City of Madison

MADISON DEPARTMENT

OF TRANSPORTATION

BRT Running Way

October 30, 2020

Executive Summary

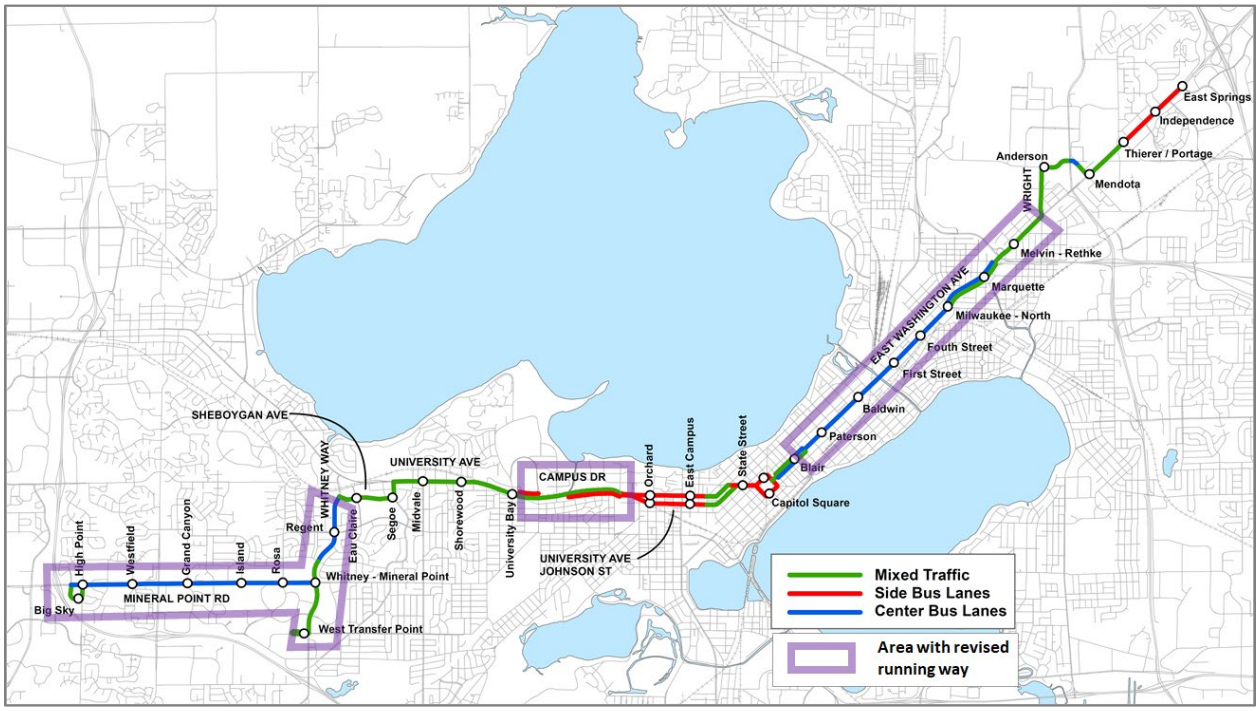
This memo re-evaluates the running way recommendation contained in the Locally Preferred Alternative (LPA), changing many sections from side running to center running. Center running has BRT buses traveling in the inside lane, with BRT stations located in the median of the roadway. Advantages of center running include:

- Bus travel times are more consistent than in a curb running lane. This can then translate into lower operating costs.
- In most instances, there are limited to no conflicts with bicycles and turning vehicles.
- Delivery vehicles do not block BRT lane.
- Only one two-sided BRT station is required, rather than one on each curb, reducing costs in most circumstances.

Center Running Station - IndyGo

Locations where the recommended running way location has changed since the adoption of the LPA include:

- Mineral Point Road
- Whitney Way
- Campus Drive
- East Washington Ave.



The following graphic illustrates the recommended running way including sections where recommended running way has been revised from that contained in the LPA.

Proposed E-W BRT Running Way

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1.0 Introduction and Purpose

The City of Madison and Metro Transit are pursuing the implementation of an East-West Bus Rapid Transit (BRT) line that will run from the West Towne area to East Towne mall. The BRT project is planned for construction in 2023 and is anticipated to cost up to $160 million, with about half the funding being provided by a Federal Small Starts grant.

Key goals for Bus Rapid Transit is that it is *rapid* and that it is *frequent*. BRT systems make their service rapid through several measures, including:

- Controlling the spacing of stations, generally to about ½ mile. This prevents the bus from stopping too frequently.
- Providing dedicated running way, eg bus lanes. These give buses priority by keeping them from experiencing congestion associated with general purpose lanes.
- Providing transit priority measures, such as queue jumps and transit signal priority.
- Providing quicker boarding and alighting, through off-board fare collection and level boarding platforms.

Dedicated running way, bus lanes, are generally located on the outside lane (side running) or near the median (center running). This memo discusses dedicated running way options for various portions of the East-West BRT routing.

2.0 Running Way Options

A. Side running

Side Running Charecteristics

Side running requires that all BRT stations be located on the curb side within the terrace. Side running BRT also generally requires that bikes and right turning vehicles share the bus lane.

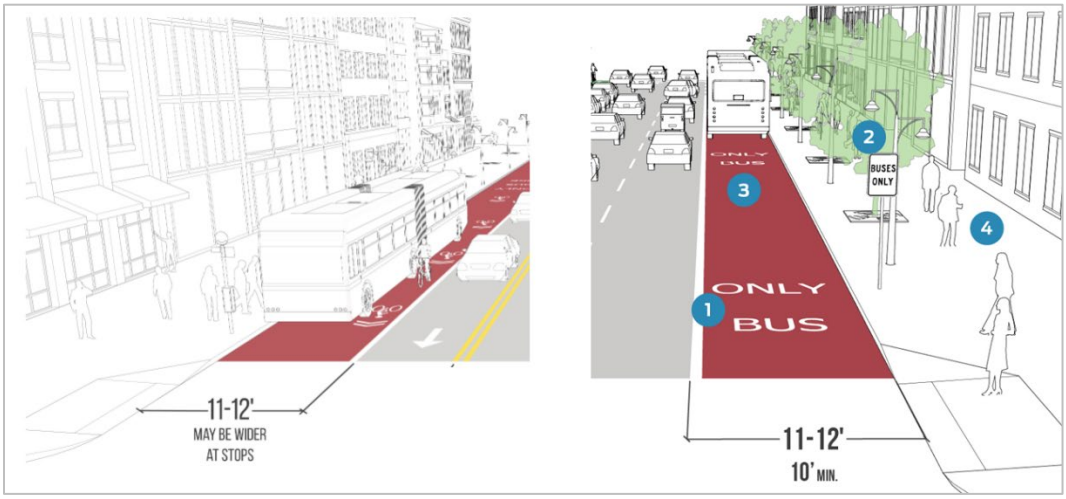


Figure 2.0-1 Side Running NACTO Transit Design Guide

Benefits of Side Running BRT

- Buses are able to pass most traffic at intersections, shielding them from routine delays as well as unpredictable incidents like crashes
- Local bus service can also use the dedicated running way.
- In constrained conditions where there are no bike facilities, bikes can use the bus lane. While not optimal, a shared bus, bike, and right turn lanes is a better bike facility than a general purpose lane.
- It is easier to implement for short stretches between mixed traffic sections.
- Flexible to run in mixed traffic without altering the station

Disadvantages of Side Running BRT

- BRT buses mix with bikes and right turning vehicles, slowing their travel time.
- The curb lane is susceptable to being blocked by delivery vehicles and service vehicles like garbage trucks.
- Each BRT station requires two stations, one on each side of the road, which generally is more costly.
- BRT stations often require the purchase of right of way, since few terraces are large enough (10 to 12 feet) for a BRT Station.
- Level boarding platforms and shelters can block driveways and front doors of businesses
- There can be more utility conflicts with BRT station construction, since often storm sewer and communications utilities often are located along the terrace.

B. Median or Center Running

Figure 2.0-2 Median Running – NACTO Transit Design

Charecteristics

Median or Center running BRT has the vehicles running in the center, often directly adjacent to a median. The BRT stations and running way must be coordinated with left turns, and in some cases may prevent left turns at station locations.

Benefits of Median/Center Running BRT.

- Bus travel times are more consistent than in a curb running lane. This can then translate into lower operating costs.
- In most instances, there are limited to no conflicts with turning vehicles.
- Delivery vehicles do not block BRT lane.
- Only one two-sided BRT station is required, rather than one on each curb, reducing costs in most circumstances.
- In many instances, there are fewer utility conflicts.
- Right of way is not needed.

Disadvantages of Median/Center Running

- Only buses with left hand doors can use the stations. This limits the ability of the bus fleet to provide relief service to the BRT line.
- It is best if adjacent lanes are dedicated bus lanes because traffic stopping in the middle lane is non-typical and a dedicated lane provides greater distance from traffic for stations users.
- Because two platforms are needed, stations need to be slightly wider than a station serving side-running BRT.
- Often the station prevents a left turning movement at an intersection. Alternatively, a protected-only left turn phase is required, increasing delay.
- There is no opportunity for bikes and buses to share the lane. Adding a facility to accommodate bicyclists may add to the project cost.

3.0 Areas Being Evaluated

For the Madison East-West BRT, the following locations provide opportunities for median running BRT.

- Mineral Point Road
- Whitney Way
- University Ave
- East Washington Ave

Other portions of the system, such as Sheboygan Ave, the University Ave/Johnson St one-way pair, State Street, and around the square, do not provide opportunities or benefits for Median/Center running. These segments are briefly discussed in Section 8.

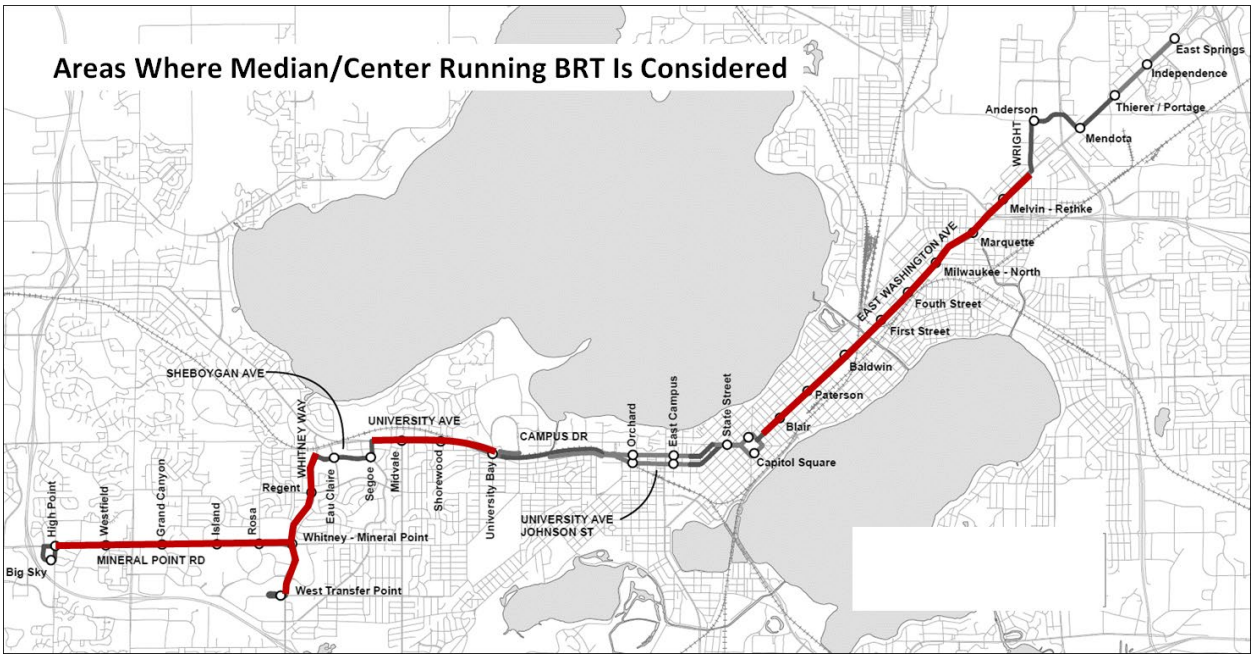


Figure 3.0-1 Areas Where Median/Center Running BRT is Being Considered

4.0 East Washington Avenue

A. Geometry

East Washington Ave is one of the most heavily used arterials within the City, carrying daily traffic volumes from 42,000 to 52,000 vehicles per day (vpd). It has three main lane configurations. From Blair to just east of Blount Street, East Washington Ave has three lanes in each direction with a bike lane. From east of Blount St to Milwaukee Street (EB) and Highway 30 (WB), East Washington Ave has three lanes in each direction with a parking lane that includes a bike lane. From Milwaukee Street/Highway 30 east to Thierer Road, East Washington Ave has three lanes with a bike lane each way.

A dedicated lane for BRT can be provided between Blount Street and Milwaukee Street/Highway 30 by converting the parking lane to either a bus lane, or a general purpose travel lane. There are 13 pedestrian bumpouts in this section that would have to be removed for this to occur. The sections of East Washington from Blair to Blount, and from Milwaukee Street/Highway 30 to Thierer Road do not

have a parking lane, and therefore providing a dedicated BRT lane would require converting a general purpose lane to exclusive bus use.

This geometry has implications for BRT running way. Center running BRT should have a dedicated lane, center running in mixed traffic results in a less comfortable waiting experience. Side running BRT may have a dedicated lane, but may also run in mixed traffic.

This section of the memo reviews BRT running way options for East Washington Ave from Blount Street to Fair Oaks/Wright Street. East of Fair Oaks and Wright Street, the BRT routing leaves East Washington Avenue to serve Madison college before rejoining East Washington east of Mendota Street.

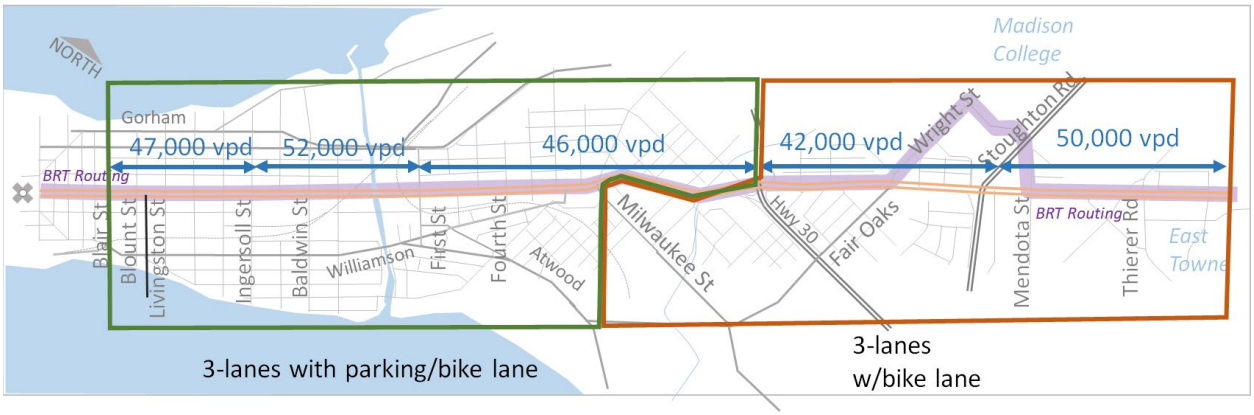


Figure 4.0-1 East Washington Ave Volumes and Lane Configuration

B. Jurisdiction

East Washington is classified a "Connecting Highway", as it carries US 151 through the City and connects with other portions of US 151 on John Nolen Drive and Park Street. There are about 52 lane miles of US 151 in the City of Madison in which the City receives aids for performing maintenance, such as snow clearing. [1] It is the responsibility of WisDOT to construct and reconstruct US 151, which includes John Nolen Drive and Park Street.[2] When East Washington Ave was recently reconstructed, WisDOT funded half of the improvements from Blount Street to Portage Road, and roughly 100 percent of the street improvements from Portage Road to East Springs Blvd.

