveway.
- Incorporate shared bus/bike zones for existing bus stops.

## Recommendations - 47th Street Long Term

- As resurfacing or sidewalk reconstruction occurs, or as grant opportunities permit, consider a raised cycle track option in the future.
- Continue to explore opportunities for bike lane + turn lane option at 47th and Mission in coordination with adjacent property owners as site configurations and property owner goals evolve over time.
- In coordination with transit improvements, street resurfacing, or reconstruction of curbs or sidewalks, incorporate floating bus boarding islands to enhance transit efficiency and minimize conflicts between buses, bikes, and pedestrians.



## Recommendations - Rainbow to State Line Near Term

- Work with the developers of the next phase of Woodside Village to provide a continuous, unobstructed ten-foot shared path along the south side of 47th Place. Explore options including narrowing of the existing roadway.
- Work with the developers of the next phase of Woodside Village to provide a pedestrian path along the existing gas line easement immediately south of the development area.
- Incorporate signage and pavement markings for cyclists on 46th Avenue to provide wayfinding for cyclists and alert drivers that cyclists frequently use the connector.

## Recommendations - Rainbow to State Line Long Term

- Construct a new ten-foot shared path on the south side of 47th Place between Woodside Village and State Line Road. Explore options including narrowing of the existing roadway.
- Extend a pedestrian path along the existing gas line easement between 47th Place and 47th Terrace, and between the next phase of Woodside Village and State Line Road. Options include a direct connection to State Line road, and a connection from the gas line easement to 47th Place. A connection to 47th Terrace is not recommended.

## Recommendations - Belinder Near Term

- Incorporate signage and pavement markings to identify Belinder Road as a “neighborhood greenway,” celebrate neighborhood identity, and provide wayfinding for cyclists.

## Recommendations - Belinder Long Term

- Modify the east side of Belinder Road to narrow travel lanes, construct a sidewalk, and add additional trees and landscaping.
- Incorporate site specific traffic calming strategies including pinch points, mini traffic circles, gateway medians, or other features in locations where traffic speeds remain high or crossing difficulties persist.

## II. Project Overview

## Project Area

The 47th Street Complete Street Plan is primarily focused on 47th Street from Rainbow Boulevard in the east to Mission Road in the west. The project also encompasses improvements to Belinder Road between 47th Street and Shawnee Mission Parkway. Finally, connections between Rainbow Boulevard and State Line Road are studied, generally between 46th Avenue and 48th Street.



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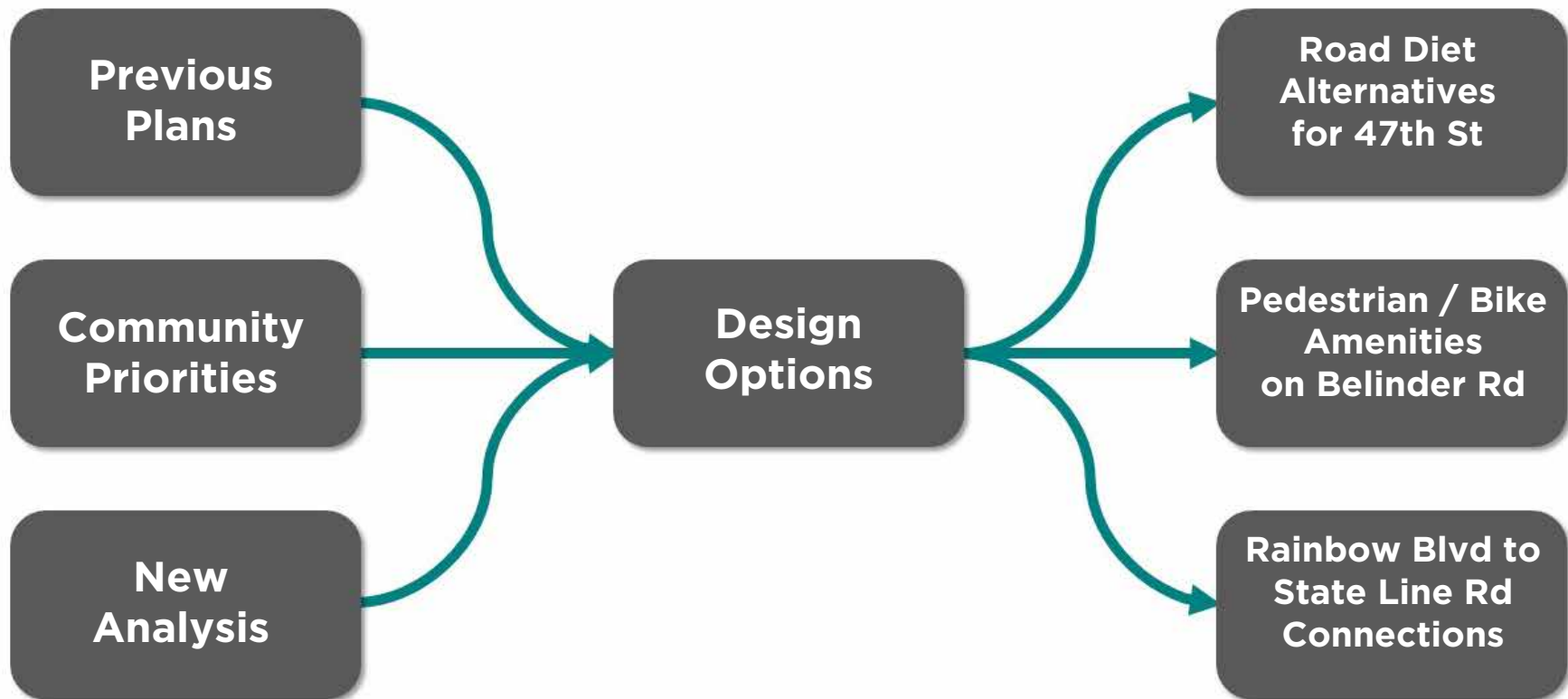


## Project Goals

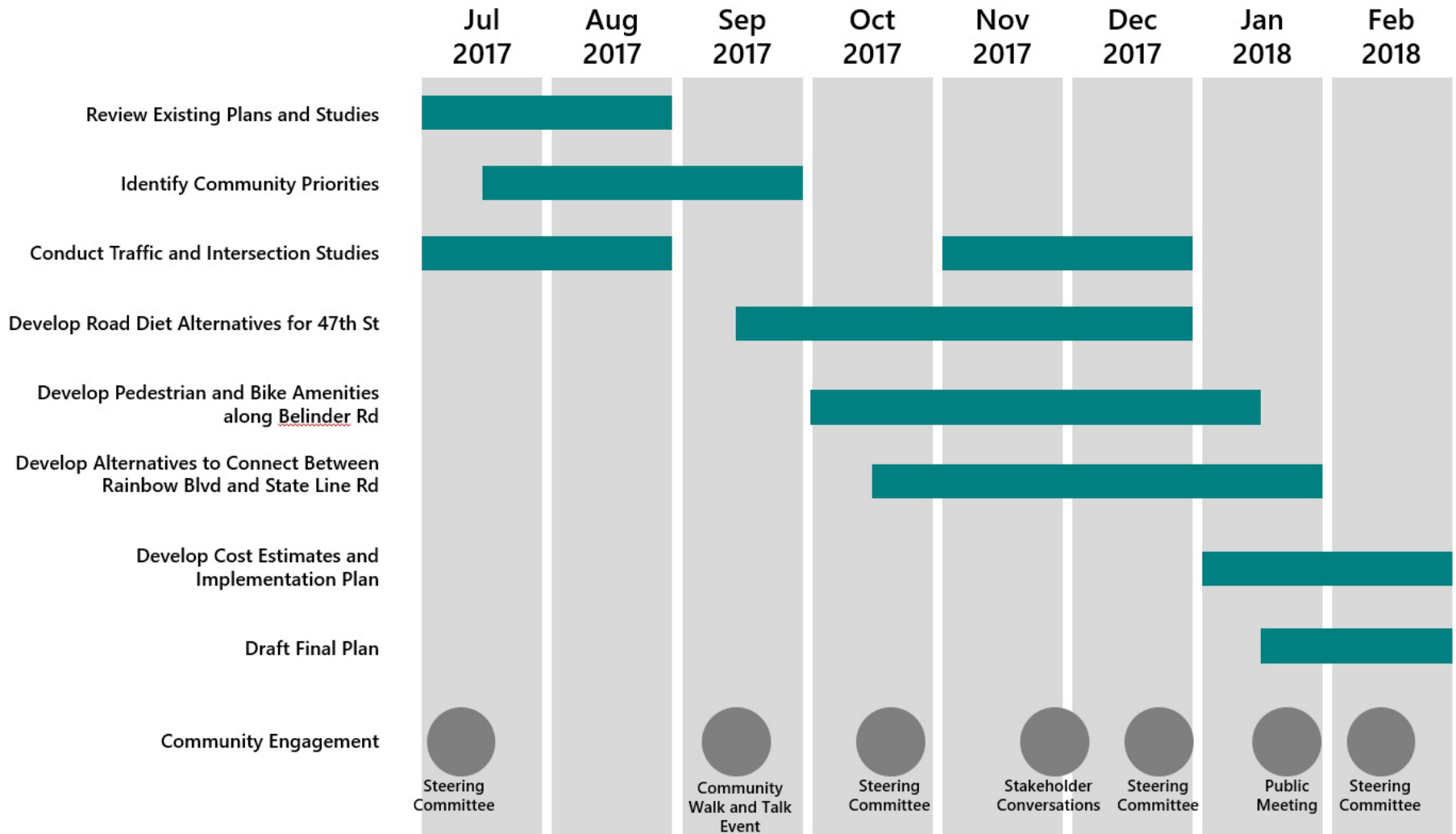
Building off of the ongoing work of the 47th and Mission Road Committee and the recent planning efforts with the Rosedale Master Plan and Westwood Master Plan, the 47th Street Complete Street Plan explores ways to enhance the walkability, bikeability, and livability of the 47th Street Corridor.

Specifically, this project explores whether a reconfiguration of travel lanes on 47th Street can help to support various community goals for the corridor, and includes traffic studies to evaluate the feasibility of potential design options.

This project is also looking at improvements to connecting areas, including pedestrian and bicycle amenities on Belinder Road and connections between Rainbow Boulevard and State Line Road.

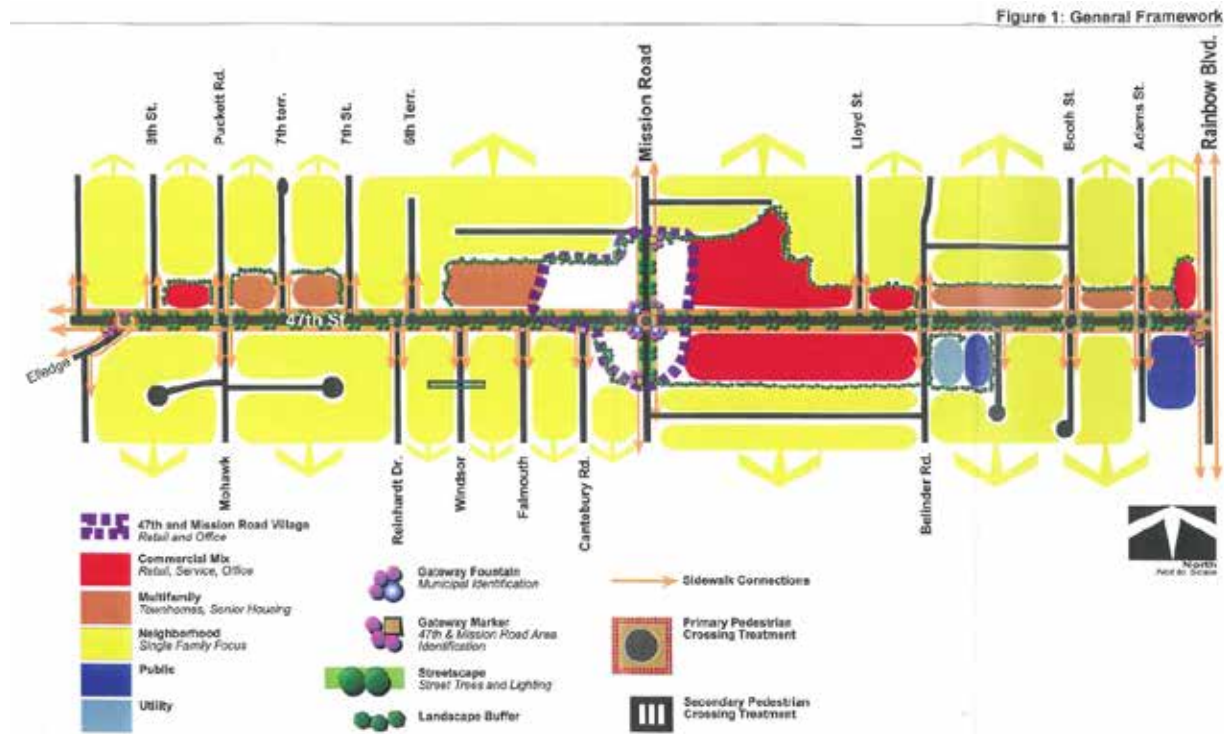


# Process



# A History of Vision, Planning, and Hard Work in the 47th Street Corridor

The 47th Street Complete Street Plan builds on nearly two decades of work in the 47th Street corridor. Beginning in 2000, community partners have planned for and invested in strategic improvements to 47th Street with the goal of enhancing the livability and vitality of the area. Most recently, both the Rosedale Master Plan and Westwood Master Plan identify potential improvements to 47th Street, including options for a “road diet” that reconfigures travel lanes on 47th Street to create a more comfortable and inviting street that accommodates all types of users.



## 47TH & MISSION ROAD AREA CONCEPT PLAN YEAR: 2000

A joint effort with Westwood, Roeland Park, and the Unified Government to create a vision for the area around 47th and Mission

- Recommends pedestrian connections throughout the area, providing access between neighborhoods and commercial areas, and enhancement of pedestrian crossings
- Recommends beautification and streetscape elements including lighting, landscaping, and gateway features
- Recommends a pedestrian-friendly neighborhood center as a focal point at the intersection of 47th Street and Mission Road

## 47TH & MISSION ROAD AREA DESIGN REVIEW OVERLAY DISTRICT YEAR: 2000

Identifies standards for new development or renovation of existing buildings, streets, and sidewalks along 47th Street

- Establishes committee to review new projects
- Overall, the standards aim to create a more attractive and walkable district and support the vision of the Concept Plan



The intersection at 47th and Mission Road is envisioned as a pedestrian friendly, neighborhood center.



# 47TH & MISSION REDEVELOPMENT STUDY YEAR: 2007

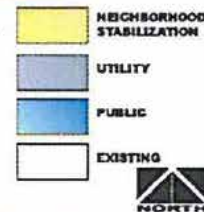


Market study and development phasing plan for the area

- Identified potential for additional 150,000 square feet of retail space (in 2007)
- Recommends merchant association or community improvement district to organize and manage improvements
- Recommends continued investment in streetscape and infrastructure improvements

## POTENTIAL REDEVELOPMENT PROJECTS

- |                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>A</b> MIXED USE:<br/>RETAIL/OFFICE OR RESIDENTIAL<br/>(APPROXIMATELY 25,000 SF)</p> <p><b>B</b> RETAIL SHOPS/RESTAURANT<br/>(APPROXIMATELY 15,000 SF)</p> <p><b>C</b> RETAIL SHOPS/RESTAURANT<br/>(APPROXIMATELY 15,000 SF)</p> <p><b>D</b> RETAIL SHOPS/RESTAURANT<br/>(APPROXIMATELY 15,000 SF)</p> | <p><b>E</b> RETAIL ANCHOR AND SHOPS<br/>APPROXIMATELY (50,000 SF)</p> <p><b>F</b> GROCERY STORE IMPROVEMENTS AND<br/>EXPANSION (EXPANSION - 4,000 SF)</p> <p><b>G</b> MIXED USE:<br/>RETAIL/OFFICE<br/>(APPROXIMATELY 30,000 SF)</p> | <p><b>H</b> RESIDENTIAL TOWNHOMES (APPROXIMATELY 64 UNITS)</p> <p>H1 - APPROXIMATELY 28 UNITS</p> <p>H2 - APPROXIMATELY 14 UNITS</p> <p>H3 - APPROXIMATELY 12 UNITS</p> <p>H4 - APPROXIMATELY 8 UNITS</p> <p>H5 - APPROXIMATELY 8 UNITS</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



PREPARED FOR:  
CITY OF WESTWOOD, KANSAS  
CITY OF HOLLAND PARK, KANSAS  
UNIFIED GOVERNMENT OF KANSAS CITY, KANSAS  
AND WYANDOTTE COUNTY

PREPARED BY:  
Zimmer Real Estate Services, L.C.  
Gouk Evans

## 47TH STREET CORRIDOR POTENTIAL LONG RANGE INITIATIVES

# ROSEDALE MASTER PLAN

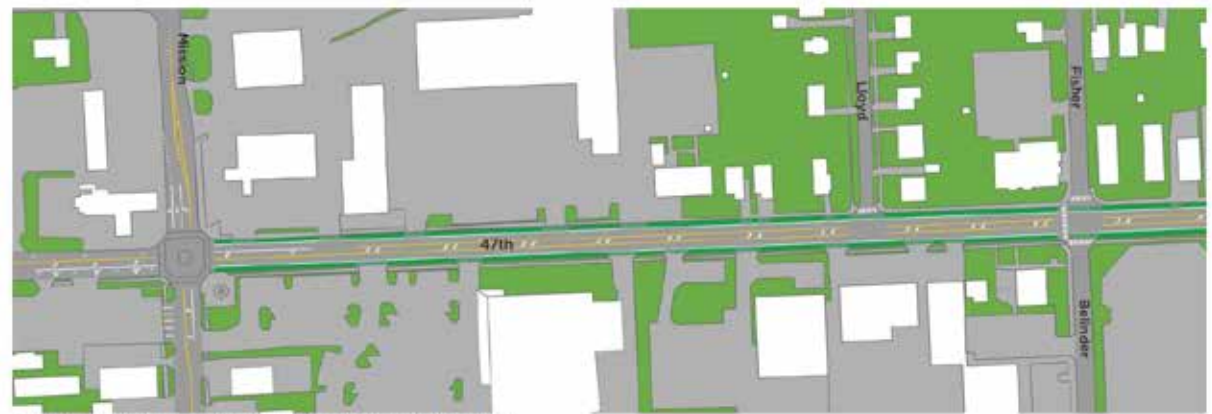
## YEAR: 2016

### Blueprint for the future growth and development of the Rosedale area, including the 47th Street Corridor

- Recognizes that improving the roadway design of 47th Avenue is an important part of continuing the forward momentum of this area
- Recognizes the design of the roadway has a big effect on the safety, walkability, and overall feel of the 47th Avenue district
- Identifies a road diet and center turn lane to benefit traffic flow and provide room for pedestrians and cyclists
- Identifies two road diet alternatives for 47th Street: one with protected bike lanes and one with on-street parking. The bike lane alternative was identified as the preferred option based on community feedback



**ROAD DIET WITH PROTECTED BIKE LANES**



**ROAD DIET WITH PARKING LANE**



# City of Westwood - Framework Plan Map

## WESTWOOD MASTER PLAN YEAR: 2017

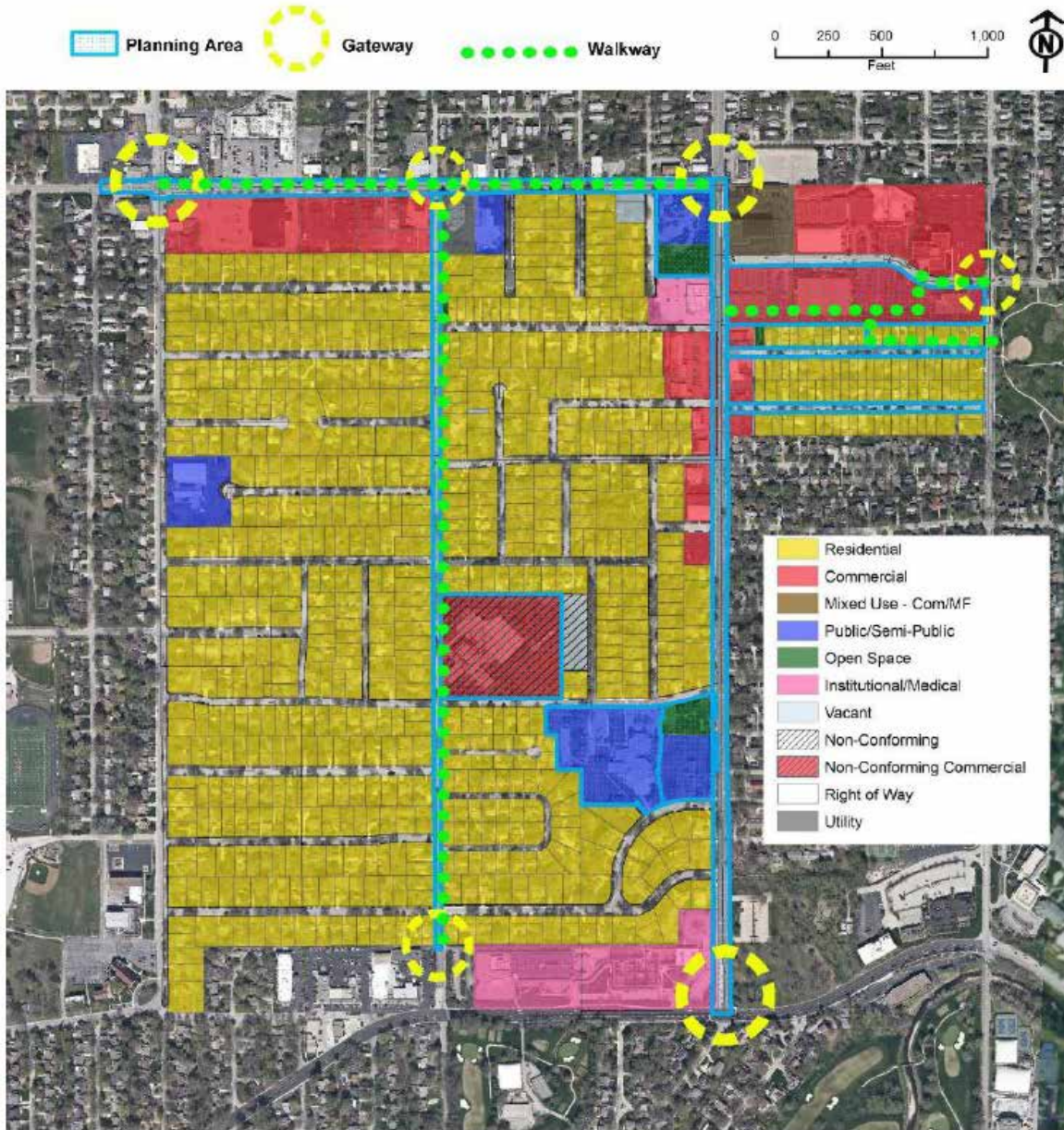


Figure 4.2 Framework Plan Map 1

Vision statement: "Westwood, Kansas is a charming, vibrant and diverse city which is safe, walkable, bikeable and comfortable. It is connected to other communities and boasts locally owned businesses, schools, and parks. Citizens strongly identify with, and value the unique and welcoming character of the community."

- Community feedback that infrastructure and development along 47th Street does not currently fully realize the vision of a vibrant, walkable corridor
- Possible improvements along 47th Street include: 1) Road diet/lane reduction, 2) Parking improvements, 3) Bike lanes, 4) Protected pedestrian crossings, 5) Upgrade existing transit stops, 6) Nodal development
- Walkway along rear of Woodside Village redevelopment proposed as important alternative connection to 47th Terrace or 48th Street

## NEW INVESTMENT, NEW ACTIVITY, NEW OPPORTUNITIES

Recent investments demonstrate the real potential of the 47th Street corridor, bringing new activity to the area and new residents, employees, and visitors to 47th Street. Recent investments also highlight the evolving character and opportunities on the corridor, and lend urgency to efforts to make 47th Street as safe, comfortable, livable, and business-supportive as possible for all types of users.



## **III. Community Priorities & Concerns**

## Community Walk & Talk September 2017

Previous planning efforts highlight some common themes for improvements to the 47th Street corridor. Many of these themes were also front and center during the September 2017 Walk and Talk event where community members shared their first hand impressions and experiences. Community members walked and experienced the corridor first hand, and shared with each other their concerns and aspirations for 47th Street.

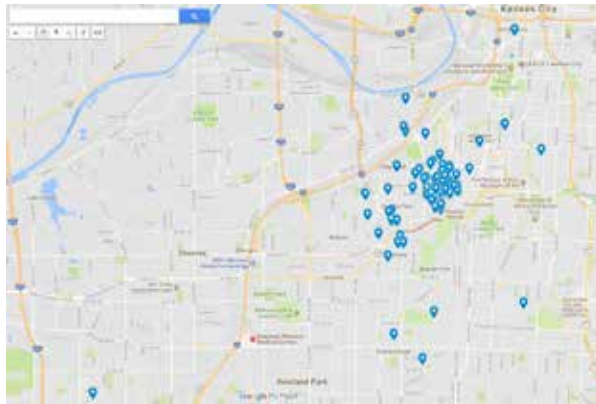


# Open House January 2018

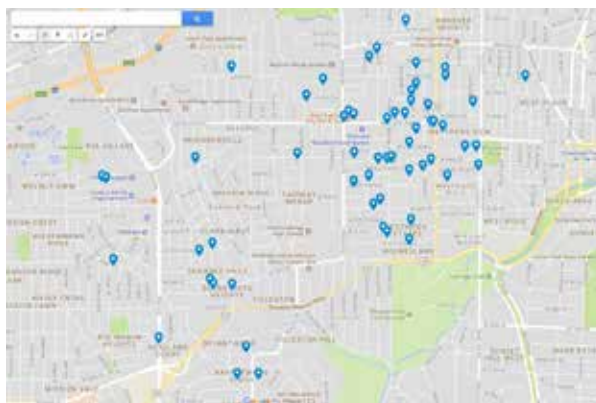
A public open house provided community members a chance to review and discuss potential improvements to the 47th Street area. Residents, business owners, and visitors identified their priorities for the corridor and evaluated the benefits and tradeoffs of various design decisions. The recommendations of this plan are shaped by the community preferences identified at the open house and related online survey.



## Participant Map: Regional



## Participant Map: Local





## Traffic Speed

47th Street is wide with relatively little traffic at most times. There are also no signals or stop signs for the 1/2 mile between Mission Road and Rainbow Boulevard. This leads to fast moving traffic, difficult crossings for drivers and pedestrians, and uncomfortable sidewalks.



## Traffic Operations

When they are busy, the intersections at 47th and Mission and at 47th and Rainbow do not always function as smoothly as they could. Changes in the number of lanes, and between drive lanes and turn lanes add to the confusion. Drivers turning in and out of business driveways and parking areas can further complicate traffic movements in the corridor.



## Accommodating All Users

Community members have asked for a more walkable, bikeable, and transit friendly 47th Street. Today, speed and proximity of traffic next to sidewalks detracts from the walking experience. There are no dedicated spaces for cyclists. There are no shelters, benches, or other amenities to support transit users in the corridor.



## Sidewalk Connections

There are some places on 47th Street itself, and on the surrounding neighborhood streets, where sidewalks are missing. In other locations, sidewalks on 47th Street are narrow and located close to fast moving traffic.



## Pedestrian Crossings

Signalized crossings of 47th Street are located 1/2 mile apart at Mission Road and Rainbow Boulevard. In between, fast traffic and multiple lanes make crossing the street difficult. For those with special mobility challenges, it can be almost impossible to cross safely.



## Parking

As new restaurants and businesses open, and new investment continues in the corridor, the number of visitors continues to grow. For those who drive, finding a place to park that is convenient and accessible to their destination can become an increasing challenge.





## Bicycle Safety

47th Street is an important regional connection for cyclists, and a destination in its own right, but today cyclists on 47th Street must navigate with fast moving cars in traffic. While some side streets are well used for biking, it can be challenging for cyclists to cross 47th Street.



## Safe, Inviting, Comfortable

In basic terms, community members have expressed a desire for 47th Street that is safe, inviting, and comfortable because such a street would enhance the livability of their community. This encompasses many elements that impact how a person experiences a street (landscaping, lighting, wayfinding, etc.).

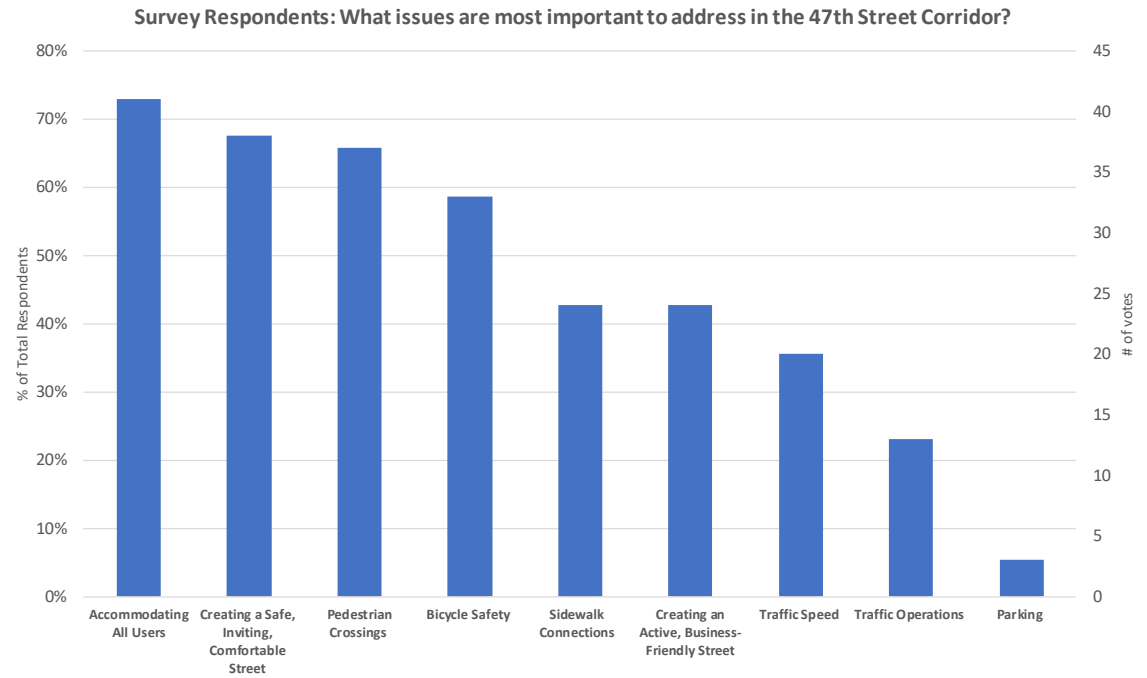


## Active & Business Friendly

A 47th Street that is active and thriving serves as an amenity to surrounding neighborhoods and strengthens the community. Improvements that support businesses and community activities support the vision for a more vital 47th Street corridor.

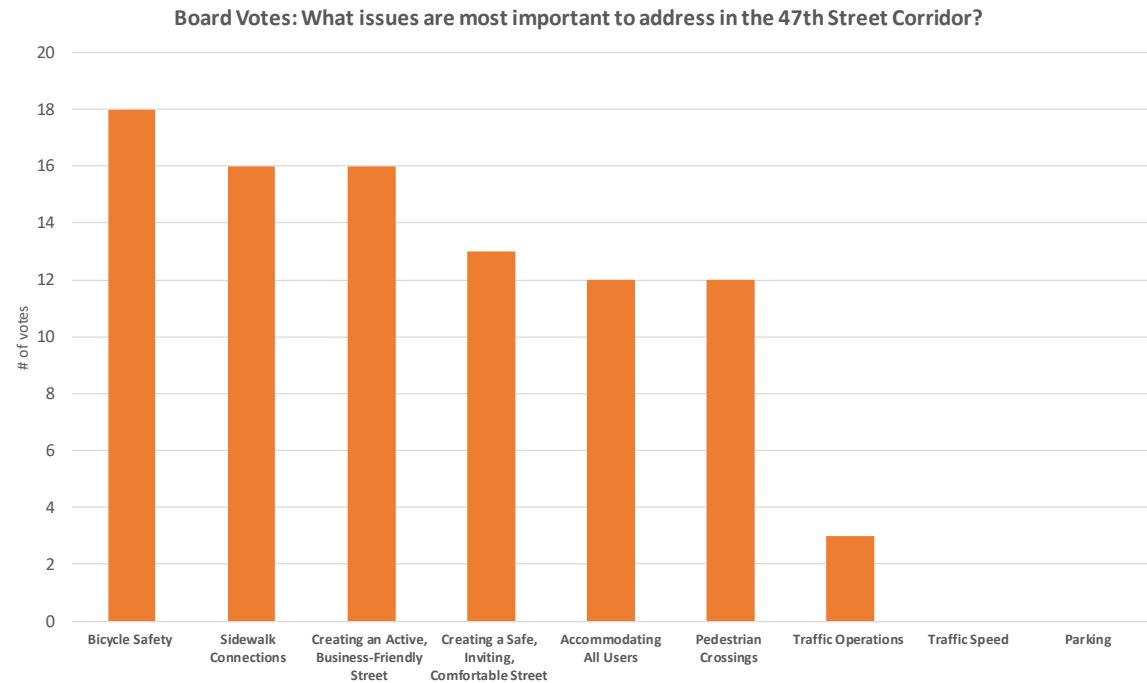
## Priorities & Concerns Open House Survey

For public meeting participants, accommodating all modes and users was the highest priority for any improvements to 47th Street. Most people also identified the need for a safe and inviting street, improved pedestrian crossings, and increased safety for cyclists as top priorities. Concerns about traffic speed, traffic operations, and parking were less important to participants overall.

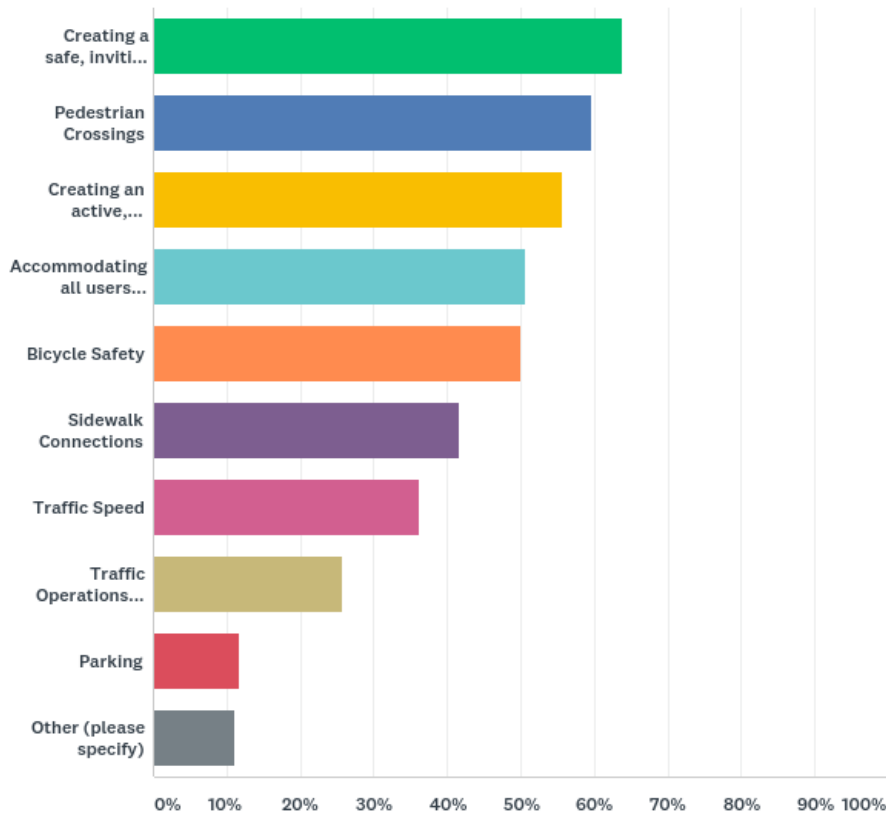


## Priorities & Concerns Open House Boards

Some public meeting participants chose to place dots to identify their most important priorities. The feedback generally reflects the written survey responses, with a strong focus on bicycle safety and pedestrian accommodations. Traffic speed, traffic operations, and parking received less priority.



## What issues are most important to address in the 47th Street Corridor?



ANSWER CHOICES	RESPONSES
▼ Creating a safe, inviting, comfortable street	63.89% 92
▼ Pedestrian Crossings	59.72% 86
▼ Creating an active, business-friendly street	55.56% 80
▼ Accommodating all users (drivers, transit users, cyclists, pedestrians, special needs)	50.69% 73
▼ Bicycle Safety	50.00% 72
▼ Sidewalk Connections	41.67% 60
▼ Traffic Speed	36.11% 52
▼ Traffic Operations (confusing or inefficient traffic movements)	25.69% 37
▼ Parking	11.81% 17
▼ Other (please specify)	<a href="#">Responses</a> 11.11% 16
<b>Total Respondents: 144</b>	

## Priorities & Concerns Online Survey

An online survey of approximately 150 participants asked for similar feedback to the public meeting topics. The online survey was generally consistent with the in-person feedback. Most survey respondents prioritized creating a safe and inviting street, improving pedestrian crossings, supporting corridor businesses, accommodating all users, and improving bicycle safety. Traffic speed, traffic operations, and parking were lower priorities overall.



## IV. Street Design Features

## Potential Design Features in the 47th Street Corridor

A wide variety of potential improvements are available to address the range of issues and aspirations identified for 47th Street. Each design feature services a specific purpose and balances priorities differently. Combined, these design features provide the design toolbox for an improved 47th Street that works well for everyone. The following bullets identify the specific community priorities potentially addressed by each design feature.



### Road Width

Changes to road width can help address:

- Traffic Speed
- Traffic Operations
- Pedestrian Crossings
- Safe, Comfortable, Inviting Street



### Lane Width

Changes to lane width can help address:

- Traffic Speed
- Traffic Operations
- Pedestrian Crossings
- Safe, Inviting, Comfortable Street



### Medians

Medians can help address:

- Traffic Speed
- Traffic Operations
- Pedestrian Crossings
- Safe, Inviting, Comfortable Street



### Bicycle Facilities

Bicycle Facilities can help address:

- Bicycle Safety
- Accommodating All Users
- Active and Business Friendly Street



## Curb Extensions

Curb extensions can help address:

- Traffic Speed
- Pedestrian Crossings
- Safe, Comfortable, Inviting Street



## Raised Crosswalks

Raised crosswalks can help address:

- Traffic Speed
- Pedestrian Crossings
- Safe, Comfortable, Inviting Street



## Signal Timing

Changes to signal timing can help address:

- Traffic Speed
- Traffic Operations
- Pedestrian Crossings



## Signage and Markings

Signage and Markings can help address:

- Traffic Operations
- Pedestrian Crossings
- Bicycle Safety
- Safe, Comfortable, Inviting Street



## Wayfinding and Branding

Wayfinding and branding can help address:

- Parking
- Safe, Comfortable, Inviting Street
- Active, Business Friendly Street



## Lighting

Lighting can help address:

- Sidewalk Connections
- Safe, Comfortable, Inviting Street
- Active, Business Friendly Street
- Traffic Speed



## On-Street Parking

On-street parking can help to address:

- Parking
- Active, Business Friendly Street



## Transit Integration

Transit integration can help address:

- Accommodating All Users
- Bicycle Safety
- Pedestrian Crossings
- Active, Business Friendly Street



## Trees and Landscaping

Trees and landscaping can help address:

- Traffic Speed
- Safe, Comfortable, Inviting Street



## Sidewalks

Sidewalks can help address:

- Sidewalk Connections
- Accommodating All Users
- Safe, Comfortable, Inviting Street
- Active, Business Friendly Street



## Traffic Speed

Street Furniture can help address:

- Safe, Comfortable, Inviting Street
- Active, Business Friendly Street



## Pedestrian Refuge Islands

Pedestrian refuge islands can help address:

- Traffic Speed
- Pedestrian Crossings
- Safe, Comfortable, Inviting Street

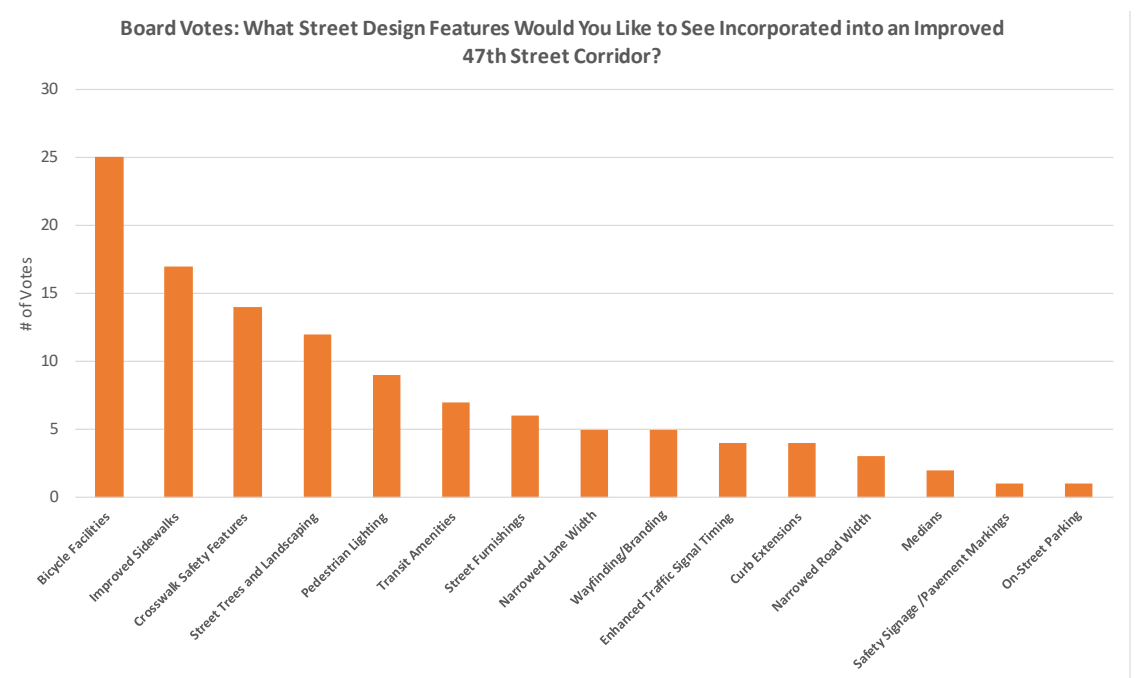
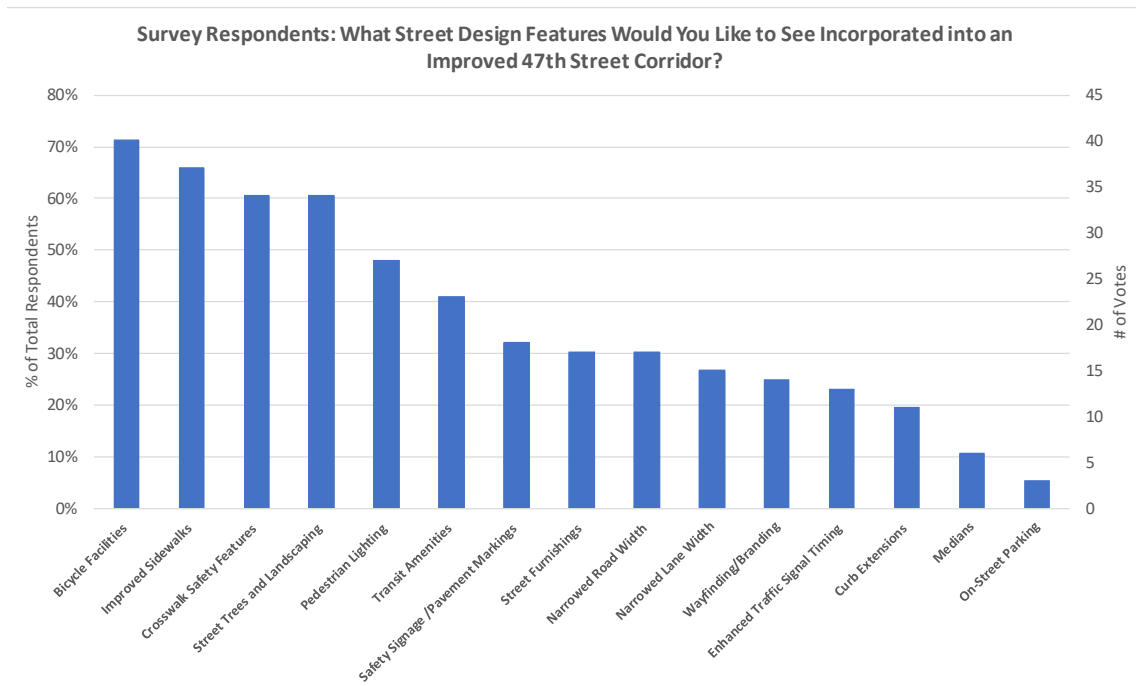


## Street Design Features Open House Survey

Most public meeting participants identified bicycle facilities, improved sidewalks, crosswalk safety features, and street trees and landscaping as design features they would like to see in the 47th Street corridor. Parking, medians, and curb extensions rated at the bottom of preferred design features, desired by fewer than one in five participants.

## Street Design Features Open House Boards

Some public meeting participants chose to place dots to identify their desired design features. The feedback generally reflects the written survey responses, with the top six priorities matching exactly. Bicycle facilities, improved sidewalks, and crosswalk safety features were at the top of the list. On-street parking, signage, and medians were lower priorities.



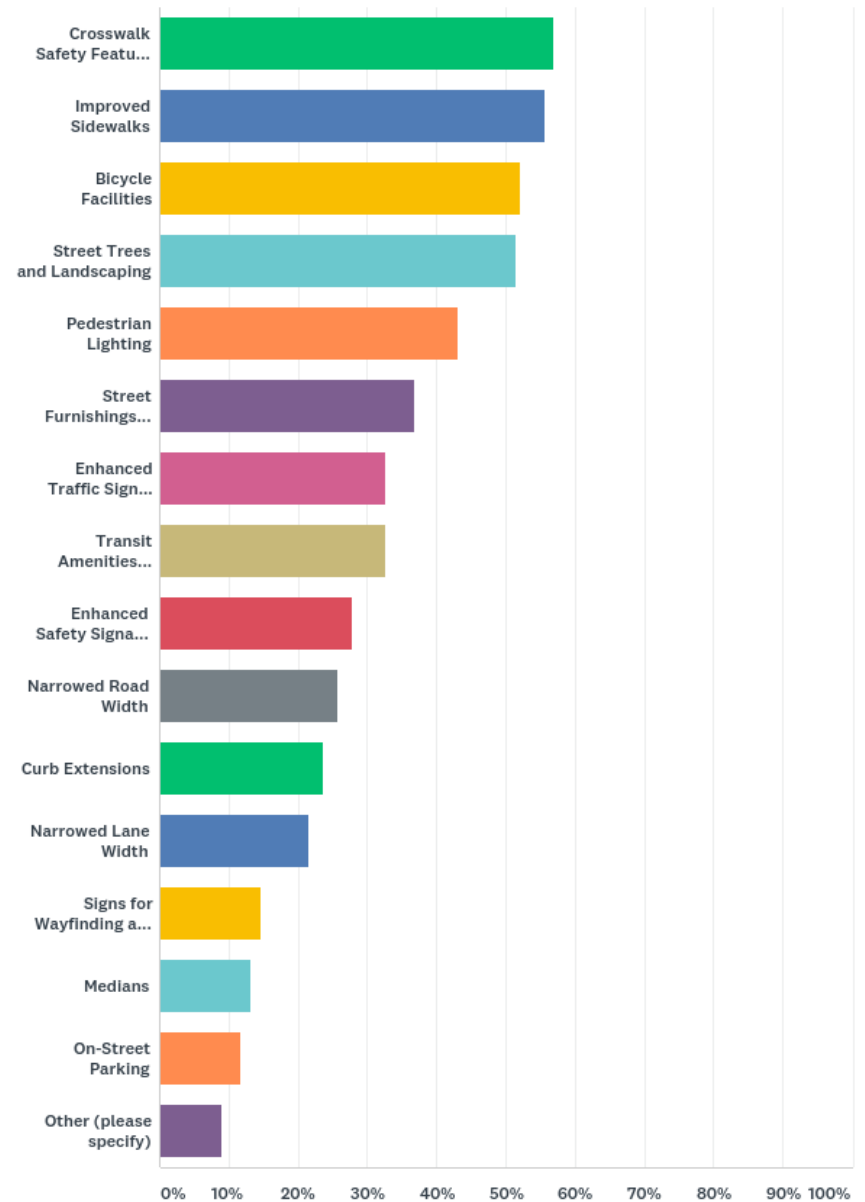
# Street Design Features Online Survey

Online survey results match public meeting feedback very closely. Survey respondents identified crosswalk safety features, improved sidewalks, and bicycle facilities as the most desired design features. On-street parking, medians, and signage were lower priorities.

ANSWER CHOICES	RESPONSES	
▼ Crosswalk Safety Features	56.94%	82
▼ Improved Sidewalks	55.56%	80
▼ Bicycle Facilities	52.08%	75
▼ Street Trees and Landscaping	51.39%	74
▼ Pedestrian Lighting	43.06%	62
▼ Street Furnishings	36.81%	53
▼ Transit Amenities	32.64%	47
▼ Enhanced Traffic Signal Timing	32.64%	47
▼ Enhanced Safety Signage and Pavement Markings	27.78%	40
▼ Narrowed Road Width	25.69%	37
▼ Curb Extensions	23.61%	34
▼ Narrowed Lane Width	21.53%	31
▼ Signs for Wayfinding and Branding	14.58%	21
▼ Medians	13.19%	19
▼ On-Street Parking	11.81%	17
▼ Other (please specify)	9.03%	13

**Total Respondents: 144**

## What street design features would you like to see incorporated into an improved 47th Street corridor?



## V. Road Diets

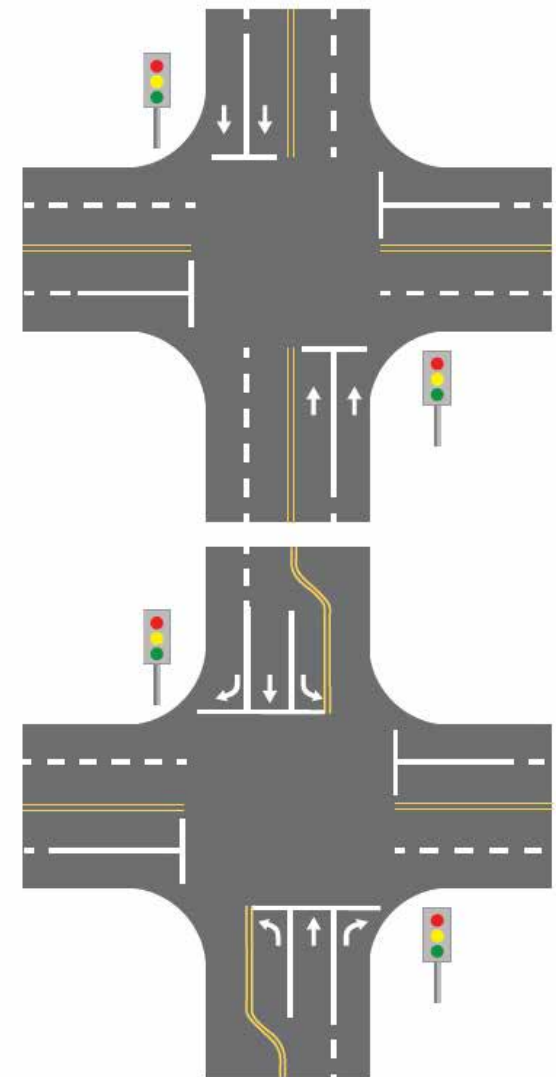
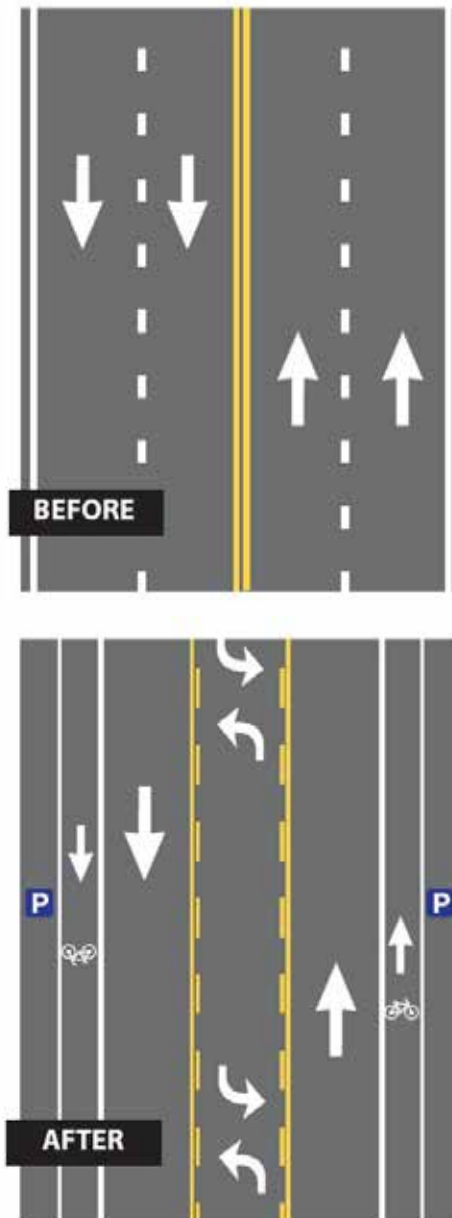
## What is a road diet?

A road diet is a reduction in the number of lanes on a road or the narrowing of lanes. A typical road diet works by reducing the number of through traffic lanes and introducing a center two-way left-turn lane.

A key benefit of a road diet is improved safety, which is achieved by reducing the potential for collisions. The center turn lane reduces conflicts between turning traffic and through traffic, while the fewer number of lanes overall reduces the number of potential conflict points for turning traffic and vehicles entering from side streets.\*

A road diet can simply involve restriping of travel lanes, but most road diets take advantage of the new space created from lane reductions to add improved pedestrian infrastructure, bicycle facilities, and/or parking.

Road diets can achieve benefits through other configurations than four lanes to three lanes. A road diet could be a five-lane to three-lane conversion or a four-lane to two-lane conversion, for instance. The same number of lanes might be retained but narrowed, with bike lanes or wider sidewalks added. Safety benefits are greatest when the number of through lanes in each direction is reduced to one.



**The extra space provided by a road diet can accommodate new uses (bike lanes, parking, transit facilities, and other amenities)**

**A three lane road diet conversion can improve the performance of intersections with many turn movements**

\*FHWA, *Road Diet Informational Guide*

# Road Diet Benefits

A road diet represents a cost-effective way to achieve multiple benefits. Road diets enable communities to manage traffic speeds and volumes, while enhancing multimodal facilities and fostering a more active and inviting street. Moreover, road diets present an opportunity to improve safety and comfort while maintaining the same traffic efficiency and capacity for automobile traffic.

- **Many road diets see reduced speeds and most result in less “aggressive” driving.**
- **Road diets reduce pedestrian crashes by as much as 80%.**
- **Road diets net an overall crash reduction of 19% to 47%.**
- **The extra space provided by a road diet can accommodate new uses (bike lanes, parking, transit facilities, and other amenities).**
- **Because road diets consist mostly of restriping, they are a relatively low-cost approach to calming traffic.**

## Calmer Traffic

With reduced travel lanes in each direction, road diets often cut down on speeding vehicles. On a typical three-lane road diet, the single travel lane in each direction means that all vehicles are forced to travel the speed of the lead vehicle.\* Most case studies of road diets report less erratic, aggressive driving, as vehicles also cannot weave between lanes to pass slower vehicles.\* Average speed can be reduced about 3 to 5 mph.\*

## Fewer Crashes

Four-lane to three-lane road diets reduce the likelihood of a variety of crash scenarios and reduce crashes overall by 19 to 47%.\* On a road with four or more lanes, left-turning traffic causes vehicles behind it to queue, producing a risk of rear-end collisions. Sideswipe crashes can occur when vehicles attempt to change lanes quickly to avoid queueing or avoid slower vehicles. With a three-lane road diet, the elimination of a second travel lane in each direction and the addition of a center turn lane reduces the risk of these types of crashes.\* Road diet configurations that retain two or more through lanes may not see some of these safety benefits.\*

## Better Pedestrian Environment

Slower and calmer vehicle traffic reduces the risk of crashes and severity of crashes, and produces a more pleasant experience for those walking. With a reduced number of travel lanes, a pedestrian has a shorter distance to cross and just one lane of traffic in each direction to cross at a time. Case studies show road diets reducing pedestrian crashes 19% to 80%.\*\*

## Better Pedestrian Environment

Reducing a four-lane road that is 40 feet wide to three lanes at 30-33 feet wide opens up space for additional features on the road. These can include infrastructure for pedestrians and cyclists, such as widened sidewalks, curb extensions, or bike lanes. On-street parallel or angled parking spaces can be added as well. These new features can be designed to improve the aesthetics and livability of a street, and can have an additional traffic calming effect. The addition of these features can be especially workable where roads currently operate below capacity for automobiles.

\*FHWA, *Road Diet Informational Guide*

\*\*FHWA *Case Studies*, “Wells Ave,” “Stone Way,” “Empire Blvd”

## Will a Road Diet Make Traffic Worse?

Because a road diet conversion reduces the number of through lanes, there is a common misconception that road diets result in more congested and difficult to travel roadways. When applied in the right locations, road diets can maintain the effective capacity of the roadway for automobiles while improving levels of service for other modes of travel. Generally, traffic flow along a road diet conversion is not only safer, but smoother and more predictable for a variety of users.

### Many four-lane roads already operate like three-lane roads

For corridors with many unsignalized side streets and access drives, through traffic will often utilize outside lanes to avoid queueing behind left-turning vehicles. In other words, whenever vehicles stop to turn left, the four-lane road effectively functions like a three-lane road. This means that a conversion from four to three lanes is unlikely to have a major impact on traffic capacity.\*\*\*

### Intersection design determines true capacity

Often, it is not the number of through lanes that is the constraining factor for movement of traffic but the design and operations of intersections. Road diet conversions from four to three lanes free up space at intersections to provide dedicated turn lanes. For intersections with large numbers of turning vehicles, this design can help reduce delay.\*\*\*

### Fewer conflict points and crashes

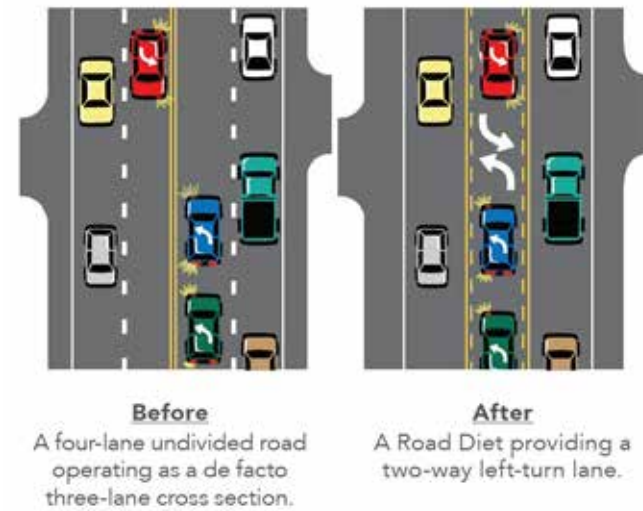
With a conversion of four lanes to three, drivers no longer have to pull across multiple lanes of traffic to turn left. Conflict points associated with cars stopping in through lanes or changing lanes are removed as well. Issues with visibility of oncoming traffic for left turning vehicles are also eliminated. Because they have fewer conflict points and increased visibility, three lane configurations allow for safer, smoother traffic.\*\*\*

### Smoother traffic flow

By removing stopped and turning vehicles from through lanes, road diet conversions result in a more consistent traffic flow, with less "accordion-style" or "slow-and-go" traffic.\*

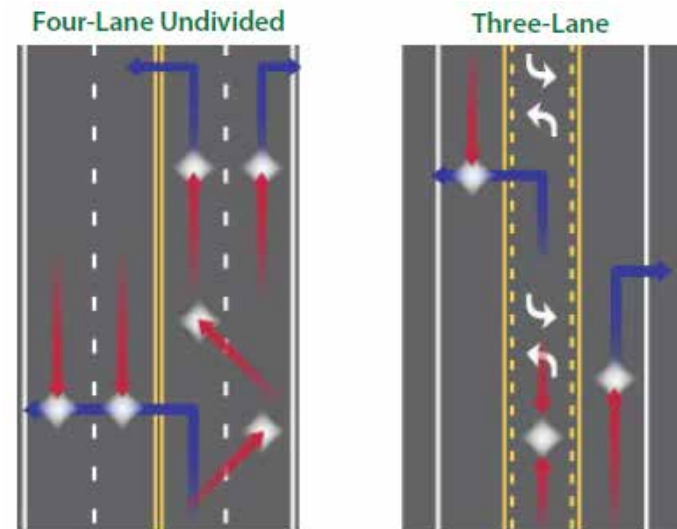
\*FHWA, *Road Diet Informational Guide*

\*\*\*FHWA, *Road Diet Mythbusters*



Source: FHWA, *Road Diet Informational Guide*

### Four lane roads with many turns already operate like three lane roads



Source: FHWA, *Road Diet Mythbusters*

### Three lane roads have fewer conflict points and crashes than four lane roads

## Is a Road Diet Feasible on 47th Street?

Road diets are an adaptable approach to calming traffic and improving safety that works in a wide range of contexts. Road diets are not feasible in every situation, however. Certain basic criteria help determine whether a road diet could work along a particular roadway:

### Traffic Volume

Road diets are effective on roads that serve up to a certain number of vehicles, though the standards vary in different locations. A 2006 study recommended a maximum average daily traffic (ADT) of between 15,000 and 17,500 vehicles per day for three-lane road diets.\*\*\*\* Multiple case studies show that road diets are feasible with ADTs near this range. Other jurisdictions have standards that allow for road diets where ADTs are up to 25,000 vehicles per day.

✓ **47th Street has fewer than 10,000 average daily trips making it an excellent road diet candidate.**

### Intersections

The number and nature of intersections (side streets and driveways) is another basic consideration for road diet feasibility. The presence of too many high-volume side streets or driveways can increase the likelihood of crashes and diminish the effectiveness of a road diet.\* Offset side street intersections increase the chances of head-on conflicts in the shared center left-turn lane of the mainline road.\* Meanwhile, too many traffic signals coupled with poor sequencing can reduce the effectiveness of a road diet.\*

✓ **Side streets along 47th are relatively low traffic. Busy cross streets (Mission and Rainbow) are signalized to manage turn movements.**

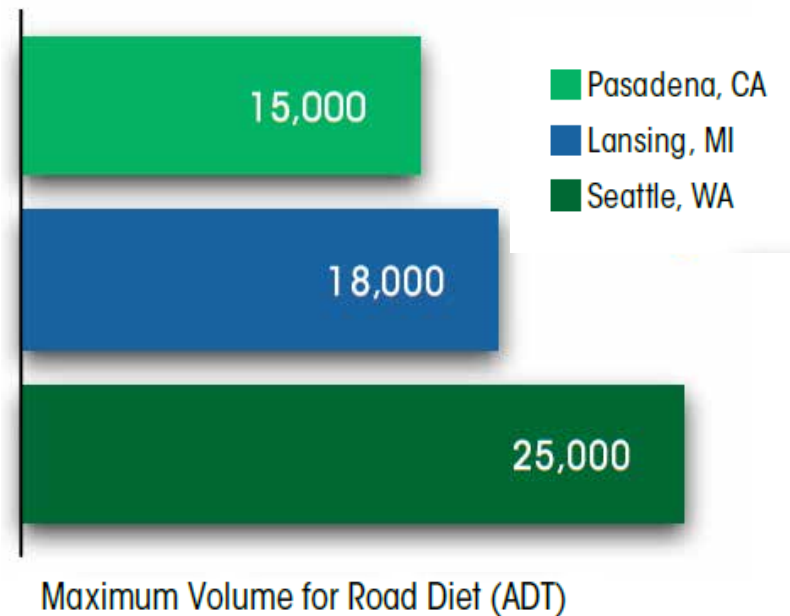
### Transitions and Project Extent

The design of transitions between road diets and different road cross sections can affect the safety outcomes of a road diet conversion. The FHWA states that "transition points should occur at locations where the only decision a driver needs to make is related to the lane drop or addition."

✓ **Because 47th Street is two lanes west of Mission and stops at Rainbow, there are no problematic lane transitions to worry about.**

\*FHWA, *Road Diet Informational Guide*

\*\*\*\*Gates, T., D. Noyce, V. Talada, L. Hill, *Safety and Operational Characteristics of Two-Way Left-Turn Lanes*







## VI. Traffic Analysis

## Introduction

For this study, traffic volumes and turning movements were observed in several locations on 47th Street at various times throughout the day over several typical weekdays and weekends. These observations tell us how the street is performing today, and help us measure how the street would function if changes were made to the design. The performance of automobile traffic is one consideration in the design of 47th Street and should be considered in balance with other community goals for the corridor.

The traffic analysis evaluated 47th Street between Mission Road and Rainbow Boulevard, 47th Terrace between Rainbow Boulevard and State Line Road, and 48th Street between Rainbow Boulevard and State Line Road. A traffic analysis was conducted to ensure the roadway alternatives maintained an appropriate capacity and level-of-service for passenger vehicles, trucks, pedestrians, bicyclists, and transit-users. The red dashed lines in the figure to the right show the streets analyzed in this study.

This traffic study includes peak-hour turning movement counts collected at 47th Street & Mission Road, 47th Street & Belinder Avenue/Fisher Street, and 47th Street & Rainbow Boulevard to evaluate the operational efficiency of the intersections along the corridor. The counts include all conventional travel modes including passenger vehicles, trucks, pedestrians, bicyclists, and transit-users. The study also includes daily vehicle traffic counts of 47th Terrace between Rainbow Boulevard and State Line Road and 48th Street between Rainbow Boulevard and State Line Road.



## Streets Included in Analysis

- W 47th Street/County Line Road – Four-lane, undivided principal arterial  
Posted speed limit of 30 mph
- Mission Road – Two-lane principal arterial  
Posted speed limit of 30 mph
- Belinder Avenue/Fisher Street – Two-lane residential collector  
Posted speed limit of 25 mph
- Rainbow Boulevard – Four-lane, undivided principal arterial  
Posted speed limit of 35 mph
- 47th Terrace – Two-lane residential street  
Posted speed limit of 25 mph
- 48th Street – Two-lane residential street  
Posted speed limit of 25 mph
- State Line Road – Two-lane, undivided principal arterial  
Posted speed limit of 30 mph

# Turning Movement Counts

Traffic counts representative of a typical weekday were taken at the intersections of 47th Street & Mission Road, 47th Street & Belinder Avenue/Fisher Street, and 47th Street & Rainbow Boulevard. Recording times included the AM peak hour, Midday peak hour, PM peak hour, and Saturday peak hour. Traffic volumes were recorded in 15 minute intervals on July 12th, July 15th, July 18th, July 19th, and July 22nd. Inclement weather conditions and national holiday traffic did not impact traffic counts. The following tables summarize the traffic volumes measured for a typical AM, Midday, PM, and Saturday PM peak hour.

Wed 7-12-2017		AM Peak Hour, 47th Street & Mission Road Turning Movement Counts										
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.94	149	281	32	18	101	78	14	179	39	89	110	92

Tues 7-18-2017		Midday Peak Hour, 47th Street & Mission Road Turning Movement Counts										
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.91	100	195	14	27	188	90	31	114	42	87	106	144

Wed 7-12-2017		PM Peak Hour, 47th Street & Mission Road Turning Movement Counts										
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.96	137	217	37	62	332	121	51	126	36	153	318	311

Sat 7-15-2017		Saturday Peak Hour, 47th Street & Mission Road Turning Movement Counts										
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.98	124	207	27	41	175	103	37	78	38	117	97	150

Wed 7-19-2017		AM Peak Hour, 47th Street & Belinder Avenue/Fisher Street Turning Movement Counts										
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.92	2	330	38	21	152	2	42	3	48	2	4	6

Wed 7-19-2017		Midday Peak Hour, 47th Street & Belinder Avenue/Fisher Street Turning Movement Counts										
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.94	5	228	33	31	229	4	39	4	45	1	5	4

Wed 7-19-2017		PM Peak Hour, 47th Street & Belinder Avenue/Fisher Street Turning Movement Counts										
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.93	15	366	64	49	412	5	52	2	54	1	7	12

Sat 7-22-2017		Saturday Peak Hour, 47th Street & Belinder Avenue/Fisher Street Turning Movement Counts										
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.97	11	289	40	23	261	5	47	6	20	1	3	9

Wed 7-12-2017		AM Peak Hour, 47th Street & Rainbow Boulevard Turning Movement Counts										
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.90	248	6	153	8	4	15	72	570	1	7	348	73

Tues 7-18-2017		Midday Peak Hour, 47th Street & Rainbow Boulevard Turning Movement Counts										
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.94	156	5	85	5	4	11	80	306	1	10	374	140

Wed 7-12-2017		PM Peak Hour, 47th Street & Rainbow Boulevard Turning Movement Counts										
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.95	195	3	148	5	7	5	141	333	4	7	817	307

Sat 7-15-2017		Saturday Peak Hour, 47th Street & Rainbow Boulevard Turning Movement Counts										
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.95	227	14	118	5	4	9	113	181	12	11	189	145

## Average Annual Daily Traffic 47th Street

An estimate of the average daily traffic on the connecting roadway segments is given below. Using the highest two-way peak hour volume on each segment to represent 10%, the average daily traffic volumes are shown on the adjacent figure. The average annual daily traffic for 47th Street is calculated at 9,210 vehicles per day at Mission Road and 8,010 vehicles per day at Rainbow Boulevard.



## Daily Traffic Counts 47th Terrace and 48th Street

Daily traffic counts were recorded for 47th Terrace and 48th Street between Rainbow Boulevard and State Line Road on Wednesday, July 12th and Thursday, July 13th. Counts were performed at both the east and west connections of 47th Terrace and 48th Street but not on Rainbow Boulevard or State Line Road. The daily counts were averaged and are shown in the figure below as the average daily traffic (ADT) in vehicles per day (vpd). 50% of traffic on 47th Terrace are local residents while 50% of traffic is passing through. 44% of traffic on 48th Street are local residents while 56% of traffic is passing through.



Truck Counts - 47th Street & Mission Road					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/12/17)	7	6	0	4	18   0.8%
PM Hours (Wed, 07/12/17)	2	4	4	6	16   0.5%
Midday Hours (Tue, 07/18/17)	9	8	4	10	31   1.5%
Saturday Hours (Sat, 07/15/17)	1	3	2	1	7   0.3%

Truck Counts - 47th Street & Belinder Avenue/Fisher Street					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/19/17)	14	5	0	1	20   1.7%
PM Hours (Wed, 07/19/17)	2	4	1	0	7   0.4%
Midday Hours (Wed, 07/19/17)	6	4	0	1	11   0.8%
Saturday Hours (Sat, 07/22/17)	1	0	0	0	1   0.1%

Truck Counts - 47th Street & Rainbow Boulevard					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/12/17)	3	1	7	15	26   1.0%
PM Hours (Wed, 07/12/17)	5	0	7	8	20   0.6%
Midday Hours (Tue, 07/18/17)	7	1	14	26	48   1.9%
Saturday Hours (Sat, 07/15/17)	0	0	5	3	8   0.4%

## Truck Counts

Trucks were counted at each of the three intersections studied during the AM hours from 7:00 until 9:00, during the PM hours from 4:00 until 6:00, during the weekday Midday hours from 11:00AM until 1:00PM, and during Saturday afternoons from 4:00PM until 6:00PM. The tables to the right show the number of trucks for the approaches at intersections along 47th Street for the two hour recorded periods.

Truck traffic was less than two percent of the traffic total measured during the two-hour count periods taken at the three intersections. The highest truck volumes were counted on northbound and southbound Rainbow Boulevard during the weekday midday period. Saturday counting period truck traffic dropped-off significantly compared to the weekday periods.

## Pedestrian Counts

Pedestrian counts were taken at each of the three intersections studied during the AM hours from 7:00 until 9:00, during the PM hours from 4:00 until 6:00, during the weekday midday hours from 11:00AM until 1:00PM, and during Saturday afternoons from 4:00PM until 6:00PM. The counts were taken during mid-July, so cold or frigid weather was not a factor in keeping people indoors. The tables below show the pedestrian counts for the two hour recorded periods.

47th & Mission is a fully-actuated, signalized intersection with two pedestrian signal heads at each corner for crossing on either side of the streets. The pedestrian push-buttons are mounted to the main traffic signal poles on each corner of the intersection. There are sidewalks along both sides of the intersecting streets on all approaches, and there are depressed ramps on all corners for ADA access.

47th & Belinder Avenue/Fisher Street is two-way stop-controlled intersection with free access for 47th Street and stop signs on Fisher Street to the north and Belinder Avenue to the south. There is sidewalk along both sides of 47th Street on both approaches. The northbound approach has sidewalk on the western side only. There is sidewalk on the western side only of the southbound approach ending approximately 130 ft to the north of the intersection. All four corners of the intersection have depressed sidewalk ramps with the ramps only on the south side of 47th Street having detectable truncated domes cast into the approaches.

The intersection of 47th & Rainbow is fully signalized with two pedestrian signal heads at each corner for crossing on either side of the streets. The western approach leg is a private drive to the recently constructed apartment building on the southeastern corner. There are short auxiliary poles for the pedestrian crossing activation buttons. There is sidewalk along both sides of each approach except for the westbound private drive which has sidewalk only on the south side. Each corner of the intersection has depressed sidewalk ramps to facilitate pedestrian crossings.

Pedestrian Counts - 47th Street & Mission Road					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/12/17)	1	1	4	1	7
PM Hours (Wed, 07/12/17)	7	3	3	1	14
Midday Hours (Tue, 07/18/17)	1	9	6	9	25
Saturday Hours (Sat, 07/15/17)	17	7	12	5	41

Pedestrian Counts - 47th Street & Belinder Avenue/Fisher Street					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/19/17)	3	2	3	5	13
PM Hours (Wed, 07/19/17)	6	1	6	6	19
Midday Hours (Wed, 07/19/17)	3	0	9	6	18
Saturday Hours (Sat, 07/22/17)	4	0	5	3	12

Pedestrian Counts - 47th Street & Rainbow Boulevard					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/12/17)	3	10	2	2	17
PM Hours (Wed, 07/12/17)	2	9	0	1	12
Midday Hours (Tue, 07/18/17)	3	5	0	2	10
Saturday Hours (Sat, 07/15/17)	0	16	5	2	23

# Bicycles on the Road

Bicyclists riding on the roadway counts were taken at each of the three intersections studied during the AM hours from 7:00 until 9:00, during the PM hours from 4:00 until 6:00, during the weekday midday hours from 11:00AM until 1:00PM, and during Saturday afternoons from 4:00PM until 6:00PM. The counts were taken during mid-July, so cold or frigid weather was not a factor in keeping bicycles off of the roads. The tables below show the bicycles on the roadway counts for the two hour recorded periods.

With the heavy volume of vehicular traffic and the absence of bike lanes or wide street lane widths, bicycle traffic was low. Both 47th Street and Rainbow Boulevard are undivided four-lane streets with no bicycle lanes, and there appears to be minimal right-of-way to expand either street for adding bicycle lanes without a road diet. A road diet converts a four-lane street to a three-lane street with the center lane acting as a two-way left-turn lane. Mission Road, Fisher Street to the north, and Belinder Avenue to the south are all two-lane streets with minimal right-of-way for adding bicycle lanes.

# Bicycles on the Sidewalk

The two-hour count periods taken at the intersection of 47th & Mission showed only one bicycle on the crosswalk during the weekday midday counts and five bicycles during the Saturday counts. 47th & Belinder Avenue/Fisher Street showed only one bicycle during the AM, Midday and PM peak hours on the sidewalk and zero bicycles during the Saturday counts. 47th & Rainbow Boulevard showed only one bicycle during the AM and Midday counting periods and zero bicycles during the PM and Saturday counting periods.

Bicycles on the Road Counts - 47th Street & Mission Road					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/12/17)	1	0	0	1	2
PM Hours (Wed, 07/12/17)	0	0	0	0	0
Midday Hours (Tue, 07/18/17)	0	0	0	0	0
Saturday Hours (Sat, 07/15/17)	0	2	0	1	3

Bicycles on the Road Counts - 47th Street & Belinder Avenue/Fisher Street					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/19/17)	1	2	4	1	8
PM Hours (Wed, 07/19/17)	2	1	0	5	8
Midday Hours (Wed, 07/19/17)	1	0	2	1	4
Saturday Hours (Sat, 07/22/17)	1	1	2	1	5

Bicycles on the Road Counts - 47th Street & Rainbow Boulevard					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/12/17)	0	0	0	0	0
PM Hours (Wed, 07/12/17)	0	0	3	0	3
Midday Hours (Tue, 07/18/17)	0	0	0	0	0
Saturday Hours (Sat, 07/15/17)	1	1	0	1	3

## Bus Counts

Buses were counted at each of the three intersections studied during the AM hours from 7:00 until 9:00, during the PM hours from 4:00 until 6:00, during the weekday midday hours from 11:00AM until 1:00PM, and during Saturday afternoons from 4:00PM until 6:00PM. The tables below show the number of buses for the approaches at intersections along 47th Street for the two hour recorded periods.

There was a significant amount of bus traffic during the AM and PM counting periods. Bus traffic during the midday hours was relatively high at 47th & Rainbow but was lower at 47th & Mission and 47th & Fisher Street/Belinder Avenue. Saturday bus service at all of the counted intersections was very light.

Bus Counts - 47th Street & Mission Road					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/12/17)	7	3	1	7	18
PM Hours (Wed, 07/12/17)	5	4	0	4	13
Midday Hours (Tue, 07/18/17)	1	0	0	4	5
Saturday Hours (Sat, 07/15/17)	0	0	0	4	4

Bus Counts - 47th Street & Belinder Avenue/Fisher Street					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/19/17)	4	3	4	0	11
PM Hours (Wed, 07/19/17)	3	4	7	0	14
Midday Hours (Wed, 07/19/17)	3	2	4	0	9
Saturday Hours (Sat, 07/22/17)	1	0	0	0	1

Bus Counts - 47th Street & Rainbow Boulevard					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/12/17)	9	0	8	12	29
PM Hours (Wed, 07/12/17)	10	0	8	16	34
Midday Hours (Tue, 07/18/17)	6	0	9	12	27
Saturday Hours (Sat, 07/15/17)	2	0	0	0	2



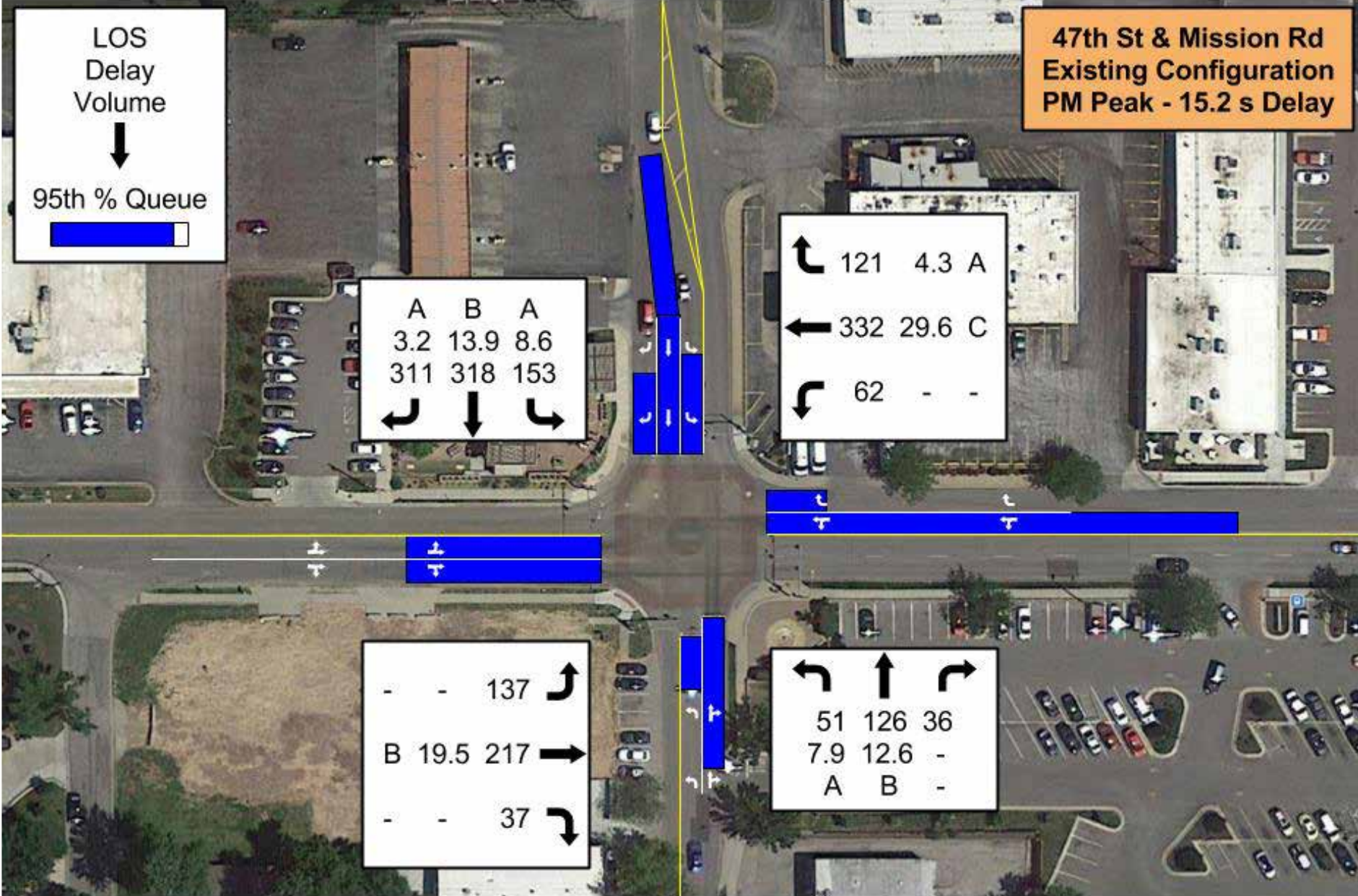
## Capacity Analysis

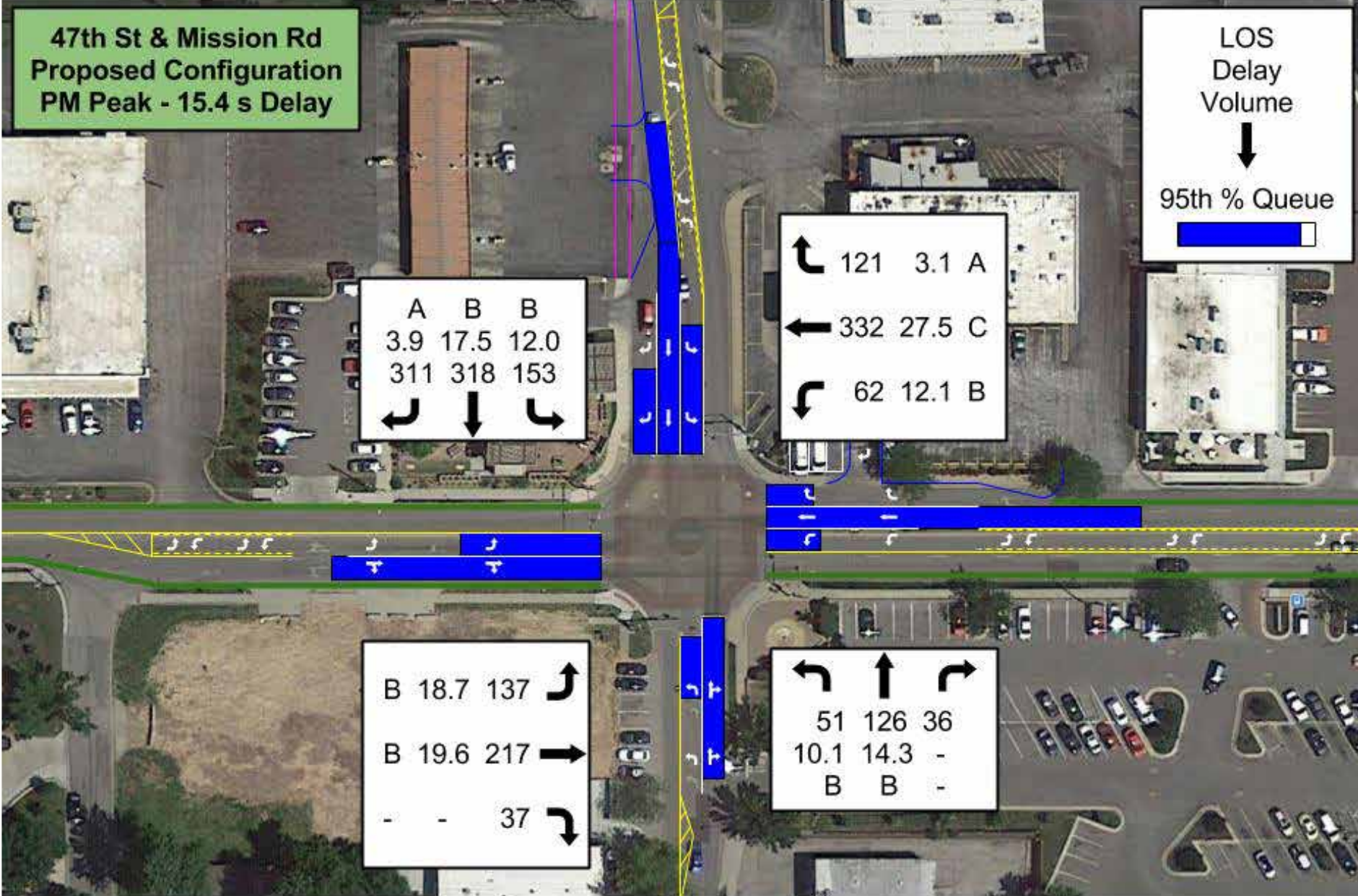
Using the traffic counts, 8 traffic models were created for the traffic conditions in the 47th Street corridor.

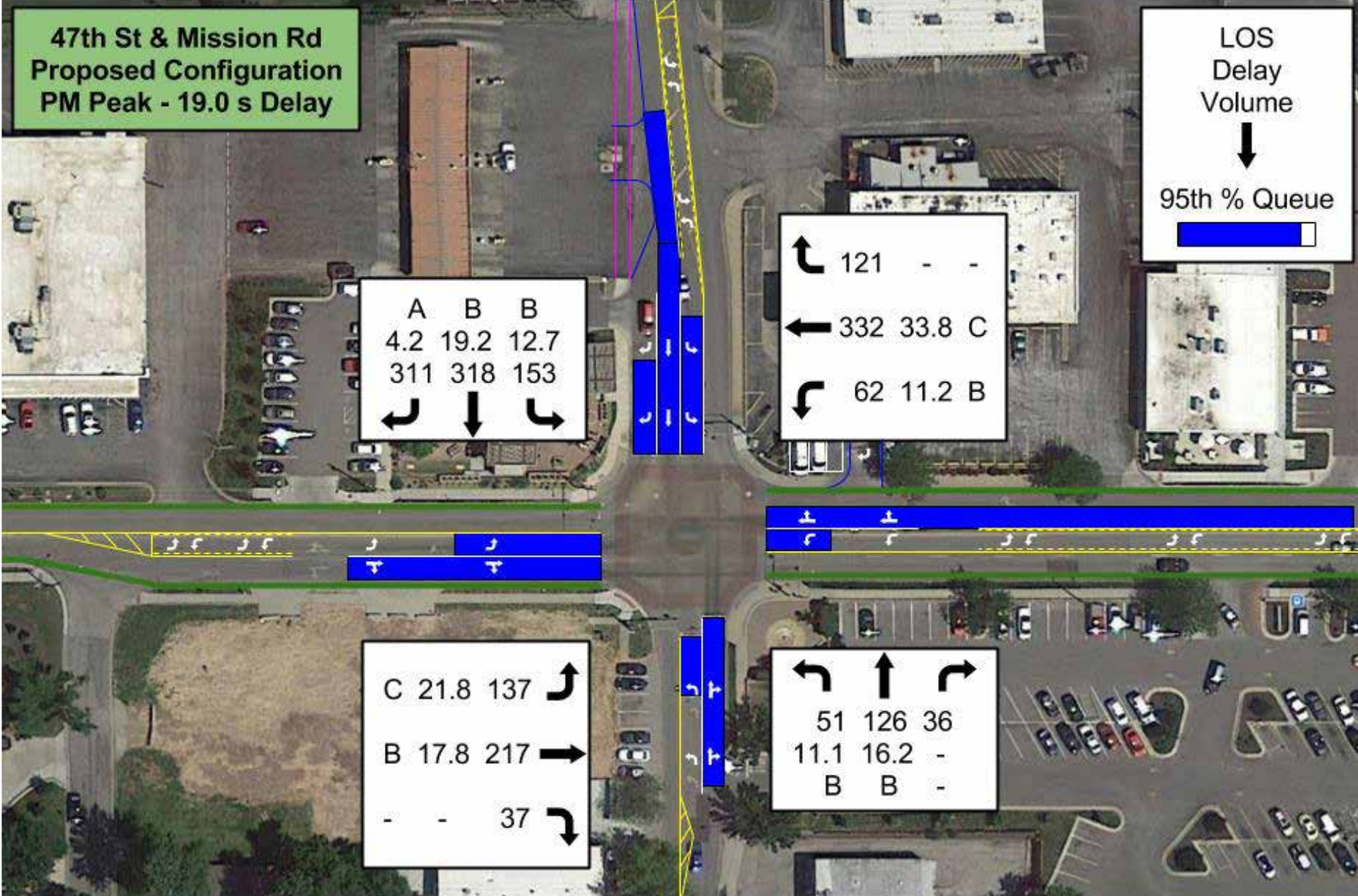
- **Scenario 1** - Existing street/pre-development conditions - (AM Peak Traffic 2017)
- **Scenario 2** - Existing street/pre-development conditions - (Midday Peak Traffic 2017)
- **Scenario 3** - Existing street/pre-development conditions - (PM Peak Traffic 2017)
- **Scenario 4** - Existing street/pre-development conditions - (Saturday Peak Traffic 2017)
- **Scenario 5** - Road Diet alternative design - (AM Peak Traffic 2017)
- **Scenario 6** - Road Diet alternative design - (Midday Peak Traffic 2017)
- **Scenario 7** - Road Diet alternative design - (PM Peak Traffic 2017)
- **Scenario 8** - Road Diet alternative design - (Saturday Peak Traffic 2017)

## Capacity and Level of Service

Three performance measures commonly used for a traffic impact analysis are vehicle delay, level-of-service (LOS), and queue length. Vehicle delay is the average delay, in seconds, experienced by one vehicle passing through the intersection. The quality of traffic operation at an intersection is defined through level-of-service (LOS) which consists of assignments of 'A' for free-flowing conditions through 'F' for congested conditions. The procedures and methodology for determining the LOS are outlined in the Highway Capacity Manual (HCM 2010), produced by the Transportation Research Board. LOS 'A' through 'C' is considered acceptable. 95th percentile queue length is the overall length of a line of stopped vehicles. Note that queue length is reported in the left\thru\right order. For stop control intersections, the queue length is measured in terms of accumulated number of vehicles which would be lined up waiting to proceed. The "-" symbol represents shared lane or non-existent movement, thus no queue length given. Highlighted results of the scenarios are summarized in the diagrams on the following pages. More detailed information can be found in the appendices.







**47th St & Belinder Ave  
Existing Configuration  
PM Peak - 2.9 s Delay**

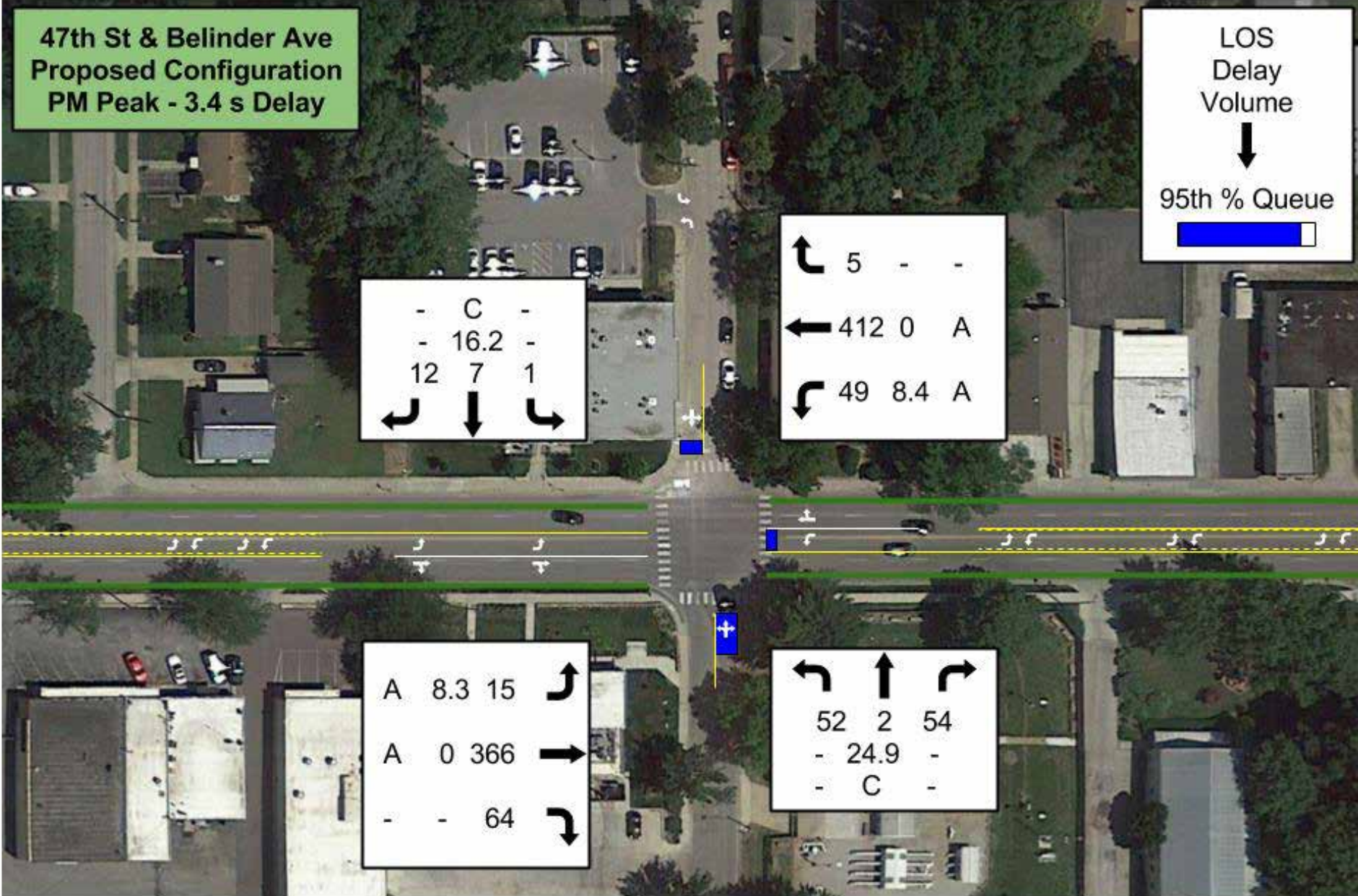
LOS  
Delay  
Volume  
↓  
95th % Queue  
[Progress bar]

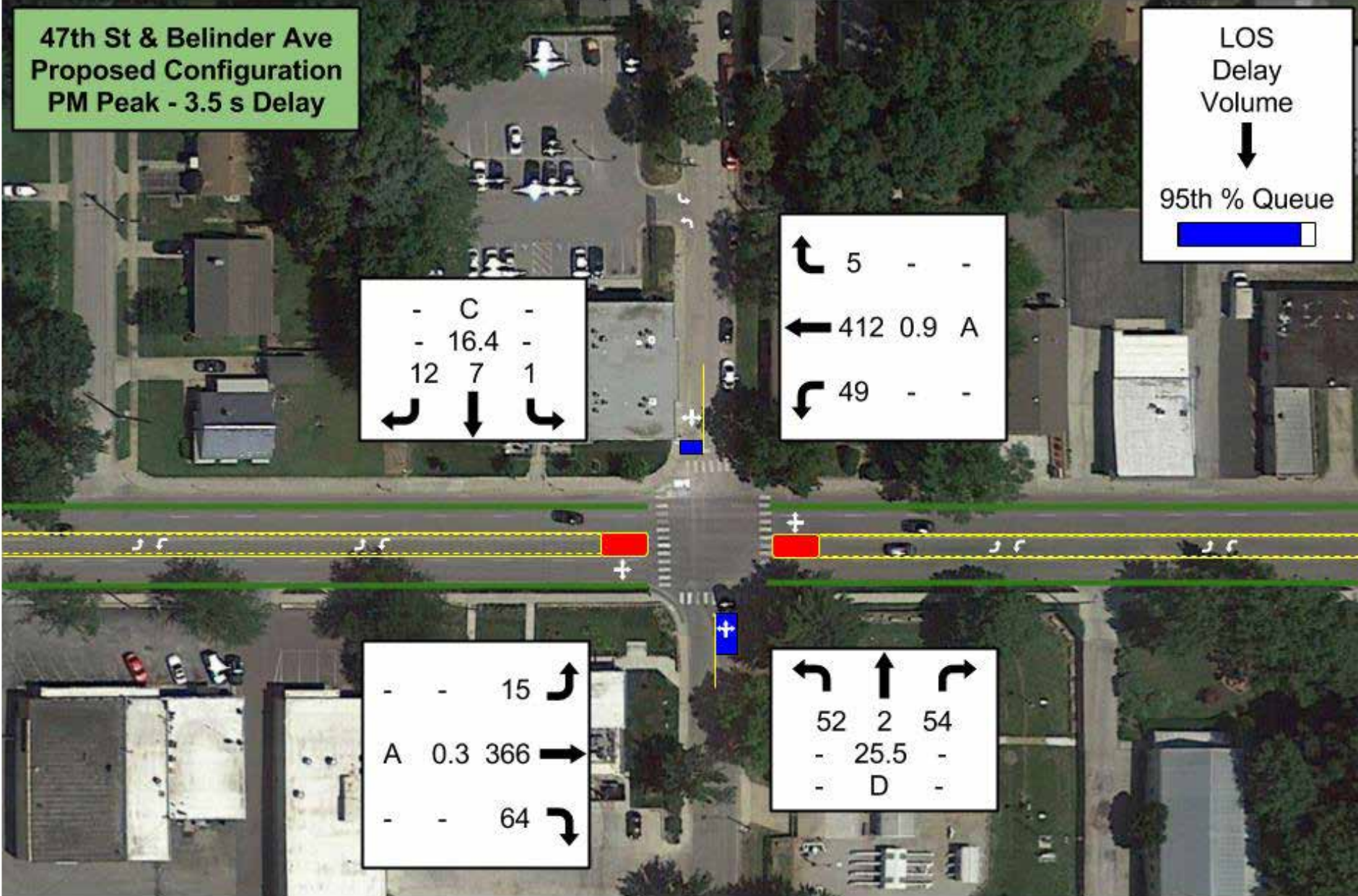
-	C	-
-	15.2	-
12	7	1
↶	↓	↷

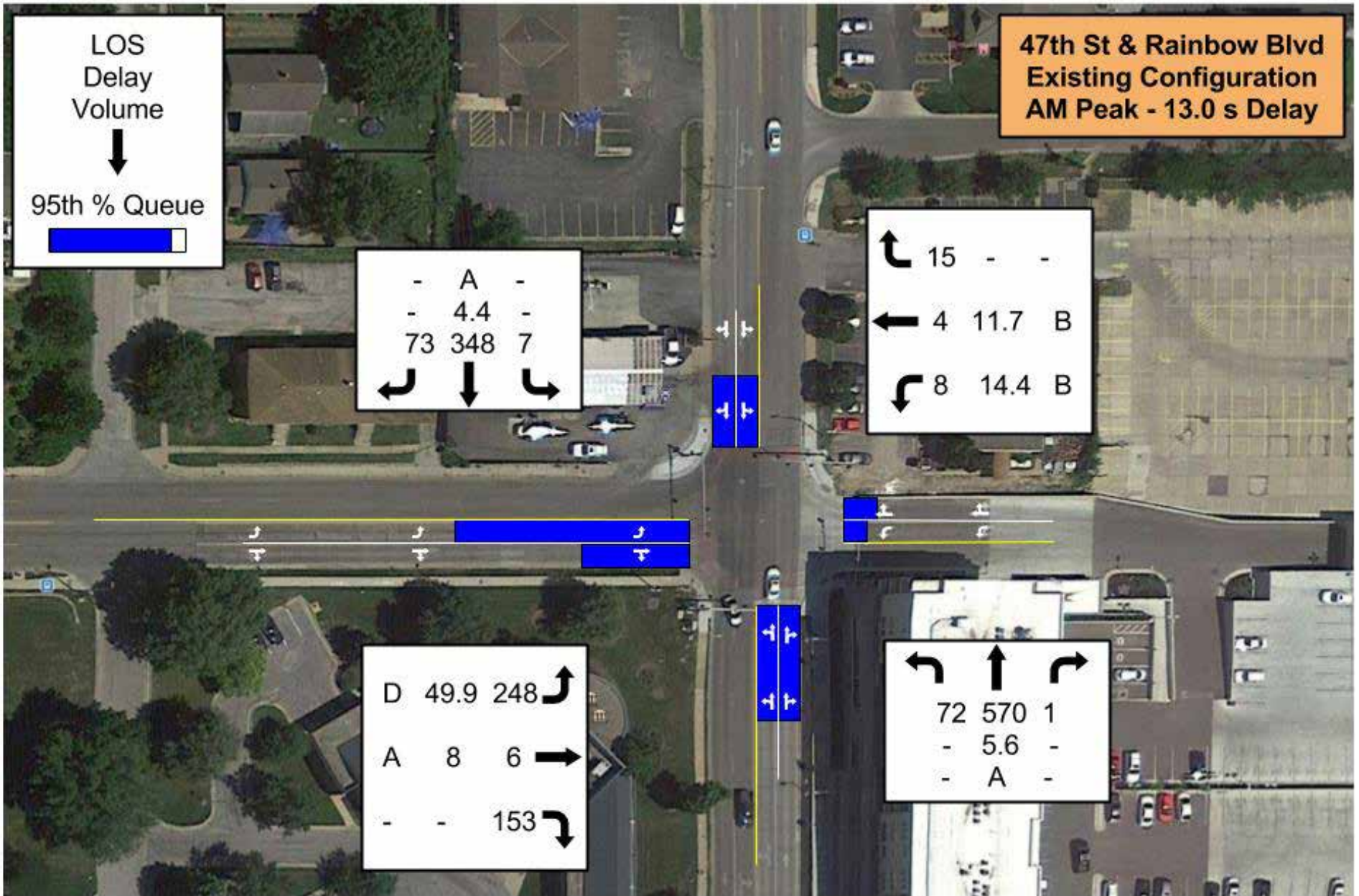
↶	5	-	-
↶	412	0.2	A
↶	49	8.4	A

A	8.3	15	↷
A	0.1	366	→
-	-	64	↷

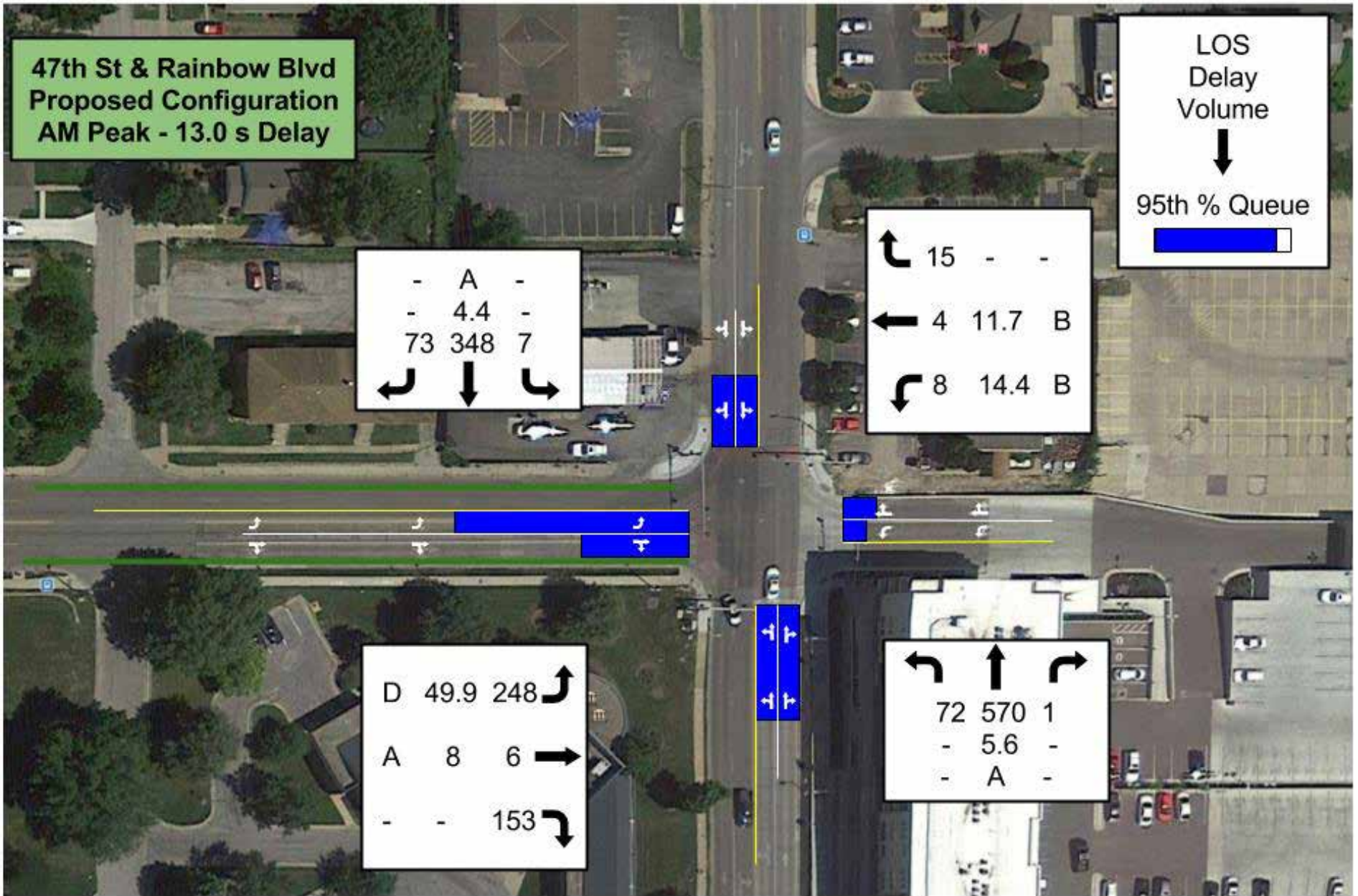
↶	↑	↷
52	2	54
-	19.1	-
-	C	-











# Truck Turning

The existing intersection at 47th Street and Mission Road has difficulty accommodating right turn movements of large trucks, which must either encroach on other lanes or the curb zone. The adjacent diagrams illustrate left and right truck turning movements for both existing conditions and a road diet scenario.

None of the proposed design options worsen truck turning movements at the intersection, but no configuration of lanes within the existing curb lines can fully address truck turning challenges.

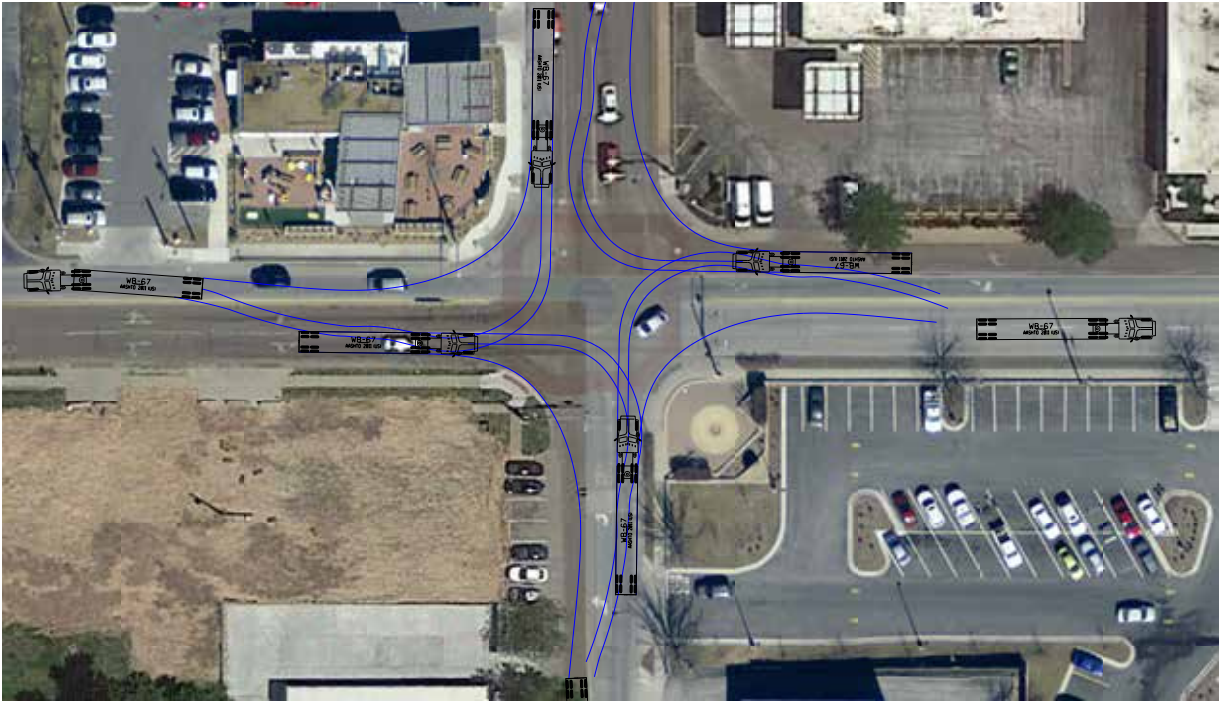
Solutions to truck turning challenges could include management of the hours or direction of truck travel, or a transition to smaller truck vehicles. Changes to the intersection footprint to accommodate truck turning would have major impacts on adjacent properties.



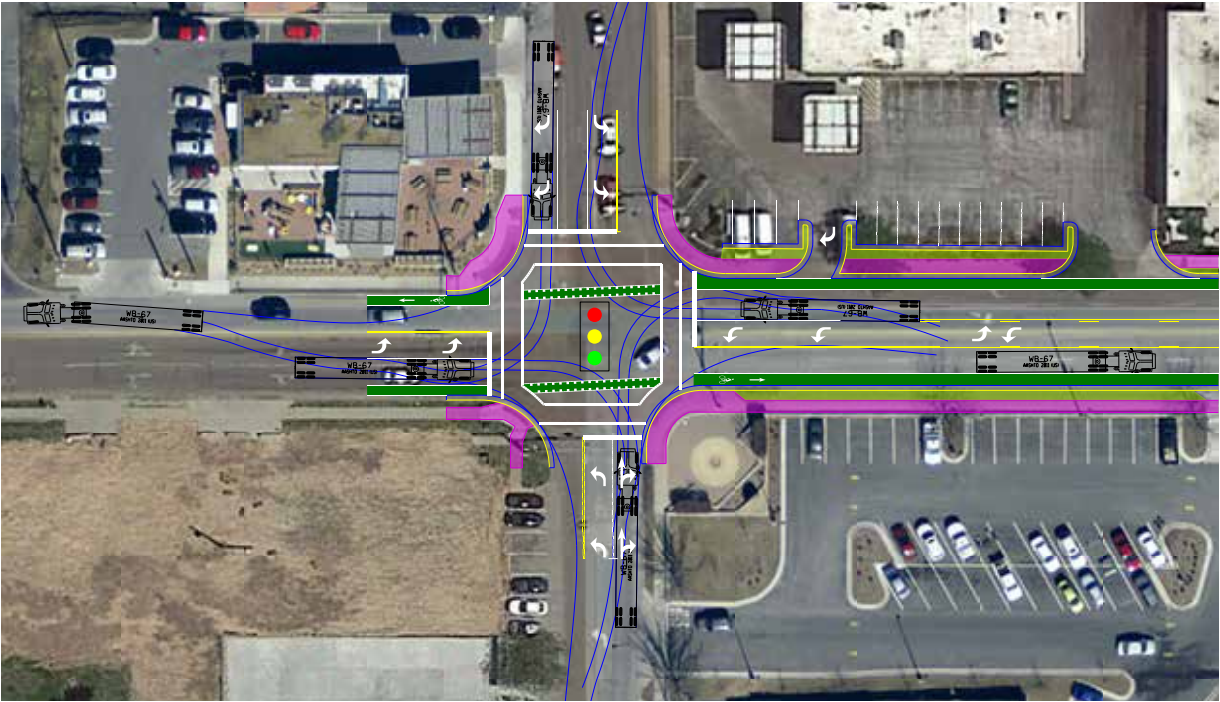
**Left Turns from 47th Street**



**Left Turns from Mission Road**



**Right Turns - Existing**



**Right Turns - Road Diet Scenario**

## Existing Traffic Conditions

### **47th Street & Mission Road (Fully-Actuated Signal)**

The intersection operated at LOS B for each of the recorded peak hours. During the weekday PM peak hour, the westbound approach operated at LOS C with a delay of 23.6 seconds per vehicle but all other approaches for all other peak hours was LOS A or B. The longest queue was for the PM peak hour westbound through movement with a 244 feet length. At the intersection, one of the westbound through lanes on 47th Street transitions into a right-turn only lane. The approaches all have adequate distance within existing left turn lanes and queue spillback into the through lane is not expected. Since the intersection has detectors on all approaches, the traffic operations flow smoothly without unacceptable delay times.

### **47th Street & Belinder Avenue/Fisher Street (Two-way Stop Controlled)**

The intersection operated at LOS A for each of the recorded peak hours. The eastbound and westbound approaches moved freely while the northbound and southbound approaches were stop controlled. For the weekday PM peak hour, the northbound and southbound approaches had a LOS C but the delay per vehicle was less than 20 seconds, which is considered acceptable. All other peak hours had movements that were LOS A or LOS B. The northbound queue was longest in the PM with a length of 1.3 vehicles at the 95th percentile level, and the southbound queue was longest in the PM with a length of 0.2 vehicles at the 95th percentile level.

### **47th Street & Rainbow Boulevard (Fully-Actuated Signal)**

The intersection operated at LOS B for the AM peak hour and Saturday peak hour while the Midday peak hour and PM peak hour were LOS A. The northbound and southbound approaches on Rainbow Boulevard were LOS A for all peak hours. The westbound approach was LOS B with the highest delay in the PM peak hour at 14.6 seconds per vehicle. The eastbound approach was LOS C for all peak hours with the AM peak hour having a delay of 33.6 seconds per vehicle. The eastbound left-turn queue reached 118 feet in the AM peak hour, which does not have a queue spillback since one of the eastbound through lanes on 47th Street transitions into a left-turn only lane.

## Road Diet Traffic Conditions

The following is an analysis of a road diet alternative design with the four-lane section of 47th Street revised to three lanes including a single eastbound, a single westbound and a center dual-direction left-turn lane.

### **47th Street & Mission Road (Fully-Actuated Signal)**

The intersection operated at LOS B for each of the recorded peak hours. During the weekday Midday, PM, and Saturday PM peak hour, the westbound approach operated at LOS C with a delay ranging from 21.7 to 31.1 seconds per vehicle but all other approaches for all other peak hours was LOS A or B. The longest queue was for the PM peak hour westbound thru movement with a 299 feet length. There were no significant changes in LOS for the intersection under the road diet alternative design compared to existing operations for any of the different traffic periods examined in this report.

### **47th Street & Belinder Avenue/Fisher Street (Two-way Stop Controlled)**

The intersection operated at LOS A for each of the recorded peak hours. For the weekday PM peak hour, the northbound and southbound approaches had a LOS C but the delay per vehicle was less than 25 seconds, which is considered acceptable. For the Saturday PM peak hour, the northbound approach had a LOS C but the delay per vehicle was less than 16 seconds (threshold time to change from B to C is 15 seconds). All other peak hours had movements that were LOS A or LOS B. The northbound queue was longest in the PM with a length of 1.8 vehicles at the 95th percentile level, and the southbound queue was longest in the PM with a length of 0.2 vehicles at the 95th percentile level. There were no significant changes in LOS for the intersection under the road diet alternative design compared to existing operations for any of the different traffic periods examined in this report.

## **47th Street & Rainbow Boulevard (Fully-Actuated Signal)**

The intersection operated at LOS B for the AM peak hour while the Midday peak hour, PM peak hour, and Saturday PM peak hour were LOS A. The northbound and southbound approaches on Rainbow Boulevard were LOS A for all peak hours. The westbound approach was LOS B with the highest delay in the PM peak hour at 14.8 seconds per vehicle. The eastbound approach was LOS C for AM and PM weekday peak hours with the AM peak hour having a delay of 33.6 seconds per vehicle and the PM peak hour having a delay of 26.9 seconds per vehicle. The eastbound left-turn queue reached 118 feet in the AM peak hour, which does not have a queue spillback since the eastbound left-turn lane has plenty of extra length due to the two-way left-turn lane along 47th Street. There were no significant changes in LOS for the intersection under the road diet alternative design compared to existing operations for any of the different traffic periods examined in this report.

## **Pedestrian Needs**

Sidewalks that are adjacent to the back of the curb should be at least 6 feet wide while sidewalks with a grassy separation strip to the back of the curb should be five feet. Due to the commercial and mixed use land categories, four feet wide sidewalks with the occasional lateral extension are not recommended. Truncated domes are needed at each sidewalk ramp to be compliant with ADA standards. Truncated domes provide an underfoot texture to denote when a pedestrian who is blind or has impaired vision is entering the roadway. The NE and NW sidewalk ramps at 47th Street & Belinder Avenue/Fisher Street need to be made ADA compliant since the ramps are lacking truncated domes and sidewalk crossing of 47th Street end in curb rather than a ramp. The 47th Street sidewalk in front of Northwood Shopping center has recently been reconstructed and is a good example to match for other segments of 47th Street that are necessary to replace. Crosswalk pushbuttons are provided at every corner at 47th Street & Mission Road and 47th Street & Rainbow Boulevard. If 47th Street is road dieted to convert to a three-lane cross section, pedestrian bulb outs are recommended to reduce the distance to cross 47th Street.

## **Bicyclist Needs**

North-south traffic on Belinder Avenue/Fisher Street currently has the highest bicycle traffic within the study area. Adding bicycle lanes would be possible for a 47th Street road diet conversion which would add to the multimodal connectivity of the district and would create a larger buffer between passenger vehicles and pedestrians on the sidewalk. On street bike lanes would need to be at least four feet wide. If 47th Street is converted to a three-lane cross section, combined pedestrian bulb outs/protected bike lanes at major intersections are recommended.

# Geometric Improvements

## Dual Left-Turn Check

The highest volume for left-turn movements is for the eastbound left-turn lane at 47th Street & Rainbow Boulevard at 248 vph in the AM peak hour. A single left-turn lane is adequate for the existing traffic and does not need to be updated to include a dual left-turn. Most left-turn lanes have a capacity per hour of around 300 vehicles and the AM peak hour had the most left-turns at 248 vehicles for the eastbound approach.

## Road Diet Alternative

The road diet concept converts a four-lane street to a three-lane street with the center lane acting as a two-way left-turn lane. Road diets are normally deemed appropriate for streets with less than 15,000 vehicles per day and 47th Street handles approximately 9,000 vehicles per day. KDOT's access management policy (2013) states that two-way left-turn lanes are appropriate for between 5,000 to 12,000 vehicles per day for two-lane roadways with a speed limit of 45 mph or below. 47th Street is within the traffic range of having a two-way left-turn lane if converted to a road diet design. The width of the two-way left-turn lane should be the same width as the through lanes.

At 47th Street & Mission Road, if 47th Street is converted to a road diet, a left-turn will be included for westbound traffic, but the existing right-turn lane is not needed according to KDOT's access management policy (2013). For the road diet, the eastbound combined through lanes and turn lanes should be changed to a left-turn lane and a through/right lane. For the road diet design, the eastbound and westbound left-turn signal heads at 47th Street & Mission Road should be changed to be protected-permitted to allow for more efficient traffic operations for left-turns.

At Belinder Avenue/Fisher Street, the road diet design functions adequately with or without a two-lane left-turn lane for eastbound and westbound approaches. Turn lanes minimize traffic delays, but pedestrian refuge islands for crossing pedestrians may be desired. Right-turn lanes are not required.

At 47th Street & Rainbow Boulevard, the road diet design would have a two-lane left-turn lane for eastbound traffic but would not need to include a right-turn lane.

# Traffic Summary

The existing traffic operations of 47th Street are all acceptable with LOS at or below LOS C. As an alternative to the existing roadway design, a road diet conversion from four-lanes to three-lanes is appropriate for 47th Street. There is no significant change in LOS for the intersection under the road diet alternative design compared to existing operations. Implementing a road diet would have the benefits of reduced conflict points for left-turning movements, a shorter distance for pedestrians and bicyclists to cross vehicle traffic, increased mobility for bicyclists, and more buffered space between vehicles and pedestrians on sidewalks.

- 47th Street is an ideal candidate for utilization of a road diet design. If 47th Street is converted to a road diet, at 47th Street & Mission Road a westbound left-turn lane should be used, the westbound right-turn lane can be removed, and the eastbound combined thru lanes and turn lanes should be changed to a left-turn lane and a thru/right lane. For the road diet design, the eastbound and westbound left-turn signal heads at 47th Street & Mission Road should be changed to be protected-permitted to allow for more efficient traffic operations for left-turns. If 47th Street is converted to a three-lane cross section, combined pedestrian bulb outs/protected bike lanes at major intersections are recommended to reduce the distance to cross 47th Street.
- Sidewalks adjacent to the back of the curb should be at least 6 feet wide while sidewalks with a grassy separation should be 5 feet wide.
- Truncated domes are needed at each sidewalk ramp to be compliant with ADA standards. The NE and NW sidewalk ramps at 47th Street & Belinder Avenue/Fisher Street need to be made ADA compliant since the ramps are lacking in truncated domes and sidewalk crossing of 47th Street ends in a curb rather than a ramp.
- A protected bike intersection should be provided at 47th Street & Belinder Avenue/Fisher Street to facilitate the increased number of bike traffic headed north and south.
- Audible pedestrian push buttons at major intersections would upgrade the current system to the recommended guidance for Accessible Pedestrian Signals (APS) for visually impaired persons.

## VII. Design Options

# 47th Street Design Option A

Near Term (No Changes to Existing Curbs and Sidewalks)

## 3 Lanes + Buffered Bike Lanes

This option modifies the striping within the existing curbs on 47th Street to add a buffered bike lane in each direction. The bike lane and buffer provide a dedicated space for cyclists, and also provide greater separation between the sidewalk and moving traffic. This option and all of the other options:

- + Maintain auto level of service (traffic flow)
- + Calm traffic (number of lanes, lane width, intersection configuration, etc.)
- + Enhance pedestrian safety (crosswalks, crossing width, refuge islands, enhanced signage, buffer from traffic, etc.)

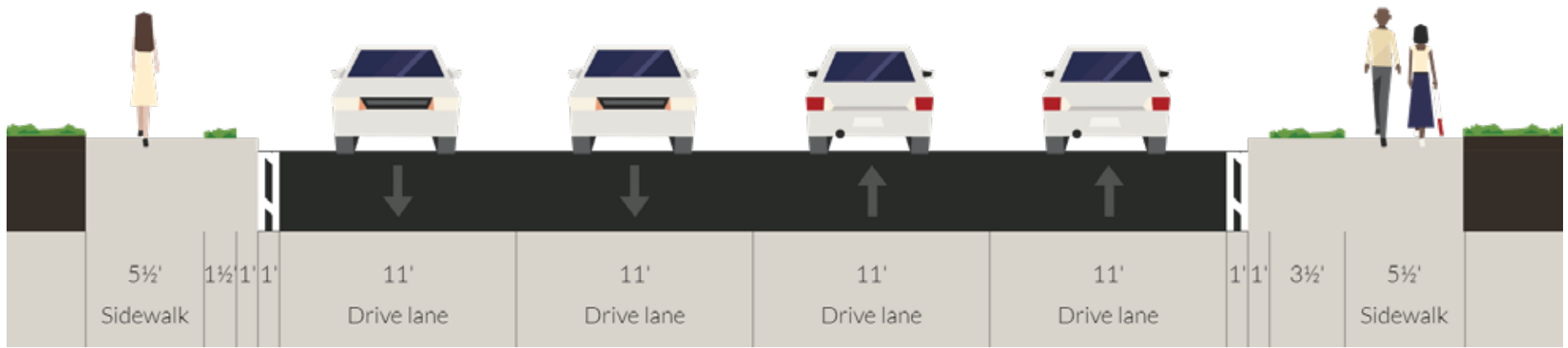
## Design Option A Tradeoffs

- + Fits with existing curb lines (lower cost)
- + Provides dedicated space for cyclists
- Require compromises for some users at busy intersections (varies by intersection option)
- Requires shared bus/bike zone at bus stops)

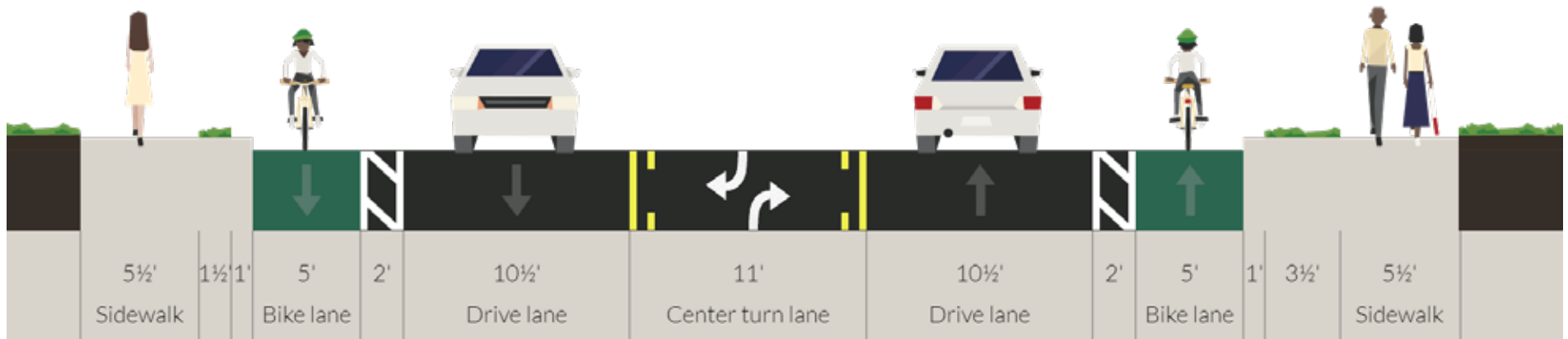


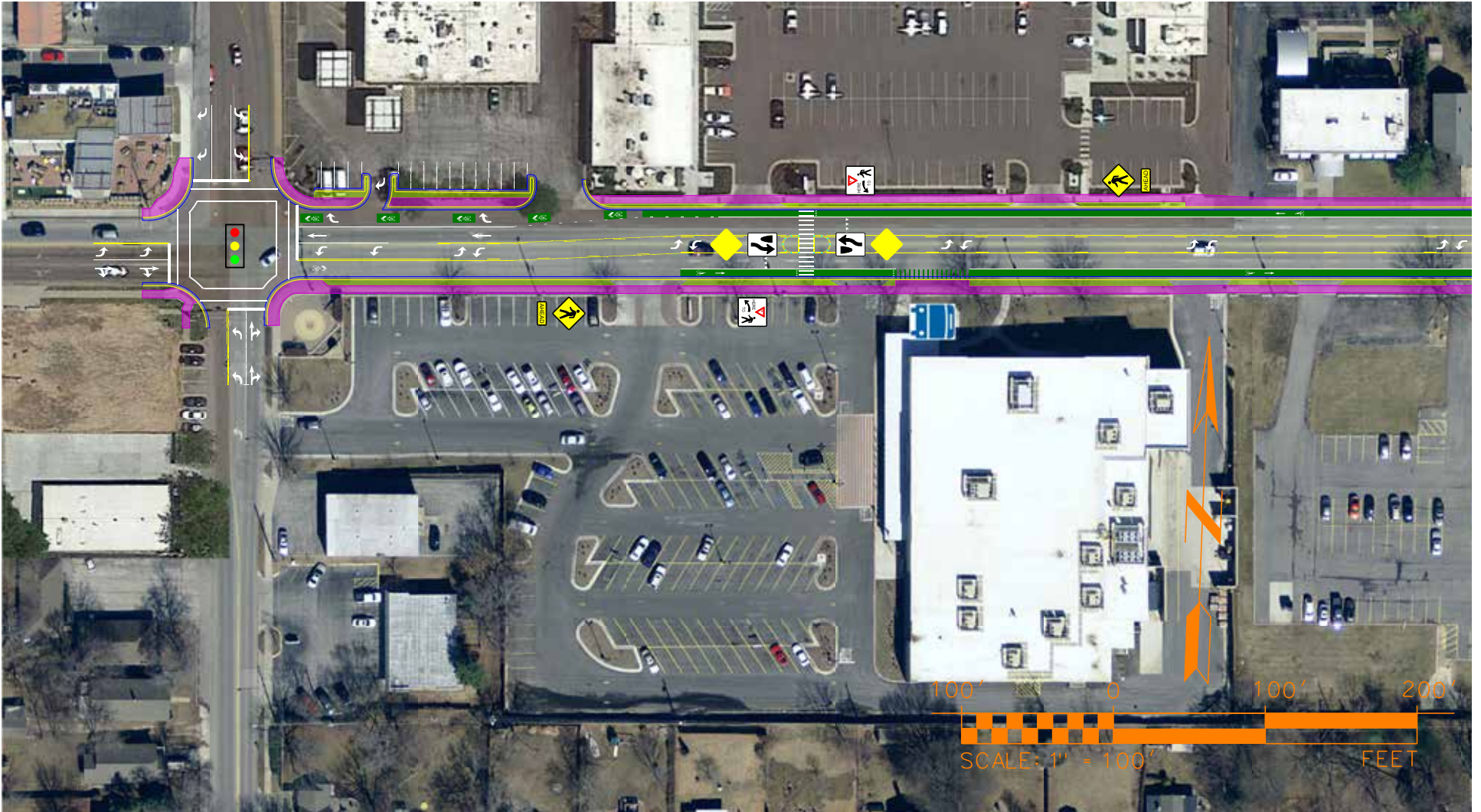


## Typical Section - Existing

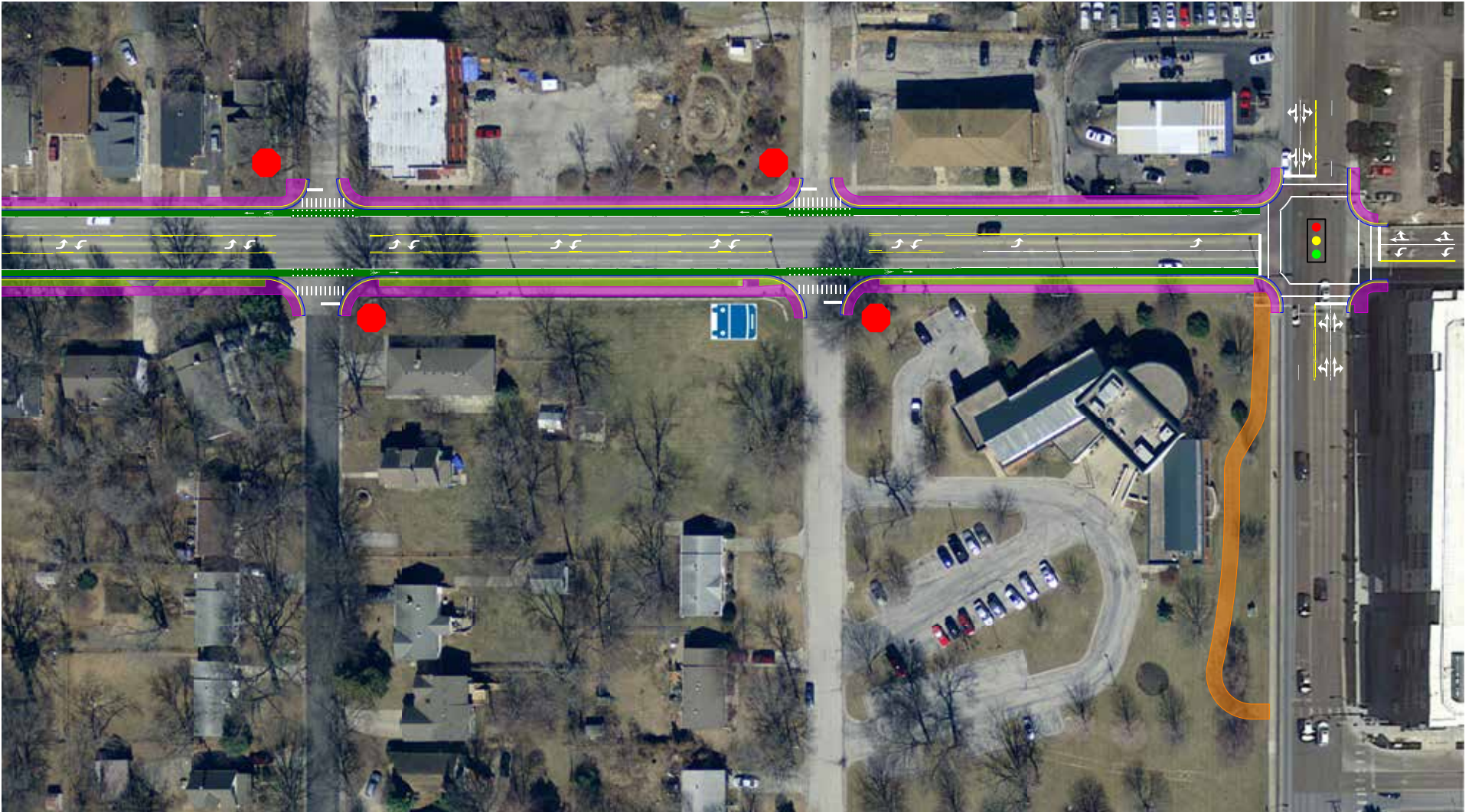


## Typical Section - Option A

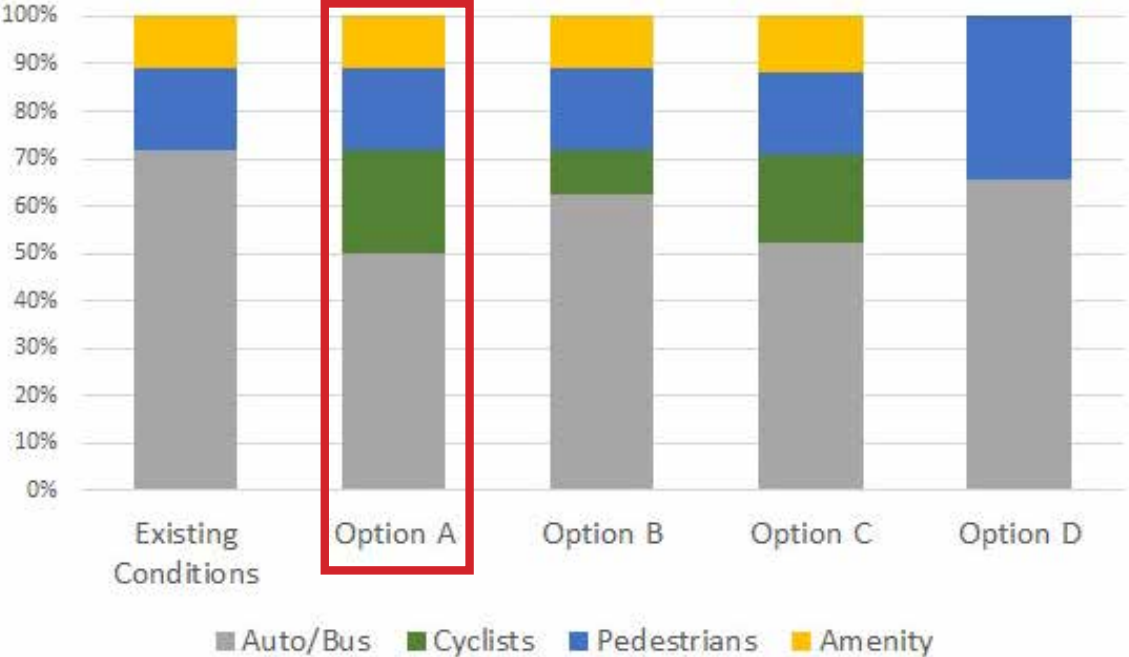




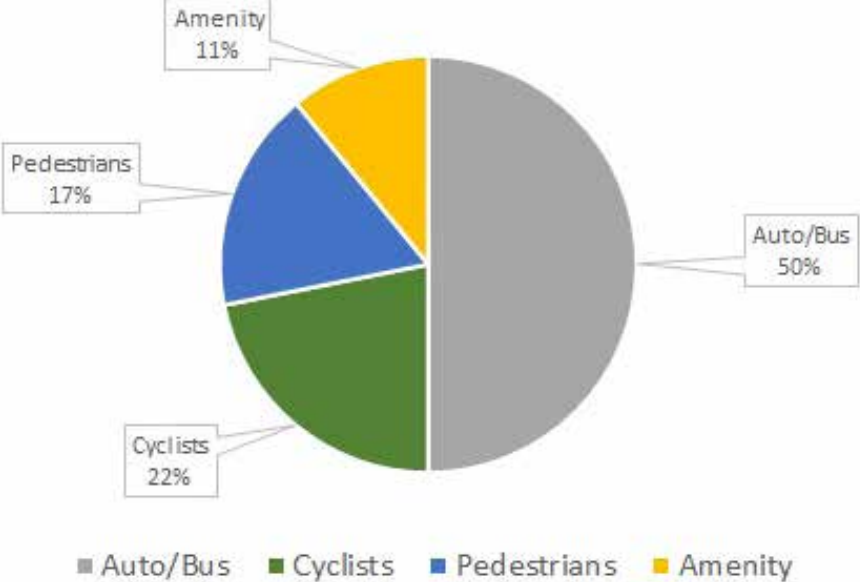


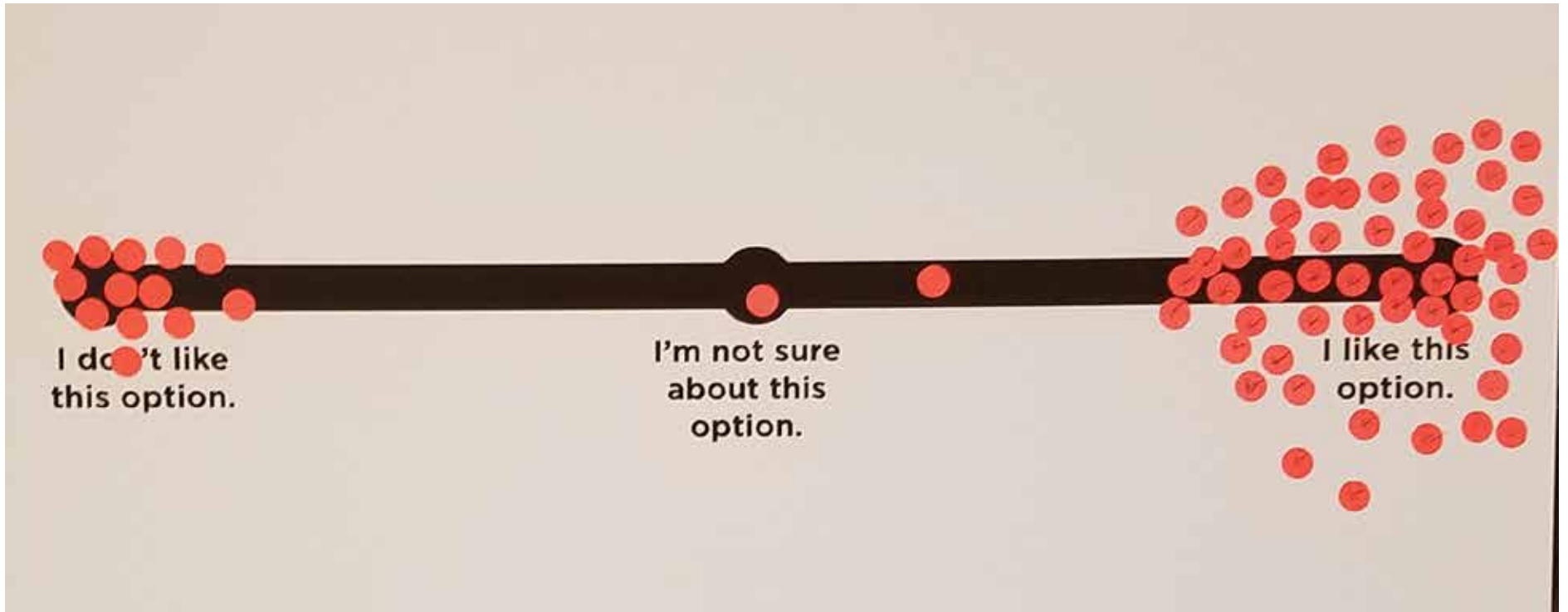


### Comparison: Right of Way Allocation

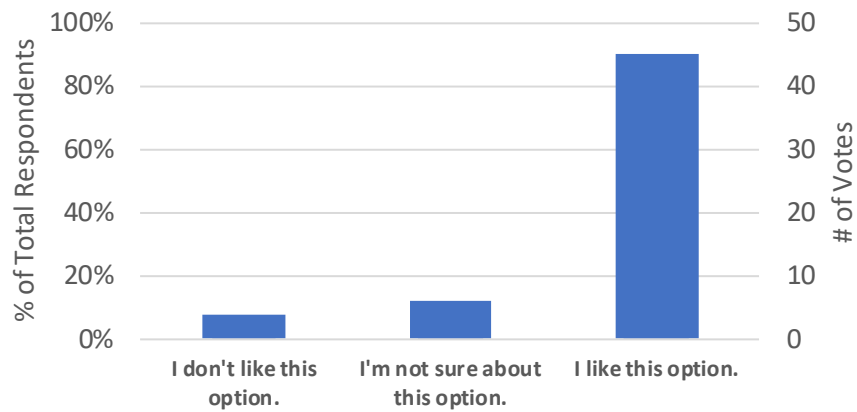


### Option A: Right of Way Allocation

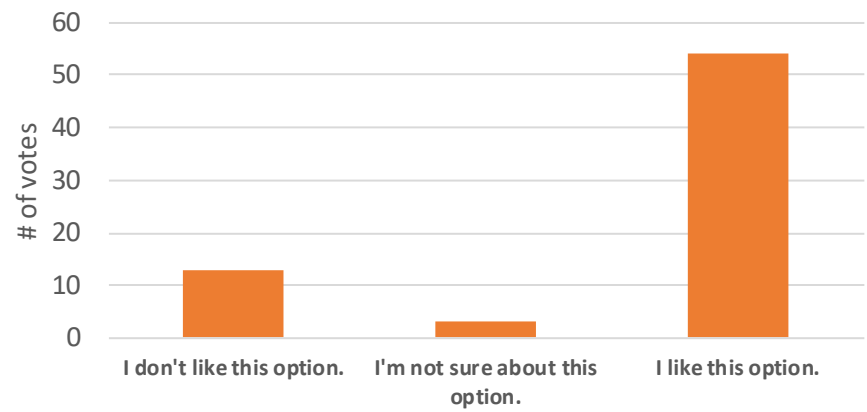




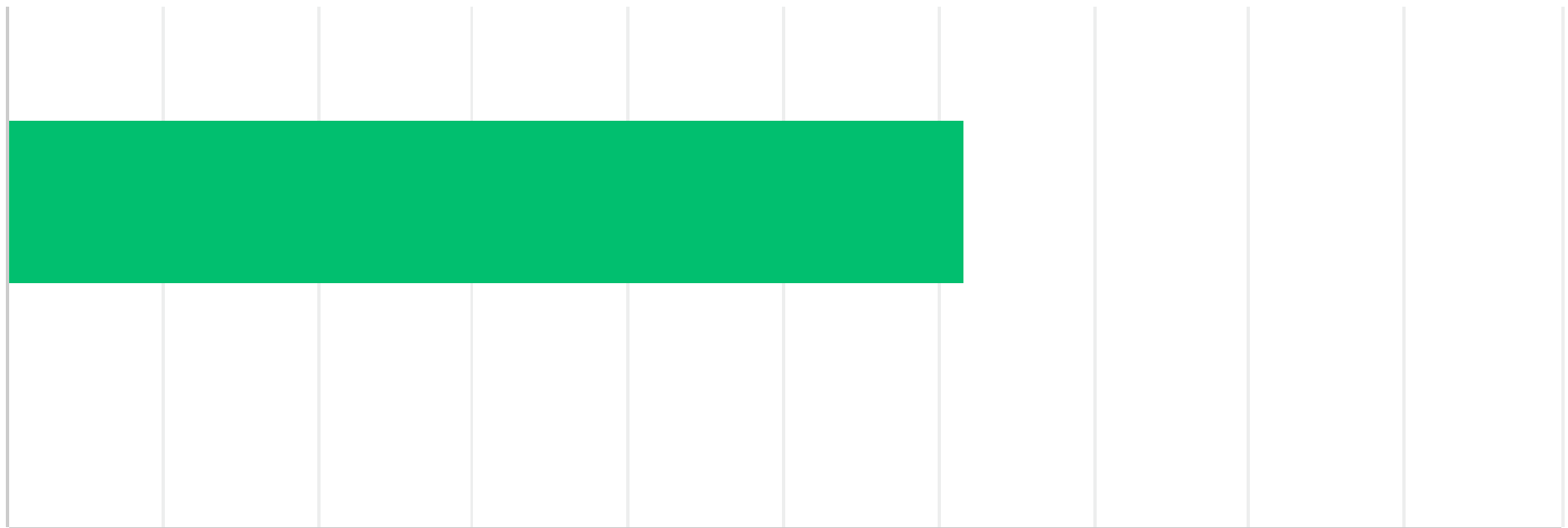
**Survey Respondents: Street Design Option A  
3 Lanes + Buffered Bike Lanes**



**Board Votes: Street Design Option A  
3 Lanes + Buffered Bike Lanes**



# What is your opinion on the following street design option for 47th Street? Online Survey Average Response



0 10 20 30 40 50 60 70 80 90 100



**I don't like  
this option.**

**I'm not sure  
about this  
option.**

**I like this  
option.**

# 47th Street Design Option B

Near Term (No Changes to Existing Curbs and Sidewalks)

## 3 Lanes + On-Street Parking

This option modifies the striping within the existing curbs on 47th Street to add a conventional bike lane in each direction for most of the corridor. Near 47th and Mission, the westbound bike lane drops, and cyclists merge with traffic to accommodate 15 on-street parking spaces. This option and all of the other options:

- + Maintain auto level of service (traffic flow)
- + Calm traffic (number of lanes, lane width, intersection configuration, etc.)
- + Enhance pedestrian safety (crosswalks, crossing width, refuge islands, enhanced signage, buffer from traffic, etc.)

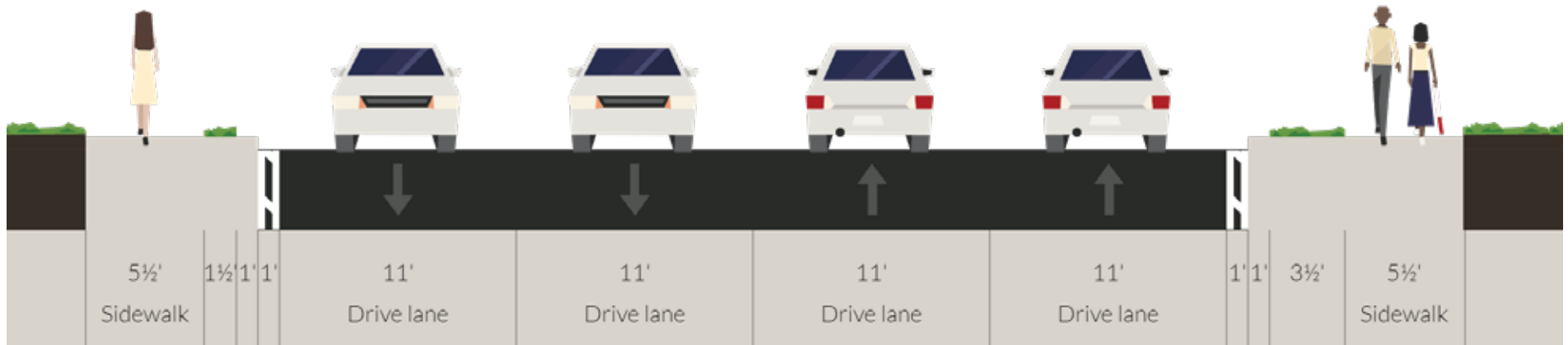
## Design Option B Tradeoffs

- + Fits with existing curb lines (lower cost)
- + Provides 15 additional on-street parking spaces
- Require compromises for some users at busy intersections (varies by intersection option)
- Requires shared bus/bike zone at bus stops
- Cyclists do not have dedicated space at locations where safety concerns are highest

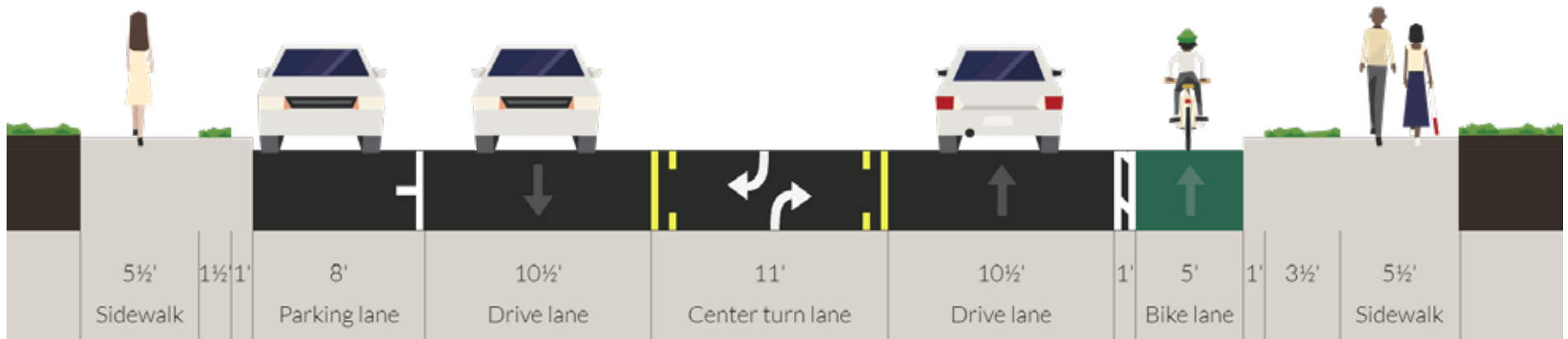


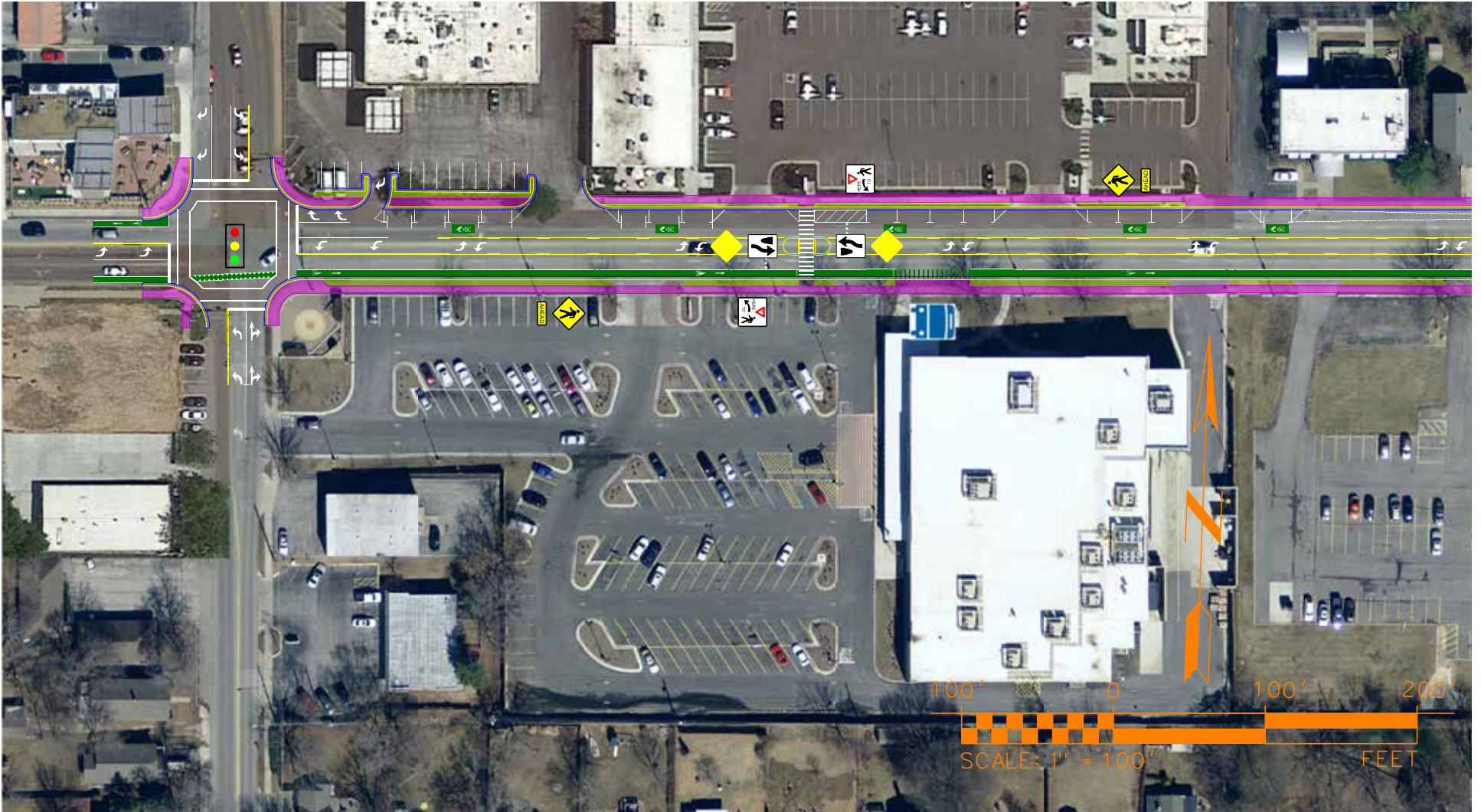


## Typical Section - Existing

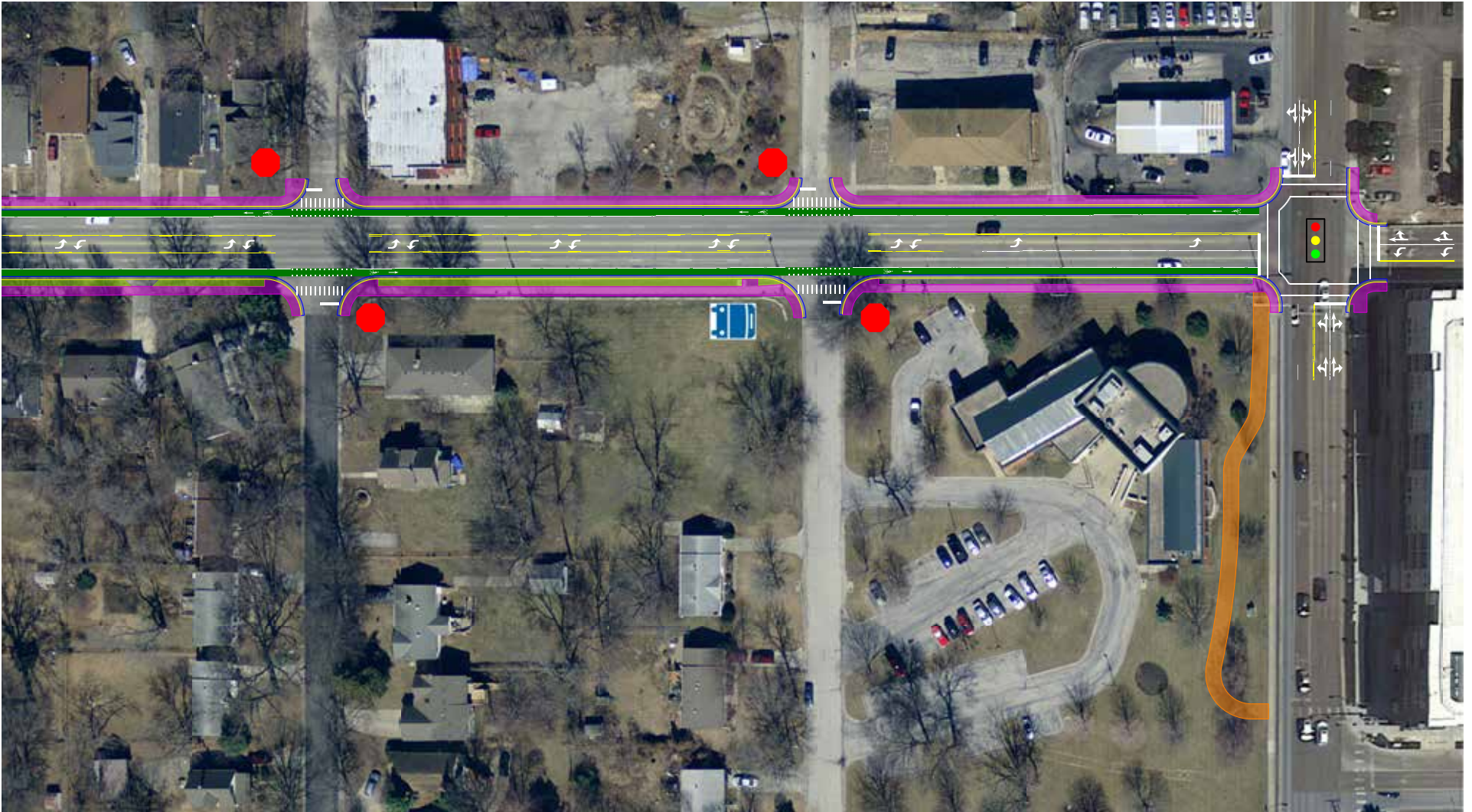


## Typical Section - Option B

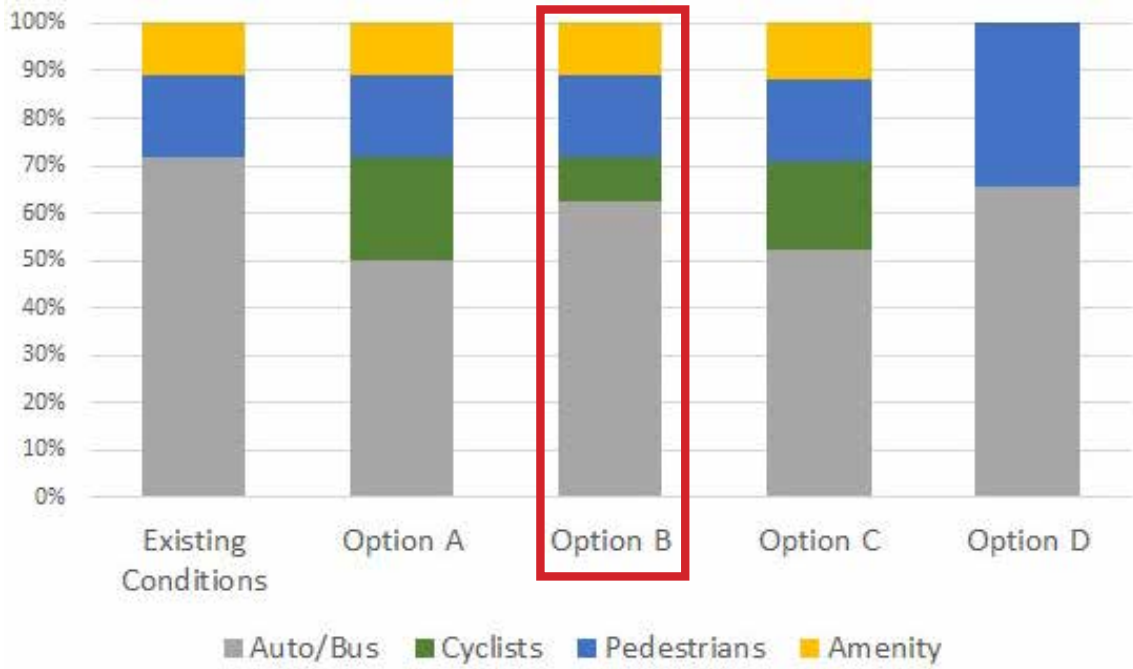




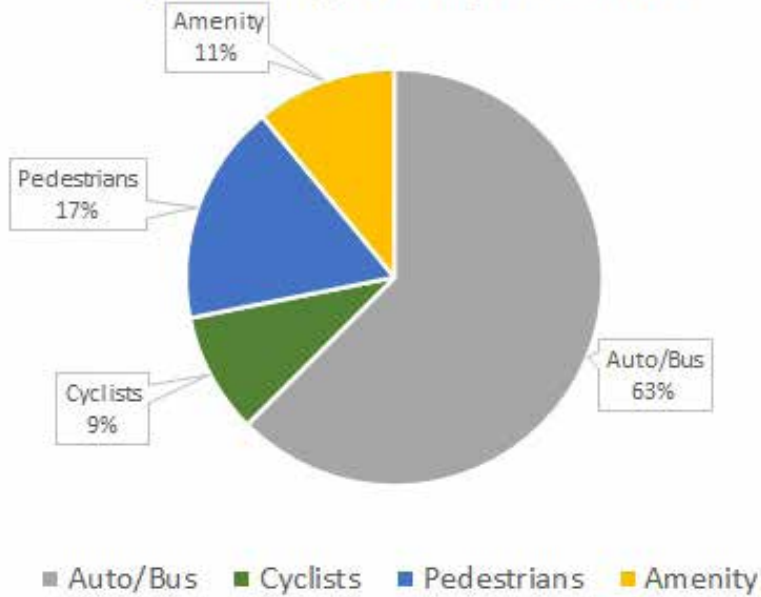


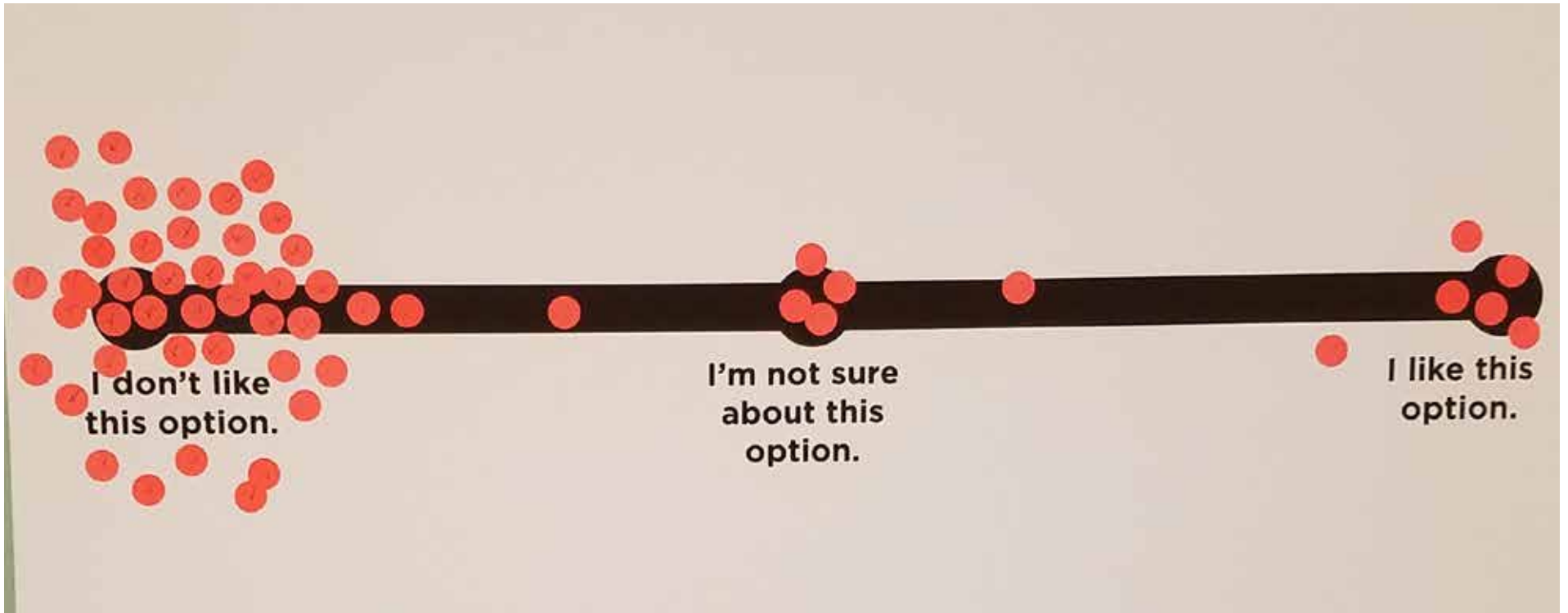


### Comparison: Right of Way Allocation

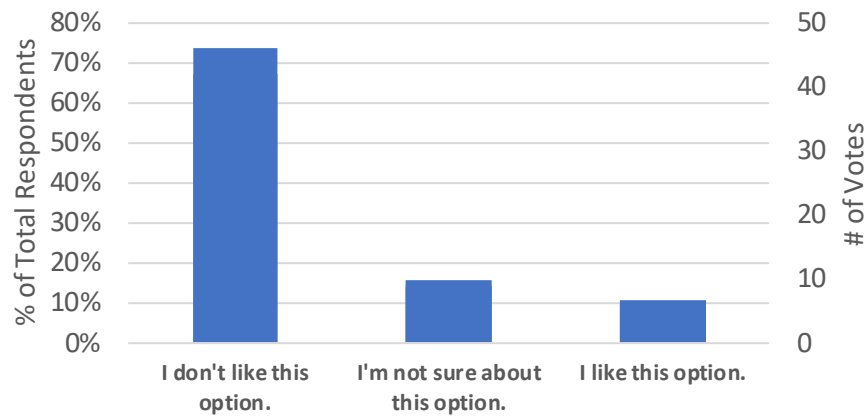


### Option B: Right of Way Allocation

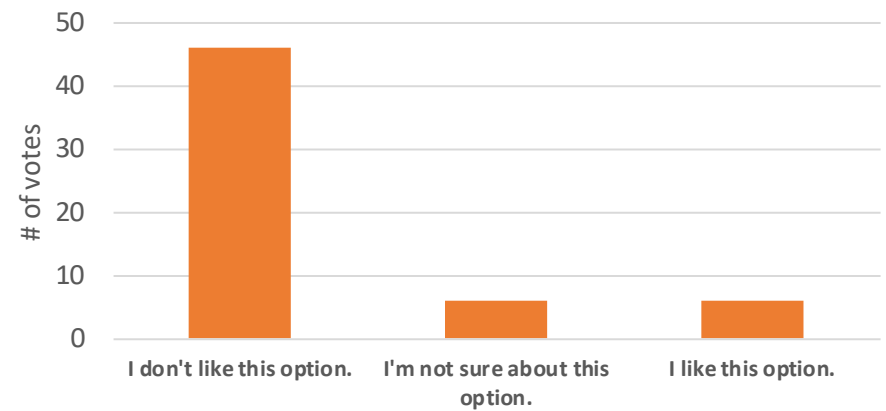




**Survey Respondents: Street Design Option B  
3 Lanes + On-Street Parking**



**Board Votes: Street Design Option B  
3 Lanes + On-Street Parking**



# What is your opinion on the following street design option for 47th Street? Online Survey Average Response



0 10 20 30 40 50 60 70 80 90 100



# 47th Street Design Option C

Long Term (Changes to Existing Curbs and Sidewalks)

## 3 Lanes + Raised Shared Path

This option provides an expanded, shared space that maximizes comfort and safety for pedestrians and cyclists above the curb. This scenario provides a landscape buffer that accommodates varied right of way on the corridor. Reconstruction of curbs is necessary, making this a long term option. This option and all of the other options:

- + Maintain auto level of service (traffic flow)
- + Calm traffic (number of lanes, lane width, intersection configuration, etc.)
- + Enhance pedestrian safety (crosswalks, crossing width, refuge islands, enhanced signage, buffer from traffic, etc.)

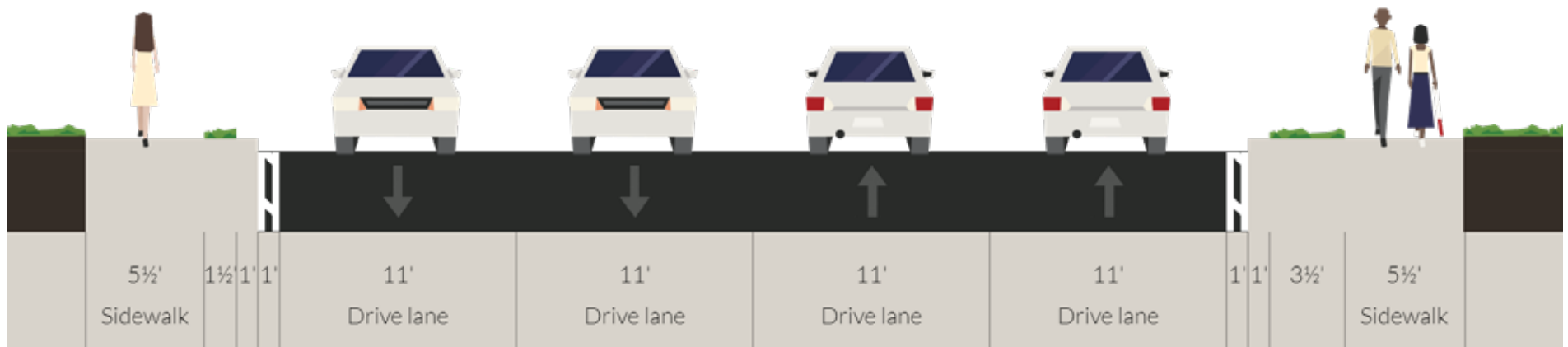
## Design Option C Tradeoffs

- + Comfortable space for cyclists above curb
- + Expanded sidewalk zone
- + Space for additional landscaping & amenities
- Requires curb modifications (higher cost)
- Ideal intersection configurations require additional right-of-way

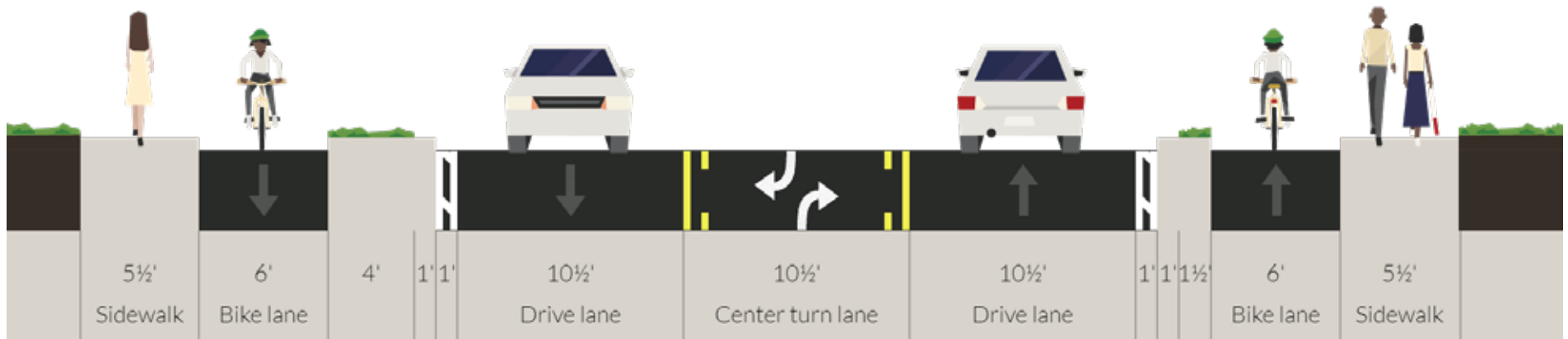




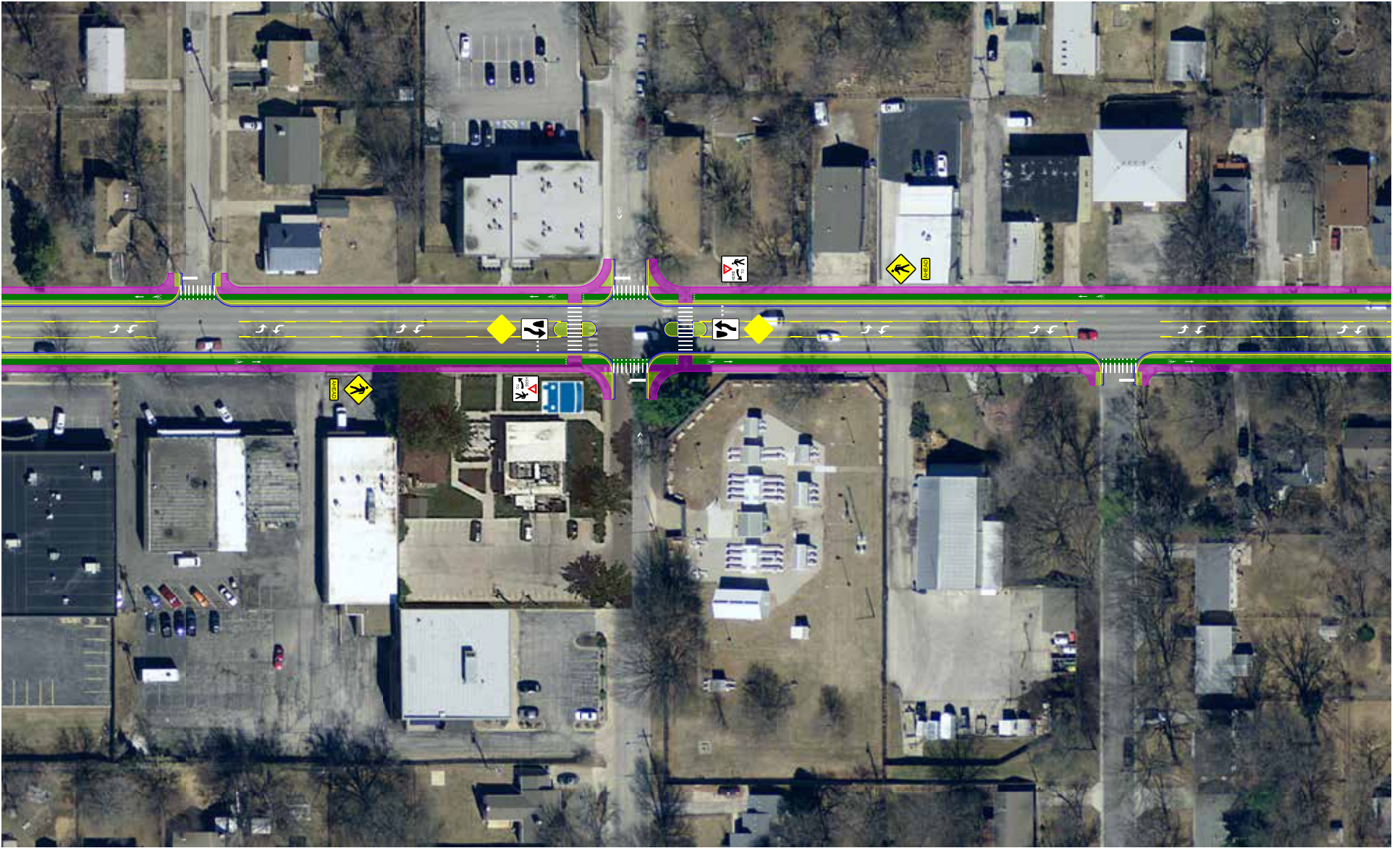
## Typical Section - Existing

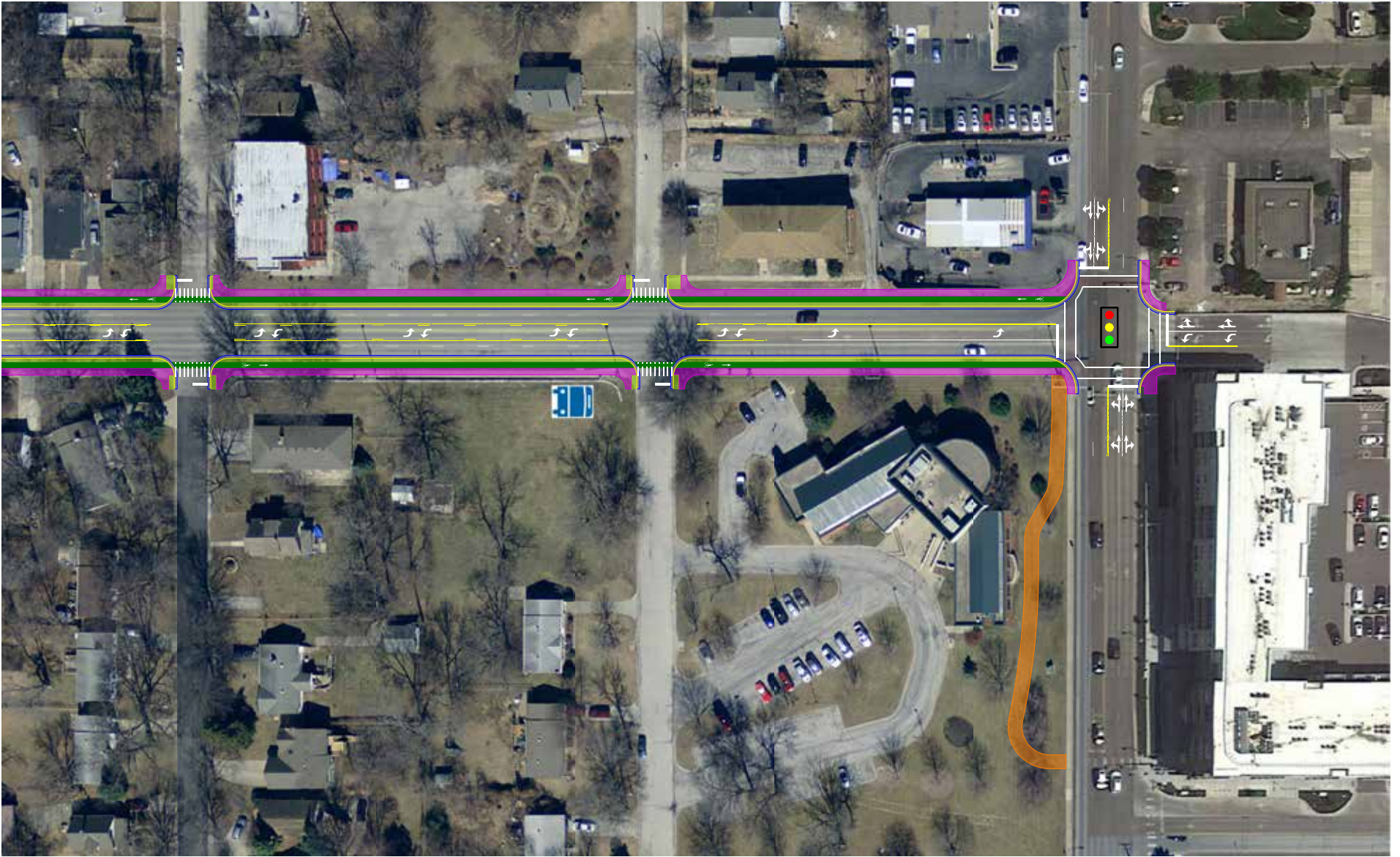


## Typical Section - Option C

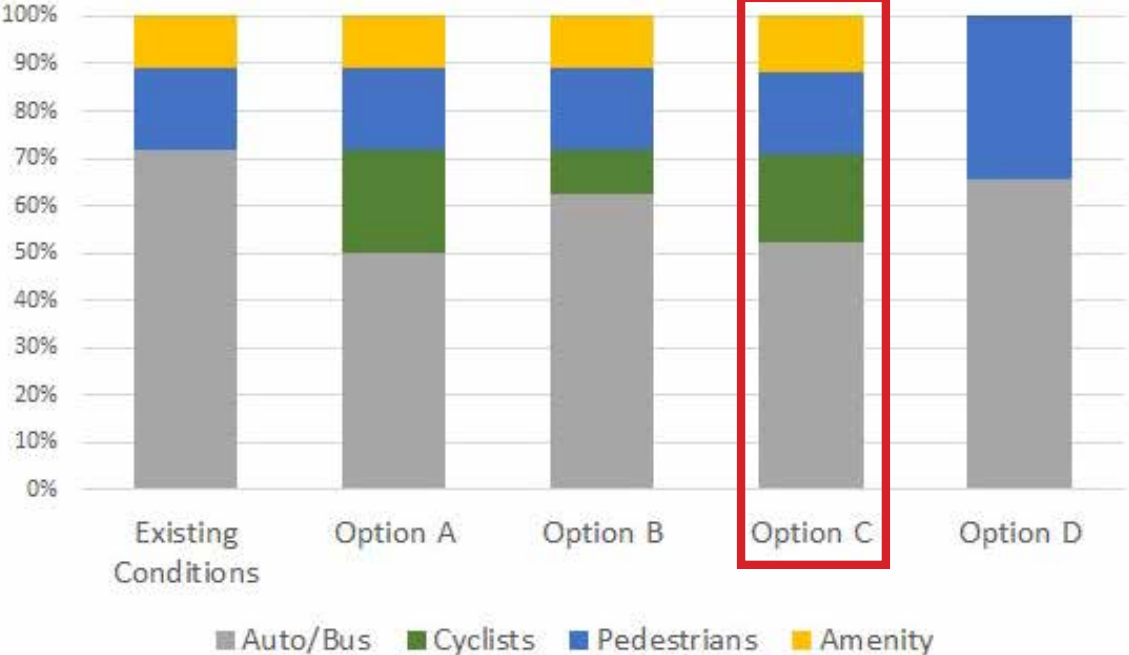




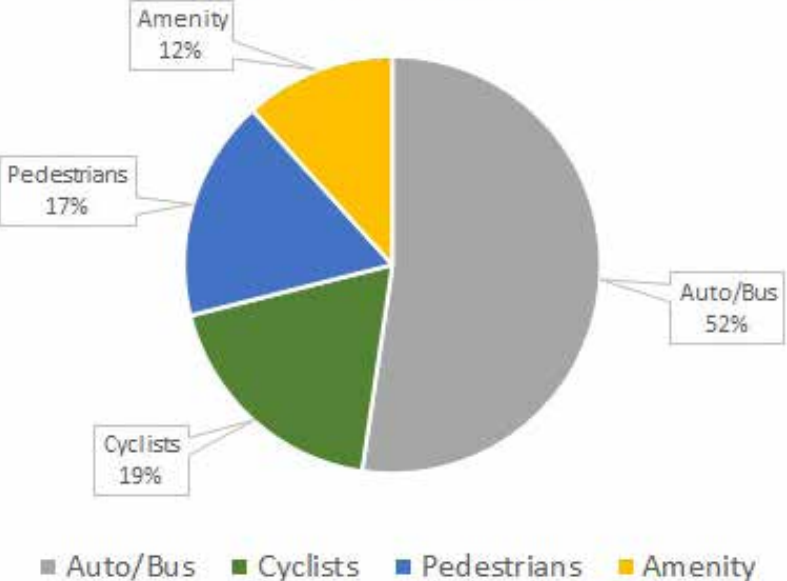


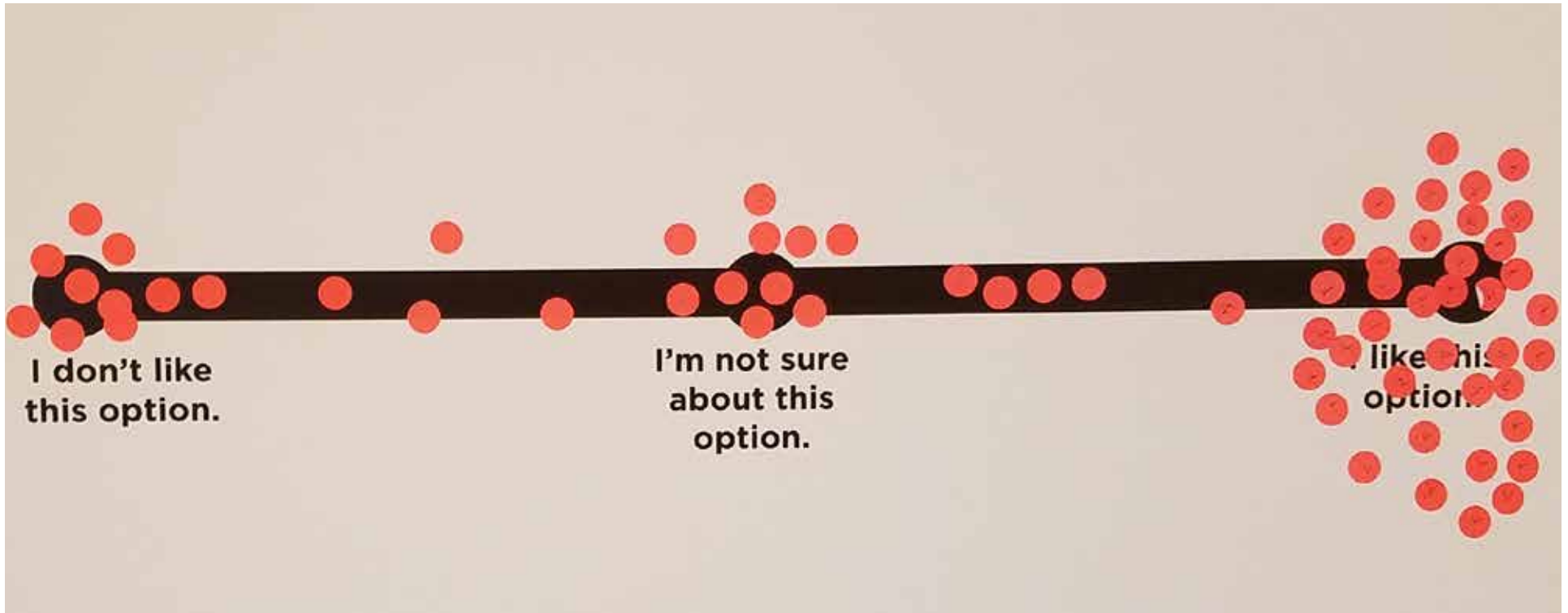


### Comparison: Right of Way Allocation

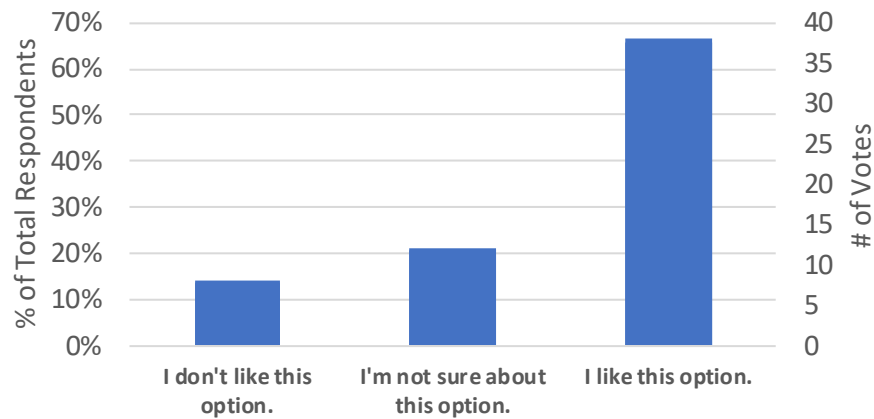


### Option C: Right of Way Allocation

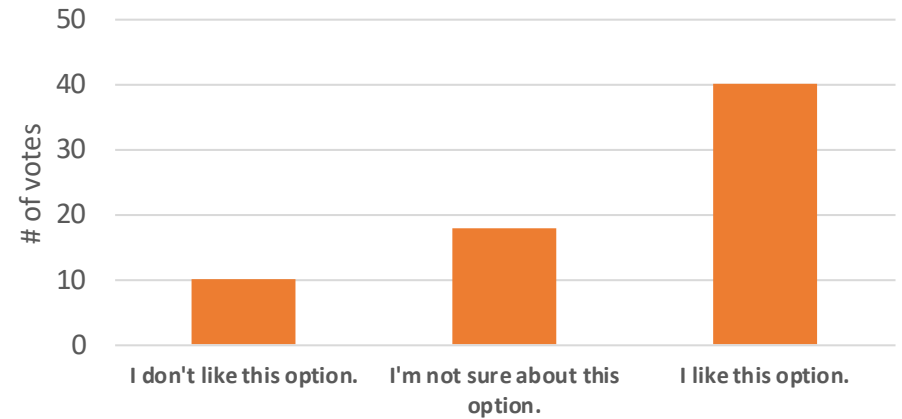




**Survey Respondents: Street Design Option C  
3 Lanes + Raised Shared Path**



**Board Votes: Street Design Option C  
3 Lanes + Raised Shared Path**



# What is your opinion on the following street design option for 47th Street? Online Survey Average Response



0 10 20 30 40 50 60 70 80 90 100



**I don't like  
this option.**

**I'm not sure  
about this  
option.**

**I like this  
option.**

# 47th Street Design Option D

Long Term (Changes to Existing Curbs and Sidewalks)

## 3 Lanes + Parking + Wide Sidewalks

This option provides expanded sidewalk zones and 9 additional parking spaces. Wide sidewalks can flexibly accommodate street furnishings, landscaping, and other amenities. Reconstruction of the curb is required, and there is not a dedicated space for cyclists. This option and all of the other options:

- + Maintain auto level of service (traffic flow)
- + Calm traffic (number of lanes, lane width, intersection configuration, etc.)
- + Enhance pedestrian safety (crosswalks, crossing width, refuge islands, enhanced signage, buffer from traffic, etc.)