Because East Washington is a connecting highway, coordination and approval is needed from WisDOT. Interactions with WisDOT staff about a potential lane reduction and conversion to a BRT lane on East

[1] SS 86.32(b)
[2] SS 84.03 (10)

Washington Ave have not been conclusive. Considerations shared by different WisDOT staff have included:

- Openness to either side running or center running, if basic roadway capacity is maintained during peak periods.
- Some concern regarding Transit Signal Priority.
- The need for a full traffic analysis if a lane were removed from general purpose use (capacity reduction). The analysis would need to include future 2040 forecast volumes.
- If a capacity reduction were pursued on East Washington, WisDOT may want to consider jurisdictionally transferring the roadway to Madison.

Note that the last bullet, if implemented, would represent a large transfer of infrastructure responsibility to the city, both in the reduction of highway aids received as well as reconstruction responsibilities.

C. Alternatives

There were seven alternatives evaluated.

1. Side Running and Mixed Traffic

This alternative is what is in the Locally Preferred Alternative. It includes side running BRT in a dedicated lane from Blount to First Street or Milwaukee Street. This lane would be obtained through converting the existing parking lane and removing the 7 to 13 bump outs. BRT would travel in mixed traffic eastbound between Milwaukee Street and Wright Street, and westbound between Wright Street and Highway 30. With this alternative, buses and bikes would share the lane from Blount to Milwaukee Street/Highway 30. East of Milwaukee/Highway 30 there would be no dedicated bus lane and the existing bike lane would be maintained. This alternative does not reduce the capacity of East Washington Ave. Figure 4.0-2 schematically illustrates the alternative.

From First Street to Milwaukee Street, parking would be allowed off-peak

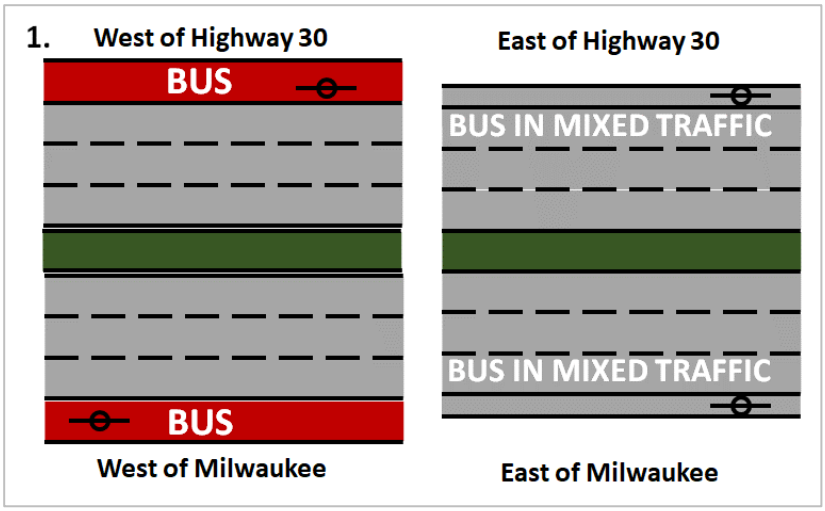


Figure 4.0-2 Alternative 1 Schematic

and weekends and buses would be in mixed traffic.

The area between First Street and Milwaukee may be more impacted by the peak-period parking restrictions. This stretch is almost entirely residential. While most or all homes have driveways, backing into and out of a residential driveway on East Washington Avenue is difficult, particularly if the curb lane becomes a general travel lane. See Figure 4.0-3.

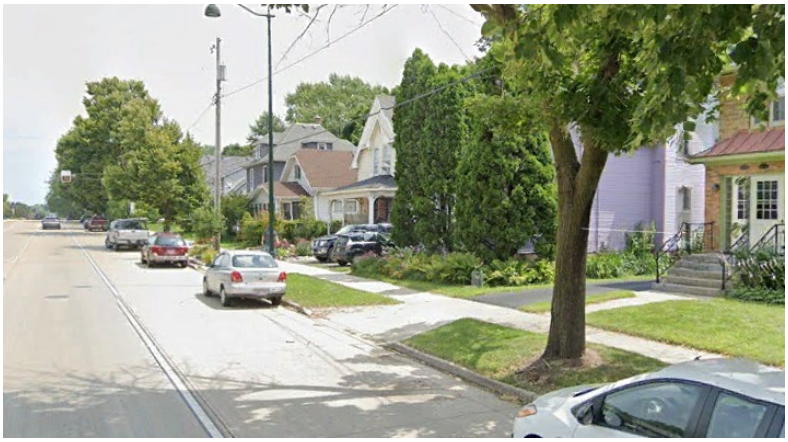


Figure 4.0-3 Street Parking, First to Milwaukee

The existing parking lane along East High School is used for staging buses and likely other vehicles, but it is assumed that bus staging can be arranged on Fourth or Fifth Street. For this section, parking would be allowed during off-peak periods and weekends. But during rush hour, parking would be restricted (Westbound in the morning, and eastbound in the evening) to allow the curb lane to serve general purpose traffic. This would be the arrangement for all alternatives except for Alternative 2, which would allow parking at all times.

2. Center Running Full Corridor with Parking

This alternative would dedicate the median lane for Bus Rapid Transit from Blount to Wright Street. As BRT re-joins East Washington east of Stoughton Road, it would run in mixed traffic. The parking lane from Blount to Milwaukee Street/Highway 30 would remain, and the bike lane adjacent to the parking lane would remain. The 13 bumpouts would remain. The bike lane east of Milwaukee Street would remain. This alternative removes a lane of motor vehicle capacity in

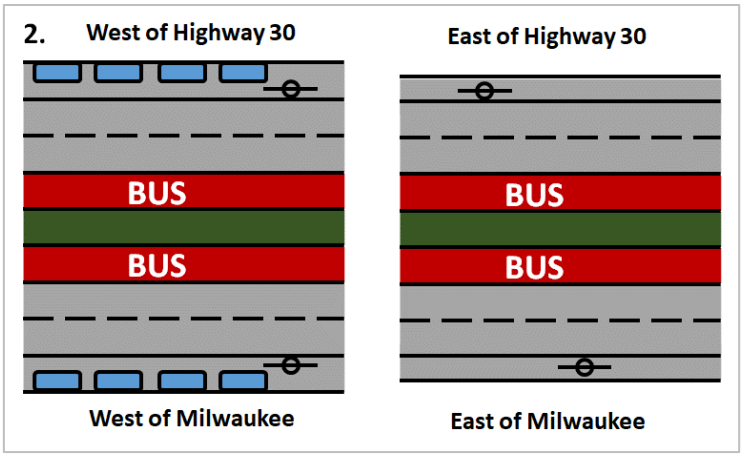


Figure 4.0-4 Alternative 2 Schematic

both directions from Blair to Wright Street.

The following figure illustrates the general typical sections with this alternative.

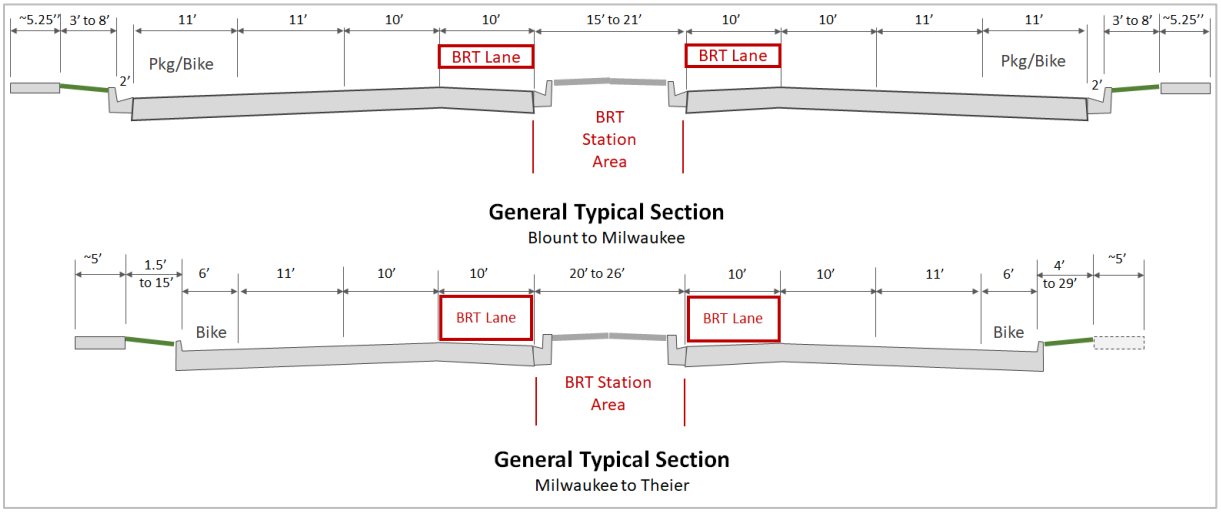


Figure 4.0-5 East Washington Typical Sections

With center running, stations are placed in the median at intersections, and typically require the space designated for left turn lanes. Figure 4.0-6 illustrates an example of a center running station from Indianapolis' IndyGo Redline BRT project. For this section of East Washington, it is likely that left turn restrictions would be needed at:

- Eastbound at Paterson
- Eastbound at Baldwin
- Westbound at Fourth
- Westbound at Milwaukee
- Eastbound at Melvin Court

The city would review where U-turns are allowed. Low volume left turn movements could be replaced by a U-turn at a subsequent intersection. For example, to make the eastbound left turn at Paterson Street, a vehicle would make a U-turn at Brearly and a right turn on Paterson. To make the westbound left at Milwaukee Street, a vehicle could turn

Figure 4.0-6 Center Running Station - IndyGo

left at Marquette towards Milwaukee Street or make a U-turn at Sixth and a right onto Milwaukee Street.

Figure 4.0-7 schematically illustrates this concept.

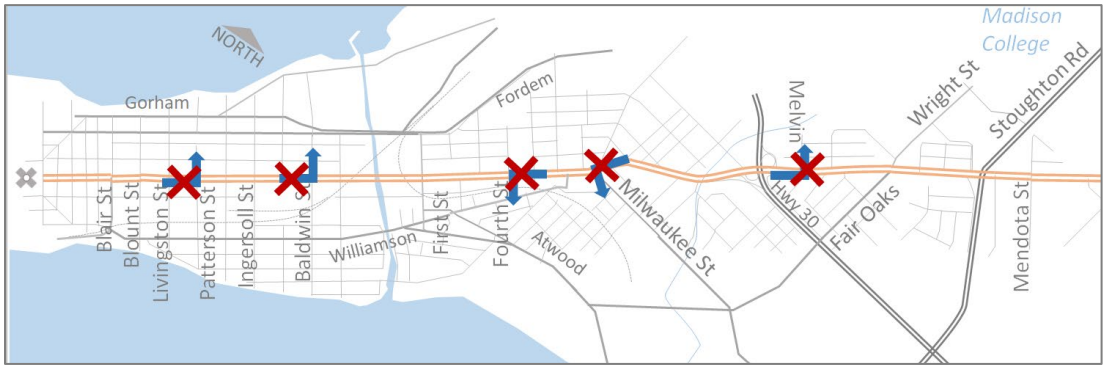


Figure 4.0-7 Turning Restrictions for Center Running

3. Center Running Full Corridor, Peak Hour Parking Restrictions

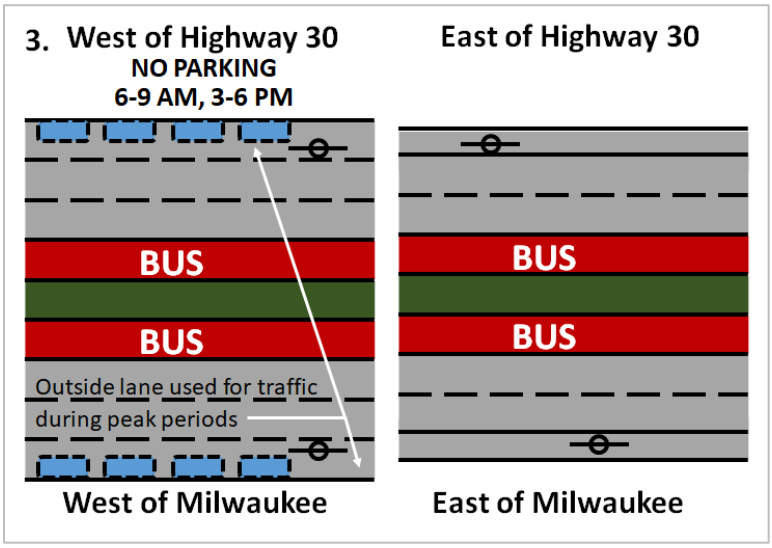


Figure 4.0-8 Alternative 3 Schematic

This alternative would dedicate the median lane for Bus Rapid Transit from Blount to Wright Street. The outside lane between Blount and Milwaukee Street/Highway 30 would allow parking during off-peak (non-rush hour) periods, but would prohibit parking during peak periods when the outside lane would be used as a travel lane. While parking is allowed during the off-peak periods, bikes would have a bike lane. But when the outside lane became a travel lane, bikes would need to travel in a general purpose lane or use a parallel route. This alternative also would require removal of 12 bumpouts. Between Milwaukee Street/Highway 30 and Wright Street, the lack of a parking lane would require converting a general

travel lane to transit use, a capacity reduction for motor vehicle traffic. The existing bike lane east of Milwaukee Street/Highway 30 would remain.

4. Center Running to Milwaukee Street/Highway 30, Peak Hour Parking Restrictions, Mixed Traffic East of Milwaukee/Highway 30

This alternative would dedicate the median lane for Bus Rapid Transit from Blount to Milwaukee Street/Highway 30. The outside lane would allow parking during off-peak (non-rush hour) periods, but would prohibit parking during peak periods when the outside lane would be used as a travel lane. While parking is allowed during the off-peak periods, cyclists would have a bike lane. But when the outside lane became a travel lane, bikes would need to travel in a general purpose lane or use a parallel route. This alternative also would require removal of 13 bumpouts. Between Milwaukee Street and Fair Oaks, BRT would be in mixed traffic with stations on the side.

One disadvantage of this combination is that buses will need to transition from center running to side running in both directions between Fourth Street and Milwaukee Street. While possible, it can cause delay. Changing lanes from left to right going eastbound is particularly difficult for buses because of their blind spot.