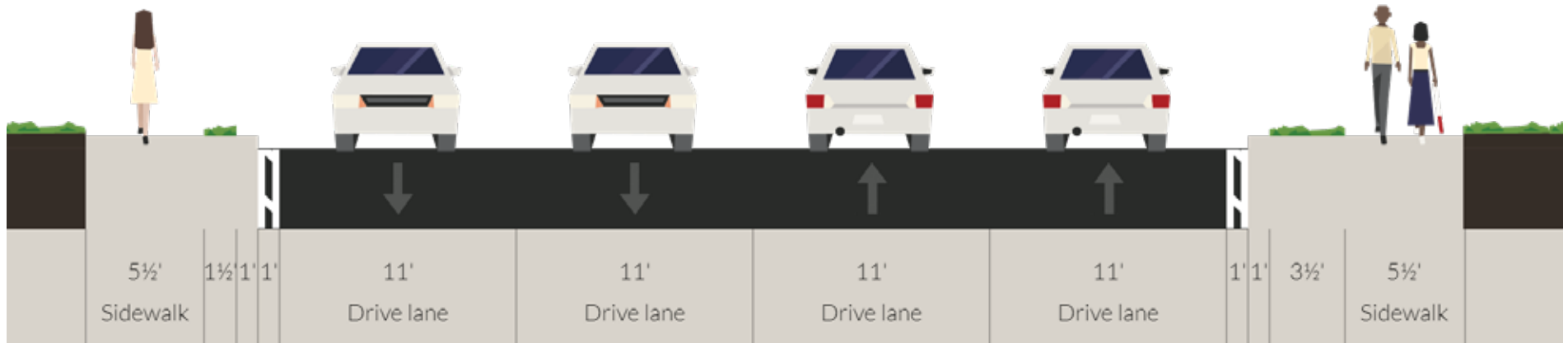
## Design Option D Tradeoffs

- + Provides 8 additional on-street parking spaces
- + Expanded sidewalk zone
- + Space for additional landscaping & amenities
- Requires curb modifications (higher cost)
- Does not provide a dedicated space for cyclists
- Ideal intersection configurations require additional right-of-way

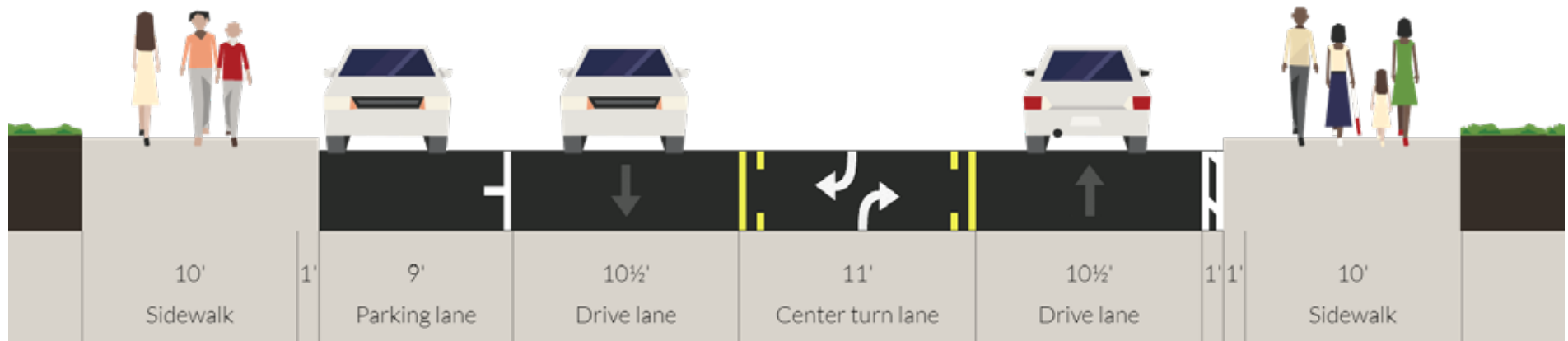




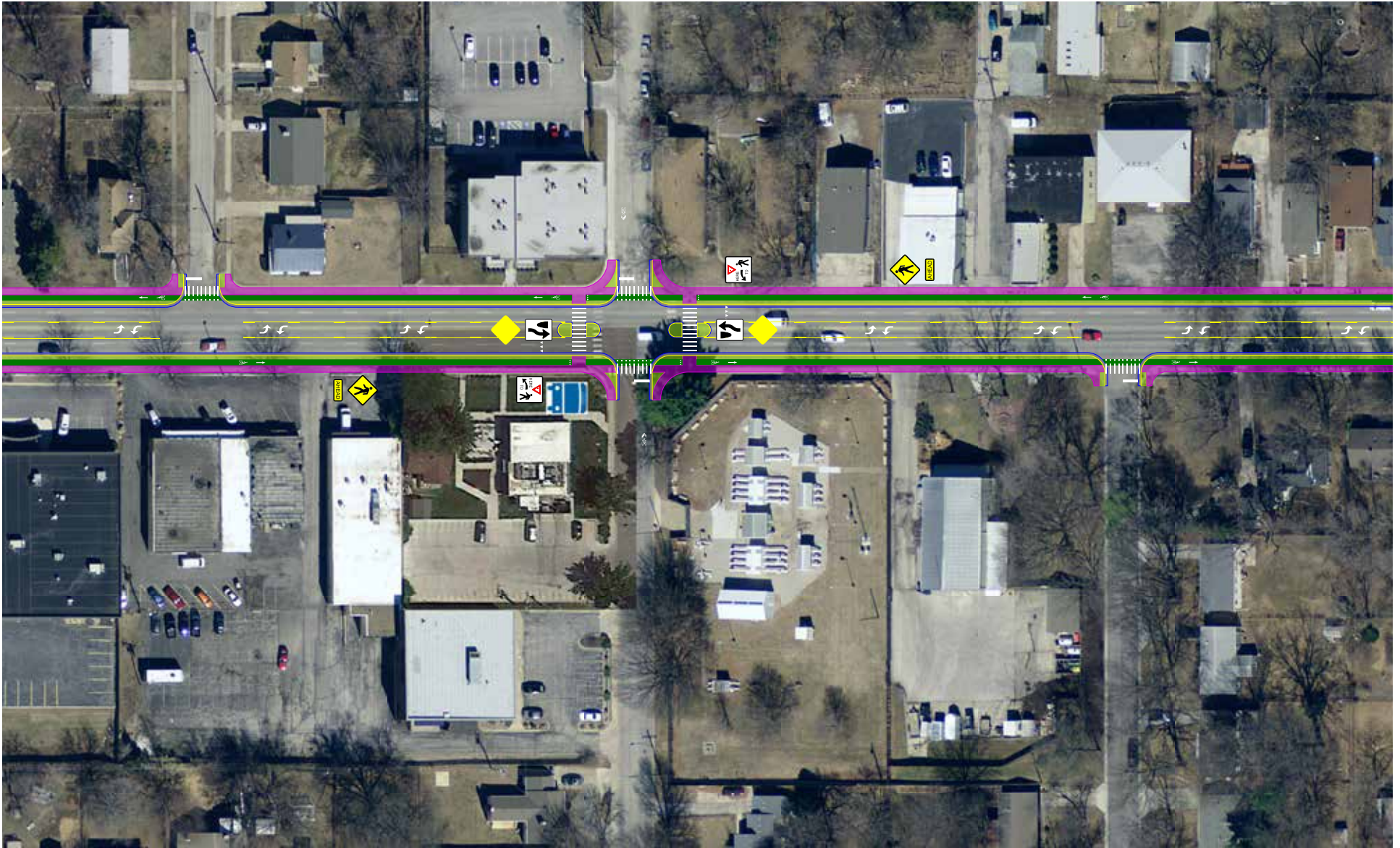
## Typical Section - Existing

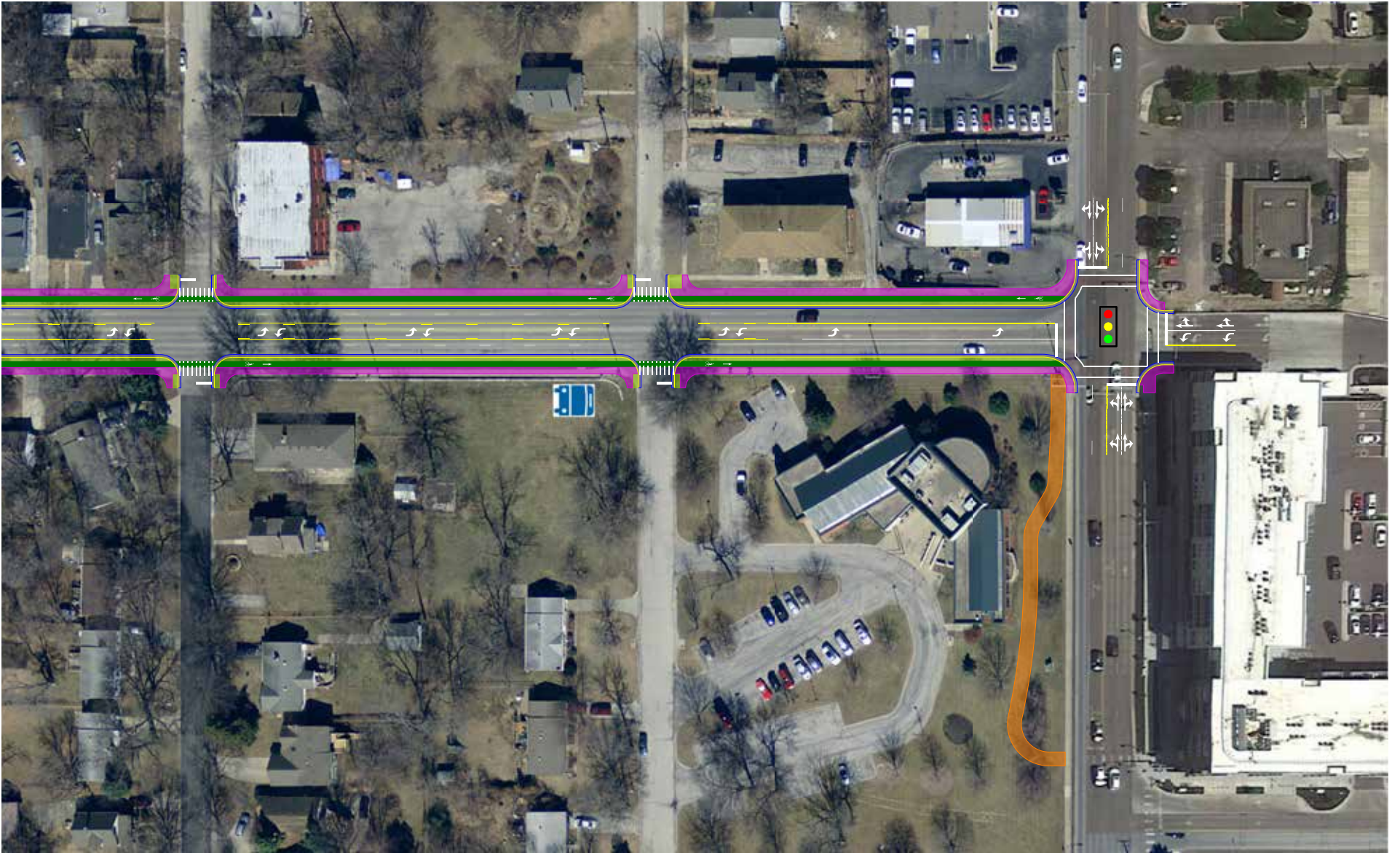


## Typical Section - Option D

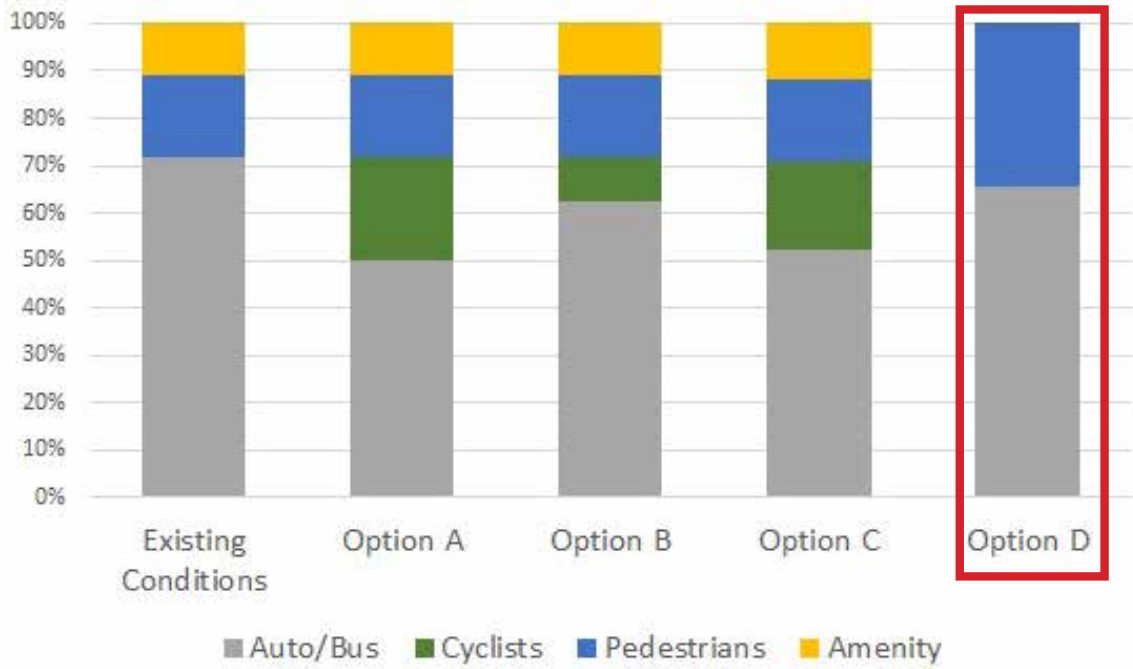




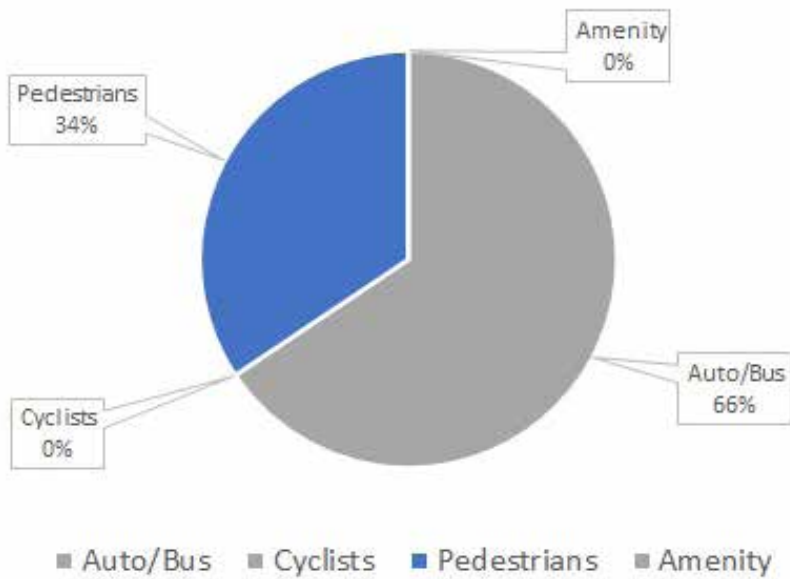


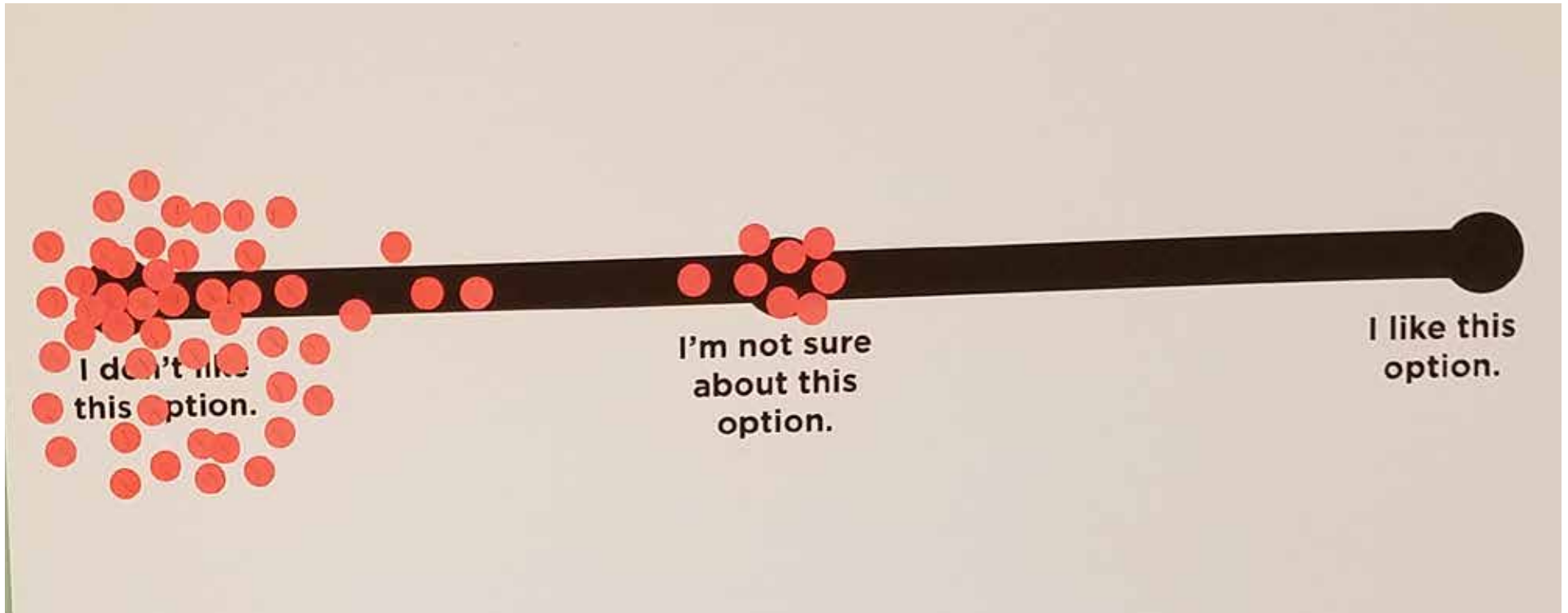


### Comparison: Right of Way Allocation

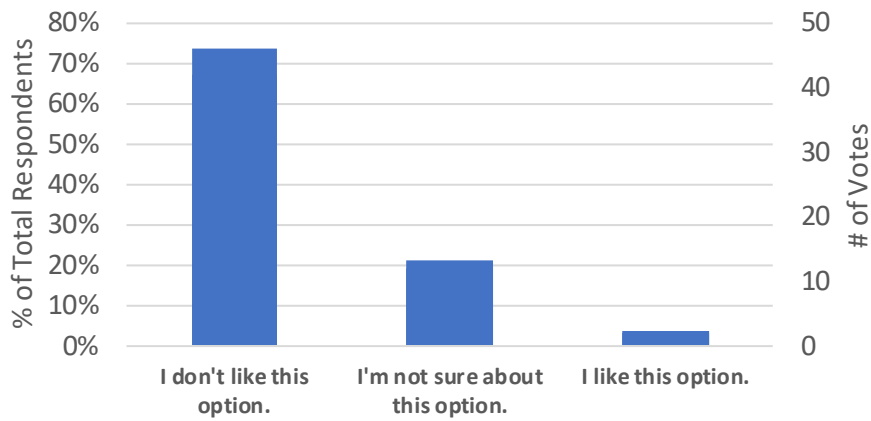


### Option D: Right of Way Allocation

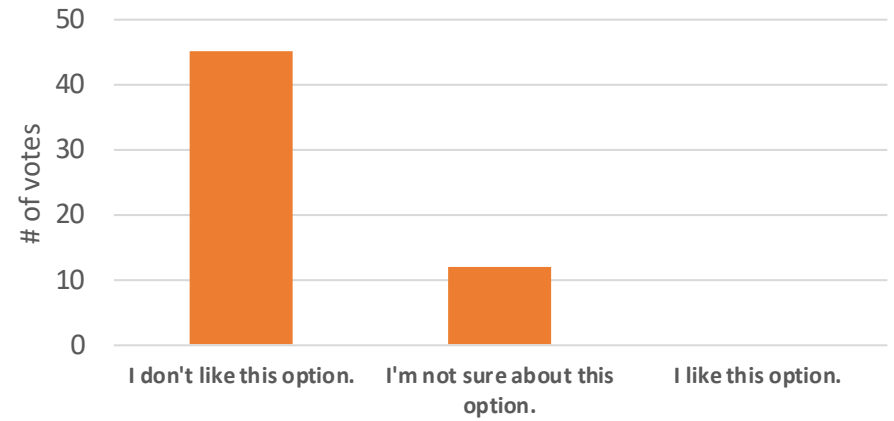




**Survey Respondents: Street Design Option D  
3 Lanes + Parking + Wide Sidewalks**



**Board Votes: Street Design Option D  
3 Lanes + Parking + Wide Sidewalks**



# What is your opinion on the following street design option for 47th Street? Online Survey Average Response



0 10 20 30 40 50 60 70 80 90 100







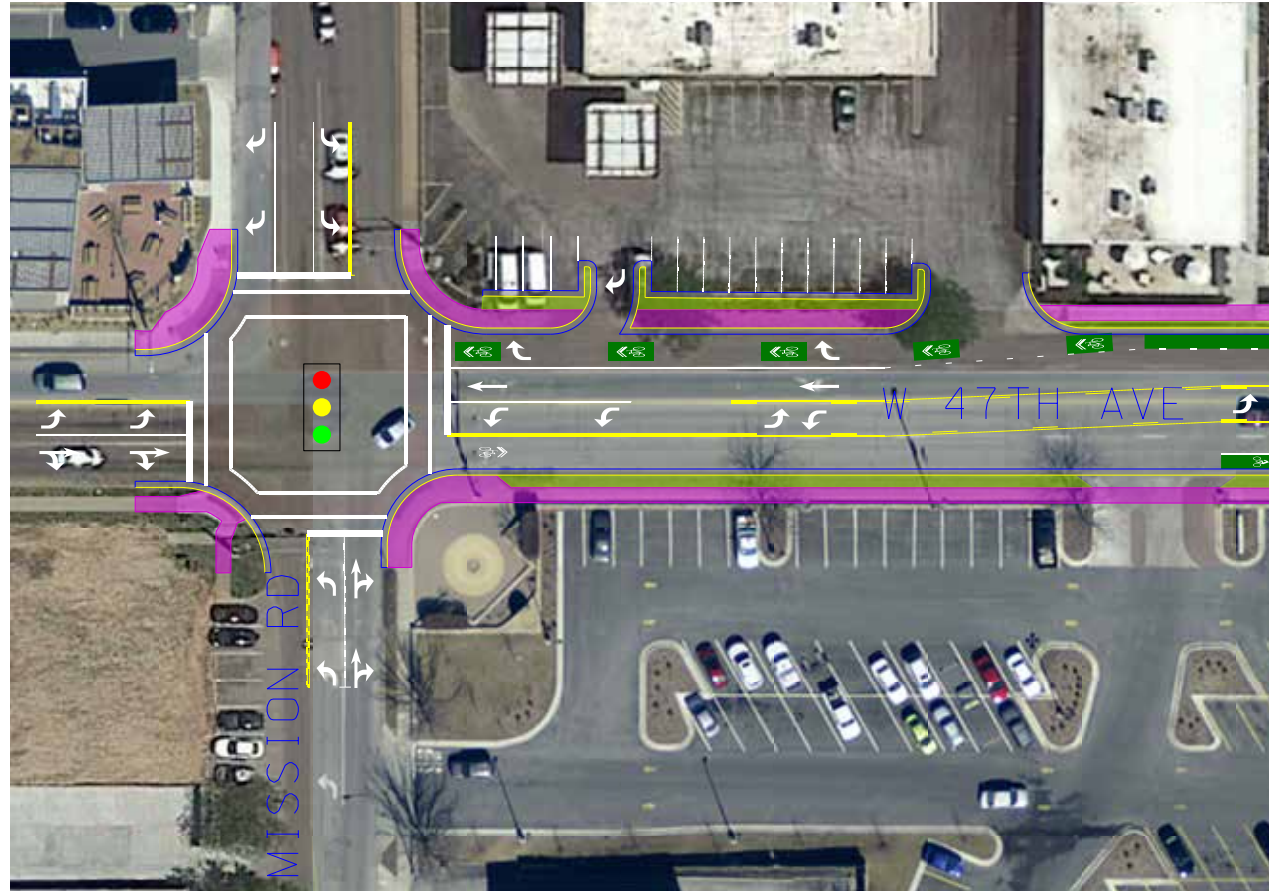
## VIII. 47th & Mission Intersection Options

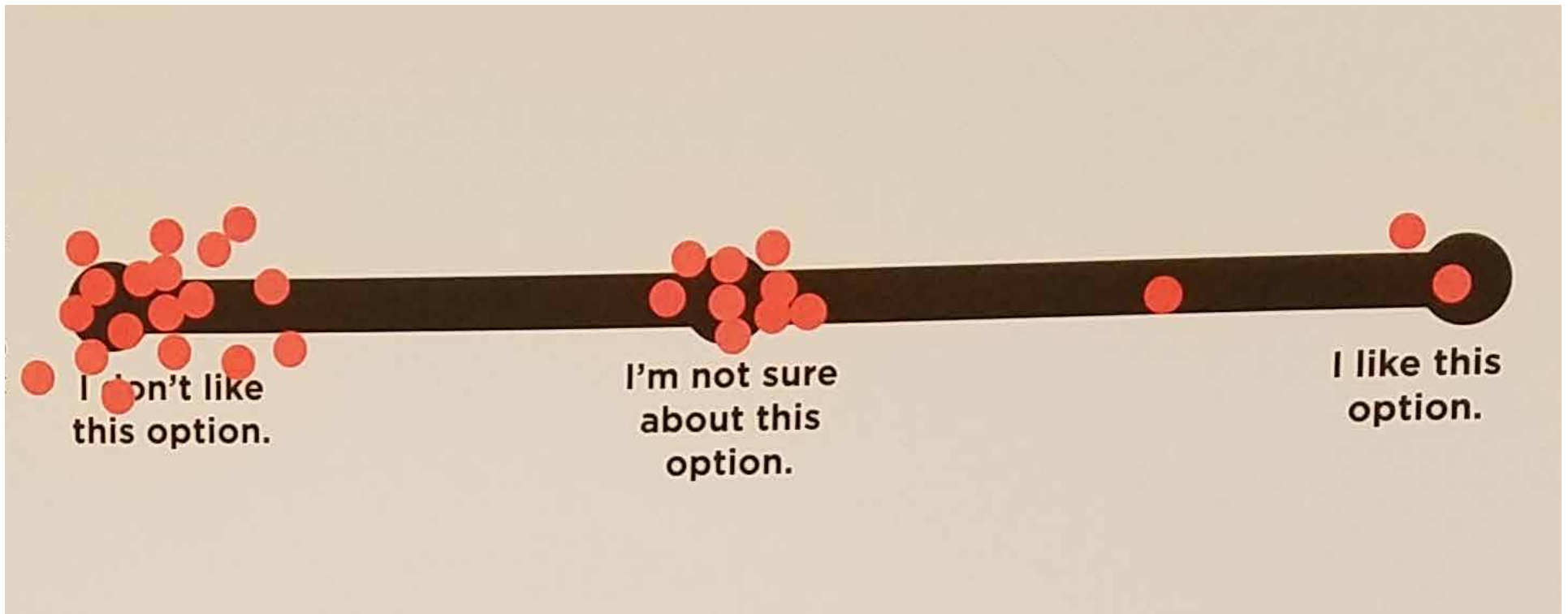
## Intersection Options

Space constraints at the 47th and Mission intersection require some compromises between different users of the street. All of the following intersection design options are functional and compatible with a road diet on 47th Street, but each intersection option balanced priorities between users slightly differently.

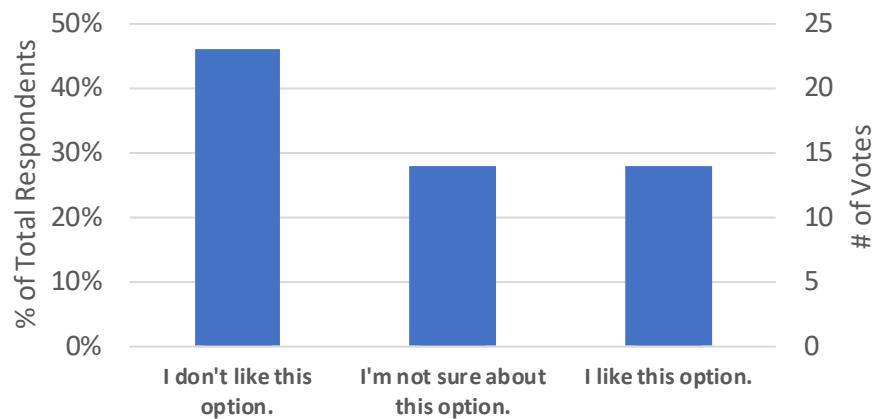
### Shared Bike + Turn Lane

- + Fits within existing curb line
- + Dedicated right turn lane
- Requires bikes to merge with cars at busy intersection

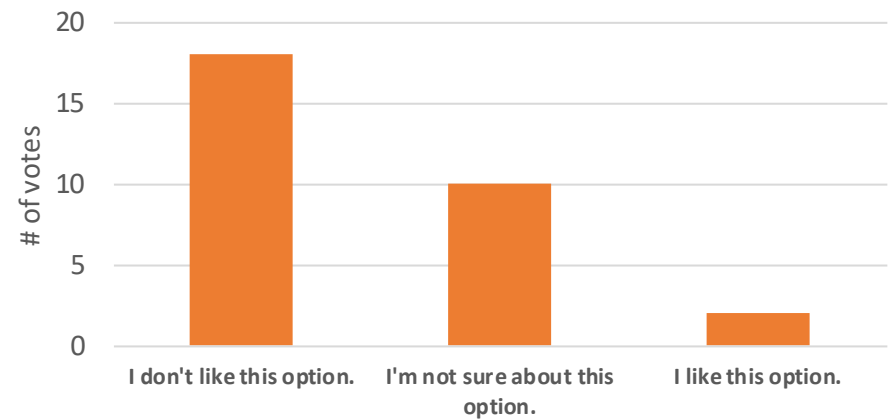




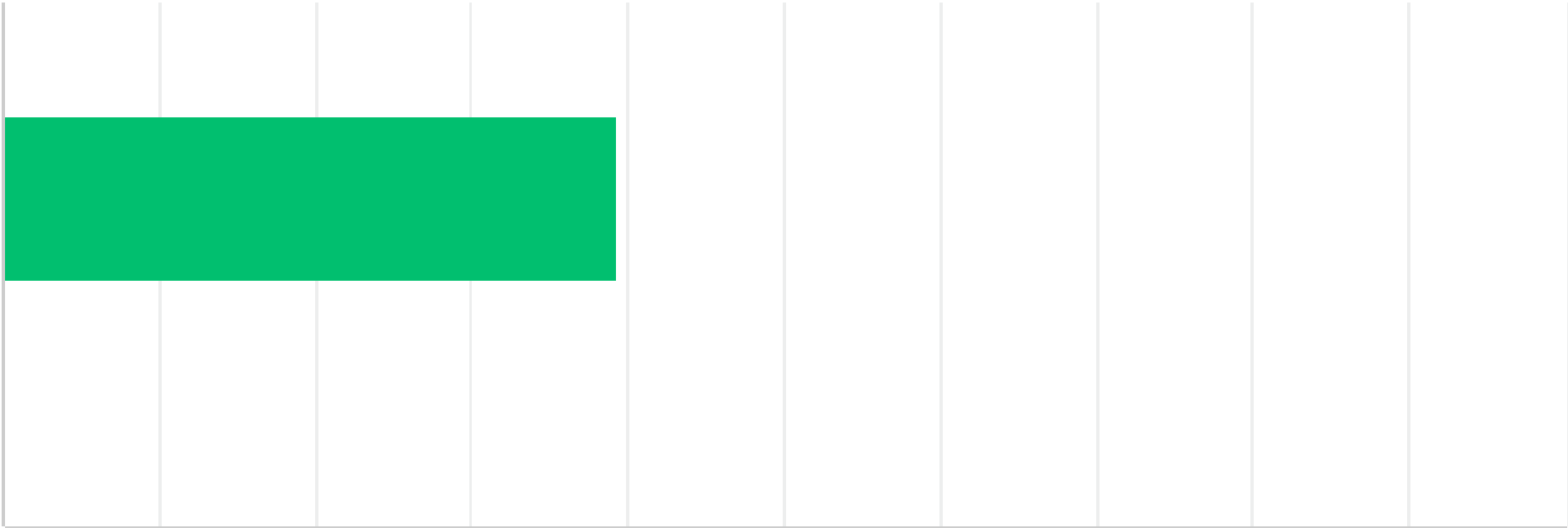
**Survey Respondents: 47th & Mission Option  
Shared Bike + Turn Lane**



**Board Votes: 47th & Mission Option  
Shared Bike + Turn Lane**



# What is your opinion on the following intersection option for 47th and Mission? Online Survey Average Response



0 10 20 30 40 50 60 70 80 90 100



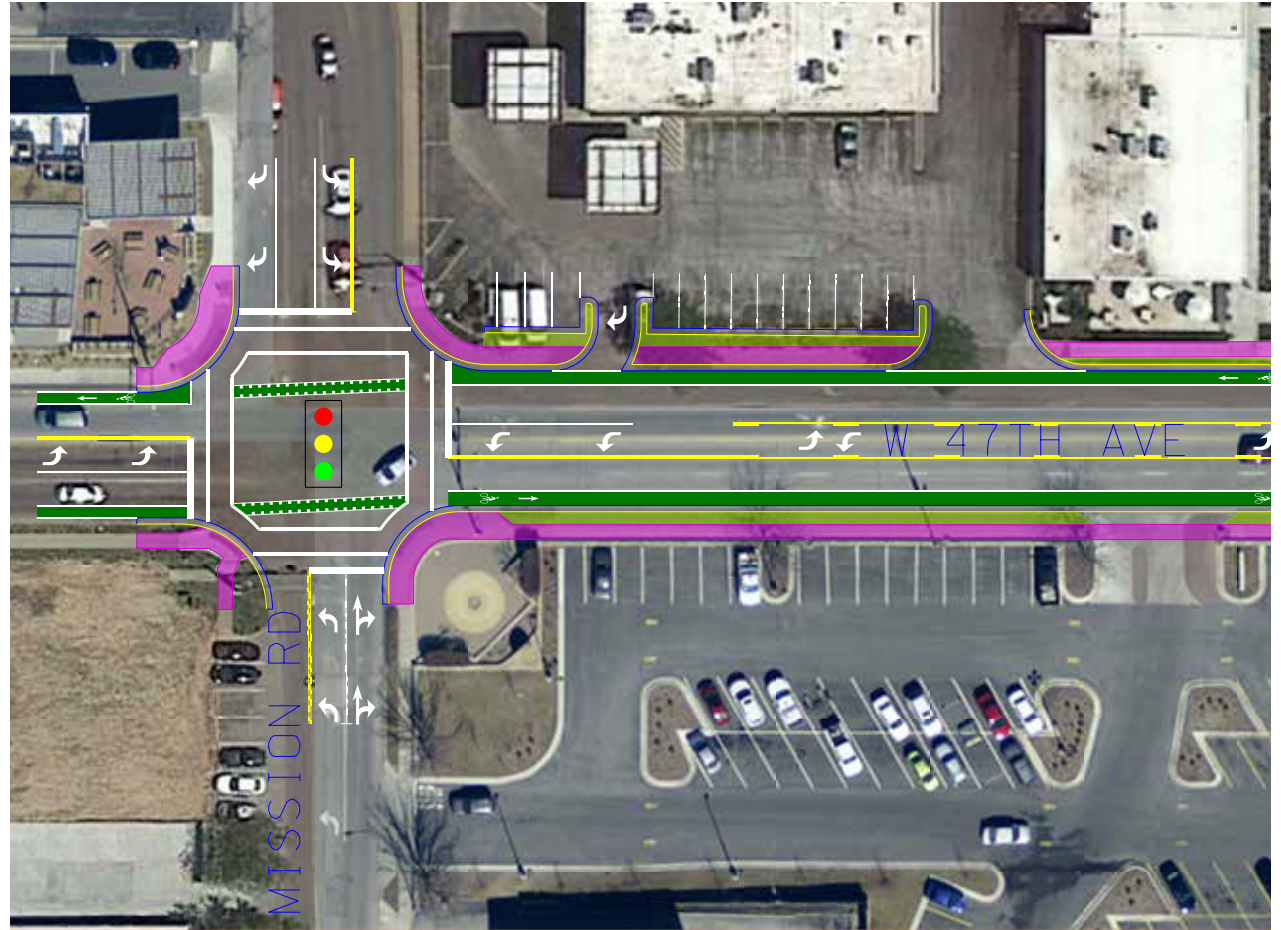
**I don't like  
this option.**

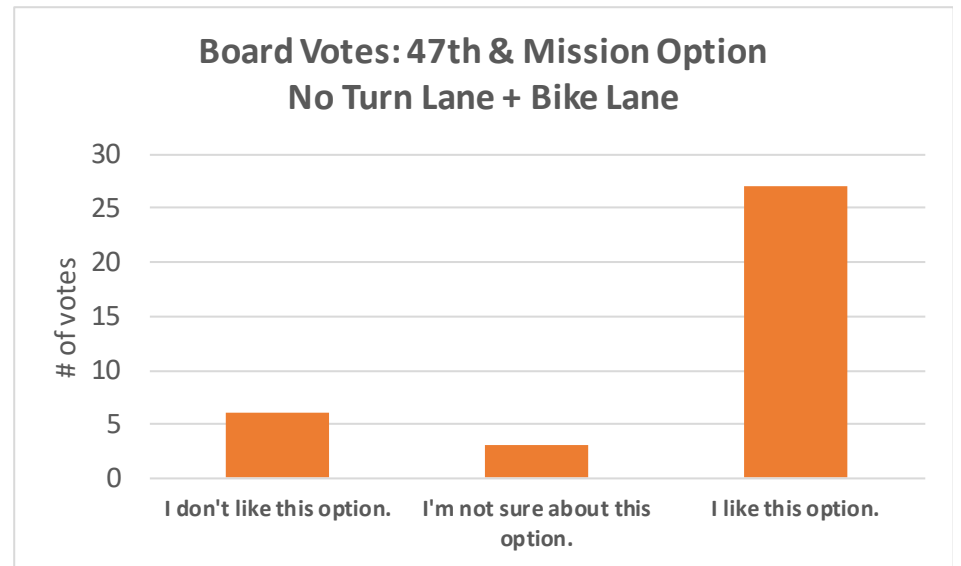
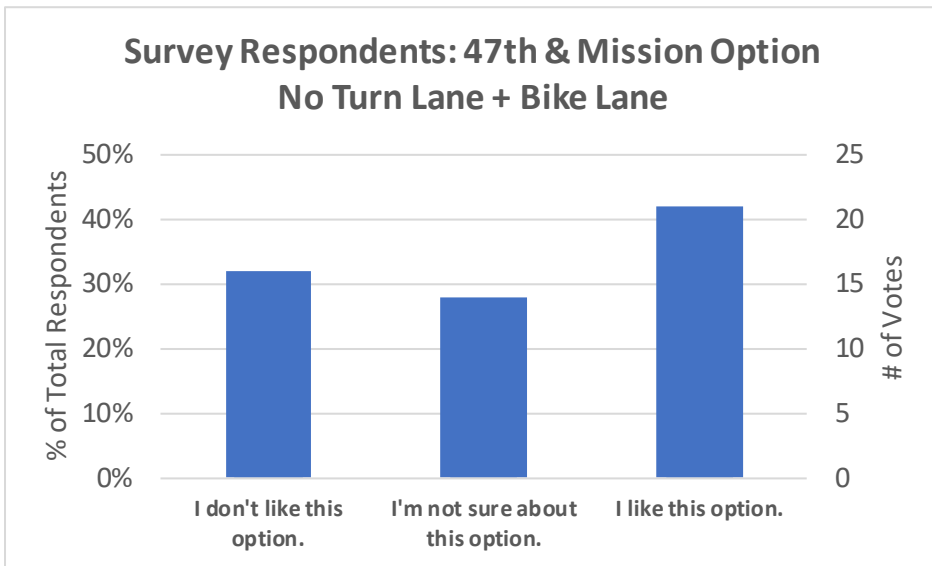
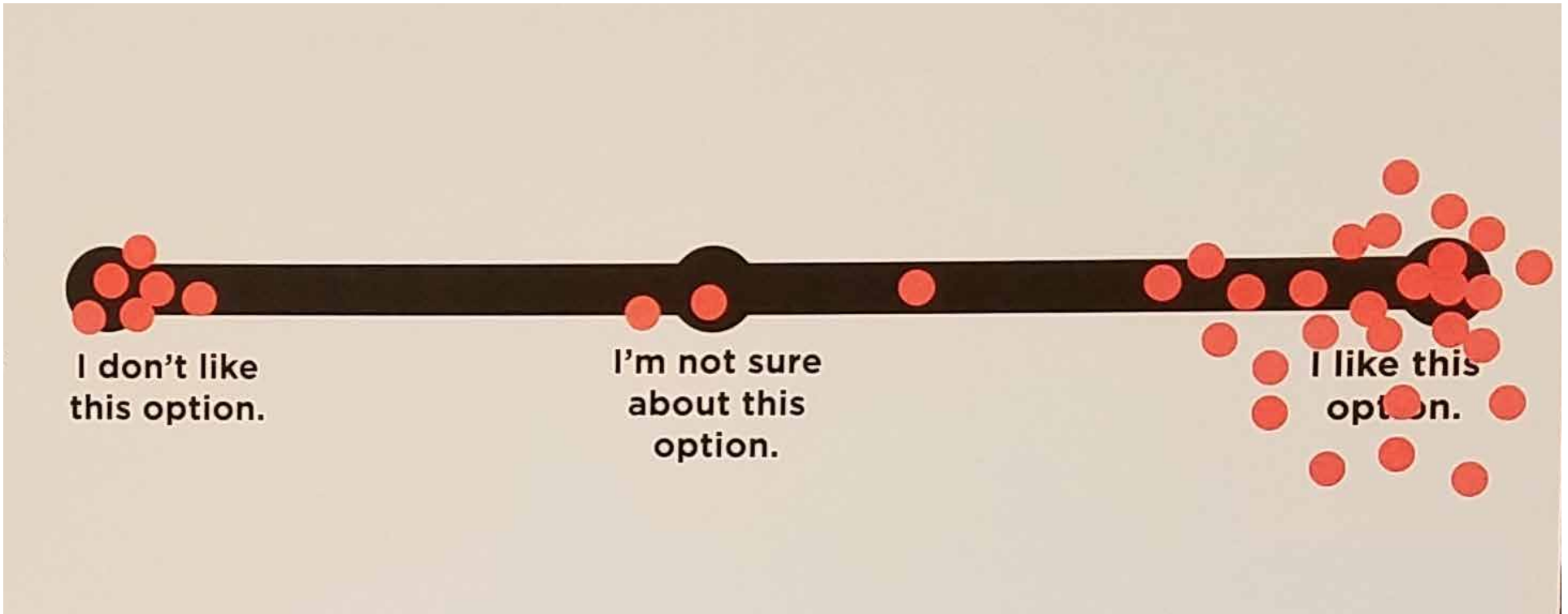
**I'm not sure  
about this  
option.**

**I like this  
option.**

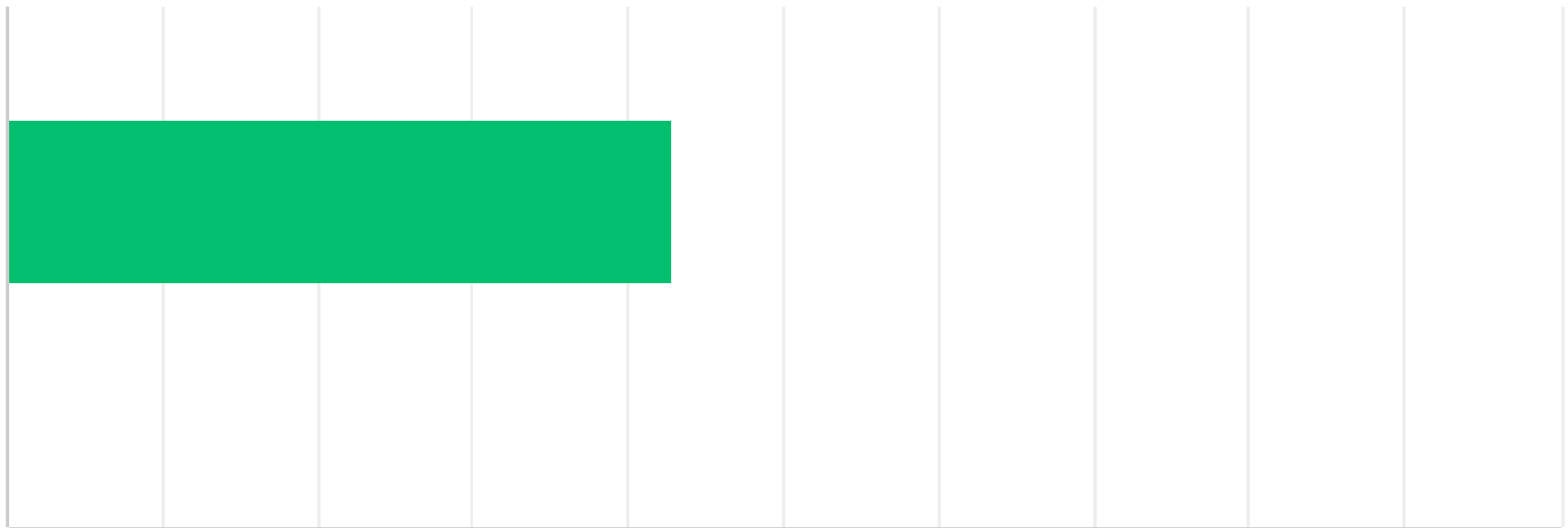
## No Turn Lane + Bike Lane

- + Fits within existing curb line
- + Dedicated space for cyclists through intersection
- No dedicated right turn lane





# What is your opinion on the following intersection option for 47th and Mission? Online Survey Average Response

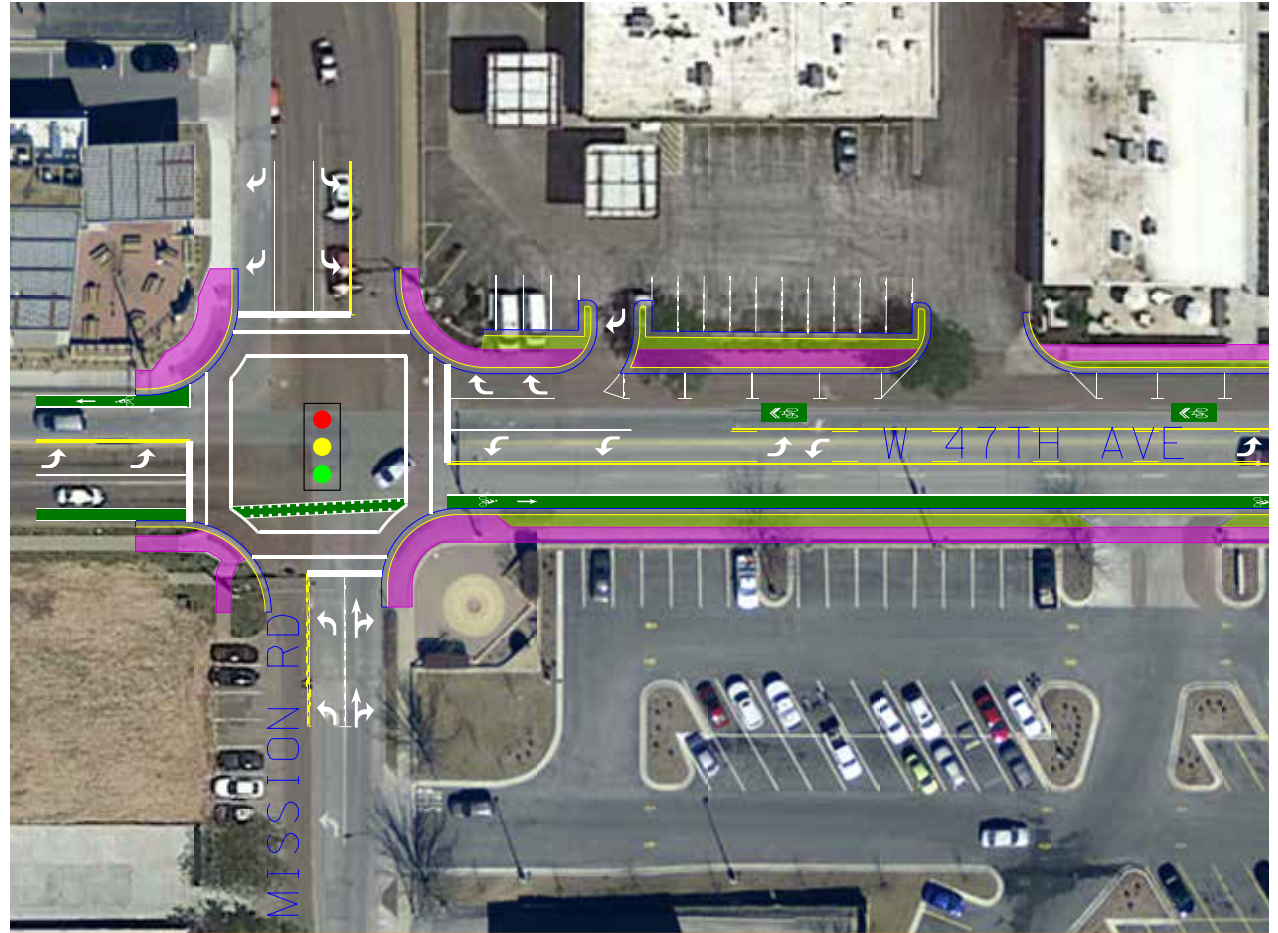


0 10 20 30 40 50 60 70 80 90 100

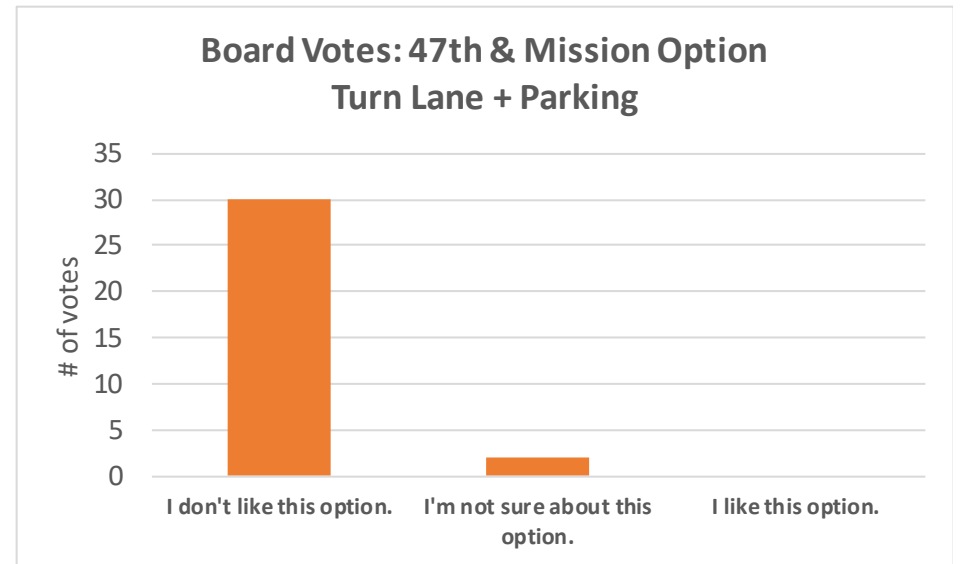
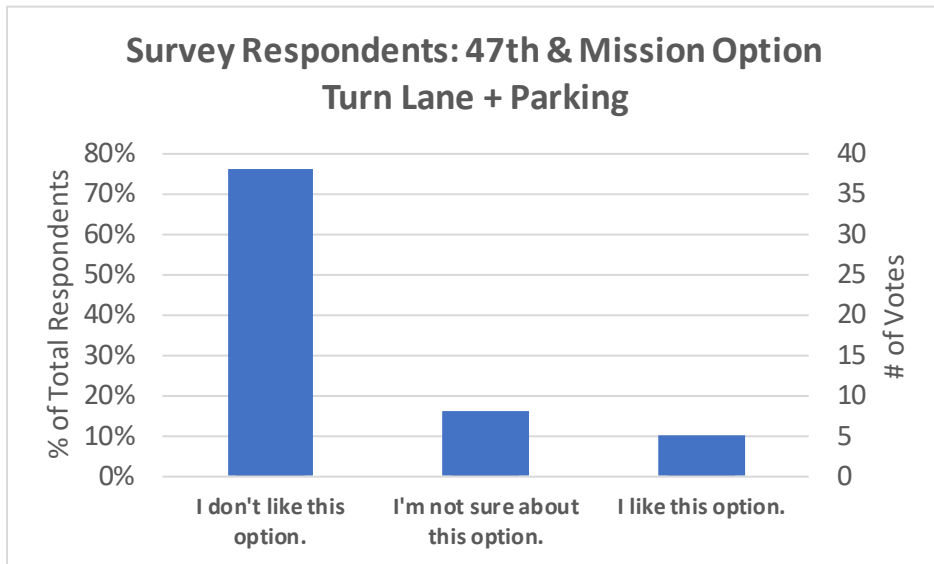
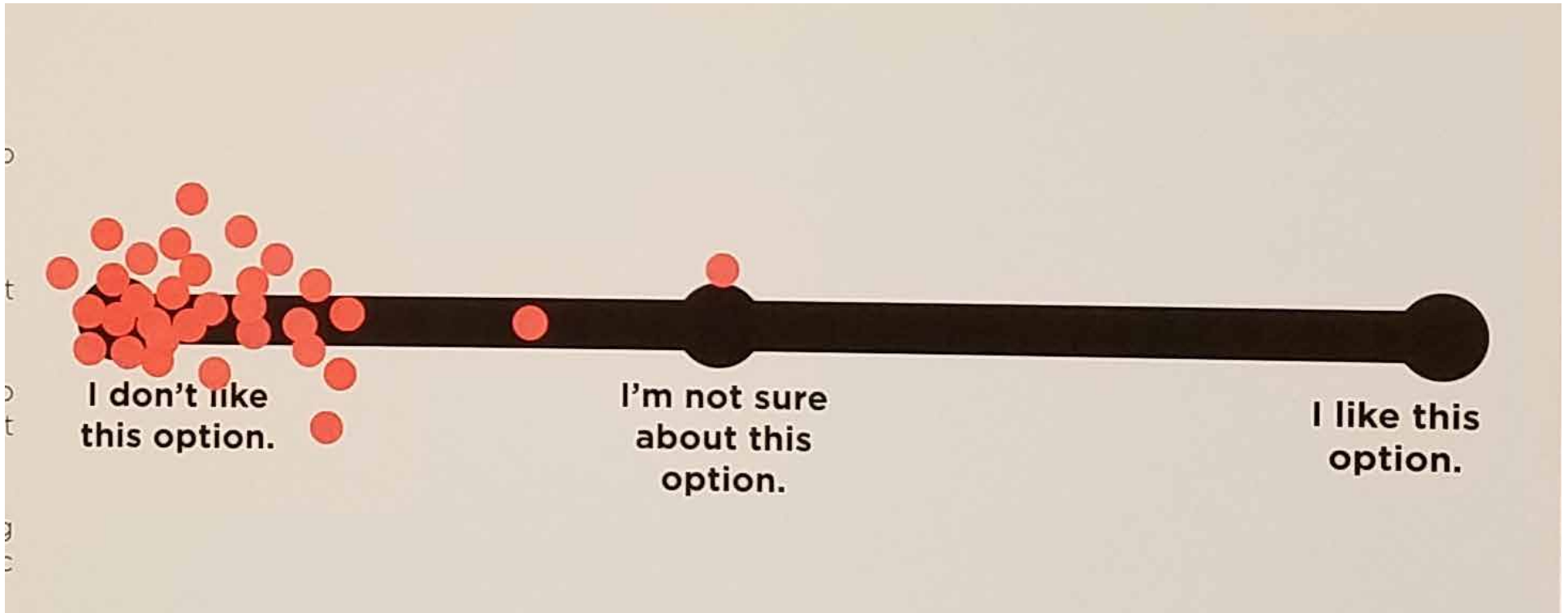


## Turn Lane + Parking

- + Fits in existing curb
- + Right turn lane
- + New on-street parking
- Requires bikes to merge with cars at busy intersection
- Parallel parking complicates traffic movements







# What is your opinion on the following intersection option for 47th and Mission? Online Survey Average Response



0 10 20 30 40 50 60 70 80 90 100



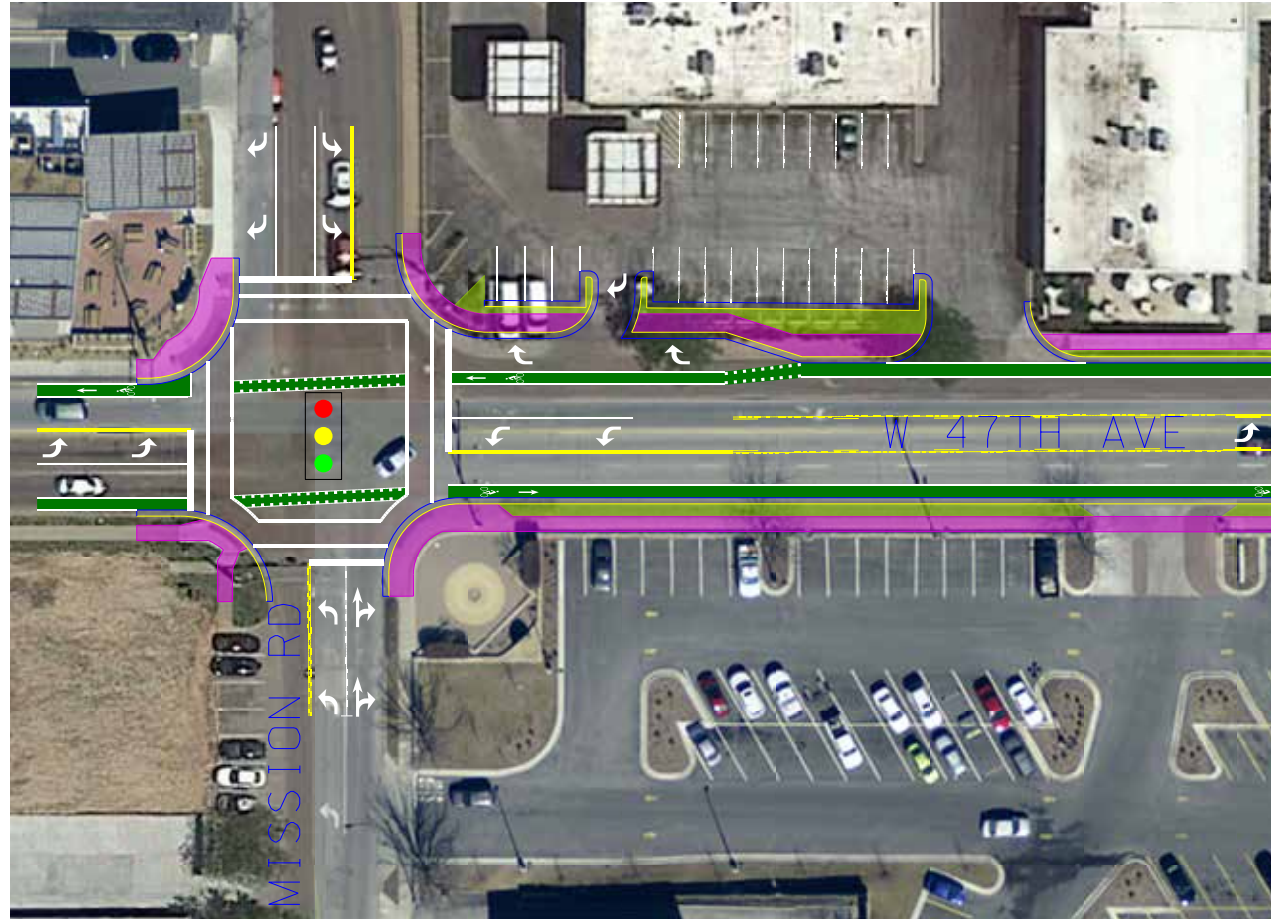
**I don't like  
this option.**

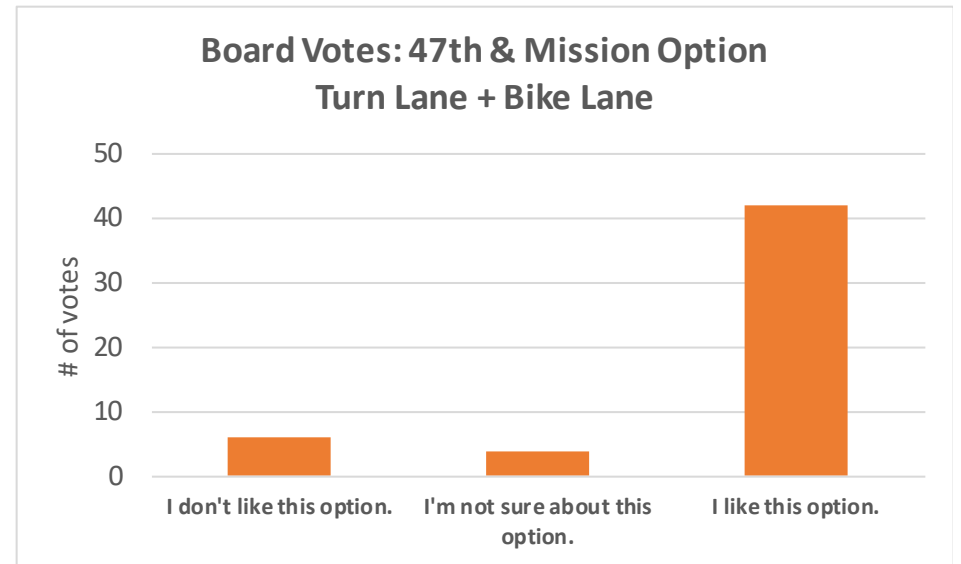
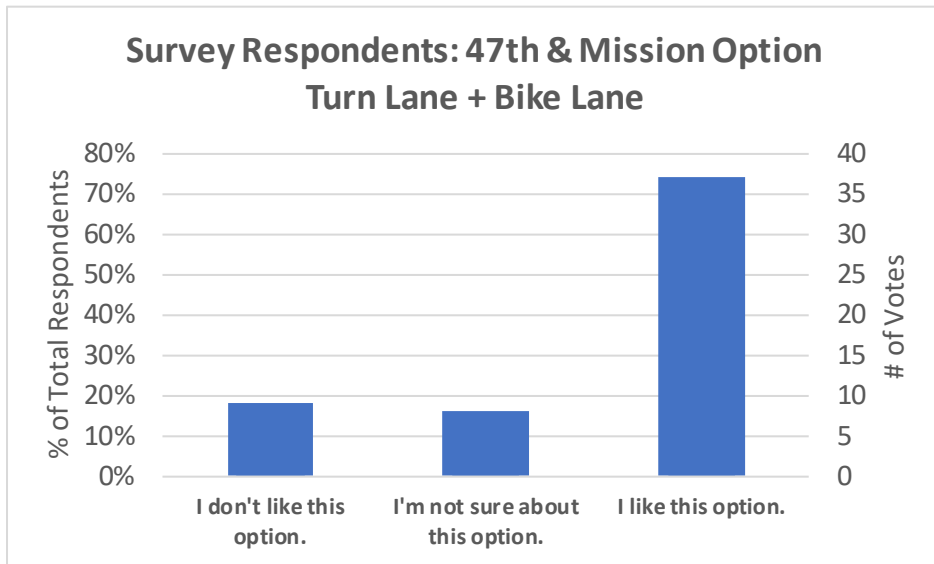
**I'm not sure  
about this  
option.**

**I like this  
option.**

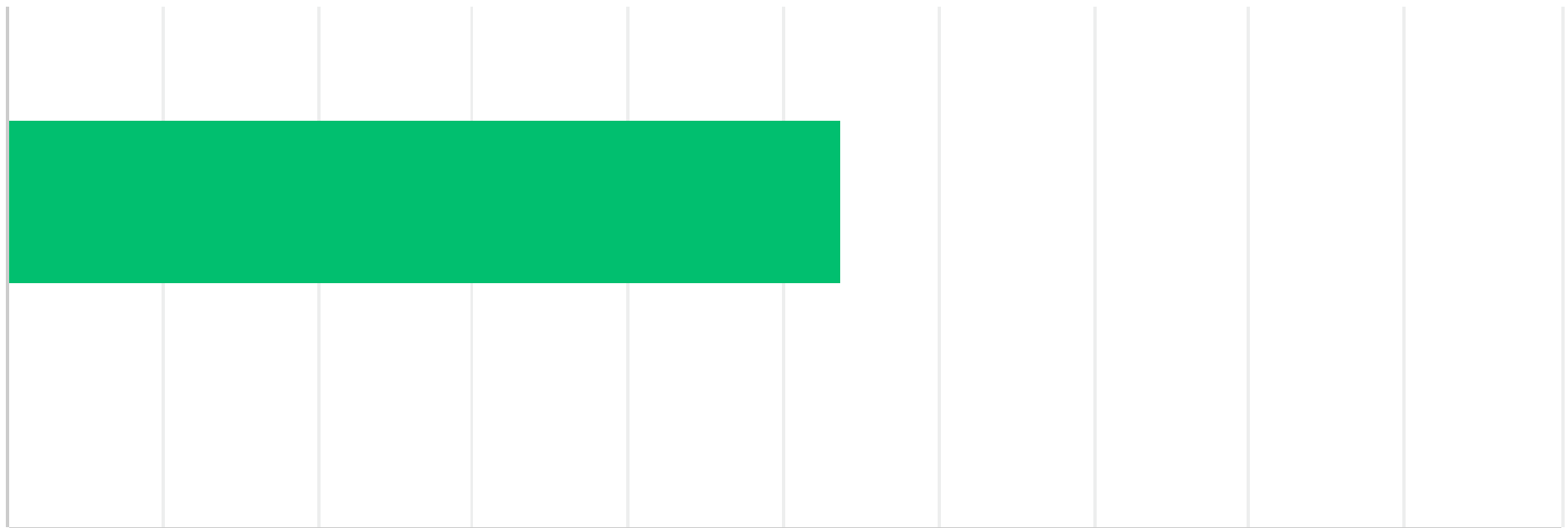
## Turn Lane + Bike Lane

- + Right turn lane
- + Dedicated space for cyclists
- Requires changes to existing curb
- Requires new right-of-way & property owner coordination





# What is your opinion on the following intersection option for 47th and Mission? Online Survey Average Response



0 10 20 30 40 50 60 70 80 90 100



**I don't like  
this option.**

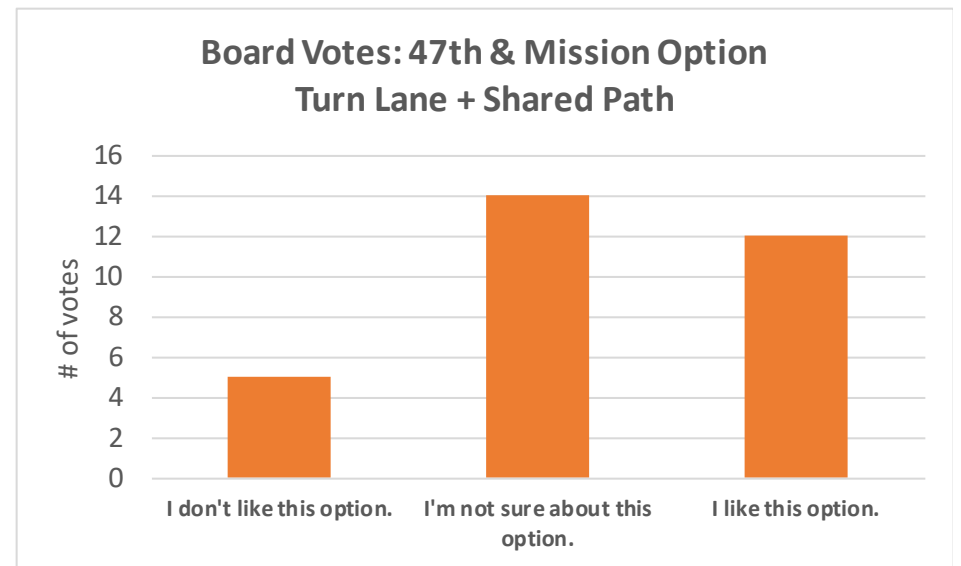
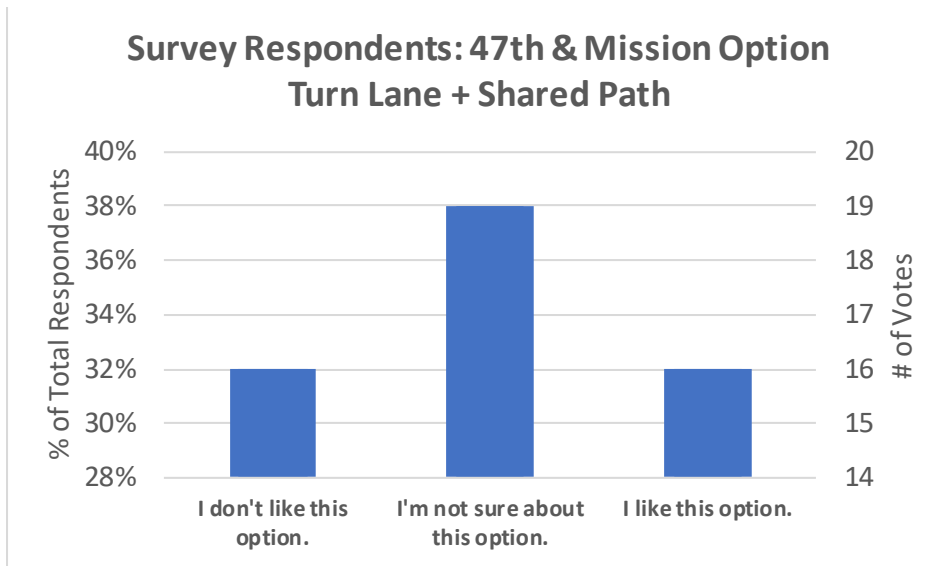
**I'm not sure  
about this  
option.**

**I like this  
option.**

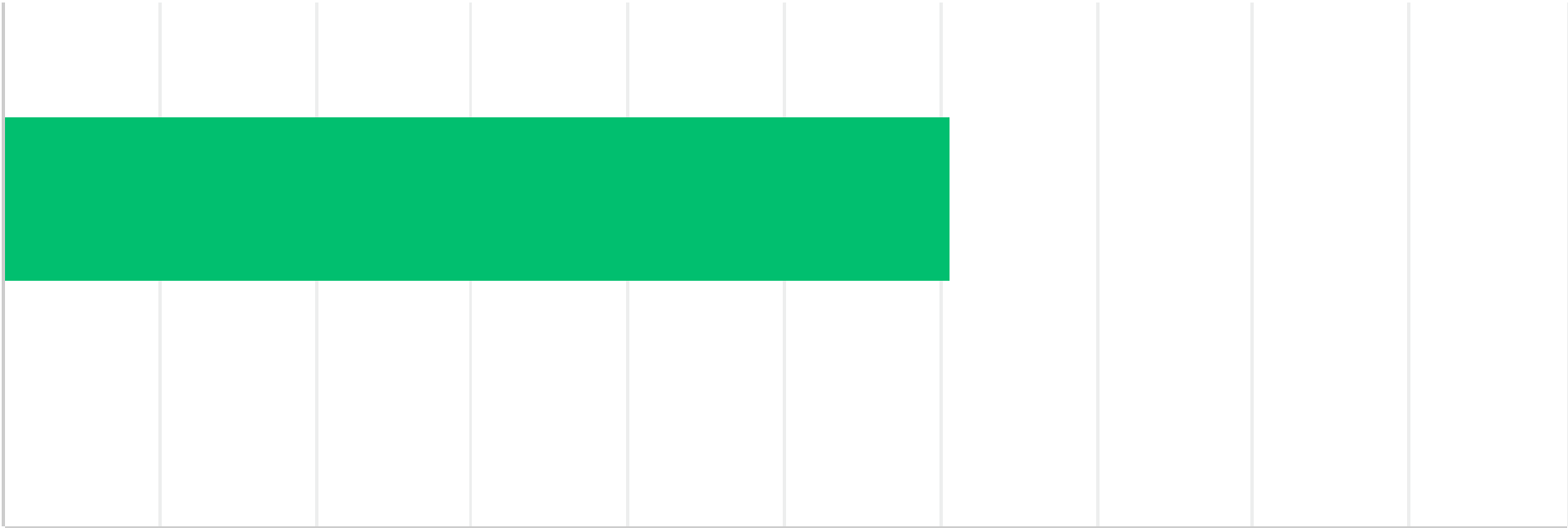
## Turn Lane + Shared Path

- + Right turn lane
- + Dedicated space for cyclists
- Requires changes to existing curb
- Requires new right-of-way & property owner coordination





# What is your opinion on the following intersection option for 47th and Mission? Online Survey Average Response



0 10 20 30 40 50 60 70 80 90 100



**I don't like  
this option.**

**I'm not sure  
about this  
option.**

**I like this  
option.**



## **IX. 47th & Belinder Intersection Options**

Improvements to the crossing of 47th Street at Belinder Road (Fisher Street) were identified among the highest priorities by community members during the September 2017 Walk and Talk event. Fast traffic, multiple travel lanes, and a wide road make 47th Street very challenging to cross, especially for those with special mobility needs.

## Intersection Challenges

- Traffic on 47th Street does not stop and often moves quickly.
- There are many potential collision points and no safe place to pause in the street.
- When motorists yield, other drivers often “cut around” to pass.



## How Does a Road Diet Help?

- Road diets reduce the overall crossing distance.
- Road diet striping can calm and slow traffic.
- “Cut around” movements by motorists are prevented.
- Turning cars have a better approach angle and visibility of crossing pedestrians.

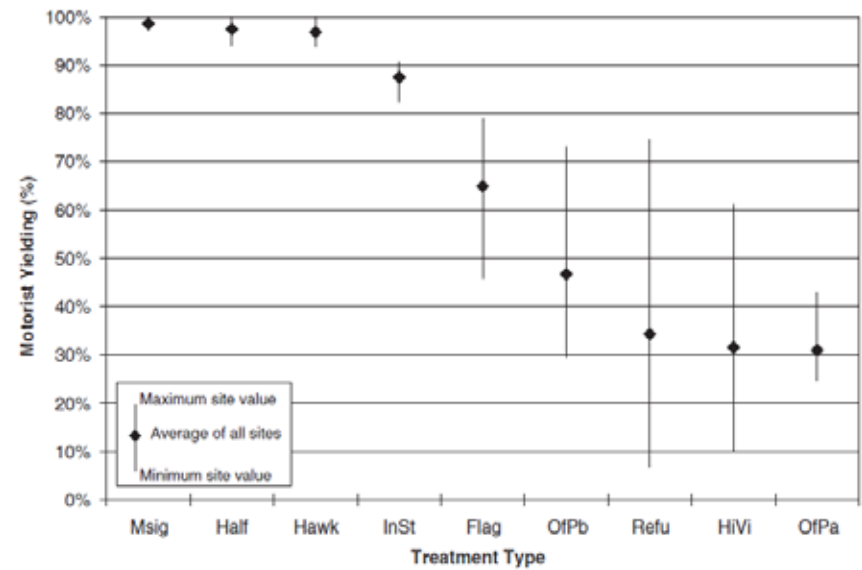


## Signage and Refuge Islands

- Refuge islands provide a physical barrier to protect pedestrians and further calm traffic.
- Pedestrians only have to worry about crossing a short distance and one direction of traffic at a time.
- Signage and refuge islands have proven, measurable safety benefits.

## What About a Traffic Signal?

- Traffic volumes do not warrant a full traffic signal at 47th and Belinder.
- On-call pedestrian signals work best in mid-block locations. Intersection locations present safety and operational challenges.
- The cost of poles and signal infrastructure is significant, while research shows that when used together, signage and refuge islands can provide comparable levels of yielding by motorists.



Abbreviations: Msig=midblock signal; Half=half signal; Hawk=HAWK signal beacon; InSt=in-street crossing signs; Flag=pedestrian crossing flags; OfPb=overhead flashing beacons (pushbutton activation); Refu=median refuge island; HiVi=high-visibility signs and markings; OfPa=overhead flashing beacons (passive activation)

Above: "Site average and range for motorist yielding by crossing treatment," See note 40.

Transportation Research Board, *Improving Pedestrian Safety at Unsignalized Crossings*, p. 49 (Figure 24)



## Intersection Option: Two-Way Left Turn Lane No Pedestrian Refuge

- + Maintains left-turn lane in both directions
- + Does not require additional infrastructure
- No additional traffic calming or protection for pedestrians



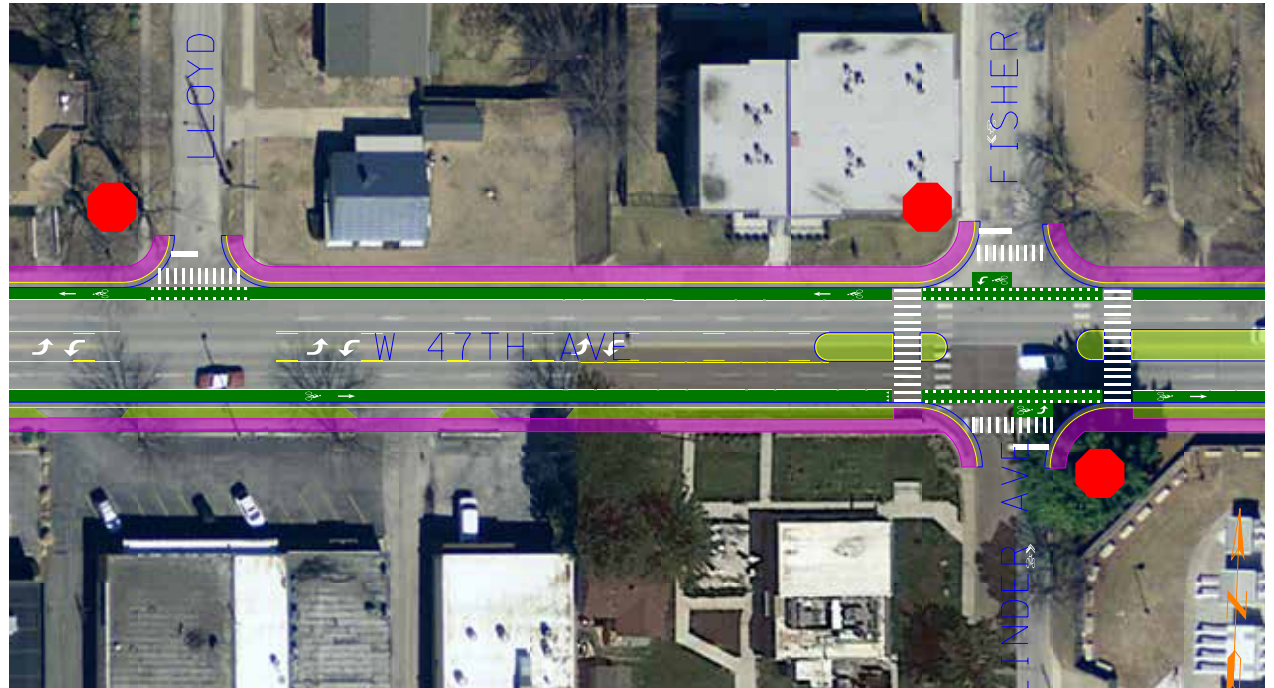
## Intersection Option: Westbound Left Turn Lane West Side Pedestrian Refuge

- + Maintains left-turn lane in busiest direction
- + Provides additional traffic calming and mid-block pedestrian protection
- Requires additional infrastructure
- Westbound traffic not calmed before intersection



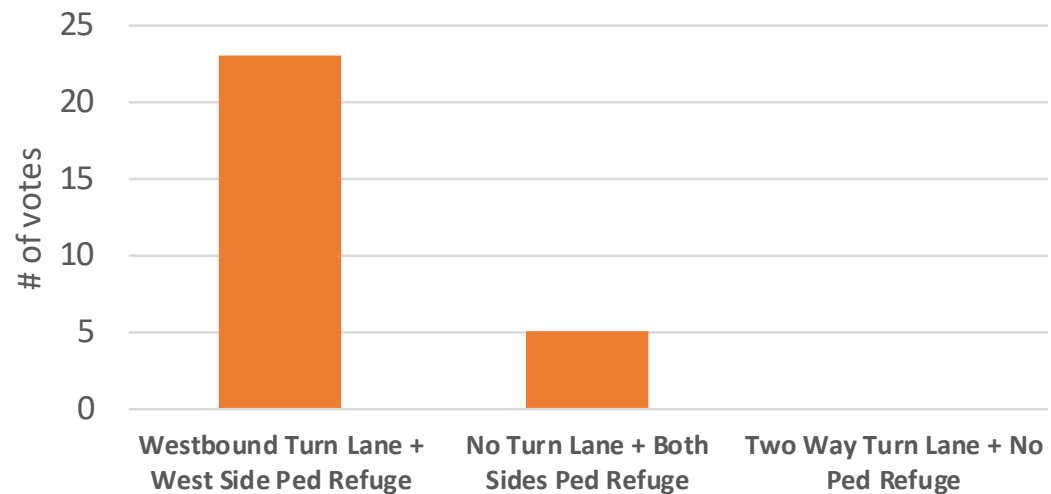
## Intersection Option: No Dedicated Turn Lane Two Sides Pedestrian Refuge

- + Calms traffic in all directions
- + Provides mid-block pedestrian protection on both sides of intersection
- Requires additional infrastructure
- Left turns made from through travel lane



While the project team did not ask public meeting participants to choose between intersection options at 47th Street and Belinder Road, some participants chose to place dots to identify their preference.

### Board Votes: 47th & Belinder Intersection Options





## X. Bus Stops and Mid-Block Crossings

# Transit in the 47th Street Corridor

## Existing Routes

KCATA Route 107 serves the area with a circulation loop utilizing Southbound Rainbow Boulevard to Westbound 43rd Street to Southbound Mission Road to Eastbound 47th Street to Northbound Rainbow Boulevard. Eight times a day, the Route 107 extends to the Mission Transit Center along 47th Street to the west of Mission Road and Roe Avenue. Currently, Route 107 transit buses travel only eastbound on 47th Street between Mission Road and Rainbow Boulevard with 30 to 60 minute arrival intervals during the weekday. 60 minute arrival periods are during the off peak hours. Saturday transit buses arrive every hour. KCATA Route 405 runs along Nall Avenue from 107th Street to Downtown Kansas City, Missouri and also passes along 47th Street between Mission Road and Rainbow Boulevard. On weekdays, a bus arrives at approximately 7:00AM and another at 7:30 AM headed eastbound on 47th Street and at 5:00PM and another at 5:30 PM headed westbound on 47th Street. There is no Saturday service for this route. There is no Sunday service for either route.

## Existing Bus Stops

The most important bus stop along 47th Street between Mission Road and Rainbow Boulevard is at Walmart. The eastbound bus stop at Belinder is used by a visually impaired resident who lives across the road along the northside of 47th Street. There is a bus stop sign along westbound 47th Street to the west of Belinder which may be used by the Route 405 buses. The bus stop at Adams Street helps serve Westwood City Hall and Woodside Village.



Eastbound 47th Street at Adams Street



Eastbound 47th Street at Belinder Road



Eastbound 47th Street at Walmart



Westbound 47th Street at Belinder Road

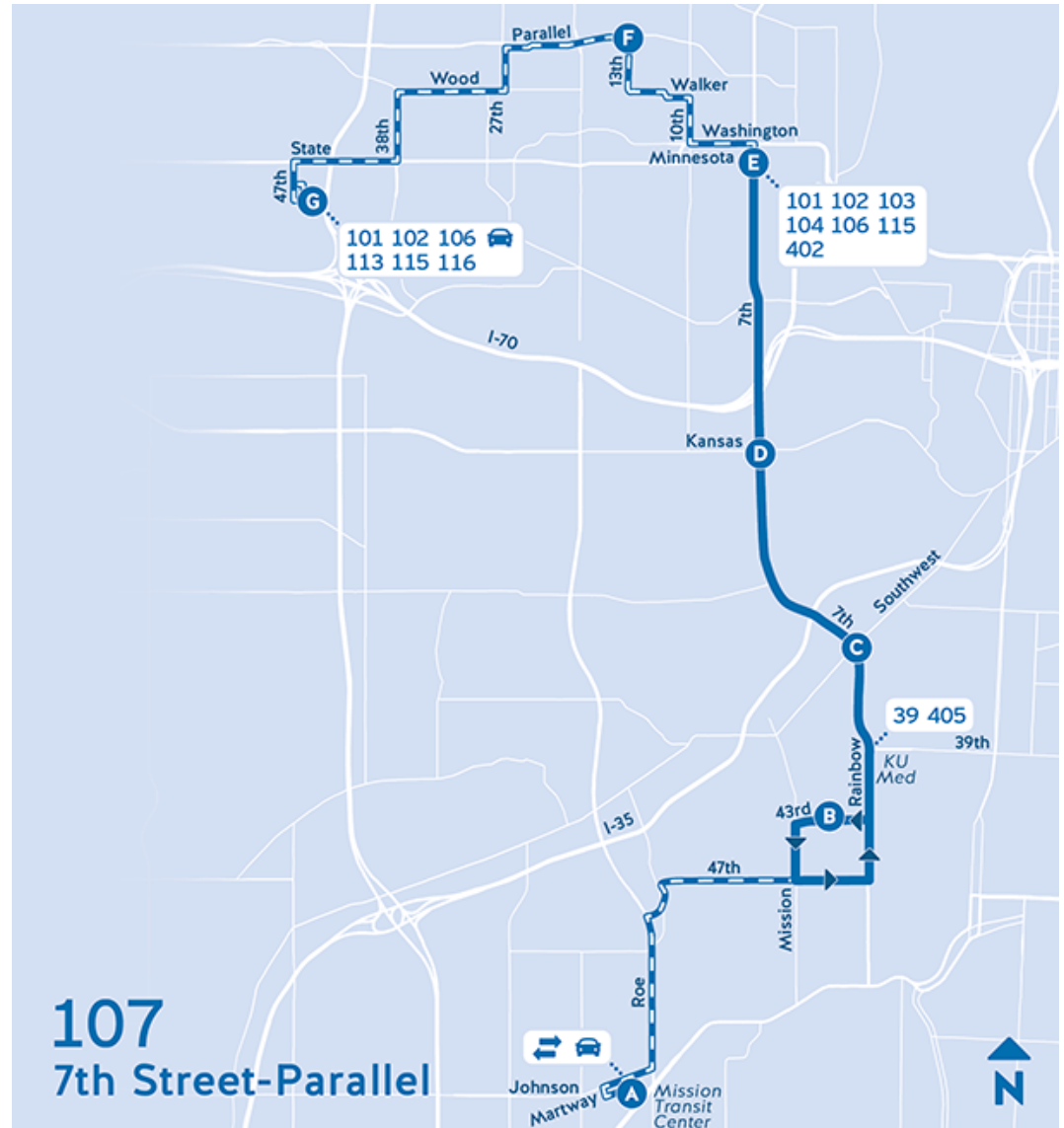


# 405 Nall-Downtown



- LEGEND**
- Regular Route
  - Schedule Time Point
  - Major Transfer Hub
  - Streetcar Route
  - Bike Share Station
  - FREE Park & Ride

# 107 7th Street-Parallel



- LEGEND**
- Regular Route
  - Extended Weekday Service
  - Schedule Time Point
  - Transfer Options
  - Major Transfer Hub
  - FREE Park & Ride

## Future Transit Service

In the future, 47th St between Mission Rd and Rainbow Blvd could see more buses heading in both directions or no buses for Route 107. If funding is made available to make ADA compliant improvements and to permanently extend the route to the Mission Transit Center for all transit trips then the circulation loop of Route 107 would be changed. Either Route 107 buses would use 43rd Street and Mission Road which was the historic ridership plan, or would use 47th Street and Rainbow Boulevard which would mean less turning movements with more efficient operations. The outlook does not show any indication that funds will be available for this potential change unless there is an unexpected significant change in ridership patterns. KCATA recommends that the 47th Street Complete Street Plan incorporate transit improvements on the south side of 47th only. However all design options maintain future flexibility and right of way capacity for additional transit service in either direction.

## Crossings Near Bus Stops

With the proposed roadway configuration for 47th Street, transit riders will have a shorter crossing distance, crossing three travel lanes instead of four. At the Walmart and Belinder stops, crossings will be improved with the possibility of adding pedestrian refuge islands now or in the future. Refuge islands are raised medians that would be on either side of the crosswalk within the center turn lane. This would allow pedestrians to only have to cross one travel lane at a time. Due to the traffic volumes, installation of pedestrian signals is not feasible so pedestrian signage and activation lights will be utilized instead. Due to the proximity of the bus stop at Adams St to the signalized intersection of 47th Street & Rainbow Boulevard, a pedestrian crossing at Adams Street is not feasible and is not recommended to be implemented.

## Bus Stop Amenities

There are no benches or shelters for the bus stops along 47th Street. Installation of a conventional shelter/bench combination would require right-of-way and reconstruction of the low stone wall along the roadway. One potential recommendation is to incorporate the low stone wall into a bench by adding a smooth layer of additional concrete on top. A cantilevered shelter could be installed with two large poles placed directly behind the wall on either side of the bench area. This would help reduce cost and match the aesthetics of the already existing wall structure but would not address shelter needs for wheelchair users. The loading/unloading pavement pad will be replaced as necessary with a bright yellow paint color added to the end of the concrete pavement to denote where the street begins. The Walmart bus stop will be moved a few feet to the east to accommodate the new marked pedestrian crossing.

# Mid-Block Crossings

- Signalized crossings at Mission Rd and Rainbow Blvd are 1/2 mile apart. Belinder Road is the only other marked crossing, located 1/4 mile from Mission and Rainbow.
- Lack of safe crossings leads many people to cross 47th Street mid-block, especially near the busy bus stop in front of Walmart.
- A signed and painted mid-block crossing with pedestrian refuge can improve connectivity and safety for pedestrians in the corridor.
- The proposed location preserves all left turn movements in and out of driveways.

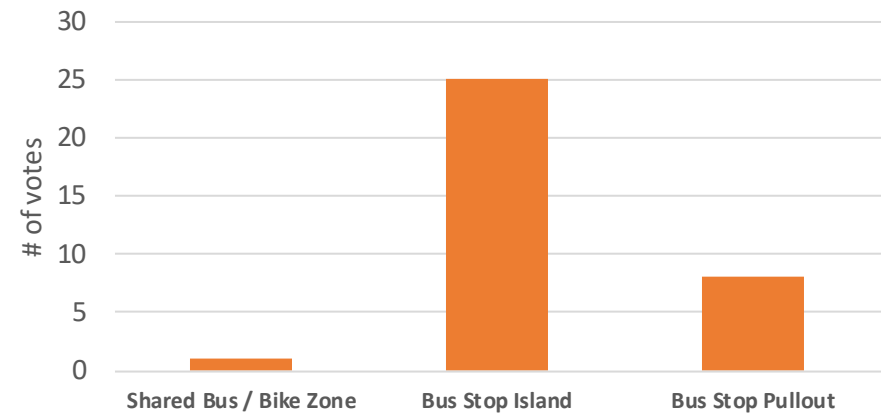


# Bus Stop Options

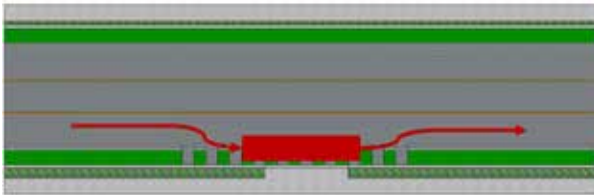
Today, bus stops on the corridor are signed only. There are no benches, shelters, or other transit amenities. Changes to the configuration of 47th Street present an opportunity to enhance the comfort and efficiency of transit service in the corridor, and to thoughtfully integrate transit with bicycle and pedestrian improvements.

While the project team did not ask public meeting participants to choose between bus stop options, some participants chose to place dots to identify their preference.

**Board Votes:  
Bus Stop Options**

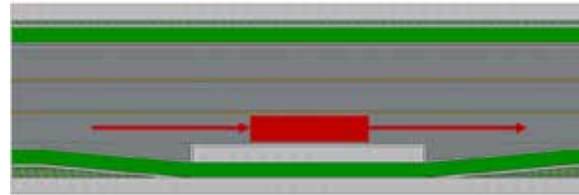


## Shared Bus/Bike Zone



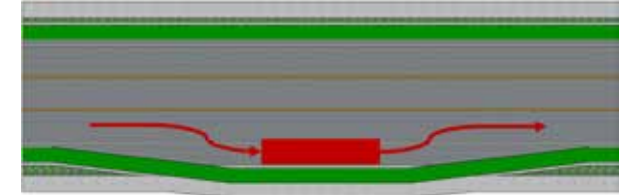
- + Fits within existing curb lines
- + Through traffic can comfortably pass
- Buses encroach in bike lane

## Bus Stop Island



- + More efficient transit operations
- + Bike facilities protected through bus stop zone
- + Dedicated spaces for bus boarding
- Requires additional infrastructure
- Loading bus briefly blocks travel lane

## Bus Stop Pull-Out



- + Through traffic can comfortably pass
- + Bike facilities protected through bus stop zone
- Requires additional infrastructure
- Requires additional right-of-way

## **XI. 47th Street Cost Estimates**

## Cost Estimate

### Design Option A: 3 Lanes + Buffered Bike Lanes

	Length	2,835	Per/Ft Cost	\$50.00
Description	Quantity	Units	Unit Price	Subtotal
Traffic Control	1	Lump Sum	\$15,000	\$15,000
Pedestrian Refuge Island	3	Each	\$1,900	\$5,700
Signal Modifications	1	Lump Sum	\$50,000	\$50,000
Permanent Signage	1	Lump Sum	\$5,000	\$5,000
Pavement Markings	1	Lump Sum	\$28,000	\$28,000
<b>Subtotal</b>				<b>\$103,700</b>
Contingency (10%)				\$10,370
<b>Subtotal of All Construction Costs</b>				<b>\$114,070</b>
Engineering Fee (15%)				\$17,110
<b>Total Estimated Costs</b>				<b>\$131,180</b>

## Cost Estimate

### Design Option B: 3 Lanes + On-Street Parking

	Length	2,835	Per/Ft Cost	\$50.00
Description	Quantity	Units	Unit Price	Subtotal
Traffic Control	1	Lump Sum	\$15,000	\$15,000
Pedestrian Refuge Island	3	Each	\$1,900	\$5,700
Signal Modifications	1	Lump Sum	\$50,000	\$50,000
Permanent Signage	1	Lump Sum	\$5,000	\$5,000
Pavement Markings	1	Lump Sum	\$28,000	\$26,000
<b>Subtotal</b>				<b>\$101,700</b>
Contingency (10%)				\$10,170
<b>Subtotal of All Construction Costs</b>				<b>\$111,870</b>
Engineering Fee (15%)				\$16,780
<b>Total Estimated Costs</b>				<b>\$128,650</b>

# Cost Estimate

## Design Option C: 3 Lanes + Raised Shared Path

	Length	2,835	Per/Ft Cost	\$520.00
Description	Quantity	Units	Unit Price	Subtotal
Mobilization	1	Lump Sum	\$21,500	\$21,500
Field Office	1	Lump Sum	\$20,000	\$20,000
Erosion Control	1	Lump Sum	\$7,000	\$7,000
Removal of Improvements	1	Lump Sum	\$20,000	\$20,000
Traffic Control	1	Lump Sum	\$15,000	\$15,000
Saw Cut	5,670	Linear Feet	\$3.00	\$117,010
Unclassified Excavation	13,000	Cubic Yards	\$5.00	\$65,000
Embankment	12,000	Cubic Yards	\$4.75	\$57,000
Pedestrian Refuge Island	3	Each	\$1,900	\$5,700
Sidewalk	5,465	Square Yards	\$41.75	\$228,164
Curb and Gutter	6,020	Linear Feet	\$20	\$120,400
Storm Sewer	1	Lump Sum	\$447,860	\$447,860
Signal Modifications	1	Lump Sum	\$50,000	\$50,000
Permanent Signage	1	Lump Sum	\$5,000	\$5,000
Pavement Markings	1	Lump Sum	\$26,000	\$26,000
Permanent Seeding	0.4	Acre	\$2,500	\$1,000
Contractor Furnished Surveying & Staking	1	Lump Sum	\$15,000	\$15,000
<b>Subtotal</b>				<b>\$1,121,634</b>
Contingency (15%)				\$168,245
<b>Subtotal of All Construction Costs</b>				<b>\$1,289,879</b>
Engineering Fee (15%)				\$193,482
<b>Total Estimated Cost</b>				<b>\$1,483,361</b>



## Cost Estimate

### Design Option D: 3 Lanes + Wide Sidewalks + On-Street Parking

	Length	2,835	Per/Ft Cost	\$520.00
Description	Quantity	Units	Unit Price	Subtotal
Mobilization	1	Lump Sum	\$21,500	\$21,500
Field Office	1	Lump Sum	\$20,000	\$20,000
Erosion Control	1	Lump Sum	\$7,000	\$7,000
Removal of Improvements	1	Lump Sum	\$20,000	\$20,000
Traffic Control	1	Lump Sum	\$15,000	\$15,000
Saw Cut	5,670	Linear Feet	\$3.00	\$117,010
Unclassified Excavation	13,000	Cubic Yards	\$5.00	\$65,000
Embankment	12,000	Cubic Yards	\$4.75	\$57,000
Pedestrian Refuge Island	3	Each	\$1,900	\$5,700
Sidewalk	5,465	Square Yards	\$41.75	\$228,164
Curb and Gutter	6,020	Linear Feet	\$20	\$120,400
Storm Sewer	1	Lump Sum	\$447,860	\$447,860
Signal Modifications	1	Lump Sum	\$50,000	\$50,000
Permanent Signage	1	Lump Sum	\$5,000	\$5,000
Pavement Markings	1	Lump Sum	\$26,000	\$26,000
Permanent Seeding	0.4	Acre	\$2,500	\$1,000
Contractor Furnished Surveying & Staking	1	Lump Sum	\$15,000	\$15,000
<b>Subtotal</b>				<b>\$1,121,634</b>
Contingency (15%)				\$168,245
<b>Subtotal of All Construction Costs</b>				<b>\$1,289,879</b>
Engineering Fee (15%)				\$193,482
<b>Total Estimated Cost</b>				<b>\$1,483,361</b>



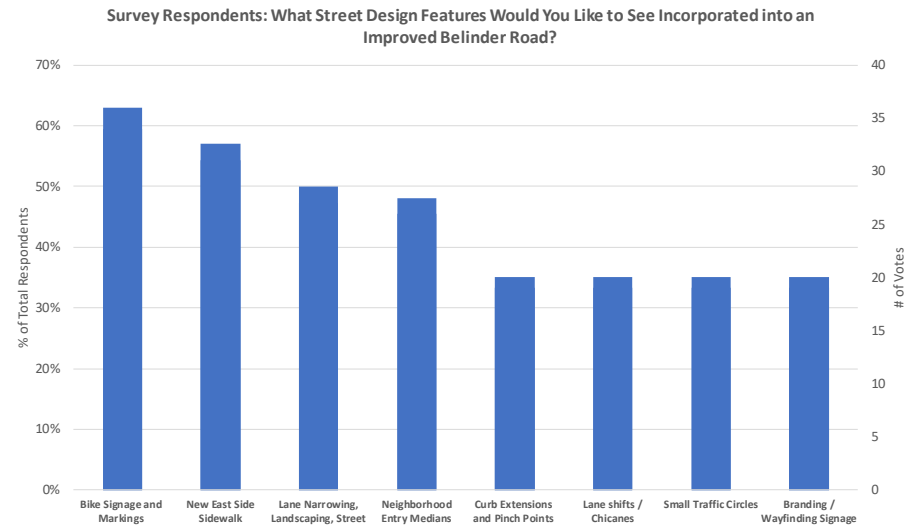
## **XII. Belinder Improvements**

# Belinder Design Features

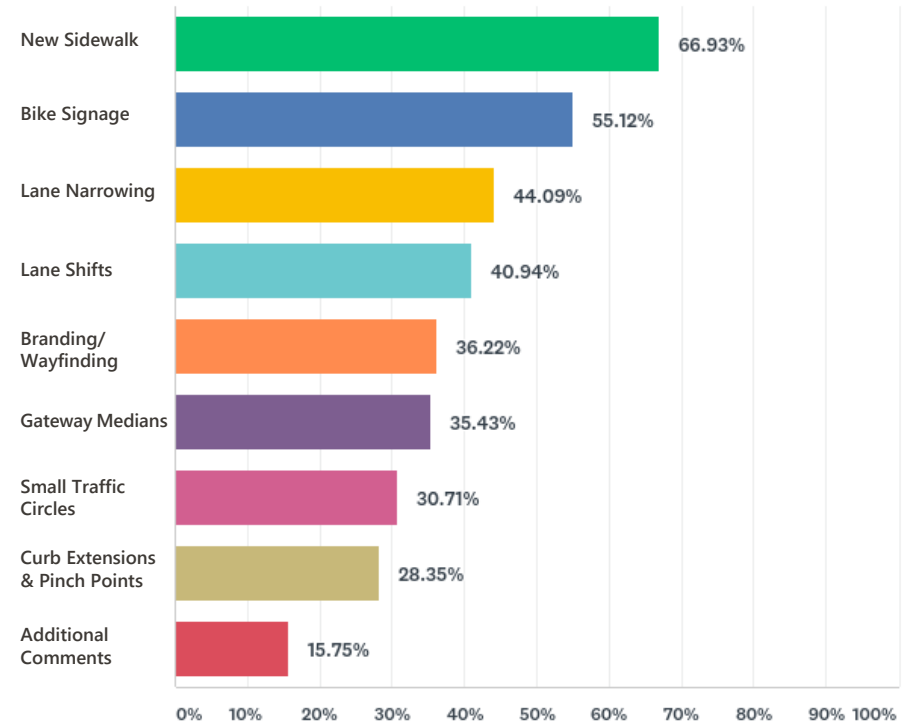
At the September 2017 Walk and Talk event, January 2018 public meeting, and through online survey feedback, community members recognized the importance of Belinder Road as an important community connector. Challenges were also identified. Speeding traffic can make the street feel less safe. Missing infrastructure for pedestrians and cyclists limits the functionality of the corridor as a true neighborhood connector. Several design features to calm traffic and improve connectivity were explored as part of the 47th Street Complete Street Plan. These features were also combined into three different scenarios that illustrate how a combination of measures can work together to transform the experience of the street.