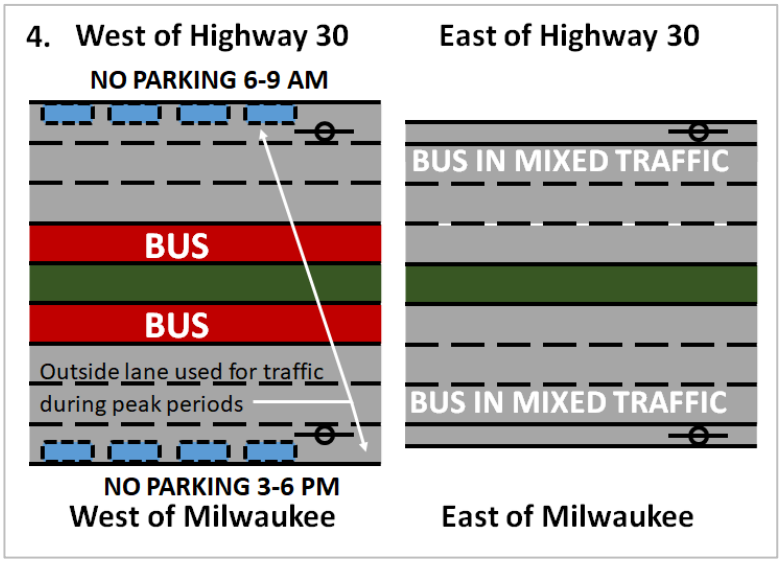
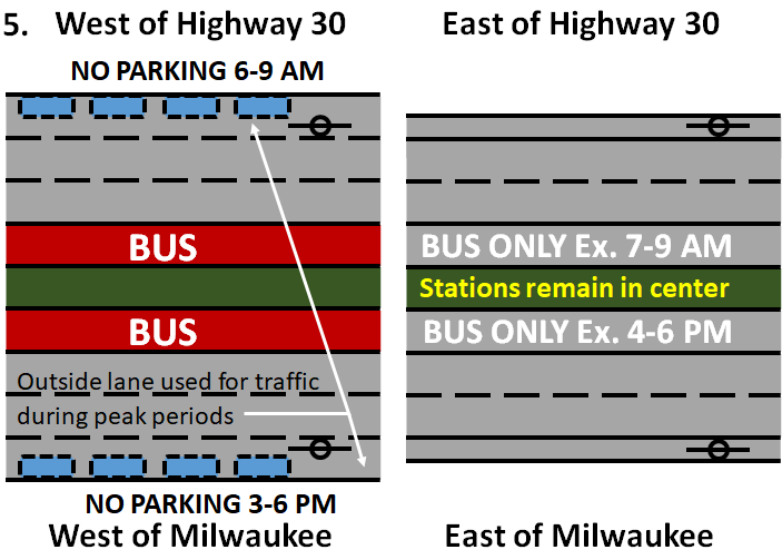


Figure 4.0-9 Alternative 4 Schematic

5. Center Running to Wright Street, Peak Hour Parking Restrictions, Mixed Traffic east of Milwaukee/ Highway 30



This alternative would be identical to Alternatives 3 and 4 west of Milwaukee Street / Highway 30. East of Milwaukee Street it operates in mixed traffic on the left side, serving stations in mixed traffic. In order to maximize comfort of waiting passengers, the left lane would be signed as bus only except during peak periods. To gain compliance on this restriction, it is likely overhead dynamic signage would be required.

This alternative generally provides the advantages of center-running BRT to Wright Street. One challenge will be BRT buses stopping in the left lane blocking through traffic. Buses stopping in lane on the left side is an unconventional approach but there are some successful examples. Figure 4.0- 11 from Google Street View illustrates a center-running station in mixed traffic as part of IndyGo's Red Line on 38th Street.

Figure 4.0-11 Center Running Station in Mixed Traffic (Google Street

6. Center running to Wright Street, Peak Hour Parking restrictions, with Pullouts

This alternative would be identical to Alternatives 3 and 4 west of Milwaukee Street/Highway 30. East of Milwaukee Street, buses operate in the center of the street in mixed traffic with left-side pullouts at three stations. Some roadway widening would be required around stations, particularly Milwaukee Street and Melvin Court, in order to maintain three travel lanes in each direction, a bike facility, bus pullout lanes, and a BRT station. This could require reconstructing more than 1,000 feet of East Washington Ave at these two station locations. The street width at the Marquette Street station may be wide enough to accommodate this cross section without widening. West of

Milwaukee/Highway 30 cyclists would use the shared parking/bike lane except during rush hour. East of Milwaukee/Highway 30 there would be bike lanes in the east and west bound directions.

The drawback to this alternative, besides the cost of widening, is the difficultly associated with the bus pulling out into the general-purpose travel lanes. Signal phasing and queue jumps may help, as well as sufficient space for the bus to accelerate and merge.

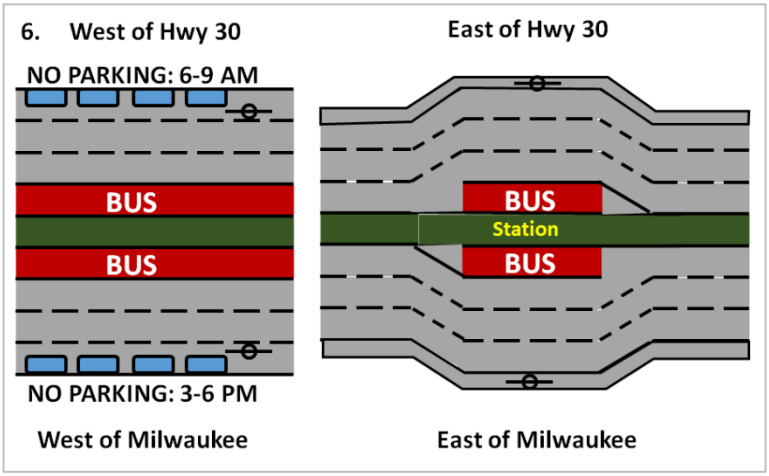


Figure 4.0-12 Alternative 6 Schematic

7. Center Running to Wright Street, Peak Hour Parking Restrictions, with a Lane Shift East of Milwaukee

This alternative would be identical to Alternatives 3 and 4 west of Milwaukee Street. East of Milwaukee Street it would use a combination of cross sections and changes to maintain center running BRT with three lanes of general purpose traffic in each direction.

Between Milwaukee Street and Highway 30, the westbound right lane would be converted from a parking and bike lane to general purpose traffic during peak periods while the left lane is converted to bus only. Eastbound, the bus would merge into the general purpose travel lane between Milwaukee and Pawling Street. Approaching the Marquette Street station, an eastbound auxiliary lane is added and the lanes shift allowing a bus lane to begin again.

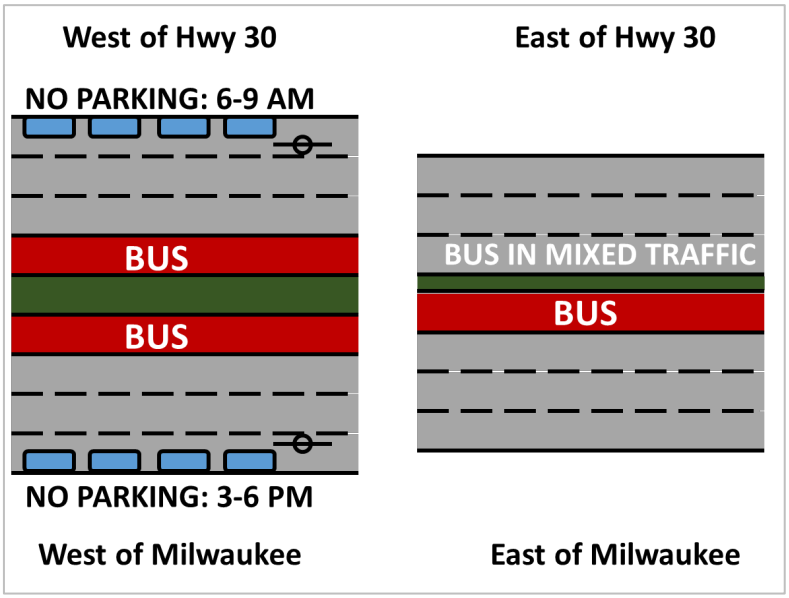


Figure 4.0-13 Alternative 7 Schematic

Between Highway 30 and Wright Street, buses would generally be in mixed traffic westbound until the Melvin Court station. Eastbound they would be in a left-hand bus only lane. Space for the bus only lane is created by removing the existing bike lanes in both directions and shifting the median.

While this alternative generally maintains the advantages of center running BRT to Wright Street, it comes with impacts. A substantial amount of roadway work would need to be completed in the median and lane lines would not line up with concrete joints – which can cause lane delineation

problems in low light and wet weather conditions. Also, bike lanes would be lost between about Highway 30 and Wright Street.

D. Analysis

Table 4.0-3 summarizes the major impact differences between running ways. The following paragraphs discuss the impacts likely to have the most stakeholder interest. These include bike accommodations, motor vehicle capacity with potential traffic diversion, and parking loss.

1. Bike Accommodations

Alt 1 – From Blount to Milwaukee (~2 miles) bikes will share a lane with the BRT bus, which will have a headway of 7.5 minutes. When a BRT bus reaches a cyclists, it will need to move to a general purpose lane to pass them. Similarly, cyclists may travel around a BRT bus stopped at a station. This arrangement is not ideal, but exists on many routes that Metro buses and bikes share, such as the Jenifer Street Bike Boulevard. Cyclists may choose to travel on parallel lower stress routes (Mifflin Bike Blvd and Capital City Trail) for this portion of East Washington. From Milwaukee Street to Fair Oaks (~1.2 miles), cyclists will travel in a 6-foot bike lane. Where stations occur, bikes will be routed around the back of the station if possible to avoid conflicts with BRT buses.

Alt 2 – From Blount to Milwaukee bikes will share the parking/bike lane, an arrangement that exists today. From Milwaukee Street to Fair Oaks, cyclists will travel in a 6-foot bike lane.

Alt 3 – From Blount to Milwaukee bikes will share the parking/bike lane that exists today for about 21 hours of the day. During rush hour peak, westbound in the morning and eastbound in the evening, the parking lane would be converted to a general purpose travel lane. This is a similar arrangement to what exists on Williamson Street. During peak hours, cyclists would need to travel within the general purpose travel lane, or use a parallel route such as the Capital City trail or the Mifflin Street bike boulevard. From Milwaukee to Fair Oaks, cyclists will travel in the existing 6-foot bike lane.

Alt 4 – For cyclists, Alternative 4 functions similarly to Alternative 3. From Blount to Milwaukee bikes will share the parking/bike lane that exists today for about 21 hours of the day. During rush hour peak, westbound in the morning and eastbound in the evening, the parking lane would be converted to a general purpose travel lane. This is a similar arrangement to what exists on Williamson Street. During peak hours, cyclists would need to travel within the general purpose travel lane, or use a parallel route such as the Capital City trail or the Mifflin Street bike boulevard. From Milwaukee to Fair Oaks, cyclists will travel in the existing 6-foot bike lane.

Alt 5 – For cyclists Alternative 5 functions the same as Alternative 3 and 4. West of Milwaukee/Highway 30, cyclists will use the shared parking/bike lane except during the rush hour. East of Milwaukee/Highway 30, cyclists will travel in the existing bike lane.

Alt 6 – West of Milwaukee/Highway 30 cyclists will use the shared parking/bike lane except during the rush hour. East of Milwaukee/Highway 30 eastbound cyclists will travel in the existing bike lane.

Alt 7 - West of Milwaukee/Highway 30 cyclists will use the shared parking/bike lane except during the rush hour. East of Milwaukee/Highway 30 there would be no bicycle accommodations. Alternate routes that are slightly less direct exist using the Starkweather Creek path or Commercial and Fair Oaks Avenue, but East Washington itself would not accommodate bicycles.

2. Motor Vehicle Capacity and Diversion

Alt 1 – From Blount to Milwaukee and from Milwaukee to Fair Oaks, Alternative 1 essentially maintains the capacity of East Washington Ave. The BRT lane is developed from the parking lane. Consequently motor vehicle operations would essentially be the same as today and significant diversion would not be expected.

Alt 2 – From Blount to Milwaukee and from Milwaukee to Fair Oaks a general purpose lane in both directions is converted to a BRT lane. This reduction in capacity on East Washington Ave would reduce traffic volumes on East Washington by roughly 20 percent west of Johnson Street and 8 percent east of Johnson Street. The capacity reduction redirects volumes to other arterials such as Johnson, Gorham, and Williamson Streets, which all see traffic increases of roughly 20 percent.

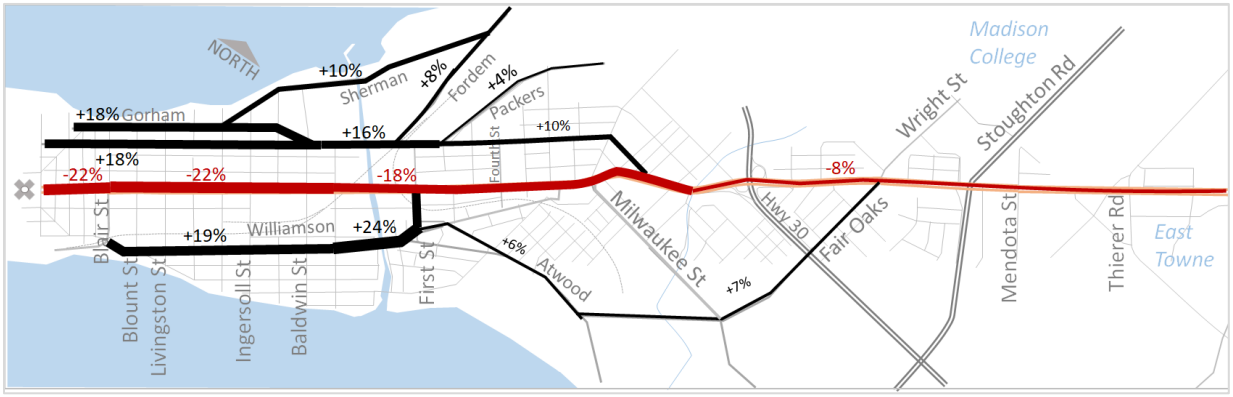


Figure 4.0-14 Alternative 2 Traffic Diversion with Capacity Reduction

On East Washington Ave there is a 33 percent capacity reduction, but also a 20 percent volume reduction. Consequently congestion levels would increase, but with the volume reduction not as greatly as might be expected with such a capacity decrease. Figure 4.0-14 illustrates the traffic redirection associated with Alternative 2 as modeled in the Greater Madison MPO's 2010 travel demand model. Table 4.0-1 provides an estimate of the daily traffic volumes that would be diverted, based on the most recent counts.

Table 4.0-1 Alt 2 Redirected Daily Traffic Volumes

Location	ADT	Percent Change	Est Diff in Daily Vol
East Washington W of Yahara	52,600	-22%	-11,600
East Washington Yahara to Hwy 30	47,000	-18%	-8,500
East Washington E of Hwy 30	43,700	-8%	-3,500
Williamson West of Yahara	15,900	19%	3,000
Atwood Ave	28,300	6%	1,700
Fair Oaks - Atwood to Milwaukee	8,000	7%	600
Sherman Ave	4,400	10%	400
Packers Ave	32,400	4%	1,300
Fordem	9,800	8%	800
Gorham E of Paterson	24,000	18%	4,300
Johnson E of Paterson	20,300	18%	3,700

Alt 3 – From Blount to Milwaukee Street there would be a capacity reduction on East Washington during non-peak hours. Because the capacity reduction occurs when traffic volumes are relatively modest, significant diversion does not occur. Also, because capacity is maintained during peak traffic volumes hours, congestion does not increase during these periods. From Milwaukee to Fair Oaks there would be a capacity reduction, although this stretch has slightly lower traffic volumes along East Washington. This results in a 5 to 8 percent reduction of traffic volume on East Washington Avenue. It increases traffic on Johnson, Gorham, and Williamson Streets from 2 to 3 percent. Atwood Ave and Fair Oaks see the biggest increases in diverted traffic, ranging from 6 to 22 percent.

The capacity of about one mile of East Washington Ave is reduced 33 percent, yet East Washington Traffic volumes are only reduced 5 to 8 percent. Therefore this section of East Washington is likely to experience greater congestion during rush hours. At Milwaukee Street, three through lanes would be provided westbound but only two eastbound. Figure 4.0-15 illustrates the traffic redirection associated with Alternative 3 as modeled in the Madison Area Transportation Planning Board's 2010 travel demand model. Table 4.0-2 provides an estimate of the diverted traffic volumes.