## Open House and Online Survey Feedback

Community feedback was consistent between the public meeting and online survey responses. The most preferred design options for Belinder Road include bike signage and pavement markings, a new sidewalk on the east side of the street where no sidewalk exists today, and a general narrowing of travel lanes.



## What street design features would you like to see incorporated into an improved Belinder Road?





Lane narrowing with expanded landscaping and street trees



Medians at neighborhood entries for traffic calming



A new sidewalk on the east side of the street



Bicycle signage and markings



Traffic calming curb extensions and pinch points



Branding and signage as a special "neighborhood greenway"



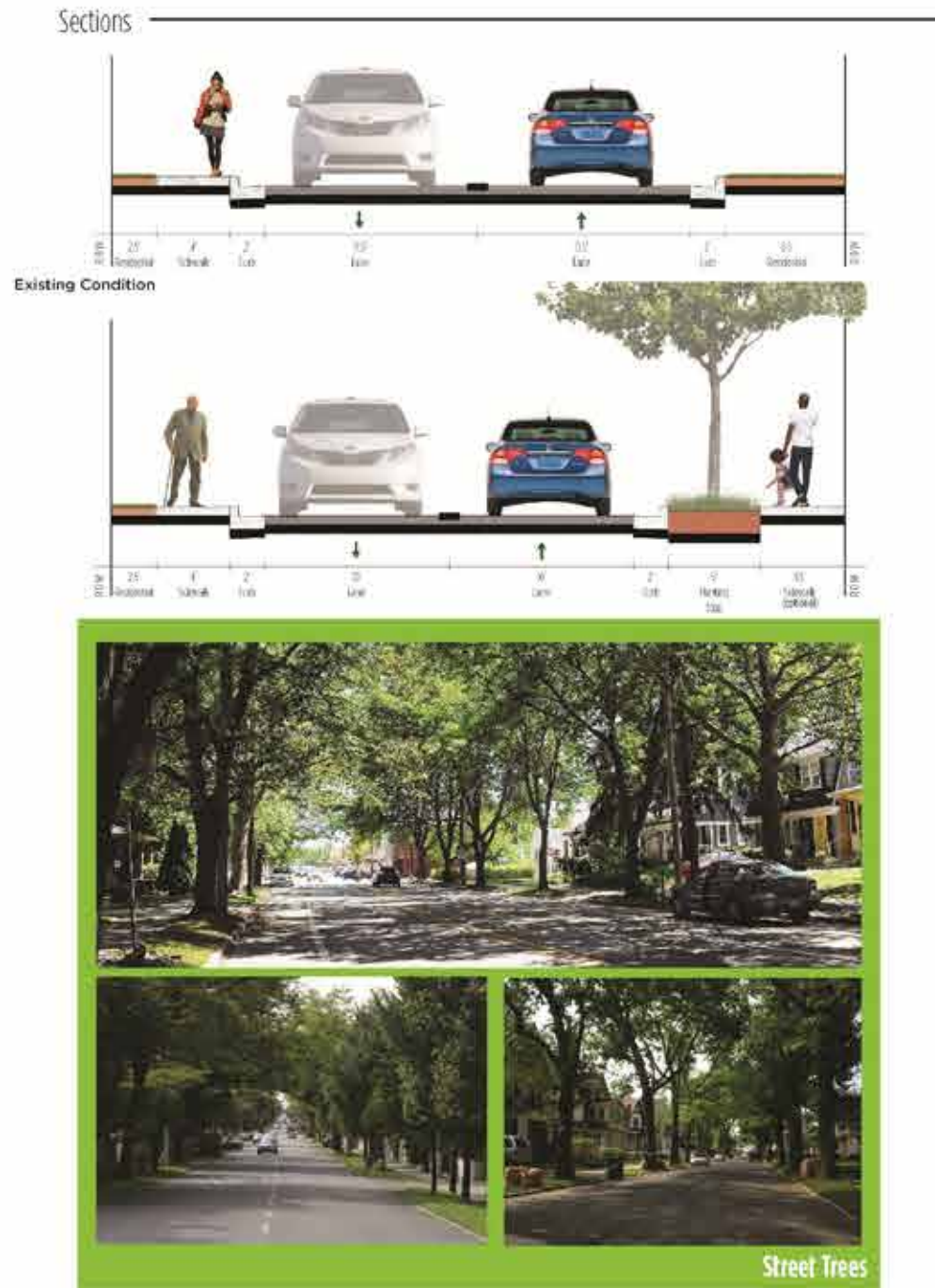
Traffic calming lane shifts / chicanes



Small traffic calming circles at intersections

## Belinder Design Scenario: Narrowed Road & Tree Lawn

The following design scenarios illustrate how various combinations of traffic calming features can be combined on Belinder Road. Concept A shows a narrowing of travel lanes with a new sidewalk on the east side of the street. A new landscaped tree lawn creates a signature element for the street that enhances its livability and beauty. By using extra space from existing travel lanes, the improvements in this scenario are generally able to avoid utility poles and other obstructions along the roadway.



Example Imagery

## Concept A: Narrowed Roadway w/ Tree Lawn



# Concept A: Narrowed Roadway w/ Tree Lawn





## Belinder Design Scenario: Mini Traffic Circle With Chicanes

Concept B utilizes mini traffic circles and lane shifting curb extensions to slow down traffic on Belinder. These design interventions break up what is a long, straight street. Easily navigable by drivers at reasonable speeds, they make it more difficult to speed down the length of the corridor. They also provide new spaces for attractive landscaping.

Sections



Mini Traffic Circle



Chicanes (curb extensions)

Example Imagery

## Concept B: Mini Traffic Circle + Chicanes

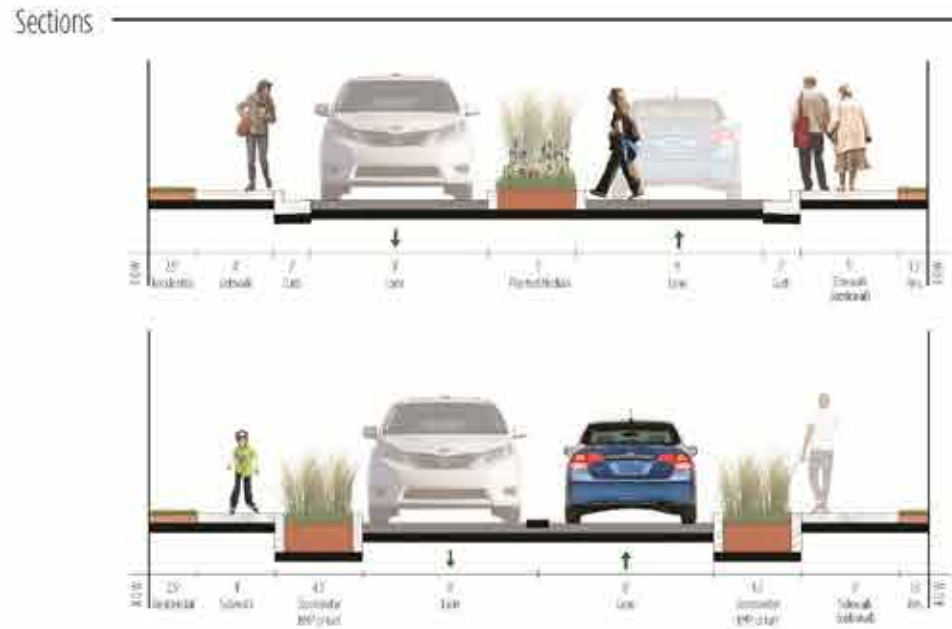


# Concept B: Mini Traffic Circle + Chicanes



# Belinder Design Scenario: Gateway Medians and Pinch Points

Concept C for Belinder Road attempts to calm traffic by “pinching” the road periodically along the corridor. Features also include narrow center medians that can serve as gateway features to neighborhoods along Belinder in addition to their traffic calming functions.



Example Imagery

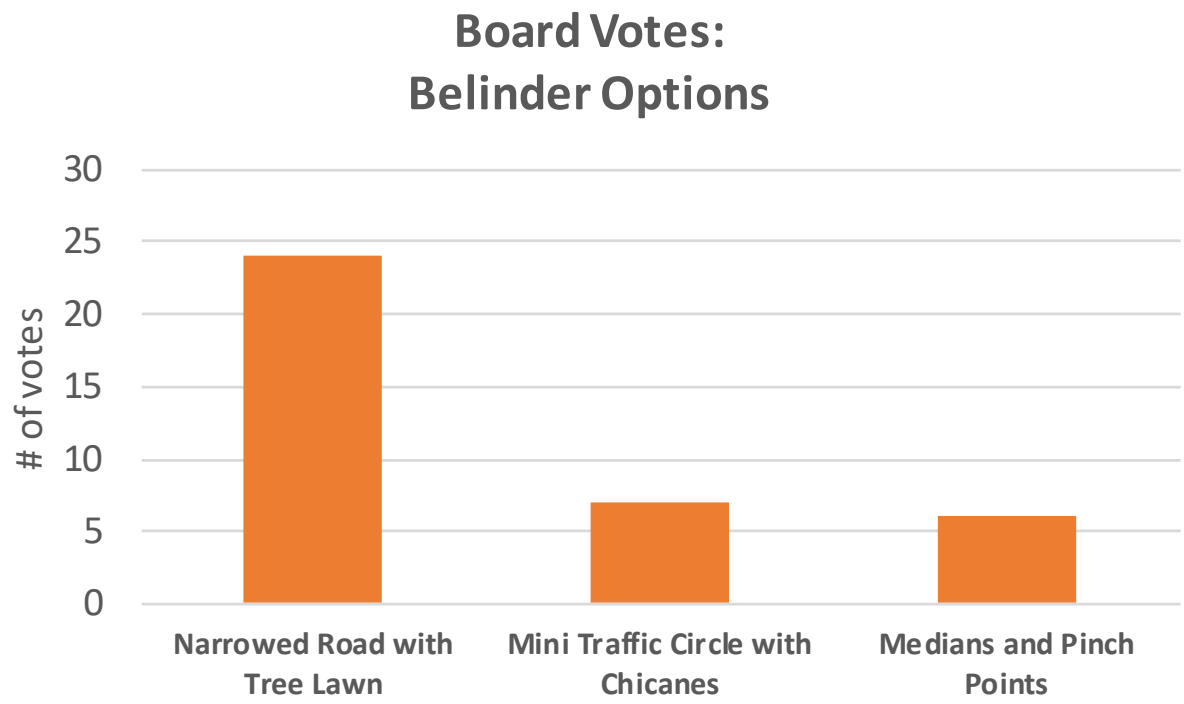
## Concept C: Medians + Pinch Points



# Concept C: Medians + Pinch Points



While the project team did not ask public meeting participants to choose between Belinder scenarios, some participants chose to place dots to identify their preference.







## **XIII. Rainbow to State Line Improvements**

Rainbow Boulevard is the eastern terminus of 47th Street, but many users of the corridor have a desire to get from 47th Street to State Line Road, Westwood Park, and destinations beyond. Today, there is no clear connection for pedestrians or cyclists to bridge this gap between Rainbow Boulevard and State Line Road, but there are several potential routes available, each with their own challenges and tradeoffs. The 47th Street Complete Street Plan explores four options to provide pedestrian and bicycle connections between Rainbow and State Line:

- 46th Avenue
- 47th Place
- 47th Terrace
- Utility Easement Between 47th Place and 47th Terrace



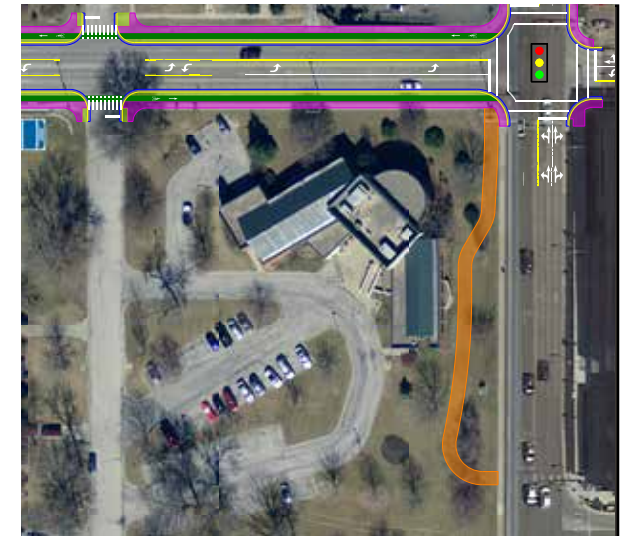
**Crossing Rainbow Boulevard at 47th Place**



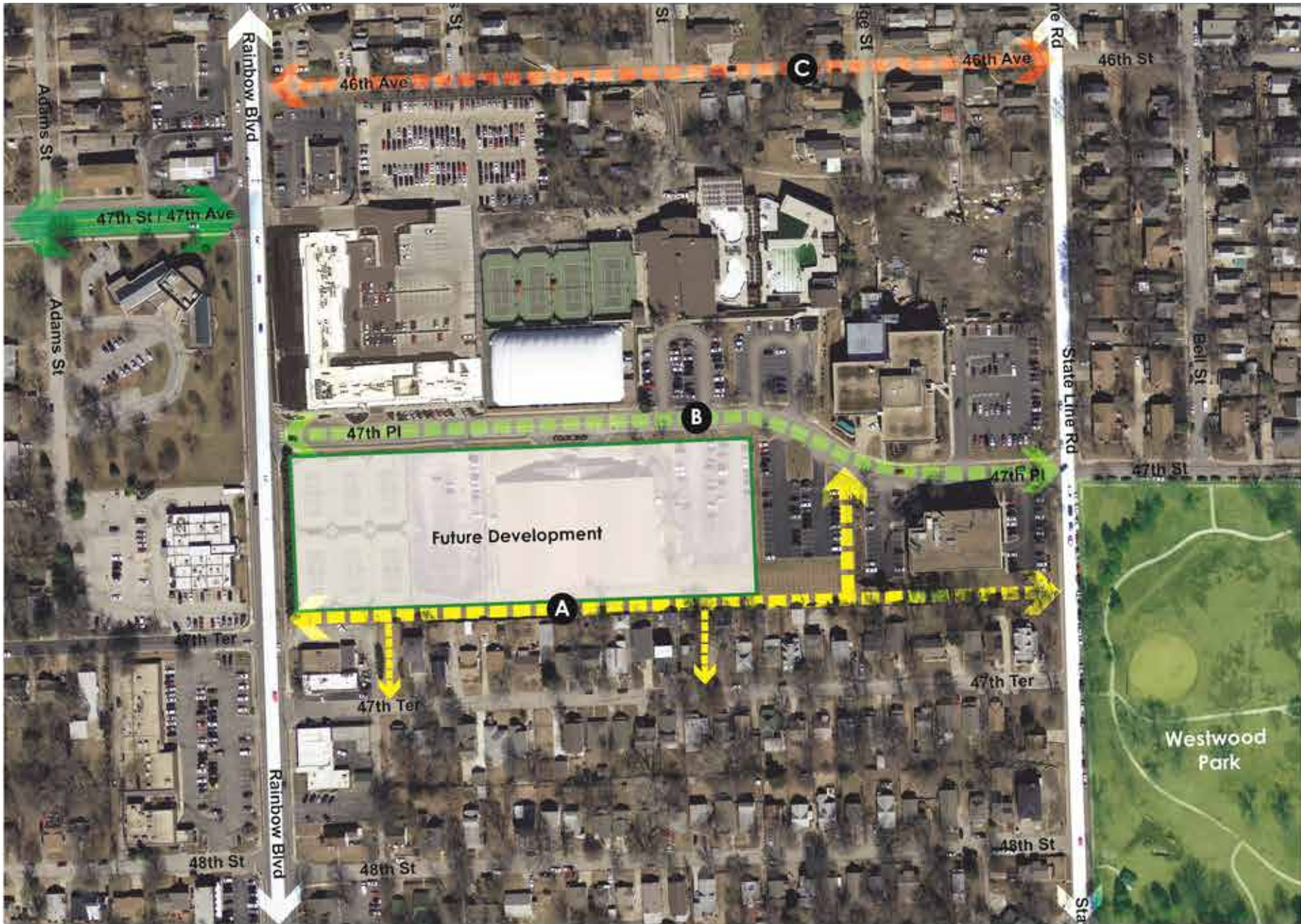
**Gas Line easement connection between Rainbow Boulevard and State Line Road**



**46th Avenue connection between Rainbow Boulevard and State Line Road**



**Shared path connecting 47th Street and 47th Place**



Connectivity Diagram



## Utility Easement Connection

An existing utility easement provides an opportunity for an off-street pedestrian connection between Rainbow Boulevard and State Line Road. The easement is located between 47th Place and 47th Terrace. Access to the easement from Rainbow Boulevard is relatively straightforward. Pedestrians are able to cross the street at the signalized intersection of Rainbow Boulevard and 47th Place. As a potential future path moves east along the easement, there are three options for connecting to State Line Road:

- 1) Connect directly from the utility easement to State Line Road.
- 2) Connect north to 47th Place.
- 3) Connect south to 47th Terrace.





## Connecting Directly to State Line Road

A direct connection between a new path on the existing utility easement and State Line Road would provide the most direct route for people traveling between Rainbow and State Line Road. However, sloping conditions pose a significant challenge to the realization of an accessible pathway and would require further design development and analysis for a direct linear connection. The steep slopes on the eastern portions of the easement area likely mean that the connection cannot reasonably accommodate cyclists. If stairs are required, it may also mean that an ADA accessible pathway is impossible. Retaining walls, switchbacks, and other site modifications are constrained by the space available in the easement area and overall cost.



## Connecting to 47th Place

As an alternative to connecting directly from the utility easement to State Line Road, a path could turn north and connect to 47th Place. This option presents friendlier grades, and there appears to be room for a path between existing parking areas. However, there is no sidewalk on the south side of 47th Place currently. Additional improvements to 47th Place would be necessary to provide a complete and fully connected path. This route is also slightly circuitous, requiring those who use it to travel south and then north again in order to travel east or west.



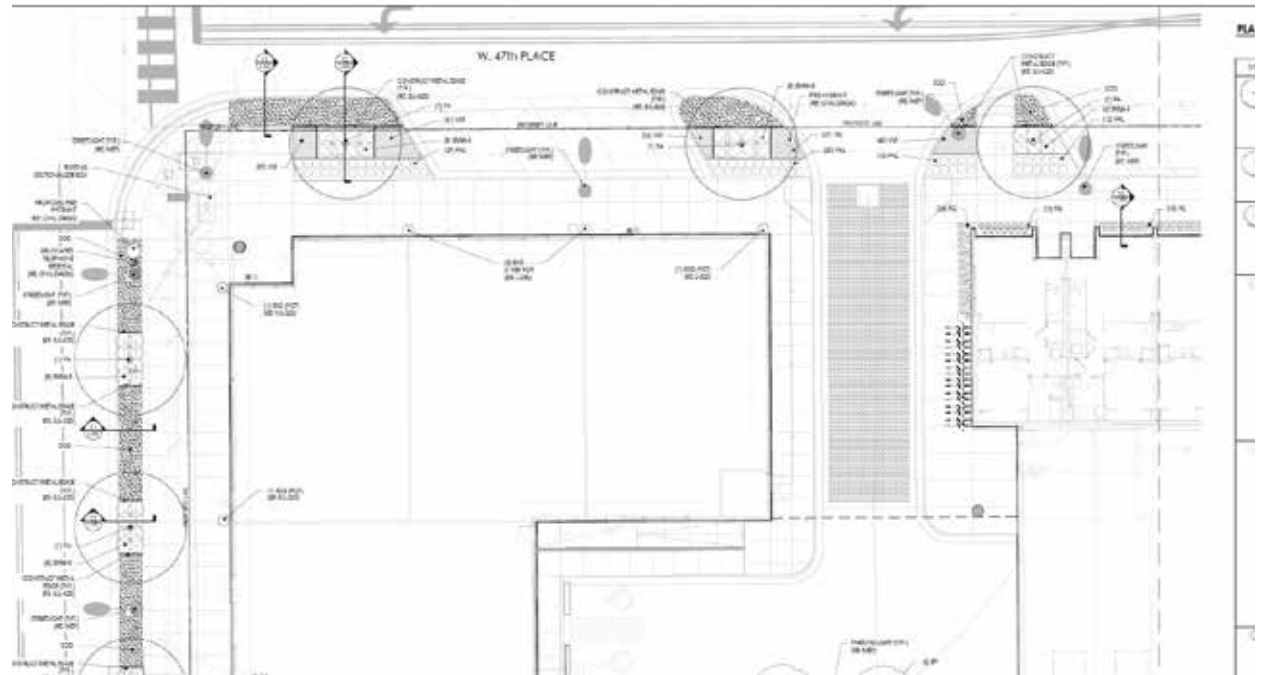
## Connecting to 47th Terrace

There is an existing pocket park and another small easement that connect the utility easement area with 47th Terrace. However, these potential connections present similar challenges to the 47th Place option. Because there is no sidewalk on 47th Terrace, additional improvements would be needed to establish the street as a viable east-west connector. Right of way is very limited on the street, and a new sidewalk may require modifications to the existing roadway and traffic operations. The grade is also very steep, making it unsuitable as a bicycle connection.

## 47th Place Connection

Because development plans already exist for the second phase of Woodside Village that include infrastructure improvements between Rainbow Boulevard and State Line Road, the project presents an opportunity to establish better bicycle and pedestrian connections in the area. The preliminary development plans submitted to the City of Westwood indicate there is the capacity to incorporate a continuous shared path along the south side of 47th Place that could be continued east to State Line Road.

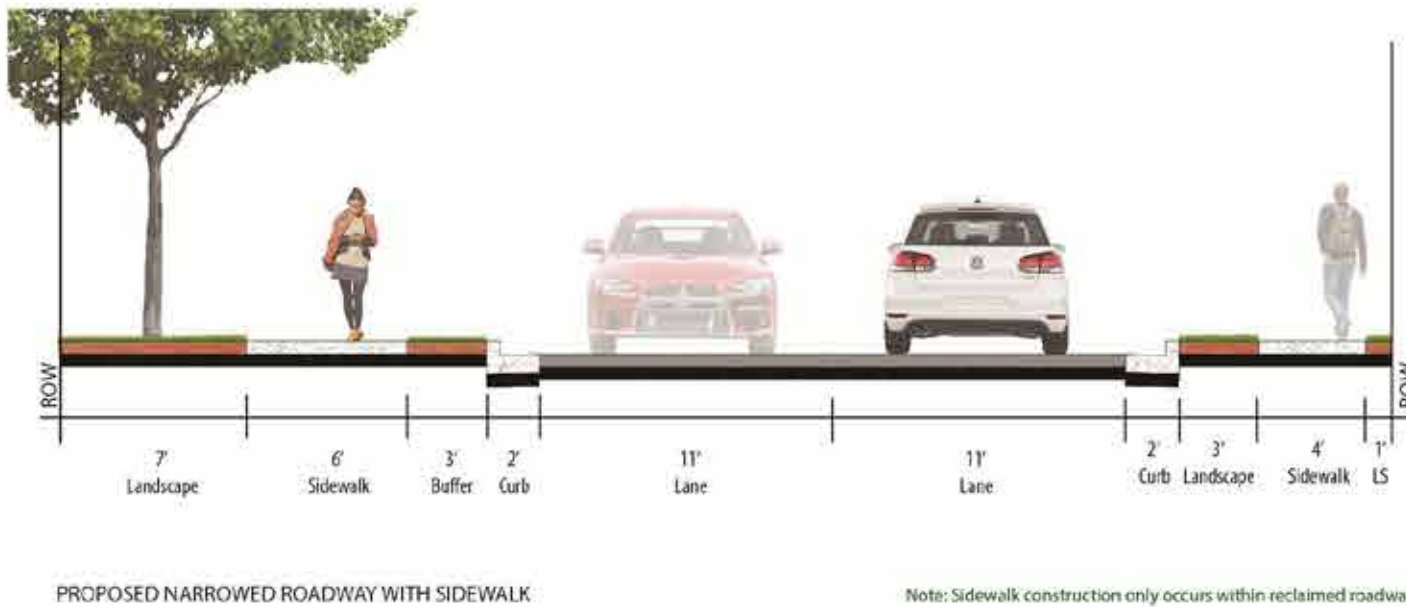
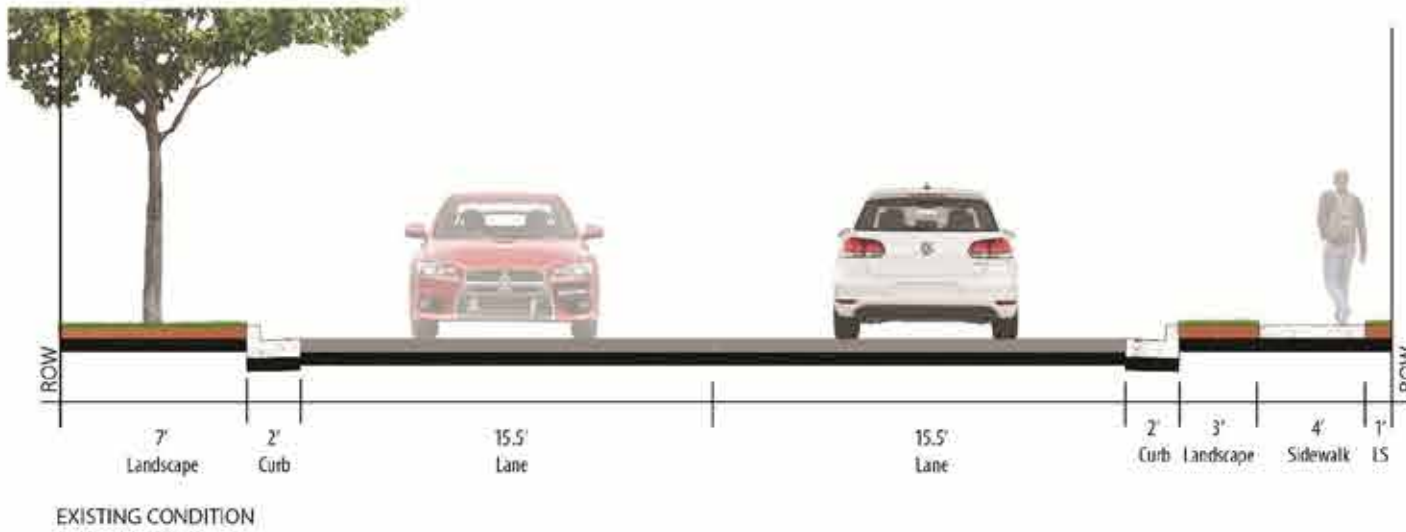
Plans for the next phase of the Woodside Village development would only account for a portion of the new infrastructure necessary to provide bicycle and pedestrian connections on 47th Place. East of the proposed development there is no sidewalk on the south side of the street today. The width of the current street, with travel lanes in excess of fifteen feet, suggests that a new path could be built on the south side of 47th Place without impacting any areas that are currently behind the curb of the road.



Preliminary streetscape plans at the southeast corner of Rainbow Boulevard and 47th Place



47th Place looking west from State Line Road. The existing street has room to incorporate a new sidewalk on the south side (left).



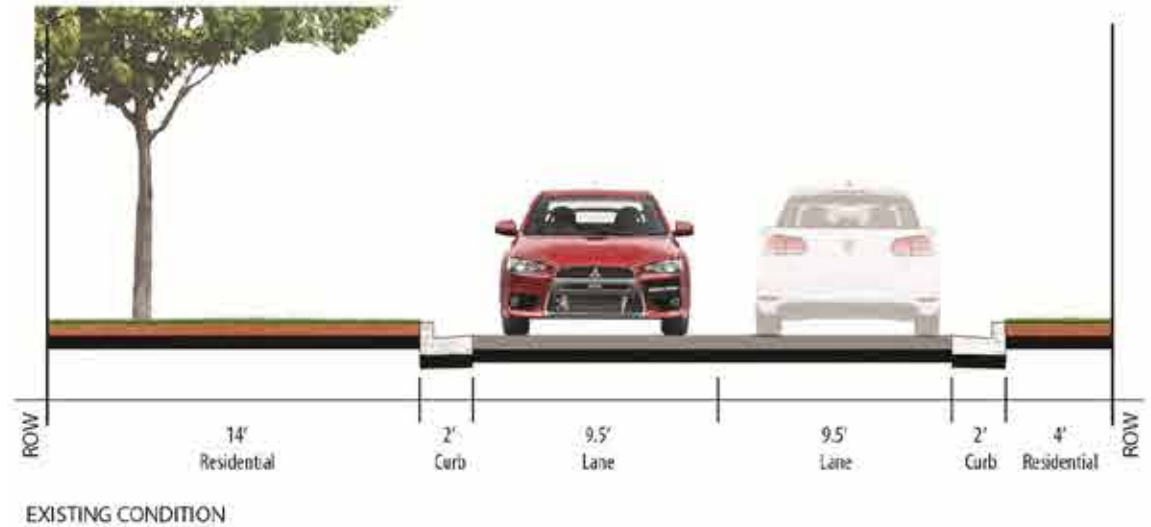
Note: Sidewalk construction only occurs within reclaimed roadway

## 46th Avenue Connection

46th Avenue has relatively calm traffic and relatively forgiving topography, which makes it a good candidate as an east-west bike connector between Rainbow Boulevard and State Line Road. There is not enough room on the narrow roadway to provide dedicated bicycle facilities, but they may not be necessary with the slow speeds and low volumes of traffic.

Pavement markings and signage could identify the route as a bike corridor, and simultaneously provide awareness for motorists and wayfinding for cyclists.

A bicycle connection on 46th Avenue would require improvements to Rainbow Boulevard to connect comfortably to 47th Street. It appears there is room on the east side of Rainbow between 47th Street and 46th Avenue to construct a shared path. Cyclists could cross Rainbow with a dedicated signal and not be required to travel with traffic in the roadway on Rainbow Boulevard.





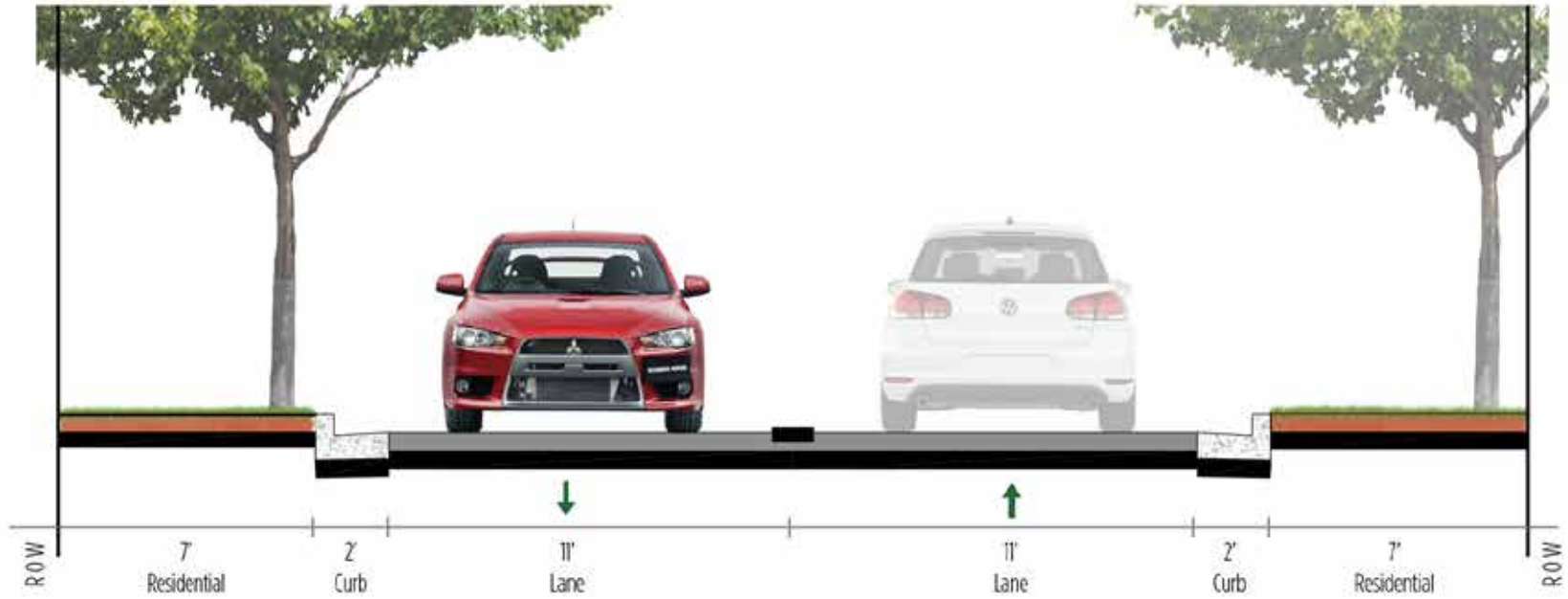


## 47th Terrace

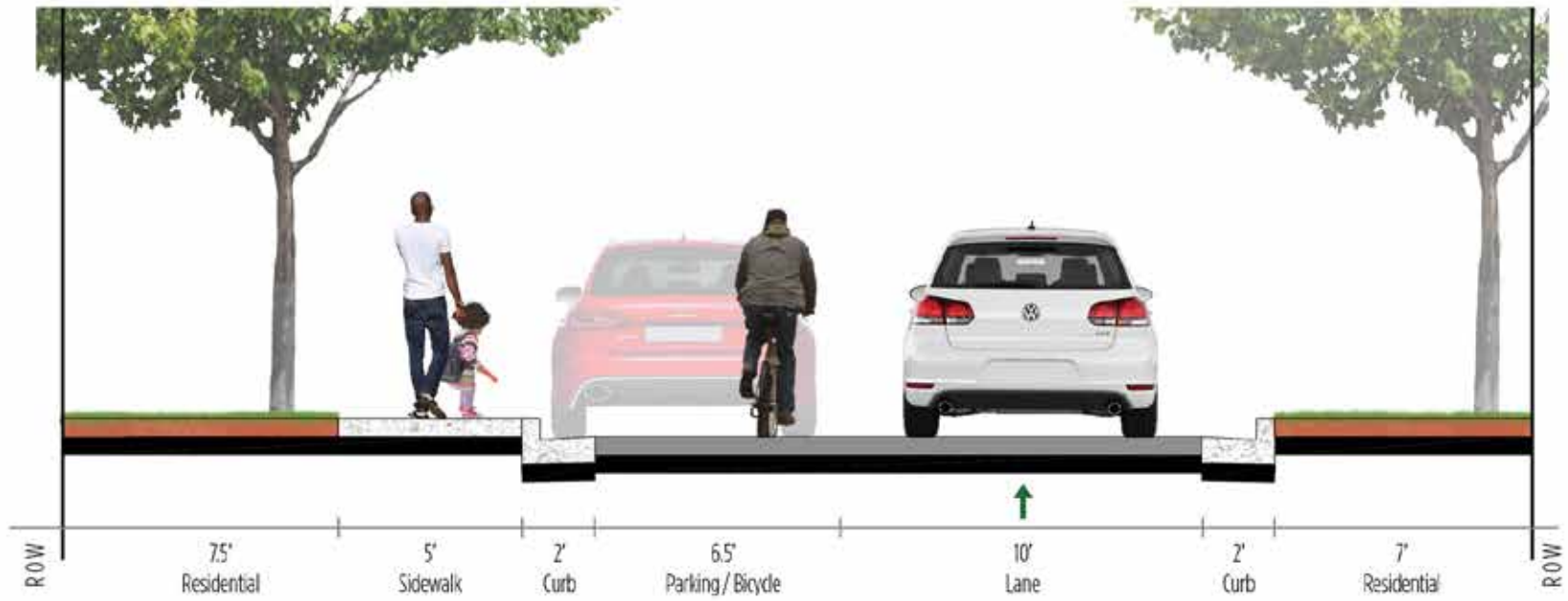
The project team explored 47th Terrace as a potential connection between Rainbow and State Line, but it presents a number of major challenges.

Near Rainbow Boulevard open parking areas cross the corridor without any driveways or management of access to adjacent properties. Further east, the roadway is relatively narrow. There is no existing sidewalk. In order to construct a sidewalk without disrupting existing residential properties, the road would need to be narrowed in way that requires it to operate as a one way street or yield street (see sections on next page). These configurations were not supported by the project advisory committee. Finally, the street is very steep, making it a poor candidate for bicycle connections of any kind. Alternative east-west connections appear to provide greater feasibility and flexibility for bicycle and pedestrian connections.





Existing Condition



One-way or Yield Streets with Sidewalk

\*Note: Sidewalk construction only occurs within reclaimed roadway



## **XIV. Recommendations**

# 47th Street

## Near Term

- **Complete a “road diet” on 47th Street, reconfiguring from a four-lane section to a three-lane section.**

A conversion of 47th Street from a street with two travel lanes in each direction to a street with one travel lane in each direction and a center turn lane is supportive of the recommendations of several previous plans and study for the area, including the Westwood Master Plan and Rosedale Master Plan. A road diet on 47th Street will provide additional space within the right of way to accommodate alternative modes of transportation, with improvements for pedestrians, cyclists, and transit users. A road diet functions as an efficient and cost-effective strategy to improve safety and comfort for all users on the corridor. Traffic analysis indicates that a 47th Street is an ideal road diet candidate based on the volume of automobile traffic, and that the existing level of service for automobiles in the corridor can be maintained.

- **Begin with a (mostly) striping project that works within existing curb lines.**

A restriping project that works within existing curb lines can be implemented much less expensively than a reconstruction project. Restriping projects also provide an opportunity to test design options, gather community feedback, and identify areas for improvement before making more permanent and expensive infrastructure changes in the corridor. An initial restriping project should include a reconfiguration from four to three lanes, as well as strategic improvements to street crossings in several locations, with enhanced signage and pedestrian refuge islands.

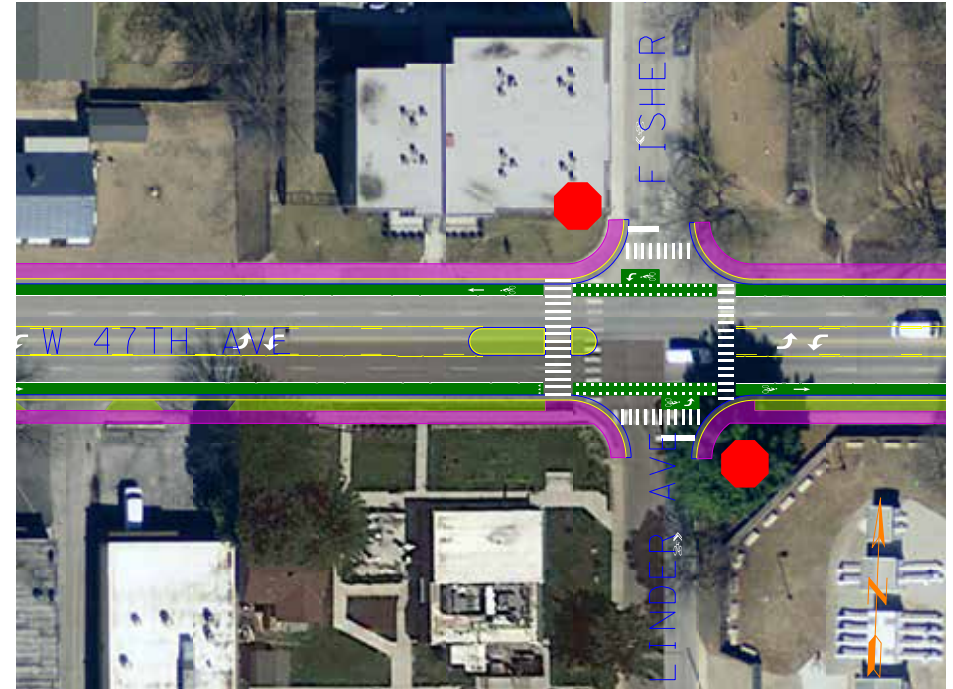
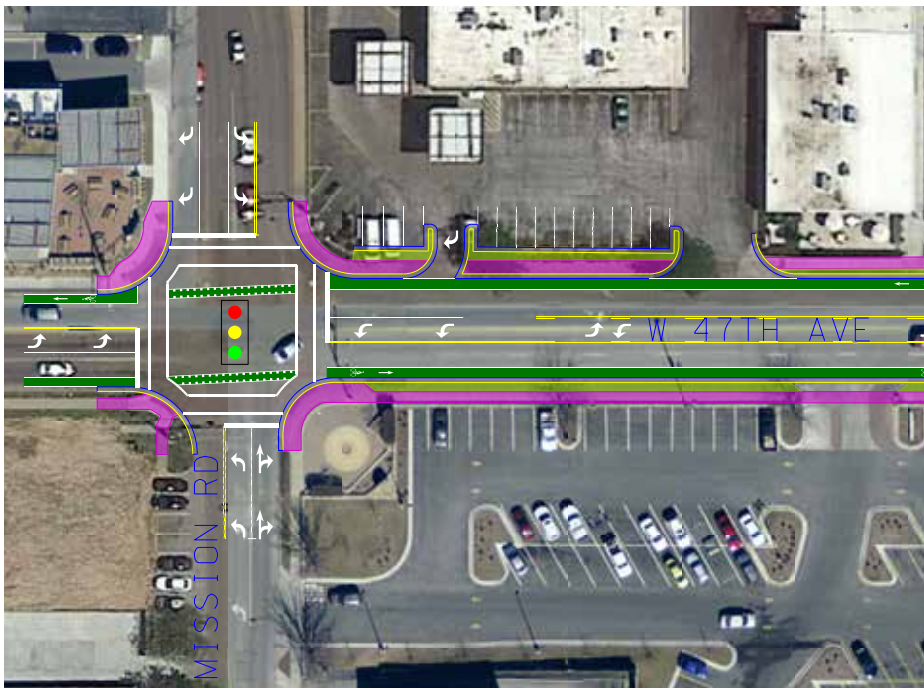


- **Reallocate new space within curb lanes to buffered bike lanes.**

Bike lanes were identified among the top priorities at both the public open house and online survey. The design scenarios for 47th Street that incorporated bike lanes were also preferred by a large margin. Based on these community priorities, and the potential to provide safe and comfortable options for cyclists that do not exist in the corridor today, it is recommended to reallocate new space within the curb lanes to buffered bike lanes. Buffered bike lanes also provide a benefit to pedestrians by move traffic further away from the existing sidewalk.

- Provide a dedicated space for cyclists, reduce the crossing distance for pedestrians, and improve the turn radius for trucks by maintaining bike lanes through the 47th Street / Mission intersection with no dedicated right turn lane from westbound 47th Street to northbound Mission Road.

Among design options for the intersection of 47th Street and Mission Road that are feasible to implement without changes to the existing curb line, community feedback at the public meeting and online survey indicated a preference for a design that maintains bike lanes through the intersection. In addition to providing a dedicated space for cyclists all the way through the busy intersection, this option has some additional benefits. It minimizes the crossing distance for pedestrians at a location that was identified by community members as particularly unsafe and uncomfortable. It also places turning trucks closer to the center of the street, which gives them more space to make tight turns.

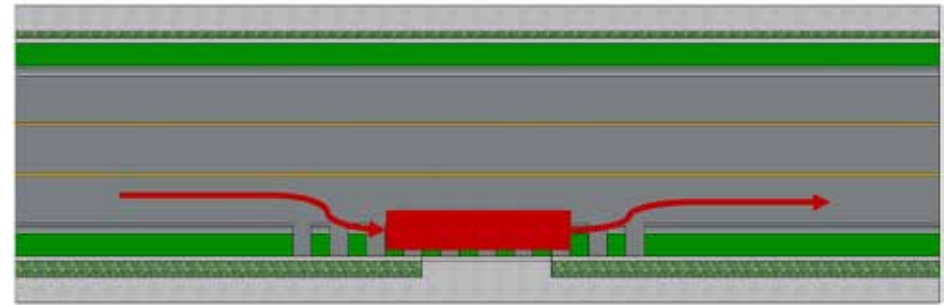


- Enhance the 47th Street / Belinder Road crossing with four-way continental striping, signage demonstrated to encourage driver compliance, turn queue boxes for bikes, and a pedestrian refuge on the west side.

A variety of improvements can be combined to make it safer and more comfortable to cross 47th Street at Belinder Road / Fisher Street. The reduction of automobile lanes from four to three reduces the overall crossing distance, prevents dangerous cut-around movements by motorists, and ensures pedestrians only need to cross one lane of traffic at a time. In addition, national research shows that crosswalk striping, enhanced crosswalks signage, and pedestrian refuge areas can provide a significant improvement in the percentage of motorists who yield to pedestrians. Community feedback indicated a preference for a pedestrian refuge on the west side of the intersection, maintaining a dedicated left turn lane on the east side of the intersection.

- **Add a mid-block crossing near Walmart with a pedestrian refuge island that maintains all turn movements, and move the existing bus stop east of the Walmart driveway.**

Because of the 1/2 mile distance between signalized crossings on 47th Street at Mission Road and at Rainbow Boulevard, and the 1/4 mile distance between the crossing at Mission Road and the unsignalized crossing at Belinder Road, pedestrians frequently cross mid-block in traffic today. A signed, painted mid-block crossing with a protected pedestrian refuge area can enhance the safety and connectivity for those crossing the street east of Mission Road. The location identified below maintains all turn movements, and provides adequate distance from the Mission Road intersection. A relocation of the bus stop on the south side of the street enhances safety for those crossing the street, and places the bus stop closer to existing benches, trash cans, overhead shelter, and other amenities for those waiting for the bus.



- **Incorporate shared bus/bike zones for existing bus stops.**

A shared bus/bike zone is recommended as an interim design solution for bus stops on 47th Street. This option works within existing curbs and does not require any new infrastructure. Because buses arrive only every thirty minutes today, potential conflicts with cyclists are minimal.



## Moving Forward

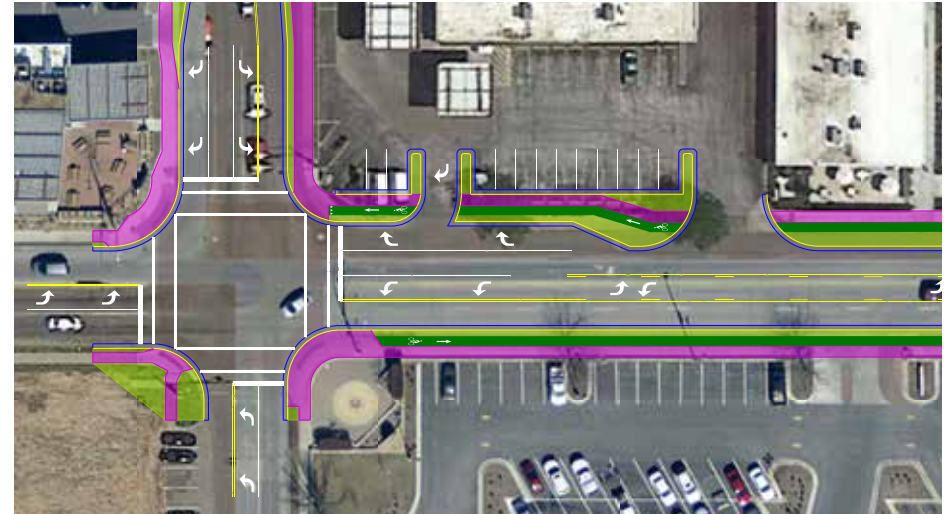
- **As resurfacing or sidewalk reconstruction occurs, or as grant opportunities permit, consider a raised cycle track option in the future.**

A raised cycle track on 47th Street provides a safe and comfortable space for cyclists of all ages and abilities, separated from the roadway and above the curb. It also allows for an expanded sidewalk zone and landscape amenities. While a raised cycle track would require reconstruction of the existing curbs, it may be feasible in coordination with an already planned sidewalk reconstruction, or through a variety of infrastructure grants that support enhancements to multimodal transportation. Matching grant costs can be further reduced for each jurisdiction through a joint partnership approach.



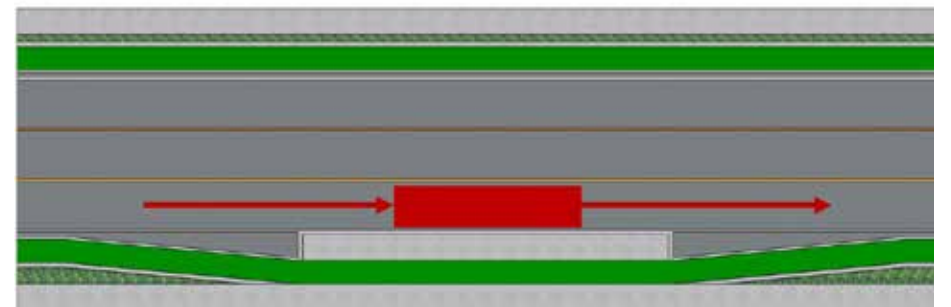
- **Continue to explore opportunities for bike lane + turn lane option at 47th and Mission in coordination with adjacent property owners as site configurations and property owner goals evolve over time.**

With the reconstruction of the existing curbs on 47th Street at the Mission Road intersection, it is possible to accommodate both a dedicated right turn lane and raised cycle track through the intersection. This intersection configuration was the most preferred option at both the public meeting and online survey. Because this option requires some additional right of way, it will require coordination with adjacent property owners.



- **In coordination with transit improvements, street resurfacing, or reconstruction of curbs or sidewalks, incorporate floating bus boarding islands to enhance transit efficiency and minimize conflicts between buses, bikes, and pedestrians.**

As part of larger infrastructure improvement or as a standalone transit improvement, a floating bus boarding island can reduce conflicts between buses and cyclists while increasing the efficiency of transit services. These improvements would be most useful in coordination with expanded transit service in the corridor.



# Belinder Road

## Near Term

- Incorporate signage and pavement markings to identify Belinder Road as a “neighborhood greenway,” celebrate neighborhood identity, and provide wayfinding for cyclists.

Bike signage and markings were among the highest priority items identified by the community at the public meeting and in the online survey. There are also relatively simple and inexpensive to implement. Signage and pavement markings can enhance the profile of Belinder Road as a gateway to local neighborhoods and important local connector. It can also assist with wayfinding for cyclists and awareness for motorists to drive calmly and cautiously.

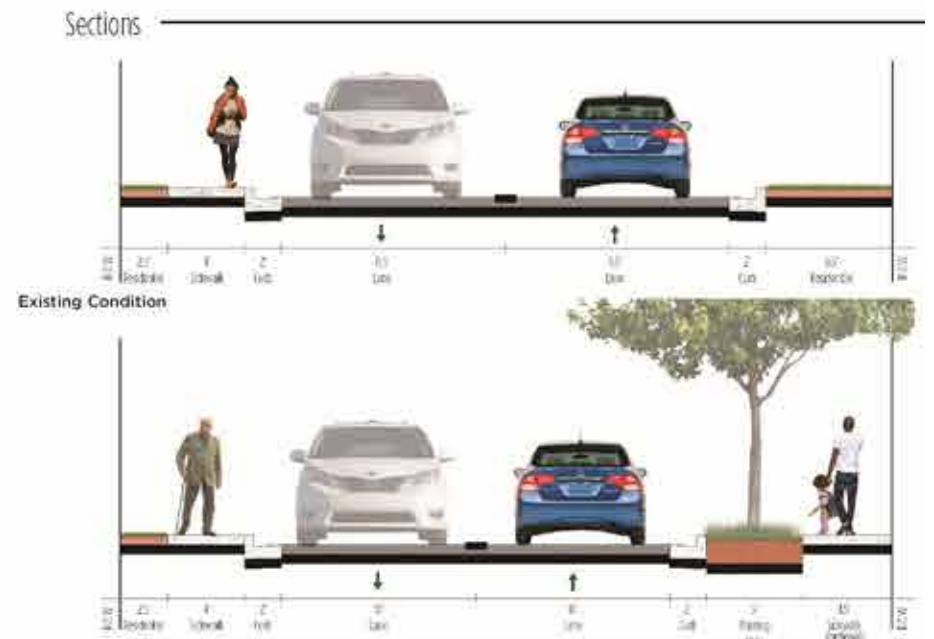
## Moving Forward

- Modify the east side of Belinder Road to narrow travel lanes, construct a sidewalk, and add additional trees and landscaping.

A variety of strategies to enhance safety and calm traffic on Belinder Road were explored as part of this project. A construction of a new sidewalk on the east side of the street in combination with a narrowing of the roadway was the scenario most preferred in the public meeting and online survey. These improvements have the benefit of improving pedestrian connectivity in addition to managing traffic speeds on the street.

- Incorporate site specific traffic calming strategies including pinch points, mini traffic circles, gateway medians, or other features in locations where traffic speeds remain high or crossing difficulties persist.

If after the narrowing of travel lanes there continue to be high traffic speeds or uncomfortable street crossings, additional targeted traffic calming measures may be desirable.



# Rainbow to State Line Connections

## Near Term

- **Work with the developers of the next phase of Woodside Village to provide a continuous, unobstructed ten-foot shared path along the south side of 47th Place. Explore options including narrowing of the existing roadway.**

Because development plans already exist for the second phase of Woodside Village that include infrastructure improvements between Rainbow Boulevard and State Line Road, the project presents an opportunity to establish better bicycle and pedestrian connections in the area. The preliminary development plans submitted to the City of Westwood indicate there is the capacity to incorporate a continuous shared path along the south side of 47th Place that could be continued east to State Line Road.

- **Work with the developers of the next phase of Woodside Village to provide a pedestrian path along the existing gas line easement immediately south of the development area.**

While steep grades likely prevent the use of the existing utility easement as a bike connection, it can provide an additional pedestrian connection between Rainbow Boulevard and State Line Road. Near the east end of the easement, stairs may be required, or a route that reconnects to 47th Place.

- **Incorporate signage and pavement markings for cyclists on 46th Avenue to provide wayfinding for cyclists and alert drivers that cyclists frequently use the connector.**

46th Avenue has more gradual topography than other nearby streets and is relatively low traffic. That makes it a good candidate for bicycle connections. Some additional signage or pavement markings formalize this route and raise awareness for cyclists and drivers.



## Moving Forward

- **Construct a new ten-foot shared path on the south side of 47th Place between Woodside Village and State Line Road. Explore options including narrowing of the existing roadway.**

There appears to be sufficient width on 47th Place to construct a sidewalk connection on the south side of the road entirely within the existing curb line. This would allow for a new sidewalk connection without any disruption to properties adjacent to the road. This connection would connect to planned improvements associated with the second phase of the Woodside Village development.

- **Extend a pedestrian path along the existing gas line easement between 47th Place and 47th Terrace, and between the next phase of Woodside Village and State Line Road.**

Options for a pedestrian connection along the gas line easement include a direct connection to State Line Road, and a connection from the gas line easement to 47th Place. A connection to 47th Terrace is not recommended because space constraints make it very challenging to continue a pedestrian path on 47th Terrace east to State Line Road. This connection would connect to planned improvements associated with the second phase of the Woodside Village development.





# 47th Street Complete Street Plan

## Appendix I: Traffic Analysis

WESTWOOD | ROELAND PARK | UNIFIED GOVERNMENT | MARC

FEBRUARY 2018

47TH STREET COMPLETE STREET PLAN  
Proposed Roadway, Roadside, & Parking Improvements  
W 47th Street between Mission Road and Rainbow Boulevard  
Westwood, Kansas 66205  
CFS Project No. 175164

*Traffic Analysis Memorandum*

August 17, 2017

Prepared for:

Mid-America Regional Council  
600 Broadway, Suite 200  
Kansas City, MO 64105

And

City of Westwood, Kansas  
4700 Rainbow Boulevard  
Westwood, KS 66205



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Prepared by:  
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1421 E. 104th Street, Suite 100 | Kansas City, Missouri 66207  
816.333.4477



# Introduction

This traffic analysis memorandum is for the 47th Street Complete Street Plan 2017. The Complete Street Plan will include new roadway and roadside design criteria, new pedestrian and bike facilities, and cost estimates of final concepts for 47th Street. Furthermore, the plan will address stakeholder needs and concerns, identify community priorities, and establish goals and a decision framework based on multiple steering committee meetings, online engagement, local walking and biking tours of the corridor, and a public meeting. The plan calls for a traffic evaluation and analysis of W 47th Street between Mission Road and Rainbow Boulevard, 47th Terrace between Rainbow Boulevard and State Line Road, and 48th Street between Rainbow Boulevard and State Line Road. A traffic analysis was needed to ensure the roadway alternatives maintained an appropriate capacity and level-of-service for passenger vehicles, trucks, pedestrians, bicyclists, and transit-users. The red dashed lines in the figure below show the streets analyzed in this traffic memorandum.



**Site Location Map, Westwood, Kansas**

This traffic study includes peak-hour turning movement counts collected at 47th Street & Mission Road, 47th Street & Belinder Avenue/Fisher Street, and 47th Street & Rainbow Boulevard to evaluate the operational efficiency of the intersections along the corridor. The counts include all conventional travel modes including passenger vehicles, trucks, pedestrians, bicyclists, and transit-users. The study also includes daily vehicle traffic counts of 47th Terrace between Rainbow Boulevard and State Line Road and 48th Street between Rainbow Boulevard and State Line Road.

Area Street and Highway Network: The existing streets for the analysis include:

- W 47th Street/County Line Road – Four-lane, undivided principal arterial.
  - Posted speed limit of 30 mph.
- Mission Road – Two-lane principal arterial.
  - Posted speed limit of 30 mph.
- Belinder Avenue/Fisher Street – Two-lane residential collector.
  - Posted speed limit of 25 mph.
- Rainbow Boulevard – Four-lane, undivided principal arterial.
  - Posted speed limit of 35 mph.
- 47th Terrace – Two-lane residential street.
  - Posted speed limit of 25 mph.
- 48th Street – Two-lane residential street.
  - Posted speed limit of 25 mph.
- State Line Road – Two-lane, undivided principal arterial.
  - Posted speed limit of 30 mph.

## 2017 Traffic Counts

Turning Movement Counts: Traffic counts representative of a typical weekday were taken at the intersections of 47th Street & Mission Road, 47th Street & Belinder Avenue/Fisher Street, and 47th Street & Rainbow Boulevard. Recording times included the AM peak hour, Midday peak hour, PM peak hour, and Saturday peak hour. Traffic volumes were recorded in 15 minute intervals on July 12th, July 15th, July 18th, July 19th, and July 22nd. Inclement weather conditions and national holiday traffic did not impact traffic counts. The following tables summarize the traffic volumes measured for a typical AM, Midday, PM, and Saturday PM peak hour.

Wed 7-12-2017	AM Peak Hour, 47th Street & Mission Road Turning Movement Counts											
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.94	149	281	32	18	101	78	14	179	39	89	110	92

Tues 7-18-2017	Midday Peak Hour, 47th Street & Mission Road Turning Movement Counts											
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.91	100	195	14	27	188	90	31	114	42	87	106	144

Wed 7-12-2017	PM Peak Hour, 47th Street & Mission Road Turning Movement Counts											
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.96	137	217	37	62	332	121	51	126	36	153	318	311

Sat 7-15-2017	Saturday Peak Hour, 47th Street & Mission Road Turning Movement Counts											
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.98	124	207	27	41	175	103	37	78	38	117	97	150

Wed 7-19-2017	AM Peak Hour, 47th Street & Belinder Avenue/Fisher Street Turning Movement Counts											
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.92	2	330	38	21	152	2	42	3	48	2	4	6

Wed 7-19-2017	Midday Peak Hour, 47th Street & Belinder Avenue/Fisher Street Turning Movement Counts											
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.94	5	228	33	31	229	4	39	4	45	1	5	4

Wed 7-19-2017	PM Peak Hour, 47th Street & Belinder Avenue/Fisher Street Turning Movement Counts											
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.93	15	366	64	49	412	5	52	2	54	1	7	12

Sat 7-22-2017	Saturday Peak Hour, 47th Street & Belinder Avenue/Fisher Street Turning Movement Counts											
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.97	11	289	40	23	261	5	47	6	20	1	3	9

Wed 7-12-2017	AM Peak Hour, 47th Street & Rainbow Boulevard Turning Movement Counts											
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.90	248	6	153	8	4	15	72	570	1	7	348	73

Tues 7-18-2017	Midday Peak Hour, 47th Street & Rainbow Boulevard Turning Movement Counts											
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.94	156	5	85	5	4	11	80	306	1	10	374	140

Wed 7-12-2017	PM Peak Hour, 47th Street & Rainbow Boulevard Turning Movement Counts											
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.95	195	3	148	5	7	5	141	333	4	7	817	307

Sat 7-15-2017	Saturday Peak Hour, 47th Street & Rainbow Boulevard Turning Movement Counts											
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.95	227	14	118	5	4	9	113	181	12	11	189	145

Average Annual Daily Traffic: Since only the peak hour traffic counts were taken at the intersections listed above, an estimate of the average daily traffic on the connecting roadway segments is given below. Using the highest two-way peak hour volume on each segment to represent 10%, the average daily traffic volumes are shown on the following figure.



**Average Annual Daily Traffic (AADT) for 47th Street (2017)**

Truck Counts: Trucks were counted at each of the three intersections studied during the AM hours from 7:00 until 9:00, during the PM hours from 4:00 until 6:00, during the weekday Midday hours from 11:00AM until 1:00PM, and during Saturday afternoons from 4:00PM until 6:00PM. The tables below show the number of trucks for the approaches at intersections along 47th Street for the 2 hours recorded periods.

Truck Counts - 47th Street & Mission Road					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/12/17)	7	6	0	4	18   0.8%
PM Hours (Wed, 07/12/17)	2	4	4	6	16   0.5%
Midday Hours (Tue, 07/18/17)	9	8	4	10	31   1.5%
Saturday Hours (Sat, 07/15/17)	1	3	2	1	7   0.3%

Truck Counts - 47th Street & Belinder Avenue/Fisher Street					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/19/17)	14	5	0	1	20   1.7%
PM Hours (Wed, 07/19/17)	2	4	1	0	7   0.4%
Midday Hours (Wed, 07/19/17)	6	4	0	1	11   0.8%
Saturday Hours (Sat, 07/22/17)	1	0	0	0	1   0.1%

Truck Counts - 47th Street & Rainbow Boulevard					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/12/17)	3	1	7	15	26   1.0%
PM Hours (Wed, 07/12/17)	5	0	7	8	20   0.6%
Midday Hours (Tue, 07/18/17)	7	1	14	26	48   1.9%
Saturday Hours (Sat, 07/15/17)	0	0	5	3	8   0.4%

Truck traffic was less than two percent of the traffic total measured during the two-hour count periods taken at the three intersections. The highest truck volumes were counted on northbound and southbound Rainbow Boulevard during the weekday midday period. Saturday counting period truck traffic dropped-off significantly compared to the weekday periods.

Pedestrian Counts: Pedestrian counts were taken at each of the three intersections studied during the AM hours from 7:00 until 9:00, during the PM hours from 4:00 until 6:00, during the weekday midday hours from 11:00AM until 1:00PM, and during Saturday afternoons from 4:00PM until 6:00PM. The counts were taken during mid-July, so cold or frigid weather was not a factor in keeping people indoors. The tables below show the pedestrian counts for the 2 hours recorded periods.

Pedestrian Counts - 47th Street & Mission Road					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/12/17)	1	1	4	1	7
PM Hours (Wed, 07/12/17)	7	3	3	1	14
Midday Hours (Tue, 07/18/17)	1	9	6	9	25
Saturday Hours (Sat, 07/15/17)	17	7	12	5	41

47th & Mission is a fully-actuated, signalized intersection with two pedestrian signal heads at each corner for crossing on either side of the streets. The pedestrian push-buttons are mounted to the main traffic signal poles on each corner of the intersection. There are sidewalks along both sides of the intersecting streets on all approaches, and there are depressed ramps on all corners for ADA access.

Pedestrian Counts - 47th Street & Belinder Avenue/Fisher Street					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/19/17)	3	2	3	5	13
PM Hours (Wed, 07/19/17)	6	1	6	6	19
Midday Hours (Wed, 07/19/17)	3	0	9	6	18
Saturday Hours (Sat, 07/22/17)	4	0	5	3	12

47th & Belinder Avenue/Fisher Street is two-way stop-controlled intersection with free access for 47th Street and stop signs on Fisher Street to the north and Belinder Avenue to the south. There is sidewalk along both sides of 47th Street on both approaches. The northbound approach has sidewalk on the western side only. There is sidewalk on the western side only of the southbound approach ending approximately 130 ft to the north of the intersection. All four corners of the intersection have depressed sidewalk ramps with the ramps only on the south side of 47th Street having detectable truncated domes cast into the approaches.

Pedestrian Counts - 47th Street & Rainbow Boulevard					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/12/17)	3	10	2	2	17
PM Hours (Wed, 07/12/17)	2	9	0	1	12
Midday Hours (Tue, 07/18/17)	3	5	0	2	10
Saturday Hours (Sat, 07/15/17)	0	16	5	2	23

The intersection of 47th & Rainbow is fully signalized with two pedestrian signal heads at each corner for crossing on either side of the streets. The western approach leg is a private drive to the recently constructed apartment building on the southeastern corner. There are short auxiliary poles for the pedestrian crossing activation buttons. There is sidewalk along both sides of each approach except for the westbound private drive which has sidewalk only on the south side. Each corner of the intersection has depressed sidewalk ramps to facilitate pedestrian crossings.

Bicycles on the Road Counts: Bicyclists riding on the roadway counts were taken at each of the three intersections studied during the AM hours from 7:00 until 9:00, during the PM hours from 4:00 until 6:00, during the weekday midday hours from 11:00AM until 1:00PM, and during Saturday afternoons from 4:00PM until 6:00PM. The counts were taken during mid-July, so cold

or frigid weather was not a factor in keeping bicycles off of the roads. The tables below show the bicycles on the roadway counts for the 2 hours recorded periods.

Bicycles on the Road Counts - 47th Street & Mission Road					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/12/17)	1	0	0	1	2
PM Hours (Wed, 07/12/17)	0	0	0	0	0
Midday Hours (Tue, 07/18/17)	0	0	0	0	0
Saturday Hours (Sat, 07/15/17)	0	2	0	1	3

Bicycles on the Road Counts - 47th Street & Belinder Avenue/Fisher Street					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/19/17)	1	2	4	1	8
PM Hours (Wed, 07/19/17)	2	1	0	5	8
Midday Hours (Wed, 07/19/17)	1	0	2	1	4
Saturday Hours (Sat, 07/22/17)	1	1	2	1	5

Bicycles on the Road Counts - 47th Street & Rainbow Boulevard					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/12/17)	0	0	0	0	0
PM Hours (Wed, 07/12/17)	0	0	3	0	3
Midday Hours (Tue, 07/18/17)	0	0	0	0	0
Saturday Hours (Sat, 07/15/17)	1	1	0	1	3

With the heavy volume of vehicular traffic and the absence of bike lanes or wide street lane widths, bicycle traffic was low. Both 47th Street and Rainbow Boulevard are undivided four-lane streets with no bicycle lanes, and there appears to be minimal right-of-way to expand either street for adding bicycle lanes without a road diet. A road diet converts a four-lane street to a three-lane street with the center lane acting as a two-way left-turn lane. Mission Road, Fisher Street to the north, and Belinder Avenue to the south are all two-lane streets with minimal right-of-way for adding bicycle lanes.



Bicycles on the Sidewalk Counts: The two-hour count periods taken at the intersection of 47th & Mission showed only one bicycle on the crosswalk during the weekday midday counts and five bicycles during the Saturday counts. 47th & Belinder Avenue/Fisher Street showed only one bicycle during the AM, Midday and PM peak hours on the sidewalk and zero bicycles during the Saturday counts. 47th & Rainbow Boulevard showed only one bicycle during the AM and Midday counting periods and zero bicycles during the PM and Saturday counting periods.

Bus Counts: Buses were counted at each of the three intersections studied during the AM hours from 7:00 until 9:00, during the PM hours from 4:00 until 6:00, during the weekday midday hours from 11:00AM until 1:00PM, and during Saturday afternoons from 4:00PM until 6:00PM. The tables below show the number of buses for the approaches at intersections along 47th Street for the 2 hours recorded periods.

Bus Counts - 47th Street & Mission Road					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/12/17)	7	3	1	7	18
PM Hours (Wed, 07/12/17)	5	4	0	4	13
Midday Hours (Tue, 07/18/17)	1	0	0	4	5
Saturday Hours (Sat, 07/15/17)	0	0	0	4	4

Bus Counts - 47th Street & Belinder Avenue/Fisher Street					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/19/17)	4	3	4	0	11
PM Hours (Wed, 07/19/17)	3	4	7	0	14
Midday Hours (Wed, 07/19/17)	3	2	4	0	9
Saturday Hours (Sat, 07/22/17)	1	0	0	0	1

Bus Counts - 47th Street & Rainbow Boulevard					
Time of Counts	EB	WB	NB	SB	Total
AM Hours (Wed, 07/12/17)	9	0	8	12	29
PM Hours (Wed, 07/12/17)	10	0	8	16	34
Midday Hours (Tue, 07/18/17)	6	0	9	12	27
Saturday Hours (Sat, 07/15/17)	2	0	0	0	2

There was a significant amount of bus traffic during the AM and PM counting periods. Bus traffic during the midday hours was relatively high at 47th & Rainbow but was lower at 47th & Mission and 47th & Fisher Street/Belinder Avenue. Saturday bus service at all of the counted intersections was very light.

Daily Traffic Counts: Daily traffic counts were recorded for 47th Terrace between Rainbow Boulevard and State Line Road and 48th Street between Rainbow Boulevard and State Line Road on Wednesday, July 12th and Thursday, July 13th. Counts were performed at both the east and west connections of 47th Terrace and 48th Street but not on Rainbow Boulevard or State Line Road. The daily counts were averaged and are shown in the figure below as the average daily traffic (ADT) in vehicles per day (vpd).



**Daily Traffic for 47th Terrace and 48th Street (2017)**

47th Terrace has an average of 369 entering trips per day, 507 exiting trips per day, and 876 total trips per day. For the 46 dwelling units, the average number of total trips is 438 vehicles per day according to the Institute of Transportation Engineer's Trip Generation Guidelines, 9<sup>th</sup> Edition. This means that 50% of traffic on 47th Terrace are local residents while 50% of traffic is passing through. The daily traffic volumes are not unusual for a developed neighborhood.

48th Street has an average of 422 entering trips per day, 491 exiting trips per day, and 913 total trips per day. For the 42 dwelling units, the average number of total trips is 400 vehicles per day according to the Institute of Transportation Engineer's Trip Generation Guidelines, 9<sup>th</sup> Edition.

This means that 44% of traffic on 48th Street are local residents while 56% of traffic is passing through. The daily traffic volumes are not unusual for a developed neighborhood.

## Capacity Analysis

Creating Synchro Scenarios: Using the traffic counts, 8 Synchro models were created for the traffic conditions surrounding the site.

- Scenario 1 - Existing street/pre-development conditions  
(AM Peak Traffic 2017)
- Scenario 2 - Existing street/pre-development conditions  
(Midday Peak Traffic 2017)
- Scenario 3 - Existing street/pre-development conditions  
(PM Peak Traffic 2017)
- Scenario 4 - Existing street/pre-development conditions  
(Saturday Peak Traffic 2017)
- Scenario 5 - Road Diet alternative design  
(AM Peak Traffic 2017)
- Scenario 6 - Road Diet alternative design  
(Midday Peak Traffic 2017)
- Scenario 7 - Road Diet alternative design  
(PM Peak Traffic 2017)
- Scenario 8 - Road Diet alternative design  
(Saturday Peak Traffic 2017)

Capacity and Level of Service Analysis: Three performance measures commonly used for a traffic impact analysis are vehicle delay, level-of-service (LOS), and queue length. Vehicle delay is the average delay, in seconds, experienced by one vehicle passing through the intersection. The quality of traffic operation at an intersection is defined through level-of-service (LOS) which consists of assignments of ‘A’ for free-flowing conditions through ‘F’ for congested conditions. The procedures and methodology for determining the LOS are outlined in the Highway Capacity Manual (HCM 2010), produced by the Transportation Research Board. LOS ‘A’ through ‘C’ is considered acceptable. 95th percentile queue length is the overall length of a line of stopped vehicles. Note that queue length is reported in the left\thru\right order. For stop control intersections, the queue length is measured in terms of accumulated number of vehicles which would be lined up waiting to proceed. The “-” symbol represents shared lane or non-existent movement, thus no queue length given. The results of the Synchro scenarios are in the tables below.

## Existing Synchro Results, July 2017

<b>Performance Measures</b>	<b>Existing AM Peak, Weekday</b>	<b>Existing Midday Peak, Weekday</b>	<b>Existing PM Peak, Weekday</b>	<b>Existing PM Peak, Saturday</b>
<b>W 47th St &amp; Mission Rd</b>				
Delay, s	13.6	12.6	15.2	13.1
LOS	B	B	B	B
NB Delay, s L/T/R	12.2 6.7/12.6/-	8.8 5.8/9.4/-	11.5 7.9/12.6/-	7.8 5.8/8.5/-
NB LOS L/T/R	B A/B/-	A A/A/-	B A/B/-	A A/A/-
NB Queue, ft	10/104/-	15/68/-	23/74/-	16/46/-
EB Delay, s L/T/R	19.6 -/19.6/-	18.8 -/18.8/-	19.5 -/19.5/-	19.7 -/19.7/-
EB LOS L/T/R	B -/B/-	B -/B/-	B -/B/-	B -/B/-
EB Queue, ft	-/108/-	-/77/-	-/97/-	-/82/-
SB Delay, s L/T/R	6.3 6.8/8.5/3.2	5.5 5.9/8.8/2.9	8.6 8.6/13.9/3.2	5.4 5.9/8.6/2.9
SB LOS L/T/R	A A/A/A	A A/A/A	A A/B/A	A A/A/A
SB Queue, ft	35/56/24	32/52/28	55/149/42	38/45/28
WB Delay, s L/T/R	11.7 -/16.5/4.4	16.5 -/21.3/5.2	23.6 -/29.6/4.3	17.0 -/22.7/5.2
WB LOS L/T/R	B -/B/A	B -/C/A	C -/C/A	B -/C/A
WB Queue, ft	-/65/21	-/117/26	-/244/29	-/111/27

## Existing Synchro Results, July 2017

<b>Performance Measures</b>	<b>Existing AM Peak, Weekday</b>	<b>Existing Midday Peak, Weekday</b>	<b>Existing PM Peak, Weekday</b>	<b>Existing PM Peak, Saturday</b>
<b>W 47th St &amp; Belinder Ave/Fisher St</b>				
Delay, s	2.3	2.6	2.9	2
LOS	A	A	A	A
NB Delay, s L/T/R	12.8 -/12.8/-	12.9 -/12.9/-	19.1 -/19.1/-	13.9 -/13.9/-
NB LOS L/T/R	B -/B/-	B -/B/-	C -/C/-	B -/B/-
NB Queue, veh	-/0.7/-	-/0.7/-	-/1.3/-	-/0.6/-
EB Delay, s L/T/R	0 7.5/0/-	0.1 7.7/0/-	0.4 8.3/0.1/-	0.3 7.8/0/-
EB LOS L/T/R	A A/A/-	A A/A/-	A A/A/-	A A/A/-
EB Queue, veh	0/-/-	0/-/-	0/-/-	0/-/-
SB Delay, s L/T/R	11.7 -/11.7/-	11.8 -/11.8/-	15.2 -/15.2/-	10.9 -/10.9/-
SB LOS L/T/R	B -/B/-	B -/B/-	C -/C/-	B -/B/-
SB Queue, veh	-/0.1/-	-/0.1/-	-/0.2/-	-/0.1/-
WB Delay, s L/T/R	1.1 8.1/0.1/-	1 8/0.1/-	1.1 8.4/0.2/-	0.7 8/0.1/-
WB LOS L/T/R	A A/A/-	A A/A/-	A A/A/-	A A/A/-
WB Queue, veh	0.1/-/-	0.1/-/-	0.1/-/-	0.1/-/-

## Existing Synchro Results, July 2017

<b>Performance Measures</b>	<b>Existing AM Peak, Weekday</b>	<b>Existing Midday Peak, Weekday</b>	<b>Existing PM Peak, Weekday</b>	<b>Existing PM Peak, Saturday</b>
<b>W 47th St &amp; Rainbow Blvd</b>				
Delay, s	13	8.4	8.8	11.4
LOS	B	A	A	B
NB Delay, s L/T/R	5.6 -/5.6/-	5.2 -/5.2/-	6.1 -/6.1/-	4.6 -/4.6/-
NB LOS L/T/R	A -/A/-	A -/A/-	A -/A/-	A -/A/-
NB Queue, ft	-/104/-	-/74/-	-/82/-	-/44/-
EB Delay, s L/T/R	33.6 49.9/8/-	21.5 30.0/8.5/-	20.0 29.3/8/-	25.3 34.9/8.8/-
EB LOS L/T/R	C D/A/-	C C/A/-	C C/A/-	C C/A/-
EB Queue, ft	118/42/-	89/38/-	90/39/-	102/40/-
SB Delay, s L/T/R	4.4 -/4.4/-	3.8 -/3.8/-	6.4 -/6.4/-	2.8 -/2.8/-
SB LOS L/T/R	A -/A/-	A -/A/-	A -/A/-	A -/A/-
SB Queue, ft	-/60/-	-/64/-	-/184/-	-/34/-
WB Delay, s L/T/R	12.5 14.4/11.7/-	11.9 13.5/11.8/-	14.6 14.0/14.9/-	13.4 14/13.2/-
WB LOS L/T/R	B B/B/-	B B/B/-	B B/B/-	B B/B/-
WB Queue, ft	9/16/-	4/17/-	6/13/-	6/13/-

Road Diet Synchro Results, July 2017

<b>Performance Measures</b>	<b>Existing AM Peak, Weekday</b>	<b>Existing Midday Peak, Weekday</b>	<b>Existing PM Peak, Weekday</b>	<b>Existing PM Peak, Saturday</b>
<b>W 47th St &amp; Mission Rd</b>				
Delay, s	14.5	15.5	19.0	14.7
LOS	B	B	B	B
NB Delay, s L/T/R	15.5 9.1/15.9/-	13.6 10.1/14.2/-	15.0 11.1/16.2/-	11.9 10.1/12.4/-
NB LOS L/T/R	B A/B/-	B B/B/-	B B/B/-	B B/B/-
NB Queue, ft	12/118/-	20/80/-	27/84/-	22/56/-
EB Delay, s L/T/R	17.2 14.6/18.4/-	15.7 13.3/16.8/-	19.2 21.8/17.8/-	15.7 13.7/16.8/-
EB LOS L/T/R	B B/B/-	B B/B/-	B C/B/-	B B/B/-
EB Queue, ft	67/172/-	49/118/-	70/132/-	55/120/-
SB Delay, s L/T/R	7.8 9.7/11.6/1.3	9.1 11.0/14.4/4.0	12.0 12.7/19.2/4.2	8.8 10.8/14.0/3.8
SB LOS L/T/R	A A/B/A	A B/B/A	B B/B/A	A B/B/A
SB Queue, ft	43/66/10	44/65/33	67/173/49	52/57/31
WB Delay, s L/T/R	17.0 11.1/17.6/-	23.8 10.8/25.0/-	31.1 11.2/33.8/-	21.7 11.2/23.3/-
WB LOS L/T/R	B B/B/-	C B/C/-	C B/C/-	C B/C/-
WB Queue, ft	14/84/-	18/155/-	32/299/-	23/139/-

Road Diet Synchro Results, July 2017

<b>Performance Measures</b>	<b>Existing AM Peak, Weekday</b>	<b>Existing Midday Peak, Weekday</b>	<b>Existing PM Peak, Weekday</b>	<b>Existing PM Peak, Saturday</b>
<b>W 47th St &amp; Belinder Ave/Fisher St</b>				
Delay, s	2.5	2.8	3.4	2.2
LOS	A	A	A	A
NB Delay, s L/T/R	14.0 -14.0/-	14.2 -14.2/-	24.9 -24.9/-	15.5 -15.5/-
NB LOS L/T/R	B -B/-	B -B/-	C -C/-	C -C/-
NB Queue, veh	-0.7/-	-0.9/-	-1.8/-	-0.7/-
EB Delay, s L/T/R	0 0/0/-	0.1 7.7/0/-	0.3 8.3/0/-	0.3 7.8/0/-
EB LOS L/T/R	A A/A/-	A A/A/-	A A/A/-	A A/A/-
EB Queue, veh	0/0/-	0/0/-	0/0/-	0/0/-
SB Delay, s L/T/R	12.2 -12.2/-	12.3 -12.3/-	16.2 -16.2/-	11.5 -11.5/-
SB LOS L/T/R	B -B/-	B -B/-	C -C/-	B -B/-
SB Queue, veh	-0.1/-	-0.1/-	-0.2/-	-0.1/-
WB Delay, s L/T/R	1.0 8.1/0/-	0.9 8.0/0/-	0.9 8.4/0/-	0.6 8/0/-
WB LOS L/T/R	A A/A/-	A A/A/-	A A/A/-	A A/A/-
WB Queue, veh	0.1/0/-	0.1/0/-	0.1/0/-	0.1/0/-



Road Diet Synchro Results, July 2017

<b>Performance Measures</b>	<b>Existing AM Peak, Weekday</b>	<b>Existing Midday Peak, Weekday</b>	<b>Existing PM Peak, Weekday</b>	<b>Existing PM Peak, Saturday</b>
<b>W 47th St &amp; Rainbow Blvd</b>				
Delay, s	13.0	7.8	9.7	7.9
LOS	B	A	A	A
NB Delay, s L/T/R	5.6 -/5.6/-	5.6 -/5.6/-	5.8 -/5.8/-	6.8 -/6.8/-
NB LOS L/T/R	A -/A/-	A -/A/-	A -/A/-	A -/A/-
NB Queue, ft	-/104/-	-/76/-	-/82/-	-/54/-
EB Delay, s L/T/R	33.6 49.9/8.0/-	17.7 24.3/7.8/-	26.9 41.0/8.6/-	12.3 16.0/5.9/-
EB LOS L/T/R	C D/A/-	B C/A/-	C D/A/-	B B/A/-
EB Queue, ft	118/42/-	86/38/-	95/41/-	85/35/-
SB Delay, s L/T/R	4.4 -/4.4/-	4.1 -/4.1/-	6.0 -/6.0/-	4.2 -/4.2/-
SB LOS L/T/R	A -/A/-	A -/A/-	A -/A/-	A -/A/-
SB Queue, ft	-/60/-	-/66/-	-/183/-	-/41/-
WB Delay, s L/T/R	12.5 14.4/11.7/-	12.0 13.5/11.9/-	14.8 14.8/14.8/-	13.0 12.6/13.2/-
WB LOS L/T/R	B B/B/-	B B/B/-	B B/B/-	B B/B/-
WB Queue, ft	9/16/-	4/17/-	7/13/-	5/13/-

Existing Conditions: The following is an analysis of existing conditions.

47th Street & Mission Road (Fully-Actuated Signal): The intersection operated at LOS B for each of the recorded peak hours. During the weekday PM peak hour, the westbound approach operated at LOS C with a delay of 23.6 seconds per vehicle but all other approaches for all other peak hours was LOS A or B. The longest queue was for the PM peak hour westbound thru movement with a 244 ft length. At the intersection, one of the westbound thru lanes on 47th Street transitions into a right-turn only lane. The approaches all have adequate distance within existing left turn lanes and queue spillback into the thru lane is not expected. Since the intersection has detectors on all approaches, the traffic operations flow smoothly without unacceptable delay times.

47th Street & Belinder Avenue/Fisher Street (Two-way Stop Controlled): The intersection operated at LOS A for each of the recorded peak hours. The eastbound and westbound approaches were the free movement and the northbound and southbound approaches were stop controlled. For the weekday PM peak hour, the northbound and southbound approaches had a LOS C but the delay per vehicle was less than 20 seconds which is considered acceptable. All other peak hours had movements that were LOS A or LOS B. The northbound queue was longest in the PM with a length of 1.3 vehicles at the 95th percentile level, and the southbound queue was longest in the PM with a length of 0.2 vehicles at the 95th percentile level.

47th Street & Rainbow Boulevard (Fully-Actuated Signal): The intersection operated at LOS B for the AM peak hour and Saturday peak hour while the Midday peak hour and PM peak hour were LOS A. The northbound and southbound approaches on Rainbow Boulevard were LOS A for all peak hours. The westbound approach was LOS B with the highest delay in the PM peak hour at 14.6 seconds per vehicle. The eastbound approach was LOS C for all peak hours with the AM peak hour having a delay of 33.6 seconds per vehicle. The eastbound left-turn queue reached 118 ft in the AM peak hour which does not have a queue spillback since one of the eastbound thru lanes on 47th Street transitions into a left-turn only lane.

Road Diet Alternative Design: The following is an analysis of a road diet alternative design with the four-lane section of 47th Street revised to three lanes including a single eastbound, a single westbound and a center dual-direction left-turn lane.

47th Street & Mission Road (Fully-Actuated Signal): The intersection operated at LOS B for each of the recorded peak hours. During the weekday Midday, PM, and Saturday PM peak hour, the westbound approach operated at LOS C with a delay ranging from 21.7 to

31.1 seconds per vehicle but all other approaches for all other peak hours was LOS A or B. The longest queue was for the PM peak hour westbound thru movement with a 299 ft length. There were no significant changes in LOS for the intersection under the road diet alternative design compared to existing operations for any of the different traffic periods examined in this report.

47th Street & Belinder Avenue/Fisher Street (Two-way Stop Controlled): The intersection operated at LOS A for each of the recorded peak hours. For the weekday PM peak hour, the northbound and southbound approaches had a LOS C but the delay per vehicle was less than 25 seconds which is considered acceptable. For the Saturday PM peak hour, the northbound approach had a LOS C but the delay per vehicle was less than 16 seconds (threshold time to change from B to C is 15 seconds). All other peak hours had movements that were LOS A or LOS B. The northbound queue was longest in the PM with a length of 1.8 vehicles at the 95th percentile level, and the southbound queue was longest in the PM with a length of 0.2 vehicles at the 95th percentile level. There were no significant changes in LOS for the intersection under the road diet alternative design compared to existing operations for any of the different traffic periods examined in this report.

47th Street & Rainbow Boulevard (Fully-Actuated Signal): The intersection operated at LOS B for the AM peak hour while the Midday peak hour, PM peak hour, and Saturday PM peak hour were LOS A. The northbound and southbound approaches on Rainbow Boulevard were LOS A for all peak hours. The westbound approach was LOS B with the highest delay in the PM peak hour at 14.8 seconds per vehicle. The eastbound approach was LOS C for AM and PM weekday peak hours with the AM peak hour having a delay of 33.6 seconds per vehicle and the PM peak hour having a delay of 26.9 seconds per vehicle. The eastbound left-turn queue reached 118 ft in the AM peak hour which does not have a queue spillback since the eastbound left-turn lane has plenty of extra length due to the two-way left-turn lane along 47th Street. There were no significant changes in LOS for the intersection under the road diet alternative design compared to existing operations for any of the different traffic periods examined in this report.

# Needs for Pedestrians, Bicyclists, and Public Transit Users

Pedestrian Needs: Sidewalks that are adjacent to the back of the curb should be at least 6 ft wide while sidewalks with a grassy separation strip to the back of the curb should be 5 ft. Due to the commercial and mixed use land categories, 4 ft wide sidewalks with the occasional lateral extension are not recommended. Truncated domes are needed at each sidewalk ramp to be compliant with ADA standards. Truncated domes provide an underfoot texture to denote when a pedestrian who is blind or has impaired vision is entering the roadway. The NE and NW sidewalk ramps at 47th Street & Belinder Avenue/Fisher Street need to be made ADA compliant since the ramps are lacking truncated domes and sidewalk crossing of 47th Street end in curb rather than a ramp. The 47th Street sidewalk in front of Northwood Shopping center has recently been reconstructed and is a good example to match for other segments of 47th Street that are necessary to replace. Crosswalk pushbuttons are provided at every corner at 47th Street & Mission Road and 47th Street & Rainbow Boulevard. If 47th Street is road dieted to convert to a three-lane cross section, pedestrian bulb outs are recommended to reduce the distance to cross 47th Street.

Bicyclist Needs: North-south traffic on Belinder Avenue/Fisher Street currently has the highest bicycle traffic within the study area. Adding bicycle lanes would be possible for a 47th Street road diet conversion which would add to the multimodal connectivity of the district and would create a larger buffer between passenger vehicles and pedestrians on the sidewalk. On street bike lanes would need to be 4 ft wide. If 47th Street is converted to a three-lane cross section, combined pedestrian bulb outs/protected bike lanes at major intersections are recommended. Protected bike lanes at intersections provide a raised concrete buffer in between bikes and vehicles on the roadway, see figure below as an example.



**Protected Bike Lane Through an Intersection**

**Image from Salt Lake City website at <http://www.slcgov.com/200West>**

Public Transit User Needs: 47th Street is currently served by the Kansas City Area Transportation Authority. The bus route #107 called 7th Street-Parallel includes a circulation pattern connecting Mission Transit Center, Westwood City Hall, KU Medical Center, 47th & State Avenue, and downtown Kansas City, Kansas. The current bus stops on 47th Street are found in front of Walmart Neighborhood Market, at the southwest corner with Belinder Avenue, and at the southwest corner with Adams Street. The figure below shows the extents of Route 107. Additional transit service route needs beyond the current system has not been reviewed by this traffic analysis memorandum.



Route 107 with Service to 47th Street

## Geometric Improvements

Dual Left-Turn Check: The highest volume for left-turn movements is for the eastbound left-turn lane at 47th Street & Rainbow Boulevard at 248 vph in the AM peak hour. A single left-turn lane is adequate for the existing traffic and does not need to be updated to include a dual left-turn. Most left-turn lanes have a capacity per hour of around 300 vehicles and the AM peak hour had the most left-turns at 248 vehicles for the eastbound approach.

Road Diet Alternative: The road diet concept converts a four-lane street to a three-lane street with the center lane acting as a two-way left-turn lane. Road diets are normally deemed

appropriate for an AADT less than 15,000 vpd and 47th Street has an AADT of around 9,000 vpd. KDOT's access management policy (2013) states that two-way left-turn lanes are appropriate for between 5,000 to 12,000 vehicles per day for two-lane roadways with a speed limit of 45 mph or below. 47th Street is within the traffic range of having a two-way left-turn lane if converted to a road diet design. The width of the two-way left-turn lane should be the same width as the thru lanes.

At 47th Street & Mission Road, if 47th Street is converted to a road diet, a left-turn will be included for westbound traffic, but the existing right-turn lane is not needed according to KDOT's access management policy (2013). For the road diet, the eastbound combined thru lanes and turn lanes should be changed to a left-turn lane and a thru/right lane. For the road diet design, the eastbound and westbound left-turn signal heads at 47th Street & Mission Road should be changed to be protected-permitted to allow for more efficient traffic operations for left-turns.

At 47th Street & Belinder Avenue/Fisher Street, the road diet design should have a two-lane left-turn lane for the eastbound and westbound approaches but would not need to include right-turn lanes.

At 47th Street & Rainbow Boulevard, the road diet design would have a two-lane left-turn lane for eastbound traffic but would not need to include a right-turn lane.

## Summary and Recommendations

Summary: The existing traffic operations of 47th Street are all acceptable with LOS at or below LOS C. As an alternative to the existing roadway design, a road diet conversion from four-lanes to three-lanes is appropriate for 47th Street. There is no significant change in LOS for the intersection under the road diet alternative design compared to existing operations. Implementing a road diet would have the benefits of reduced conflict points for left-turning movements, a shorter distance for pedestrians and bicyclists to cross vehicle traffic, increased mobility for bicyclists, and more buffered space between vehicles and pedestrians on sidewalks.

Recommendation: The following recommendations are made for 47th Street and the surrounding area:

- 47th Street is an ideal candidate for utilization of a road diet design. If 47th Street is converted to a road diet, at 47th Street & Mission Road a westbound left-turn lane should be used, the westbound right-turn lane can be removed, and the eastbound combined thru lanes and turn lanes should be changed to a left-turn lane and a thru/right lane. For the road diet design, the eastbound and westbound left-turn signal heads at 47th Street &

Mission Road should be changed to be protected-permitted to allow for more efficient traffic operations for left-turns. If 47th Street is converted to a three-lane cross section, combined pedestrian bulb outs/protected bike lanes at major intersections are recommended to reduce the distance to cross 47th Street.

- Sidewalks that are adjacent to the back of the curb should be at least 6 ft wide while sidewalks with a grassy separation to the back of the curb should be 5 ft.
- Truncated domes are needed at each sidewalk ramp to be compliant with ADA standards.
- The NE and NW sidewalk ramps at 47th Street & Belinder Avenue/Fisher Street need to be made ADA compliant since the ramps are lacking in truncated domes and sidewalk crossing of 47th Street end in curb rather than a ramp.
- A protected bike intersection should be provided at 47th Street & Belinder Avenue/Fisher Street to facilitate the increased number of bike traffic headed north and south.
- Another consideration is to add audible pedestrian pushbuttons at major intersections to upgrade the current system to the recommended guidance for Accessible Pedestrian Signals (APS) for visually impaired persons.