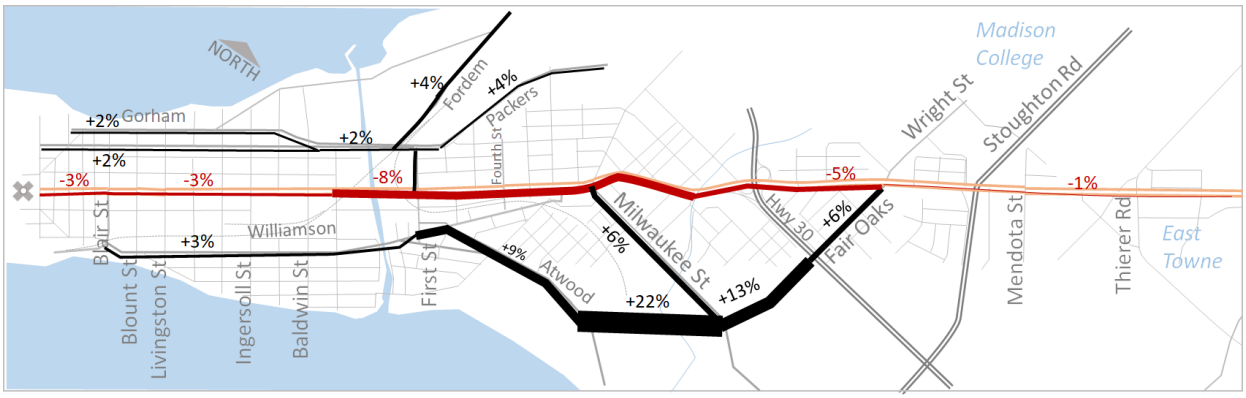


Figure 4.0-15 Alternative 3 Traffic Redirection with Capacity Reduction

Table 4.0-2 Alt 3 Estimated Redirected Daily Traffic Volumes

Location	ADT	Percent Change	Est Diff in Daily Vol
East Washington W of Yahara	52,650	-3%	-1,600
East Washington Yahara to Hwy 30	47,000	-8%	-3,800
East Washington E of Hwy 30	43,750	-4%	-1,800
Williamson West of Yahara	15,900	3%	500
Atwood Ave	28,250	9%	2,500
Fair Oaks - Atwood to Milwaukee	8,000	22%	1,800
Fair Oaks - Milwaukee to Hwy 30	10,800	13%	1,400
Fair Oaks - Hwy 30 to East Wash	7,250	6%	400
Milwaukee - East Wash to Fair Oaks	10,700	6%	600
Packers Ave	32,350	4%	1,300
Fordem	9,800	4%	400
Gorham E of Paterson	24,050	2%	500
Johnson E of Paterson	20,300	2%	400

Alt 4 – As with Alternative 3, from Blount to Milwaukee Street there would be a capacity reduction on East Washington during non-peak hours. Because the capacity reduction occurs when traffic volumes are relatively modest, significant diversion does not occur. Also, because capacity is maintained during peak traffic volumes hours, congestion does not increase during these periods. From Milwaukee to Fair Oaks there would be no capacity reduction, so traffic operations would remain as exists today and the would be no traffic diversion.

Alt 5 – West of Milwaukee/Highway 30, there would be a capacity reduction during non-peak hours, yet during peak hours 3-lanes would be available in the peak direction. No redirection or increase in congestion is anticipated. East of Milwaukee/Highway 30. BRT would stop in-lane in-traffic similar to what currently occurs on the right side of the street. While this is somewhat unconventional, no additional congestion or redirection would be anticipated. And as mentioned previously, the IndyGo Red line has a similar arrangement on portions of its BRT and has not been experiencing detrimental effects.

Alt 6 – The only capacity reduction on East Washington Avenue would be west of Milwaukee Street outside of peak periods. Consequently no additional congestion or redirection is anticipated.

Alt 7 – The only capacity reduction on East Washington Avenue would be west of Milwaukee Street outside of peak periods. Consequently no additional congestion or redirection is anticipated.

3. On-street Parking Loss

Alt 1 – With Alternative 1, about 405 on-street parking spaces would be repurposed to a BRT lane between Blount Street and Milwaukee Street. West of First Street, many of these spaces already have 2 hour parking restrictions. From First Street to Sixth Street on-street parking is used by the adjacent residences. From First Street to Milwaukee Street, about 116 parking spots would be available during off-peak and weekend periods. During rush hour there would be parking restrictions in the peak direction, 67 spaces westbound (AM) and 49 spaces eastbound (PM). Parking would be permanently removed EB approaching Fourth Street (5 spaces), between Sixth and Milwaukee (18 spaces), and WB between Milwaukee and Seventh Street (6 spaces).

Alt 2 – No parking spaces would be lost with Alternative 2 because the BRT lane is developed from a repurposed general travel lane.

Alts 3-7 – For the majority of the day and on weekends all parking would remain. During the weekday morning rush hour about 190 westbound parking spaces would have parking restrictions. During the weekday evening rush hour about 215 eastbound parking spaces would have parking restrictions. As with other streets in the city that have peak hour parking restrictions (eg Williamson, Monroe, etc.), there would be a towing contract to enforce the peak hour restrictions.

For all alternatives except Alternative 2, existing westbound parking between Milwaukee Street and Highway 30 would also be removed, but parking utilization in that area is near zero.

4. Pedestrians

The difference in performance between the alternatives for pedestrians is very minor. In all alternatives, the sidewalk and terrace remains the same width and the street crossing infrastructure is the same. For median stations, transit users have to cross half of East Washington twice; for side stations they have to cross the full width once in one direction and not at all in the other, so the total amount of crossing is the same.

Alt 1 – Alternative 1 is slightly worse than existing for pedestrians in that it replaces a parking lane with full time bus lane, removing the physical buffer between the sidewalk and traffic and removes

the bumpouts that exist at some intersections. However, the curb lane would only have bikes and buses in it, not a steady stream of cars.

Alt 2 – Alternative 2 would provide the best alternative for pedestrians because it retains all the existing parking and bumpouts and moves transit users to the median, giving them a better waiting experience while removing conflicts between bus passengers and pedestrians. Further, the increased traffic congestion at rush hour would likely reduce traffic speeds.

Alts 3-7 – All other alternatives are effectively neutral or a slight gain for pedestrians over existing conditions. They move most bus passengers to the median, giving them a better waiting experience while removing conflicts between bus passengers and pedestrians and reduce capacity and likely traffic speeds outside of rush hour. However, they also remove the bumpouts and the parking buffer during peak periods, placing general-purpose traffic next to the curb for a few hours each day.

Yield compliance at unsignalized crosswalks is very low on East Washington Avenue and the level of comfort is extremely low regardless of whether or not a bump out exists. Most pedestrians cross at the signalized intersections.

Table 4.0-3 Alternative Comparison

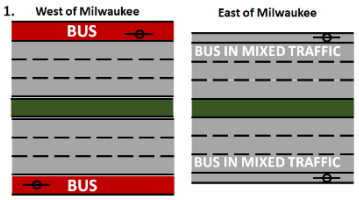
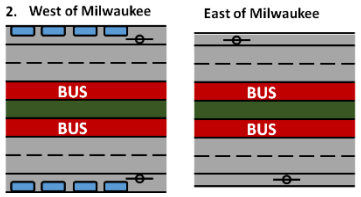
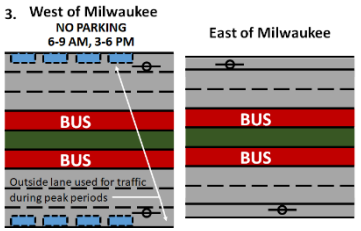
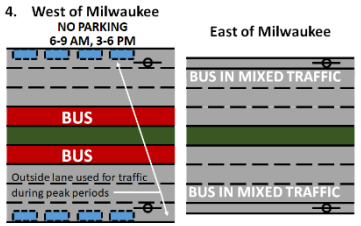
Item	**Alt 1** Side Running and Mixed Traffic	**Alt 2** Center Running Full Corridor with Parking	**Alt 3** Center Running Full Corridor, Peak Hour Parking Restrictions	**Alt 4** Center Running to Milwaukee Street, Peak Hour Parking Restrictions, Mixed Traffic East of Milwaukee
				
BRT Operations	Fair. Side running provides a time advantage. East of Milwaukee, traveling in mixed traffic reduces BRT speed.	Very Good Center running provides a better time advantage than side running (~5%). This alternative would have that for the full corridor.	Very Good Center running provides a better time advantage than side running (~5%). This alternative would have that for the full corridor.	Fair-Good Center running provides a better time advantage than side running (~5%). East of Milwaukee, traveling in mixed traffic reduces BRT speed and forces the bus to make several merges.
Bike Accommodations	Fair West of Milwaukee, bikes will share a lane with BRT buses. Buses in this segment will run every 7.5 minutes, and will have conflicts with cyclists. East of Milwaukee, bikes will have a 6-foot bike lane.	Good West of Milwaukee, bikes will travel in the shared parking bike lane that exists currently. East of Milwaukee, bikes will travel in a 6-foot bike lane.	Fair-Good West of Milwaukee, during non-rush hour, bikes will travel in the shared parking bike lane that exists currently. During rush hour, the parking lane will carry motor vehicle traffic and will not provide a dedicated bike facility. East of Milwaukee, bike will travel in a 6-foot bike lane.	Fair-Good West of Milwaukee, during non-rush hour, bikes will travel in the shared parking bike lane that exists currently. During rush hour, the parking lane will carry motor vehicle traffic and will not provide a dedicated bike facility. East of Milwaukee, bike will travel in a 6-foot bike lane.
Parking	262 on-street parking spaces would be removed permanently through the isthmus plus 29 between First and Milwaukee and 25 between Milwaukee and Oak. 116 would have peak period restrictions between First and Milwaukee.	No on-street parking spaces would be removed.	190 on-street parking spaces would be removed during peak hour in the westbound direction (AM), and 215 on-street parking spaces would be removed during peak hours in the eastbound direction (PM). 25 would be removed between Milwaukee and Oak.	190 on-street parking spaces would be removed during peak hours in the westbound direction (AM), and 215 on-street parking spaces would be removed during peak hours in the eastbound direction (PM). 25 would be removed between Milwaukee and Oak.
BRT Station #/cost	West of Milwaukee – 12 stations $9 million East of Milwaukee – 4 stations $3 million 8 side running pairs	West of Milwaukee – 6 stations $5.1 million East of Milwaukee – 2 stations $1.7 million 8 median stations	West of Milwaukee – 6 stations $5.1 million East of Milwaukee – 2 stations $1.7 million 8 median stations	West of Milwaukee – 6 stations $5.1 million East of Milwaukee – 4 stations $3 million 5 median stations, 3 side running pairs

Table 4.0-3 Alternative Comparison

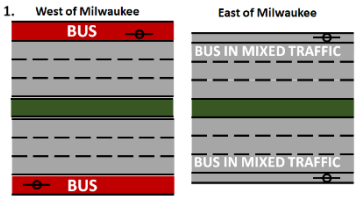
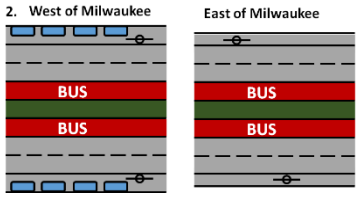
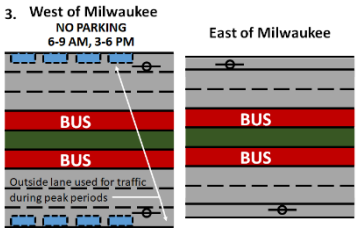
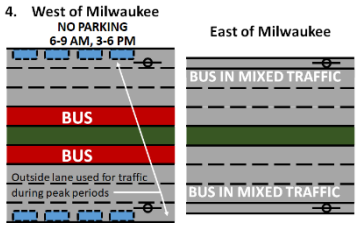
Item	**Alt 1** Side Running and Mixed Traffic	**Alt 2** Center Running Full Corridor with Parking	**Alt 3** Center Running Full Corridor, Peak Hour Parking Restrictions	**Alt 4** Center Running to Milwaukee Street, Peak Hour Parking Restrictions, Mixed Traffic East of Milwaukee
				
Turning Movements Removed		EB left at Paterson EB left at Baldwin WB left at Fourth St WB left at Milwaukee St EB left at Melvin Ct	EB left at Paterson EB left at Baldwin WB left at Fourth St WB left at Milwaukee St EB left at Melvin Ct	EB left at Paterson EB left at Baldwin WB left at Fourth St
Diminishment in Motor vehicle Capacity	None Bus lane created from existing parking lane	33 percent reduction Parking lane remains. General purpose travel lane repurposed to BRT lane.	Almost none west of Milwaukee 33 percent reduction east of Milwaukee. Parking restrictions during peak hour provide 3 general purpose travel lanes during rush hour west of Milwaukee. East of Milwaukee a general purpose travel lane would be repurposed to a BRT lane	Almost none. Parking restrictions during peak hour provide 3 general purpose travel lanes during rush hour west of Milwaukee. East of Milwaukee, all general purpose travel lanes would be maintained.
Diversion	Essentially none. EW capacity remains as is.	East Wash volumes reduced ~20% Williamson volumes increased ~20% Johnson volumes increased ~18% Gorham volumes increased ~18% Sherman volumes increased ~10%	East Wash east of Baldwin reduced ~8% Atwood Ave increased ~9% Fair Oaks increased 6% to 22% Johnson/Gorham increased ~2%	Essentially none. EW capacity remains as is.
Other factors	Bikes, right turns, and service vehicles could impede BRT vehicles. Would require towing contract for illegally parked vehicles.		Would require towing contract for illegally parked vehicles.	Would require towing contract for illegally parked vehicles.
Potential WisDOT concerns	Few. Parking lane converted to BRT use was paid for by local funds.	Potentially many. This alternative reduces capacity by 33 percent.	Potentially some. West of Milwaukee, peak hour lane capacity is preserved during peak hours, so concerns should be modest. East of Milwaukee, the lane reduction is likely to be a concern.	Probably few. West of Milwaukee, peak hour lane capacity is preserved during peak hours, so concerns should be modest. East of Milwaukee there is no capacity reduction.
Pedestrian changes	Bump-outs removed, buses operate in curb lane.	No impacts, traffic calming at all times, transit riders in the median.	Bump-outs removed, traffic calming, transit riders in the median.	Bump-outs removed, traffic calming, transit riders in the median.