# **Appendix of Traffic Count Data -**

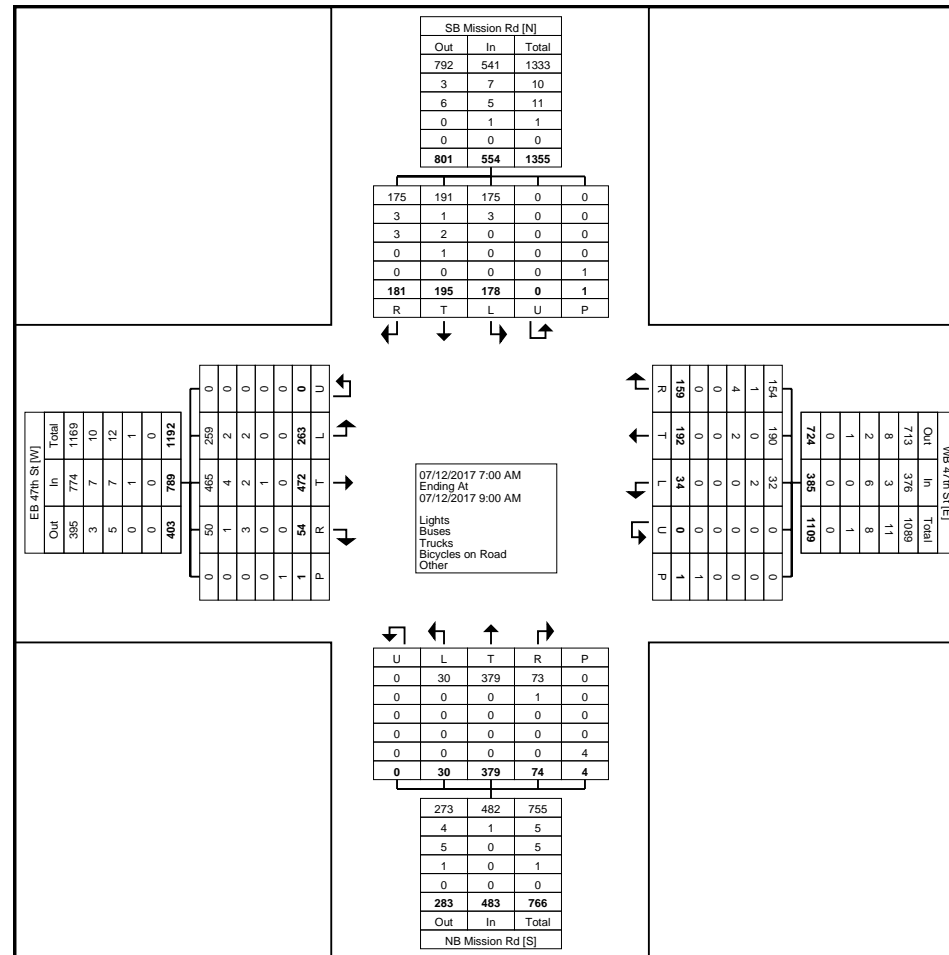


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 (816) 333-4477 arobertson@cfse.com

Count Name: 47th St & Mission  
 Site Code:  
 Start Date: 07/12/2017  
 Page No: 1

### Turning Movement Data

Start Time	SB Mission Rd Southbound						WB 47th St Westbound						NB Mission Rd Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
7:00 AM	18	21	28	0	0	67	16	19	2	0	1	37	5	38	5	0	1	48	6	40	16	0	0	62	214
7:15 AM	27	22	20	0	0	69	15	21	3	0	0	39	5	54	3	0	0	62	4	40	35	0	0	79	249
7:30 AM	21	30	18	0	0	69	21	19	6	0	0	46	4	46	4	0	1	54	5	74	43	0	0	122	291
7:45 AM	25	28	27	0	1	80	14	31	8	0	0	53	12	42	2	0	0	56	12	78	36	0	1	126	315
Hourly Total	91	101	93	0	1	285	66	90	19	0	1	175	26	180	14	0	2	220	27	232	130	0	1	389	1069
8:00 AM	24	25	27	0	0	76	20	29	1	0	0	50	13	41	3	0	1	57	7	73	34	0	0	114	297
8:15 AM	22	27	17	0	0	66	23	22	3	0	0	48	10	50	5	0	0	65	8	56	36	0	0	100	279
8:30 AM	27	21	18	0	0	66	27	29	3	0	0	59	11	62	5	0	0	78	6	55	22	0	0	83	286
8:45 AM	17	21	23	0	0	61	23	22	8	0	0	53	14	46	3	0	1	63	6	56	41	0	0	103	280
Hourly Total	90	94	85	0	0	269	93	102	15	0	0	210	48	199	16	0	2	263	27	240	133	0	0	400	1142
Grand Total	181	195	178	0	1	554	159	192	34	0	1	385	74	379	30	0	4	483	54	472	263	0	1	789	2211
Approach %	32.7	35.2	32.1	0.0	-	-	41.3	49.9	8.8	0.0	-	-	15.3	78.5	6.2	0.0	-	-	6.8	59.8	33.3	0.0	-	-	-
Total %	8.2	8.8	8.1	0.0	-	25.1	7.2	8.7	1.5	0.0	-	17.4	3.3	17.1	1.4	0.0	-	21.8	2.4	21.3	11.9	0.0	-	35.7	-
Lights	175	191	175	0	-	541	154	190	32	0	-	376	73	379	30	0	-	482	50	465	259	0	-	774	2173
% Lights	96.7	97.9	98.3	-	-	97.7	96.9	99.0	94.1	-	-	97.7	98.6	100.0	100.0	-	-	99.8	92.6	98.5	98.5	-	-	98.1	98.3
Buses	3	1	3	0	-	7	1	0	2	0	-	3	1	0	0	0	-	1	1	4	2	0	-	7	18
% Buses	1.7	0.5	1.7	-	-	1.3	0.6	0.0	5.9	-	-	0.8	1.4	0.0	0.0	-	-	0.2	1.9	0.8	0.8	-	-	0.9	0.8
Trucks	3	2	0	0	-	5	4	2	0	0	-	6	0	0	0	0	-	0	3	2	2	0	-	7	18
% Trucks	1.7	1.0	0.0	-	-	0.9	2.5	1.0	0.0	-	-	1.6	0.0	0.0	0.0	-	-	0.0	5.6	0.4	0.8	-	-	0.9	0.8
Bicycles on Road	0	1	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	2
% Bicycles on Road	0.0	0.5	0.0	-	-	0.2	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.2	0.0	-	-	0.1	0.1
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	4	-	-	-	-	-	1	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



Turning Movement Data Plot

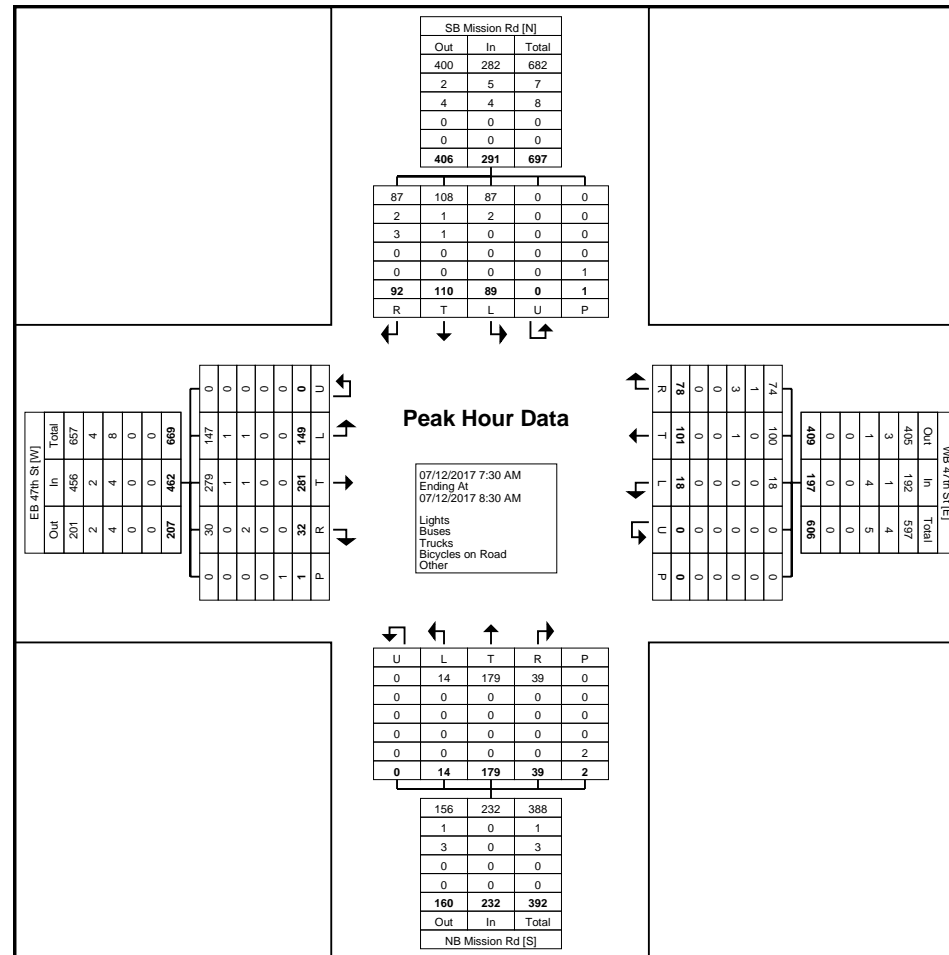


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Count Name: 47th St & Mission  
 Site Code:  
 Start Date: 07/12/2017  
 Page No: 3

### Turning Movement Peak Hour Data (7:30 AM)

Start Time	SB Mission Rd Southbound						WB 47th St Westbound						NB Mission Rd Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
7:30 AM	21	30	18	0	0	69	21	19	6	0	0	46	4	46	4	0	1	54	5	74	43	0	0	122	291
7:45 AM	25	28	27	0	1	80	14	31	8	0	0	53	12	42	2	0	0	56	12	78	36	0	1	126	315
8:00 AM	24	25	27	0	0	76	20	29	1	0	0	50	13	41	3	0	1	57	7	73	34	0	0	114	297
8:15 AM	22	27	17	0	0	66	23	22	3	0	0	48	10	50	5	0	0	65	8	56	36	0	0	100	279
Total	92	110	89	0	1	291	78	101	18	0	0	197	39	179	14	0	2	232	32	281	149	0	1	462	1182
Approach %	31.6	37.8	30.6	0.0	-	-	39.6	51.3	9.1	0.0	-	-	16.8	77.2	6.0	0.0	-	-	6.9	60.8	32.3	0.0	-	-	-
Total %	7.8	9.3	7.5	0.0	-	24.6	6.6	8.5	1.5	0.0	-	16.7	3.3	15.1	1.2	0.0	-	19.6	2.7	23.8	12.6	0.0	-	39.1	-
PHF	0.920	0.917	0.824	0.000	-	0.909	0.848	0.815	0.563	0.000	-	0.929	0.750	0.895	0.700	0.000	-	0.892	0.667	0.901	0.866	0.000	-	0.917	0.938
Lights	87	108	87	0	-	282	74	100	18	0	-	192	39	179	14	0	-	232	30	279	147	0	-	456	1162
% Lights	94.6	98.2	97.8	-	-	96.9	94.9	99.0	100.0	-	-	97.5	100.0	100.0	100.0	-	-	100.0	93.8	99.3	98.7	-	-	98.7	98.3
Buses	2	1	2	0	-	5	1	0	0	0	-	1	0	0	0	0	-	0	0	1	1	0	-	2	8
% Buses	2.2	0.9	2.2	-	-	1.7	1.3	0.0	0.0	-	-	0.5	0.0	0.0	0.0	-	-	0.0	0.0	0.4	0.7	-	-	0.4	0.7
Trucks	3	1	0	0	-	4	3	1	0	0	-	4	0	0	0	0	-	0	2	1	1	0	-	4	12
% Trucks	3.3	0.9	0.0	-	-	1.4	3.8	1.0	0.0	-	-	2.0	0.0	0.0	0.0	-	-	0.0	6.3	0.4	0.7	-	-	0.9	1.0
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	2	-	-	-	-	-	1	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



Turning Movement Peak Hour Data Plot (7:30 AM)

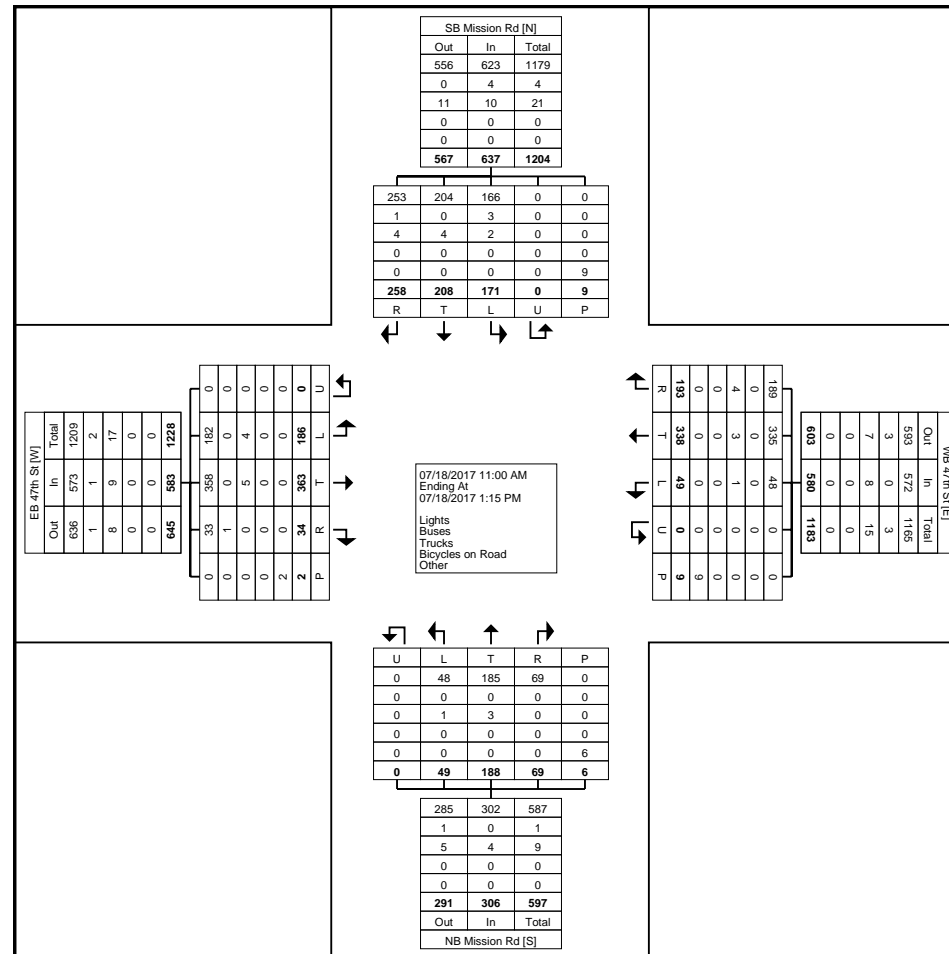


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Count Name: 47th St & Mission Rd  
 Site Code:  
 Start Date: 07/18/2017  
 Page No: 1

### Turning Movement Data

Start Time	SB Mission Rd Southbound						WB 47th St Westbound						NB Mission Rd Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
11:00 AM	19	24	20	0	0	63	21	38	7	0	0	66	6	10	2	0	0	18	2	38	25	0	0	65	212
11:15 AM	28	22	19	0	0	69	18	32	4	0	0	54	7	22	6	0	1	35	7	42	19	0	0	68	226
11:30 AM	35	21	21	0	4	77	32	38	6	0	2	76	9	23	5	0	1	37	5	34	28	0	0	67	257
11:45 AM	32	35	24	0	0	91	32	42	5	0	0	79	5	19	5	0	0	29	6	54	14	0	1	74	273
Hourly Total	114	102	84	0	4	300	103	150	22	0	2	275	27	74	18	0	2	119	20	168	86	0	1	274	968
12:00 PM	33	23	18	0	4	74	14	46	7	0	0	67	8	29	8	0	1	45	2	36	24	0	1	62	248
12:15 PM	40	38	20	0	0	98	27	54	7	0	3	88	10	31	7	0	2	48	4	53	17	0	0	74	308
12:30 PM	37	31	27	0	1	95	25	48	6	0	0	79	10	33	11	0	1	54	4	45	36	0	0	85	313
12:45 PM	34	14	22	0	0	70	24	40	7	0	4	71	14	21	5	0	0	40	4	61	23	0	0	88	269
Hourly Total	144	106	87	0	5	337	90	188	27	0	7	305	42	114	31	0	4	187	14	195	100	0	1	309	1138
1:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	258	208	171	0	9	637	193	338	49	0	9	580	69	188	49	0	6	306	34	363	186	0	2	583	2106
Approach %	40.5	32.7	26.8	0.0	-	-	33.3	58.3	8.4	0.0	-	-	22.5	61.4	16.0	0.0	-	-	5.8	62.3	31.9	0.0	-	-	-
Total %	12.3	9.9	8.1	0.0	-	30.2	9.2	16.0	2.3	0.0	-	27.5	3.3	8.9	2.3	0.0	-	14.5	1.6	17.2	8.8	0.0	-	27.7	-
Lights	253	204	166	0	-	623	189	335	48	0	-	572	69	185	48	0	-	302	33	358	182	0	-	573	2070
% Lights	98.1	98.1	97.1	-	-	97.8	97.9	99.1	98.0	-	-	98.6	100.0	98.4	98.0	-	-	98.7	97.1	98.6	97.8	-	-	98.3	98.3
Buses	1	0	3	0	-	4	0	0	0	0	-	0	0	0	0	0	-	0	1	0	0	0	-	1	5
% Buses	0.4	0.0	1.8	-	-	0.6	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	2.9	0.0	0.0	-	-	0.2	0.2
Trucks	4	4	2	0	-	10	4	3	1	0	-	8	0	3	1	0	-	4	0	5	4	0	-	9	31
% Trucks	1.6	1.9	1.2	-	-	1.6	2.1	0.9	2.0	-	-	1.4	0.0	1.6	2.0	-	-	1.3	0.0	1.4	2.2	-	-	1.5	1.5
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	1	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	50.0	-	-
Pedestrians	-	-	-	-	9	-	-	-	-	-	9	-	-	-	-	-	6	-	-	-	-	-	1	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	50.0	-	-



Turning Movement Data Plot



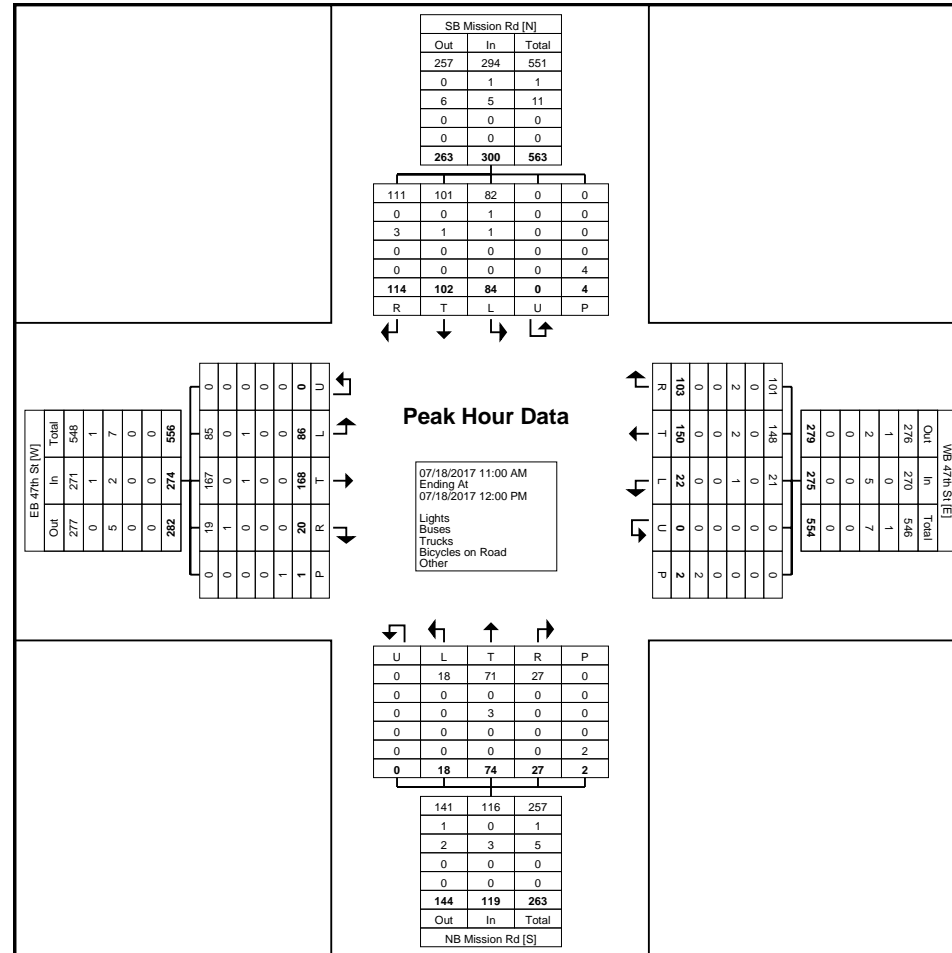
CFS Engineers - Missouri  
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 Kansas City, Missouri, United States 64114  
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Count Name: 47th St & Mission Rd  
 Site Code:  
 Start Date: 07/18/2017  
 Page No: 3

### Turning Movement Peak Hour Data (11:00 AM)

Start Time	SB Mission Rd Southbound						WB 47th St Westbound						NB Mission Rd Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
11:00 AM	19	24	20	0	0	63	21	38	7	0	0	66	6	10	2	0	0	18	2	38	25	0	0	65	212
11:15 AM	28	22	19	0	0	69	18	32	4	0	0	54	7	22	6	0	1	35	7	42	19	0	0	68	226
11:30 AM	35	21	21	0	4	77	32	38	6	0	2	76	9	23	5	0	1	37	5	34	28	0	0	67	257
11:45 AM	32	35	24	0	0	91	32	42	5	0	0	79	5	19	5	0	0	29	6	54	14	0	1	74	273
<b>Total</b>	<b>114</b>	<b>102</b>	<b>84</b>	<b>0</b>	<b>4</b>	<b>300</b>	<b>103</b>	<b>150</b>	<b>22</b>	<b>0</b>	<b>2</b>	<b>275</b>	<b>27</b>	<b>74</b>	<b>18</b>	<b>0</b>	<b>2</b>	<b>119</b>	<b>20</b>	<b>168</b>	<b>86</b>	<b>0</b>	<b>1</b>	<b>274</b>	<b>968</b>
Approach %	38.0	34.0	28.0	0.0	-	-	37.5	54.5	8.0	0.0	-	-	22.7	62.2	15.1	0.0	-	-	7.3	61.3	31.4	0.0	-	-	-
Total %	11.8	10.5	8.7	0.0	-	31.0	10.6	15.5	2.3	0.0	-	28.4	2.8	7.6	1.9	0.0	-	12.3	2.1	17.4	8.9	0.0	-	28.3	-
PHF	0.814	0.729	0.875	0.000	-	0.824	0.805	0.893	0.786	0.000	-	0.870	0.750	0.804	0.750	0.000	-	0.804	0.714	0.778	0.768	0.000	-	0.926	0.886
Lights	111	101	82	0	-	294	101	148	21	0	-	270	27	71	18	0	-	116	19	167	85	0	-	271	951
% Lights	97.4	99.0	97.6	-	-	98.0	98.1	98.7	95.5	-	-	98.2	100.0	95.9	100.0	-	-	97.5	95.0	99.4	98.8	-	-	98.9	98.2
Buses	0	0	1	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	1	0	0	0	-	1	2
% Buses	0.0	0.0	1.2	-	-	0.3	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	5.0	0.0	0.0	-	-	0.4	0.2
Trucks	3	1	1	0	-	5	2	2	1	0	-	5	0	3	0	0	-	3	0	1	1	0	-	2	15
% Trucks	2.6	1.0	1.2	-	-	1.7	1.9	1.3	4.5	-	-	1.8	0.0	4.1	0.0	-	-	2.5	0.0	0.6	1.2	-	-	0.7	1.5
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	1	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	100.0	-	-
Pedestrians	-	-	-	-	4	-	-	-	-	-	2	-	-	-	-	-	2	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	0.0	-	-





Turning Movement Peak Hour Data Plot (11:00 AM)



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Count Name: 47th St & Mission Rd  
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 Start Date: 07/18/2017  
 Page No: 5

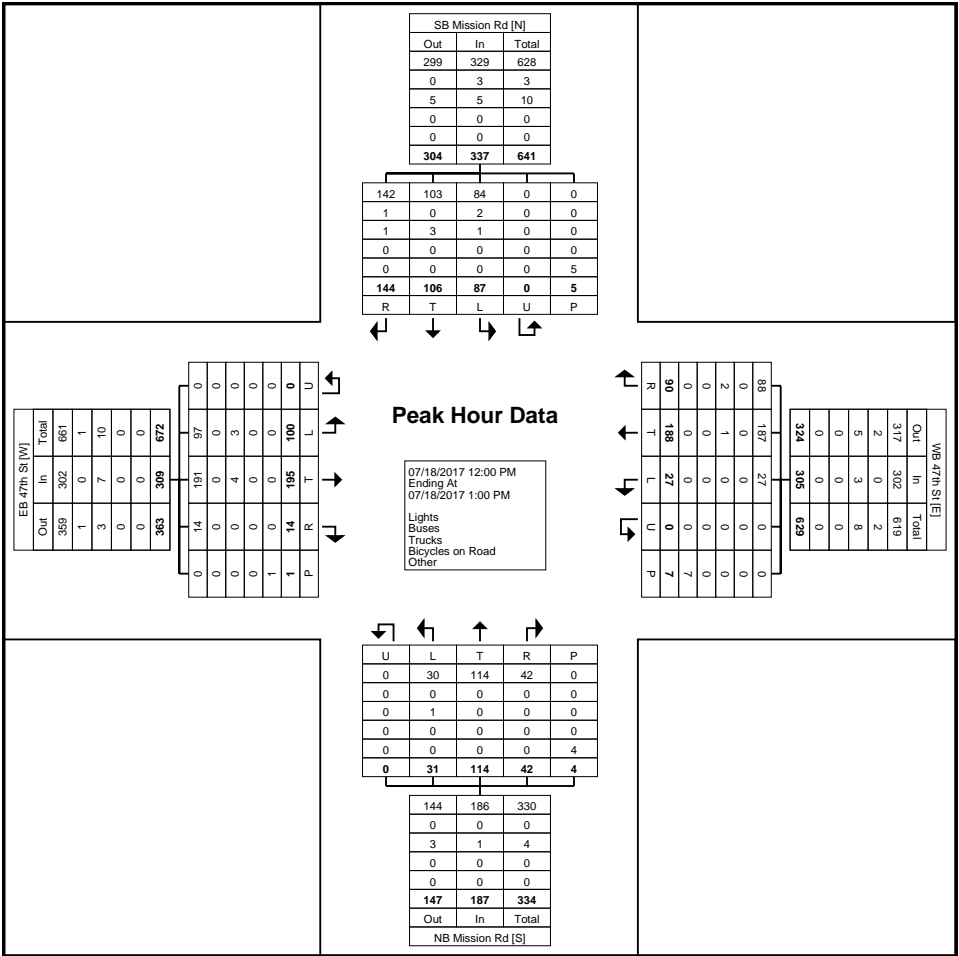
### Turning Movement Peak Hour Data (12:00 PM)

Start Time	SB Mission Rd Southbound						WB 47th St Westbound						NB Mission Rd Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
12:00 PM	33	23	18	0	4	74	14	46	7	0	0	67	8	29	8	0	1	45	2	36	24	0	1	62	248
12:15 PM	40	38	20	0	0	98	27	54	7	0	3	88	10	31	7	0	2	48	4	53	17	0	0	74	308
12:30 PM	37	31	27	0	1	95	25	48	6	0	0	79	10	33	11	0	1	54	4	45	36	0	0	85	313
12:45 PM	34	14	22	0	0	70	24	40	7	0	4	71	14	21	5	0	0	40	4	61	23	0	0	88	269
<b>Total</b>	<b>144</b>	<b>106</b>	<b>87</b>	<b>0</b>	<b>5</b>	<b>337</b>	<b>90</b>	<b>188</b>	<b>27</b>	<b>0</b>	<b>7</b>	<b>305</b>	<b>42</b>	<b>114</b>	<b>31</b>	<b>0</b>	<b>4</b>	<b>187</b>	<b>14</b>	<b>195</b>	<b>100</b>	<b>0</b>	<b>1</b>	<b>309</b>	<b>1138</b>
Approach %	42.7	31.5	25.8	0.0	-	-	29.5	61.6	8.9	0.0	-	-	22.5	61.0	16.6	0.0	-	-	4.5	63.1	32.4	0.0	-	-	-
Total %	12.7	9.3	7.6	0.0	-	29.6	7.9	16.5	2.4	0.0	-	26.8	3.7	10.0	2.7	0.0	-	16.4	1.2	17.1	8.8	0.0	-	27.2	-
PHF	0.900	0.697	0.806	0.000	-	0.860	0.833	0.870	0.964	0.000	-	0.866	0.750	0.864	0.705	0.000	-	0.866	0.875	0.799	0.694	0.000	-	0.878	0.909
Lights	142	103	84	0	-	329	88	187	27	0	-	302	42	114	30	0	-	186	14	191	97	0	-	302	1119
% Lights	98.6	97.2	96.6	-	-	97.6	97.8	99.5	100.0	-	-	99.0	100.0	100.0	96.8	-	-	99.5	100.0	97.9	97.0	-	-	97.7	98.3
Buses	1	0	2	0	-	3	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	3
% Buses	0.7	0.0	2.3	-	-	0.9	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.3
Trucks	1	3	1	0	-	5	2	1	0	0	-	3	0	0	1	0	-	1	0	4	3	0	-	7	16
% Trucks	0.7	2.8	1.1	-	-	1.5	2.2	0.5	0.0	-	-	1.0	0.0	0.0	3.2	-	-	0.5	0.0	2.1	3.0	-	-	2.3	1.4
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	5	-	-	-	-	-	7	-	-	-	-	-	4	-	-	-	-	-	1	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



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Count Name: 47th St & Mission Rd  
 Site Code:  
 Start Date: 07/18/2017  
 Page No: 6



Turning Movement Peak Hour Data Plot (12:00 PM)

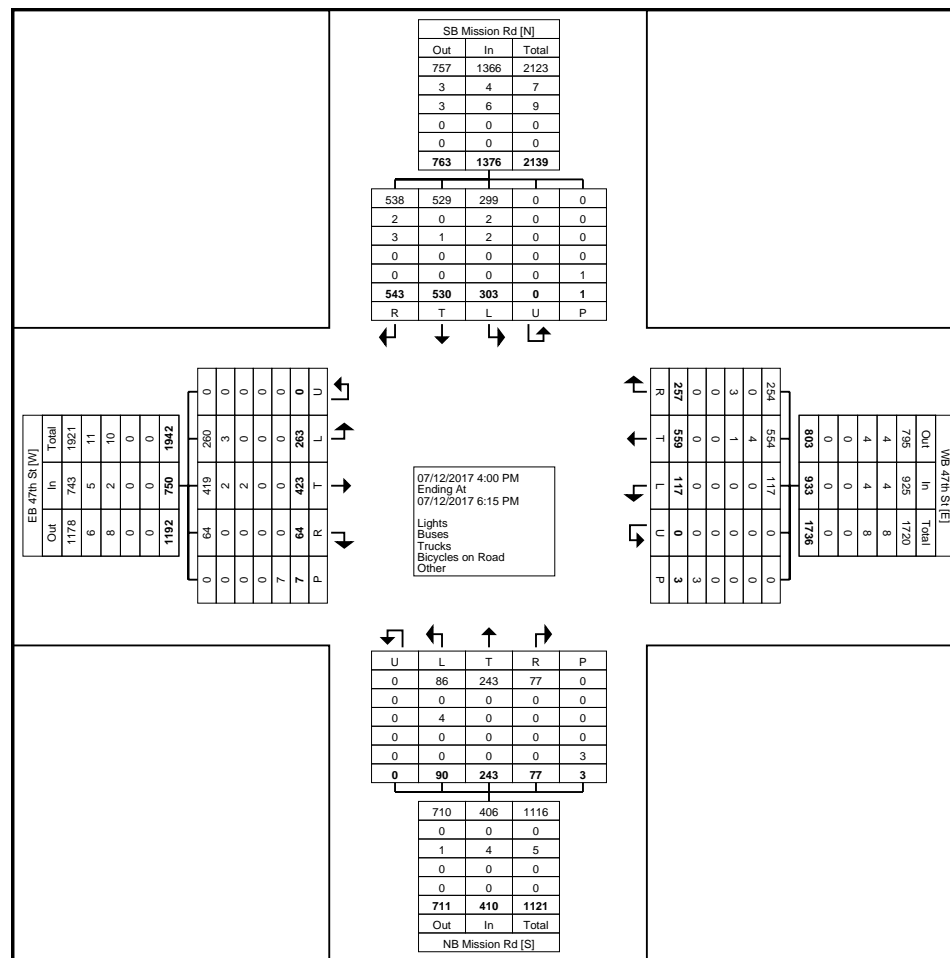


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Count Name: 47th St & Mission  
 Site Code:  
 Start Date: 07/12/2017  
 Page No: 1

### Turning Movement Data

Start Time	SB Mission Rd Southbound						WB 47th St Westbound						NB Mission Rd Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
4:00 PM	43	29	36	0	0	108	35	48	9	0	1	92	8	25	7	0	1	40	5	46	28	0	2	79	319
4:15 PM	61	54	33	0	0	148	47	57	14	0	0	118	11	25	11	0	0	47	5	55	36	0	0	96	409
4:30 PM	71	62	44	0	0	177	31	52	19	0	0	102	12	34	11	0	0	57	9	49	26	0	0	84	420
4:45 PM	65	75	42	0	0	182	20	94	17	0	0	131	6	27	11	0	1	44	7	38	28	0	2	73	430
Hourly Total	240	220	155	0	0	615	133	251	59	0	1	443	37	111	40	0	2	188	26	188	118	0	4	332	1578
5:00 PM	82	78	40	0	0	200	36	81	17	0	0	134	8	38	15	0	0	61	8	51	34	0	1	93	488
5:15 PM	85	87	36	0	0	208	26	82	12	0	0	120	10	39	10	0	1	59	14	56	32	0	1	102	489
5:30 PM	79	78	35	0	0	192	39	75	16	0	1	130	12	22	15	0	0	49	8	72	43	0	0	123	494
5:45 PM	57	67	37	0	1	161	23	70	13	0	1	106	10	33	10	0	0	53	8	56	36	0	1	100	420
Hourly Total	303	310	148	0	1	761	124	308	58	0	2	490	40	132	50	0	1	222	38	235	145	0	3	418	1891
6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	543	530	303	0	1	1376	257	559	117	0	3	933	77	243	90	0	3	410	64	423	263	0	7	750	3469
Approach %	39.5	38.5	22.0	0.0	-	-	27.5	59.9	12.5	0.0	-	-	18.8	59.3	22.0	0.0	-	-	8.5	56.4	35.1	0.0	-	-	-
Total %	15.7	15.3	8.7	0.0	-	39.7	7.4	16.1	3.4	0.0	-	26.9	2.2	7.0	2.6	0.0	-	11.8	1.8	12.2	7.6	0.0	-	21.6	-
Lights	538	529	299	0	-	1366	254	554	117	0	-	925	77	243	86	0	-	406	64	419	260	0	-	743	3440
% Lights	99.1	99.8	98.7	-	-	99.3	98.8	99.1	100.0	-	-	99.1	100.0	100.0	95.6	-	-	99.0	100.0	99.1	98.9	-	-	99.1	99.2
Buses	2	0	2	0	-	4	0	4	0	0	-	4	0	0	0	0	-	0	0	2	3	0	-	5	13
% Buses	0.4	0.0	0.7	-	-	0.3	0.0	0.7	0.0	-	-	0.4	0.0	0.0	0.0	-	-	0.0	0.0	0.5	1.1	-	-	0.7	0.4
Trucks	3	1	2	0	-	6	3	1	0	0	-	4	0	0	4	0	-	4	0	2	0	0	-	2	16
% Trucks	0.6	0.2	0.7	-	-	0.4	1.2	0.2	0.0	-	-	0.4	0.0	0.0	4.4	-	-	1.0	0.0	0.5	0.0	-	-	0.3	0.5
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	3	-	-	-	-	-	3	-	-	-	-	-	7	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



Turning Movement Data Plot

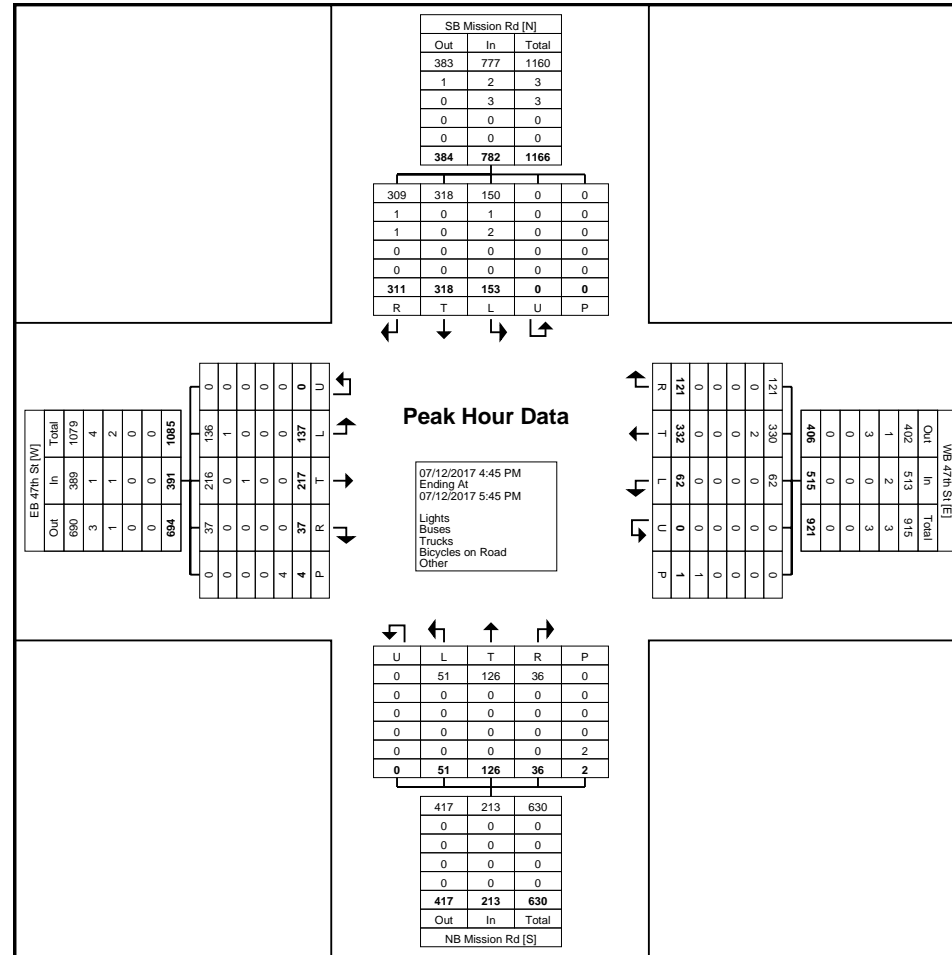


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Count Name: 47th St & Mission  
 Site Code:  
 Start Date: 07/12/2017  
 Page No: 3

### Turning Movement Peak Hour Data (4:45 PM)

Start Time	SB Mission Rd Southbound						WB 47th St Westbound						NB Mission Rd Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
4:45 PM	65	75	42	0	0	182	20	94	17	0	0	131	6	27	11	0	1	44	7	38	28	0	2	73	430
5:00 PM	82	78	40	0	0	200	36	81	17	0	0	134	8	38	15	0	0	61	8	51	34	0	1	93	488
5:15 PM	85	87	36	0	0	208	26	82	12	0	0	120	10	39	10	0	1	59	14	56	32	0	1	102	489
5:30 PM	79	78	35	0	0	192	39	75	16	0	1	130	12	22	15	0	0	49	8	72	43	0	0	123	494
<b>Total</b>	<b>311</b>	<b>318</b>	<b>153</b>	<b>0</b>	<b>0</b>	<b>782</b>	<b>121</b>	<b>332</b>	<b>62</b>	<b>0</b>	<b>1</b>	<b>515</b>	<b>36</b>	<b>126</b>	<b>51</b>	<b>0</b>	<b>2</b>	<b>213</b>	<b>37</b>	<b>217</b>	<b>137</b>	<b>0</b>	<b>4</b>	<b>391</b>	<b>1901</b>
Approach %	39.8	40.7	19.6	0.0	-	-	23.5	64.5	12.0	0.0	-	-	16.9	59.2	23.9	0.0	-	-	9.5	55.5	35.0	0.0	-	-	-
Total %	16.4	16.7	8.0	0.0	-	41.1	6.4	17.5	3.3	0.0	-	27.1	1.9	6.6	2.7	0.0	-	11.2	1.9	11.4	7.2	0.0	-	20.6	-
PHF	0.915	0.914	0.911	0.000	-	0.940	0.776	0.883	0.912	0.000	-	0.961	0.750	0.808	0.850	0.000	-	0.873	0.661	0.753	0.797	0.000	-	0.795	0.962
Lights	309	318	150	0	-	777	121	330	62	0	-	513	36	126	51	0	-	213	37	216	136	0	-	389	1892
% Lights	99.4	100.0	98.0	-	-	99.4	100.0	99.4	100.0	-	-	99.6	100.0	100.0	100.0	-	-	100.0	100.0	99.5	99.3	-	-	99.5	99.5
Buses	1	0	1	0	-	2	0	2	0	0	-	2	0	0	0	0	-	0	0	0	1	0	-	1	5
% Buses	0.3	0.0	0.7	-	-	0.3	0.0	0.6	0.0	-	-	0.4	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.7	-	-	0.3	0.3
Trucks	1	0	2	0	-	3	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	4
% Trucks	0.3	0.0	1.3	-	-	0.4	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.5	0.0	-	-	0.3	0.2
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-	4	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



Turning Movement Peak Hour Data Plot (4:45 PM)



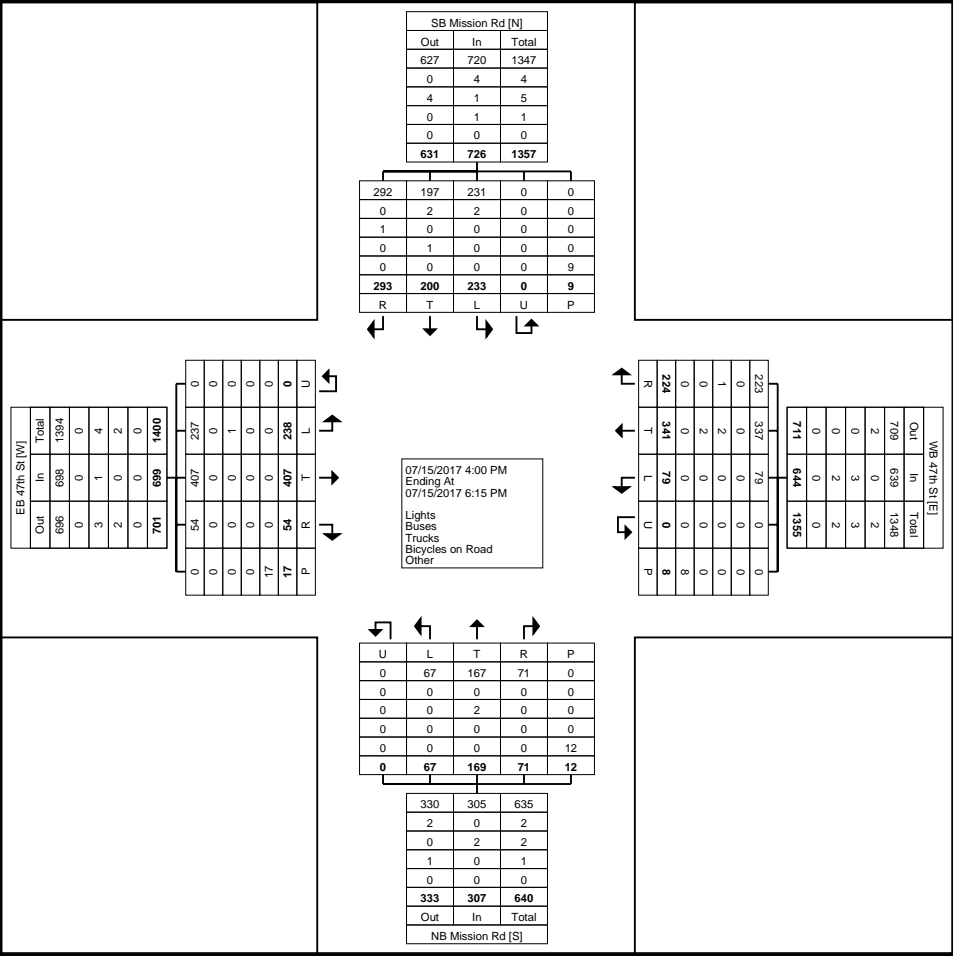
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Count Name: 47th St & Mission  
 Site Code:  
 Start Date: 07/15/2017  
 Page No: 1

### Turning Movement Data

Start Time	SB Mission Rd Southbound						WB 47th St Westbound						NB Mission Rd Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
4:00 PM	34	26	34	0	0	94	27	49	12	0	0	88	12	13	7	0	0	32	9	62	28	0	2	99	313
4:15 PM	32	28	25	0	1	85	33	52	5	0	0	90	8	27	10	0	0	45	9	56	26	0	0	91	311
4:30 PM	37	19	28	0	4	84	26	35	10	0	0	71	6	21	8	0	3	35	5	43	30	0	0	78	268
4:45 PM	40	30	29	0	0	99	35	30	11	0	3	76	7	30	5	0	0	42	4	39	30	0	0	73	290
Hourly Total	143	103	116	0	5	362	121	166	38	0	3	325	33	91	30	0	3	154	27	200	114	0	2	341	1182
5:00 PM	35	31	27	0	0	93	29	48	6	0	1	83	9	15	7	0	4	31	8	58	32	0	4	98	305
5:15 PM	32	26	38	0	3	96	22	45	13	0	2	80	10	18	8	0	0	36	8	52	27	0	2	87	299
5:30 PM	39	22	24	0	0	85	19	42	9	0	2	70	10	18	15	0	0	43	5	56	31	0	0	92	290
5:45 PM	44	18	28	0	1	90	33	40	13	0	0	86	9	27	7	0	5	43	6	41	34	0	9	81	300
Hourly Total	150	97	117	0	4	364	103	175	41	0	5	319	38	78	37	0	9	153	27	207	124	0	15	358	1194
6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	293	200	233	0	9	726	224	341	79	0	8	644	71	169	67	0	12	307	54	407	238	0	17	699	2376
Approach %	40.4	27.5	32.1	0.0	-	-	34.8	53.0	12.3	0.0	-	-	23.1	55.0	21.8	0.0	-	-	7.7	58.2	34.0	0.0	-	-	-
Total %	12.3	8.4	9.8	0.0	-	30.6	9.4	14.4	3.3	0.0	-	27.1	3.0	7.1	2.8	0.0	-	12.9	2.3	17.1	10.0	0.0	-	29.4	-
Lights	292	197	231	0	-	720	223	337	79	0	-	639	71	167	67	0	-	305	54	407	237	0	-	698	2362
% Lights	99.7	98.5	99.1	-	-	99.2	99.6	98.8	100.0	-	-	99.2	100.0	98.8	100.0	-	-	99.3	100.0	100.0	99.6	-	-	99.9	99.4
Buses	0	2	2	0	-	4	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	4
% Buses	0.0	1.0	0.9	-	-	0.6	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.2
Trucks	1	0	0	0	-	1	1	2	0	0	-	3	0	2	0	0	-	2	0	0	1	0	-	1	7
% Trucks	0.3	0.0	0.0	-	-	0.1	0.4	0.6	0.0	-	-	0.5	0.0	1.2	0.0	-	-	0.7	0.0	0.0	0.4	-	-	0.1	0.3
Bicycles on Road	0	1	0	0	-	1	0	2	0	0	-	2	0	0	0	0	-	0	0	0	0	0	-	0	3
% Bicycles on Road	0.0	0.5	0.0	-	-	0.1	0.0	0.6	0.0	-	-	0.3	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.1
Bicycles on Crosswalk	-	-	-	-	4	-	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	44.4	-	-	-	-	-	12.5	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	5	-	-	-	-	-	7	-	-	-	-	-	12	-	-	-	-	-	17	-	-
% Pedestrians	-	-	-	-	55.6	-	-	-	-	-	87.5	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-





Turning Movement Data Plot

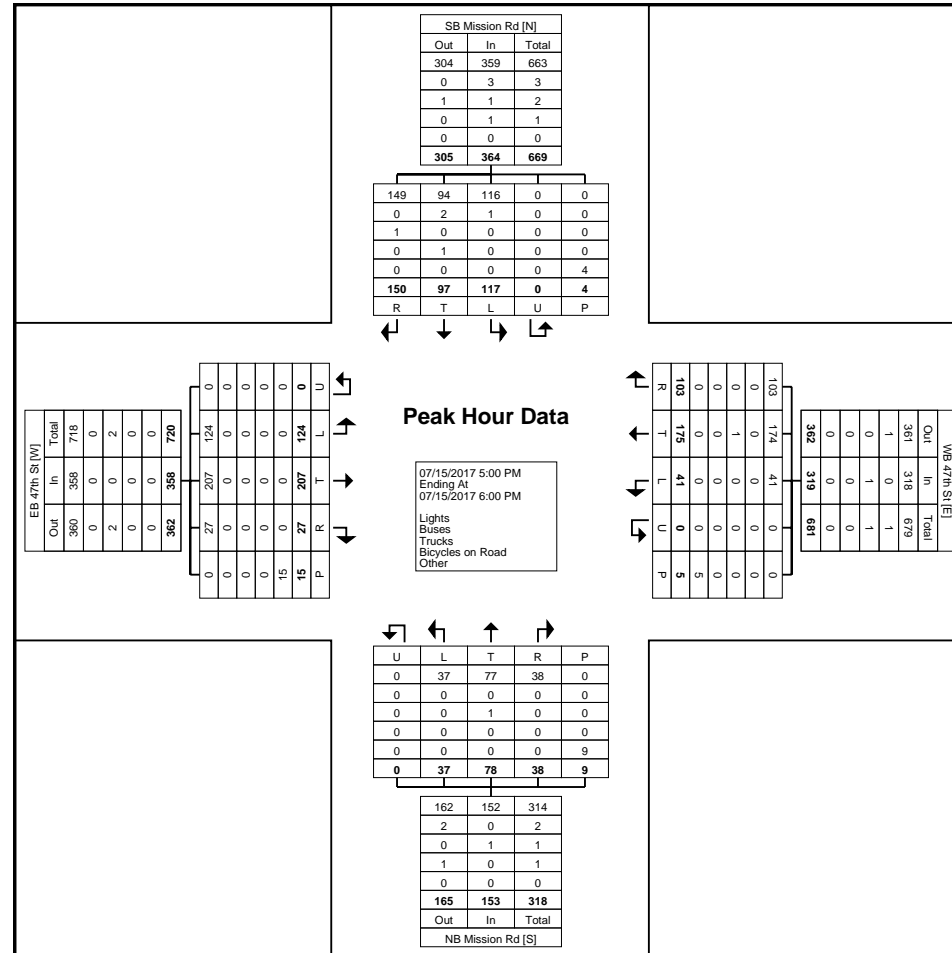


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Count Name: 47th St & Mission  
 Site Code:  
 Start Date: 07/15/2017  
 Page No: 3

### Turning Movement Peak Hour Data (5:00 PM)

Start Time	SB Mission Rd Southbound						WB 47th St Westbound						NB Mission Rd Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
5:00 PM	35	31	27	0	0	93	29	48	6	0	1	83	9	15	7	0	4	31	8	58	32	0	4	98	305
5:15 PM	32	26	38	0	3	96	22	45	13	0	2	80	10	18	8	0	0	36	8	52	27	0	2	87	299
5:30 PM	39	22	24	0	0	85	19	42	9	0	2	70	10	18	15	0	0	43	5	56	31	0	0	92	290
5:45 PM	44	18	28	0	1	90	33	40	13	0	0	86	9	27	7	0	5	43	6	41	34	0	9	81	300
<b>Total</b>	<b>150</b>	<b>97</b>	<b>117</b>	<b>0</b>	<b>4</b>	<b>364</b>	<b>103</b>	<b>175</b>	<b>41</b>	<b>0</b>	<b>5</b>	<b>319</b>	<b>38</b>	<b>78</b>	<b>37</b>	<b>0</b>	<b>9</b>	<b>153</b>	<b>27</b>	<b>207</b>	<b>124</b>	<b>0</b>	<b>15</b>	<b>358</b>	<b>1194</b>
Approach %	41.2	26.6	32.1	0.0	-	-	32.3	54.9	12.9	0.0	-	-	24.8	51.0	24.2	0.0	-	-	7.5	57.8	34.6	0.0	-	-	-
Total %	12.6	8.1	9.8	0.0	-	30.5	8.6	14.7	3.4	0.0	-	26.7	3.2	6.5	3.1	0.0	-	12.8	2.3	17.3	10.4	0.0	-	30.0	-
PHF	0.852	0.782	0.770	0.000	-	0.948	0.780	0.911	0.788	0.000	-	0.927	0.950	0.722	0.617	0.000	-	0.890	0.844	0.892	0.912	0.000	-	0.913	0.979
Lights	149	94	116	0	-	359	103	174	41	0	-	318	38	77	37	0	-	152	27	207	124	0	-	358	1187
% Lights	99.3	96.9	99.1	-	-	98.6	100.0	99.4	100.0	-	-	99.7	100.0	98.7	100.0	-	-	99.3	100.0	100.0	100.0	-	-	100.0	99.4
Buses	0	2	1	0	-	3	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	3
% Buses	0.0	2.1	0.9	-	-	0.8	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.3
Trucks	1	0	0	0	-	1	0	1	0	0	-	1	0	1	0	0	-	1	0	0	0	0	-	0	3
% Trucks	0.7	0.0	0.0	-	-	0.3	0.0	0.6	0.0	-	-	0.3	0.0	1.3	0.0	-	-	0.7	0.0	0.0	0.0	-	-	0.0	0.3
Bicycles on Road	0	1	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	1
% Bicycles on Road	0.0	1.0	0.0	-	-	0.3	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.1
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	20.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	4	-	-	-	-	-	4	-	-	-	-	-	9	-	-	-	-	-	15	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	80.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



Turning Movement Peak Hour Data Plot (5:00 PM)

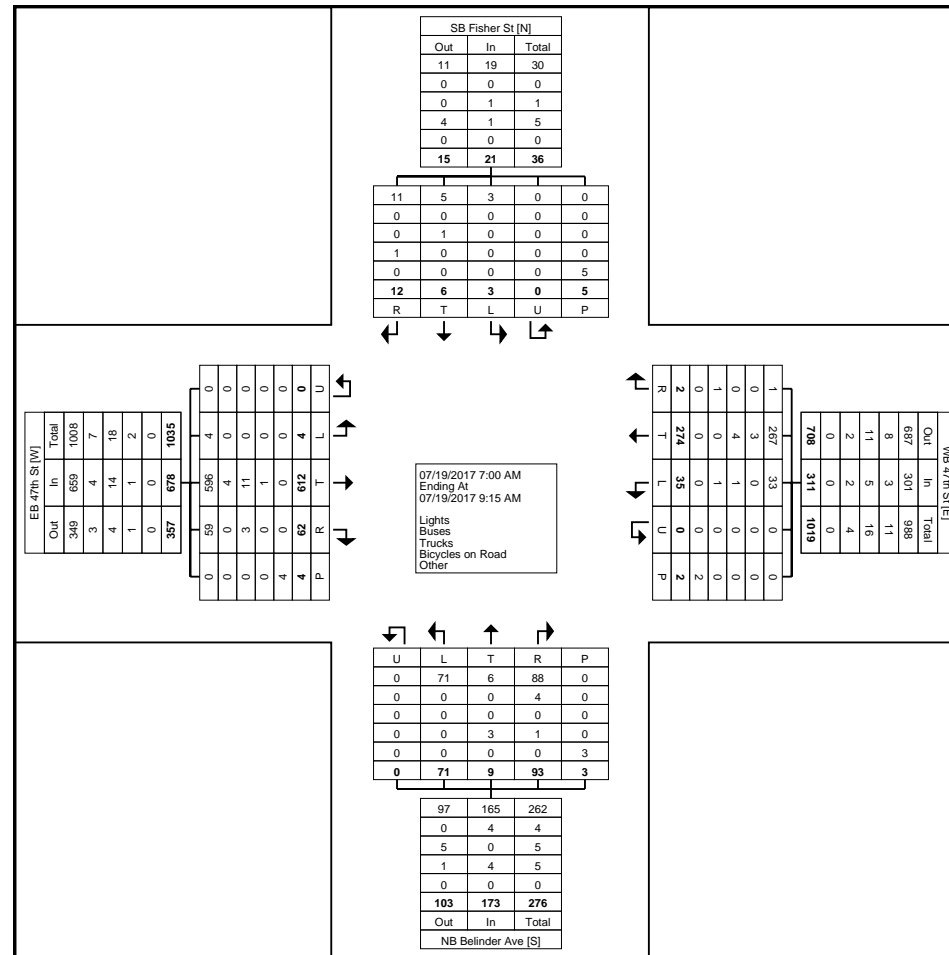


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Count Name: 47th St & Belinder Ave  
 Site Code:  
 Start Date: 07/19/2017  
 Page No: 1

### Turning Movement Data

Start Time	SB Fisher St Southbound						WB 47th St Westbound						NB Belinder Ave Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
7:00 AM	1	1	1	0	0	3	0	24	3	0	0	27	7	4	2	0	1	13	5	49	0	0	0	54	97
7:15 AM	2	1	0	0	1	3	0	21	2	0	2	23	9	2	5	0	0	16	7	76	1	0	0	84	126
7:30 AM	1	0	1	0	0	2	0	41	5	0	0	46	9	1	9	0	1	19	12	85	1	0	0	98	165
7:45 AM	1	1	0	0	1	2	0	35	7	0	0	42	15	1	10	0	0	26	10	97	0	0	0	107	177
Hourly Total	5	3	2	0	2	10	0	121	17	0	2	138	40	8	26	0	2	74	34	307	2	0	0	343	565
8:00 AM	3	2	1	0	0	6	1	36	6	0	0	43	12	1	9	0	1	22	9	63	1	0	3	73	144
8:15 AM	1	1	0	0	2	2	1	40	3	0	0	44	12	0	14	0	0	26	7	85	0	0	0	92	164
8:30 AM	2	0	0	0	0	2	0	38	4	0	0	42	10	0	11	0	0	21	5	74	1	0	0	80	145
8:45 AM	1	0	0	0	1	1	0	39	5	0	0	44	19	0	11	0	0	30	7	83	0	0	1	90	165
Hourly Total	7	3	1	0	3	11	2	153	18	0	0	173	53	1	45	0	1	99	28	305	2	0	4	335	618
9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	12	6	3	0	5	21	2	274	35	0	2	311	93	9	71	0	3	173	62	612	4	0	4	678	1183
Approach %	57.1	28.6	14.3	0.0	-	-	0.6	88.1	11.3	0.0	-	-	53.8	5.2	41.0	0.0	-	-	9.1	90.3	0.6	0.0	-	-	-
Total %	1.0	0.5	0.3	0.0	-	1.8	0.2	23.2	3.0	0.0	-	26.3	7.9	0.8	6.0	0.0	-	14.6	5.2	51.7	0.3	0.0	-	-	57.3
Lights	11	5	3	0	-	19	1	267	33	0	-	301	88	6	71	0	-	165	59	596	4	0	-	659	1144
% Lights	91.7	83.3	100.0	-	-	90.5	50.0	97.4	94.3	-	-	96.8	94.6	66.7	100.0	-	-	95.4	95.2	97.4	100.0	-	-	97.2	96.7
Buses	0	0	0	0	-	0	0	3	0	0	-	3	4	0	0	0	-	4	0	4	0	0	-	4	11
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	1.1	0.0	-	-	1.0	4.3	0.0	0.0	-	-	2.3	0.0	0.7	0.0	-	-	0.6	0.9
Trucks	0	1	0	0	-	1	0	4	1	0	-	5	0	0	0	0	-	0	3	11	0	0	-	14	20
% Trucks	0.0	16.7	0.0	-	-	4.8	0.0	1.5	2.9	-	-	1.6	0.0	0.0	0.0	-	-	0.0	4.8	1.8	0.0	-	-	2.1	1.7
Bicycles on Road	1	0	0	0	-	1	1	0	1	0	-	2	1	3	0	0	-	4	0	1	0	0	-	1	8
% Bicycles on Road	8.3	0.0	0.0	-	-	4.8	50.0	0.0	2.9	-	-	0.6	1.1	33.3	0.0	-	-	2.3	0.0	0.2	0.0	-	-	0.1	0.7
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	1	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	25.0	-	-
Pedestrians	-	-	-	-	5	-	-	-	-	-	2	-	-	-	-	-	3	-	-	-	-	-	3	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	75.0	-	-



Turning Movement Data Plot

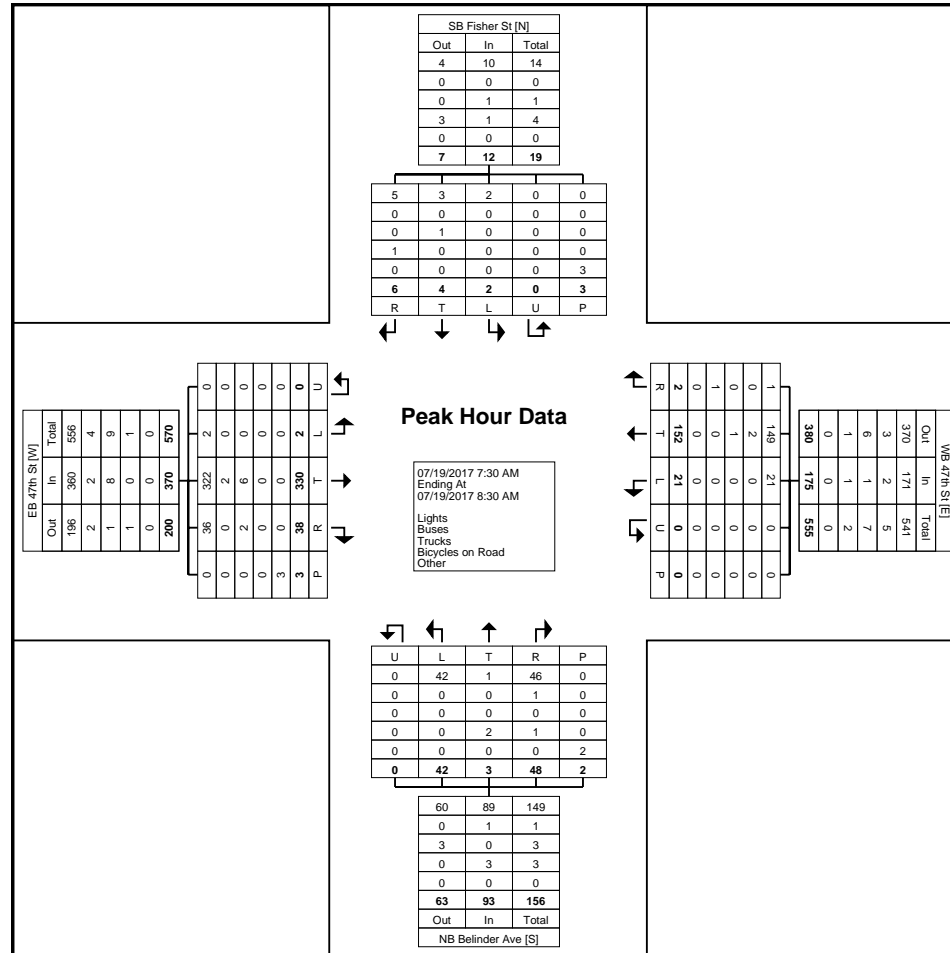


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Count Name: 47th St & Belinder Ave  
 Site Code:  
 Start Date: 07/19/2017  
 Page No: 3

### Turning Movement Peak Hour Data (7:30 AM)

Start Time	SB Fisher St Southbound						WB 47th St Westbound						NB Belinder Ave Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
7:30 AM	1	0	1	0	0	2	0	41	5	0	0	46	9	1	9	0	1	19	12	85	1	0	0	98	165
7:45 AM	1	1	0	0	1	2	0	35	7	0	0	42	15	1	10	0	0	26	10	97	0	0	0	107	177
8:00 AM	3	2	1	0	0	6	1	36	6	0	0	43	12	1	9	0	1	22	9	63	1	0	3	73	144
8:15 AM	1	1	0	0	2	2	1	40	3	0	0	44	12	0	14	0	0	26	7	85	0	0	0	92	164
<b>Total</b>	<b>6</b>	<b>4</b>	<b>2</b>	<b>0</b>	<b>3</b>	<b>12</b>	<b>2</b>	<b>152</b>	<b>21</b>	<b>0</b>	<b>0</b>	<b>175</b>	<b>48</b>	<b>3</b>	<b>42</b>	<b>0</b>	<b>2</b>	<b>93</b>	<b>38</b>	<b>330</b>	<b>2</b>	<b>0</b>	<b>3</b>	<b>370</b>	<b>650</b>
Approach %	50.0	33.3	16.7	0.0	-	-	1.1	86.9	12.0	0.0	-	-	51.6	3.2	45.2	0.0	-	-	10.3	89.2	0.5	0.0	-	-	-
Total %	0.9	0.6	0.3	0.0	-	1.8	0.3	23.4	3.2	0.0	-	26.9	7.4	0.5	6.5	0.0	-	14.3	5.8	50.8	0.3	0.0	-	56.9	-
PHF	0.500	0.500	0.500	0.000	-	0.500	0.500	0.927	0.750	0.000	-	0.951	0.800	0.750	0.750	0.000	-	0.894	0.792	0.851	0.500	0.000	-	0.864	0.918
Lights	5	3	2	0	-	10	1	149	21	0	-	171	46	1	42	0	-	89	36	322	2	0	-	360	630
% Lights	83.3	75.0	100.0	-	-	83.3	50.0	98.0	100.0	-	-	97.7	95.8	33.3	100.0	-	-	95.7	94.7	97.6	100.0	-	-	97.3	96.9
Buses	0	0	0	0	-	0	0	2	0	0	-	2	1	0	0	0	-	1	0	2	0	0	-	2	5
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	1.3	0.0	-	-	1.1	2.1	0.0	0.0	-	-	1.1	0.0	0.6	0.0	-	-	0.5	0.8
Trucks	0	1	0	0	-	1	0	1	0	0	-	1	0	0	0	0	-	0	2	6	0	0	-	8	10
% Trucks	0.0	25.0	0.0	-	-	8.3	0.0	0.7	0.0	-	-	0.6	0.0	0.0	0.0	-	-	0.0	5.3	1.8	0.0	-	-	2.2	1.5
Bicycles on Road	1	0	0	0	-	1	1	0	0	0	-	1	1	2	0	0	-	3	0	0	0	0	-	0	5
% Bicycles on Road	16.7	0.0	0.0	-	-	8.3	50.0	0.0	0.0	-	-	0.6	2.1	66.7	0.0	-	-	3.2	0.0	0.0	0.0	-	-	0.0	0.8
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	3	-	-	-	-	-	0	-	-	-	-	-	2	-	-	-	-	-	3	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



Turning Movement Peak Hour Data Plot (7:30 AM)



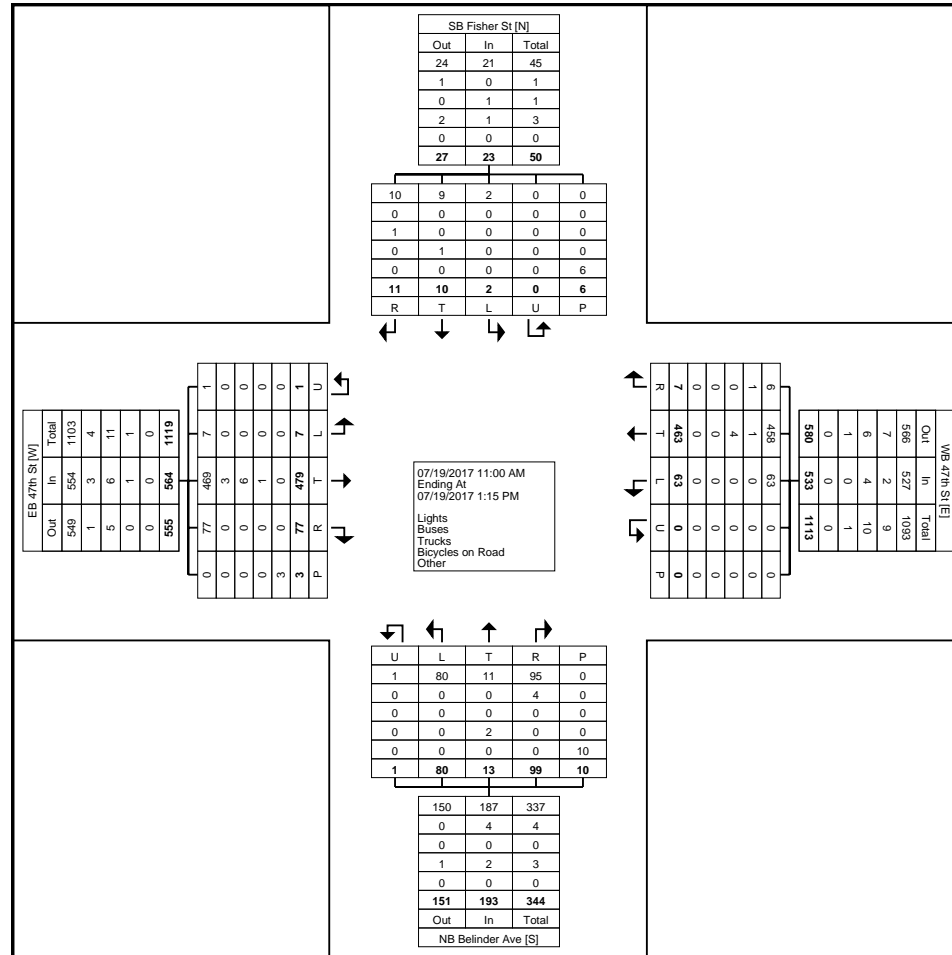
CFS Engineers - Missouri  
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 Suite 110  
 Kansas City, Missouri, United States 64114  
 (816) 333-4477 arobertson@cfse.com

Count Name: 47th St & Belinder Ave  
 Site Code:  
 Start Date: 07/19/2017  
 Page No: 1

### Turning Movement Data

Start Time	SB Fisher St Southbound						WB 47th St Westbound						NB Belinder Ave Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
11:00 AM	1	1	0	0	1	2	0	55	9	0	0	64	11	1	6	0	0	18	9	56	0	0	1	65	149
11:15 AM	1	2	0	0	3	3	0	57	5	0	0	62	9	2	9	0	0	20	6	59	3	0	0	68	153
11:30 AM	0	1	0	0	0	1	2	61	7	0	0	70	13	1	8	0	2	22	9	55	1	0	0	65	158
11:45 AM	2	1	1	0	1	4	2	56	10	0	0	68	12	0	16	0	5	28	9	58	1	0	0	68	168
Hourly Total	4	5	1	0	5	10	4	229	31	0	0	264	45	4	39	0	7	88	33	228	5	0	1	266	628
12:00 PM	1	1	1	0	0	3	1	64	9	0	0	74	11	3	12	0	0	26	10	60	0	0	0	70	173
12:15 PM	2	0	0	0	0	2	1	49	8	0	0	58	16	3	9	1	1	29	14	64	1	0	1	79	168
12:30 PM	1	1	0	0	1	2	1	71	8	0	0	80	11	3	10	0	1	24	14	66	0	0	1	80	186
12:45 PM	3	3	0	0	0	6	0	50	7	0	0	57	16	0	10	0	1	26	6	61	1	1	0	69	158
Hourly Total	7	5	1	0	1	13	3	234	32	0	0	269	54	9	41	1	3	105	44	251	2	1	2	298	685
1:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	11	10	2	0	6	23	7	463	63	0	0	533	99	13	80	1	10	193	77	479	7	1	3	564	1313
Approach %	47.8	43.5	8.7	0.0	-	-	1.3	86.9	11.8	0.0	-	-	51.3	6.7	41.5	0.5	-	-	13.7	84.9	1.2	0.2	-	-	-
Total %	0.8	0.8	0.2	0.0	-	1.8	0.5	35.3	4.8	0.0	-	40.6	7.5	1.0	6.1	0.1	-	14.7	5.9	36.5	0.5	0.1	-	43.0	-
Lights	10	9	2	0	-	21	6	458	63	0	-	527	95	11	80	1	-	187	77	469	7	1	-	554	1289
% Lights	90.9	90.0	100.0	-	-	91.3	85.7	98.9	100.0	-	-	98.9	96.0	84.6	100.0	100.0	-	96.9	100.0	97.9	100.0	100.0	-	98.2	98.2
Buses	0	0	0	0	-	0	1	1	0	0	-	2	4	0	0	0	-	4	0	3	0	0	-	3	9
% Buses	0.0	0.0	0.0	-	-	0.0	14.3	0.2	0.0	-	-	0.4	4.0	0.0	0.0	0.0	-	2.1	0.0	0.6	0.0	0.0	-	0.5	0.7
Trucks	1	0	0	0	-	1	0	4	0	0	-	4	0	0	0	0	-	0	0	6	0	0	-	6	11
% Trucks	9.1	0.0	0.0	-	-	4.3	0.0	0.9	0.0	-	-	0.8	0.0	0.0	0.0	0.0	-	0.0	0.0	1.3	0.0	0.0	-	1.1	0.8
Bicycles on Road	0	1	0	0	-	1	0	0	0	0	-	0	0	2	0	0	-	2	0	1	0	0	-	1	4
% Bicycles on Road	0.0	10.0	0.0	-	-	4.3	0.0	0.0	0.0	-	-	0.0	0.0	15.4	0.0	0.0	-	1.0	0.0	0.2	0.0	0.0	-	0.2	0.3
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	10.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	6	-	-	-	-	-	0	-	-	-	-	-	9	-	-	-	-	-	3	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	90.0	-	-	-	-	-	100.0	-	-





Turning Movement Data Plot

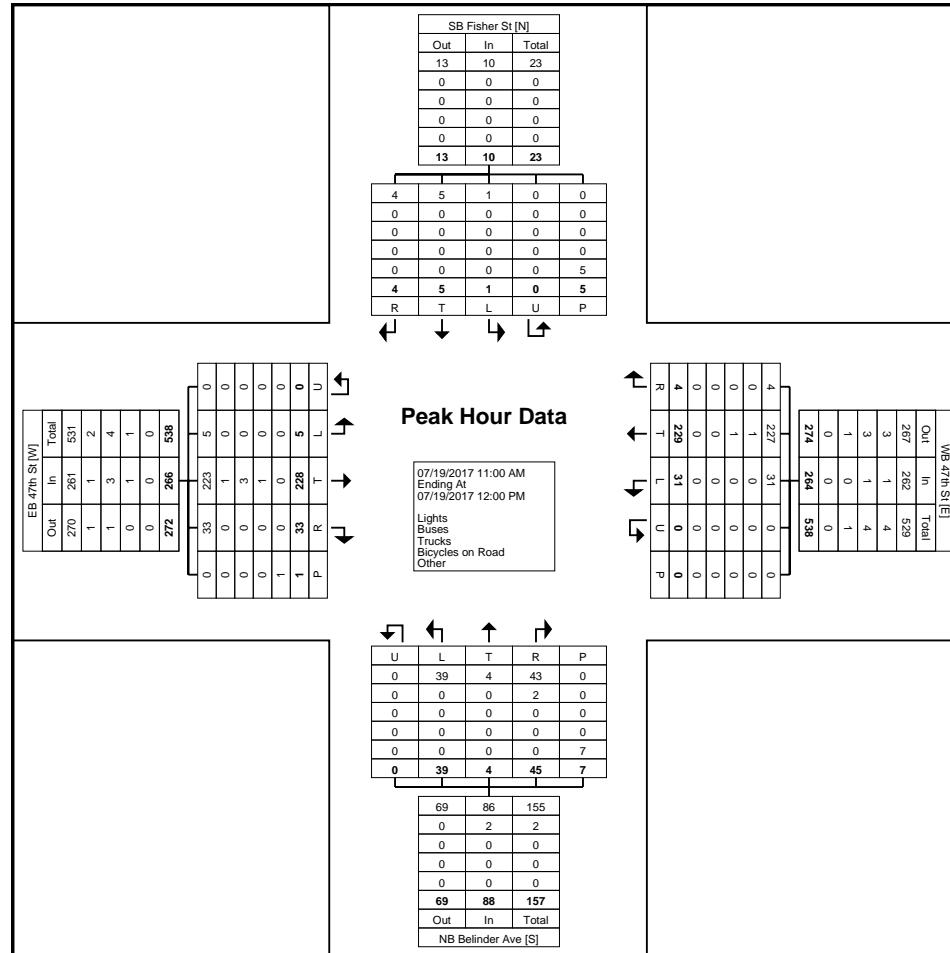


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Count Name: 47th St & Belinder Ave  
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 Start Date: 07/19/2017  
 Page No: 3

### Turning Movement Peak Hour Data (11:00 AM)

Start Time	SB Fisher St Southbound						WB 47th St Westbound						NB Belinder Ave Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
11:00 AM	1	1	0	0	1	2	0	55	9	0	0	64	11	1	6	0	0	18	9	56	0	0	1	65	149
11:15 AM	1	2	0	0	3	3	0	57	5	0	0	62	9	2	9	0	0	20	6	59	3	0	0	68	153
11:30 AM	0	1	0	0	0	1	2	61	7	0	0	70	13	1	8	0	2	22	9	55	1	0	0	65	158
11:45 AM	2	1	1	0	1	4	2	56	10	0	0	68	12	0	16	0	5	28	9	58	1	0	0	68	168
<b>Total</b>	<b>4</b>	<b>5</b>	<b>1</b>	<b>0</b>	<b>5</b>	<b>10</b>	<b>4</b>	<b>229</b>	<b>31</b>	<b>0</b>	<b>0</b>	<b>264</b>	<b>45</b>	<b>4</b>	<b>39</b>	<b>0</b>	<b>7</b>	<b>88</b>	<b>33</b>	<b>228</b>	<b>5</b>	<b>0</b>	<b>1</b>	<b>266</b>	<b>628</b>
Approach %	40.0	50.0	10.0	0.0	-	-	1.5	86.7	11.7	0.0	-	-	51.1	4.5	44.3	0.0	-	-	12.4	85.7	1.9	0.0	-	-	-
Total %	0.6	0.8	0.2	0.0	-	1.6	0.6	36.5	4.9	0.0	-	42.0	7.2	0.6	6.2	0.0	-	14.0	5.3	36.3	0.8	0.0	-	42.4	-
PHF	0.500	0.625	0.250	0.000	-	0.625	0.500	0.939	0.775	0.000	-	0.943	0.865	0.500	0.609	0.000	-	0.786	0.917	0.966	0.417	0.000	-	0.978	0.935
Lights	4	5	1	0	-	10	4	227	31	0	-	262	43	4	39	0	-	86	33	223	5	0	-	261	619
% Lights	100.0	100.0	100.0	-	-	100.0	100.0	99.1	100.0	-	-	99.2	95.6	100.0	100.0	-	-	97.7	100.0	97.8	100.0	-	-	98.1	98.6
Buses	0	0	0	0	-	0	0	1	0	0	-	1	2	0	0	0	-	2	0	1	0	0	-	1	4
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	0.4	0.0	-	-	0.4	4.4	0.0	0.0	-	-	2.3	0.0	0.4	0.0	-	-	0.4	0.6
Trucks	0	0	0	0	-	0	0	1	0	0	-	1	0	0	0	0	-	0	0	3	0	0	-	3	4
% Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.4	0.0	-	-	0.4	0.0	0.0	0.0	-	-	0.0	0.0	1.3	0.0	-	-	1.1	0.6
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	1
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.4	0.0	-	-	0.4	0.2
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	14.3	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	5	-	-	-	-	-	0	-	-	-	-	-	6	-	-	-	-	-	1	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	85.7	-	-	-	-	-	100.0	-	-



Turning Movement Peak Hour Data Plot (11:00 AM)

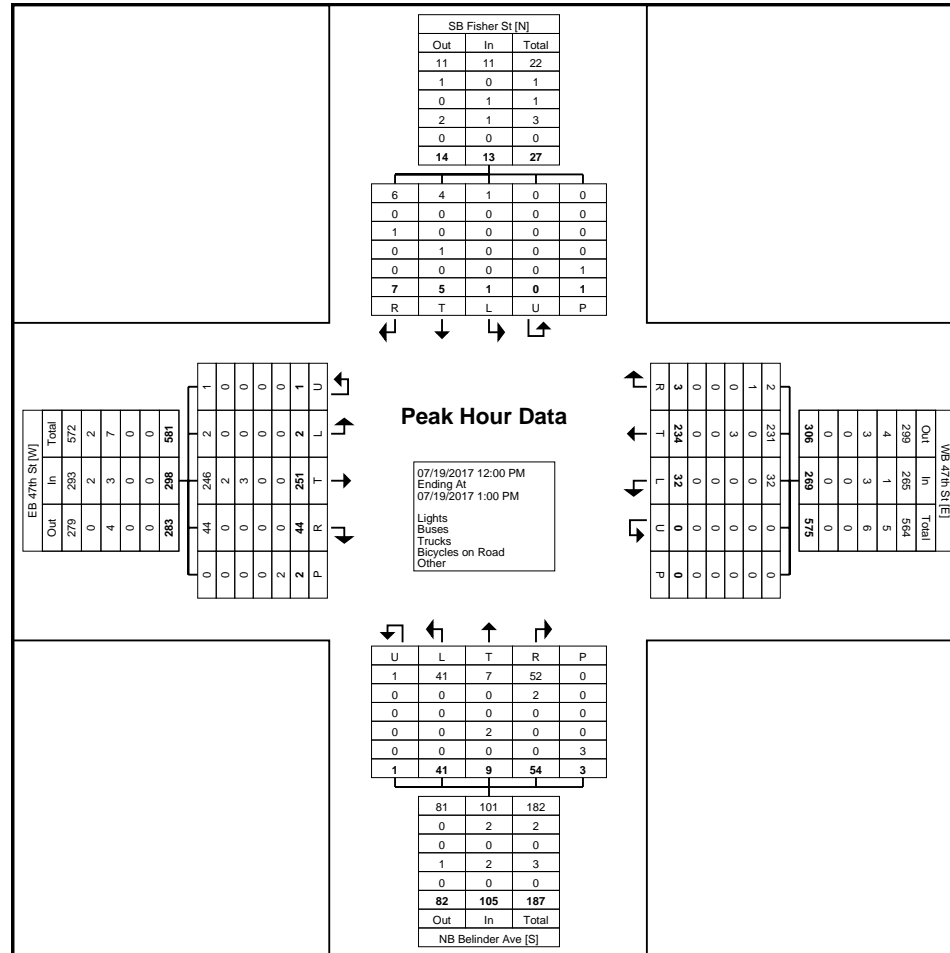


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Count Name: 47th St & Belinder Ave  
 Site Code:  
 Start Date: 07/19/2017  
 Page No: 5

### Turning Movement Peak Hour Data (12:00 PM)

Start Time	SB Fisher St Southbound						WB 47th St Westbound						NB Belinder Ave Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
12:00 PM	1	1	1	0	0	3	1	64	9	0	0	74	11	3	12	0	0	26	10	60	0	0	0	70	173
12:15 PM	2	0	0	0	0	2	1	49	8	0	0	58	16	3	9	1	1	29	14	64	1	0	1	79	168
12:30 PM	1	1	0	0	1	2	1	71	8	0	0	80	11	3	10	0	1	24	14	66	0	0	1	80	186
12:45 PM	3	3	0	0	0	6	0	50	7	0	0	57	16	0	10	0	1	26	6	61	1	1	0	69	158
<b>Total</b>	<b>7</b>	<b>5</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>13</b>	<b>3</b>	<b>234</b>	<b>32</b>	<b>0</b>	<b>0</b>	<b>269</b>	<b>54</b>	<b>9</b>	<b>41</b>	<b>1</b>	<b>3</b>	<b>105</b>	<b>44</b>	<b>251</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>298</b>	<b>685</b>
Approach %	53.8	38.5	7.7	0.0	-	-	1.1	87.0	11.9	0.0	-	-	51.4	8.6	39.0	1.0	-	-	14.8	84.2	0.7	0.3	-	-	-
Total %	1.0	0.7	0.1	0.0	-	1.9	0.4	34.2	4.7	0.0	-	39.3	7.9	1.3	6.0	0.1	-	15.3	6.4	36.6	0.3	0.1	-	43.5	-
PHF	0.583	0.417	0.250	0.000	-	0.542	0.750	0.824	0.889	0.000	-	0.841	0.844	0.750	0.854	0.250	-	0.905	0.786	0.951	0.500	0.250	-	0.931	0.921
Lights	6	4	1	0	-	11	2	231	32	0	-	265	52	7	41	1	-	101	44	246	2	1	-	293	670
% Lights	85.7	80.0	100.0	-	-	84.6	66.7	98.7	100.0	-	-	98.5	96.3	77.8	100.0	100.0	-	96.2	100.0	98.0	100.0	100.0	-	98.3	97.8
Buses	0	0	0	0	-	0	1	0	0	0	-	1	2	0	0	0	-	2	0	2	0	0	-	2	5
% Buses	0.0	0.0	0.0	-	-	0.0	33.3	0.0	0.0	-	-	0.4	3.7	0.0	0.0	0.0	-	1.9	0.0	0.8	0.0	0.0	-	0.7	0.7
Trucks	1	0	0	0	-	1	0	3	0	0	-	3	0	0	0	0	-	0	0	3	0	0	-	3	7
% Trucks	14.3	0.0	0.0	-	-	7.7	0.0	1.3	0.0	-	-	1.1	0.0	0.0	0.0	0.0	-	0.0	0.0	1.2	0.0	0.0	-	1.0	1.0
Bicycles on Road	0	1	0	0	-	1	0	0	0	0	-	0	0	2	0	0	-	2	0	0	0	0	-	0	3
% Bicycles on Road	0.0	20.0	0.0	-	-	7.7	0.0	0.0	0.0	-	-	0.0	0.0	22.2	0.0	0.0	-	1.9	0.0	0.0	0.0	0.0	-	0.0	0.4
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	3	-	-	-	-	-	2	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



Turning Movement Peak Hour Data Plot (12:00 PM)

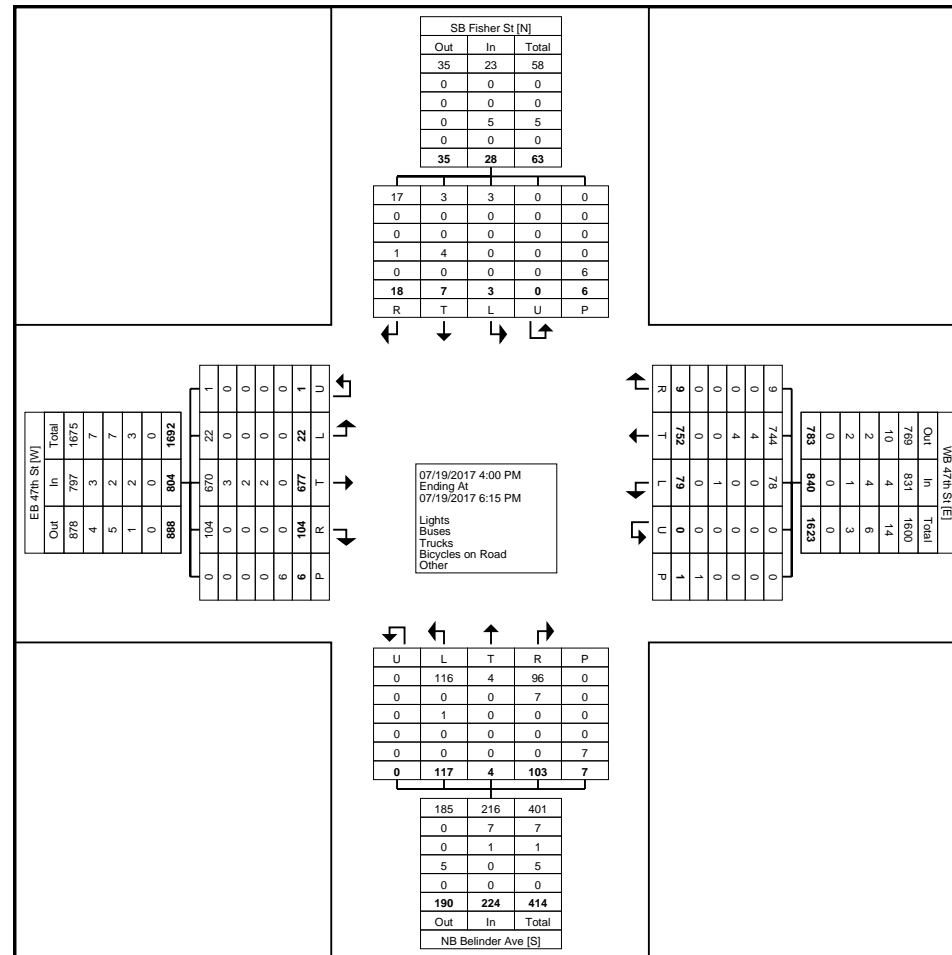


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Count Name: 47th St & Belinder Ave  
 Site Code:  
 Start Date: 07/19/2017  
 Page No: 1

### Turning Movement Data

Start Time	SB Fisher St Southbound						WB 47th St Westbound						NB Belinder Ave Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
4:00 PM	0	0	0	0	0	0	3	74	3	0	0	80	12	0	23	0	2	35	13	60	0	0	0	73	188
4:15 PM	1	0	1	0	0	2	0	83	10	0	0	93	9	1	16	0	0	26	7	88	3	0	1	98	219
4:30 PM	3	0	0	0	0	3	1	85	9	0	0	95	14	1	13	0	2	28	6	76	1	0	1	83	209
4:45 PM	3	2	0	0	0	5	1	106	16	0	0	123	15	1	8	0	0	24	16	83	4	0	0	103	255
Hourly Total	7	2	1	0	0	10	5	348	38	0	0	391	50	3	60	0	4	113	42	307	8	0	2	357	871
5:00 PM	3	0	0	0	0	3	2	113	8	0	0	123	17	0	13	0	1	30	15	82	3	0	0	100	256
5:15 PM	2	1	1	0	4	4	1	88	14	0	0	103	13	0	17	0	0	30	18	89	4	0	2	111	248
5:30 PM	4	4	0	0	0	8	1	105	11	0	0	117	9	1	14	0	1	24	15	112	4	0	1	131	280
5:45 PM	2	0	1	0	2	3	0	98	8	0	1	106	14	0	13	0	1	27	14	87	3	1	1	105	241
Hourly Total	11	5	2	0	6	18	4	404	41	0	1	449	53	1	57	0	3	111	62	370	14	1	4	447	1025
6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	18	7	3	0	6	28	9	752	79	0	1	840	103	4	117	0	7	224	104	677	22	1	6	804	1896
Approach %	64.3	25.0	10.7	0.0	-	-	1.1	89.5	9.4	0.0	-	-	46.0	1.8	52.2	0.0	-	-	12.9	84.2	2.7	0.1	-	-	-
Total %	0.9	0.4	0.2	0.0	-	1.5	0.5	39.7	4.2	0.0	-	44.3	5.4	0.2	6.2	0.0	-	11.8	5.5	35.7	1.2	0.1	-	42.4	-
Lights	17	3	3	0	-	23	9	744	78	0	-	831	96	4	116	0	-	216	104	670	22	1	-	797	1867
% Lights	94.4	42.9	100.0	-	-	82.1	100.0	98.9	98.7	-	-	98.9	93.2	100.0	99.1	-	-	96.4	100.0	99.0	100.0	100.0	-	99.1	98.5
Buses	0	0	0	0	-	0	0	4	0	0	-	4	7	0	0	0	-	7	0	3	0	0	-	3	14
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	0.5	0.0	-	-	0.5	6.8	0.0	0.0	-	-	3.1	0.0	0.4	0.0	0.0	-	0.4	0.7
Trucks	0	0	0	0	-	0	0	4	0	0	-	4	0	0	1	0	-	1	0	2	0	0	-	2	7
% Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.5	0.0	-	-	0.5	0.0	0.0	0.9	-	-	0.4	0.0	0.3	0.0	0.0	-	0.2	0.4
Bicycles on Road	1	4	0	0	-	5	0	0	1	0	-	1	0	0	0	0	-	0	0	2	0	0	-	2	8
% Bicycles on Road	5.6	57.1	0.0	-	-	17.9	0.0	0.0	1.3	-	-	0.1	0.0	0.0	0.0	-	-	0.0	0.0	0.3	0.0	0.0	-	0.2	0.4
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	14.3	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	6	-	-	-	-	-	1	-	-	-	-	-	6	-	-	-	-	-	6	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	85.7	-	-	-	-	-	100.0	-	-



Turning Movement Data Plot



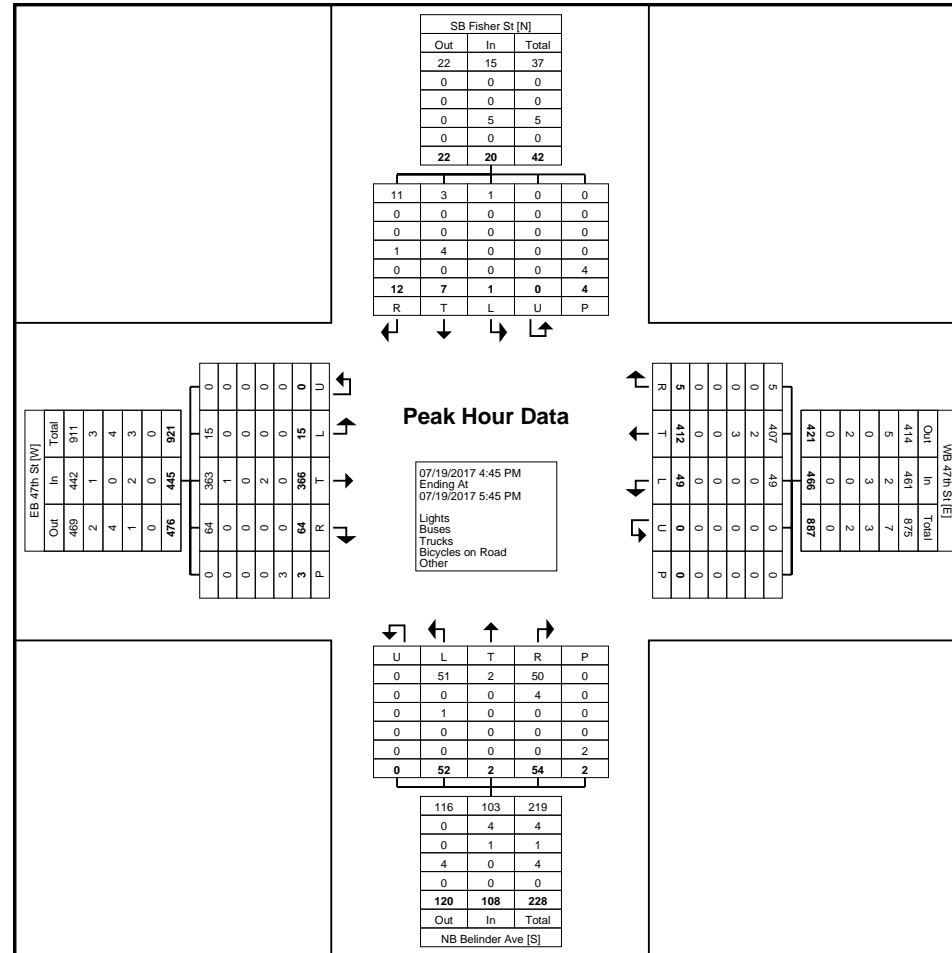
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Count Name: 47th St & Belinder Ave  
 Site Code:  
 Start Date: 07/19/2017  
 Page No: 3

### Turning Movement Peak Hour Data (4:45 PM)

Start Time	SB Fisher St Southbound						WB 47th St Westbound						NB Belinder Ave Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
4:45 PM	3	2	0	0	0	5	1	106	16	0	0	123	15	1	8	0	0	24	16	83	4	0	0	103	255
5:00 PM	3	0	0	0	0	3	2	113	8	0	0	123	17	0	13	0	1	30	15	82	3	0	0	100	256
5:15 PM	2	1	1	0	4	4	1	88	14	0	0	103	13	0	17	0	0	30	18	89	4	0	2	111	248
5:30 PM	4	4	0	0	0	8	1	105	11	0	0	117	9	1	14	0	1	24	15	112	4	0	1	131	280
<b>Total</b>	<b>12</b>	<b>7</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>20</b>	<b>5</b>	<b>412</b>	<b>49</b>	<b>0</b>	<b>0</b>	<b>466</b>	<b>54</b>	<b>2</b>	<b>52</b>	<b>0</b>	<b>2</b>	<b>108</b>	<b>64</b>	<b>366</b>	<b>15</b>	<b>0</b>	<b>3</b>	<b>445</b>	<b>1039</b>
Approach %	60.0	35.0	5.0	0.0	-	-	1.1	88.4	10.5	0.0	-	-	50.0	1.9	48.1	0.0	-	-	14.4	82.2	3.4	0.0	-	-	-
Total %	1.2	0.7	0.1	0.0	-	1.9	0.5	39.7	4.7	0.0	-	44.9	5.2	0.2	5.0	0.0	-	10.4	6.2	35.2	1.4	0.0	-	42.8	-
PHF	0.750	0.438	0.250	0.000	-	0.625	0.625	0.912	0.766	0.000	-	0.947	0.794	0.500	0.765	0.000	-	0.900	0.889	0.817	0.938	0.000	-	0.849	0.928
Lights	11	3	1	0	-	15	5	407	49	0	-	461	50	2	51	0	-	103	64	363	15	0	-	442	1021
% Lights	91.7	42.9	100.0	-	-	75.0	100.0	98.8	100.0	-	-	98.9	92.6	100.0	98.1	-	-	95.4	100.0	99.2	100.0	-	-	99.3	98.3
Buses	0	0	0	0	-	0	0	2	0	0	-	2	4	0	0	0	-	4	0	1	0	0	-	1	7
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	0.5	0.0	-	-	0.4	7.4	0.0	0.0	-	-	3.7	0.0	0.3	0.0	-	-	0.2	0.7
Trucks	0	0	0	0	-	0	0	3	0	0	-	3	0	0	1	0	-	1	0	0	0	0	-	0	4
% Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.7	0.0	-	-	0.6	0.0	0.0	1.9	-	-	0.9	0.0	0.0	0.0	-	-	0.0	0.4
Bicycles on Road	1	4	0	0	-	5	0	0	0	0	-	0	0	0	0	0	-	0	0	2	0	0	-	2	7
% Bicycles on Road	8.3	57.1	0.0	-	-	25.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.5	0.0	-	-	0.4	0.7
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	4	-	-	-	-	-	0	-	-	-	-	-	2	-	-	-	-	-	3	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-





Turning Movement Peak Hour Data Plot (4:45 PM)

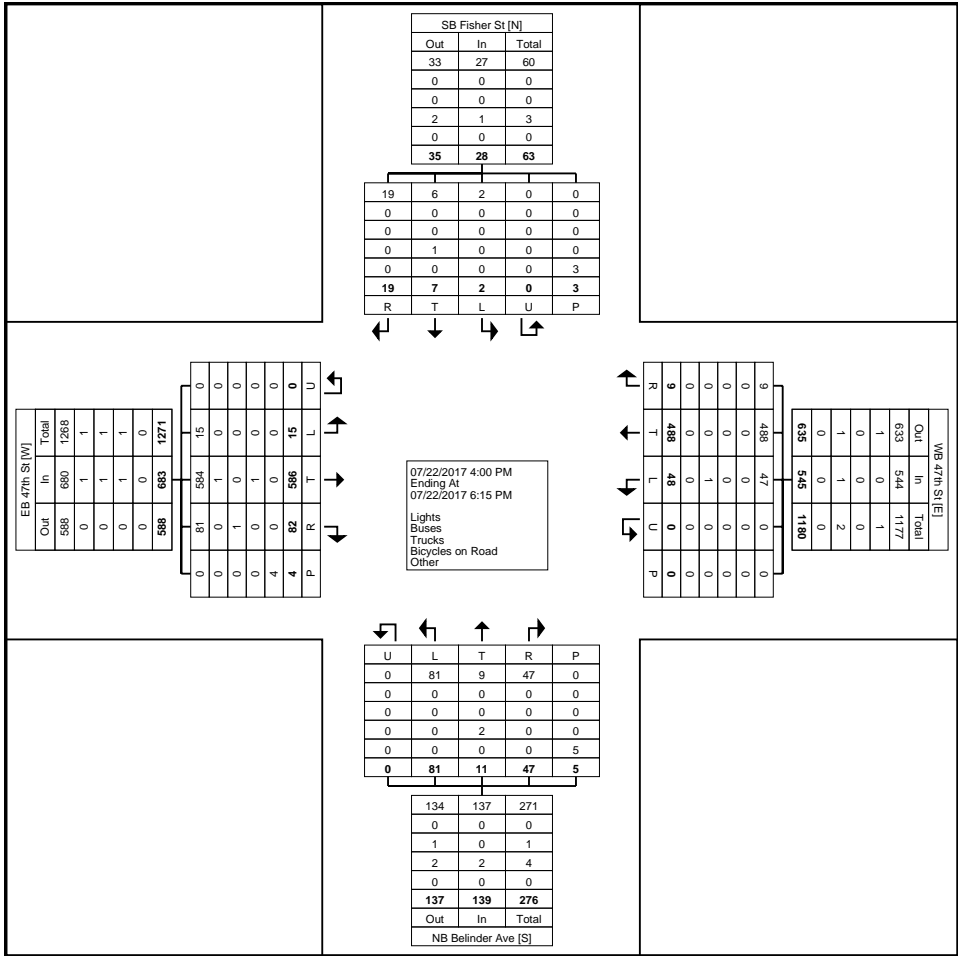


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Count Name: 47th St & Belinder Ave  
 Site Code:  
 Start Date: 07/22/2017  
 Page No: 1

### Turning Movement Data

Start Time	SB Fisher St Southbound						WB 47th St Westbound						NB Belinder Ave Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
4:00 PM	1	1	0	0	0	2	3	59	9	0	0	71	6	1	5	0	1	12	10	74	1	0	1	85	170
4:15 PM	3	1	0	0	2	4	0	53	12	0	0	65	9	2	12	0	2	23	6	82	0	0	1	88	180
4:30 PM	5	1	0	0	0	6	0	57	3	0	0	60	6	1	10	0	0	17	11	69	1	0	0	81	164
4:45 PM	1	1	1	0	0	3	1	58	1	0	0	60	6	1	7	0	0	14	15	72	2	0	1	89	166
Hourly Total	10	4	1	0	2	15	4	227	25	0	0	256	27	5	34	0	3	66	42	297	4	0	3	343	680
5:00 PM	3	1	0	0	0	4	2	76	8	0	0	86	5	1	12	0	1	18	11	64	1	0	0	76	184
5:15 PM	2	1	0	0	1	3	1	64	4	0	0	69	2	1	10	0	0	13	13	65	5	0	0	83	168
5:30 PM	1	0	1	0	0	2	2	58	5	0	0	65	4	3	8	0	1	15	7	88	1	0	1	96	178
5:45 PM	3	1	0	0	0	4	0	63	6	0	0	69	9	1	17	0	0	27	9	72	4	0	0	85	185
Hourly Total	9	3	1	0	1	13	5	261	23	0	0	289	20	6	47	0	2	73	40	289	11	0	1	340	715
6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	19	7	2	0	3	28	9	488	48	0	0	545	47	11	81	0	5	139	82	586	15	0	4	683	1395
Approach %	67.9	25.0	7.1	0.0	-	-	1.7	89.5	8.8	0.0	-	-	33.8	7.9	58.3	0.0	-	-	12.0	85.8	2.2	0.0	-	-	-
Total %	1.4	0.5	0.1	0.0	-	2.0	0.6	35.0	3.4	0.0	-	39.1	3.4	0.8	5.8	0.0	-	10.0	5.9	42.0	1.1	0.0	-	49.0	-
Lights	19	6	2	0	-	27	9	488	47	0	-	544	47	9	81	0	-	137	81	584	15	0	-	680	1388
% Lights	100.0	85.7	100.0	-	-	96.4	100.0	100.0	97.9	-	-	99.8	100.0	81.8	100.0	-	-	98.6	98.8	99.7	100.0	-	-	99.6	99.5
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	1
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.2	0.0	-	-	0.1	0.1
Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	1	0	0	0	-	1	1
% Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	1.2	0.0	0.0	-	-	0.1	0.1
Bicycles on Road	0	1	0	0	-	1	0	0	1	0	-	1	0	2	0	0	-	2	0	1	0	0	-	1	5
% Bicycles on Road	0.0	14.3	0.0	-	-	3.6	0.0	0.0	2.1	-	-	0.2	0.0	18.2	0.0	-	-	1.4	0.0	0.2	0.0	-	-	0.1	0.4
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	3	-	-	-	-	-	0	-	-	-	-	-	5	-	-	-	-	-	4	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



Turning Movement Data Plot



CFS Engineers - Missouri  
 9229 Ward Parkway  
 Suite 110  
 Kansas City, Missouri, United States 64114  
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Count Name: 47th St & Belinder Ave  
 Site Code:  
 Start Date: 07/22/2017  
 Page No: 3

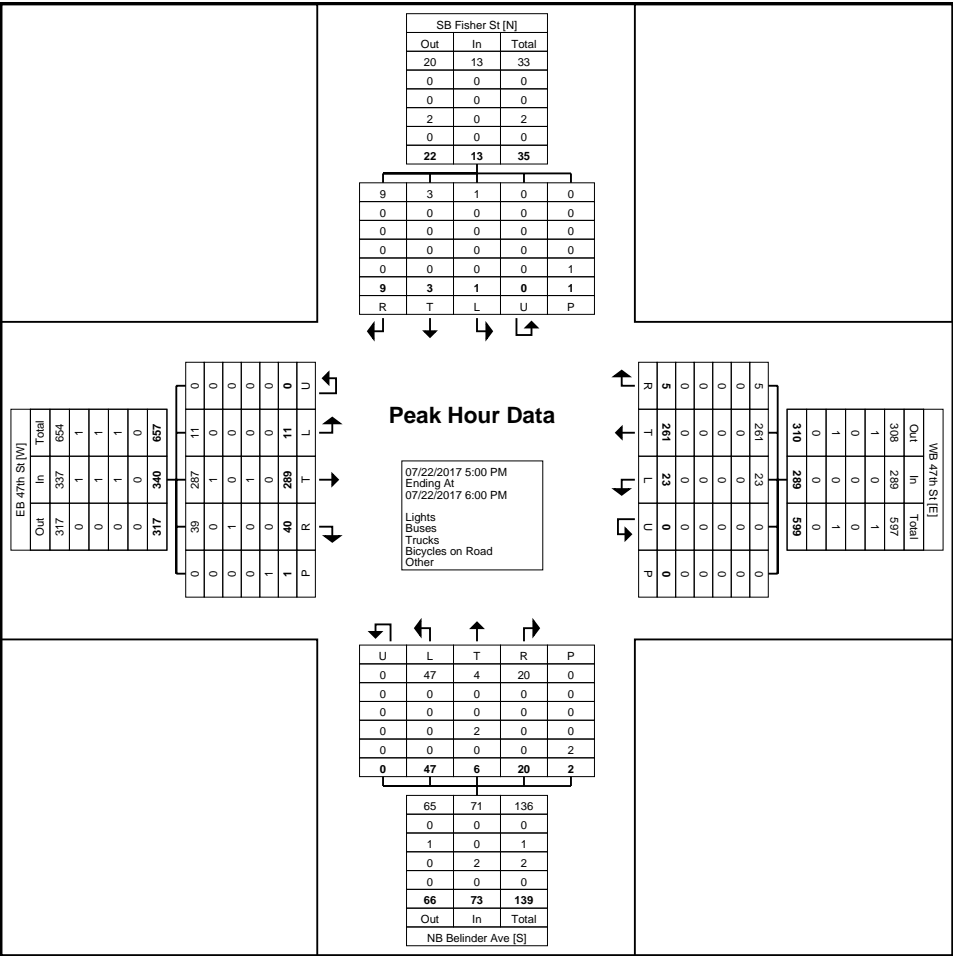
### Turning Movement Peak Hour Data (5:00 PM)

Start Time	SB Fisher St Southbound						WB 47th St Westbound						NB Belinder Ave Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
5:00 PM	3	1	0	0	0	4	2	76	8	0	0	86	5	1	12	0	1	18	11	64	1	0	0	76	184
5:15 PM	2	1	0	0	1	3	1	64	4	0	0	69	2	1	10	0	0	13	13	65	5	0	0	83	168
5:30 PM	1	0	1	0	0	2	2	58	5	0	0	65	4	3	8	0	1	15	7	88	1	0	1	96	178
5:45 PM	3	1	0	0	0	4	0	63	6	0	0	69	9	1	17	0	0	27	9	72	4	0	0	85	185
<b>Total</b>	<b>9</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>13</b>	<b>5</b>	<b>261</b>	<b>23</b>	<b>0</b>	<b>0</b>	<b>289</b>	<b>20</b>	<b>6</b>	<b>47</b>	<b>0</b>	<b>2</b>	<b>73</b>	<b>40</b>	<b>289</b>	<b>11</b>	<b>0</b>	<b>1</b>	<b>340</b>	<b>715</b>
Approach %	69.2	23.1	7.7	0.0	-	-	1.7	90.3	8.0	0.0	-	-	27.4	8.2	64.4	0.0	-	-	11.8	85.0	3.2	0.0	-	-	-
Total %	1.3	0.4	0.1	0.0	-	1.8	0.7	36.5	3.2	0.0	-	40.4	2.8	0.8	6.6	0.0	-	10.2	5.6	40.4	1.5	0.0	-	47.6	-
PHF	0.750	0.750	0.250	0.000	-	0.813	0.625	0.859	0.719	0.000	-	0.840	0.556	0.500	0.691	0.000	-	0.676	0.769	0.821	0.550	0.000	-	0.885	0.966
Lights	9	3	1	0	-	13	5	261	23	0	-	289	20	4	47	0	-	71	39	287	11	0	-	337	710
% Lights	100.0	100.0	100.0	-	-	100.0	100.0	100.0	100.0	-	-	100.0	100.0	66.7	100.0	-	-	97.3	97.5	99.3	100.0	-	-	99.1	99.3
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	1
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.3	0.0	-	-	0.3	0.1
Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	1	0	0	0	-	1	1
% Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	2.5	0.0	0.0	-	-	0.3	0.1
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	2	0	0	-	2	0	1	0	0	-	1	3
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	33.3	0.0	-	-	2.7	0.0	0.3	0.0	-	-	0.3	0.4
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	2	-	-	-	-	-	1	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



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Count Name: 47th St & Belinder Ave  
 Site Code:  
 Start Date: 07/22/2017  
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Turning Movement Peak Hour Data Plot (5:00 PM)



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Count Name: 47th St & Rainbow Blvd  
 Site Code:  
 Start Date: 07/12/2017  
 Page No: 1

### Turning Movement Data

Start Time	SB Rainbow Blvd/US-169 Southbound						WB Access Drive Westbound						NB Rainbow Blvd/US-169 Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
7:00 AM	16	46	3	0	0	65	1	0	1	0	3	2	0	89	18	0	2	107	26	0	35	0	1	61	235
7:15 AM	12	56	0	0	0	68	2	0	2	0	1	4	0	132	12	0	0	144	30	2	46	0	0	78	294
7:30 AM	18	75	3	0	1	96	3	2	1	0	2	6	0	182	18	0	0	200	29	0	60	0	0	89	391
7:45 AM	22	106	1	0	0	129	4	1	2	0	0	7	0	145	15	0	0	160	53	2	68	0	1	123	419
Hourly Total	68	283	7	0	1	358	10	3	6	0	6	19	0	548	63	0	2	611	138	4	209	0	2	351	1339
8:00 AM	18	84	2	0	0	104	4	1	3	0	0	8	0	124	19	0	0	143	38	1	63	0	0	102	357
8:15 AM	15	83	1	0	0	99	4	0	2	0	0	6	1	119	20	0	0	140	33	3	57	0	0	93	338
8:30 AM	17	88	3	0	0	108	3	1	1	0	2	5	0	107	19	0	0	126	30	1	53	0	0	84	323
8:45 AM	21	71	1	0	1	93	0	0	2	0	2	2	1	103	19	0	1	123	40	1	51	0	1	92	310
Hourly Total	71	326	7	0	1	404	11	2	8	0	4	21	2	453	77	0	1	532	141	6	224	0	1	371	1328
9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	139	609	14	0	2	762	21	5	14	0	10	40	2	1001	140	0	3	1143	279	10	433	0	3	722	2667
Approach %	18.2	79.9	1.8	0.0	-	-	52.5	12.5	35.0	0.0	-	-	0.2	87.6	12.2	0.0	-	-	38.6	1.4	60.0	0.0	-	-	-
Total %	5.2	22.8	0.5	0.0	-	28.6	0.8	0.2	0.5	0.0	-	1.5	0.1	37.5	5.2	0.0	-	42.9	10.5	0.4	16.2	0.0	-	27.1	-
Lights	133	589	13	0	-	735	21	5	13	0	-	39	2	988	138	0	-	1128	279	9	422	0	-	710	2612
% Lights	95.7	96.7	92.9	-	-	96.5	100.0	100.0	92.9	-	-	97.5	100.0	98.7	98.6	-	-	98.7	100.0	90.0	97.5	-	-	98.3	97.9
Buses	0	12	0	0	-	12	0	0	0	0	-	0	0	8	0	0	-	8	0	0	9	0	-	9	29
% Buses	0.0	2.0	0.0	-	-	1.6	0.0	0.0	0.0	-	-	0.0	0.0	0.8	0.0	-	-	0.7	0.0	0.0	2.1	-	-	1.2	1.1
Trucks	6	8	1	0	-	15	0	0	1	0	-	1	0	5	2	0	-	7	0	1	2	0	-	3	26
% Trucks	4.3	1.3	7.1	-	-	2.0	0.0	0.0	7.1	-	-	2.5	0.0	0.5	1.4	-	-	0.6	0.0	10.0	0.5	-	-	0.4	1.0
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	33.3	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	2	-	-	-	-	-	10	-	-	-	-	-	2	-	-	-	-	-	3	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	66.7	-	-	-	-	-	100.0	-	-





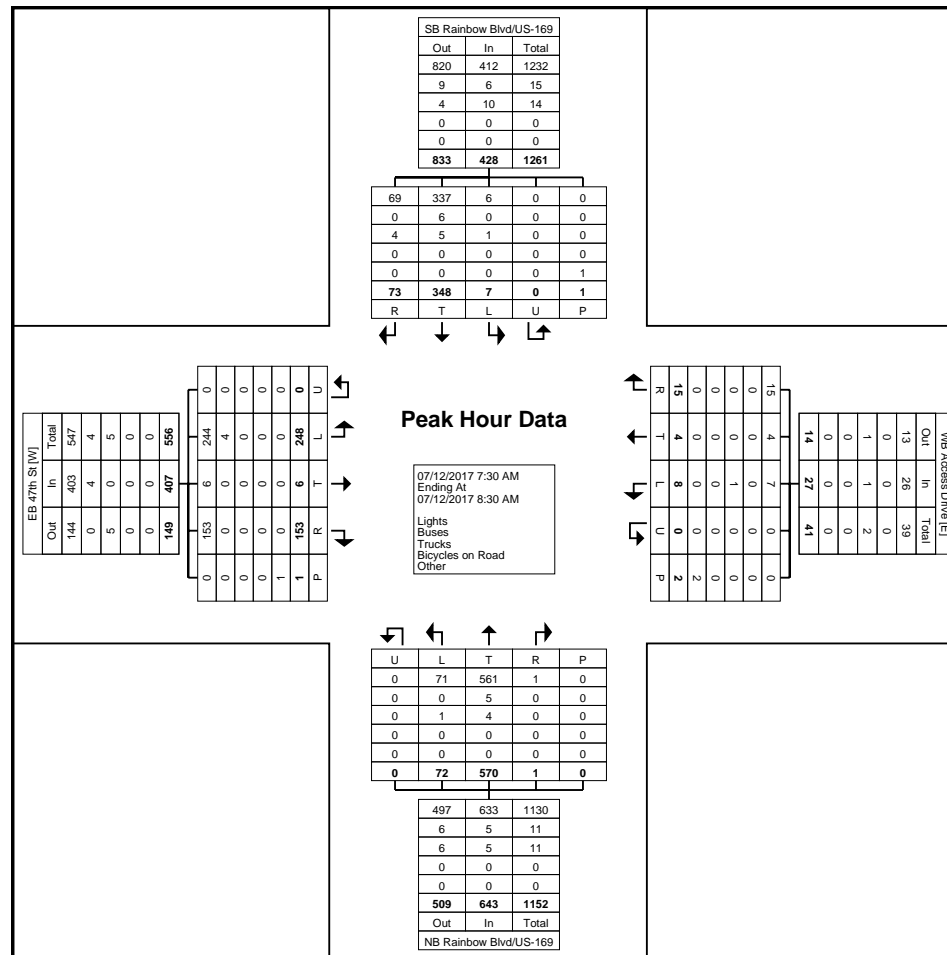
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Count Name: 47th St & Rainbow Blvd  
 Site Code:  
 Start Date: 07/12/2017  
 Page No: 3

### Turning Movement Peak Hour Data (7:30 AM)

Start Time	SB Rainbow Blvd/US-169 Southbound						WB Access Drive Westbound						NB Rainbow Blvd/US-169 Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
7:30 AM	18	75	3	0	1	96	3	2	1	0	2	6	0	182	18	0	0	200	29	0	60	0	0	89	391
7:45 AM	22	106	1	0	0	129	4	1	2	0	0	7	0	145	15	0	0	160	53	2	68	0	1	123	419
8:00 AM	18	84	2	0	0	104	4	1	3	0	0	8	0	124	19	0	0	143	38	1	63	0	0	102	357
8:15 AM	15	83	1	0	0	99	4	0	2	0	0	6	1	119	20	0	0	140	33	3	57	0	0	93	338
Total	73	348	7	0	1	428	15	4	8	0	2	27	1	570	72	0	0	643	153	6	248	0	1	407	1505
Approach %	17.1	81.3	1.6	0.0	-	-	55.6	14.8	29.6	0.0	-	-	0.2	88.6	11.2	0.0	-	-	37.6	1.5	60.9	0.0	-	-	-
Total %	4.9	23.1	0.5	0.0	-	28.4	1.0	0.3	0.5	0.0	-	1.8	0.1	37.9	4.8	0.0	-	42.7	10.2	0.4	16.5	0.0	-	27.0	-
PHF	0.830	0.821	0.583	0.000	-	0.829	0.938	0.500	0.667	0.000	-	0.844	0.250	0.783	0.900	0.000	-	0.804	0.722	0.500	0.912	0.000	-	0.827	0.898
Lights	69	337	6	0	-	412	15	4	7	0	-	26	1	561	71	0	-	633	153	6	244	0	-	403	1474
% Lights	94.5	96.8	85.7	-	-	96.3	100.0	100.0	87.5	-	-	96.3	100.0	98.4	98.6	-	-	98.4	100.0	100.0	98.4	-	-	99.0	97.9
Buses	0	6	0	0	-	6	0	0	0	0	-	0	0	5	0	0	-	5	0	0	4	0	-	4	15
% Buses	0.0	1.7	0.0	-	-	1.4	0.0	0.0	0.0	-	-	0.0	0.0	0.9	0.0	-	-	0.8	0.0	0.0	1.6	-	-	1.0	1.0
Trucks	4	5	1	0	-	10	0	0	1	0	-	1	0	4	1	0	-	5	0	0	0	0	-	0	16
% Trucks	5.5	1.4	14.3	-	-	2.3	0.0	0.0	12.5	-	-	3.7	0.0	0.7	1.4	-	-	0.8	0.0	0.0	0.0	-	-	0.0	1.1
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-	0	-	-	-	-	-	1	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	0	-	-	-	-	-	100.0	-	-





Turning Movement Peak Hour Data Plot (7:30 AM)

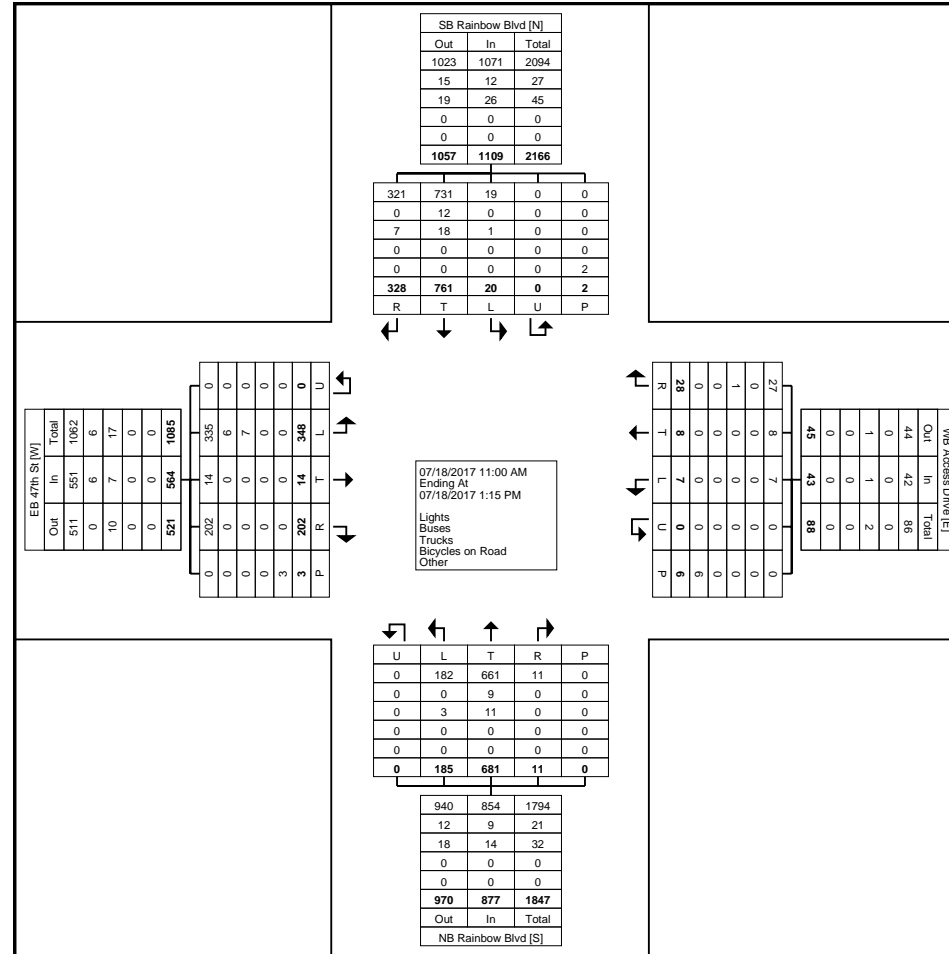


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Count Name: 47th St & Rainbow Blvd  
 Site Code:  
 Start Date: 07/18/2017  
 Page No: 1

### Turning Movement Data

Start Time	SB Rainbow Blvd Southbound						WB Access Drive Westbound						NB Rainbow Blvd Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
11:00 AM	40	80	2	0	0	122	3	1	0	0	0	4	0	65	21	0	0	86	17	1	33	0	0	51	263
11:15 AM	25	97	2	0	0	124	2	1	2	0	0	5	0	94	20	0	0	114	19	1	46	0	0	66	309
11:30 AM	39	94	2	0	1	135	2	1	2	0	1	5	1	79	18	0	0	98	22	1	31	0	0	54	292
11:45 AM	36	103	4	0	0	143	4	1	1	0	2	6	0	68	21	0	0	89	27	2	46	0	0	75	313
Hourly Total	140	374	10	0	1	524	11	4	5	0	3	20	1	306	80	0	0	387	85	5	156	0	0	246	1177
12:00 PM	45	102	5	0	1	152	6	2	0	0	2	8	4	80	26	0	0	110	27	3	41	0	2	71	341
12:15 PM	49	108	3	0	0	160	3	0	1	0	1	4	4	94	32	0	0	130	34	3	47	0	1	84	378
12:30 PM	45	85	1	0	0	131	4	1	0	0	0	5	1	110	28	0	0	139	31	1	41	0	0	73	348
12:45 PM	49	92	1	0	0	142	4	1	1	0	0	6	1	91	19	0	0	111	25	2	63	0	0	90	349
Hourly Total	188	387	10	0	1	585	17	4	2	0	3	23	10	375	105	0	0	490	117	9	192	0	3	318	1416
1:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	328	761	20	0	2	1109	28	8	7	0	6	43	11	681	185	0	0	877	202	14	348	0	3	564	2593
Approach %	29.6	68.6	1.8	0.0	-	-	65.1	18.6	16.3	0.0	-	-	1.3	77.7	21.1	0.0	-	-	35.8	2.5	61.7	0.0	-	-	-
Total %	12.6	29.3	0.8	0.0	-	42.8	1.1	0.3	0.3	0.0	-	1.7	0.4	26.3	7.1	0.0	-	33.8	7.8	0.5	13.4	0.0	-	21.8	-
Lights	321	731	19	0	-	1071	27	8	7	0	-	42	11	661	182	0	-	854	202	14	335	0	-	551	2518
% Lights	97.9	96.1	95.0	-	-	96.6	96.4	100.0	100.0	-	-	97.7	100.0	97.1	98.4	-	-	97.4	100.0	100.0	96.3	-	-	97.7	97.1
Buses	0	12	0	0	-	12	0	0	0	0	-	0	0	9	0	0	-	9	0	0	6	0	-	6	27
% Buses	0.0	1.6	0.0	-	-	1.1	0.0	0.0	0.0	-	-	0.0	0.0	1.3	0.0	-	-	1.0	0.0	0.0	1.7	-	-	1.1	1.0
Trucks	7	18	1	0	-	26	1	0	0	0	-	1	0	11	3	0	-	14	0	0	7	0	-	7	48
% Trucks	2.1	2.4	5.0	-	-	2.3	3.6	0.0	0.0	-	-	2.3	0.0	1.6	1.6	-	-	1.6	0.0	0.0	2.0	-	-	1.2	1.9
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	16.7	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	2	-	-	-	-	-	5	-	-	-	-	-	0	-	-	-	-	-	3	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	83.3	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-



Turning Movement Data Plot

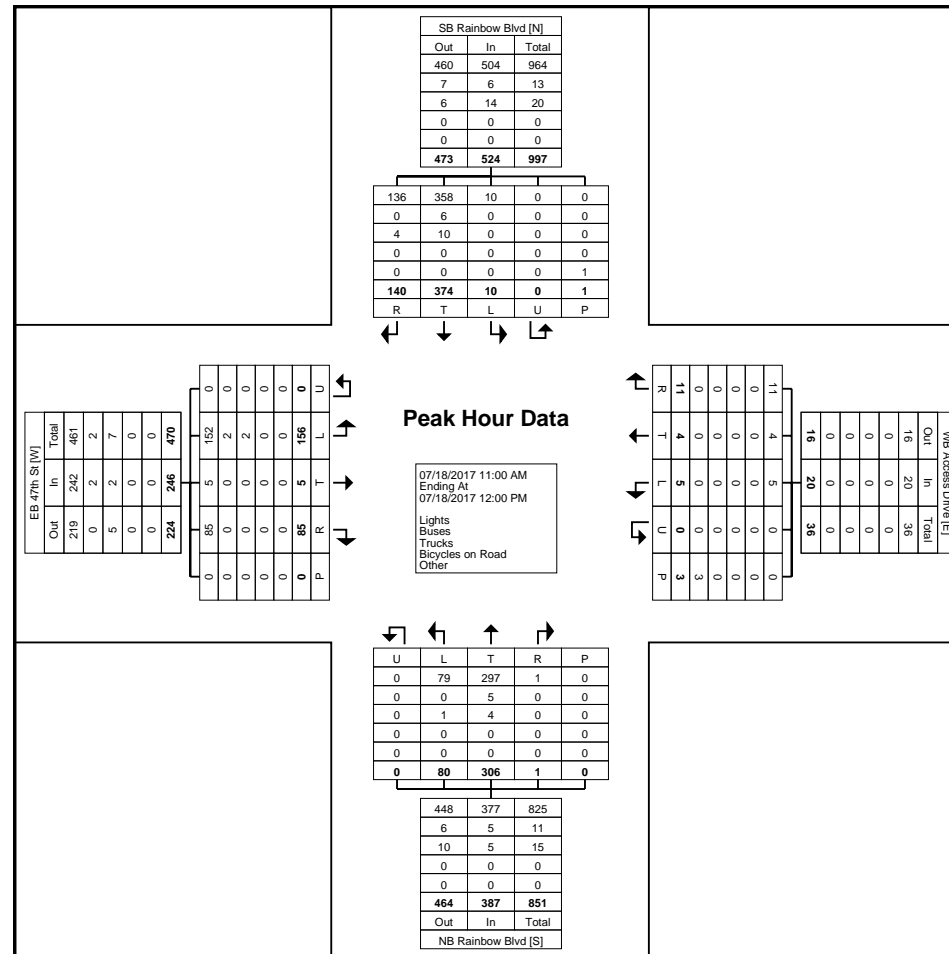


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 Start Date: 07/18/2017  
 Page No: 3

### Turning Movement Peak Hour Data (11:00 AM)

Start Time	SB Rainbow Blvd Southbound						WB Access Drive Westbound						NB Rainbow Blvd Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
11:00 AM	40	80	2	0	0	122	3	1	0	0	0	4	0	65	21	0	0	86	17	1	33	0	0	51	263
11:15 AM	25	97	2	0	0	124	2	1	2	0	0	5	0	94	20	0	0	114	19	1	46	0	0	66	309
11:30 AM	39	94	2	0	1	135	2	1	2	0	1	5	1	79	18	0	0	98	22	1	31	0	0	54	292
11:45 AM	36	103	4	0	0	143	4	1	1	0	2	6	0	68	21	0	0	89	27	2	46	0	0	75	313
Total	140	374	10	0	1	524	11	4	5	0	3	20	1	306	80	0	0	387	85	5	156	0	0	246	1177
Approach %	26.7	71.4	1.9	0.0	-	-	55.0	20.0	25.0	0.0	-	-	0.3	79.1	20.7	0.0	-	-	34.6	2.0	63.4	0.0	-	-	-
Total %	11.9	31.8	0.8	0.0	-	44.5	0.9	0.3	0.4	0.0	-	1.7	0.1	26.0	6.8	0.0	-	32.9	7.2	0.4	13.3	0.0	-	20.9	-
PHF	0.875	0.908	0.625	0.000	-	0.916	0.688	1.000	0.625	0.000	-	0.833	0.250	0.814	0.952	0.000	-	0.849	0.787	0.625	0.848	0.000	-	0.820	0.940
Lights	136	358	10	0	-	504	11	4	5	0	-	20	1	297	79	0	-	377	85	5	152	0	-	242	1143
% Lights	97.1	95.7	100.0	-	-	96.2	100.0	100.0	100.0	-	-	100.0	100.0	97.1	98.8	-	-	97.4	100.0	100.0	97.4	-	-	98.4	97.1
Buses	0	6	0	0	-	6	0	0	0	0	-	0	0	5	0	0	-	5	0	0	2	0	-	2	13
% Buses	0.0	1.6	0.0	-	-	1.1	0.0	0.0	0.0	-	-	0.0	0.0	1.6	0.0	-	-	1.3	0.0	0.0	1.3	-	-	0.8	1.1
Trucks	4	10	0	0	-	14	0	0	0	0	-	0	0	4	1	0	-	5	0	0	2	0	-	2	21
% Trucks	2.9	2.7	0.0	-	-	2.7	0.0	0.0	0.0	-	-	0.0	0.0	1.3	1.3	-	-	1.3	0.0	0.0	1.3	-	-	0.8	1.8
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	3	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Turning Movement Peak Hour Data Plot (11:00 AM)



CFS Engineers - Missouri  
 9229 Ward Parkway  
 Suite 110  
 Kansas City, Missouri, United States 64114  
 (816) 333-4477 arobertson@cfse.com

Count Name: 47th St & Rainbow Blvd  
 Site Code:  
 Start Date: 07/18/2017  
 Page No: 5

### Turning Movement Peak Hour Data (12:00 PM)

Start Time	SB Rainbow Blvd Southbound						WB Access Drive Westbound						NB Rainbow Blvd Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
12:00 PM	45	102	5	0	1	152	6	2	0	0	2	8	4	80	26	0	0	110	27	3	41	0	2	71	341
12:15 PM	49	108	3	0	0	160	3	0	1	0	1	4	4	94	32	0	0	130	34	3	47	0	1	84	378
12:30 PM	45	85	1	0	0	131	4	1	0	0	0	5	1	110	28	0	0	139	31	1	41	0	0	73	348
12:45 PM	49	92	1	0	0	142	4	1	1	0	0	6	1	91	19	0	0	111	25	2	63	0	0	90	349
<b>Total</b>	<b>188</b>	<b>387</b>	<b>10</b>	<b>0</b>	<b>1</b>	<b>585</b>	<b>17</b>	<b>4</b>	<b>2</b>	<b>0</b>	<b>3</b>	<b>23</b>	<b>10</b>	<b>375</b>	<b>105</b>	<b>0</b>	<b>0</b>	<b>490</b>	<b>117</b>	<b>9</b>	<b>192</b>	<b>0</b>	<b>3</b>	<b>318</b>	<b>1416</b>
Approach %	32.1	66.2	1.7	0.0	-	-	73.9	17.4	8.7	0.0	-	-	2.0	76.5	21.4	0.0	-	-	36.8	2.8	60.4	0.0	-	-	-
Total %	13.3	27.3	0.7	0.0	-	41.3	1.2	0.3	0.1	0.0	-	1.6	0.7	26.5	7.4	0.0	-	34.6	8.3	0.6	13.6	0.0	-	22.5	-
PHF	0.959	0.896	0.500	0.000	-	0.914	0.708	0.500	0.500	0.000	-	0.719	0.625	0.852	0.820	0.000	-	0.881	0.860	0.750	0.762	0.000	-	0.883	0.937
Lights	185	373	9	0	-	567	16	4	2	0	-	22	10	364	103	0	-	477	117	9	183	0	-	309	1375
% Lights	98.4	96.4	90.0	-	-	96.9	94.1	100.0	100.0	-	-	95.7	100.0	97.1	98.1	-	-	97.3	100.0	100.0	95.3	-	-	97.2	97.1
Buses	0	6	0	0	-	6	0	0	0	0	-	0	0	4	0	0	-	4	0	0	4	0	-	4	14
% Buses	0.0	1.6	0.0	-	-	1.0	0.0	0.0	0.0	-	-	0.0	0.0	1.1	0.0	-	-	0.8	0.0	0.0	2.1	-	-	1.3	1.0
Trucks	3	8	1	0	-	12	1	0	0	0	-	1	0	7	2	0	-	9	0	0	5	0	-	5	27
% Trucks	1.6	2.1	10.0	-	-	2.1	5.9	0.0	0.0	-	-	4.3	0.0	1.9	1.9	-	-	1.8	0.0	0.0	2.6	-	-	1.6	1.9
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	33.3	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-	0	-	-	-	-	-	3	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	66.7	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-





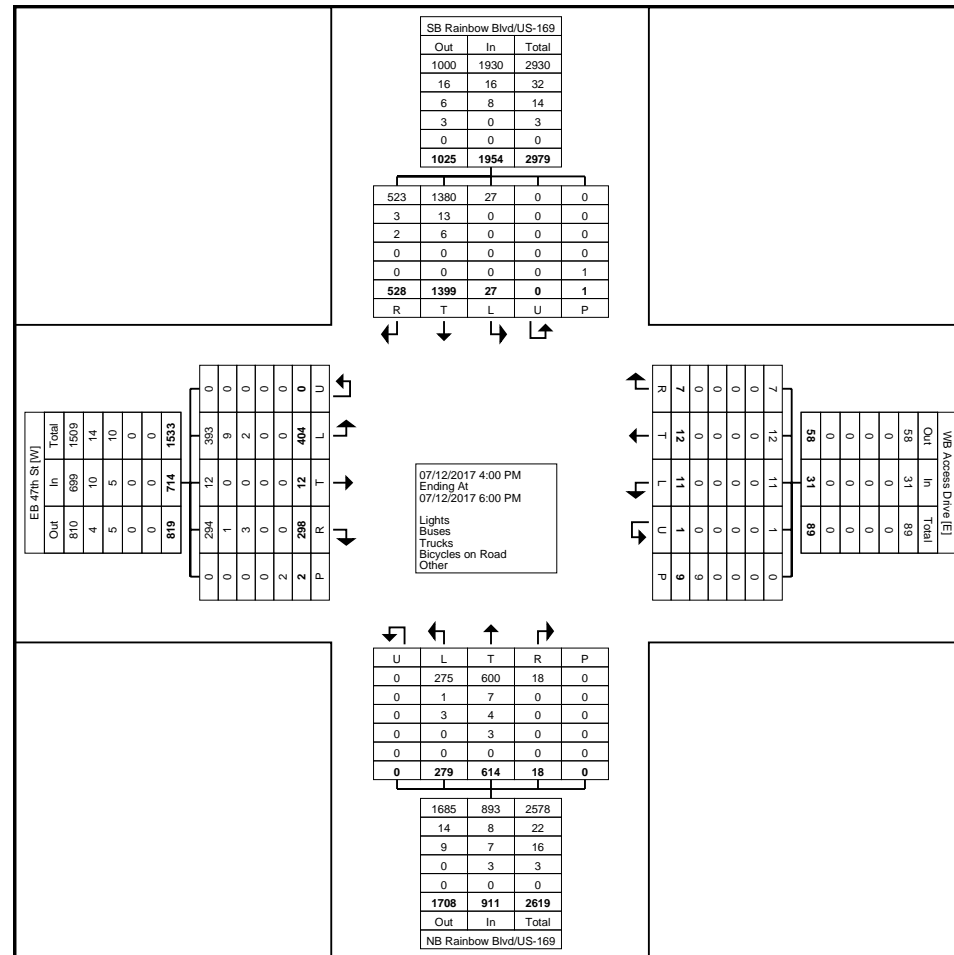
CFS Engineers - Missouri  
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Count Name: 47th St & Rainbow Blvd  
 Site Code:  
 Start Date: 07/12/2017  
 Page No: 1

### Turning Movement Data

Start Time	SB Rainbow Blvd/US-169 Southbound						WB Access Drive Westbound						NB Rainbow Blvd/US-169 Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
4:00 PM	54	102	6	0	0	162	0	1	2	0	1	3	0	71	37	0	0	108	35	1	45	0	0	81	354
4:15 PM	54	173	1	0	0	228	0	0	2	0	2	2	2	74	38	0	0	114	32	4	51	0	0	87	431
4:30 PM	55	202	1	0	1	258	1	3	2	1	1	7	0	76	30	0	0	106	39	0	51	0	0	90	461
4:45 PM	95	227	0	0	0	322	2	0	1	0	2	3	0	80	40	0	0	120	30	2	45	0	0	77	522
Hourly Total	258	704	8	0	1	970	3	4	7	1	6	15	2	301	145	0	0	448	136	7	192	0	0	335	1768
5:00 PM	73	196	5	0	0	274	2	3	1	0	0	6	2	90	26	0	0	118	44	1	49	0	0	94	492
5:15 PM	84	192	1	0	0	277	0	1	1	0	0	2	2	87	45	0	0	134	35	0	50	0	1	85	498
5:30 PM	55	164	6	0	0	225	2	2	0	0	2	4	5	66	35	0	0	106	36	1	58	0	1	95	430
5:45 PM	58	143	7	0	0	208	0	2	2	0	1	4	7	70	28	0	0	105	47	3	55	0	0	105	422
Hourly Total	270	695	19	0	0	984	4	8	4	0	3	16	16	313	134	0	0	463	162	5	212	0	2	379	1842
Grand Total	528	1399	27	0	1	1954	7	12	11	1	9	31	18	614	279	0	0	911	298	12	404	0	2	714	3610
Approach %	27.0	71.6	1.4	0.0	-	-	22.6	38.7	35.5	3.2	-	-	2.0	67.4	30.6	0.0	-	-	41.7	1.7	56.6	0.0	-	-	-
Total %	14.6	38.8	0.7	0.0	-	54.1	0.2	0.3	0.3	0.0	-	0.9	0.5	17.0	7.7	0.0	-	25.2	8.3	0.3	11.2	0.0	-	19.8	-
Lights	523	1380	27	0	-	1930	7	12	11	1	-	31	18	600	275	0	-	893	294	12	393	0	-	699	3553
% Lights	99.1	98.6	100.0	-	-	98.8	100.0	100.0	100.0	100.0	-	100.0	100.0	97.7	98.6	-	-	98.0	98.7	100.0	97.3	-	-	97.9	98.4
Buses	3	13	0	0	-	16	0	0	0	0	-	0	0	7	1	0	-	8	1	0	9	0	-	10	34
% Buses	0.6	0.9	0.0	-	-	0.8	0.0	0.0	0.0	0.0	-	0.0	0.0	1.1	0.4	-	-	0.9	0.3	0.0	2.2	-	-	1.4	0.9
Trucks	2	6	0	0	-	8	0	0	0	0	-	0	0	4	3	0	-	7	3	0	2	0	-	5	20
% Trucks	0.4	0.4	0.0	-	-	0.4	0.0	0.0	0.0	0.0	-	0.0	0.0	0.7	1.1	-	-	0.8	1.0	0.0	0.5	-	-	0.7	0.6
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	3	0	0	-	3	0	0	0	0	-	0	3
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.5	0.0	-	-	0.3	0.0	0.0	0.0	-	-	0.0	0.1
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	9	-	-	-	-	-	0	-	-	-	-	-	2	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-





Turning Movement Data Plot

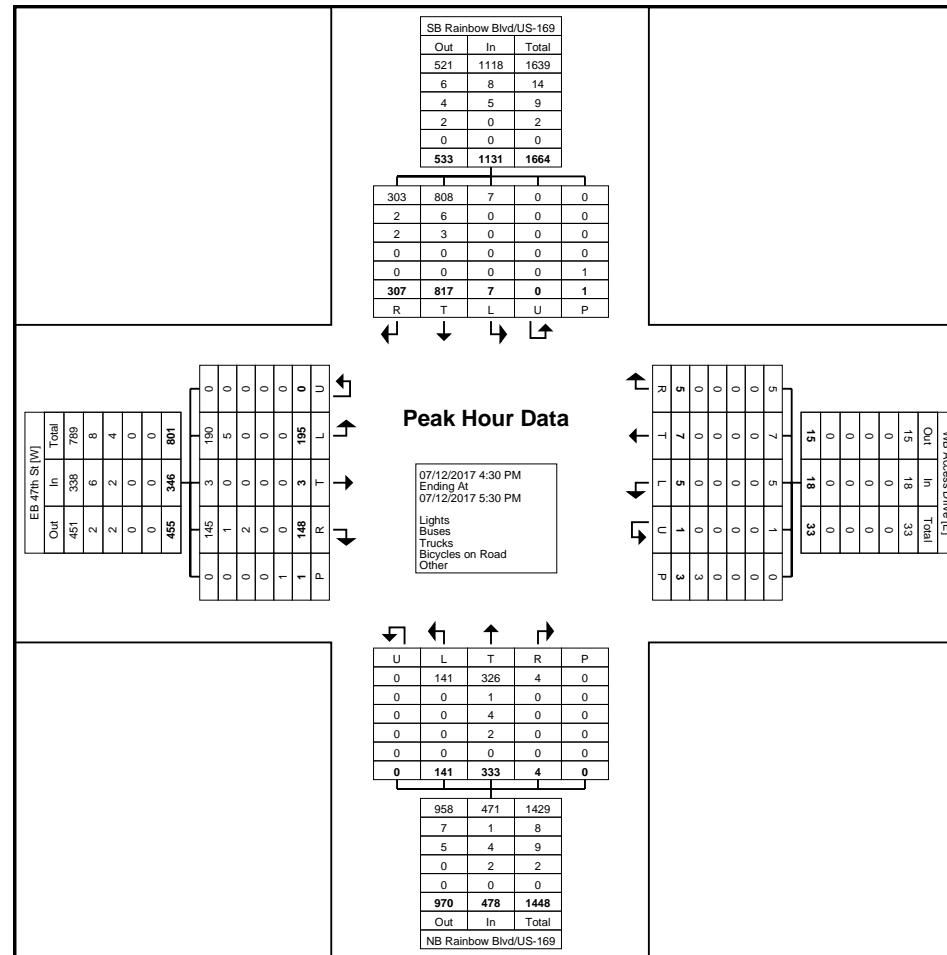


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Count Name: 47th St & Rainbow Blvd  
 Site Code:  
 Start Date: 07/12/2017  
 Page No: 3

### Turning Movement Peak Hour Data (4:30 PM)

Start Time	SB Rainbow Blvd/US-169 Southbound						WB Access Drive Westbound						NB Rainbow Blvd/US-169 Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
4:30 PM	55	202	1	0	1	258	1	3	2	1	1	7	0	76	30	0	0	106	39	0	51	0	0	90	461
4:45 PM	95	227	0	0	0	322	2	0	1	0	2	3	0	80	40	0	0	120	30	2	45	0	0	77	522
5:00 PM	73	196	5	0	0	274	2	3	1	0	0	6	2	90	26	0	0	118	44	1	49	0	0	94	492
5:15 PM	84	192	1	0	0	277	0	1	1	0	0	2	2	87	45	0	0	134	35	0	50	0	1	85	498
Total	307	817	7	0	1	1131	5	7	5	1	3	18	4	333	141	0	0	478	148	3	195	0	1	346	1973
Approach %	27.1	72.2	0.6	0.0	-	-	27.8	38.9	27.8	5.6	-	-	0.8	69.7	29.5	0.0	-	-	42.8	0.9	56.4	0.0	-	-	-
Total %	15.6	41.4	0.4	0.0	-	57.3	0.3	0.4	0.3	0.1	-	0.9	0.2	16.9	7.1	0.0	-	24.2	7.5	0.2	9.9	0.0	-	17.5	-
PHF	0.808	0.900	0.350	0.000	-	0.878	0.625	0.583	0.625	0.250	-	0.643	0.500	0.925	0.783	0.000	-	0.892	0.841	0.375	0.956	0.000	-	0.920	0.945
Lights	303	808	7	0	-	1118	5	7	5	1	-	18	4	326	141	0	-	471	145	3	190	0	-	338	1945
% Lights	98.7	98.9	100.0	-	-	98.9	100.0	100.0	100.0	100.0	-	100.0	100.0	97.9	100.0	-	-	98.5	98.0	100.0	97.4	-	-	97.7	98.6
Buses	2	6	0	0	-	8	0	0	0	0	-	0	0	1	0	0	-	1	1	0	5	0	-	6	15
% Buses	0.7	0.7	0.0	-	-	0.7	0.0	0.0	0.0	0.0	-	0.0	0.0	0.3	0.0	-	-	0.2	0.7	0.0	2.6	-	-	1.7	0.8
Trucks	2	3	0	0	-	5	0	0	0	0	-	0	0	4	0	0	-	4	2	0	0	0	-	2	11
% Trucks	0.7	0.4	0.0	-	-	0.4	0.0	0.0	0.0	0.0	-	0.0	0.0	1.2	0.0	-	-	0.8	1.4	0.0	0.0	-	-	0.6	0.6
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	2	0	0	-	2	0	0	0	0	-	0	2
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.6	0.0	-	-	0.4	0.0	0.0	0.0	-	-	0.0	0.1
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	3	-	-	-	-	-	0	-	-	-	-	-	1	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-



Turning Movement Peak Hour Data Plot (4:30 PM)

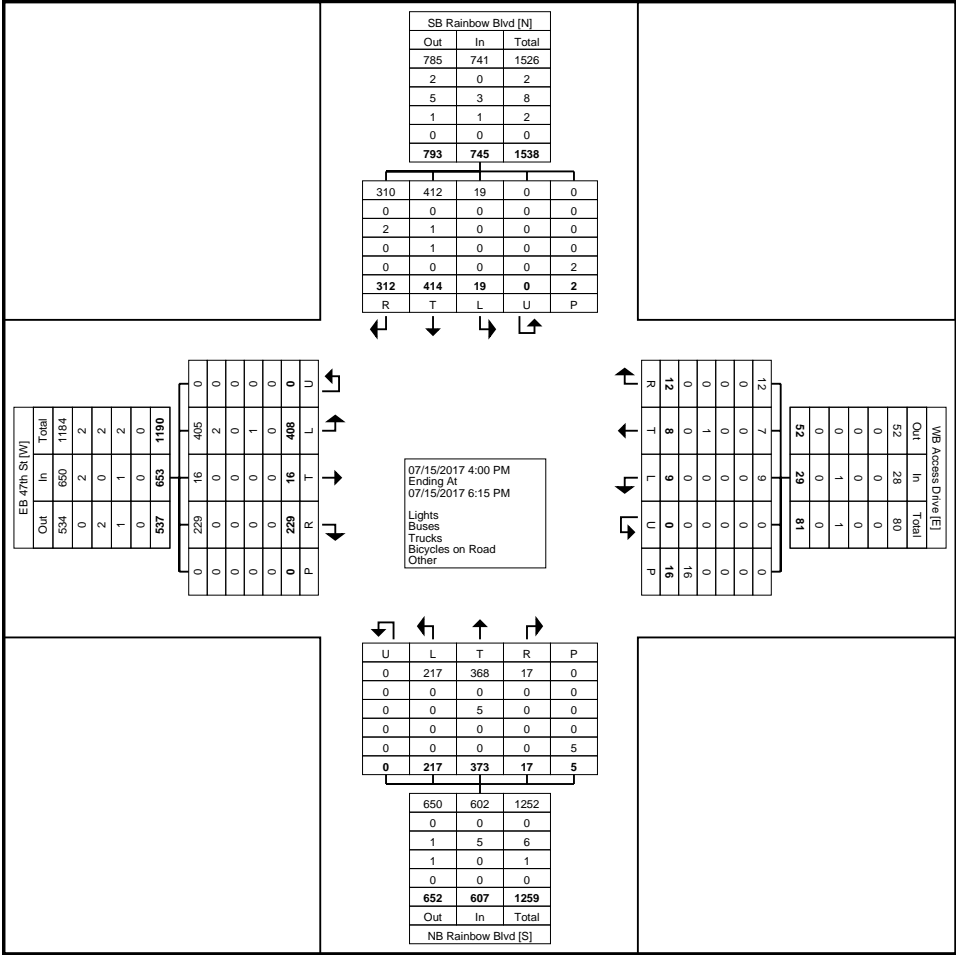


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Count Name: 47th St & Rainbow Blvd  
 Site Code:  
 Start Date: 07/15/2017  
 Page No: 1

### Turning Movement Data

Start Time	SB Rainbow Blvd Southbound						WB Access Drive Westbound						NB Rainbow Blvd Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
4:00 PM	50	61	4	0	0	115	1	2	1	0	1	4	2	52	30	0	3	84	32	1	61	0	0	94	297
4:15 PM	42	54	1	0	0	97	1	1	0	0	3	2	1	41	29	0	0	71	32	0	41	0	0	73	243
4:30 PM	29	57	1	0	0	87	0	0	2	0	4	2	0	58	22	0	1	80	28	0	41	0	0	69	238
4:45 PM	45	53	2	0	0	100	1	1	1	0	4	3	2	41	23	0	0	66	19	1	38	0	0	58	227
Hourly Total	166	225	8	0	0	399	3	4	4	0	12	11	5	192	104	0	4	301	111	2	181	0	0	294	1005
5:00 PM	38	48	3	0	2	89	5	1	0	0	3	6	2	41	30	0	0	73	35	4	58	0	0	97	265
5:15 PM	39	54	4	0	0	97	2	0	3	0	0	5	3	53	22	0	0	78	31	3	56	0	0	90	270
5:30 PM	30	44	2	0	0	76	0	3	1	0	1	4	4	43	31	0	1	78	25	6	69	0	0	100	258
5:45 PM	38	43	2	0	0	83	2	0	1	0	0	3	3	44	30	0	0	77	27	1	44	0	0	72	235
Hourly Total	145	189	11	0	2	345	9	4	5	0	4	18	12	181	113	0	1	306	118	14	227	0	0	359	1028
6:00 PM	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Grand Total	312	414	19	0	2	745	12	8	9	0	16	29	17	373	217	0	5	607	229	16	408	0	0	653	2034
Approach %	41.9	55.6	2.6	0.0	-	-	41.4	27.6	31.0	0.0	-	-	2.8	61.4	35.7	0.0	-	-	35.1	2.5	62.5	0.0	-	-	-
Total %	15.3	20.4	0.9	0.0	-	36.6	0.6	0.4	0.4	0.0	-	1.4	0.8	18.3	10.7	0.0	-	29.8	11.3	0.8	20.1	0.0	-	32.1	-
Lights	310	412	19	0	-	741	12	7	9	0	-	28	17	368	217	0	-	602	229	16	405	0	-	650	2021
% Lights	99.4	99.5	100.0	-	-	99.5	100.0	87.5	100.0	-	-	96.6	100.0	98.7	100.0	-	-	99.2	100.0	100.0	99.3	-	-	99.5	99.4
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	2	0	-	2	2
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.5	-	-	0.3	0.1
Trucks	2	1	0	0	-	3	0	0	0	0	-	0	0	5	0	0	-	5	0	0	0	0	-	0	8
% Trucks	0.6	0.2	0.0	-	-	0.4	0.0	0.0	0.0	-	-	0.0	0.0	1.3	0.0	-	-	0.8	0.0	0.0	0.0	-	-	0.0	0.4
Bicycles on Road	0	1	0	0	-	1	0	1	0	0	-	1	0	0	0	0	-	0	0	0	1	0	-	1	3
% Bicycles on Road	0.0	0.2	0.0	-	-	0.1	0.0	12.5	0.0	-	-	3.4	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.2	-	-	0.2	0.1
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	-	2	-	-	-	-	-	16	-	-	-	-	-	5	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-



Turning Movement Data Plot



CFS Engineers - Missouri  
 9229 Ward Parkway  
 Suite 110  
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Count Name: 47th St & Rainbow Blvd  
 Site Code:  
 Start Date: 07/15/2017  
 Page No: 3

### Turning Movement Peak Hour Data (5:00 PM)

Start Time	SB Rainbow Blvd Southbound						WB Access Drive Westbound						NB Rainbow Blvd Northbound						EB 47th St Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
5:00 PM	38	48	3	0	2	89	5	1	0	0	3	6	2	41	30	0	0	73	35	4	58	0	0	97	265
5:15 PM	39	54	4	0	0	97	2	0	3	0	0	5	3	53	22	0	0	78	31	3	56	0	0	90	270
5:30 PM	30	44	2	0	0	76	0	3	1	0	1	4	4	43	31	0	1	78	25	6	69	0	0	100	258
5:45 PM	38	43	2	0	0	83	2	0	1	0	0	3	3	44	30	0	0	77	27	1	44	0	0	72	235
<b>Total</b>	<b>145</b>	<b>189</b>	<b>11</b>	<b>0</b>	<b>2</b>	<b>345</b>	<b>9</b>	<b>4</b>	<b>5</b>	<b>0</b>	<b>4</b>	<b>18</b>	<b>12</b>	<b>181</b>	<b>113</b>	<b>0</b>	<b>1</b>	<b>306</b>	<b>118</b>	<b>14</b>	<b>227</b>	<b>0</b>	<b>0</b>	<b>359</b>	<b>1028</b>
Approach %	42.0	54.8	3.2	0.0	-	-	50.0	22.2	27.8	0.0	-	-	3.9	59.2	36.9	0.0	-	-	32.9	3.9	63.2	0.0	-	-	-
Total %	14.1	18.4	1.1	0.0	-	33.6	0.9	0.4	0.5	0.0	-	1.8	1.2	17.6	11.0	0.0	-	29.8	11.5	1.4	22.1	0.0	-	34.9	-
PHF	0.929	0.875	0.688	0.000	-	0.889	0.450	0.333	0.417	0.000	-	0.750	0.750	0.854	0.911	0.000	-	0.981	0.843	0.583	0.822	0.000	-	0.898	0.952
Lights	144	189	11	0	-	344	9	4	5	0	-	18	12	179	113	0	-	304	118	14	226	0	-	358	1024
% Lights	99.3	100.0	100.0	-	-	99.7	100.0	100.0	100.0	-	-	100.0	100.0	98.9	100.0	-	-	99.3	100.0	100.0	99.6	-	-	99.7	99.6
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	1	0	-	1	1
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.4	-	-	0.3	0.1
Trucks	1	0	0	0	-	1	0	0	0	0	-	0	0	2	0	0	-	2	0	0	0	0	-	0	3
% Trucks	0.7	0.0	0.0	-	-	0.3	0.0	0.0	0.0	-	-	0.0	0.0	1.1	0.0	-	-	0.7	0.0	0.0	0.0	-	-	0.0	0.3
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	-	2	-	-	-	-	-	4	-	-	-	-	-	1	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-



**Appendix of Synchro Results -  
Scenario 1 - Existing street/pre-development  
conditions (AM Peak Traffic 2017)**



Lanes, Volumes, Timings  
3: Mission Rd & W 47th St

8/1/2017



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕	↕	↕	↕		↕	↕	↕
Volume (vph)	149	281	32	18	101	78	14	179	39	89	110	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00					1.00			1.00		
Frt		0.990				0.850		0.973				0.850
Flt Protected		0.984			0.993		0.950			0.950		
Satd. Flow (prot)	0	3470	0	0	1871	1538	1805	1849	0	1770	1863	1524
Flt Permitted		0.816			0.898		0.682			0.519		
Satd. Flow (perm)	0	2876	0	0	1692	1538	1292	1849	0	966	1863	1524
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		14				91		20				98
Link Speed (mph)		30			30			30				30
Link Distance (ft)		173			222			132				127
Travel Time (s)		3.9			5.0			3.0				2.9
Confl. Peds. (#/hr)	1						2			1		
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	1%	1%	6%	0%	1%	5%	0%	0%	0%	2%	2%	6%
Adj. Flow (vph)	159	299	34	19	107	83	15	190	41	95	117	98
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	492	0	0	126	83	15	231	0	95	117	98
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2		1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100	20	20	100		20	100	20
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0	0	0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6	20	20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8	2			6		6
Detector Phase	4	4		8	8	8	5	2		1	6	6

Lanes, Volumes, Timings  
3: Mission Rd & W 47th St

8/1/2017



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	20.0	20.0		20.0	20.0	20.0	8.0	20.0		8.0	20.0	20.0
Total Split (s)	25.0	25.0		25.0	25.0	25.0	8.0	25.0		10.0	27.0	27.0
Total Split (%)	41.7%	41.7%		41.7%	41.7%	41.7%	13.3%	41.7%		16.7%	45.0%	45.0%
Maximum Green (s)	21.0	21.0		21.0	21.0	21.0	4.0	21.0		6.0	23.0	23.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5
All-Red Time (s)	0.5	0.5		0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None	None	None	Max		None	Max	Max
Walk Time (s)	5.0	5.0		5.0	5.0	5.0		5.0			5.0	5.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0		11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0	0		0			0	0
Act Effct Green (s)		14.4			14.4	14.4	25.0	22.0		29.2	28.1	28.1
Actuated g/C Ratio		0.28			0.28	0.28	0.48	0.42		0.56	0.54	0.54
v/c Ratio		0.61			0.27	0.17	0.02	0.29		0.15	0.12	0.11
Control Delay		19.6			16.5	4.4	6.7	12.6		6.8	8.5	3.2
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay		19.6			16.5	4.4	6.7	12.6		6.8	8.5	3.2
LOS		B			B	A	A	B		A	A	A
Approach Delay		19.6			11.7			12.2			6.3	
Approach LOS		B			B			B			A	
90th %ile Green (s)	20.9	20.9		20.9	20.9	20.9	4.0	21.0		6.0	23.0	23.0
90th %ile Term Code	Gap	Gap		Hold	Hold	Hold	Max	MaxR		Max	MaxR	MaxR
70th %ile Green (s)	16.8	16.8		16.8	16.8	16.8	0.0	21.0		6.0	31.0	31.0
70th %ile Term Code	Gap	Gap		Hold	Hold	Hold	Skip	MaxR		Max	Hold	Hold
50th %ile Green (s)	14.8	14.8		14.8	14.8	14.8	0.0	21.0		6.0	31.0	31.0
50th %ile Term Code	Gap	Gap		Hold	Hold	Hold	Skip	MaxR		Max	Hold	Hold
30th %ile Green (s)	12.0	12.0		12.0	12.0	12.0	0.0	21.0		6.0	31.0	31.0
30th %ile Term Code	Gap	Gap		Hold	Hold	Hold	Skip	MaxR		Max	Hold	Hold
10th %ile Green (s)	8.8	8.8		8.8	8.8	8.8	0.0	23.0		0.0	23.0	23.0
10th %ile Term Code	Gap	Gap		Hold	Hold	Hold	Skip	Hold		Skip	MaxR	MaxR
Stops (vph)		353			81	14	8	130		39	54	14
Fuel Used(gal)		6			1	0	0	1		1	1	1
CO Emissions (g/hr)		389			73	20	5	105		73	96	61
NOx Emissions (g/hr)		76			14	4	1	20		14	19	12
VOC Emissions (g/hr)		90			17	5	1	24		17	22	14
Dilemma Vehicles (#)		0			0	0	0	0		0	0	0
Queue Length 50th (ft)		69			31	0	2	44		12	15	0
Queue Length 95th (ft)		108			65	21	10	104		35	56	24
Internal Link Dist (ft)		93			142			52			47	
Turn Bay Length (ft)												
Base Capacity (vph)		1191			695	686	659	790		635	1006	868
Starvation Cap Reductn		0			0	0	0	0		0	0	0
Spillback Cap Reductn		0			0	0	0	0		0	0	0

Lanes, Volumes, Timings  
 3: Mission Rd & W 47th St

8/1/2017

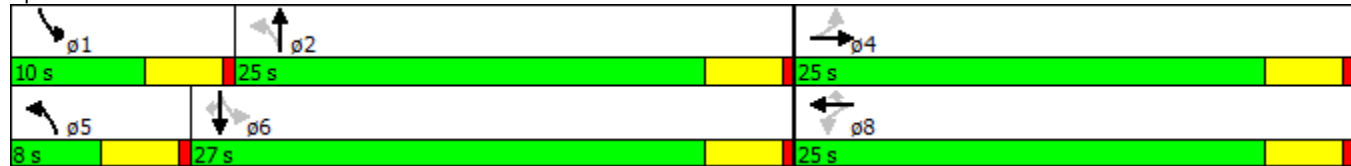


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Storage Cap Reductn		0			0	0	0	0		0	0	0
Reduced v/c Ratio		0.41			0.18	0.12	0.02	0.29		0.15	0.12	0.11

Intersection Summary

Area Type:	Other
Cycle Length:	60
Actuated Cycle Length:	52.1
Natural Cycle:	50
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.61
Intersection Signal Delay:	13.6
Intersection LOS:	B
Intersection Capacity Utilization	47.4%
ICU Level of Service	A
Analysis Period (min)	15
90th %ile Actuated Cycle:	59.9
70th %ile Actuated Cycle:	55.8
50th %ile Actuated Cycle:	53.8
30th %ile Actuated Cycle:	51
10th %ile Actuated Cycle:	39.8

Splits and Phases: 3: Mission Rd & W 47th St



**Intersection**

Int Delay, s/veh 2.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	330	38	21	152	2	42	3	48	2	4	6
Conflicting Peds, #/hr	3	0	0	0	0	0	2	0	0	3	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	2	5	0	2	0	0	0	2	0	25	0
Mvmt Flow	2	359	41	23	165	2	46	3	52	2	4	7

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	170	0	0	402	0	0	519	602	202	402	621	90
Stage 1	-	-	-	-	-	-	386	386	-	215	215	-
Stage 2	-	-	-	-	-	-	133	216	-	187	406	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.5	6.5	6.94	7.5	7	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.5	6	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.5	6	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.32	3.5	4.25	3.3
Pot Cap-1 Maneuver	1420	-	-	1168	-	-	444	416	805	538	357	956
Stage 1	-	-	-	-	-	-	614	614	-	773	670	-
Stage 2	-	-	-	-	-	-	862	728	-	803	542	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1416	-	-	1168	-	-	427	404	804	490	347	951
Mov Cap-2 Maneuver	-	-	-	-	-	-	427	404	-	490	347	-
Stage 1	-	-	-	-	-	-	612	612	-	770	654	-
Stage 2	-	-	-	-	-	-	830	710	-	745	540	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	1.1	12.8	11.7
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	562	1416	-	-	1168	-	-	547
HCM Lane V/C Ratio	0.18	0.002	-	-	0.02	-	-	0.024
HCM Control Delay (s)	12.8	7.5	0	-	8.1	0.1	-	11.7
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.7	0	-	-	0.1	-	-	0.1

Lanes, Volumes, Timings  
 9: Rainbow Blvd & W 47th St

8/1/2017



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗			↕			↕	
Volume (vph)	248	6	153	8	4	15	72	570	1	7	348	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor	1.00			1.00								1.00
Frt		0.856			0.879							0.974
Flt Protected	0.950			0.950				0.994				0.999
Satd. Flow (prot)	1770	1626	0	1612	1670	0	0	3522	0	0	3387	0
Flt Permitted	0.741							0.860				0.945
Satd. Flow (perm)	1379	1626	0	1693	1670	0	0	3047	0	0	3204	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		170			17							50
Link Speed (mph)		30			30			35				35
Link Distance (ft)		320			259			783				134
Travel Time (s)		7.3			5.9			15.3				2.6
Confl. Peds. (#/hr)	1			2						1		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	0%	0%	12%	0%	0%	1%	2%	0%	14%	3%	6%
Adj. Flow (vph)	276	7	170	9	4	17	80	633	1	8	387	81
Shared Lane Traffic (%)												
Lane Group Flow (vph)	276	177	0	9	21	0	0	714	0	0	476	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0				0
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		2	2		6	6	

Lanes, Volumes, Timings  
9: Rainbow Blvd & W 47th St

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	8.0	20.0		8.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	10.0	22.0		8.0	20.0		30.0	30.0		30.0	30.0	
Total Split (%)	16.7%	36.7%		13.3%	33.3%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	6.0	18.0		4.0	16.0		26.0	26.0		26.0	26.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Max	Max		Max	Max	
Walk Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Flash Dont Walk (s)		11.0			11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effct Green (s)	8.0	7.0		5.4	6.1			27.4			27.4	
Actuated g/C Ratio	0.18	0.16		0.12	0.14			0.63			0.63	
v/c Ratio	0.90	0.44		0.04	0.09			0.37			0.24	
Control Delay	49.9	8.0		14.4	11.7			5.6			4.4	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	49.9	8.0		14.4	11.7			5.6			4.4	
LOS	D	A		B	B			A			A	
Approach Delay		33.6			12.5			5.6			4.4	
Approach LOS		C			B			A			A	
90th %ile Green (s)	6.0	10.1		4.0	8.1		26.0	26.0		26.0	26.0	
90th %ile Term Code	Max	Gap		Max	Hold		MaxR	MaxR		MaxR	MaxR	
70th %ile Green (s)	7.0	7.0		0.0	0.0		26.0	26.0		26.0	26.0	
70th %ile Term Code	Hold	Gap		Skip	Skip		MaxR	MaxR		MaxR	MaxR	
50th %ile Green (s)	6.0	6.0		0.0	0.0		26.0	26.0		26.0	26.0	
50th %ile Term Code	Max	Hold		Skip	Skip		MaxR	MaxR		MaxR	MaxR	
30th %ile Green (s)	6.0	6.0		0.0	0.0		26.0	26.0		26.0	26.0	
30th %ile Term Code	Max	Hold		Skip	Skip		MaxR	MaxR		MaxR	MaxR	
10th %ile Green (s)	6.0	6.0		0.0	0.0		31.9	31.9		31.9	31.9	
10th %ile Term Code	Max	Hold		Skip	Skip		Dwell	Dwell		Dwell	Dwell	
Stops (vph)	217	36		10	13			285			151	
Fuel Used(gal)	4	1		0	0			7			5	
CO Emissions (g/hr)	303	60		7	11			455			331	
NOx Emissions (g/hr)	59	12		1	2			89			64	
VOC Emissions (g/hr)	70	14		2	3			106			77	
Dilemma Vehicles (#)	0	0		0	0			74			49	
Queue Length 50th (ft)	~67	1		2	1			27			14	
Queue Length 95th (ft)	118	42		9	16			104			60	
Internal Link Dist (ft)		240			179			703			54	
Turn Bay Length (ft)												
Base Capacity (vph)	307	774		201	627			1906			2023	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	

Lanes, Volumes, Timings  
 9: Rainbow Blvd & W 47th St

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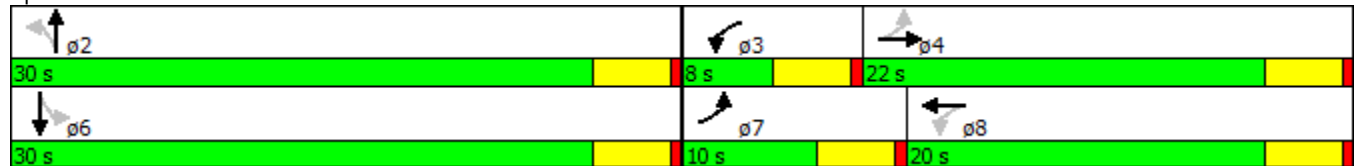


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.90	0.23		0.04	0.03			0.37			0.24	

Intersection Summary

Area Type:	Other
Cycle Length:	60
Actuated Cycle Length:	43.8
Natural Cycle:	50
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.90
Intersection Signal Delay:	13.0
Intersection LOS:	B
Intersection Capacity Utilization:	60.4%
ICU Level of Service:	B
Analysis Period (min):	15
90th %ile Actuated Cycle:	52.1
70th %ile Actuated Cycle:	41
50th %ile Actuated Cycle:	40
30th %ile Actuated Cycle:	40
10th %ile Actuated Cycle:	45.9
~ Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.	

Splits and Phases: 9: Rainbow Blvd & W 47th St



## **Scenario 2 - Existing street/pre-development conditions (Midday Peak Traffic 2017)**



Lanes, Volumes, Timings  
3: Mission Rd & W 47th St

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕	↕	↕	↕		↕	↕	↕
Volume (vph)	100	195	14	27	188	90	31	114	42	87	106	144
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			1.00		0.99			1.00		
Frt		0.993				0.850		0.960				0.850
Flt Protected		0.984			0.994		0.950			0.950		
Satd. Flow (prot)	0	3450	0	0	1889	1583	1752	1824	0	1752	1845	1599
Flt Permitted		0.729			0.919		0.682			0.603		
Satd. Flow (perm)	0	2555	0	0	1744	1583	1250	1824	0	1108	1845	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8				99		34				158
Link Speed (mph)		30			30			30				30
Link Distance (ft)		173			222			132				127
Travel Time (s)		3.9			5.0			3.0				2.9
Confl. Peds. (#/hr)	1			7			4			5		
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	3%	2%	0%	0%	0%	2%	3%	0%	0%	3%	3%	1%
Adj. Flow (vph)	110	214	15	30	207	99	34	125	46	96	116	158
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	339	0	0	237	99	34	171	0	96	116	158
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2		1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100	20	20	100		20	100	20
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0	0	0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6	20	20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8	2			6		6
Detector Phase	4	4		8	8	8	5	2		1	6	6

Lanes, Volumes, Timings  
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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	20.0	20.0		20.0	20.0	20.0	8.0	20.0		8.0	20.0	20.0
Total Split (s)	25.0	25.0		25.0	25.0	25.0	8.0	25.0		10.0	27.0	27.0
Total Split (%)	41.7%	41.7%		41.7%	41.7%	41.7%	13.3%	41.7%		16.7%	45.0%	45.0%
Maximum Green (s)	21.0	21.0		21.0	21.0	21.0	4.0	21.0		6.0	23.0	23.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5
All-Red Time (s)	0.5	0.5		0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None	None	None	Max		None	Max	Max
Walk Time (s)	5.0	5.0		5.0	5.0	5.0		5.0			5.0	5.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0		11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0	0		0			0	0
Act Effct Green (s)		12.0			12.0	12.0	24.6	22.5		27.2	25.1	25.1
Actuated g/C Ratio		0.25			0.25	0.25	0.51	0.47		0.57	0.52	0.52
v/c Ratio		0.53			0.54	0.21	0.05	0.20		0.14	0.12	0.17
Control Delay		18.8			21.3	5.2	5.8	9.4		5.9	8.8	2.9
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay		18.8			21.3	5.2	5.8	9.4		5.9	8.8	2.9
LOS		B			C	A	A	A		A	A	A
Approach Delay		18.8			16.5			8.8			5.5	
Approach LOS		B			B			A			A	
90th %ile Green (s)	18.2	18.2		18.2	18.2	18.2	4.0	21.0		6.0	23.0	23.0
90th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Max	MaxR		Max	MaxR	MaxR
70th %ile Green (s)	13.9	13.9		13.9	13.9	13.9	4.0	21.0		6.0	23.0	23.0
70th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Max	MaxR		Max	MaxR	MaxR
50th %ile Green (s)	11.9	11.9		11.9	11.9	11.9	0.0	21.0		6.0	31.0	31.0
50th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Skip	MaxR		Max	Hold	Hold
30th %ile Green (s)	10.0	10.0		10.0	10.0	10.0	0.0	23.0		0.0	23.0	23.0
30th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Skip	Hold		Skip	MaxR	MaxR
10th %ile Green (s)	7.4	7.4		7.4	7.4	7.4	0.0	23.0		0.0	23.0	23.0
10th %ile Term Code	Gap	Gap		Hold	Hold	Hold	Skip	Hold		Skip	MaxR	MaxR
Stops (vph)		233			170	18	16	76		36	54	20
Fuel Used(gal)		4			2	0	0	1		1	1	1
CO Emissions (g/hr)		255			157	25	11	62		70	93	94
NOx Emissions (g/hr)		50			31	5	2	12		14	18	18
VOC Emissions (g/hr)		59			36	6	3	14		16	22	22
Dilemma Vehicles (#)		0			0	0	0	0		0	0	0
Queue Length 50th (ft)		45			63	0	3	25		10	12	0
Queue Length 95th (ft)		77			117	26	15	68		32	52	28
Internal Link Dist (ft)		93			142			52			47	
Turn Bay Length (ft)												
Base Capacity (vph)		1146			779	762	682	870		708	961	909
Starvation Cap Reductn		0			0	0	0	0		0	0	0
Spillback Cap Reductn		0			0	0	0	0		0	0	0

Lanes, Volumes, Timings  
 3: Mission Rd & W 47th St

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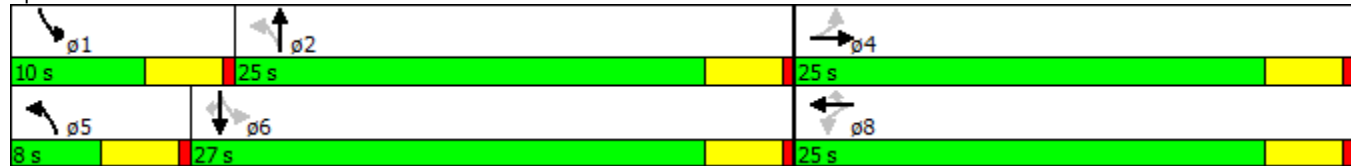


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Storage Cap Reductn		0			0	0	0	0		0	0	0
Reduced v/c Ratio		0.30			0.30	0.13	0.05	0.20		0.14	0.12	0.17

Intersection Summary

Area Type:	Other
Cycle Length:	60
Actuated Cycle Length:	48.1
Natural Cycle:	50
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.54
Intersection Signal Delay:	12.6
Intersection LOS:	B
Intersection Capacity Utilization	46.8%
ICU Level of Service	A
Analysis Period (min)	15
90th %ile Actuated Cycle:	57.2
70th %ile Actuated Cycle:	52.9
50th %ile Actuated Cycle:	50.9
30th %ile Actuated Cycle:	41
10th %ile Actuated Cycle:	38.4

Splits and Phases: 3: Mission Rd & W 47th St



Intersection												
Int Delay, s/veh	2.6											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	251	44	32	234	3	41	9	54	1	5	7
Conflicting Peds, #/hr	2	0	0	0	0	0	3	0	0	1	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	2	0	0	1	33	0	0	4	0	0	14
Mvmt Flow	2	273	48	35	254	3	45	10	59	1	5	8

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	259	0	0	324	0	0	504	632	163	476	655	132
Stage 1	-	-	-	-	-	-	304	304	-	327	327	-
Stage 2	-	-	-	-	-	-	200	328	-	149	328	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.5	6.5	6.98	7.5	6.5	7.18
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.34	3.5	4	3.44
Pot Cap-1 Maneuver	1317	-	-	1247	-	-	455	400	847	477	388	856
Stage 1	-	-	-	-	-	-	686	667	-	665	651	-
Stage 2	-	-	-	-	-	-	789	651	-	844	651	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1315	-	-	1247	-	-	432	385	845	423	373	854
Mov Cap-2 Maneuver	-	-	-	-	-	-	432	385	-	423	373	-
Stage 1	-	-	-	-	-	-	683	664	-	663	629	-
Stage 2	-	-	-	-	-	-	748	629	-	772	648	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	1	12.9	11.8
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	571	1315	-	-	1247	-	-	542
HCM Lane V/C Ratio	0.198	0.002	-	-	0.028	-	-	0.026
HCM Control Delay (s)	12.9	7.7	0	-	8	0.1	-	11.8
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.7	0	-	-	0.1	-	-	0.1

Lanes, Volumes, Timings  
9: Rainbow Blvd & W 47th St

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	192	9	117	2	4	17	105	375	10	10	387	188
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor	1.00			1.00								1.00
Frt		0.861			0.877			0.997				0.952
Flt Protected	0.950			0.950				0.989				0.999
Satd. Flow (prot)	1719	1636	0	1805	1588	0	0	3465	0	0	3318	0
Flt Permitted	0.755							0.754				0.947
Satd. Flow (perm)	1362	1636	0	1895	1588	0	0	2642	0	0	3146	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		124			18			4				165
Link Speed (mph)		30			30			35				35
Link Distance (ft)		320			259			783				134
Travel Time (s)		7.3			5.9			15.3				2.6
Confl. Peds. (#/hr)	3			3						1		
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	5%	0%	0%	0%	0%	6%	2%	3%	0%	10%	4%	2%
Adj. Flow (vph)	204	10	124	2	4	18	112	399	11	11	412	200
Shared Lane Traffic (%)												
Lane Group Flow (vph)	204	134	0	2	22	0	0	522	0	0	623	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0				0
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		2	2		6	6	

Lanes, Volumes, Timings  
9: Rainbow Blvd & W 47th St

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	8.0	20.0		8.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	10.0	22.0		8.0	20.0		30.0	30.0		30.0	30.0	
Total Split (%)	16.7%	36.7%		13.3%	33.3%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	6.0	18.0		4.0	16.0		26.0	26.0		26.0	26.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Max	Max		Max	Max	
Walk Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Flash Dont Walk (s)		11.0			11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effct Green (s)	8.0	6.9		5.4	6.1			29.0			29.0	
Actuated g/C Ratio	0.18	0.15		0.12	0.13			0.64			0.64	
v/c Ratio	0.71	0.38		0.01	0.10			0.31			0.30	
Control Delay	30.0	8.5		13.5	11.8			5.2			3.8	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	30.0	8.5		13.5	11.8			5.2			3.8	
LOS	C	A		B	B			A			A	
Approach Delay		21.5			11.9			5.2			3.8	
Approach LOS		C			B			A			A	
90th %ile Green (s)	6.0	9.5		4.0	7.5		26.0	26.0		26.0	26.0	
90th %ile Term Code	Max	Gap		Max	Hold		MaxR	MaxR		MaxR	MaxR	
70th %ile Green (s)	6.9	6.9		0.0	0.0		26.0	26.0		26.0	26.0	
70th %ile Term Code	Hold	Gap		Skip	Skip		MaxR	MaxR		MaxR	MaxR	
50th %ile Green (s)	6.0	6.0		0.0	0.0		26.0	26.0		26.0	26.0	
50th %ile Term Code	Max	Hold		Skip	Skip		MaxR	MaxR		MaxR	MaxR	
30th %ile Green (s)	6.0	6.0		0.0	0.0		26.3	26.3		26.3	26.3	
30th %ile Term Code	Max	Hold		Skip	Skip		Dwell	Dwell		Dwell	Dwell	
10th %ile Green (s)	6.0	6.0		0.0	0.0		41.0	41.0		41.0	41.0	
10th %ile Term Code	Max	Hold		Skip	Skip		Dwell	Dwell		Dwell	Dwell	
Stops (vph)	168	34		3	13			204			179	
Fuel Used(gal)	3	1		0	0			5			6	
CO Emissions (g/hr)	180	50		2	12			337			434	
NOx Emissions (g/hr)	35	10		0	2			66			84	
VOC Emissions (g/hr)	42	12		0	3			78			101	
Dilemma Vehicles (#)	0	0		0	0			55			66	
Queue Length 50th (ft)	45	2		0	1			18			15	
Queue Length 95th (ft)	89	38		4	17			74			64	
Internal Link Dist (ft)		240			179			703			54	
Turn Bay Length (ft)												
Base Capacity (vph)	288	732		216	580			1686			2066	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	

Lanes, Volumes, Timings  
 9: Rainbow Blvd & W 47th St

8/1/2017

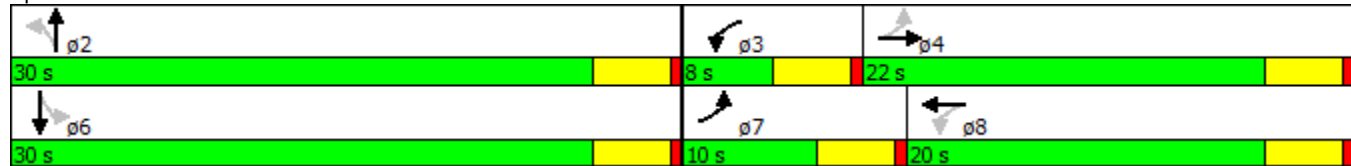


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.71	0.18		0.01	0.04			0.31			0.30	

Intersection Summary

Area Type:	Other
Cycle Length:	60
Actuated Cycle Length:	45.5
Natural Cycle:	50
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.71
Intersection Signal Delay:	8.4
Intersection LOS:	A
Intersection Capacity Utilization	58.0%
ICU Level of Service	B
Analysis Period (min)	15
90th %ile Actuated Cycle:	51.5
70th %ile Actuated Cycle:	40.9
50th %ile Actuated Cycle:	40
30th %ile Actuated Cycle:	40.3
10th %ile Actuated Cycle:	55

Splits and Phases: 9: Rainbow Blvd & W 47th St



# **Scenario 3 - Existing street/pre-development conditions (PM Peak Traffic 2017)**



Lanes, Volumes, Timings  
3: Mission Rd & W 47th St

8/1/2017



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕	↕	↕	↕		↕	↕	↕
Volume (vph)	137	217	37	62	332	121	51	126	36	153	318	311
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			1.00		1.00					
Frt		0.986				0.850		0.966				0.850
Flt Protected		0.983			0.992		0.950			0.950		
Satd. Flow (prot)	0	3487	0	0	1869	1615	1805	1835	0	1770	1900	1599
Flt Permitted		0.587			0.876		0.540			0.591		
Satd. Flow (perm)	0	2080	0	0	1650	1615	1024	1835	0	1101	1900	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		20				126		27				324
Link Speed (mph)		30			30			30				30
Link Distance (ft)		173			222			132				127
Travel Time (s)		3.9			5.0			3.0				2.9
Confl. Peds. (#/hr)	4			1			2					
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	1%	0%	0%	0%	1%	0%	0%	0%	0%	2%	0%	1%
Adj. Flow (vph)	143	226	39	65	346	126	53	131	38	159	331	324
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	408	0	0	411	126	53	169	0	159	331	324
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2		1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100	20	20	100		20	100	20
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0	0	0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6	20	20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8	2			6		6
Detector Phase	4	4		8	8	8	5	2		1	6	6

Lanes, Volumes, Timings  
3: Mission Rd & W 47th St

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	20.0	20.0		20.0	20.0	20.0	8.0	20.0		8.0	20.0	20.0
Total Split (s)	25.0	25.0		25.0	25.0	25.0	8.0	25.0		10.0	27.0	27.0
Total Split (%)	41.7%	41.7%		41.7%	41.7%	41.7%	13.3%	41.7%		16.7%	45.0%	45.0%
Maximum Green (s)	21.0	21.0		21.0	21.0	21.0	4.0	21.0		6.0	23.0	23.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5
All-Red Time (s)	0.5	0.5		0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None	None	None	Max		None	Max	Max
Walk Time (s)	5.0	5.0		5.0	5.0	5.0		5.0			5.0	5.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0		11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0	0		0			0	0
Act Effct Green (s)		17.6			17.6	17.6	25.0	21.9		28.4	25.0	25.0
Actuated g/C Ratio		0.32			0.32	0.32	0.45	0.40		0.51	0.45	0.45
v/c Ratio		0.60			0.78	0.21	0.10	0.23		0.25	0.38	0.36
Control Delay		19.5			29.5	4.3	7.9	12.6		8.6	13.9	3.2
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay		19.5			29.5	4.3	7.9	12.6		8.6	13.9	3.2
LOS		B			C	A	A	B		A	B	A
Approach Delay		19.5			23.6			11.5			8.6	
Approach LOS		B			C			B			A	
90th %ile Green (s)	21.0	21.0		21.0	21.0	21.0	4.0	21.0		6.0	23.0	23.0
90th %ile Term Code	Max	Max		Max	Max	Max	Max	MaxR		Max	MaxR	MaxR
70th %ile Green (s)	21.0	21.0		21.0	21.0	21.0	4.0	21.0		6.0	23.0	23.0
70th %ile Term Code	Hold	Hold		Max	Max	Max	Max	MaxR		Max	MaxR	MaxR
50th %ile Green (s)	20.5	20.5		20.5	20.5	20.5	4.0	21.0		6.0	23.0	23.0
50th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Max	MaxR		Max	MaxR	MaxR
30th %ile Green (s)	16.1	16.1		16.1	16.1	16.1	0.0	21.0		6.0	31.0	31.0
30th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Skip	MaxR		Max	Hold	Hold
10th %ile Green (s)	10.6	10.6		10.6	10.6	10.6	0.0	23.0		0.0	23.0	23.0
10th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Skip	Hold		Skip	MaxR	MaxR
Stops (vph)		289			327	20	27	89		73	207	34
Fuel Used(gal)		5			5	0	0	1		2	5	3
CO Emissions (g/hr)		326			340	30	20	75		132	320	201
NOx Emissions (g/hr)		63			66	6	4	15		26	62	39
VOC Emissions (g/hr)		76			79	7	5	17		31	74	46
Dilemma Vehicles (#)		0			0	0	0	0		0	0	0
Queue Length 50th (ft)		57			125	0	9	35		27	85	0
Queue Length 95th (ft)		97			#244	29	23	74		55	149	42
Internal Link Dist (ft)		93			142			52			47	
Turn Bay Length (ft)												
Base Capacity (vph)		819			639	703	520	745		640	862	902
Starvation Cap Reductn		0			0	0	0	0		0	0	0
Spillback Cap Reductn		0			0	0	0	0		0	0	0

Lanes, Volumes, Timings  
 3: Mission Rd & W 47th St

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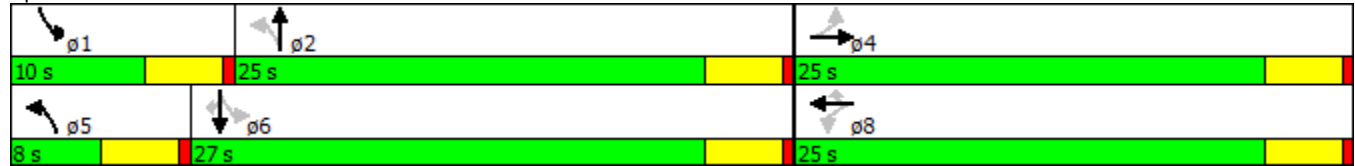


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Storage Cap Reductn		0			0	0	0	0		0	0	0
Reduced v/c Ratio		0.50			0.64	0.18	0.10	0.23		0.25	0.38	0.36

Intersection Summary

Area Type: Other  
 Cycle Length: 60  
 Actuated Cycle Length: 55.2  
 Natural Cycle: 50  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.78  
 Intersection Signal Delay: 15.2  
 Intersection LOS: B  
 Intersection Capacity Utilization 65.5%  
 ICU Level of Service C  
 Analysis Period (min) 15  
 90th %ile Actuated Cycle: 60  
 70th %ile Actuated Cycle: 60  
 50th %ile Actuated Cycle: 59.5  
 30th %ile Actuated Cycle: 55.1  
 10th %ile Actuated Cycle: 41.6  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 3: Mission Rd & W 47th St



**Intersection**

Int Delay, s/veh 2.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	15	366	64	49	412	5	52	2	54	1	7	12
Conflicting Peds, #/hr	3	0	0	0	0	0	2	0	0	4	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	0	0	0	1	0	2	0	7	0	0	0
Mvmt Flow	16	394	69	53	443	5	56	2	58	1	8	13

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	452	0	0	464	0	0	797	1020	233	787	1052	231
Stage 1	-	-	-	-	-	-	462	462	-	555	555	-
Stage 2	-	-	-	-	-	-	335	558	-	232	497	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.54	6.5	7.04	7.5	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.5	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.52	4	3.37	3.5	4	3.3
Pot Cap-1 Maneuver	1119	-	-	1108	-	-	277	239	754	286	228	777
Stage 1	-	-	-	-	-	-	549	568	-	489	516	-
Stage 2	-	-	-	-	-	-	653	515	-	756	548	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1116	-	-	1108	-	-	247	218	753	245	208	772
Mov Cap-2 Maneuver	-	-	-	-	-	-	247	218	-	245	208	-
Stage 1	-	-	-	-	-	-	538	556	-	478	481	-
Stage 2	-	-	-	-	-	-	590	480	-	682	537	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	1.1	19.1	15.2
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	371	1116	-	-	1108	-	-	375
HCM Lane V/C Ratio	0.313	0.014	-	-	0.048	-	-	0.057
HCM Control Delay (s)	19.1	8.3	0.1	-	8.4	0.2	-	15.2
HCM Lane LOS	C	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	1.3	0	-	-	0.1	-	-	0.2

Lanes, Volumes, Timings  
9: Rainbow Blvd & W 47th St

8/1/2017



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗			↕			↕	
Volume (vph)	195	3	148	5	7	5	141	333	4	7	817	307
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor	1.00			1.00								1.00
Frt		0.853			0.937			0.999				0.959
Flt Protected	0.950			0.950				0.985				
Satd. Flow (prot)	1752	1590	0	1805	1780	0	0	3503	0	0	3428	0
Flt Permitted	0.741							0.580			0.953	
Satd. Flow (perm)	1365	1590	0	1895	1780	0	0	2063	0	0	3267	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		157			5			2				113
Link Speed (mph)		30			30			35				35
Link Distance (ft)		320			259			783				134
Travel Time (s)		7.3			5.9			15.3				2.6
Confl. Peds. (#/hr)	1			3							1	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	3%	0%	2%	0%	0%	0%	0%	2%	0%	0%	1%	1%
Adj. Flow (vph)	207	3	157	5	7	5	150	354	4	7	869	327
Shared Lane Traffic (%)												
Lane Group Flow (vph)	207	160	0	5	12	0	0	508	0	0	1203	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0				0
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		2	2		6	6	

Lanes, Volumes, Timings  
9: Rainbow Blvd & W 47th St

8/1/2017



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	8.0	20.0		8.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	10.0	22.0		8.0	20.0		30.0	30.0		30.0	30.0	
Total Split (%)	16.7%	36.7%		13.3%	33.3%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	6.0	18.0		4.0	16.0		26.0	26.0		26.0	26.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Max	Max		Max	Max	
Walk Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Flash Dont Walk (s)		11.0			11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effct Green (s)	8.1	7.0		5.5	6.1			29.0			29.0	
Actuated g/C Ratio	0.18	0.15		0.12	0.13			0.64			0.64	
v/c Ratio	0.70	0.42		0.02	0.05			0.39			0.57	
Control Delay	29.3	8.0		14.0	14.9			6.1			6.4	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	29.3	8.0		14.0	14.9			6.1			6.4	
LOS	C	A		B	B			A			A	
Approach Delay		20.0			14.6			6.1			6.4	
Approach LOS		C			B			A			A	
90th %ile Green (s)	6.0	9.9		4.0	7.9		26.0	26.0		26.0	26.0	
90th %ile Term Code	Max	Gap		Max	Hold		MaxR	MaxR		MaxR	MaxR	
70th %ile Green (s)	6.9	6.9		0.0	0.0		26.0	26.0		26.0	26.0	
70th %ile Term Code	Hold	Gap		Skip	Skip		MaxR	MaxR		MaxR	MaxR	
50th %ile Green (s)	6.0	6.0		0.0	0.0		26.0	26.0		26.0	26.0	
50th %ile Term Code	Max	Hold		Skip	Skip		MaxR	MaxR		MaxR	MaxR	
30th %ile Green (s)	6.0	6.0		0.0	0.0		26.0	26.0		26.0	26.0	
30th %ile Term Code	Max	Hold		Skip	Skip		MaxR	MaxR		MaxR	MaxR	
10th %ile Green (s)	6.0	6.0		0.0	0.0		41.0	41.0		41.0	41.0	
10th %ile Term Code	Max	Hold		Skip	Skip		Dwell	Dwell		Dwell	Dwell	
Stops (vph)	170	33		8	11			219			542	
Fuel Used(gal)	3	1		0	0			5			14	
CO Emissions (g/hr)	181	56		5	8			346			983	
NOx Emissions (g/hr)	35	11		1	2			67			191	
VOC Emissions (g/hr)	42	13		1	2			80			228	
Dilemma Vehicles (#)	0	0		0	0			54			127	
Queue Length 50th (ft)	46	1		1	1			19			47	
Queue Length 95th (ft)	90	39		6	13			82			184	
Internal Link Dist (ft)		240			179			703			54	
Turn Bay Length (ft)												
Base Capacity (vph)	294	733		219	640			1313			2120	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	