Table 4.0-3 Comparison of Alternatives (cont)

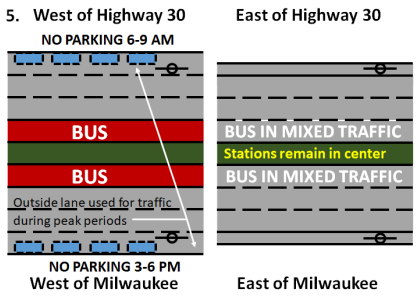
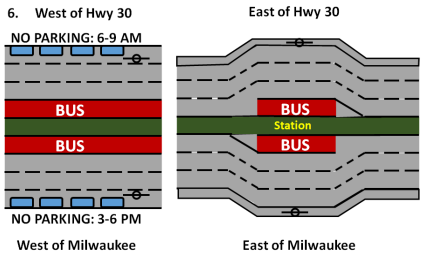
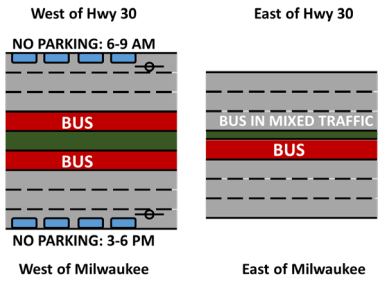
Item	Alt 5 Center Running with Mixed Traffic East of Milwaukee Street	Alt 6 Center Running with Pullouts	Alt 7 Center Running with Lane Shift East of Milwaukee Street
			
BRT Operations	Good. Center running is maintained until Wright Street, but mixed traffic could cause delays.	Fair-Good . Center running is maintained until Wright Street, but mixed traffic and pull-outs could cause delays.	Good. Center running is maintained until Wright Street. Although there is some operations in mixed traffic, delays should be minimal.
Bike Accommodations	Fair-Good West of Milwaukee, during non-rush hour, bikes will travel in the shared parking bike lane that exists currently. During rush hour, the parking lane will carry motor vehicle traffic and will not provide a dedicated bike facility. East of Milwaukee, bikes will travel in a 6-foot bike lane.	Fair-Good West of Milwaukee, during non-rush hour, bikes will travel in the shared parking bike lane that exists currently. During rush hour, the parking lane will carry motor vehicle traffic and will not provide a dedicated bike facility. East of Milwaukee, bikes will travel in a 6-foot bike lane.	Poor Bike lanes are lost through the isthmus as well as between Milwaukee WB / Highway 30 EB and Wright Street
Parking	190 on-street parking spaces would be removed during peak hour in the westbound direction (AM), and 215 on-street parking spaces would be removed during peak hours in the eastbound direction (PM). 25 would be removed between Milwaukee and Oak.	190 on-street parking spaces would be removed during peak hour in the westbound direction (AM), and 215 on-street parking spaces would be removed during peak hours in the eastbound direction (PM). 25 would be removed between Milwaukee and Oak.	190 on-street parking spaces would be removed during peak hour in the westbound direction (AM), and 215 on-street parking spaces would be removed during peak hours in the eastbound direction (PM). 25 would be removed between Milwaukee and Oak.

Table 4.0-3 Comparison of Alternatives (cont)

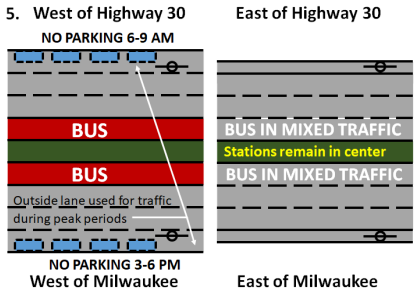
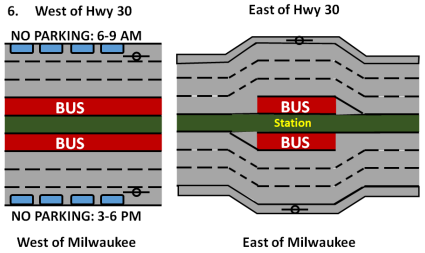
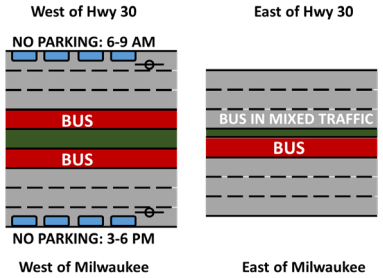
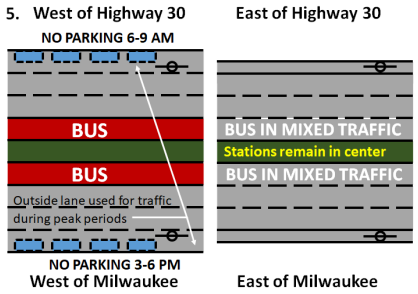
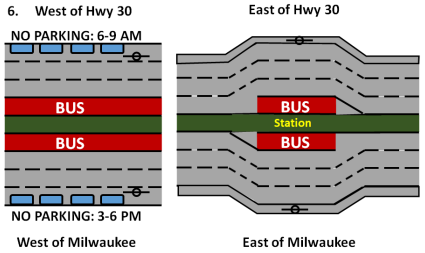
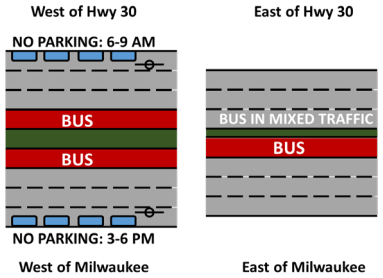
Item	**Alt 5** Center Running with Mixed Traffic East of Milwaukee Street	**Alt 6** Center Running with Pullouts	**Alt 7** Center Running with Lane Shift East of Milwaukee Street
			
BRT Station #/estimated cost	West of Milwaukee – 6 stations $5.1 million East of Milwaukee – 2 stations $1.7 million 8 median stations	West of Milwaukee – 6 stations $5.1 million East of Milwaukee – 2 stations $1.7 million 8 median stations	West of Milwaukee – 6 stations $5.1 million East of Milwaukee – 2 stations $1.7 million 8 median stations
Turning Movements Removed	EB left at Paterson EB left at Baldwin WB left at Fourth St WB left at Milwaukee St EB left at Melvin Ct	EB left at Paterson EB left at Baldwin WB left at Fourth St WB left at Milwaukee St EB left at Melvin Ct	EB left at Paterson EB left at Baldwin WB left at Fourth St WB left at Milwaukee St EB left at Melvin Ct
Diminishment in Motor vehicle Capacity	None Bus lane created from existing parking lane	None Bus lane created from existing parking lane	None Bus lane created from existing parking lane
Diversion	Almost none. Parking restrictions during peak hour provide 3 general purpose travel lanes during rush hour west of Milwaukee. East of Milwaukee, all general purpose travel lanes would be maintained.	Almost none. Parking restrictions during peak hour provide 3 general purpose travel lanes during rush hour west of Milwaukee. East of Milwaukee, all general purpose travel lanes would be maintained.	Almost none. Parking restrictions during peak hour provide 3 general purpose travel lanes during rush hour west of Milwaukee. East of Milwaukee, all general purpose travel lanes would be maintained.
Other factors	Potential for conflicts with buses stopping in-lane on the left side.	Increased cost due to widening around two stations.	Increased cost due to median reconstruction, concrete joints may not line up with lane lines on some segments.
Potential WisDOT concerns	Potential concern with stopping on the left side.		WisDOT may have input on the new roadway geometry.

Table 4.0-3 Comparison of Alternatives (cont)

Item	**Alt 5** Center Running with Mixed Traffic East of Milwaukee Street	**Alt 6** Center Running with Pullouts	**Alt 7** Center Running with Lane Shift East of Milwaukee Street
			
Pedestrian changes	Bump-outs removed, traffic calming, transit riders in the median.	Bump-outs removed, traffic calming, transit riders in the median.	Bump-outs removed, traffic calming, transit riders in the median.

E. Draft Recommendation

Alternative 5 is the recommended alternative. Figures 5.0-16 and 17 illustrate this recommendation. Advantages of Alternative 5 include:

- It provides the advantages of center running for the full corridor between Webster and Wright.
- It has acceptable bike accommodations for the majority of the week on the isthmus.
- There is the ability to maintain parking for the majority of the week.
- Is has limited to no traffic diversion.
- Is limited to no effect on traffic operations.
- Because it does not reduce capacity during peak periods, there is a good probability of acceptance by WisDOT, who has some jurisdiction over the US 151 highway.

In the selection of Alternative 5, the following impacts are acknowledged:

- During the peak traffic hours, cyclists will not have a dedicated bike facilities between Blount and Milwaukee Street (EB) and Hwy 30 (WB).
- Homes from First and Sixth Street will not have access to street parking during peak hours of the day.
- There will likely be left turn restrictions at Eastbound at Paterson, Eastbound at Baldwin, Westbound at Fourth, Westbound at Milwaukee, and Eastbound at Melvin Court
- The city will have to manage the peak hour parking restrictions.
- Buses will stop in the peak-period general purpose lane east of Milwaukee Street for a few stations. This is an unconventional arrangement.

It is noted that WisDOT may have objections to Alternative 5. In the event that concerns cannot be addressed, Alternative 6 would provide the next level of benefits while minimizing negative impacts.

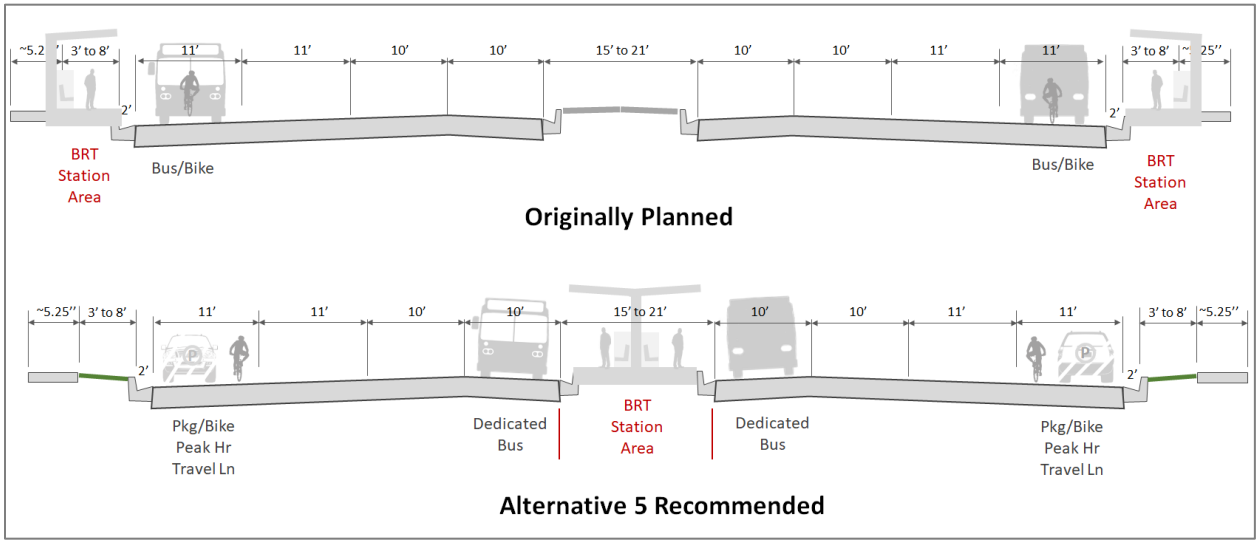


Figure 4.0-16 Alternative 5 West of Milwaukee St/Highway 30

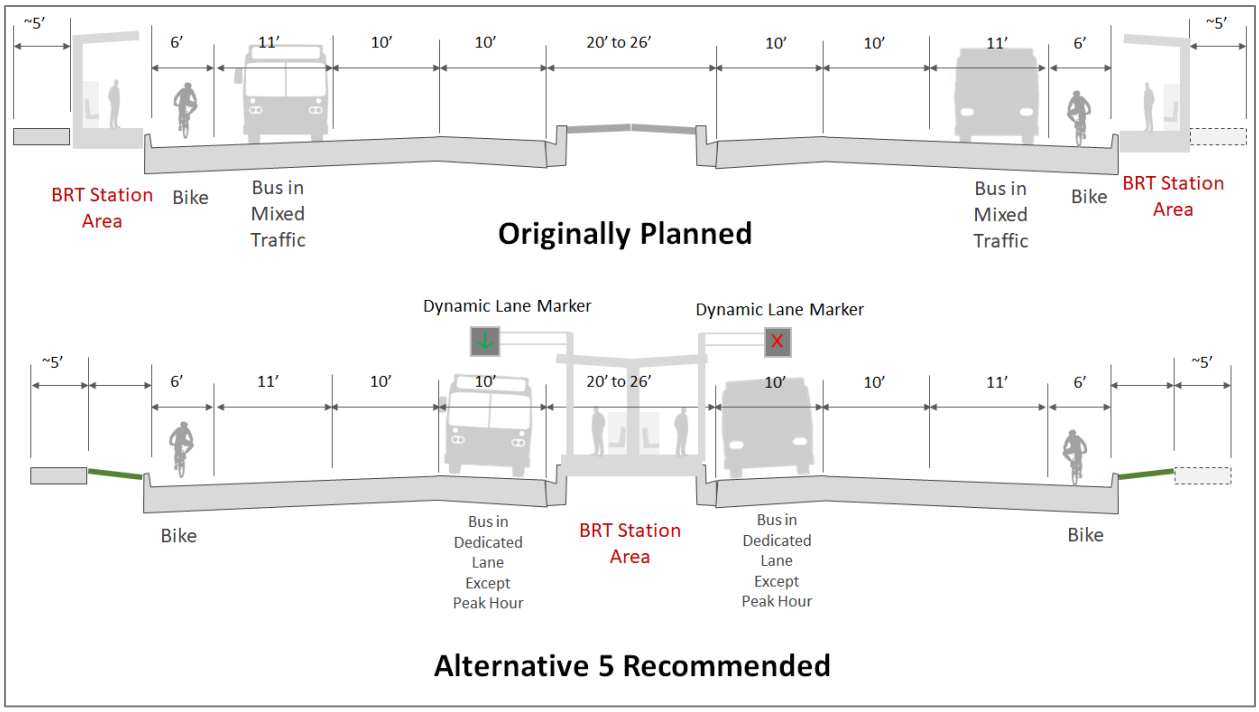


Figure 4.0-17 Alternative 5 West of Wright Street and East of Milwaukee St/Highway 30

5.0 University Avenue

A. Introduction

University Avenue is a 6-lane principle arterial that carries up to 48,000 vehicles per day. BRT will travel on this section of Campus Drive from Segoe Road east 1.2 miles to the beginning of Campus Drive. The roadway falls under three jurisdictions, Dane County west of Shorewood Blvd, and both Village of Shorewood and City of Madison east of Shorewood Blvd. Figure 5.0-1 illustrates the BRT routing and jurisdictions. Figure 5.0-2 shows current (preCovid) daily traffic volumes on University Ave.