Lanes, Volumes, Timings  
 9: Rainbow Blvd & W 47th St

8/1/2017

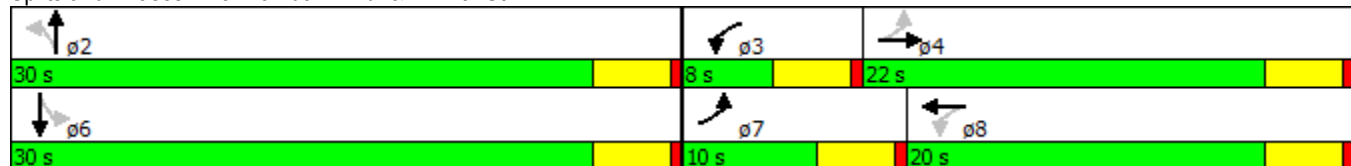


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.70	0.22		0.02	0.02			0.39			0.57	

Intersection Summary

Area Type:	Other
Cycle Length:	60
Actuated Cycle Length:	45.6
Natural Cycle:	60
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.70
Intersection Signal Delay:	8.8
Intersection LOS:	A
Intersection Capacity Utilization	73.5%
ICU Level of Service	D
Analysis Period (min)	15
90th %ile Actuated Cycle:	51.9
70th %ile Actuated Cycle:	40.9
50th %ile Actuated Cycle:	40
30th %ile Actuated Cycle:	40
10th %ile Actuated Cycle:	55

Splits and Phases: 9: Rainbow Blvd & W 47th St



# **Scenario 4 - Existing street/pre-development conditions (Saturday Peak Traffic 2017)**



Lanes, Volumes, Timings

3: Mission Rd /Mission Rd & W 47th St/W 47th St

8/1/2017



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕	↕	↕	↕		↕	↕	↕
Volume (vph)	124	207	27	41	175	103	37	78	38	117	97	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99			1.00		0.99			1.00		
Frt		0.989				0.850		0.951				0.850
Flt Protected		0.983			0.991		0.950			0.950		
Satd. Flow (prot)	0	3510	0	0	1868	1615	1805	1795	0	1787	1863	1599
Flt Permitted		0.734			0.867		0.693			0.599		
Satd. Flow (perm)	0	2603	0	0	1632	1615	1297	1795	0	1123	1863	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		16				105		39				153
Link Speed (mph)		30			30			30				30
Link Distance (ft)		173			222			132				127
Travel Time (s)		3.9			5.0			3.0				2.9
Confl. Peds. (#/hr)	15			5			9			4		
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	0%	0%	0%	0%	1%	0%	0%	1%	0%	1%	2%	1%
Adj. Flow (vph)	127	211	28	42	179	105	38	80	39	119	99	153
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	366	0	0	221	105	38	119	0	119	99	153
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2		1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100	20	20	100		20	100	20
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0	0	0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6	20	20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8	2			6		6
Detector Phase	4	4		8	8	8	5	2		1	6	6

Lanes, Volumes, Timings

3: Mission Rd /Mission Rd & W 47th St/W 47th St

8/1/2017



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	20.0	20.0		20.0	20.0	20.0	8.0	20.0		8.0	20.0	20.0
Total Split (s)	25.0	25.0		25.0	25.0	25.0	8.0	25.0		10.0	27.0	27.0
Total Split (%)	41.7%	41.7%		41.7%	41.7%	41.7%	13.3%	41.7%		16.7%	45.0%	45.0%
Maximum Green (s)	21.0	21.0		21.0	21.0	21.0	4.0	21.0		6.0	23.0	23.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5
All-Red Time (s)	0.5	0.5		0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lead/Lag							Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None	None	None	Max		None	Max	Max
Walk Time (s)	5.0	5.0		5.0	5.0	5.0		5.0			5.0	5.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0		11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0	0		0			0	0
Act Effct Green (s)		12.1			12.1	12.1	24.9	21.9		28.8	26.6	26.6
Actuated g/C Ratio		0.24			0.24	0.24	0.50	0.44		0.58	0.54	0.54
v/c Ratio		0.57			0.56	0.22	0.05	0.15		0.16	0.10	0.17
Control Delay		19.7			22.7	5.2	5.8	8.5		5.9	8.6	2.9
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay		19.7			22.7	5.2	5.8	8.5		5.9	8.6	2.9
LOS		B			C	A	A	A		A	A	A
Approach Delay		19.7			17.0			7.8			5.4	
Approach LOS		B			B			A			A	
90th %ile Green (s)	18.2	18.2		18.2	18.2	18.2	4.0	21.0		6.0	23.0	23.0
90th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Max	MaxR		Max	MaxR	MaxR
70th %ile Green (s)	13.9	13.9		13.9	13.9	13.9	4.0	21.0		6.0	23.0	23.0
70th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Max	MaxR		Max	MaxR	MaxR
50th %ile Green (s)	11.8	11.8		11.8	11.8	11.8	0.0	21.0		6.0	31.0	31.0
50th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Skip	MaxR		Max	Hold	Hold
30th %ile Green (s)	10.1	10.1		10.1	10.1	10.1	0.0	21.0		6.0	31.0	31.0
30th %ile Term Code	Gap	Gap		Hold	Hold	Hold	Skip	MaxR		Max	Hold	Hold
10th %ile Green (s)	7.6	7.6		7.6	7.6	7.6	0.0	23.0		0.0	23.0	23.0
10th %ile Term Code	Gap	Gap		Hold	Hold	Hold	Skip	Hold		Skip	MaxR	MaxR
Stops (vph)		274			173	20	19	51		47	50	21
Fuel Used(gal)		4			2	0	0	1		1	1	1
CO Emissions (g/hr)		303			163	28	13	42		93	85	98
NOx Emissions (g/hr)		59			32	5	3	8		18	17	19
VOC Emissions (g/hr)		70			38	6	3	10		22	20	23
Dilemma Vehicles (#)		0			0	0	0	0		0	0	0
Queue Length 50th (ft)		48			59	0	4	14		12	10	0
Queue Length 95th (ft)		82			111	27	16	46		38	45	28
Internal Link Dist (ft)		93			142			52			47	
Turn Bay Length (ft)												
Base Capacity (vph)		1127			701	754	691	812		731	996	926
Starvation Cap Reductn		0			0	0	0	0		0	0	0
Spillback Cap Reductn		0			0	0	0	0		0	0	0

Lanes, Volumes, Timings

3: Mission Rd /Mission Rd & W 47th St/W 47th St

8/1/2017

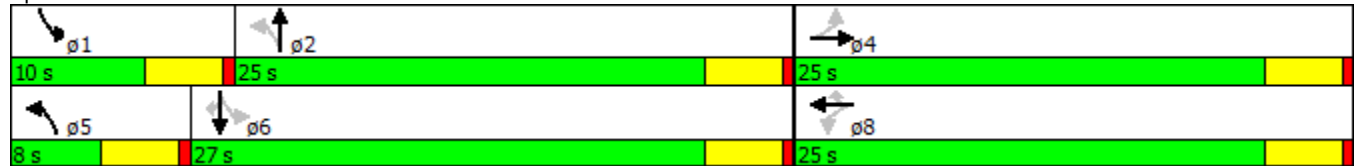


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Storage Cap Reductn		0			0	0	0	0		0	0	0
Reduced v/c Ratio		0.32			0.32	0.14	0.05	0.15		0.16	0.10	0.17

Intersection Summary

Area Type:	Other
Cycle Length:	60
Actuated Cycle Length:	49.7
Natural Cycle:	50
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.57
Intersection Signal Delay:	13.1
Intersection LOS:	B
Intersection Capacity Utilization	44.8%
ICU Level of Service	A
Analysis Period (min)	15
90th %ile Actuated Cycle:	57.2
70th %ile Actuated Cycle:	52.9
50th %ile Actuated Cycle:	50.8
30th %ile Actuated Cycle:	49.1
10th %ile Actuated Cycle:	38.6

Splits and Phases: 3: Mission Rd /Mission Rd & W 47th St/W 47th St



**Intersection**

Int Delay, s/veh 2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	11	289	40	23	261	5	47	6	20	1	3	9
Conflicting Peds, #/hr	1	0	0	0	0	0	2	0	0	1	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	97	97	97	97	97	97	97	97	97	97	97	97
Heavy Vehicles, %	0	0	2	0	0	0	0	0	0	0	0	0
Mvmt Flow	11	298	41	24	269	5	48	6	21	1	3	9

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	275	0	0	341	0	0	528	666	172	497	684	139
Stage 1	-	-	-	-	-	-	343	343	-	320	320	-
Stage 2	-	-	-	-	-	-	185	323	-	177	364	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.5	6.5	6.9	7.5	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1300	-	-	1229	-	-	438	383	848	461	374	890
Stage 1	-	-	-	-	-	-	651	641	-	672	656	-
Stage 2	-	-	-	-	-	-	805	654	-	813	627	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1299	-	-	1229	-	-	419	370	847	433	361	889
Mov Cap-2 Maneuver	-	-	-	-	-	-	419	370	-	433	361	-
Stage 1	-	-	-	-	-	-	643	634	-	665	640	-
Stage 2	-	-	-	-	-	-	774	638	-	778	620	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0.7	13.9	10.9
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	480	1299	-	-	1229	-	-	627
HCM Lane V/C Ratio	0.157	0.009	-	-	0.019	-	-	0.021
HCM Control Delay (s)	13.9	7.8	0	-	8	0.1	-	10.9
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.6	0	-	-	0.1	-	-	0.1

# Lanes, Volumes, Timings

## 9: Rainbow Blvd/Rainbow Blvd & W 47th St

8/1/2017



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	227	14	118	5	4	9	113	181	12	11	189	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor				1.00				1.00			1.00	
Frt		0.866			0.896			0.994			0.937	
Flt Protected	0.950			0.950				0.982			0.998	
Satd. Flow (prot)	1805	1645	0	1805	1702	0	0	3503	0	0	3362	0
Flt Permitted	0.741							0.751			0.944	
Satd. Flow (perm)	1408	1645	0	1893	1702	0	0	2678	0	0	3180	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		124			9			9			153	
Link Speed (mph)		30			30			35			35	
Link Distance (ft)		320			259			783			134	
Travel Time (s)		7.3			5.9			15.3			2.6	
Confl. Peds. (#/hr)				4			1			2		
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	1%
Adj. Flow (vph)	239	15	124	5	4	9	119	191	13	12	199	153
Shared Lane Traffic (%)												
Lane Group Flow (vph)	239	139	0	5	13	0	0	323	0	0	364	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		2	2		6	6	

Lanes, Volumes, Timings  
 9: Rainbow Blvd/Rainbow Blvd & W 47th St

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	8.0	20.0		8.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	10.0	22.0		8.0	20.0		30.0	30.0		30.0	30.0	
Total Split (%)	16.7%	36.7%		13.3%	33.3%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	6.0	18.0		4.0	16.0		26.0	26.0		26.0	26.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Max	Max		Max	Max	
Walk Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Flash Dont Walk (s)		11.0			11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effct Green (s)	8.0	7.0		5.4	6.1			28.7			28.7	
Actuated g/C Ratio	0.18	0.15		0.12	0.13			0.63			0.63	
v/c Ratio	0.78	0.39		0.02	0.06			0.19			0.18	
Control Delay	34.9	8.8		14.0	13.2			4.6			2.8	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	34.9	8.8		14.0	13.2			4.6			2.8	
LOS	C	A		B	B			A			A	
Approach Delay		25.3			13.4			4.6			2.8	
Approach LOS		C			B			A			A	
90th %ile Green (s)	6.0	9.7		4.0	7.7		26.0	26.0		26.0	26.0	
90th %ile Term Code	Max	Gap		Max	Hold		MaxR	MaxR		MaxR	MaxR	
70th %ile Green (s)	7.0	7.0		0.0	0.0		26.0	26.0		26.0	26.0	
70th %ile Term Code	Hold	Gap		Skip	Skip		MaxR	MaxR		MaxR	MaxR	
50th %ile Green (s)	6.0	6.0		0.0	0.0		26.0	26.0		26.0	26.0	
50th %ile Term Code	Max	Hold		Skip	Skip		MaxR	MaxR		MaxR	MaxR	
30th %ile Green (s)	6.0	6.0		0.0	0.0		26.0	26.0		26.0	26.0	
30th %ile Term Code	Max	Hold		Skip	Skip		MaxR	MaxR		MaxR	MaxR	
10th %ile Green (s)	6.0	6.0		0.0	0.0		39.3	39.3		39.3	39.3	
10th %ile Term Code	Max	Hold		Skip	Skip		Dwell	Dwell		Dwell	Dwell	
Stops (vph)	201	36		8	10			116			79	
Fuel Used(gal)	3	1		0	0			3			3	
CO Emissions (g/hr)	230	53		5	8			202			238	
NOx Emissions (g/hr)	45	10		1	2			39			46	
VOC Emissions (g/hr)	53	12		1	2			47			55	
Dilemma Vehicles (#)	0	0		0	0			35			39	
Queue Length 50th (ft)	54	3		1	1			10			6	
Queue Length 95th (ft)	102	40		6	13			44			34	
Internal Link Dist (ft)		240			179			703			54	
Turn Bay Length (ft)												
Base Capacity (vph)	305	739		218	618			1703			2074	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	

Lanes, Volumes, Timings  
 9: Rainbow Blvd/Rainbow Blvd & W 47th St

8/1/2017

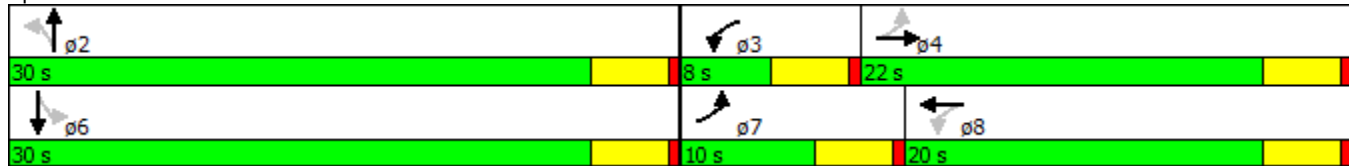


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.78	0.19		0.02	0.02			0.19			0.18	

Intersection Summary

Area Type:	Other
Cycle Length:	60
Actuated Cycle Length:	45.2
Natural Cycle:	50
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.78
Intersection Signal Delay:	11.4
Intersection LOS:	B
Intersection Capacity Utilization	48.1%
ICU Level of Service	A
Analysis Period (min)	15
90th %ile Actuated Cycle:	51.7
70th %ile Actuated Cycle:	41
50th %ile Actuated Cycle:	40
30th %ile Actuated Cycle:	40
10th %ile Actuated Cycle:	53.3

Splits and Phases: 9: Rainbow Blvd/Rainbow Blvd & W 47th St



# **Scenario 5 - Road Diet alternative design (AM Peak Traffic 2017)**



Lanes, Volumes, Timings  
3: Mission Rd & W 47th St

8/17/2017



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	149	281	32	18	101	78	14	179	39	89	110	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	50		0	0		0	90		90
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00						1.00			1.00		
Frt		0.985			0.934			0.973				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1844	0	1805	1727	0	1805	1849	0	1770	1863	1524
Flt Permitted	0.446			0.492			0.682			0.498		
Satd. Flow (perm)	838	1844	0	935	1727	0	1292	1849	0	927	1863	1524
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		10			63			18				164
Link Speed (mph)		30			30			30				30
Link Distance (ft)		296			222			132				172
Travel Time (s)		6.7			5.0			3.0				3.9
Confl. Peds. (#/hr)	1						2			1		
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	1%	1%	6%	0%	1%	5%	0%	0%	0%	2%	2%	6%
Adj. Flow (vph)	159	299	34	19	107	83	15	190	41	95	117	98
Shared Lane Traffic (%)												
Lane Group Flow (vph)	159	333	0	19	190	0	15	231	0	95	117	98
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane					Yes							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100		20	100	20
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm

Lanes, Volumes, Timings  
3: Mission Rd & W 47th St

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	7	4		3	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	8.0	20.0		8.0	20.0		8.0	20.0		8.0	20.0	20.0
Total Split (s)	10.0	22.0		8.0	20.0		8.0	21.0		9.0	22.0	22.0
Total Split (%)	16.7%	36.7%		13.3%	33.3%		13.3%	35.0%		15.0%	36.7%	36.7%
Maximum Green (s)	6.0	18.0		4.0	16.0		4.0	17.0		5.0	18.0	18.0
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	3.5
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	Max		None	Max	Max
Walk Time (s)		5.0			5.0			5.0			5.0	5.0
Flash Dont Walk (s)		11.0			11.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)		0			0			0			0	0
Act Effct Green (s)	17.4	16.4		13.3	10.4		21.0	18.0		24.2	23.3	23.3
Actuated g/C Ratio	0.34	0.32		0.26	0.20		0.41	0.35		0.48	0.46	0.46
v/c Ratio	0.39	0.55		0.06	0.47		0.03	0.35		0.18	0.14	0.12
Control Delay	14.6	18.4		11.1	17.6		9.1	15.9		9.7	11.6	1.3
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	14.6	18.4		11.1	17.6		9.1	15.9		9.7	11.6	1.3
LOS	B	B		B	B		A	B		A	B	A
Approach Delay		17.2			17.0			15.5			7.8	
Approach LOS		B			B			B			A	
90th %ile Green (s)	6.0	18.0		4.0	16.0		4.0	17.0		5.0	18.0	18.0
90th %ile Term Code	Max	Max		Max	Hold		Max	MaxR		Max	MaxR	MaxR
70th %ile Green (s)	6.0	21.2		0.0	11.2		0.0	17.0		5.0	26.0	26.0
70th %ile Term Code	Max	Hold		Skip	Gap		Skip	MaxR		Max	Hold	Hold
50th %ile Green (s)	6.0	19.3		0.0	9.3		0.0	17.0		5.0	26.0	26.0
50th %ile Term Code	Max	Hold		Skip	Gap		Skip	MaxR		Max	Hold	Hold
30th %ile Green (s)	6.0	17.5		0.0	7.5		0.0	17.0		5.0	26.0	26.0
30th %ile Term Code	Max	Hold		Skip	Gap		Skip	MaxR		Max	Hold	Hold
10th %ile Green (s)	0.0	7.8		0.0	7.8		0.0	18.0		0.0	18.0	18.0
10th %ile Term Code	Skip	Gap		Skip	Hold		Skip	Hold		Skip	MaxR	MaxR
Stops (vph)	91	230		13	103		10	146		48	63	4
Fuel Used(gal)	2	4		0	2		0	2		1	1	1
CO Emissions (g/hr)	106	255		10	106		7	121		80	104	55
NOx Emissions (g/hr)	21	50		2	21		1	24		16	20	11
VOC Emissions (g/hr)	25	59		2	25		2	28		19	24	13
Dilemma Vehicles (#)	0	0		0	0		0	0		0	0	0
Queue Length 50th (ft)	34	76		4	36		2	51		15	18	0
Queue Length 95th (ft)	67	172		14	84		12	118		43	66	10
Internal Link Dist (ft)		216			142			52			92	
Turn Bay Length (ft)				50						90		90

Lanes, Volumes, Timings  
 3: Mission Rd & W 47th St

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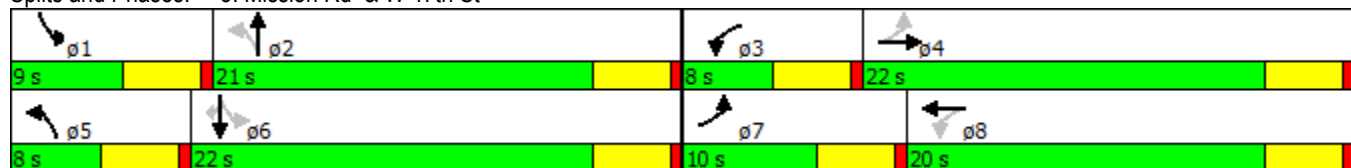


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	404	717		316	608		575	667		527	855	788
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.39	0.46		0.06	0.31		0.03	0.35		0.18	0.14	0.12

Intersection Summary

Area Type:	Other
Cycle Length:	60
Actuated Cycle Length:	50.8
Natural Cycle:	60
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.55
Intersection Signal Delay:	14.5
Intersection LOS:	B
Intersection Capacity Utilization	50.1%
ICU Level of Service	A
Analysis Period (min)	15
90th %ile Actuated Cycle:	60
70th %ile Actuated Cycle:	55.2
50th %ile Actuated Cycle:	53.3
30th %ile Actuated Cycle:	51.5
10th %ile Actuated Cycle:	33.8

Splits and Phases: 3: Mission Rd & W 47th St



**Intersection**

Int Delay, s/veh 2.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	330	38	21	152	2	42	3	48	2	4	6
Conflicting Peds, #/hr	3	0	0	0	0	0	2	0	0	3	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	-	50	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	2	5	0	2	0	0	0	2	0	25	0
Mvmt Flow	2	359	41	23	165	2	46	3	52	2	4	7

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	170	0	0	402	0	0	606	602	381	628	621	172
Stage 1	-	-	-	-	-	-	386	386	-	215	215	-
Stage 2	-	-	-	-	-	-	220	216	-	413	406	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.22	7.1	6.75	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.75	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.75	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.318	3.5	4.225	3.3
Pot Cap-1 Maneuver	1420	-	-	1168	-	-	412	416	666	398	375	877
Stage 1	-	-	-	-	-	-	641	614	-	792	684	-
Stage 2	-	-	-	-	-	-	787	728	-	620	560	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1416	-	-	1168	-	-	397	406	665	358	366	873
Mov Cap-2 Maneuver	-	-	-	-	-	-	397	406	-	358	366	-
Stage 1	-	-	-	-	-	-	639	612	-	789	669	-
Stage 2	-	-	-	-	-	-	759	712	-	568	558	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	1	14	12.2
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	502	1416	-	-	1168	-	-	513
HCM Lane V/C Ratio	0.201	0.002	-	-	0.02	-	-	0.025
HCM Control Delay (s)	14	7.5	-	-	8.1	-	-	12.2
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.7	0	-	-	0.1	-	-	0.1

Lanes, Volumes, Timings  
9: Rainbow Blvd & W 47th St

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	248	6	153	8	4	15	72	570	1	7	348	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	0		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor	1.00			1.00								1.00
Frt		0.856			0.879							0.974
Flt Protected	0.950			0.950				0.994				0.999
Satd. Flow (prot)	1770	1626	0	1612	1670	0	0	3522	0	0	3387	0
Flt Permitted	0.741							0.860				0.945
Satd. Flow (perm)	1379	1626	0	1693	1670	0	0	3047	0	0	3204	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		170			17							50
Link Speed (mph)		30			30			35				35
Link Distance (ft)		320			259			783				134
Travel Time (s)		7.3			5.9			15.3				2.6
Confl. Peds. (#/hr)	1			2						1		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	0%	0%	12%	0%	0%	1%	2%	0%	14%	3%	6%
Adj. Flow (vph)	276	7	170	9	4	17	80	633	1	8	387	81
Shared Lane Traffic (%)												
Lane Group Flow (vph)	276	177	0	9	21	0	0	714	0	0	476	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0				0
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane		Yes										
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	

Lanes, Volumes, Timings  
 9: Rainbow Blvd & W 47th St

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases	7	4		3	8			2				6
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		2	2		6		6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0		4.0
Minimum Split (s)	8.0	20.0		8.0	20.0		20.0	20.0		20.0		20.0
Total Split (s)	10.0	22.0		8.0	20.0		30.0	30.0		30.0		30.0
Total Split (%)	16.7%	36.7%		13.3%	33.3%		50.0%	50.0%		50.0%		50.0%
Maximum Green (s)	6.0	18.0		4.0	16.0		26.0	26.0		26.0		26.0
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5		3.5
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5		0.5
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0				0.0
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0				4.0
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0		3.0
Recall Mode	None	None		None	None		Max	Max		Max		Max
Walk Time (s)		5.0			5.0		5.0	5.0		5.0		5.0
Flash Dont Walk (s)		11.0			11.0		11.0	11.0		11.0		11.0
Pedestrian Calls (#/hr)		0			0		0	0		0		0
Act Effct Green (s)	8.0	7.0		5.4	6.1			27.4				27.4
Actuated g/C Ratio	0.18	0.16		0.12	0.14			0.63				0.63
v/c Ratio	0.90	0.44		0.04	0.09			0.37				0.24
Control Delay	49.9	8.0		14.4	11.7			5.6				4.4
Queue Delay	0.0	0.0		0.0	0.0			0.0				0.0
Total Delay	49.9	8.0		14.4	11.7			5.6				4.4
LOS	D	A		B	B			A				A
Approach Delay		33.6			12.5			5.6				4.4
Approach LOS		C			B			A				A
90th %ile Green (s)	6.0	10.1		4.0	8.1		26.0	26.0		26.0		26.0
90th %ile Term Code	Max	Gap		Max	Hold		MaxR	MaxR		MaxR		MaxR
70th %ile Green (s)	7.0	7.0		0.0	0.0		26.0	26.0		26.0		26.0
70th %ile Term Code	Hold	Gap		Skip	Skip		MaxR	MaxR		MaxR		MaxR
50th %ile Green (s)	6.0	6.0		0.0	0.0		26.0	26.0		26.0		26.0
50th %ile Term Code	Max	Hold		Skip	Skip		MaxR	MaxR		MaxR		MaxR
30th %ile Green (s)	6.0	6.0		0.0	0.0		26.0	26.0		26.0		26.0
30th %ile Term Code	Max	Hold		Skip	Skip		MaxR	MaxR		MaxR		MaxR
10th %ile Green (s)	6.0	6.0		0.0	0.0		31.9	31.9		31.9		31.9
10th %ile Term Code	Max	Hold		Skip	Skip		Dwell	Dwell		Dwell		Dwell
Stops (vph)	217	36		10	13			285				151
Fuel Used(gal)	4	1		0	0			7				5
CO Emissions (g/hr)	303	60		7	11			455				331
NOx Emissions (g/hr)	59	12		1	2			89				64
VOC Emissions (g/hr)	70	14		2	3			106				77
Dilemma Vehicles (#)	0	0		0	0			74				49
Queue Length 50th (ft)	~67	1		2	1			27				14
Queue Length 95th (ft)	118	42		9	16			104				60
Internal Link Dist (ft)		240			179			703				54
Turn Bay Length (ft)	150											

Lanes, Volumes, Timings  
 9: Rainbow Blvd & W 47th St

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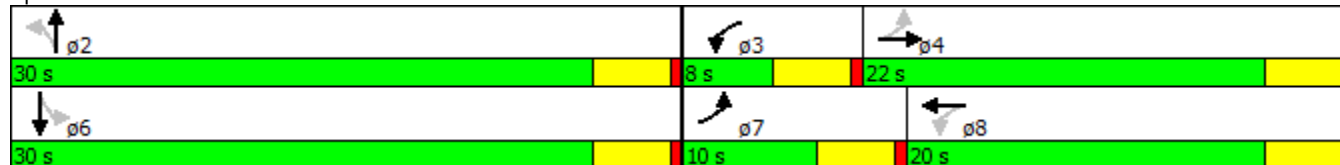


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	307	774		201	627			1906			2023	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.90	0.23		0.04	0.03			0.37			0.24	

Intersection Summary

Area Type: Other  
 Cycle Length: 60  
 Actuated Cycle Length: 43.8  
 Natural Cycle: 50  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.90  
 Intersection Signal Delay: 13.0  
 Intersection LOS: B  
 Intersection Capacity Utilization 60.4%  
 ICU Level of Service B  
 Analysis Period (min) 15  
 90th %ile Actuated Cycle: 52.1  
 70th %ile Actuated Cycle: 41  
 50th %ile Actuated Cycle: 40  
 30th %ile Actuated Cycle: 40  
 10th %ile Actuated Cycle: 45.9  
 ~ Volume exceeds capacity, queue is theoretically infinite.  
 Queue shown is maximum after two cycles.

Splits and Phases: 9: Rainbow Blvd & W 47th St



# **Scenario 6 - Road Diet alternative design (Midday Peak Traffic 2017)**



Lanes, Volumes, Timings  
3: Mission Rd & W 47th St

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	195	14	27	188	90	31	114	42	87	106	144
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	50		0	0		0	90		90
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00			0.99			0.99			0.99		
Frt		0.990			0.951			0.960				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1752	1846	0	1805	1795	0	1752	1824	0	1752	1845	1599
Flt Permitted	0.306			0.616			0.682			0.605		
Satd. Flow (perm)	564	1846	0	1159	1795	0	1250	1824	0	1108	1845	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			39			32				164
Link Speed (mph)		30			30			30				30
Link Distance (ft)		291			222			132				175
Travel Time (s)		6.6			5.0			3.0				4.0
Confl. Peds. (#/hr)	1			7			4			5		
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	3%	2%	0%	0%	0%	2%	3%	0%	0%	3%	3%	1%
Adj. Flow (vph)	110	214	15	30	207	99	34	125	46	96	116	158
Shared Lane Traffic (%)												
Lane Group Flow (vph)	110	229	0	30	306	0	34	171	0	96	116	158
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane					Yes							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100		20	100	20
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm

Lanes, Volumes, Timings  
3: Mission Rd & W 47th St

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	7	4		3	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	8.0	20.0		8.0	20.0		8.0	20.0		8.0	20.0	20.0
Total Split (s)	10.0	22.0		8.0	20.0		8.0	22.0		8.0	22.0	22.0
Total Split (%)	16.7%	36.7%		13.3%	33.3%		13.3%	36.7%		13.3%	36.7%	36.7%
Maximum Green (s)	6.0	18.0		4.0	16.0		4.0	18.0		4.0	18.0	18.0
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	3.5
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	Max		None	Max	Max
Walk Time (s)		5.0			5.0			5.0			5.0	5.0
Flash Dont Walk (s)		11.0			11.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)		0			0			0			0	0
Act Effct Green (s)	19.2	17.1		15.6	12.6		21.9	19.0		23.4	22.0	22.0
Actuated g/C Ratio	0.36	0.32		0.29	0.24		0.41	0.36		0.44	0.41	0.41
v/c Ratio	0.32	0.38		0.08	0.67		0.06	0.26		0.18	0.15	0.21
Control Delay	13.3	16.8		10.8	25.0		10.1	14.2		11.0	14.4	4.0
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	13.3	16.8		10.8	25.0		10.1	14.2		11.0	14.4	4.0
LOS	B	B		B	C		B	B		B	B	A
Approach Delay		15.7			23.8			13.6			9.1	
Approach LOS		B			C			B			A	
90th %ile Green (s)	6.0	18.0		4.0	16.0		4.0	18.0		4.0	18.0	18.0
90th %ile Term Code	Max	Hold		Max	Max		Max	MaxR		Max	MaxR	MaxR
70th %ile Green (s)	6.0	18.0		4.0	16.0		4.0	18.0		4.0	18.0	18.0
70th %ile Term Code	Max	Hold		Max	Max		Max	MaxR		Max	MaxR	MaxR
50th %ile Green (s)	6.0	23.8		0.0	13.8		0.0	18.0		4.0	26.0	26.0
50th %ile Term Code	Max	Hold		Skip	Gap		Skip	MaxR		Max	Hold	Hold
30th %ile Green (s)	6.0	21.3		0.0	11.3		0.0	18.0		4.0	26.0	26.0
30th %ile Term Code	Max	Hold		Skip	Gap		Skip	MaxR		Max	Hold	Hold
10th %ile Green (s)	0.0	7.0		0.0	7.0		0.0	18.0		0.0	18.0	18.0
10th %ile Term Code	Skip	Hold		Skip	Gap		Skip	MaxR		Skip	MaxR	MaxR
Stops (vph)	59	144		19	207		21	91		50	69	21
Fuel Used(gal)	1	2		0	3		0	1		1	2	1
CO Emissions (g/hr)	69	161		15	213		15	78		81	107	97
NOx Emissions (g/hr)	13	31		3	41		3	15		16	21	19
VOC Emissions (g/hr)	16	37		3	49		3	18		19	25	22
Dilemma Vehicles (#)	0	0		0	0		0	0		0	0	0
Queue Length 50th (ft)	23	49		6	83		6	35		18	22	0
Queue Length 95th (ft)	49	118		18	155		20	80		44	65	33
Internal Link Dist (ft)		211			142			52			95	
Turn Bay Length (ft)				50						90		90

Lanes, Volumes, Timings  
3: Mission Rd & W 47th St

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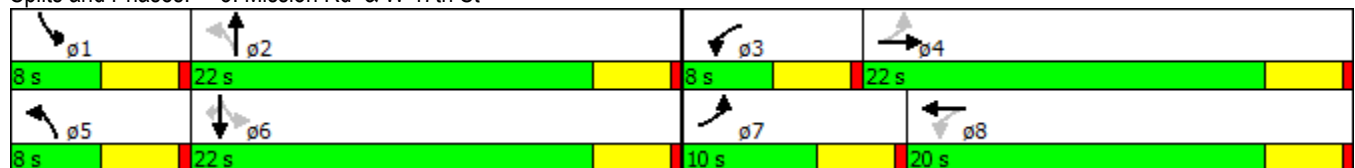


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	345	720		390	595		553	670		538	762	756
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.32	0.32		0.08	0.51		0.06	0.26		0.18	0.15	0.21

Intersection Summary

Area Type:	Other
Cycle Length:	60
Actuated Cycle Length:	53.2
Natural Cycle:	60
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.67
Intersection Signal Delay:	15.5
Intersection LOS:	B
Intersection Capacity Utilization	47.6%
ICU Level of Service	A
Analysis Period (min)	15
90th %ile Actuated Cycle:	60
70th %ile Actuated Cycle:	60
50th %ile Actuated Cycle:	57.8
30th %ile Actuated Cycle:	55.3
10th %ile Actuated Cycle:	33

Splits and Phases: 3: Mission Rd & W 47th St



**Intersection**

Int Delay, s/veh 2.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	251	44	32	234	3	41	9	54	1	5	7
Conflicting Peds, #/hr	2	0	0	0	0	0	3	0	0	1	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	-	50	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	2	0	0	1	33	0	0	4	0	0	14
Mvmt Flow	2	273	48	35	254	3	45	10	59	1	5	8

Major/Minor	Major1	Major2	Minor1	Minor2								
Conflicting Flow All	259	0	0	324	0	0	637	632	300	665	655	259
Stage 1	-	-	-	-	-	-	304	304	-	327	327	-
Stage 2	-	-	-	-	-	-	333	328	-	338	328	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.24	7.1	6.5	6.34
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.336	3.5	4	3.426
Pot Cap-1 Maneuver	1317	-	-	1247	-	-	393	400	735	376	388	751
Stage 1	-	-	-	-	-	-	710	667	-	690	651	-
Stage 2	-	-	-	-	-	-	685	651	-	681	651	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1315	-	-	1247	-	-	374	387	733	331	375	749
Mov Cap-2 Maneuver	-	-	-	-	-	-	374	387	-	331	375	-
Stage 1	-	-	-	-	-	-	707	664	-	688	632	-
Stage 2	-	-	-	-	-	-	652	632	-	616	648	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.9	14.2	12.3
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	504	1315	-	-	1247	-	-	506
HCM Lane V/C Ratio	0.224	0.002	-	-	0.028	-	-	0.028
HCM Control Delay (s)	14.2	7.7	-	-	8	-	-	12.3
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.9	0	-	-	0.1	-	-	0.1

Lanes, Volumes, Timings  
9: Rainbow Blvd & W 47th St

8/17/2017



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	192	9	117	2	4	17	105	375	10	10	387	188
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	0		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor	1.00			1.00								1.00
Frt		0.861			0.877			0.997				0.952
Flt Protected	0.950			0.950				0.989				0.999
Satd. Flow (prot)	1719	1636	0	1805	1588	0	0	3465	0	0	3318	0
Flt Permitted	0.755							0.753				0.947
Satd. Flow (perm)	1362	1636	0	1895	1588	0	0	2638	0	0	3146	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		124			18			4				161
Link Speed (mph)		30			30			35				35
Link Distance (ft)		320			259			783				134
Travel Time (s)		7.3			5.9			15.3				2.6
Confl. Peds. (#/hr)	3			3							1	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	5%	0%	0%	0%	0%	6%	2%	3%	0%	10%	4%	2%
Adj. Flow (vph)	204	10	124	2	4	18	112	399	11	11	412	200
Shared Lane Traffic (%)												
Lane Group Flow (vph)	204	134	0	2	22	0	0	522	0	0	623	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0				0
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane		Yes										
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	

Lanes, Volumes, Timings  
 9: Rainbow Blvd & W 47th St

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases	7	4		3	8			2				6
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		2	2		6		6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0		4.0
Minimum Split (s)	8.0	20.0		8.0	20.0		20.0	20.0		20.0		20.0
Total Split (s)	11.0	23.0		8.0	20.0		29.0	29.0		29.0		29.0
Total Split (%)	18.3%	38.3%		13.3%	33.3%		48.3%	48.3%		48.3%		48.3%
Maximum Green (s)	7.0	19.0		4.0	16.0		25.0	25.0		25.0		25.0
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5		3.5
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5		0.5
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0				0.0
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0				4.0
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0		3.0
Recall Mode	None	None		None	None		Max	Max		Max		Max
Walk Time (s)		5.0			5.0		5.0	5.0		5.0		5.0
Flash Dont Walk (s)		11.0			11.0		11.0	11.0		11.0		11.0
Pedestrian Calls (#/hr)		0			0		0	0		0		0
Act Effct Green (s)	8.9	7.7		5.3	6.0			28.0				28.0
Actuated g/C Ratio	0.20	0.17		0.12	0.13			0.62				0.62
v/c Ratio	0.63	0.35		0.01	0.10			0.32				0.31
Control Delay	24.3	7.8		13.5	11.9			5.6				4.1
Queue Delay	0.0	0.0		0.0	0.0			0.0				0.0
Total Delay	24.3	7.8		13.5	11.9			5.6				4.1
LOS	C	A		B	B			A				A
Approach Delay		17.7			12.0			5.6				4.1
Approach LOS		B			B			A				A
90th %ile Green (s)	7.0	10.0		4.0	7.0		25.0	25.0		25.0		25.0
90th %ile Term Code	Max	Hold		Max	Gap		MaxR	MaxR		MaxR		MaxR
70th %ile Green (s)	7.0	7.0		0.0	0.0		25.0	25.0		25.0		25.0
70th %ile Term Code	Max	Hold		Skip	Skip		MaxR	MaxR		MaxR		MaxR
50th %ile Green (s)	7.0	7.0		0.0	0.0		25.0	25.0		25.0		25.0
50th %ile Term Code	Max	Hold		Skip	Skip		MaxR	MaxR		MaxR		MaxR
30th %ile Green (s)	7.0	7.0		0.0	0.0		25.3	25.3		25.3		25.3
30th %ile Term Code	Max	Hold		Skip	Skip		Dwell	Dwell		Dwell		Dwell
10th %ile Green (s)	7.0	7.0		0.0	0.0		40.0	40.0		40.0		40.0
10th %ile Term Code	Max	Hold		Skip	Skip		Dwell	Dwell		Dwell		Dwell
Stops (vph)	162	34		3	13			216				189
Fuel Used(gal)	2	1		0	0			5				6
CO Emissions (g/hr)	162	49		2	12			347				442
NOx Emissions (g/hr)	32	10		0	2			67				86
VOC Emissions (g/hr)	38	11		0	3			80				102
Dilemma Vehicles (#)	0	0		0	0			56				66
Queue Length 50th (ft)	43	2		0	1			21				17
Queue Length 95th (ft)	86	38		4	17			76				66
Internal Link Dist (ft)		240			179			703				54
Turn Bay Length (ft)	150											

Lanes, Volumes, Timings  
 9: Rainbow Blvd & W 47th St

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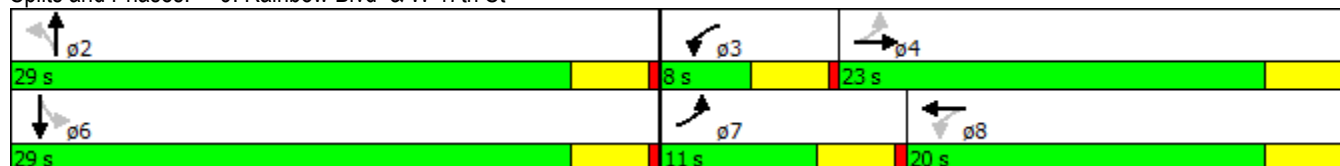


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	324	771		214	583			1634			2008	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.63	0.17		0.01	0.04			0.32			0.31	

Intersection Summary

Area Type: Other  
 Cycle Length: 60  
 Actuated Cycle Length: 45.3  
 Natural Cycle: 50  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.63  
 Intersection Signal Delay: 7.8  
 Intersection LOS: A  
 Intersection Capacity Utilization 58.0%  
 ICU Level of Service B  
 Analysis Period (min) 15  
 90th %ile Actuated Cycle: 51  
 70th %ile Actuated Cycle: 40  
 50th %ile Actuated Cycle: 40  
 30th %ile Actuated Cycle: 40.3  
 10th %ile Actuated Cycle: 55

Splits and Phases: 9: Rainbow Blvd & W 47th St



# **Scenario 7 - Road Diet alternative design (PM Peak Traffic 2017)**



Lanes, Volumes, Timings  
3: Mission Rd & W 47th St

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	137	217	37	62	332	121	51	126	36	153	318	311
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	50		0	0		0	90		90
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00			1.00			1.00					
Frt		0.978			0.960			0.966				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1858	0	1805	1811	0	1805	1835	0	1770	1900	1599
Flt Permitted	0.221			0.520			0.466			0.597		
Satd. Flow (perm)	415	1858	0	987	1811	0	884	1835	0	1112	1900	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		15			31			24				324
Link Speed (mph)		30			30			30				30
Link Distance (ft)		324			222			132				171
Travel Time (s)		7.4			5.0			3.0				3.9
Confl. Peds. (#/hr)	4			1			2					
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	1%	0%	0%	0%	1%	0%	0%	0%	0%	2%	0%	1%
Adj. Flow (vph)	143	226	39	65	346	126	53	131	38	159	331	324
Shared Lane Traffic (%)												
Lane Group Flow (vph)	143	265	0	65	472	0	53	169	0	159	331	324
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane					Yes							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100		20	100	20
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm

Lanes, Volumes, Timings  
3: Mission Rd & W 47th St

8/17/2017



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	7	4		3	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	8.0	20.0		8.0	20.0		8.0	20.0		8.0	20.0	20.0
Total Split (s)	8.0	22.0		8.0	22.0		8.0	21.0		9.0	22.0	22.0
Total Split (%)	13.3%	36.7%		13.3%	36.7%		13.3%	35.0%		15.0%	36.7%	36.7%
Maximum Green (s)	4.0	18.0		4.0	18.0		4.0	17.0		5.0	18.0	18.0
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	3.5
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	Max		None	Max	Max
Walk Time (s)		5.0			5.0			5.0			5.0	5.0
Flash Dont Walk (s)		11.0			11.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)		0			0			0			0	0
Act Effct Green (s)	20.3	18.1		19.6	16.6		20.9	17.9		22.9	20.1	20.1
Actuated g/C Ratio	0.37	0.33		0.35	0.30		0.38	0.32		0.41	0.36	0.36
v/c Ratio	0.56	0.43		0.16	0.84		0.13	0.28		0.31	0.48	0.41
Control Delay	21.8	17.8		11.2	33.8		11.1	16.2		12.7	19.2	4.2
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	21.8	17.8		11.2	33.8		11.1	16.2		12.7	19.2	4.2
LOS	C	B		B	C		B	B		B	B	A
Approach Delay		19.2			31.1			15.0			12.0	
Approach LOS		B			C			B			B	
90th %ile Green (s)	4.0	18.0		4.0	18.0		4.0	17.0		5.0	18.0	18.0
90th %ile Term Code	Max	Max		Max	Max		Max	MaxR		Max	MaxR	MaxR
70th %ile Green (s)	4.0	18.0		4.0	18.0		4.0	17.0		5.0	18.0	18.0
70th %ile Term Code	Max	Hold		Max	Max		Max	MaxR		Max	MaxR	MaxR
50th %ile Green (s)	4.0	18.0		4.0	18.0		4.0	17.0		5.0	18.0	18.0
50th %ile Term Code	Max	Hold		Max	Max		Max	MaxR		Max	MaxR	MaxR
30th %ile Green (s)	4.0	26.0		0.0	18.0		0.0	17.0		5.0	26.0	26.0
30th %ile Term Code	Max	Hold		Skip	Max		Skip	MaxR		Max	Hold	Hold
10th %ile Green (s)	0.0	11.1		0.0	11.1		0.0	18.0		0.0	18.0	18.0
10th %ile Term Code	Skip	Hold		Skip	Gap		Skip	Hold		Skip	MaxR	MaxR
Stops (vph)	82	177		37	350		33	103		92	242	38
Fuel Used(gal)	2	3		0	6		0	1		2	5	3
CO Emissions (g/hr)	111	201		32	408		24	89		149	358	207
NOx Emissions (g/hr)	22	39		6	79		5	17		29	70	40
VOC Emissions (g/hr)	26	47		7	95		6	21		34	83	48
Dilemma Vehicles (#)	0	0		0	0		0	0		0	0	0
Queue Length 50th (ft)	30	72		13	148		11	40		34	100	0
Queue Length 95th (ft)	#70	132		32	#299		27	84		67	173	49
Internal Link Dist (ft)		244			142			52			91	
Turn Bay Length (ft)				50						90		90

Lanes, Volumes, Timings  
 3: Mission Rd & W 47th St

8/17/2017

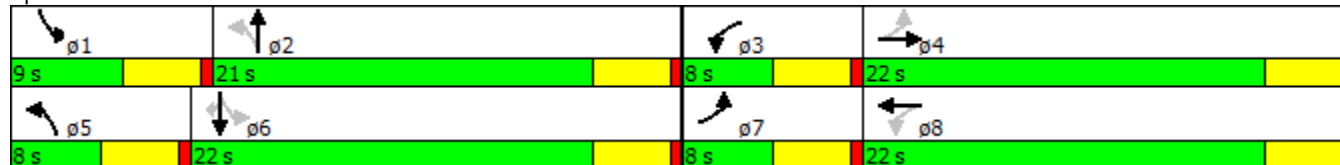


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	254	685		409	631		402	610		521	691	787
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.56	0.39		0.16	0.75		0.13	0.28		0.31	0.48	0.41

Intersection Summary

Area Type:	Other
Cycle Length:	60
Actuated Cycle Length:	55.4
Natural Cycle:	60
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.84
Intersection Signal Delay:	19.0
Intersection LOS:	B
Intersection Capacity Utilization:	65.8%
ICU Level of Service:	C
Analysis Period (min):	15
90th %ile Actuated Cycle:	60
70th %ile Actuated Cycle:	60
50th %ile Actuated Cycle:	60
30th %ile Actuated Cycle:	60
10th %ile Actuated Cycle:	37.1
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.	

Splits and Phases: 3: Mission Rd & W 47th St



**Intersection**

Int Delay, s/veh 3.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	15	366	64	49	412	5	52	2	54	1	7	12
Conflicting Peds, #/hr	3	0	0	0	0	0	2	0	0	4	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	-	50	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	0	0	0	1	0	2	0	7	0	0	0
Mvmt Flow	16	394	69	53	443	5	56	2	58	1	8	13

Major/Minor	Major1	Major2	Minor1	Minor2								
Conflicting Flow All	452	0	0	464	0	0	1027	1020	430	1047	1052	453
Stage 1	-	-	-	-	-	-	462	462	-	555	555	-
Stage 2	-	-	-	-	-	-	565	558	-	492	497	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.12	6.5	6.27	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.518	4	3.363	3.5	4	3.3
Pot Cap-1 Maneuver	1119	-	-	1108	-	-	213	239	615	208	228	611
Stage 1	-	-	-	-	-	-	580	568	-	520	516	-
Stage 2	-	-	-	-	-	-	510	515	-	562	548	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1116	-	-	1108	-	-	193	223	614	178	213	607
Mov Cap-2 Maneuver	-	-	-	-	-	-	193	223	-	178	213	-
Stage 1	-	-	-	-	-	-	571	559	-	511	490	-
Stage 2	-	-	-	-	-	-	467	489	-	500	539	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0.9	24.9	16.2
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	295	1116	-	-	1108	-	-	343
HCM Lane V/C Ratio	0.394	0.014	-	-	0.048	-	-	0.063
HCM Control Delay (s)	24.9	8.3	-	-	8.4	-	-	16.2
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	1.8	0	-	-	0.1	-	-	0.2

Lanes, Volumes, Timings  
 9: Rainbow Blvd & W 47th St

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	195	3	148	5	7	5	141	333	4	7	817	307
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	0		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor	1.00			1.00								1.00
Frt		0.853			0.937			0.999				0.959
Flt Protected	0.950			0.950				0.985				
Satd. Flow (prot)	1752	1590	0	1805	1780	0	0	3503	0	0	3428	0
Flt Permitted	0.690							0.581				0.953
Satd. Flow (perm)	1271	1590	0	1895	1780	0	0	2067	0	0	3267	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		157			5			2				120
Link Speed (mph)		30			30			35				35
Link Distance (ft)		320			259			783				134
Travel Time (s)		7.3			5.9			15.3				2.6
Confl. Peds. (#/hr)	1			3							1	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	3%	0%	2%	0%	0%	0%	0%	2%	0%	0%	1%	1%
Adj. Flow (vph)	207	3	157	5	7	5	150	354	4	7	869	327
Shared Lane Traffic (%)												
Lane Group Flow (vph)	207	160	0	5	12	0	0	508	0	0	1203	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0				0
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane		Yes										
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	

Lanes, Volumes, Timings  
 9: Rainbow Blvd & W 47th St

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	8.0	20.0		8.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	8.0	20.0		8.0	20.0		32.0	32.0		32.0	32.0	
Total Split (%)	13.3%	33.3%		13.3%	33.3%		53.3%	53.3%		53.3%	53.3%	
Maximum Green (s)	4.0	16.0		4.0	16.0		28.0	28.0		28.0	28.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Max	Max		Max	Max	
Walk Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Flash Dont Walk (s)		11.0			11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effct Green (s)	7.4	6.7		5.8	6.5			31.0			31.0	
Actuated g/C Ratio	0.16	0.14		0.12	0.14			0.66			0.66	
v/c Ratio	0.81	0.44		0.02	0.05			0.37			0.55	
Control Delay	41.0	8.6		14.8	14.8			5.8			6.0	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	41.0	8.6		14.8	14.8			5.8			6.0	
LOS	D	A		B	B			A			A	
Approach Delay		26.9			14.8			5.8			6.0	
Approach LOS		C			B			A			A	
90th %ile Green (s)	4.0	10.1		4.0	10.1		28.0	28.0		28.0	28.0	
90th %ile Term Code	Max	Gap		Max	Hold		MaxR	MaxR		MaxR	MaxR	
70th %ile Green (s)	7.0	7.0		0.0	0.0		28.0	28.0		28.0	28.0	
70th %ile Term Code	Hold	Gap		Skip	Skip		MaxR	MaxR		MaxR	MaxR	
50th %ile Green (s)	5.5	5.5		0.0	0.0		28.0	28.0		28.0	28.0	
50th %ile Term Code	Hold	Gap		Skip	Skip		MaxR	MaxR		MaxR	MaxR	
30th %ile Green (s)	5.5	5.5		0.0	0.0		28.0	28.0		28.0	28.0	
30th %ile Term Code	Hold	Gap		Skip	Skip		MaxR	MaxR		MaxR	MaxR	
10th %ile Green (s)	5.5	5.5		0.0	0.0		43.0	43.0		43.0	43.0	
10th %ile Term Code	Hold	Hold		Skip	Skip		Dwell	Dwell		Dwell	Dwell	
Stops (vph)	187	32		8	11			206			510	
Fuel Used(gal)	3	1		0	0			5			14	
CO Emissions (g/hr)	220	57		5	8			336			960	
NOx Emissions (g/hr)	43	11		1	2			65			187	
VOC Emissions (g/hr)	51	13		1	2			78			222	
Dilemma Vehicles (#)	0	0		0	0			52			122	
Queue Length 50th (ft)	49	1		1	1			18			44	
Queue Length 95th (ft)	95	41		7	13			82			183	
Internal Link Dist (ft)		240			179			703			54	
Turn Bay Length (ft)	150											

Lanes, Volumes, Timings  
 9: Rainbow Blvd & W 47th St

8/17/2017

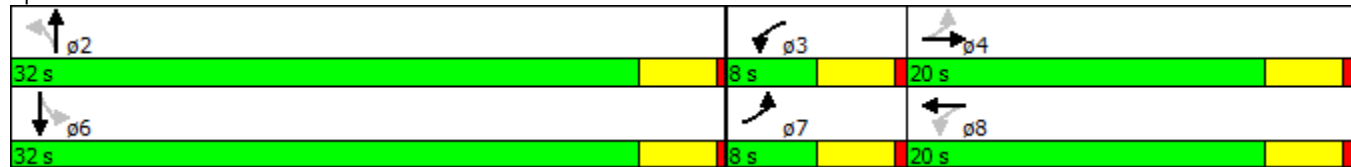


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	257	650		225	616			1356			2184	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.81	0.25		0.02	0.02			0.37			0.55	

Intersection Summary

Area Type:	Other
Cycle Length:	60
Actuated Cycle Length:	47.3
Natural Cycle:	60
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.81
Intersection Signal Delay:	9.7
Intersection LOS:	A
Intersection Capacity Utilization:	73.5%
ICU Level of Service:	D
Analysis Period (min):	15
90th %ile Actuated Cycle:	54.1
70th %ile Actuated Cycle:	43
50th %ile Actuated Cycle:	41.5
30th %ile Actuated Cycle:	41.5
10th %ile Actuated Cycle:	56.5

Splits and Phases: 9: Rainbow Blvd & W 47th St



# **Scenario 8 - Road Diet alternative design (Saturday Peak Traffic 2017)**



Lanes, Volumes, Timings

3: Mission Rd /Mission Rd & W 47th St/W 47th St

8/17/2017



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	124	207	27	41	175	103	37	78	38	117	97	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	50		0	0		0	90		90
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.98			0.99			0.99			0.99		
Frt		0.982			0.945			0.951				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1866	0	1805	1784	0	1805	1795	0	1787	1863	1599
Flt Permitted	0.330			0.610			0.693			0.609		
Satd. Flow (perm)	617	1866	0	1151	1784	0	1297	1795	0	1139	1863	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		11			48			39				164
Link Speed (mph)		30			30			30				30
Link Distance (ft)		293			222			132				175
Travel Time (s)		6.7			5.0			3.0				4.0
Confl. Peds. (#/hr)	15			5			9			4		
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	0%	0%	0%	0%	1%	0%	0%	1%	0%	1%	2%	1%
Adj. Flow (vph)	127	211	28	42	179	105	38	80	39	119	99	153
Shared Lane Traffic (%)												
Lane Group Flow (vph)	127	239	0	42	284	0	38	119	0	119	99	153
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane					Yes							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100		20	100	20
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm

# Lanes, Volumes, Timings

## 3: Mission Rd /Mission Rd & W 47th St/W 47th St

8/17/2017



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	7	4		3	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	8.0	20.0		8.0	20.0		8.0	20.0		8.0	20.0	20.0
Total Split (s)	10.0	22.0		8.0	20.0		8.0	21.0		9.0	22.0	22.0
Total Split (%)	16.7%	36.7%		13.3%	33.3%		13.3%	35.0%		15.0%	36.7%	36.7%
Maximum Green (s)	6.0	18.0		4.0	16.0		4.0	17.0		5.0	18.0	18.0
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	3.5
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	Max		None	Max	Max
Walk Time (s)		5.0			5.0			5.0			5.0	5.0
Flash Dont Walk (s)		11.0			11.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)		0			0			0			0	0
Act Effct Green (s)	18.6	16.5		15.0	12.0		21.2	18.2		23.8	22.0	22.0
Actuated g/C Ratio	0.35	0.31		0.29	0.23		0.40	0.35		0.45	0.42	0.42
v/c Ratio	0.35	0.40		0.11	0.64		0.07	0.18		0.21	0.13	0.20
Control Delay	13.7	16.8		11.2	23.3		10.1	12.4		10.8	14.0	3.8
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	13.7	16.8		11.2	23.3		10.1	12.4		10.8	14.0	3.8
LOS	B	B		B	C		B	B		B	B	A
Approach Delay		15.7			21.7			11.9			8.8	
Approach LOS		B			C			B			A	
90th %ile Green (s)	6.0	18.0		4.0	16.0		4.0	17.0		5.0	18.0	18.0
90th %ile Term Code	Max	Hold		Max	Max		Max	MaxR		Max	MaxR	MaxR
70th %ile Green (s)	6.0	17.4		4.0	15.4		4.0	17.0		5.0	18.0	18.0
70th %ile Term Code	Max	Hold		Max	Gap		Max	MaxR		Max	MaxR	MaxR
50th %ile Green (s)	6.0	22.8		0.0	12.8		0.0	17.0		5.0	26.0	26.0
50th %ile Term Code	Max	Hold		Skip	Gap		Skip	MaxR		Max	Hold	Hold
30th %ile Green (s)	6.0	20.4		0.0	10.4		0.0	17.0		5.0	26.0	26.0
30th %ile Term Code	Max	Hold		Skip	Gap		Skip	MaxR		Max	Hold	Hold
10th %ile Green (s)	0.0	6.6		0.0	6.6		0.0	18.0		0.0	18.0	18.0
10th %ile Term Code	Skip	Hold		Skip	Gap		Skip	Hold		Skip	MaxR	MaxR
Stops (vph)	71	160		27	195		23	60		65	63	21
Fuel Used(gal)	1	3		0	3		0	1		2	1	1
CO Emissions (g/hr)	85	181		22	201		17	52		108	98	100
NOx Emissions (g/hr)	17	35		4	39		3	10		21	19	19
VOC Emissions (g/hr)	20	42		5	47		4	12		25	23	23
Dilemma Vehicles (#)	0	0		0	0		0	0		0	0	0
Queue Length 50th (ft)	27	51		8	72		7	20		22	18	0
Queue Length 95th (ft)	55	120		23	139		22	56		52	57	31
Internal Link Dist (ft)		213			142			52			95	
Turn Bay Length (ft)				50						90		90

# Lanes, Volumes, Timings

## 3: Mission Rd /Mission Rd & W 47th St/W 47th St

8/17/2017



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	361	727		379	604		562	647		579	778	763
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.35	0.33		0.11	0.47		0.07	0.18		0.21	0.13	0.20

### Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 52.6

Natural Cycle: 60

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.64

Intersection Signal Delay: 14.7

Intersection LOS: B

Intersection Capacity Utilization 45.5%

ICU Level of Service A

Analysis Period (min) 15

90th %ile Actuated Cycle: 60

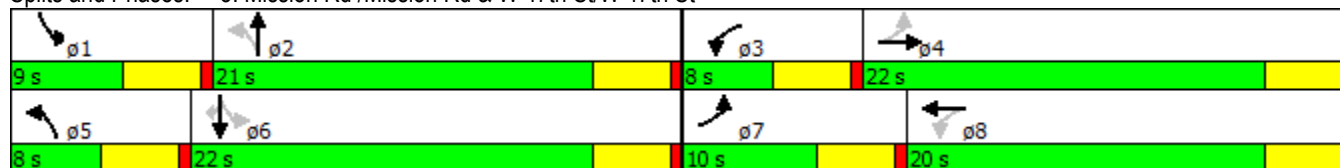
70th %ile Actuated Cycle: 59.4

50th %ile Actuated Cycle: 56.8

30th %ile Actuated Cycle: 54.4

10th %ile Actuated Cycle: 32.6

### Splits and Phases: 3: Mission Rd /Mission Rd & W 47th St/W 47th St



**Intersection**

Int Delay, s/veh 2.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	11	289	40	23	261	5	47	6	20	1	3	9
Conflicting Peds, #/hr	1	0	0	0	0	0	2	0	0	1	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	-	50	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	97	97	97	97	97	97	97	97	97	97	97	97
Heavy Vehicles, %	0	0	2	0	0	0	0	0	0	0	0	0
Mvmt Flow	11	298	41	24	269	5	48	6	21	1	3	9

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	275	0	0	341	0	0	669	666	321	677	684	274
Stage 1	-	-	-	-	-	-	343	343	-	320	320	-
Stage 2	-	-	-	-	-	-	326	323	-	357	364	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1300	-	-	1229	-	-	374	383	724	369	374	770
Stage 1	-	-	-	-	-	-	676	641	-	696	656	-
Stage 2	-	-	-	-	-	-	691	654	-	665	627	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1299	-	-	1229	-	-	358	371	723	346	363	769
Mov Cap-2 Maneuver	-	-	-	-	-	-	358	371	-	346	363	-
Stage 1	-	-	-	-	-	-	669	635	-	690	643	-
Stage 2	-	-	-	-	-	-	666	641	-	634	621	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0.6	15.5	11.5
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	417	1299	-	-	1229	-	-	569
HCM Lane V/C Ratio	0.18	0.009	-	-	0.019	-	-	0.024
HCM Control Delay (s)	15.5	7.8	-	-	8	-	-	11.5
HCM Lane LOS	C	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.7	0	-	-	0.1	-	-	0.1

# Lanes, Volumes, Timings

## 9: Rainbow Blvd/Rainbow Blvd & W 47th St

8/17/2017



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	227	14	118	5	4	9	113	181	12	11	189	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	0		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor				1.00				1.00				1.00
Frt		0.866			0.896			0.994				0.937
Flt Protected	0.950			0.950				0.982				0.998
Satd. Flow (prot)	1805	1645	0	1805	1702	0	0	3503	0	0	3362	0
Flt Permitted	0.784							0.748				0.944
Satd. Flow (perm)	1490	1645	0	1893	1702	0	0	2667	0	0	3180	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		124			9			8				153
Link Speed (mph)		30			30			35				35
Link Distance (ft)		320			259			783				134
Travel Time (s)		7.3			5.9			15.3				2.6
Confl. Peds. (#/hr)				4			1			2		
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	1%
Adj. Flow (vph)	239	15	124	5	4	9	119	191	13	12	199	153
Shared Lane Traffic (%)												
Lane Group Flow (vph)	239	139	0	5	13	0	0	323	0	0	364	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0				0
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane		Yes										
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm		NA

Lanes, Volumes, Timings  
 9: Rainbow Blvd/Rainbow Blvd & W 47th St

8/17/2017



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases	7	4		3	8			2				6
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		2	2		6		6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0		4.0
Minimum Split (s)	8.0	20.0		8.0	20.0		20.0	20.0		20.0		20.0
Total Split (s)	15.0	27.0		8.0	20.0		25.0	25.0		25.0		25.0
Total Split (%)	25.0%	45.0%		13.3%	33.3%		41.7%	41.7%		41.7%		41.7%
Maximum Green (s)	11.0	23.0		4.0	16.0		21.0	21.0		21.0		21.0
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5		3.5
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5		0.5
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0				0.0
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0				4.0
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0		3.0
Recall Mode	None	None		None	None		Max	Max		Max		Max
Walk Time (s)		5.0			5.0		5.0	5.0		5.0		5.0
Flash Dont Walk (s)		11.0			11.0		11.0	11.0		11.0		11.0
Pedestrian Calls (#/hr)		0			0		0	0		0		0
Act Effct Green (s)	11.8	10.4		5.2	5.9			23.7				23.7
Actuated g/C Ratio	0.27	0.24		0.12	0.14			0.54				0.54
v/c Ratio	0.50	0.29		0.02	0.06			0.22				0.20
Control Delay	16.0	5.9		12.6	13.2			6.8				4.2
Queue Delay	0.0	0.0		0.0	0.0			0.0				0.0
Total Delay	16.0	5.9		12.6	13.2			6.8				4.2
LOS	B	A		B	B			A				A
Approach Delay		12.3			13.0			6.8				4.2
Approach LOS		B			B			A				A
90th %ile Green (s)	11.0	13.6		4.0	6.6		21.0	21.0		21.0		21.0
90th %ile Term Code	Max	Hold		Max	Gap		MaxR	MaxR		MaxR		MaxR
70th %ile Green (s)	11.0	11.0		0.0	0.0		21.0	21.0		21.0		21.0
70th %ile Term Code	Max	Hold		Skip	Skip		MaxR	MaxR		MaxR		MaxR
50th %ile Green (s)	10.3	10.3		0.0	0.0		21.0	21.0		21.0		21.0
50th %ile Term Code	Gap	Hold		Skip	Skip		MaxR	MaxR		MaxR		MaxR
30th %ile Green (s)	8.9	8.9		0.0	0.0		21.0	21.0		21.0		21.0
30th %ile Term Code	Gap	Hold		Skip	Skip		MaxR	MaxR		MaxR		MaxR
10th %ile Green (s)	7.7	7.7		0.0	0.0		34.3	34.3		34.3		34.3
10th %ile Term Code	Gap	Hold		Skip	Skip		Dwell	Dwell		Dwell		Dwell
Stops (vph)	169	32		8	10			149				102
Fuel Used(gal)	2	1		0	0			3				4
CO Emissions (g/hr)	157	47		5	8			229				256
NOx Emissions (g/hr)	30	9		1	2			45				50
VOC Emissions (g/hr)	36	11		1	2			53				59
Dilemma Vehicles (#)	0	0		0	0			36				40
Queue Length 50th (ft)	44	2		1	1			16				10
Queue Length 95th (ft)	85	35		5	13			54				41
Internal Link Dist (ft)		240			179			703				54
Turn Bay Length (ft)	150											

Lanes, Volumes, Timings  
 9: Rainbow Blvd/Rainbow Blvd & W 47th St

8/17/2017

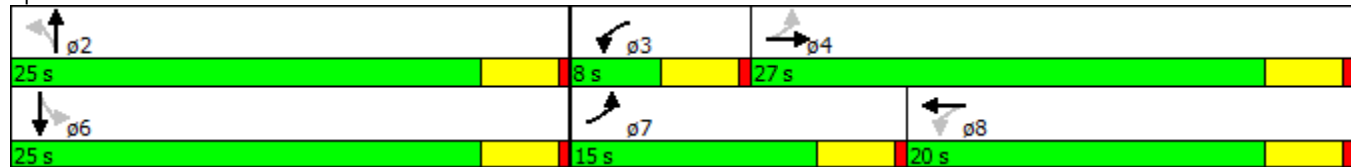


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	525	939		217	640			1451			1796	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.46	0.15		0.02	0.02			0.22			0.20	

Intersection Summary

Area Type:	Other
Cycle Length:	60
Actuated Cycle Length:	43.6
Natural Cycle:	50
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.50
Intersection Signal Delay:	7.9
Intersection LOS:	A
Intersection Capacity Utilization:	48.1%
ICU Level of Service:	A
Analysis Period (min):	15
90th %ile Actuated Cycle:	50.6
70th %ile Actuated Cycle:	40
50th %ile Actuated Cycle:	39.3
30th %ile Actuated Cycle:	37.9
10th %ile Actuated Cycle:	50

Splits and Phases: 9: Rainbow Blvd/Rainbow Blvd & W 47th St



# 47th Street Complete Street Plan

## Appendix II: Parking Analysis

WESTWOOD | ROELAND PARK | UNIFIED GOVERNMENT | MARC

FEBRUARY 2018



# 47th and Mission Parking Summary

47th Street Complete Street Plan  
November 2017



# Parking Inventory

The 47th Street Complete Street Plan studies the potential for a redesigned roadway that better serves the needs of all users. This includes safe and convenient accommodations for pedestrians, bicyclists, transit users, and motorists. It also includes features that support the corridor as a destination that people want to visit and spend time. The 47th and Mission area has several of the corridor’s most popular destinations and recent investment and development is poised to continue. Parking in the 47th and Mission area is in high demand because of the area’s success in attracting visitors and businesses.

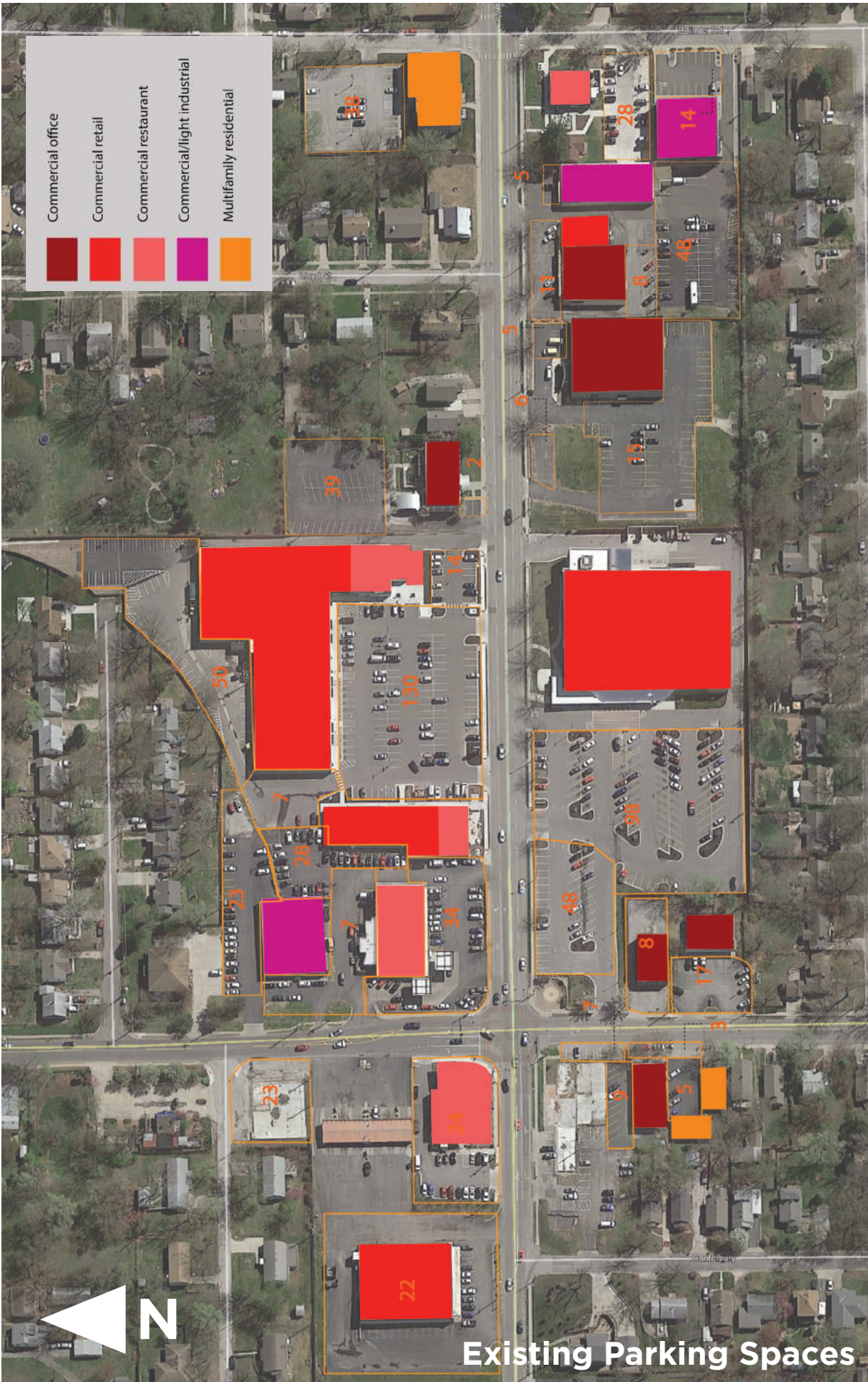
One of the major decisions for the 47th Street Complete Street Plan will be whether to create additional on-street parking. New parking may come at the expense of better accommodations for other modes (such as bike lanes, pedestrian

amenities, or transit facilities). This Parking Summary was undertaken to inform decisions about these tradeoffs and identify the characteristics of parking demand in the area.

Today there are just under 800 parking spaces in the 47th and Mission area. Some of these spaces may be restricted in use or inconvenient to utilize today. However, this study assumes that the total parking supply has the potential to be efficiently shared and accessed by visitors to the district. In other words, this study focuses on whether there is enough parking supply, but not on the management of that parking supply. The existing parking supply serves approximately 94,000 square feet of commercial space, 33,000 square feet of office space, 20,000 square feet of restaurant space, 20,000 of flex commercial space, and 22 residential units.

## Parking and Land Use Inventory

	Residential Units	Office Square Feet	Commercial Square Feet	Restaurant Square Feet	Flex Com Square Feet	Parking Spaces
Northwest Corner	0	0	11,760	2,800	0	69
Northeast Corner	18	6,400	46,750	14,948	8,000	372
Southwest Corner	4	3,825	0	0	0	24
Southeast Corner	0	22,735	35,735	2,184	12,084	333
<b>Total</b>	<b>22</b>	<b>32,960</b>	<b>94,325</b>	<b>19,932</b>	<b>20,084</b>	<b>798</b>

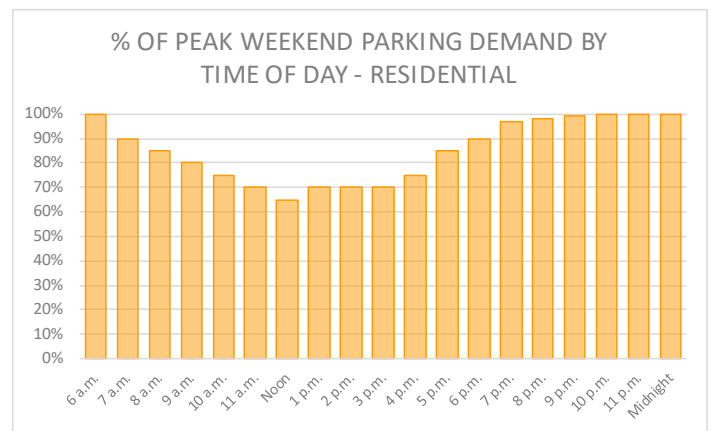
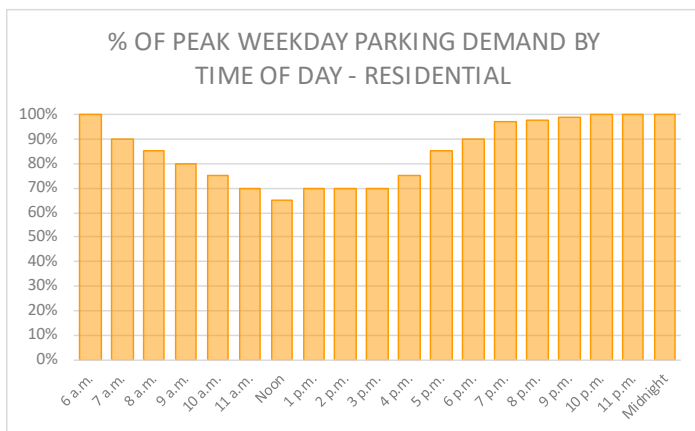


# Parking Patterns

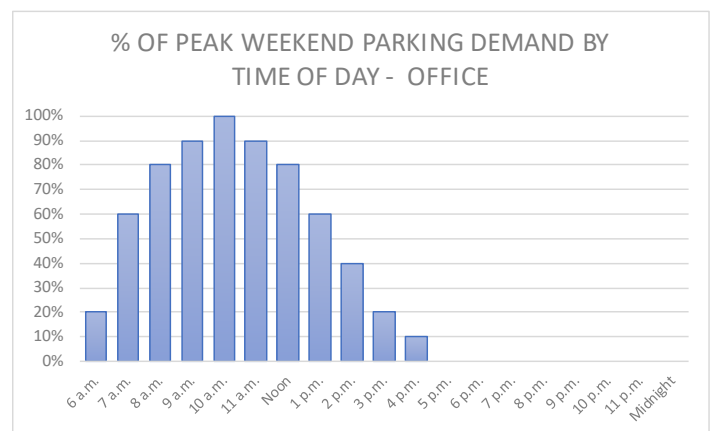
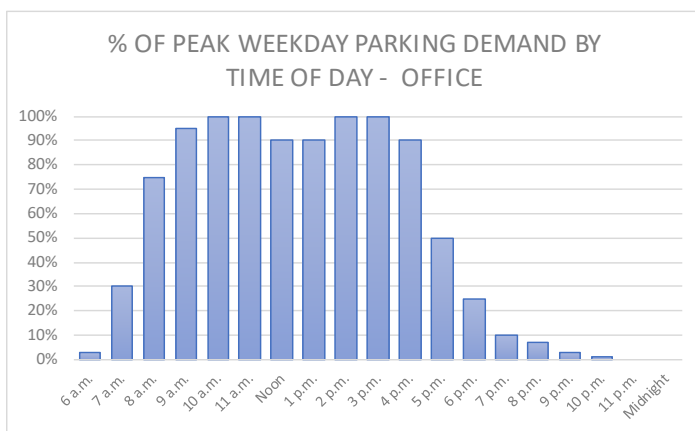
The 47th and Mission area has a healthy mix of different land uses. This is helpful when it comes to parking because different land uses have different requirements for parking throughout the day. For example residential uses need parking most at night, when everyone is at home. During the day when people leave for work, the parking demand is lower. Office uses, on the other hand, require the most parking during business hours but almost no parking late at night. Restaurant uses are busiest around lunch and dinner times. When a mix of uses is

located in a single area, the parking patterns for each land use overlap, and a single parking space can be utilized for several different uses throughout the day. This increases the efficiency of the parking supply and reduces the overall demand for spaces. Daily parking profiles for the uses in the 47th and Mission area are outlined in the charts below. This data is based on research from the ULI Shared Parking Manual, which compiles parking data from several national sources.

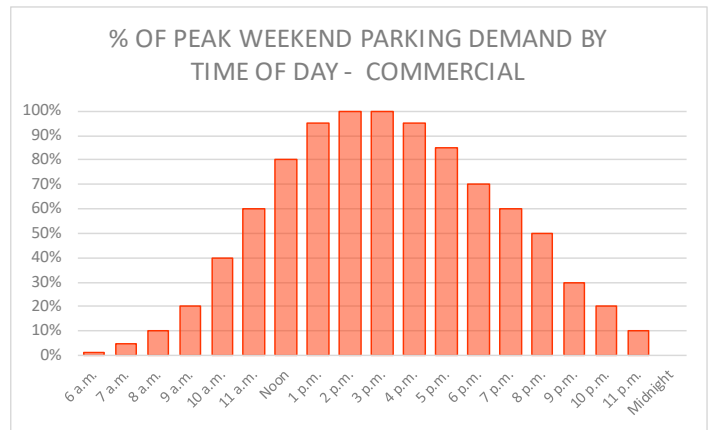
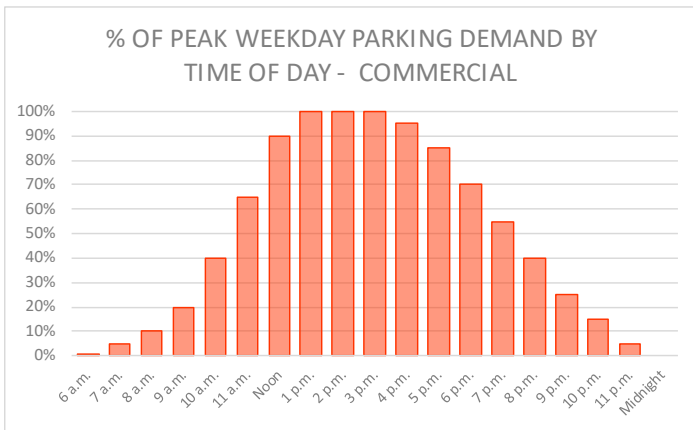
## Residential



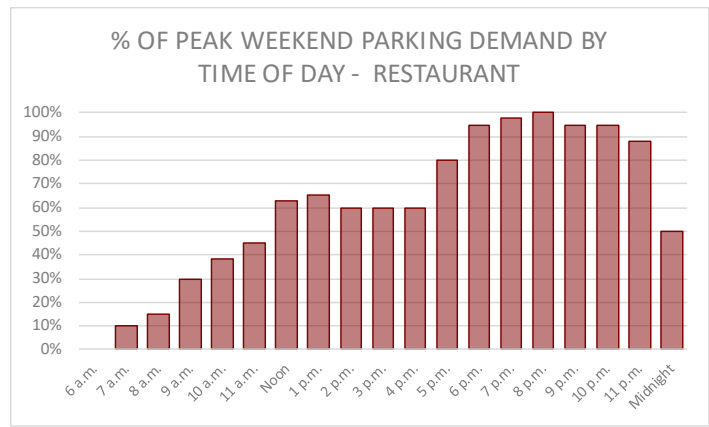
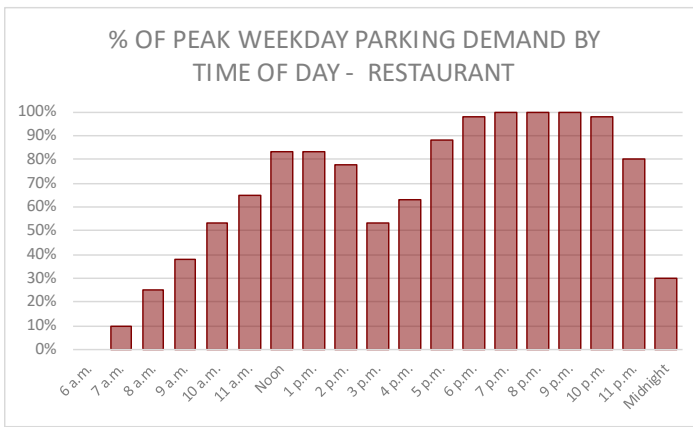
## Office



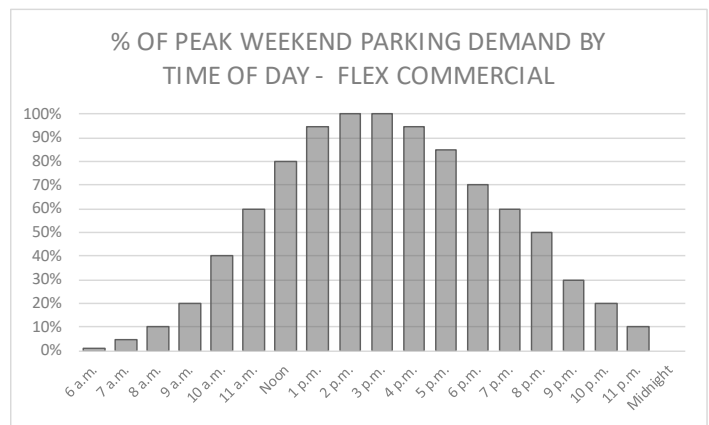
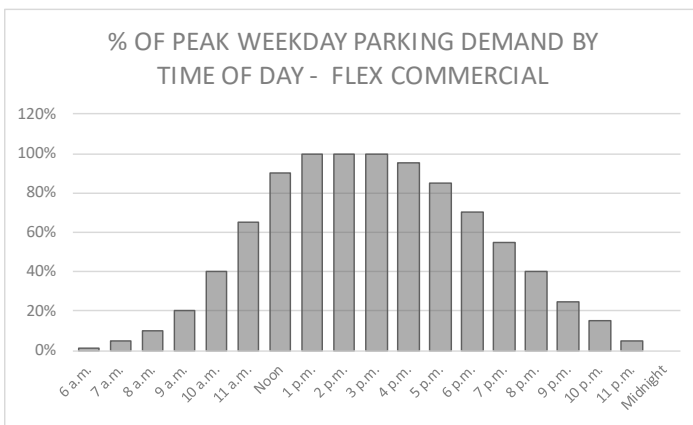
# Commercial



# Restaurant



# Flex Commercial



# Parking Observations

The mix of uses in the 47th and Mission area, combined with the hourly parking profiles for each use, suggest that weekday lunch times and weekend evenings have the highest potential parking demand. During weekday lunch hours, parking demand for those working regular business hours combines with parking demand for those driving to the area to eat lunch or shop. On Friday evenings, some parking demand remains from employees working regular business hours, combined with residential parkers returning home and those driving to the area to shop or eat at restaurants.

To understand the actual parking at these peak times, the project team conducted observations of all of the parking spaces in the 47th and Mission area, identifying how many spaces in each parking lot were utilized at different times.

Generally a goal of at least ten percent parking vacancy is considered ideal. If a parking lot is more than ninety percent occupied, the lot is operating close to capacity, and drivers perceive parking problems. If the occupancy is very low, this indicates that too much land is being devoted to storage of automobiles, and could be converted to more active and productive uses.

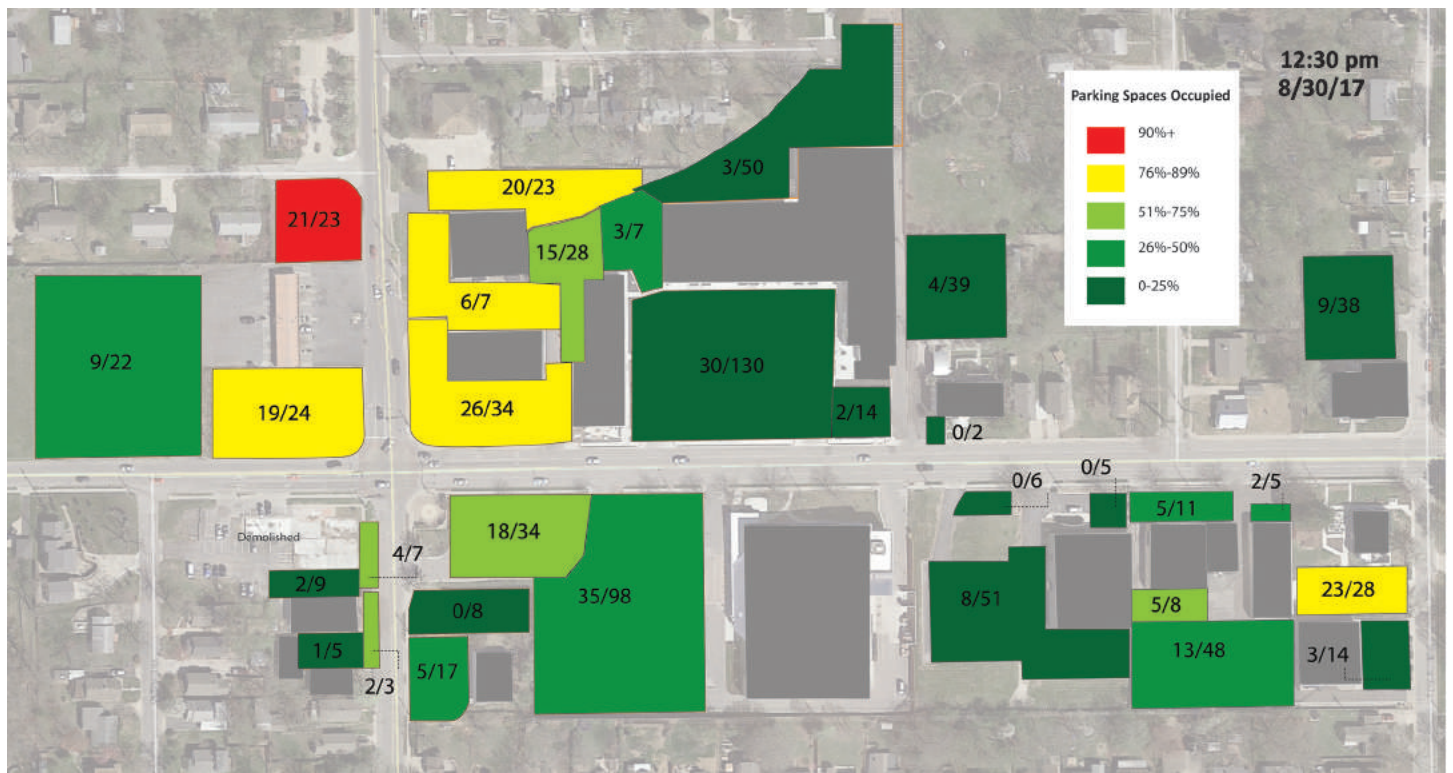
The highest observed parking use occurred during lunch hours on weekdays. At this time 293 spaces were occupied out of a total of 798 spaces, for a parking utilization rate of thirty-seven

percent. Weekend evening parking was slightly lower, with 263 spaces occupied out a total of 798 spaces, for a parking utilization rate of thirty-three percent.

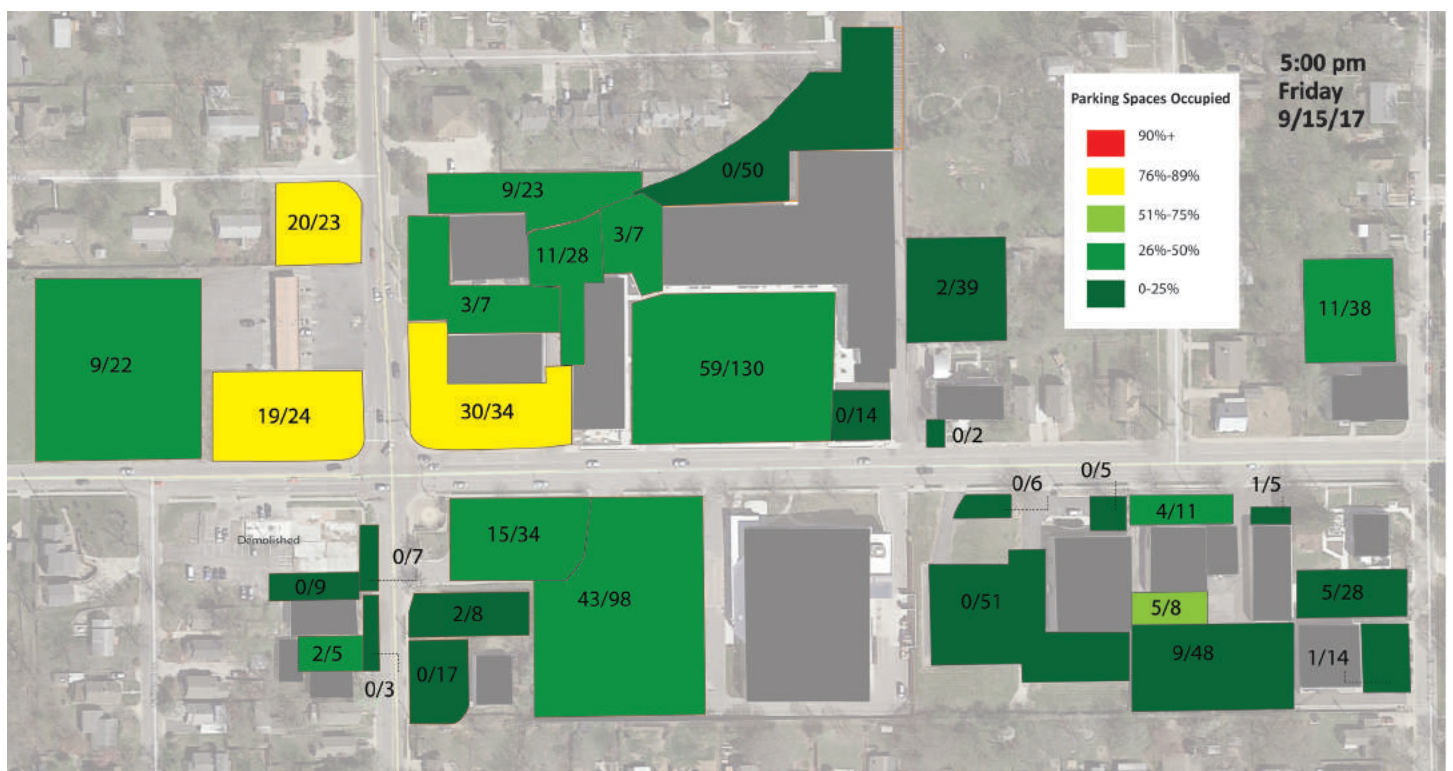
While the overall parking utilization was low even at peak times, parking spaces directly adjacent to Joe's Kansas City and Taco Republic were in higher demand. These locations fell in the "sweet spot" with eighty to ninety percent occupancy at the busiest times, but always with some parking spaces available.



## Parking Utilization - Wednesday 12:30pm



## Parking Utilization - Friday 5:00pm



# Existing Parking Demand

To determine demand for parking in the 47th and Mission area, the project team first identified peak parking rates for individual uses in the corridor based on research from the ULI Shared Parking Manual, which compiles parking data from several national sources. These parking demand estimates were calibrated to actual conditions in the 47th Street corridor with on-the-ground observations of actual parking utilization at peak times. The calibrated parking demand rates shown in the table below result in a model that slightly overestimates parking demand in order to provide a very conservative estimate of future parking availability.

## Peak Parking Rates

	Predicted Parking Demand*	Observed Parking Demand
Residential	1.2 Spaces per Unit	1 Space per Unit
Office	3.4 Spaces per 1,000 sf	2.5 Spaces per 1,000 sf
Commercial	4 Spaces per 1,000 sf	2.5 Spaces per 1,000 sf
Restaurant	18 Spaces per 1,000 sf	8 Spaces per 1,000 sf
Flex Commercial	2.5 Spaces per 1,000 sf	2 Spaces per 1,000 sf

\*ULI Shared Parking Manual

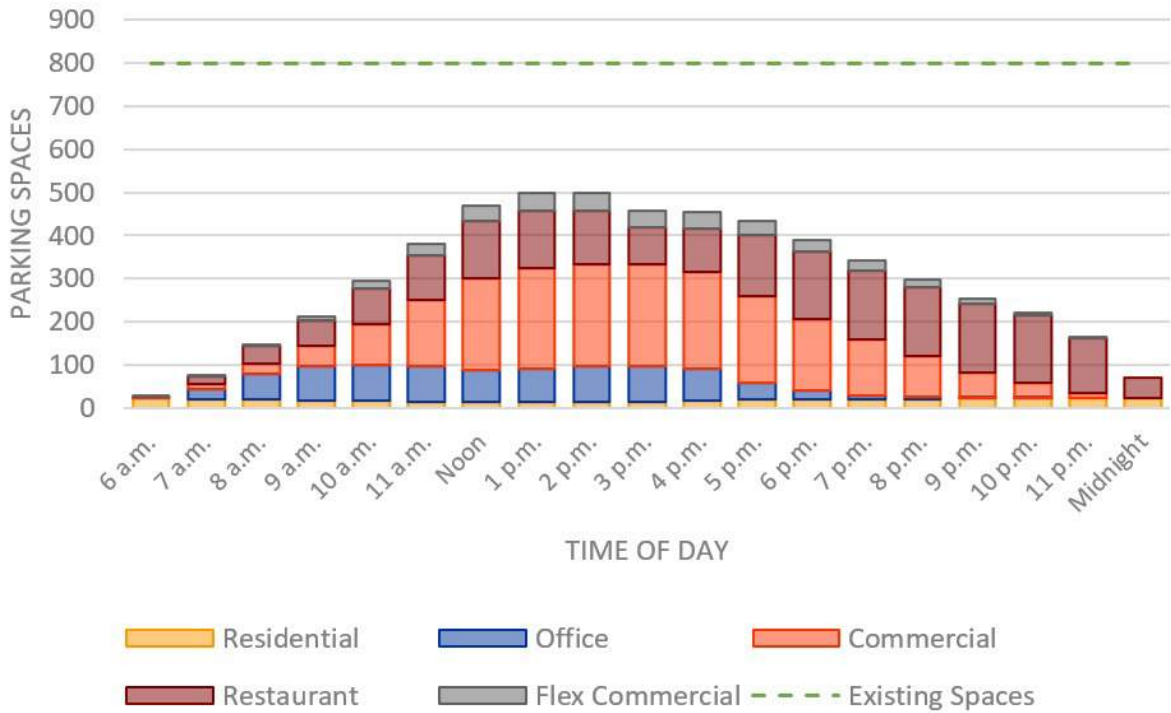
The charts on the following page show the demand for parking in the 47th and Mission area when the mix of uses in the district is combined to determine how much parking is necessary at any given hour throughout the day. These charts indicate that the periods of highest parking demand are between noon and 5:00pm on weekdays and weekends. The peak demand on weekdays is approximately 498 out of a total of 798 parking spaces, meaning that there are approximately 300 spaces available at the busiest weekday times (62% utilization). This represents a peak parking utilization of The peak demand on weekends is slightly lower at 430 out of a total of 798 parking spaces (54% utilization).

This data indicates that even at peak times there is a large amount of unused parking in the 47th and Mission area. The data also suggests that there are large parts of the day where the available parking spaces are substantially empty. The space that is dedicated to unused car storage is space that is not being used for more active and productive uses.

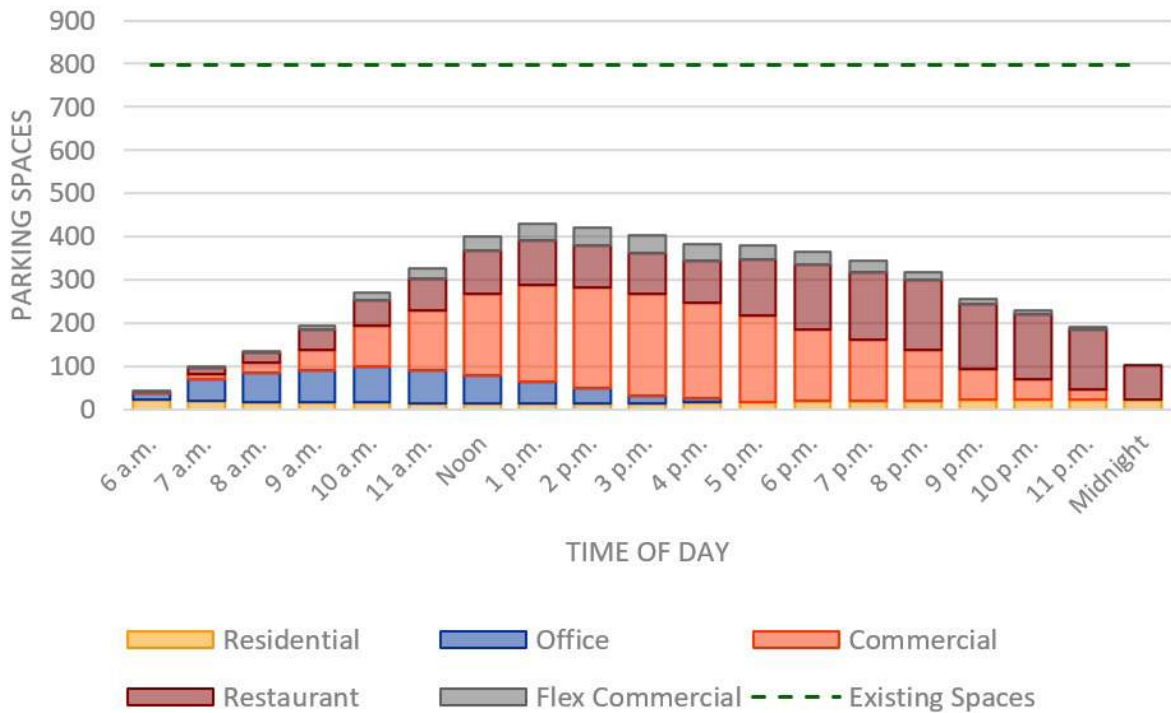
While there appears to be sufficient parking in the district currently, there are several opportunities for additional off-street parking within the existing development pattern that could expand supply. There is also the potential to reduce the future parking demand by increasing the number of trips that don't require an automobile (walking, biking, and transit). These trips may be encouraged by improved infrastructure for these alternative modes. All of these factors should be considered as design alternatives for 47th Street are developed.



### SHARED PARKING DEMAND BY TIME OF DAY - WEEKDAYS



### SHARED PARKING DEMAND BY TIME OF DAY- WEEKENDS



# Future Parking Demand

Westwood, Roeland Park, and Kansas City, Kansas share a vision to support new investment and development on the 47th Street corridor, and in particular in the 47th and Mission area. As new development occurs, demand for new parking could increase at the same time that existing parking spaces are removed from the parking supply. To understand the impact of new development on parking supply and utilization, a hypothetical development scenario was developed that includes a mix of new commercial, restaurant, office, and residential uses in the 47th and Mission area. This development is imagined to create new active frontage on 47th Street, and fill in some of the gaps along the corridor. It is assumed that some development will take up existing parking spaces, while other sites can be developed with no impact to existing parking supply. It is also assumed that some new development will provide new off-street parking.

The scenario illustrated by the diagram below envisions:

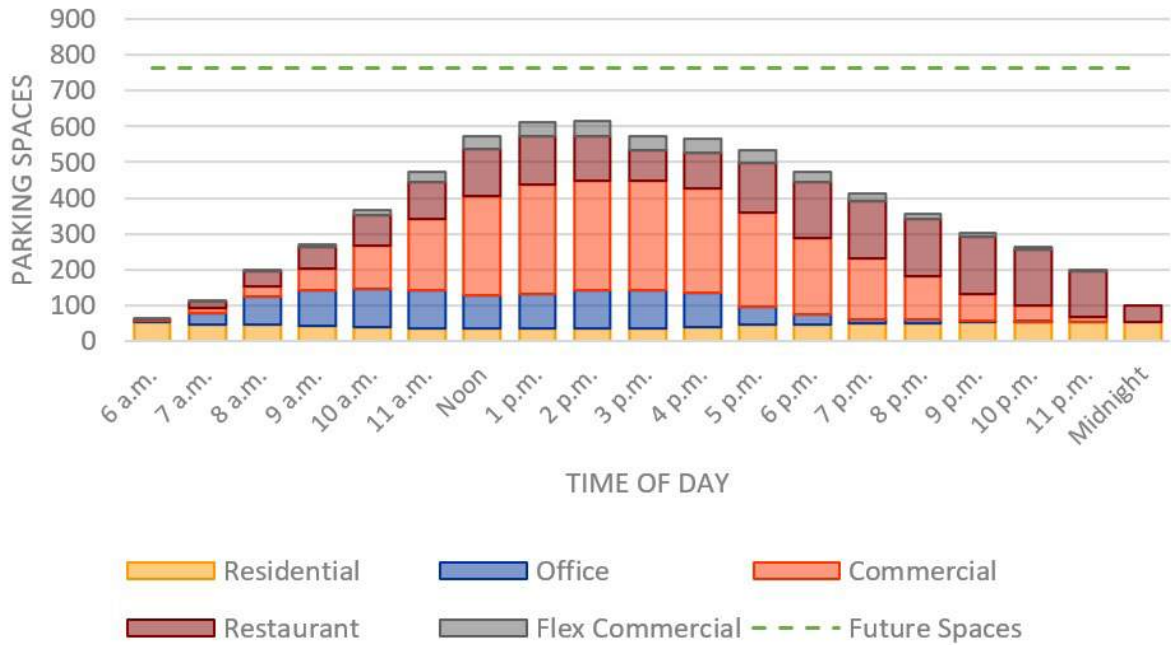
- **29,000 square feet of additional commercial/restaurant uses**
- **9,000 square feet of additional office uses**
- **30 new residential units**
- **A net parking loss 33 spaces**

The charts on the following page indicate there is sufficient parking in the 47th and Mission area to accommodate substantial new development. The peak demand on weekdays in the future development scenario is approximately 614 out of a total of 765 parking spaces (80% utilization) at the busiest times. The peak demand on weekends is slightly lower at 534 out of a total of 765 parking spaces (70% utilization).

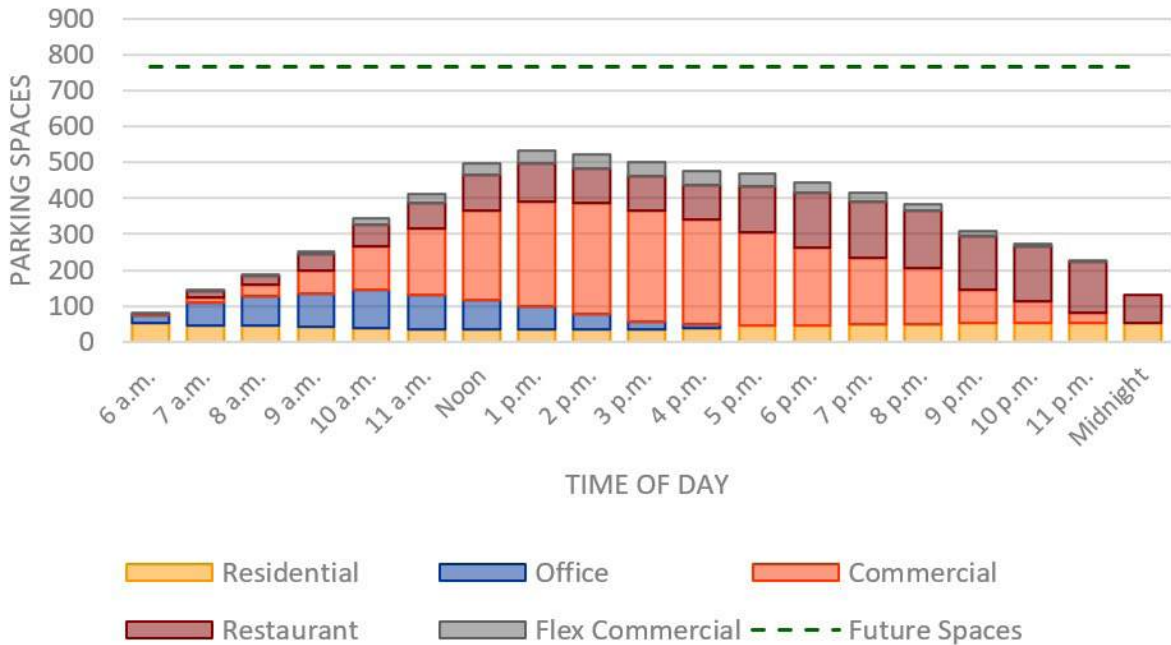
Based on the analysis of existing and future parking demand, new on-street parking supply is not necessary to meet the parking needs of the district.



## FUTURE PARKING DEMAND BY TIME OF DAY - WEEKDAYS



## FUTURE PARKING DEMAND BY TIME OF DAY - WEEKENDS





# 47th Street Complete Street Plan

## Appendix III: Public Meeting Summary

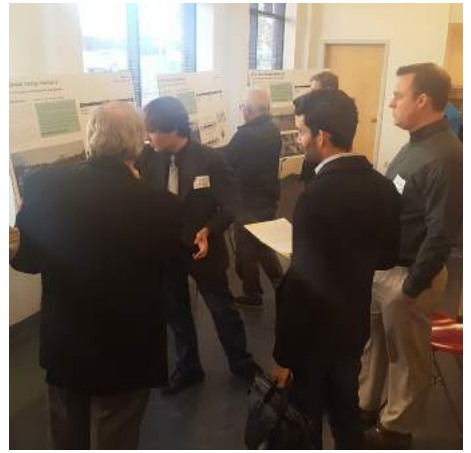
WESTWOOD | ROELAND PARK | UNIFIED GOVERNMENT | MARC

FEBRUARY 2018

# January 23 Public Meeting Summary

47th Street Complete Street Plan

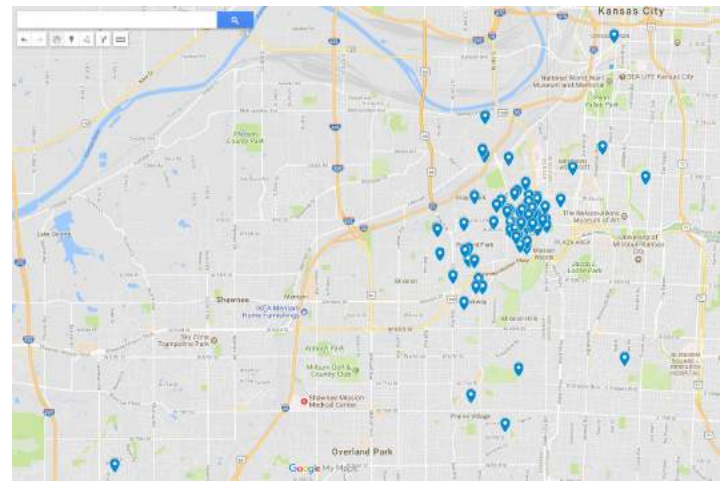




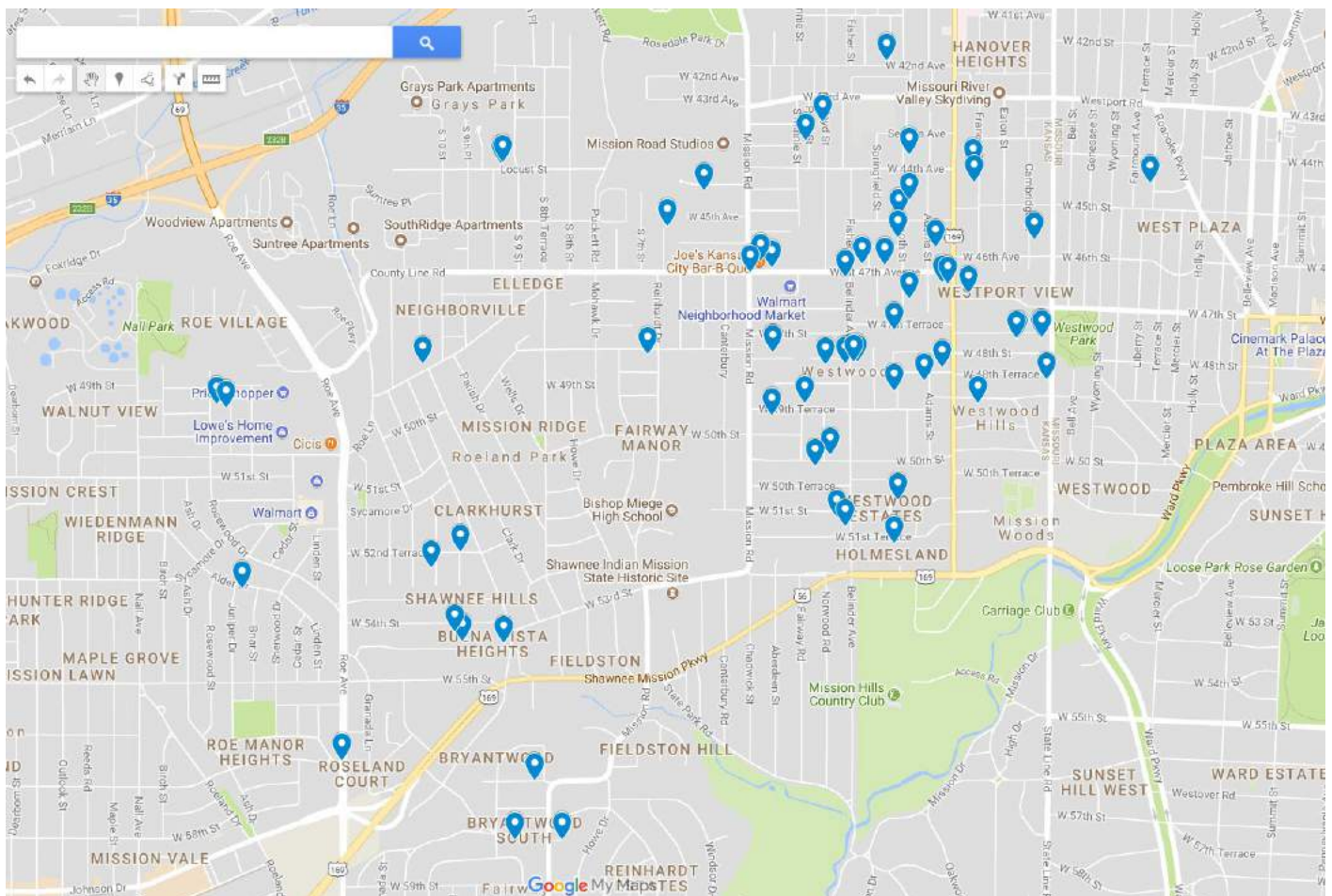
# Participants

- 86 participants signed in.
- 58 surveys were completed.
- Participant ages ranged from young adults to elderly.
- Participant addresses were concentrated on and around the 47th Street corridor, with many attendees from nearby areas of Westwood, Roeland Park, Wyandotte County, and adjacent communities.
- Participants included a mix of residents, business owners, and visitors
- Participants included staff and elected officials from several jurisdictions.

## Participant Addresses: Regional View

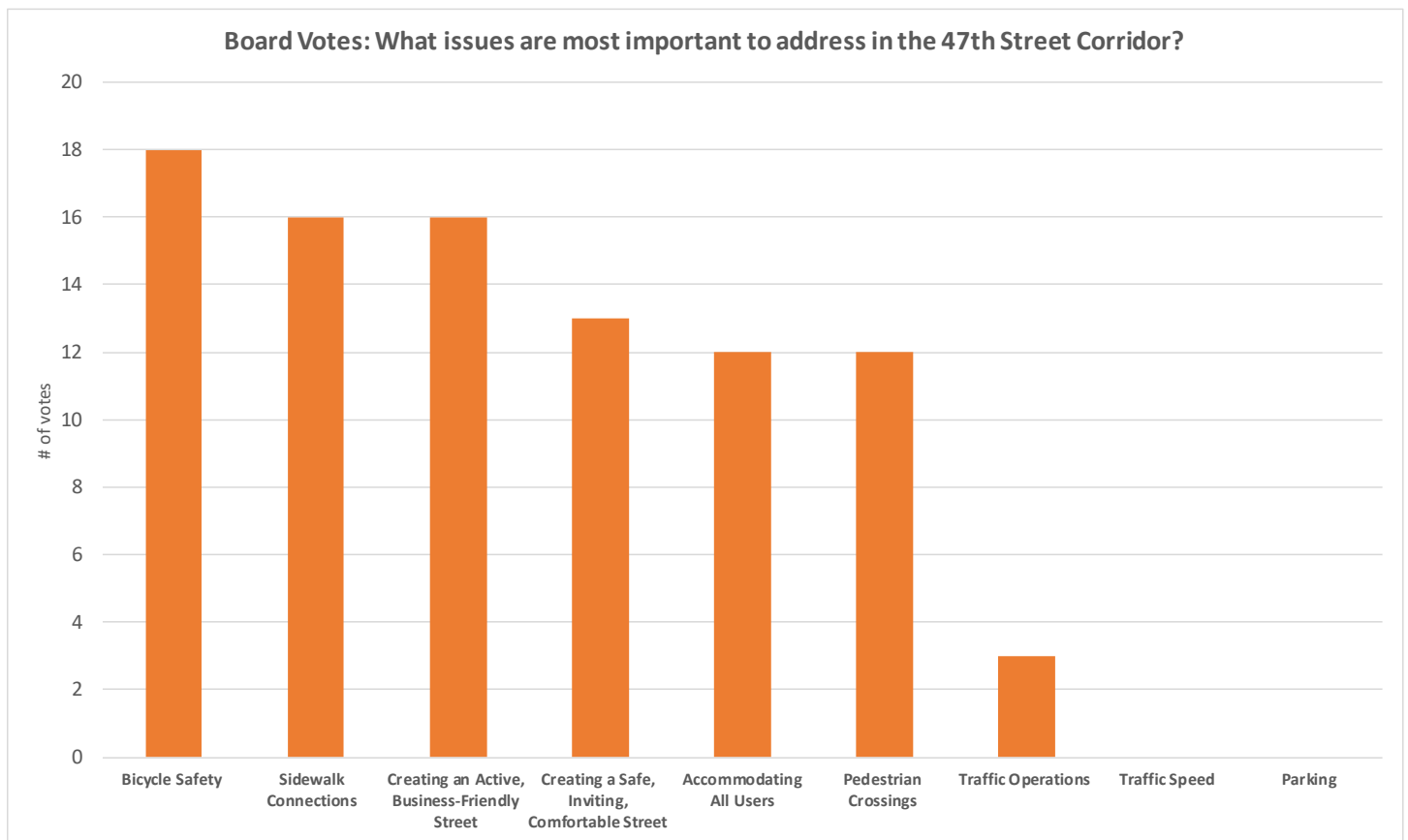
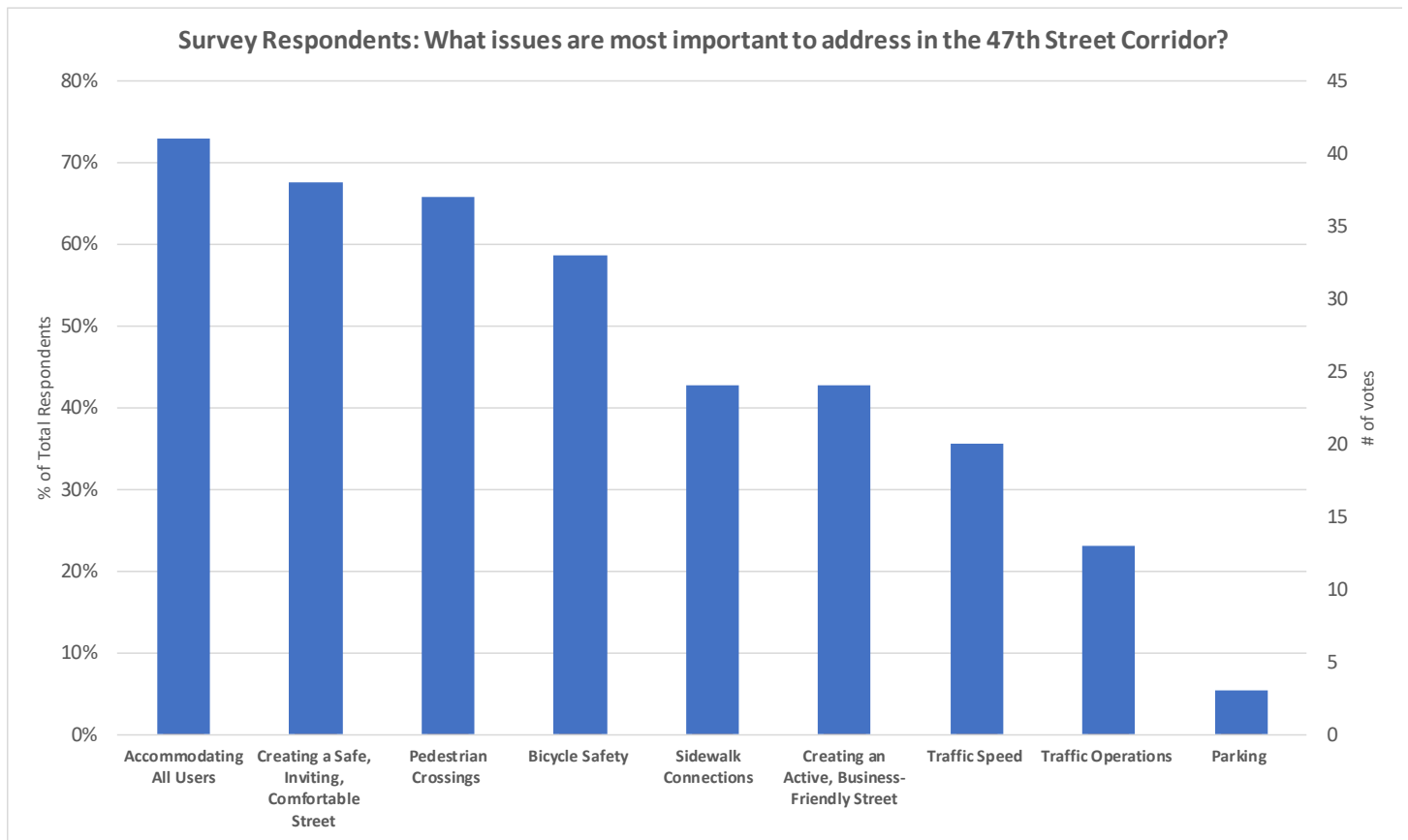


## Participant Addresses: Local View





# Community Priorities



## Additional Comments on Community Priorities

### Cars and Parking

- 47th street is too car focused and not neighborhoodly
- Shared parking agreement should be explored, there is enough parking, just needs to be officially shared Would love some street parking by Lulus and OK Joes
- Too much parking already

### Transit

- Emphasize transit
- Cover people waiting for the bus, Walmart should donate land
- Creating a stronger presence for transit, more service over time and visible infrastructure
- Please prioritize safety for all travel modes

### Cyclists and Pedestrians

- Interested in walk, bike, and transit family, not in need of improving car experience
- Crosswalk connecting Walmart to Dynamic Disc
- Bicycles right-of-way, create an active people friendly street
- Businesses offer incentive to locals who walk or bike to create road diet effect
- Not much bicycle usage on the street now
- Pedestrian friendly business street:
- As an active pedestrian and bus user in the neighborhood, there is a desperate need for safe pedestrian crossings, thank you!

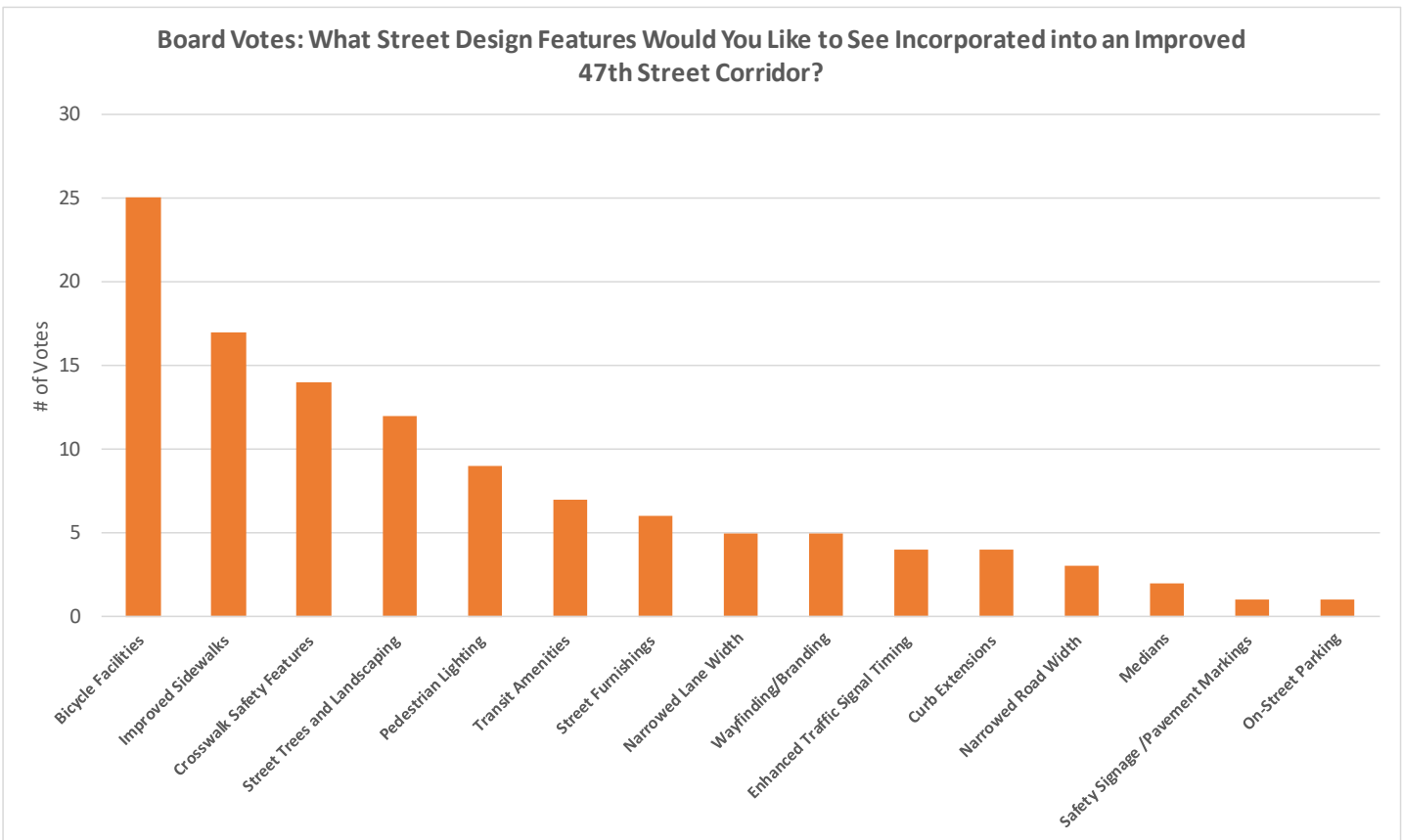
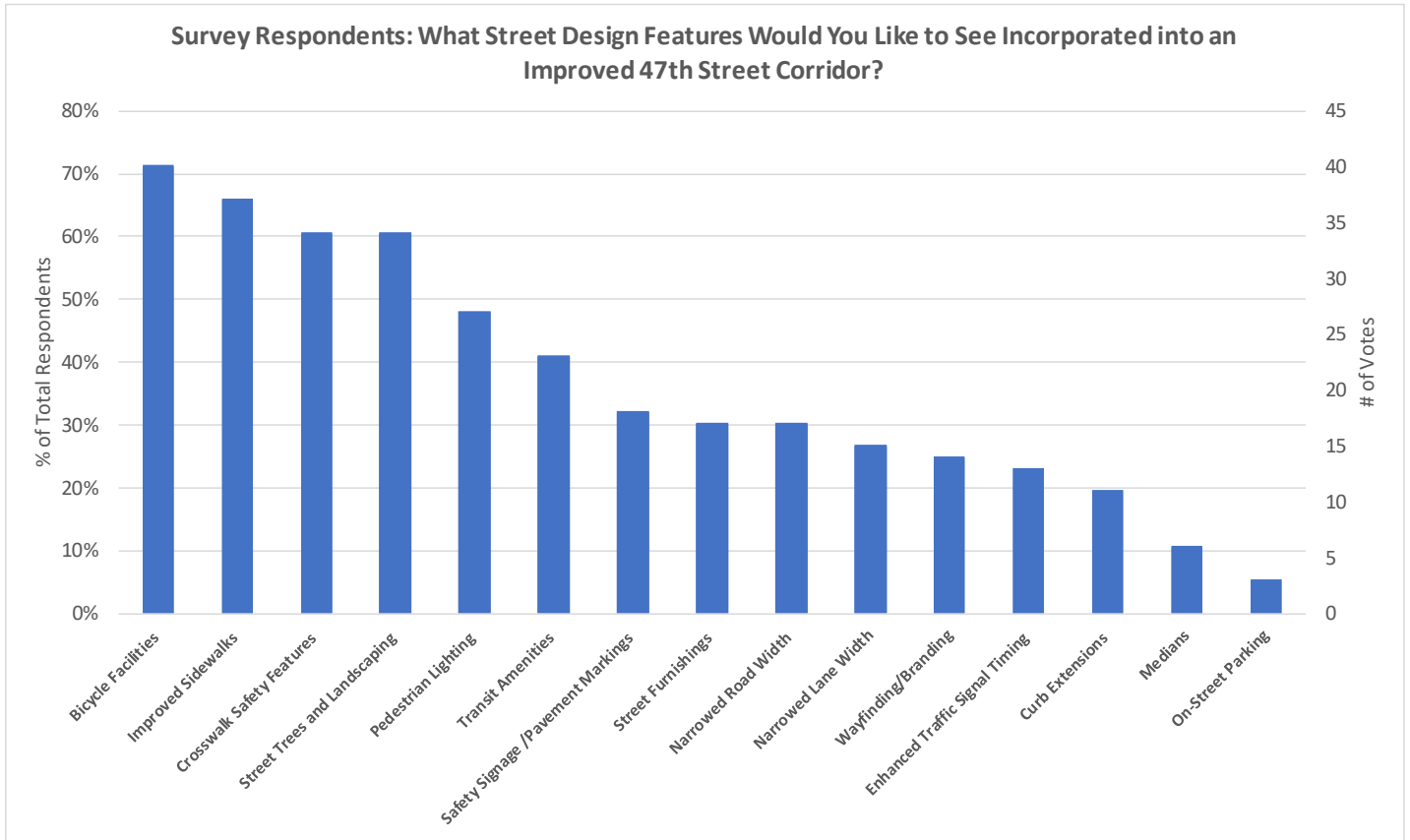
### Transit

- Enforce current traffic lanes
- Connect all neighborhoods, KU MED etc

## Facilitator Notes

- 47th and Rainbow gets very busy and the intersection gets blocked
- Difficult turning into Woodside Village, especially at rush hour
- More traffic on Rainbow with KU Med expansion. 50th & Rainbow (elementary crossing, people run red lights
- Will tax dollars help other cities? (from KCK resident)
- Concern how design/value is linked - who is being served by improvements?
- Would like to see trolley on 47th Street, to Fairway North, Joes KC w/ free punch cards to ride; Fairway North would be a great mass transit stop.
- Transit options enable people to live less expensively, helps encourage growth & use of other modes & uses; adding sidewalks makes walking & changes mindset about the area visually.

# Street Design Features



## Additional Comments on Street Design Features

### Bike / Pedestrian

- Need to consider connectivity for bikes at east end of 47th- need somewhere to go when eastbound and reach rainbow

### Corridor Appearance

- Would love street art
- Connected character of commercial corridor state line to mission
- Showing sidewalks looking bad is on property owner, not government, deceiving
- Need trash cans and corridor identity
- Need trash cans

### Corridor Function

- Parklets
- No on street parking
- Designated turn lane
- Improve what you've got, this is just busy work, and park barrel projects

## Additional Comments on Design Scenarios

### Cost

- Option D is more expensive, maybe tell us more about funding options
- Like option C but too expensive

### Bike Related

- Need dedicated bike lane
- Love the wider sidewalks, but also need bike infrastructure
- Don't do a just paint option for bikes

### Other

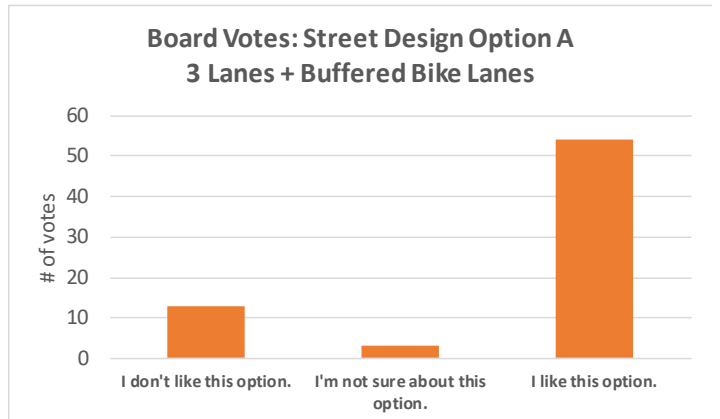
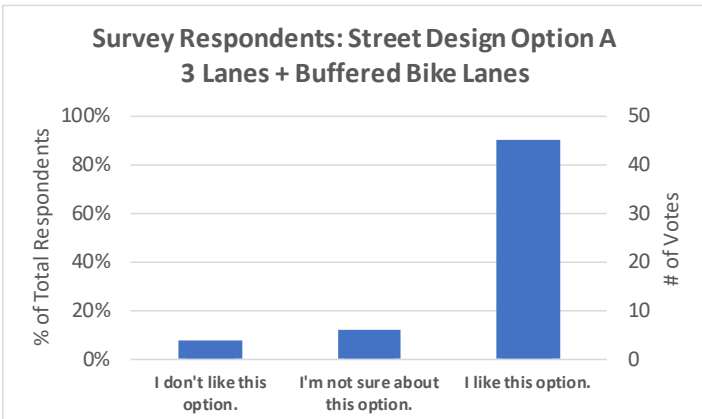
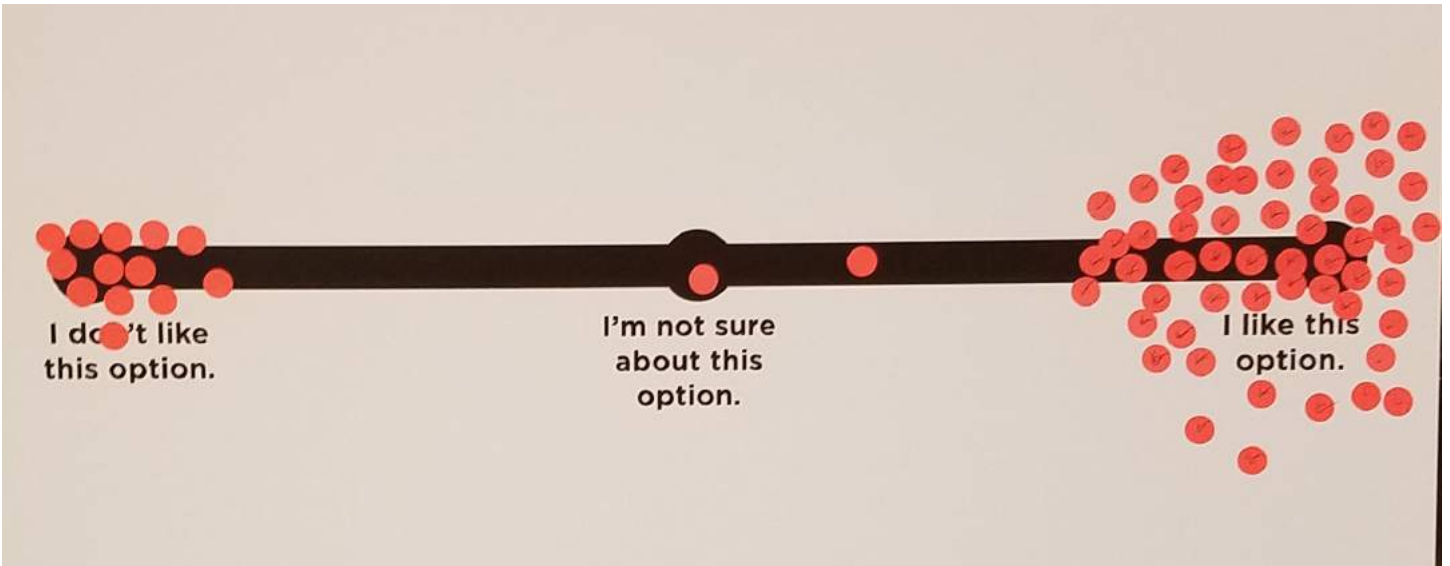
- In Option C, bikes may hit pedestrians if curb isn't high enough
- I like option C the best
- Traffic calming is not worth adding parking, too much parking
- Love option C as longer term
- Don't change anything

## Facilitator Notes

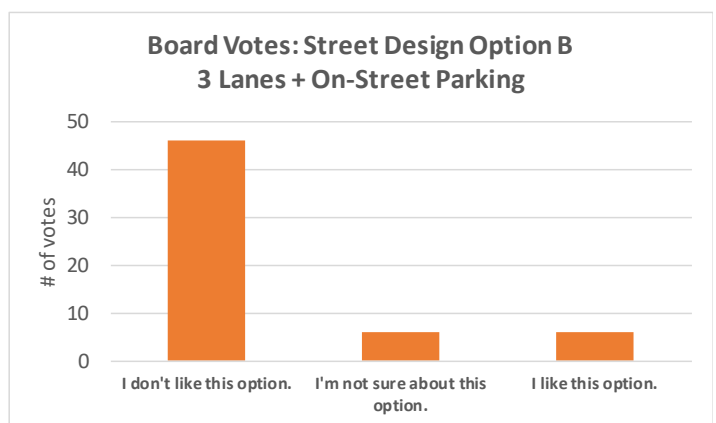
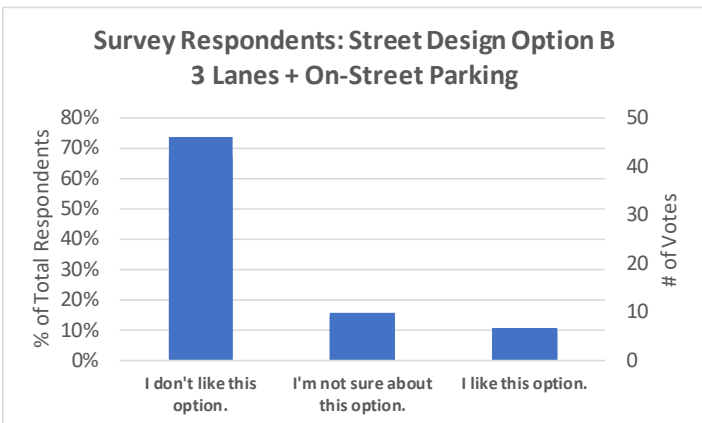
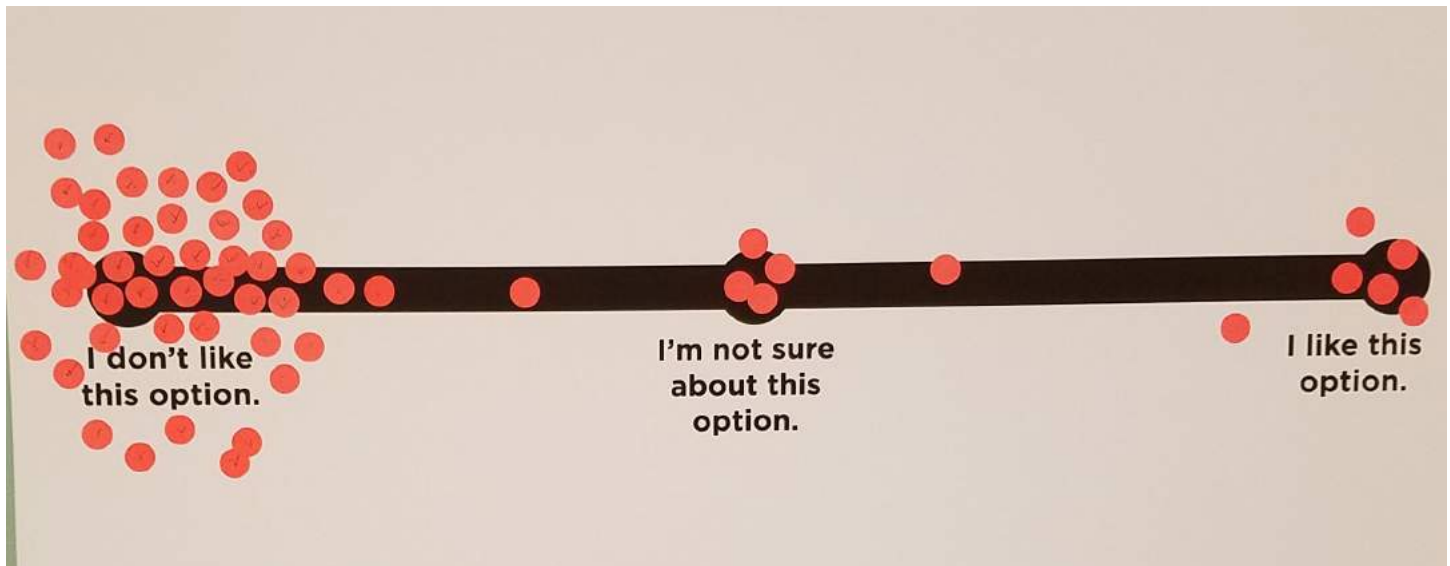
- Rather than street furniture, do parklets (more permanent).

# Street Design Options

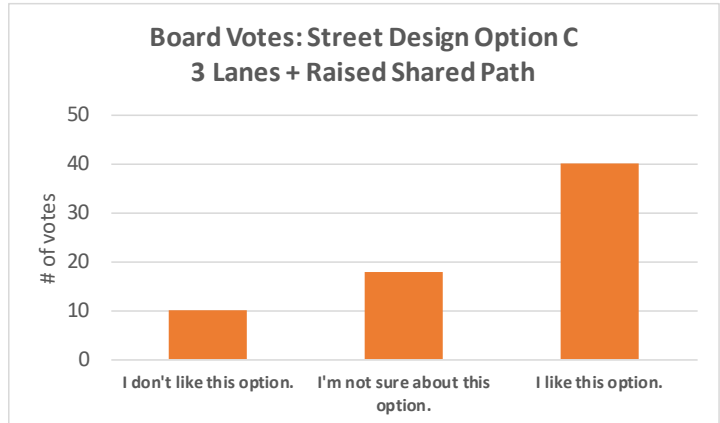
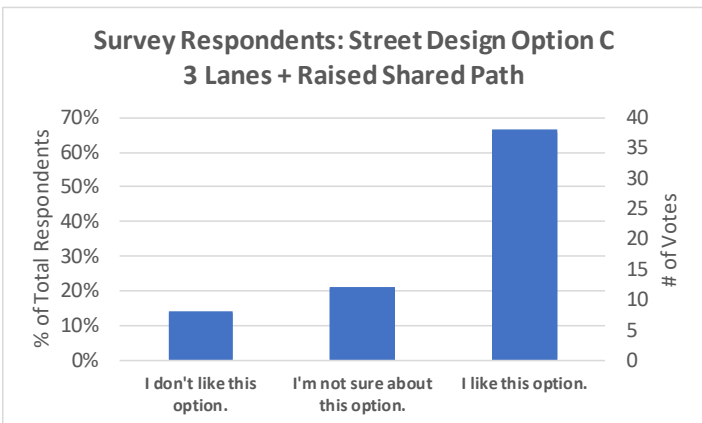
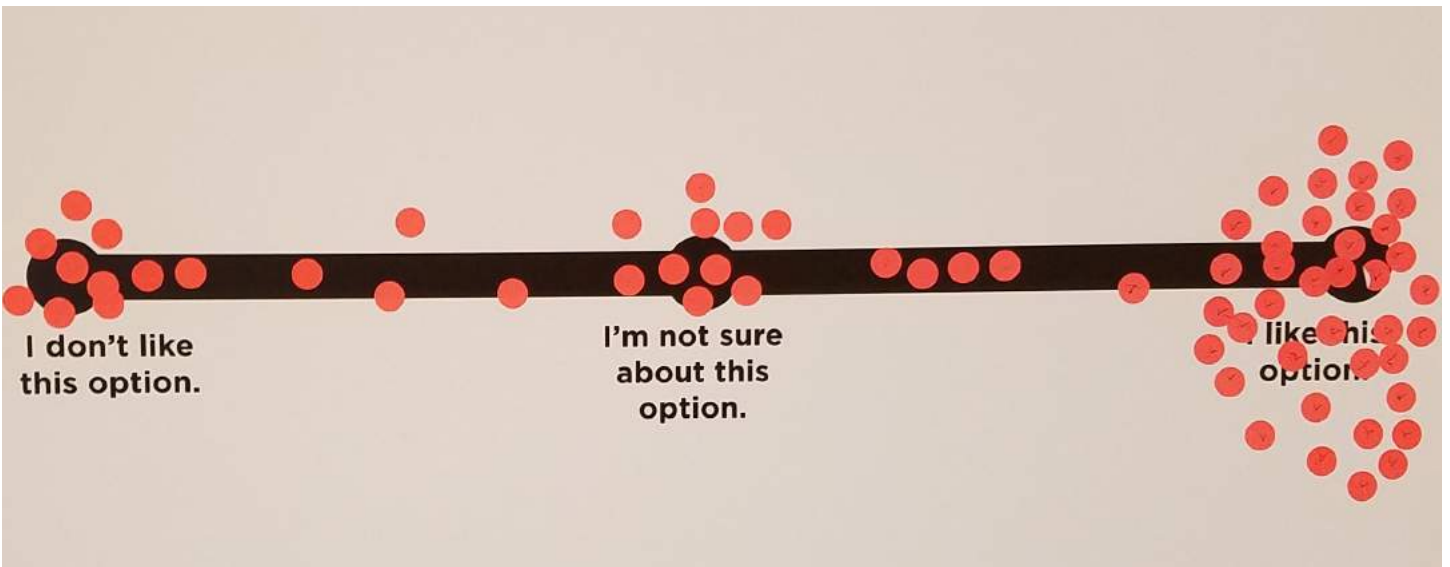
## 3 Lanes + Buffered Bike Lanes



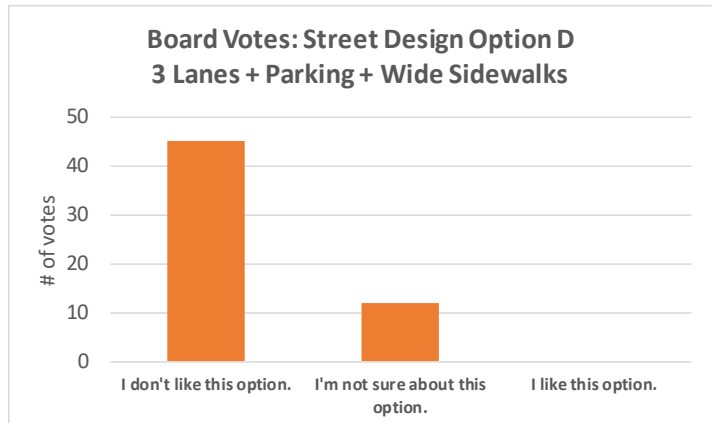
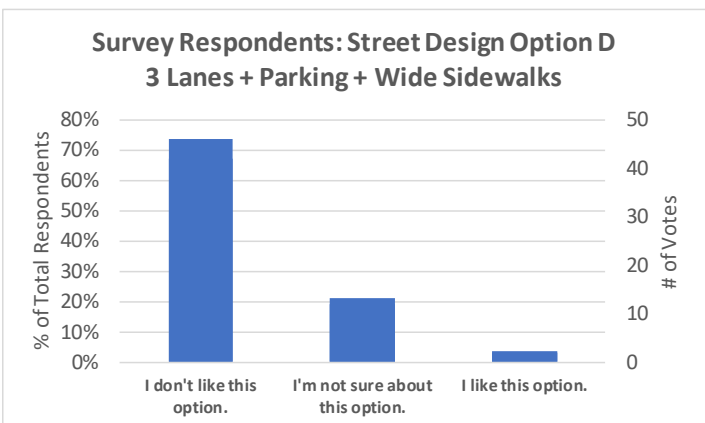
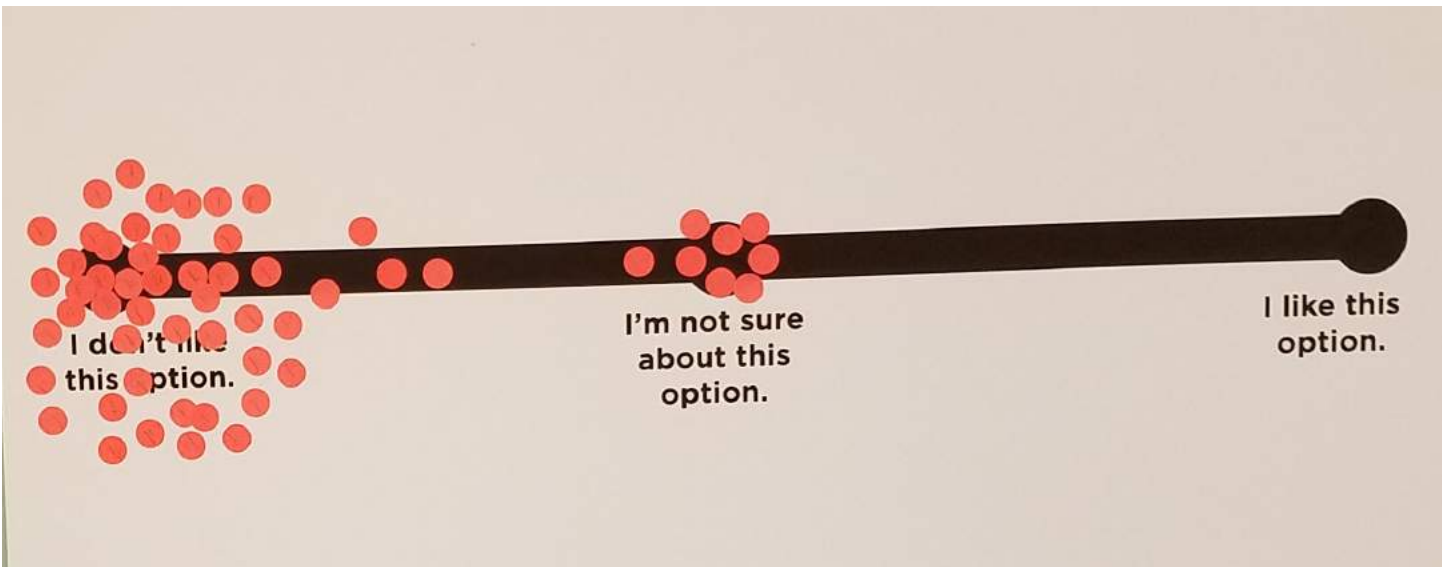
### 3 Lanes + On-Street Parking



### 3 Lanes + Raised Shared Path



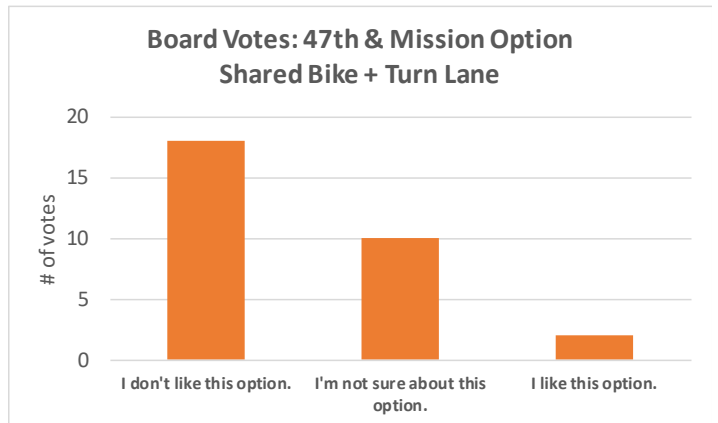
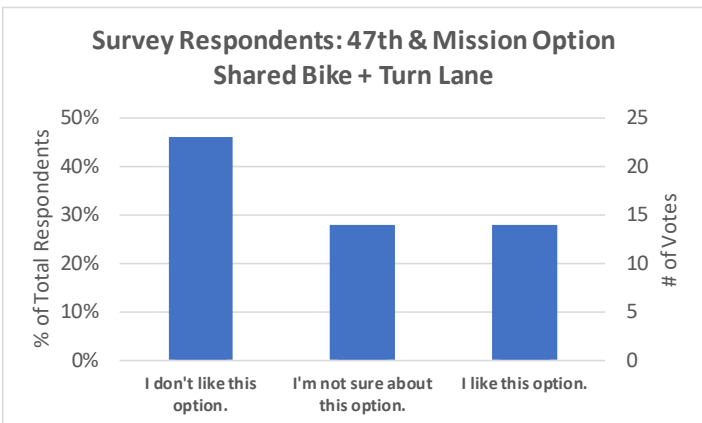
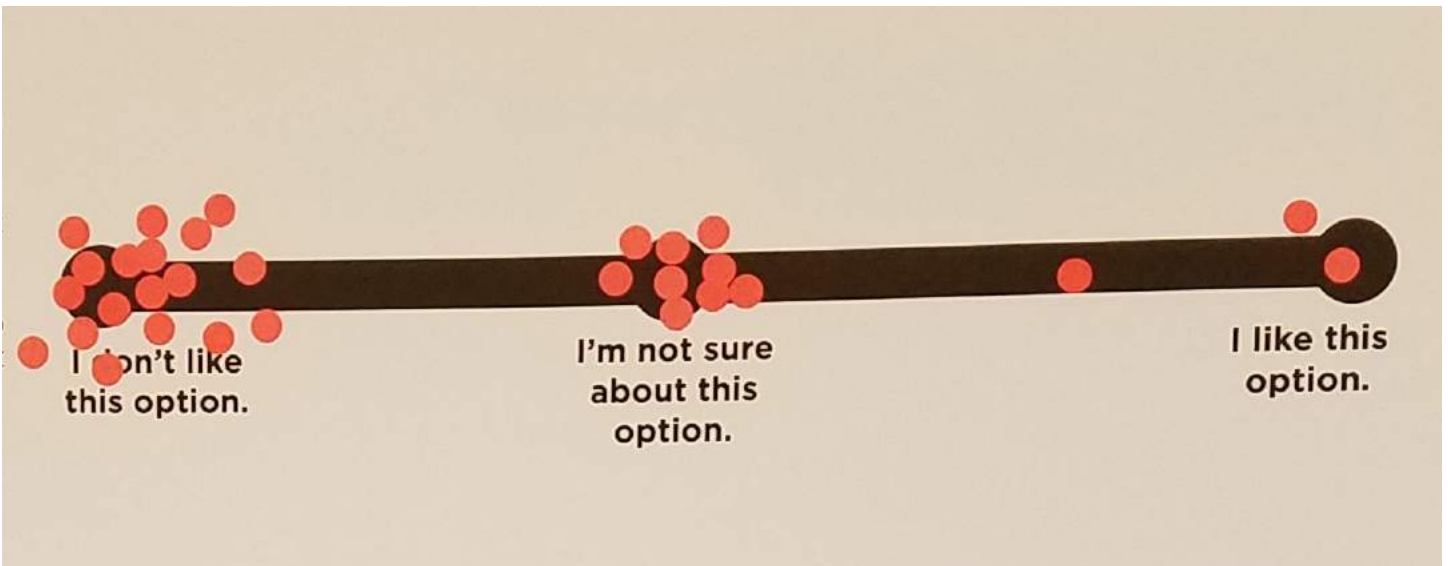
### 3 Lanes + On-Street Park + Wide Sidewalks



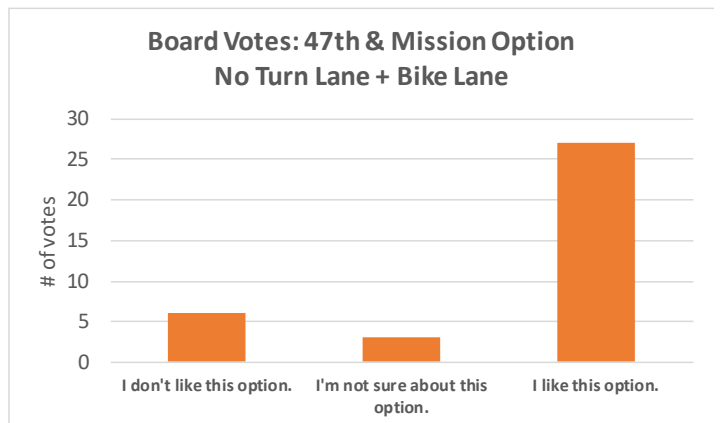
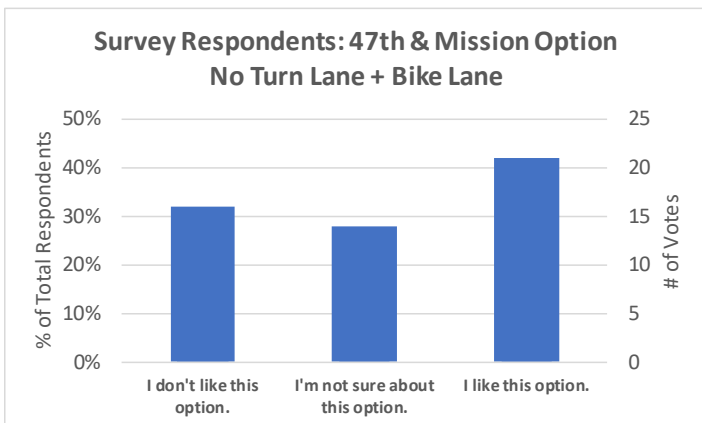
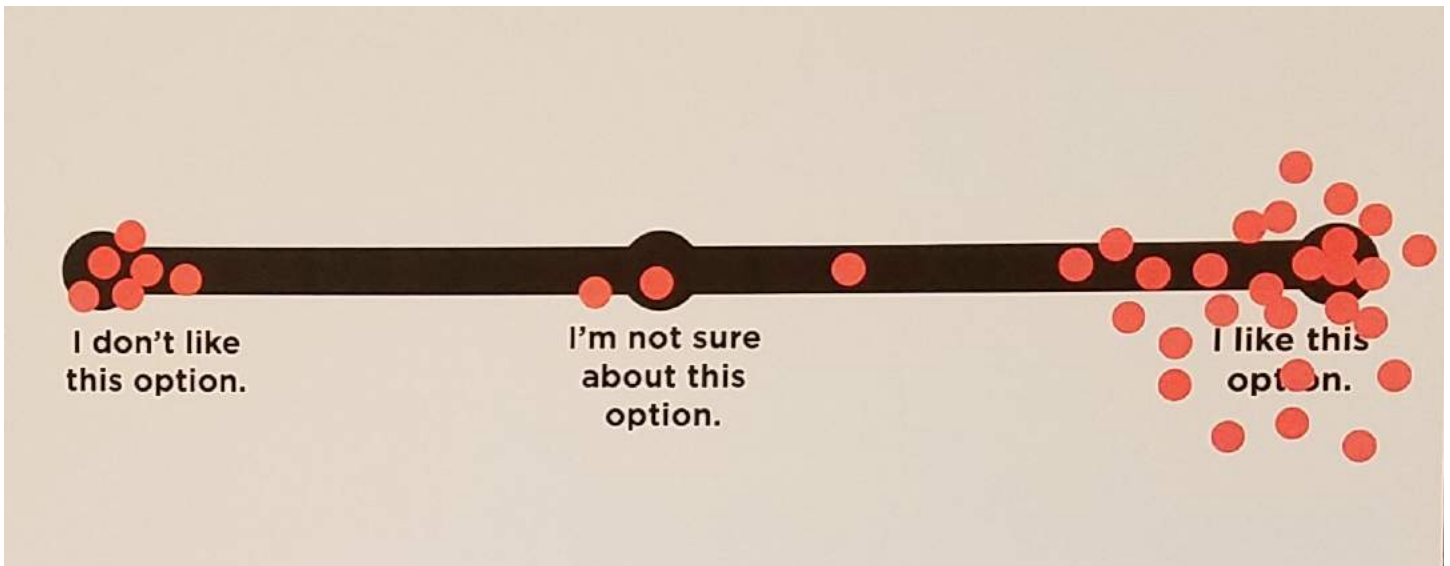


# 47th & Mission Intersection

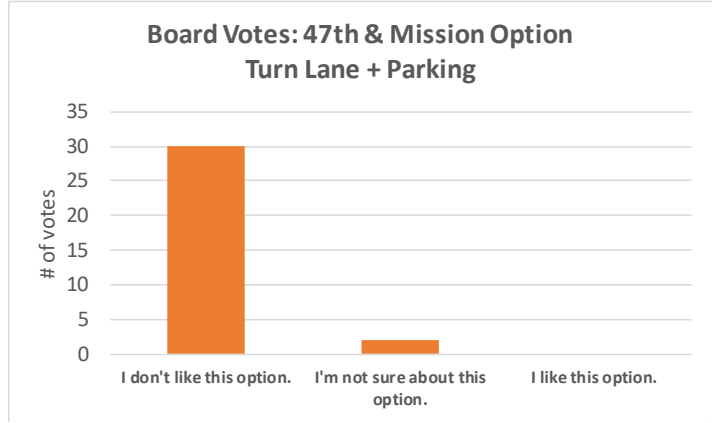
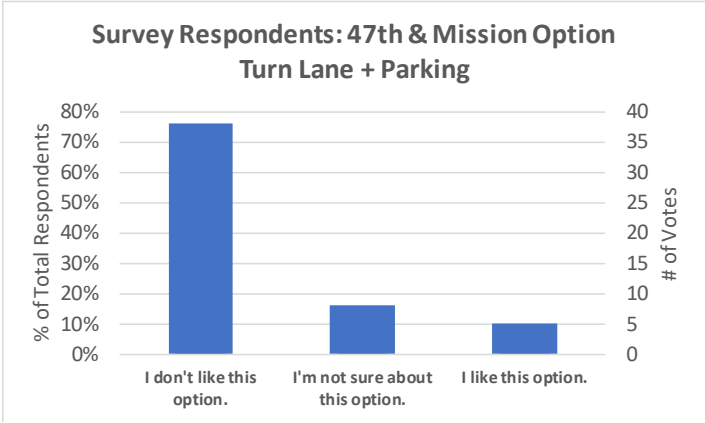
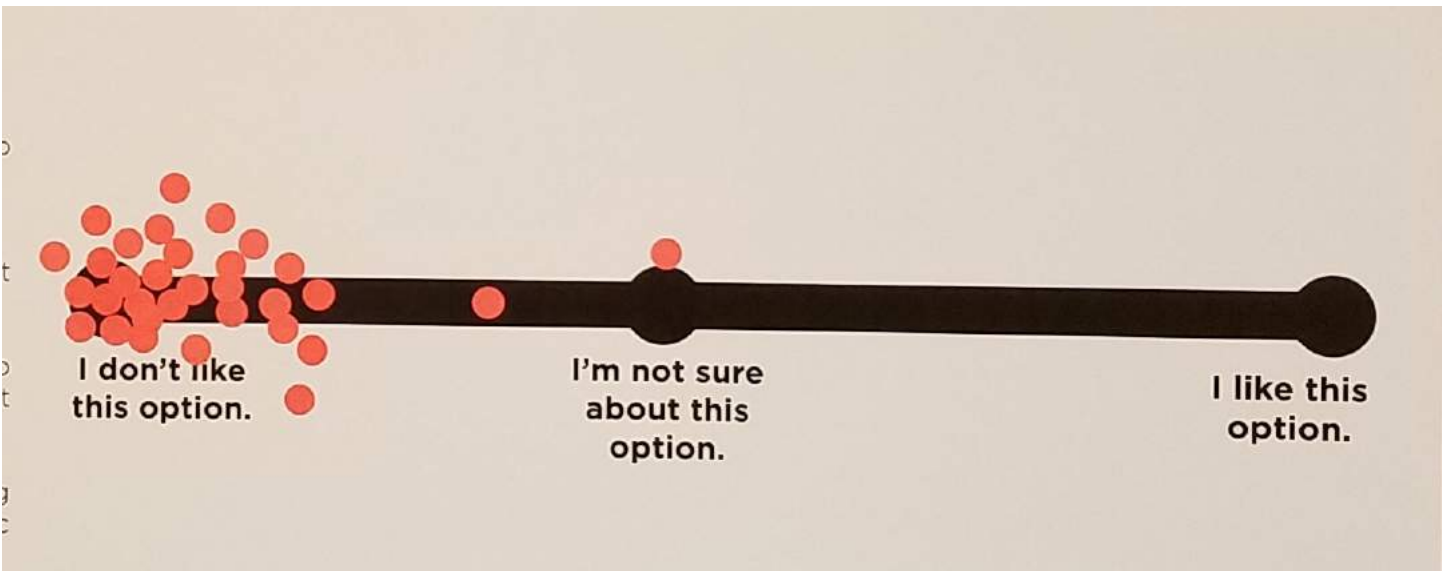
## Shared Bike + Turn Lane



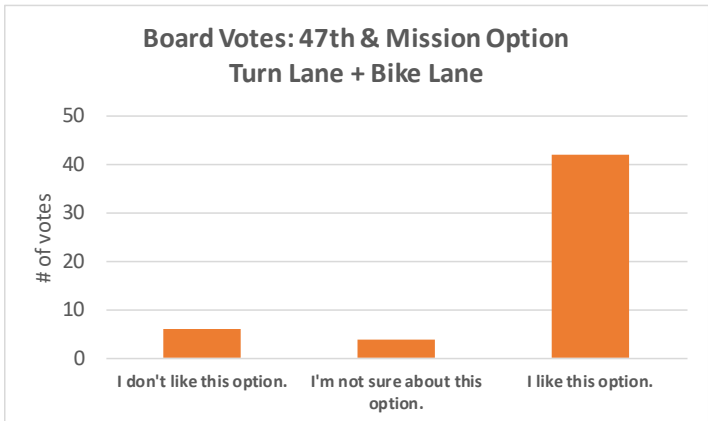
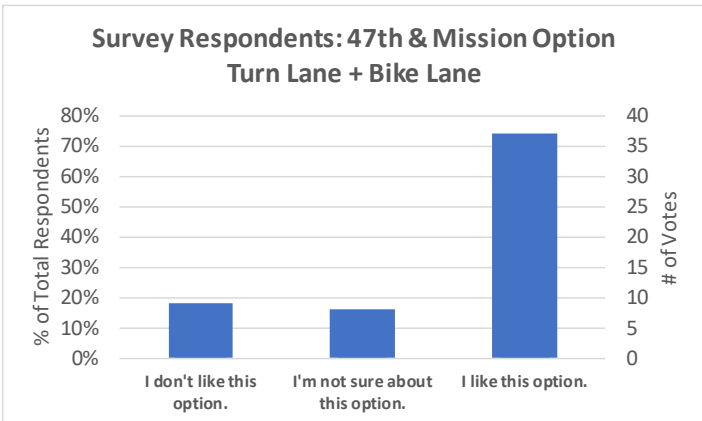
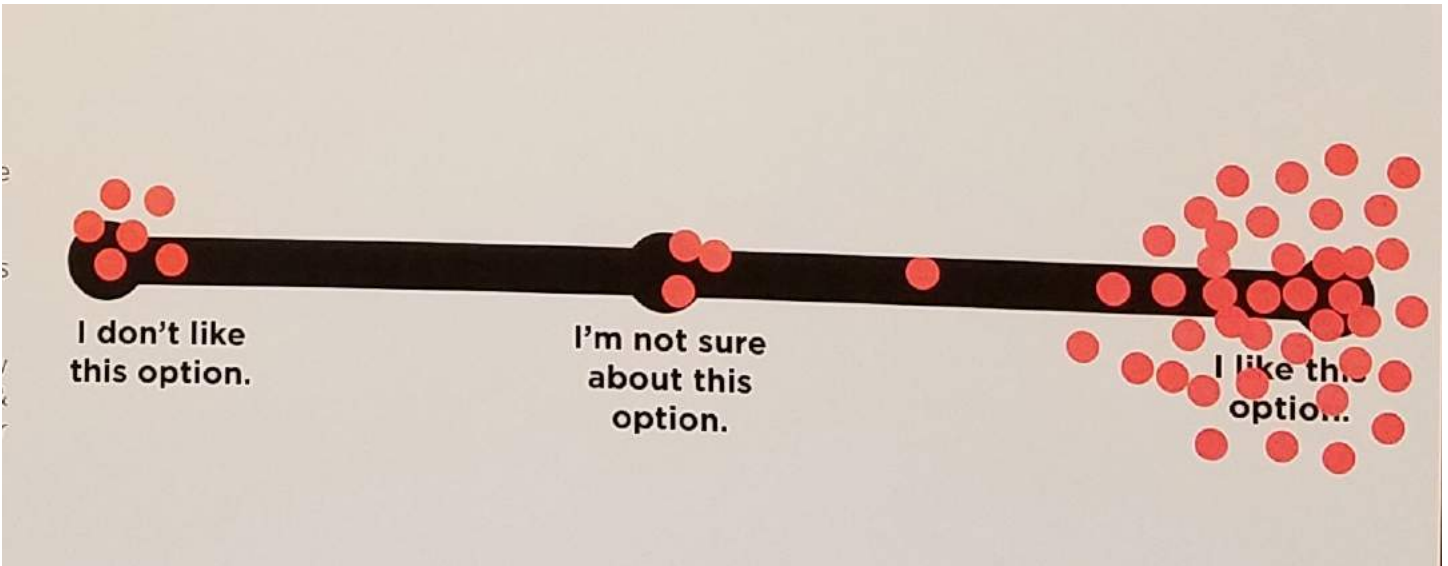
## No Turn Lane + Bike Lane



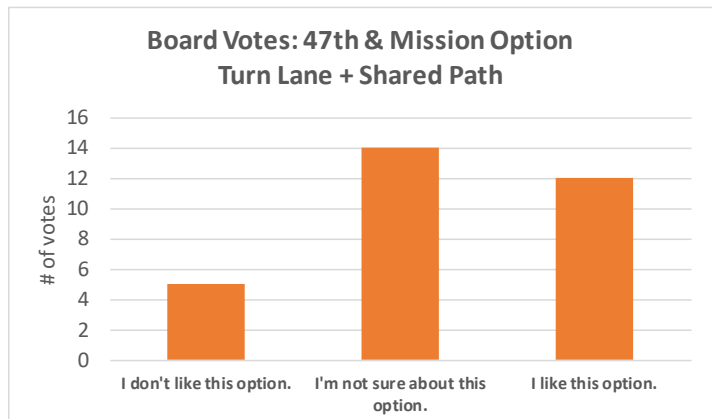
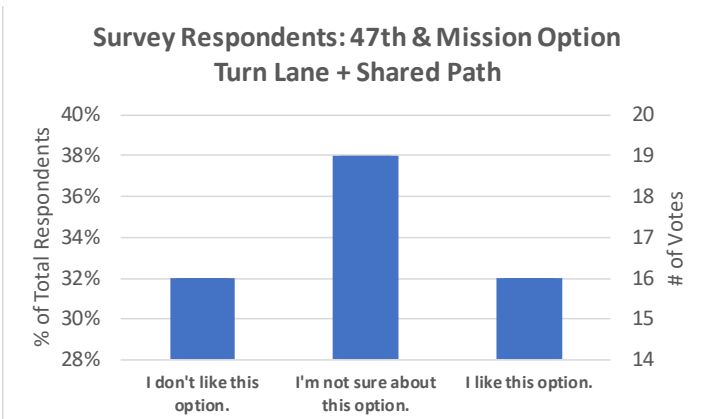
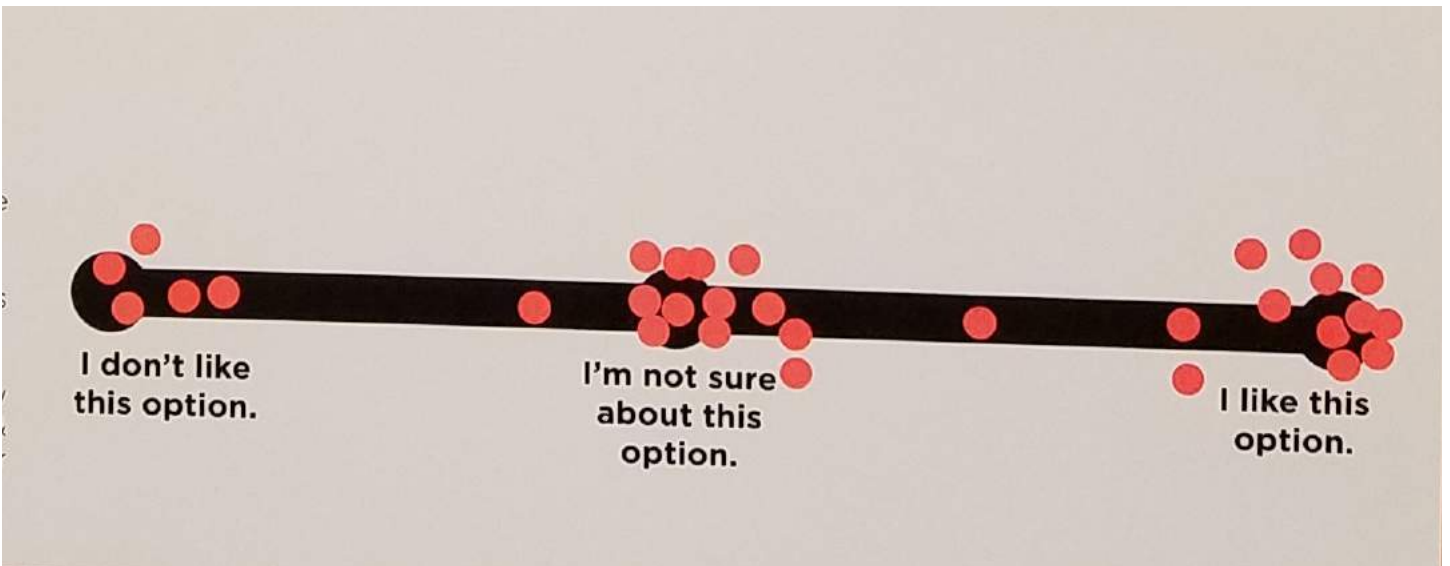
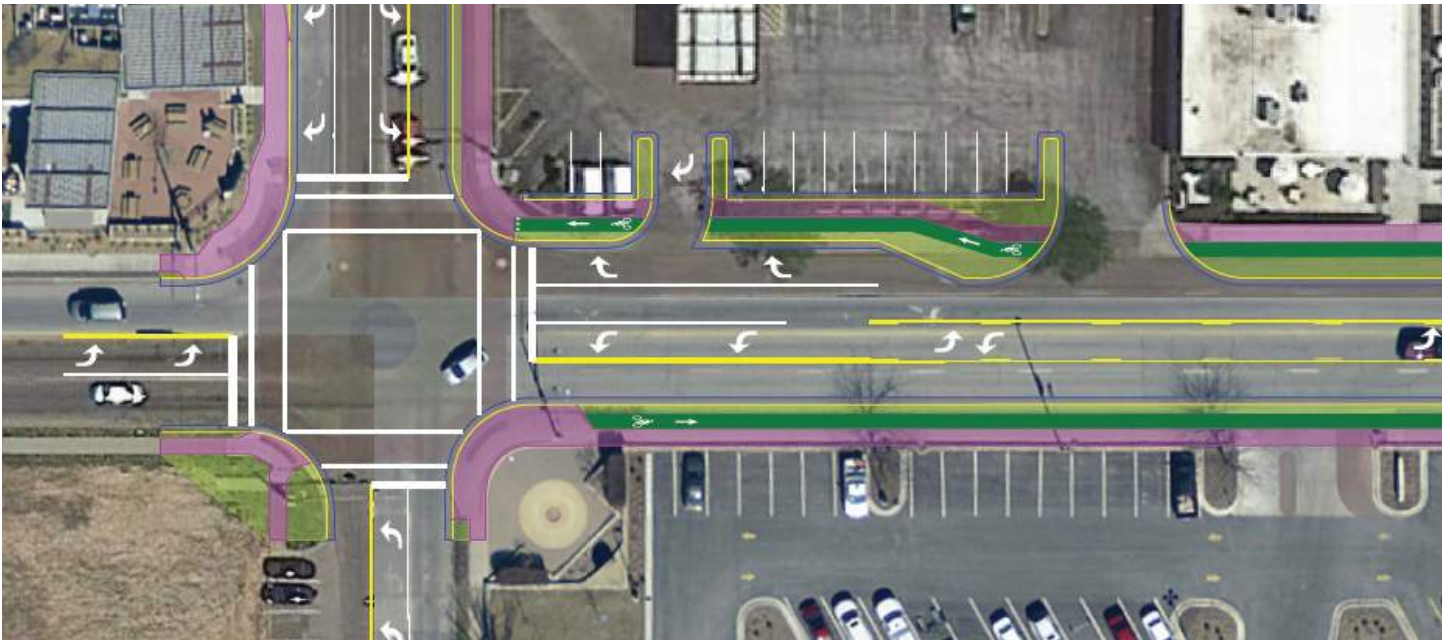
# Turn Lane + Parking



# Turn Lane + Bike Lane



## Turn Lane + Shared Path



## **Additional Comments**

### **Mixing of Traffic**

- Keep bikes and cars separate when possible
- Don't mix bikes and cars
- All this indicates an accident waiting to happen
- Make the streets a public space where families and people can walk, ride, play and enjoy the neighborhood and street businesses will flourish when people can enjoy themselves. Pedestrians buy more than traffic does
- Suggestion for bike boxes at 47th and Mission

### **Congestion**

- Would not having a right turn only lane slow down traffic?
- Add drive through to Joe's KC to reduce parking and congestion

### **Other**

- This is a pork barrel project, bikes are already allowed on street. Budget is too low and it's safe enough, also we should nto be helping out business owners with parking, it isn't even being used.

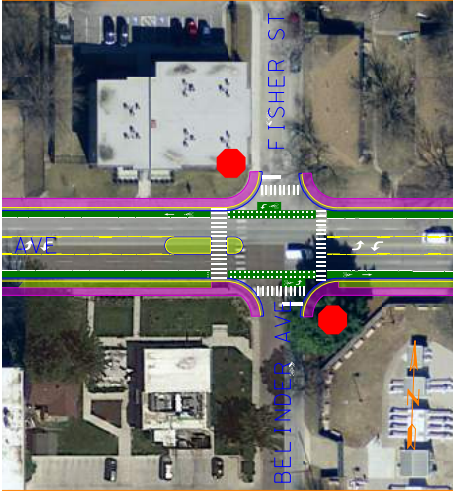
## **Facilitator Notes**

- Suggestion for bike boxes at 47th and Mission
- Most people were more concerned about safety for the road crossings than they were with the traffic operations in the intersection.

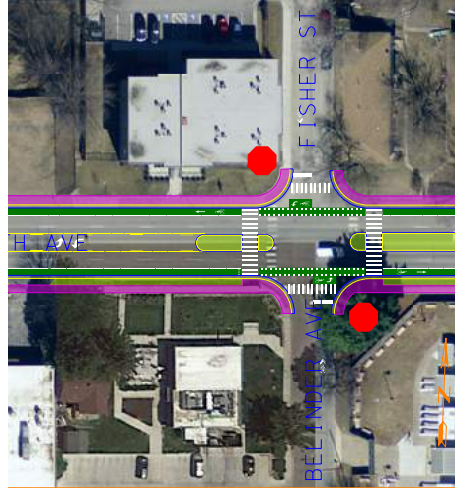
# 47th & Belinder Intersection

The project team did not ask participants to choose between intersection options at 47th Street and Belinder Road, but some participants chose to place dots to identify their preference.

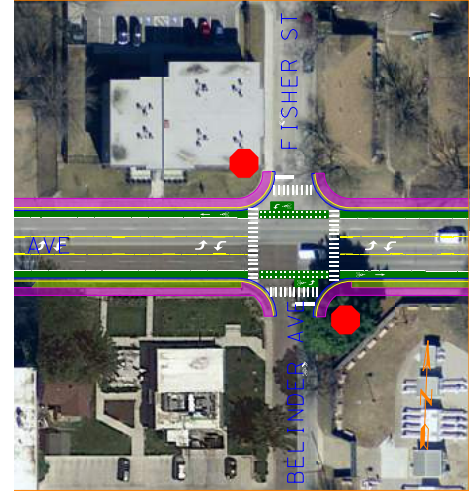
**Westbound Turn Lane +  
West Side Ped Refuge**



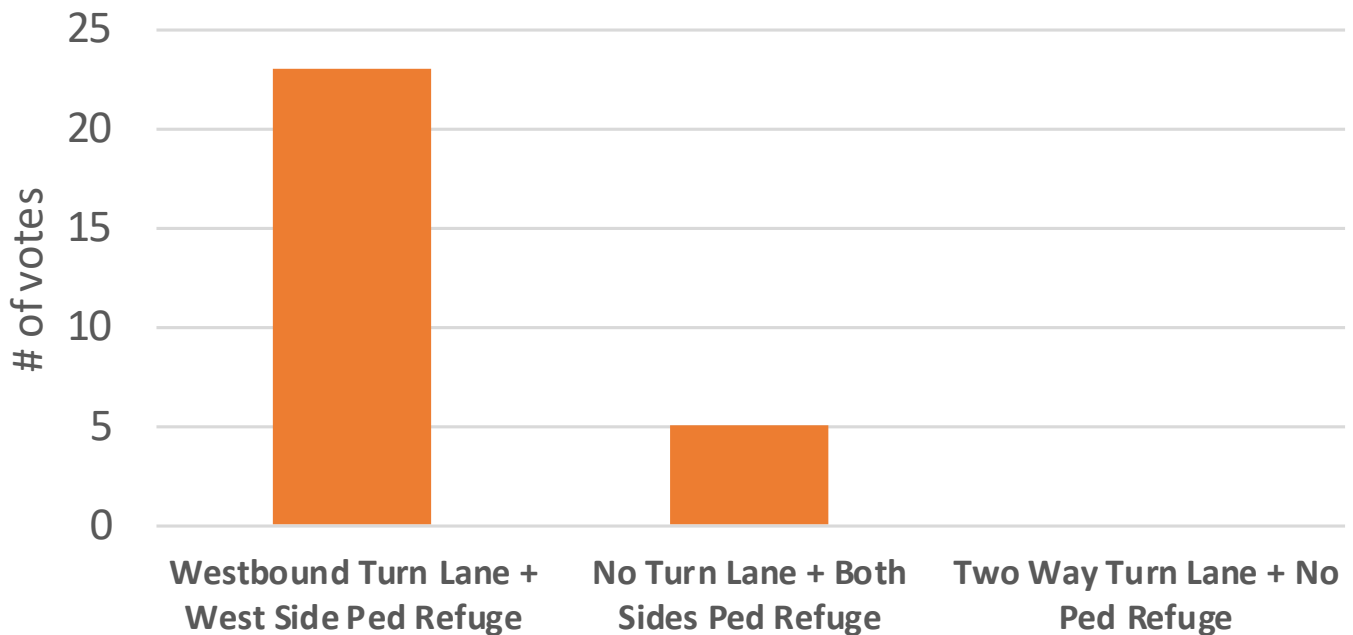
**No Turn Lane +  
Both Sides Ped Refuge**



**Two Way Turn Lane +  
No Ped Refuge**



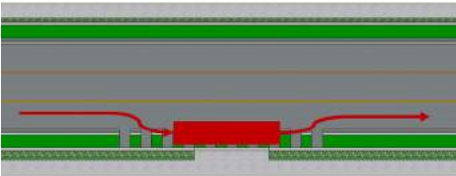
**Board Votes:  
47th & Belinder Intersection Options**



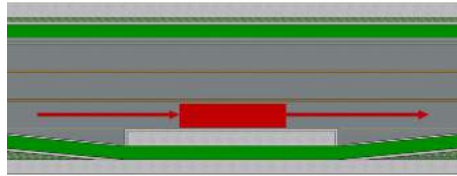
# Bus Stop Options

The project team did not ask participants to choose between bus stop options on 47th Street, but some participants chose to place dots to identify their preference.

## Shared Bus/Bike Zone



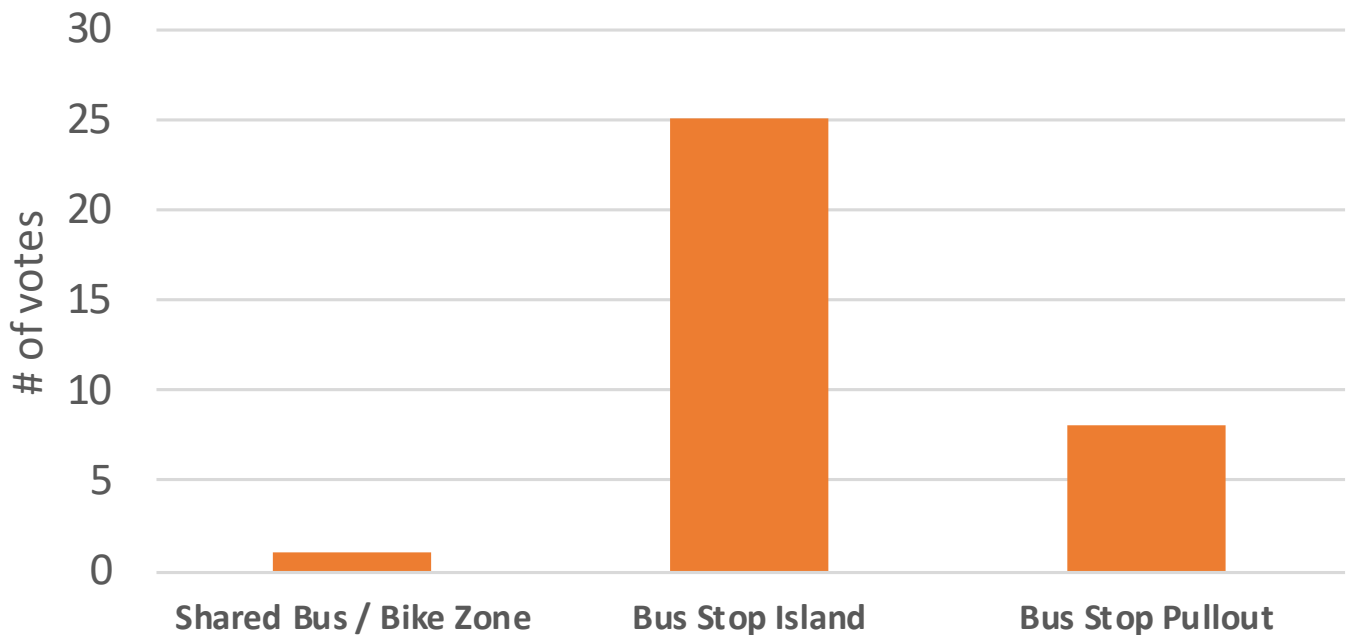
## Bus Stop Island



## Bus Stop Pullout



## Board Votes: Bus Stop Options

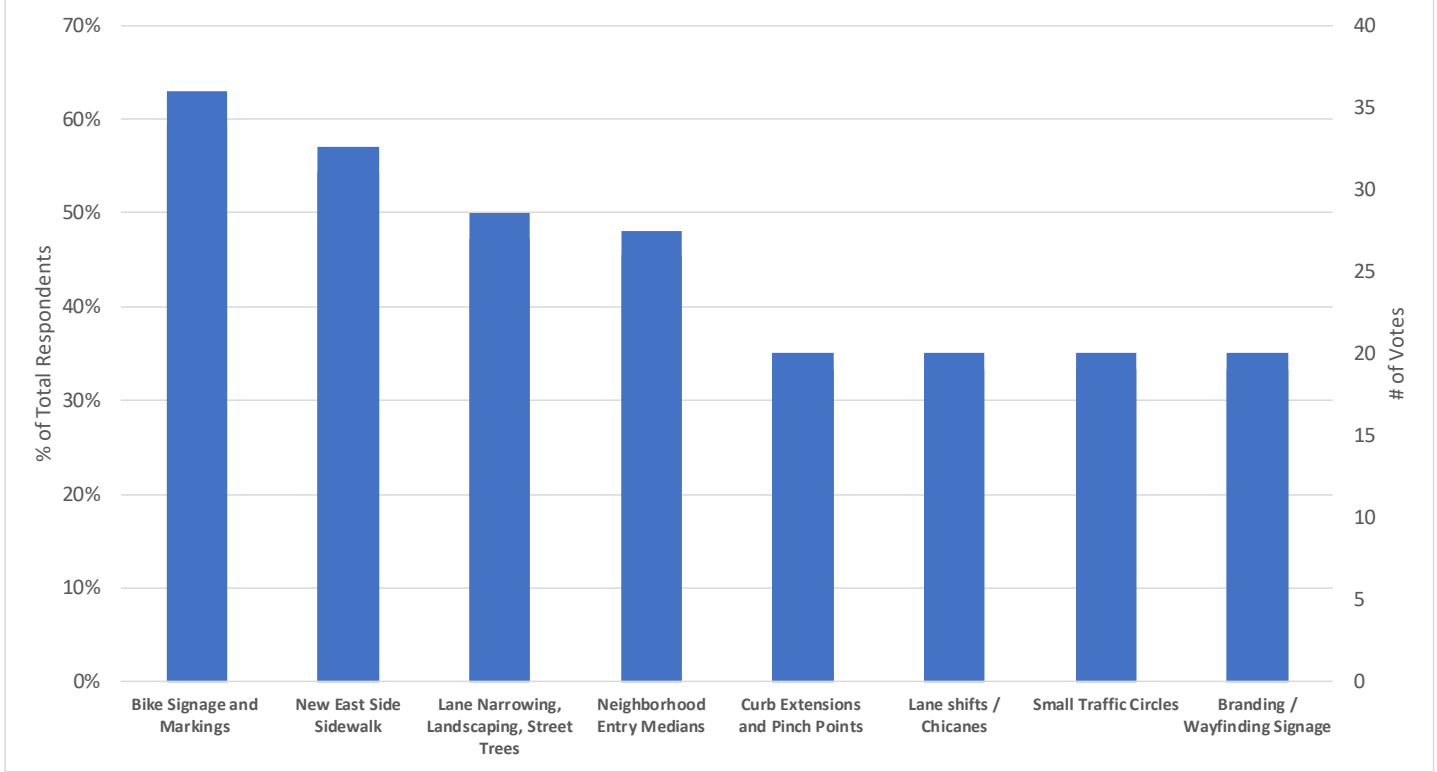




# Belinder Design Options



Survey Respondents: What Street Design Features Would You Like to See Incorporated into an Improved Belinder Road?

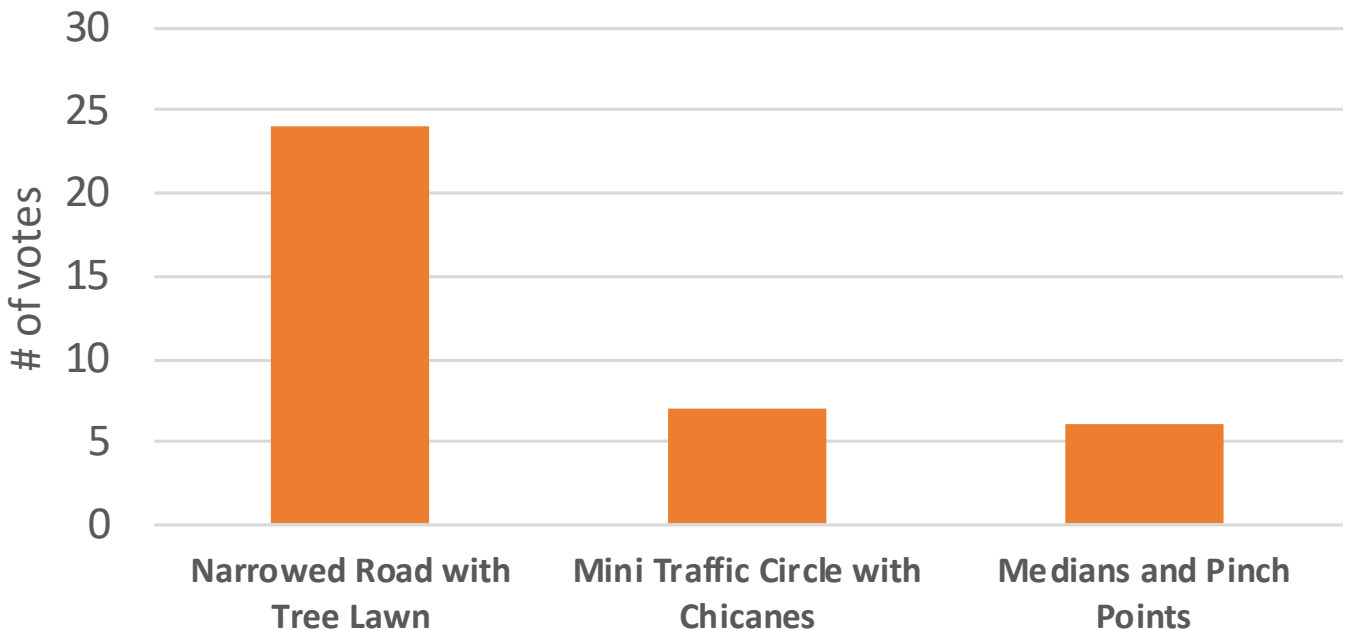


# Belinder Design Scenarios

The project team did not ask participants to choose between three examples of how various design options could be combined on Belinder Road, but some participants chose to place dots to identify their preference.



## Board Votes: Belinder Options



## Additional Comments on Belinder, Rainbow, and Transit

### Biking

- Worried about risky low visibility for cyclists
- Belinder is already good for drivers and cyclists, not sure any traffic calming is required
- I bike this regularly as its one of the only (sort of) safe N/S routes in the area

### Walking

- Better options for crossing while walking, cars do not obey crosswalk markings
- New sidewalk with new school
- Wider sidewalks on the west side of the street
- School needs to be in on this, how many people walk or ride with parents/bus?

### Transit

- Transit is not timed correctly, improve service

### Efficiency

- No obstacle courses
- In favor of Rainbow to State Line connections
- What is the efficiency of circles? Key is to first have a great street to be on

### Other

- Bigger concern is reducing speed on mission- can we apply to mission road also
- Defer to people who live on Belinder
- I do not live on Belinder therefore this doesn't affect me
- Can someone direct me to that money tree? Where do property taxes go up from?
- Thank you for making 47th street safer for us

## Facilitator Notes

- Though voting wasn't necessarily the intent, an overwhelming majority opted for the Belinder concept with street trees.
- A handful of residents who live on Belinder Ave. attended the open house and indicated that they were in favor of having sidewalks on the east side of the roadway, particularly with the Shawnee Mission School District purchase of property.
- No one seemed particularly opposed to any of the three proposed options. A few property owners were intrigued with the chicane concept, thought it would be a great addition as "something new."
- One attendee opposed the project all together, mentioned how a road diet had ruined his street and brought more traffic.
- A few people wondered about cost, but this was not expressed as a concern.
- One person had an interesting idea about a trail connection on the east side of Woodside Health Club up to Cambridge St. This could then connect to the proposed easement trail.
- Shawn Strate of KCATA indicated that the ATA is in favor of the Shared Bus / Bike & Bus Island options, but do not support the Bus Stop Pullout, as ADA boarding and exiting into the bike lane is vague in relation to FHWA standards.
- The feedback was generally very positive, as people were happy to see additional connectivity being considered in conjunction with the 47th street improvements.
- Trail on easement - Some residents might not like / want people walking behind their house.