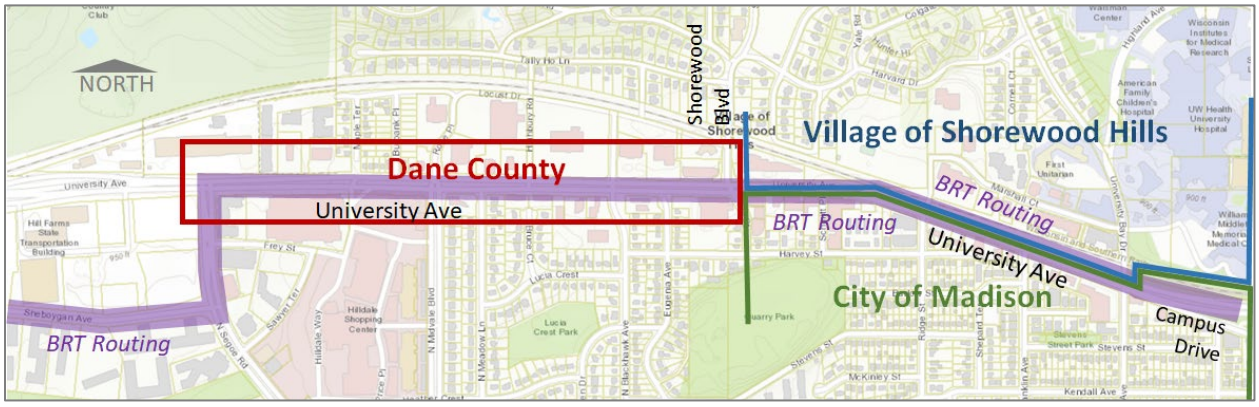
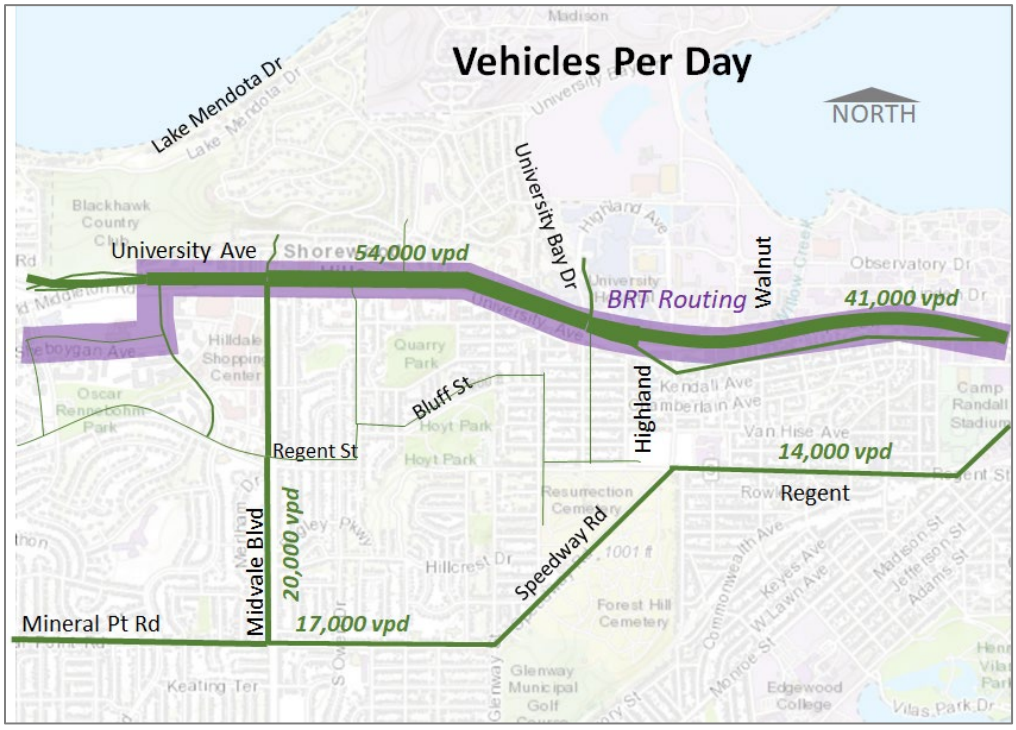
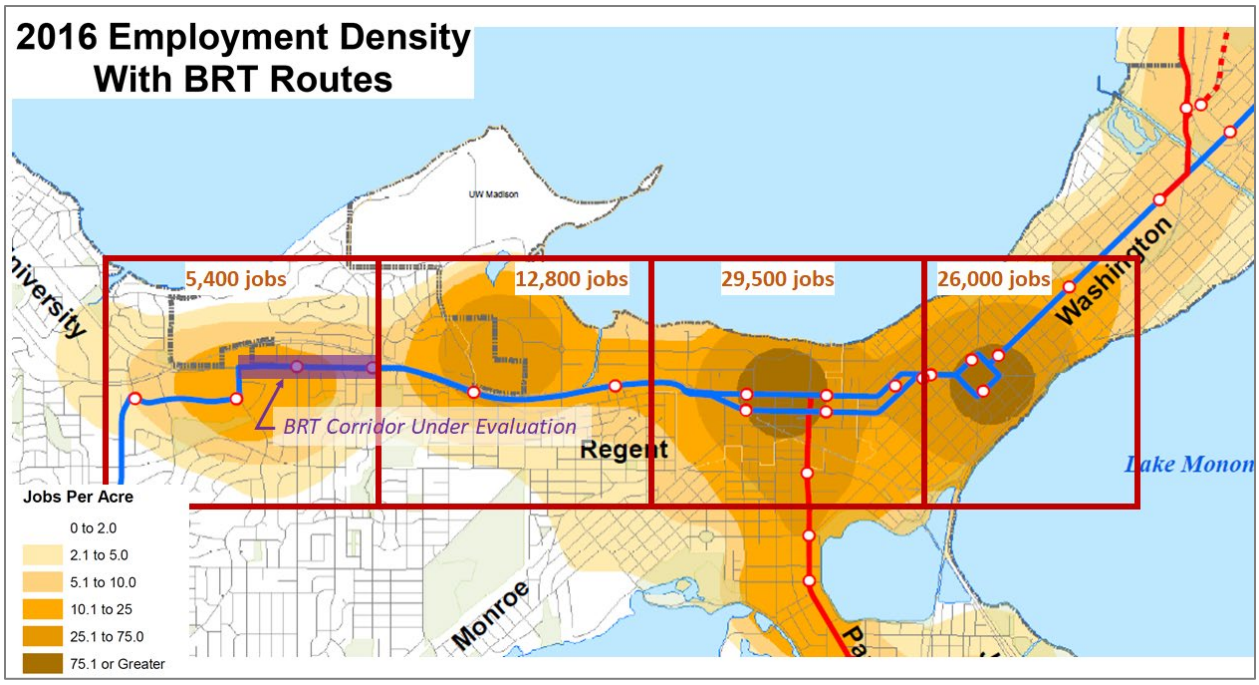


Figure 5.0-1 University Ave. Jurisdiction



5.0-2 University Ave 2018 Daily Traffic Volumes

This section of University Avenue serves the Madison Yards employment center to the west, and the UW campus to the east, two central employment hubs in the Madison area. Figure 5.0-3 illustrates job density and jobs



5.0-3 University Ave Employment Density

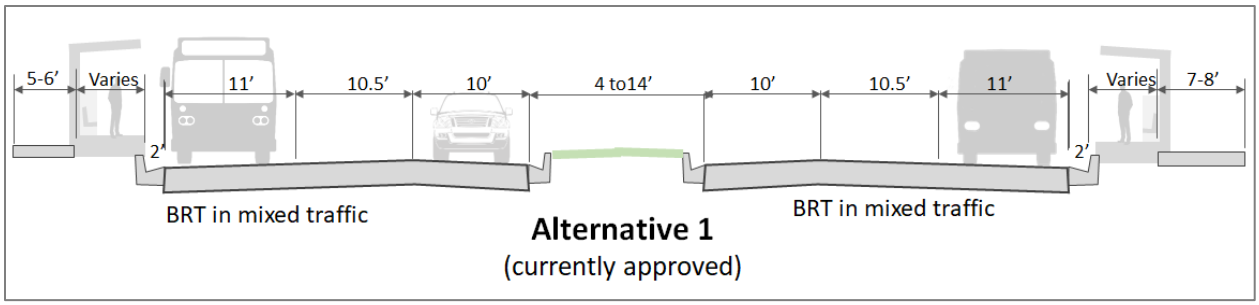
The City of Madison and Village of Shorewood Hills are planning to reconstruct University Ave, from just east of Shorewood Blvd to just east of University Bay Drive. The project will cost about $32 million, of which about $12.6 million is being paid for by Federal Surface Transportation Block Grant (STBG) funds, $13.4 million is being paid by the City of Madison, and $6 million is being paid by the Village of Shorewood Hills. In early 2020 the project has received approvals from the City of Madison, Village of Shorewood Hills, and the Greater Madison MPO.

There is the potential opportunity to combine the University Avenue Project with the BRT project. This would then allow the costs associated with University Avenue to be counted as part of the BRT project, increasing the total project cost, and thereby reducing the Small Starts percentage share. The effort is complicated in that the Federal funds associated with University Ave. need to be let in the fall of 2021 (with signed contract in the spring of 2022) or the Madison Area MPO allotted Federal funding for the 2025-2026 cycle will be delayed until the next cycle.

B. Alternatives

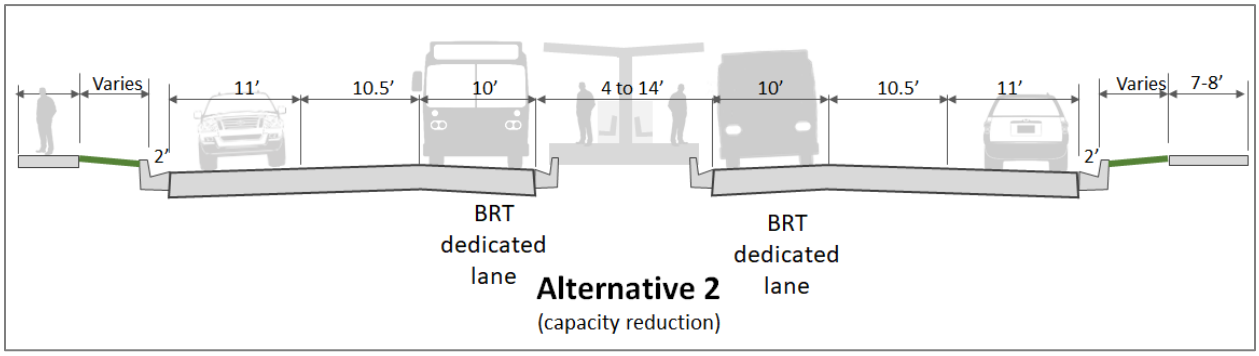
There are two basic alternatives under this analysis for the comparison of the BRT lane.

Alternative 1 - The currently proposed University Ave would maintain three lanes in both directions from just west of Segoe Road to the Farley/University Bay Drive intersection. BRT would run in the curbside lanes in mixed traffic. The east section planned for reconstruction from Shorewood Blvd to University Bay Drive would not have bicycle accommodations, yet the south sidewalk would be widened and a parallel path north of University Ave would be improved. West of Shorewood Blvd, the existing bike lanes would remain. Figure XX illustrates this alternative.



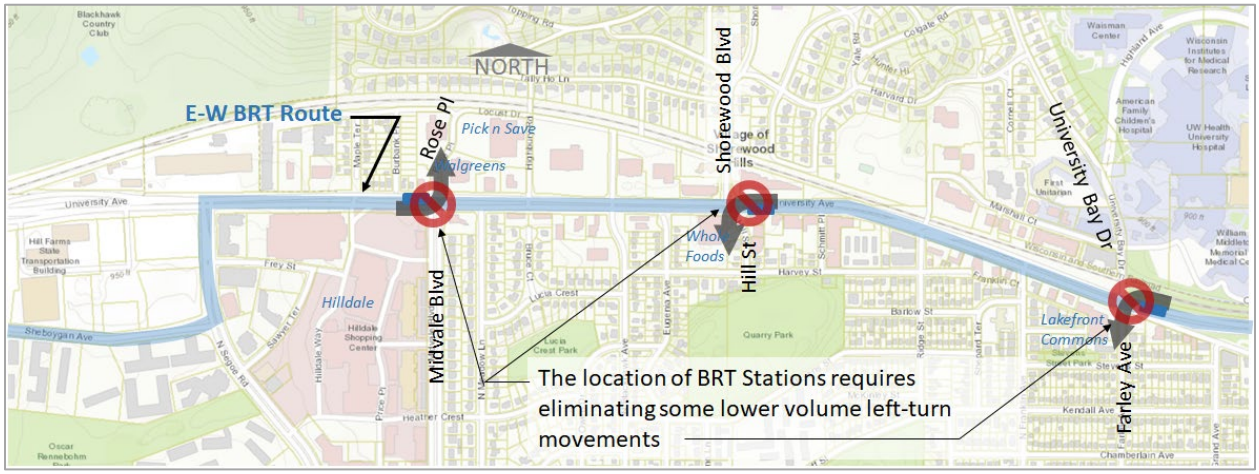
5.0-4 Currently Approved University Ave Typical Section (Alternative 1)

Alternative 2 - The second alternative would have two general purpose travel lanes in both directions of University Ave, and one dedicated median running transit lane in both directions. With this second alternative, the transit lanes would extend from Segoe Road (just west of Midvale) through the Farley University Bay Drive intersection. Bicycle accommodations would be the same as with Alternative 1.



5.0-5 Center Running University Ave Typical Section (Alternative 2)

With Alternative 2, median stations would likely require the elimination of some left turns so that the station could occupy the left turn lane. It is likely that left turn restrictions may be required at EB Rose Place (Midvale), WB Hill St (Shorewood Blvd) and WB Farley Ave. These left turn movements are relatively low volume, however the prohibitions would reduce access to some businesses, notably Pick n Save and Whole Foods. Figure 5.0-6 illustrates these locations.



5.0-6 Left turn Restrictions With Alternative 2 Center Running

C. Evaluation

Table 5.0-1 summarizes the effects of the two alternatives.

Table 5.0-1 Alternative Comparison

	Alternative 1 Side Running	Alternative 3 Median Running
BRT Efficiency	Poor. Buses are in mixed traffic in a corridor that is prone to congestion	Good – the dedicated lane in the median helps buses circumvent congestion.
Traffic Redirection	No traffic redirection anticipated.	Capacity reduction will cause roughly a 17 percent volume reduction on University Ave. Other adjacent local streets see a volume increase. Regent St would see an additional 2,000, Bluff St an additional 1,400, and Lake Mendota Dr an additional 900 vpd.
Traffic Operations	Traffic operations would be similar to what exists today.	Even with the 17 percent reduction due to redirection, overall travel times for autos increase about 9 percent in the morning peak hour in the eastbound peak direction, and about 36 percent longer in the westbound peak direction.
Potential Turning Restrictions*	None	Left turn restrictions likely will be needed at EB Rose (Midvale), WB Hilll St, and WB Farley.
Station Efficiency	6 stations needed	3 to 4 stations needed
Bike Accommodations	The existing bike lanes from Segoe to Shorewood Blvd Remain. Parallel accommodations exist north of University Ave east of Shorewood Blvd. West of Shorewood Blvd, BRT stations likely would encroach upon the bike lanes.	The existing bike lanes from Segoe to Shorewood Blvd Remain. Parallel accommodations exist north of University Ave east of Shorewood Blvd.
Pedestrian Accommodations	Pedestrians would not cross University Ave to get to one station, yet on the return trip they would cross the full roadway.	Pedestrians would need to cross half of University Ave to access a station, both on the initial and on the return trip.
Right of Way Acquisition	Right of way would probably be needed for up to 6 stations.	No right of way anticipated.

1. Traffic Redirection

As travel time increases, people evaluate route and mode choices to minimize the travel cost of different trips. Decreasing the number of general purpose travel lanes by one in each direction as is done with Alternative 2 would increase travel time delay, and prompt drivers to use alternate routes, modes, or times to travel. The Madison Area Transportation Planning Board is required to maintain a travel demand model (TDM), which links existing and future land use with the street network. The model is revised with each census and typically has an update between census years. Broken into Traffic Analysis Zones (TAZs), the model generates trips based on land uses, assigns the travel mode and routes the trip. The model can be altered to vary the street network, street capacity, or the land uses and predict the changes in mode choice, traffic volumes, and travel patterns. The model also uses a congestion feedback loop for the distribution, mode choice, and traffic assignment steps. Therefore, as the travel time costs of congestion increases, some trips are reassigned to other modes (transit/bike) and/or to other streets.

While the travel demand model has limitations, a considerable amount of federal dollars are invested in this tool, it is the official source for travel forecasts for the Madison metropolitan area.

Figure 5.0-7 graphically illustrates demand model results for the percent change in motor vehicle traffic resulting from removing one travel lane in each direction of University Ave. and dedicating it for transit use in the 2010 base scenario (Alternative 2). Note that the Travel Demand Model only includes roadways classified as arterials and collectors, and does not include the local street network. With the reduction in capacity, University Ave sees a traffic reduction of about 17 percent. Other side streets such as Bluff St and Lake Mendota Drive see traffic volume increases that are larger. Note that as traffic increases on lower volume side streets, the added volume makes up a larger percentage of the side street traffic. The *percentage* traffic volume increase can be large while the actual *added volume* is moderate.

The traffic volume increases on side streets such as Bluff St or Lake Mendota Drive do not result solely from traffic leaving University Ave, traveling on a side street, and then re-entering University Ave. Instead the traffic volume increases result from trips generated within the neighborhood that would ordinarily go directly to University Ave., but instead may use neighborhood streets for a portion of their trip prior to entering University Ave.

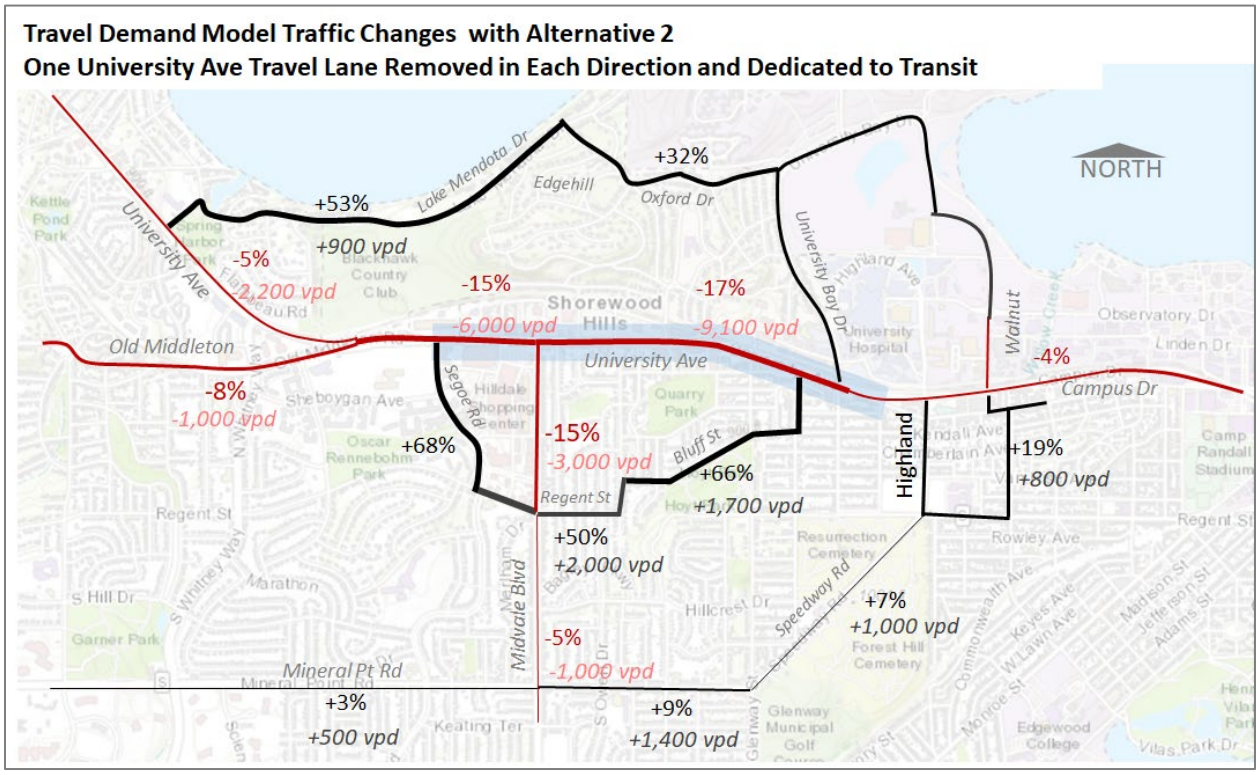


Figure 5.0-7 Traffic Volume Changes with Alternative 2 – 2010 TDM

Table 5.0-2 is a table that shows affected roadways, the most recent traffic volume count on the roadway, the percent change in daily traffic volume projected by the Travel Demand Model, and the extrapolated traffic volume change as the TDM percent change is applied to the most recent traffic count. Again note that on lower volume roadways, a small added volume results in a larger percentage increase.

Table 5.0-2 Extrapolated Traffic Volume Changes with Alternative 2

Roadway Segment	2016-2019 Traffic Volume	Demand Model Projected % Change	Extrapolated Traffic Volume Change
	Alt 1 Vol		Alt 2 Vol Change
University Ave West of Midvale	40,200	-15%	-6,000
University Ave East of Midvale	53,300	-17%	-9,100
Campus Dr	41,400	-4%	-1,700
Midvale Blvd north of Regent	19,850	-15%	-3,000
Midvale Blvd south of Regent	19,800	-5%	-1,000
Lake Mendota Dr	1,650	+53%	+900
Segoe Rd	6,500	+68%	+4,400
Regent St East of Midvale	4,050	+50%	+2,000
Bluff St	2,650	+66%	+1,700
Old Middleton Rd	12,300	-8%	-1,000
University Ave west of Whitney Way	43,450	-5%	-2,200
Speedway Rd	14,900	+7%	+1,000
Mineral Pt Rd East of Midvale	15,450	+9%	+1,400
Mineral Pt Rd West of Midvale	17,250	+3%	+500
Allen Blvd	4,400	+19%	+800

2. BRT Efficiency and Traffic Operations

The previous Travel Demand analysis illustrates how network capacity changes can influence traffic routing. Similarly, the Covid-19 crisis is likely to influence travel demand in the coming years in ways that we are not able to quantify currently. The analysis was performed using both Synchro[3] Traffic modeling software and Simtraffic[4] Traffic modeling software. For simplicity, the results of only the Synchro traffic modeling is presented in the following paragraphs.

The following Scenarios were modeled.

1. Alternative 1 - 2018 volumes with 3 lanes in both directions. (Current pre-Covid conditions)
2. Alternative 2 - 83% of 2018 volumes with 2 lanes in both directions. (To represent repurposing a travel lane in each direction for buses and the resulting decrease in motor vehicle traffic predicted by the TDM.)

Note that the analysis does not assume traffic growth, but rather assume a decrease or plateauing of traffic volumes due to Covid-19 travel changes and/or University Ave capacity reductions. Pre-Covid traffic forecasts made for the University Ave project (below), show an increase of about 4 percent over the next 20 years, a relatively modest growth rate. Post-Covid, this may be considered a larger growth rate.

2022 Average Annual Daily Traffic = 52,465 vpd

2042 Average Annual Daily Traffic = 54,765 vpd

[3] Synchro uses equations from the Highway Capacity Manual (HCM) by the Transportation Research Board (TRB) to calculate results.

[4] SimTraffic simulates individual vehicles traveling on the roadway network to calculate results.

Tables 5.0-3 and 4 below show the travel time which is measured from Segoe Road and Sheboygan Ave to Campus Drive at the Alicia Ashman overpass.

Table 5.0-3 AM Bus and Motor vehicle Travel Times

Morning Peak Hour				
	Alternative 1		Alternative 2	
	100% 2018 Traffic Volumes 3-lanes each direction		83% 2018 Traffic Volumes 2-lanes each direction	
	Traffic	Bus	Traffic	Bus
Westbound AM Peak Hour				
Delay[5]	125.5s	199.3s	168.8s	107.4s
Travel Time	6m 36s	7m 48s	7m 18s	6m 18s
Eastbound AM Peak Hour				
Delay[1]	139.3s	191.3s	170.9s	122.8s
Travel Time	6m 48s	7m 42s	7m 24s	6m 36s

Table 5.0-4 PM Bus and Motor vehicle Travel Times

Evening Peak Hour				
	Alternative 1		Alternative 2	
	100% 2018 Traffic Volumes 3-lanes each direction		83% 2018 Traffic Volumes 2-lanes each direction	
	Traffic	Bus	Traffic	Bus
Westbound PM Peak Hour				
Delay[1]	227.9s	307.2s	405.6s	121.2s
Travel Time	8m 18s	9m 36s	11m 18s	6m 30s
Eastbound PM Peak Hour				
Delay[1]	134.9s	175.6s	163.4s	115.4s
Travel Time	6m 48s	7m 24s	7m 12s	6m 4s

If one compares Alternative 1 - 100% 3-lane option (BRT mixed traffic) with Alternative 2 - the 83% 2-lane option (BRT in a dedicated transit lane), overall travel times for autos increase about 9 percent in the morning peak hour in the eastbound peak direction, a relatively modest increase. In the evening peak hour they are about 36 percent longer in the westbound peak direction – a greater travel time increase. Simulation modeling shows much longer queues in the evening peak hour. The number of intersection queues that are greater than 1000 feet goes from 0 with Alternative 1 (100% 3-lane option) with BRT in mixed traffic to 5 with Alternative 2 (83% 2-lane option) in the AM model, and from 1 to 2 in the PM model. This would result in some vehicles waiting additional signal cycles during the peak hour peak direction to get through an intersection.

[5] Delay includes traffic signal and bus stop dwell time delay

Note that BRT travel time in Alternative 2 - 83% traffic 2-lane option, is 15 percent less in the morning eastbound peak direction and 32 percent less in the evening westbound peak direction. This would provide a substantial travel time improvement for BRT riders of about 3 minutes in the evening. Perhaps a greater benefit is the on-time reliability it provides for the BRT during sporadic periods of congestion. If traffic volumes grow and congestion increases above the levels shown, then the travel time savings for BRT will be greater.

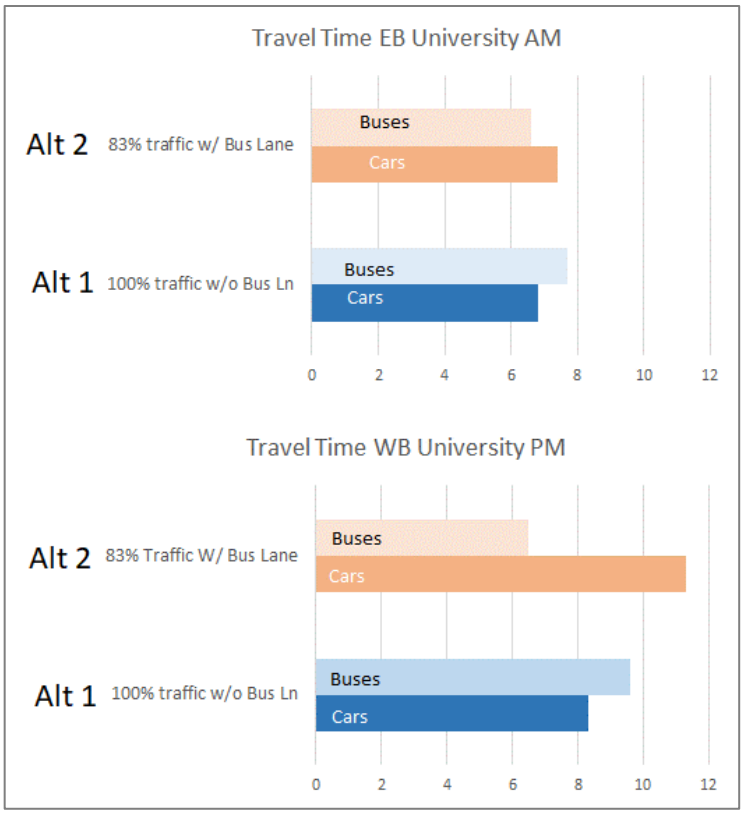


Figure 5.0-8 Travel Time Comparison

Some have raised concerns regarding how increased congestion could affect hospital access. Emergency response vehicles would have access to the dedicated BRT lane. However many trips to the emergency room occur in private vehicles that travel in the general travel lanes hindered by congestion.

The Synchro Traffic model did a sensitivity analysis to understand what volume reduction would be needed to achieve congestion levels/travel time comparable to 2018 levels with the removal of one lane in each direction for traffic. For the morning peak hour with the removal of a lane in each direction, 75 percent of 2018 volumes provided operation levels comparable to 2018. For the evening peak hour with the removal of a lane in each direction, 70 percent of 2018 volumes provided operation levels comparable to 2018. University Ave. currently is carrying about 65 percent of 2018 volumes.

Table 5.0-5 Average Travel Time per Person

	Ave Trav Time Per Person (min)	Ave Trav Time Per Person (min)
	Alternative 1	**Alternative 2**
AM Peak	6.9 m	7.2 m
PM Peak	7.9 m	9.2 m

Using a base set of assumptions[6], one can look at "people travel time" instead of vehicle travel time. Figure 5.0-5 illustrates average people travel time for the morning and evening peak hours for Alternative 1 (100% 3-lane) and Alternative 2 (83% 2-lane). Scenario 1 has the lower travel time per person, particularly in the evening. As more people shift to transit, the difference in average travel time per person decreases between Alternative 1 and 2.

[6] AM Directional Distribution 60 EB/40 WB, reversed in PM peak hour, Vehicle Occupancy 1.0 (increasing VO increases gap), Transit mode share 15%.

3. Turning Restrictions

As mentioned, there would be no additional turning restrictions with Alternative 1 other than those already exist. With Alternative 2 lefts would be restricted to make room for the center stations. Anticipated left turn restrictions include westbound Hill St and westbound Farley St. The Eastbound left turn at Rose Place (Midvale) may also need to be restricted.

4. Station Efficiency

Because side running requires stations on each side of the street, Alternative 1 will require 6 stations along this corridor. Center running can require only one station to serve both directions of travel. However, preserving the eastbound left at Rose Place/Midvale may require an extra station. Consequently Alternative 2 would require between 3 to 4 stations.

5. Bike Accommodations

Bike lanes exist on University Avenue west of Shorewood Blvd. East of Shorewood Blvd no accommodation exists and because of limited right of way and the adjacent railroad, the ability to install bike lanes is very difficult. A shared use path exists immediately north of University Avenue, and there are plans to grade separate the path over University Bay Drive, one of the busiest path/roadway intersections, in 2022. Neither Alternative 1 nor Alternative 2 would change these planned accommodations. Alternative 1, side running, may interfere more with cyclists since stations would encroach into the bike lane. Conflicts associated with this encroachment would be infrequent, but would still exist.

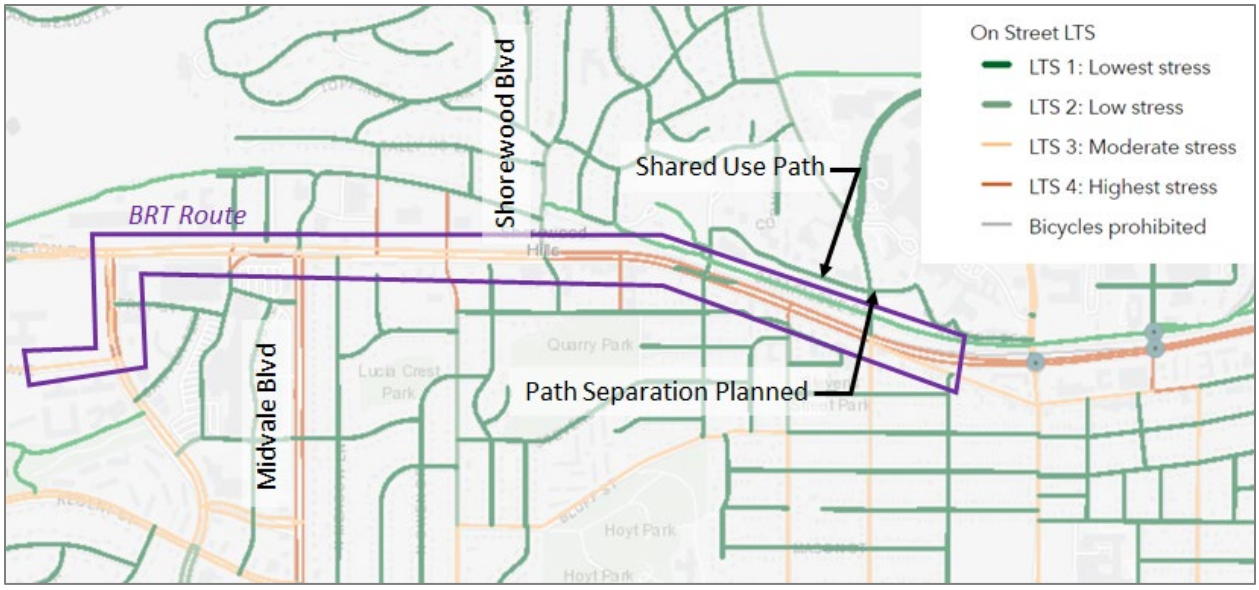


Figure 5.0-9 Bicycle Stress Along University Ave.

6. Pedestrian Accommodations

The amount of walking to stations associated with Alternative 1 and 2 would be the same. Alternative 1 requires crossing the full roadway on either the initial or return trip. Alternative 2 requires crossing half of the roadway on both the initial and return trip. All stations would be located at signals with pedestrian phases. Riders may feel more exposed at a center running station (Alternative 2) than at a side running station (Alternative 1).

7. Right of Way

Alternative 1 would require right of way acquisition for each of the 6 planned stations. Alternative 2 probably would not require additional right of way.

D. Recommendation

Alternative 1, side running in mixed traffic, is the recommended alternative for this section of the University Ave. BRT alignment. Reasons for this recommendation include:

- In initial meetings with stakeholders they expressed strong concerns regarding traffic diversion.
- Suspected business concerns regarding elimination of left turns.
- All three jurisdictions would have to fully endorse lane reduction plan by early 2021 to not jeopardize federal funding. Includes revisions to environmental documentation.
- Despite some dissatisfaction, the current proposal for the University Avenue design plans went through public process with multiple stakeholders and is approved by Village Shorewood Hills and Madison.
- Side running does not preclude a dedicated BRT lane in future on the right side.

E. Campus Drive

Campus Drive is an expressway segment of the BRT alignment directly east of University Ave. As an expressway it does not have at-grade intersections but instead has an interchange at Highland Ave and a grade separation at Walnut Street.

Originally a dedicated running way was planned for in both directions of Campus Drive for Bus Rapid Transit. A technical memo, available upon request, evaluated the clear width at the bridge locations and found that it would be difficult to provide sufficient clear width, and crash worthy bridge parapets, at the bridge crossings if dedicated running way was provided in both directions. Consequently, a dedicated westbound running way is proposed directly west of Walnut Street and a dedicated eastbound running way is proposed east of Walnut Street. Since side running is proposed for University Avenue west of Campus Drive, and for University/Johnson Ave east of Campus Drive, side running is also proposed for Campus Drive. Figure 5.0-10 illustrates the recommended running way for Campus Drive.

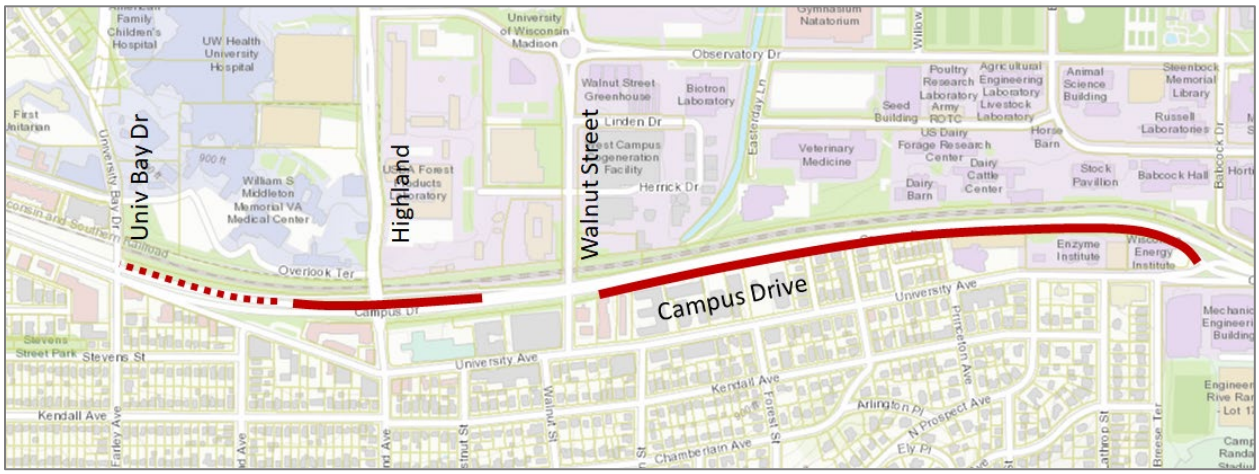


Figure 5.0-10 Campus Drive Running Way

6.0 Whitney Way

A. Introduction

Whitney Way comprises a 1.5 mile section of the BRT running way between the West Transfer Point and Sheboygan Avenue. It has two stations – one at Mineral Point Road and one at Regent Street.

Whitney Way is a divided street with a median and left turn bays, and has essentially two cross sections. North of South Hill Drive it has two travel lanes, a bike lane, and parking in each direction. South of South Hill Drive it has three travel lanes in each direction with no parking and no bike facilities. The roadway width is also slightly narrower north of South Hill Drive with 30 feet of asphalt pavement plus two gutter pans in each direction. South of South Hill Drive, it has 33 feet of asphalt pavement plus gutter pans.

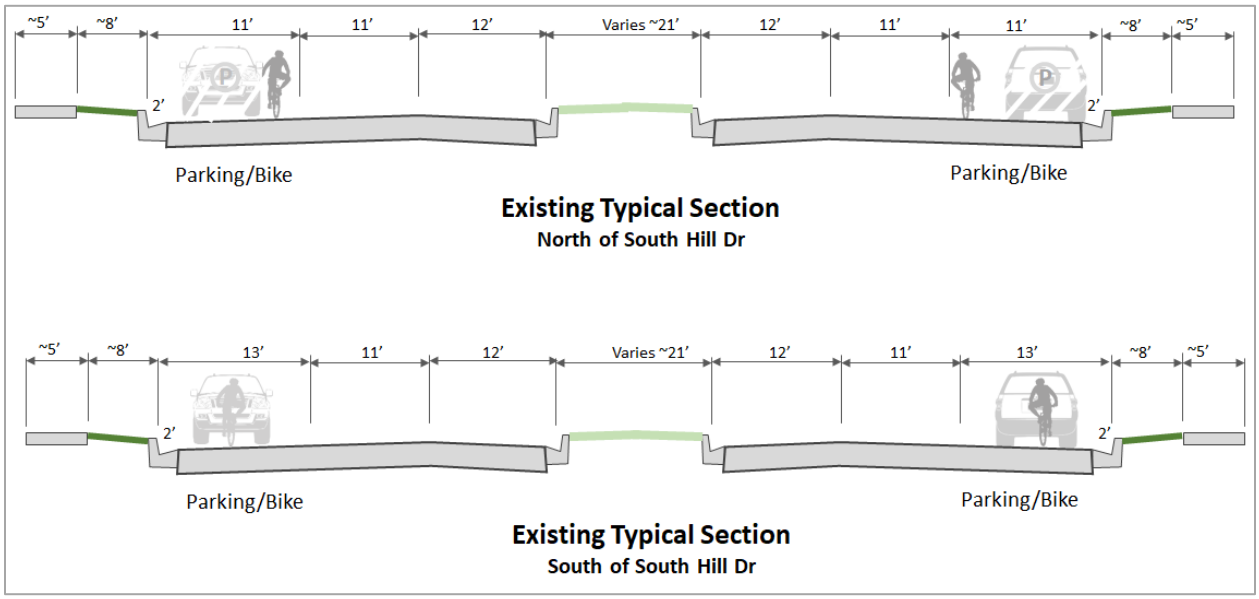


Figure 6.0-1 Whitney Way Typical Section

Figure 6.0-2 Whitney Way Typical Section

Traffic volumes range from about 16,000 vehicles per day at Sheboygan Avenue to 22,000 at Tokay Boulevard. This volume can generally be handled with two lanes in each direction, yet it on the upper range of traffic volumes that can be handled by a two lane road. Mineral Point Road east of Whitney Way and Williamson Street have about the same volume. Capacity is mostly constrained on the south end of the corridor at Tokay Boulevard and the Beltline Highway. As Whitney Way approaches the Mineral Point Road intersection, two general purpose lanes in each direction would be needed to accommodate traffic volumes and the multiple signal phases.

The adopted locally preferred alternative (LPA) travels south on Whitney Way, serves the West Transfer Point, then continues to Mineral Point Road via Tokay Boulevard and Rosa Road. However, it is likely that the Rosa Road extension needed for this route will not be feasible because of stormwater impacts and projected costs. Without the Rosa Road extension, the westbound route would travel south on Whitney Way to the West Transfer Point, turn around, and come back north on Whitney before traveling on Mineral Point Road. If the Transit Network Design Study recommends eliminating the West Transfer Point, the likely route would travel directly from Whitney Way to Mineral Point Road.

These three alignments may play a role in station location on Whitney Way and Mineral Point Road intersection. A separate memo covers the Rosa Road extension and West Transfer Point options.

The land uses along Whitney Way are generally residential north of Mineral Point Road and office space south of Mineral Point Road. The houses have frontages of about 100 feet and generally have two-car garages and driveways. As a result, the parking along Whitney Way is lightly used, or used for short-term parking, deliveries, and guests. The office space is part of the University Research Park. It is suburban in nature with office buildings spread apart with open spaces and ample parking. However, the research park plans infill development on the southwest corner of Mineral Point Road and Whitney Way with urban density and a mix of land uses.

There are four signalized intersections along Whitney Way currently – Tokay Boulevard, Research Park Boulevard, Mineral Point Road, and Regent Street. A fifth signal would need to be added at Sheboygan Avenue so that buses can make the westbound left turn. If a traffic signal is impractical, then a channelization island similar to the Whitney Way and Hammersley Road intersection would be used.

Figure 6.0-3 BRT Routing on Whitney Way

B. Alternatives – North of South Hill Drive

The width and moderate traffic volumes on Whitney Way provide options for adding BRT treatments. Since the three-lane section south of South Hill Drive is over the needed capacity, alternatives include converting one of the 3 lanes in each direction to a bus lane.

Alternative 1 - A and B. Side-running bus lanes with bumpouts

Alternative 1 - North of South Hill Drive - buses operate in the right travel lane in a dedicated lane (A) or in mixed traffic (B). The parking lane shared with bikes would remain, or parking could be removed and a buffered bike lane installed. In order to eliminate pull-out delay and provide more space for stations, the bumpouts would be constructed at Regent Street on the northeast and southwest quadrants. For Alternative 1, the BRT stations would be far side in-lane stops. Alternative 1 provides a bumpout while Alternative 2 would use the existing terrace space.

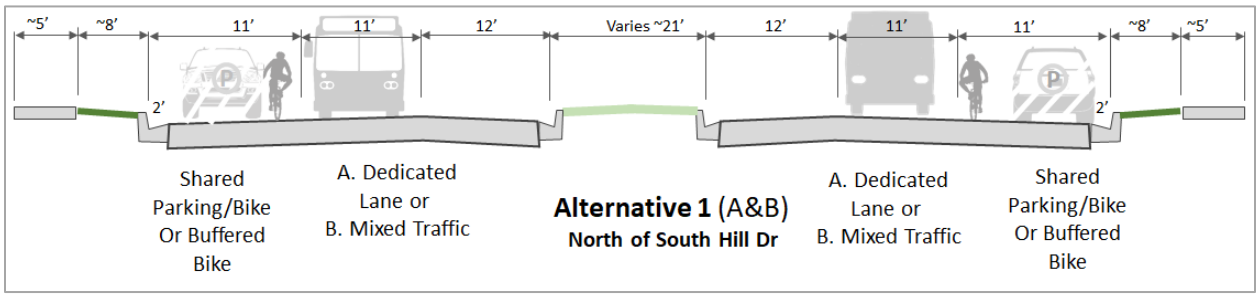


Figure 6.0-4 Alternative 1 Typical Section

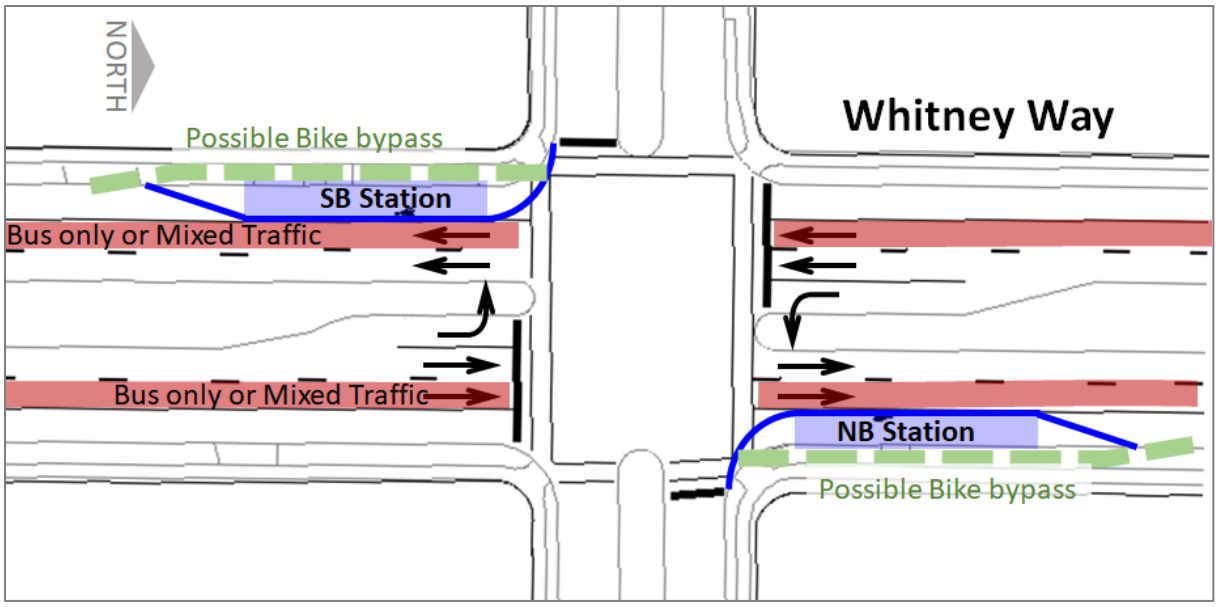


Figure 6.0-5 Alternative 1 Station Location

Runningway Configuration A: Dedicated lane. The right lane is converted to a floating bus-only lane, separate from parking, bikes, and right turns. One general-purpose travel lane remains.

Runningway Configuration B: Mixed traffic. The two general-purpose travel lanes remain. Because traffic volumes are relatively low and Regent Street, the only signalized intersection, has plenty of capacity, traffic delays are low.

Alternative 2 - Side-running bus lanes

Alternative 2 eliminates the curb-side parking and bike lanes north of South Hill Drive and replaces them with bus, bike, and right-turn-only lanes.

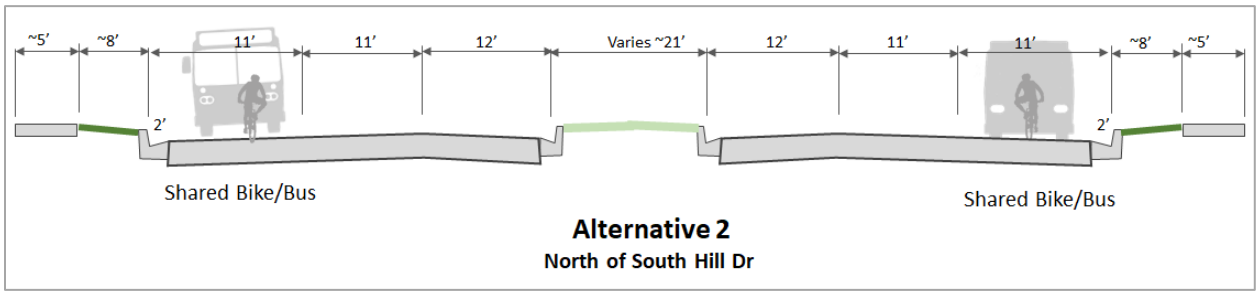


Figure 6.0-6 Alternative 2 Typical Section

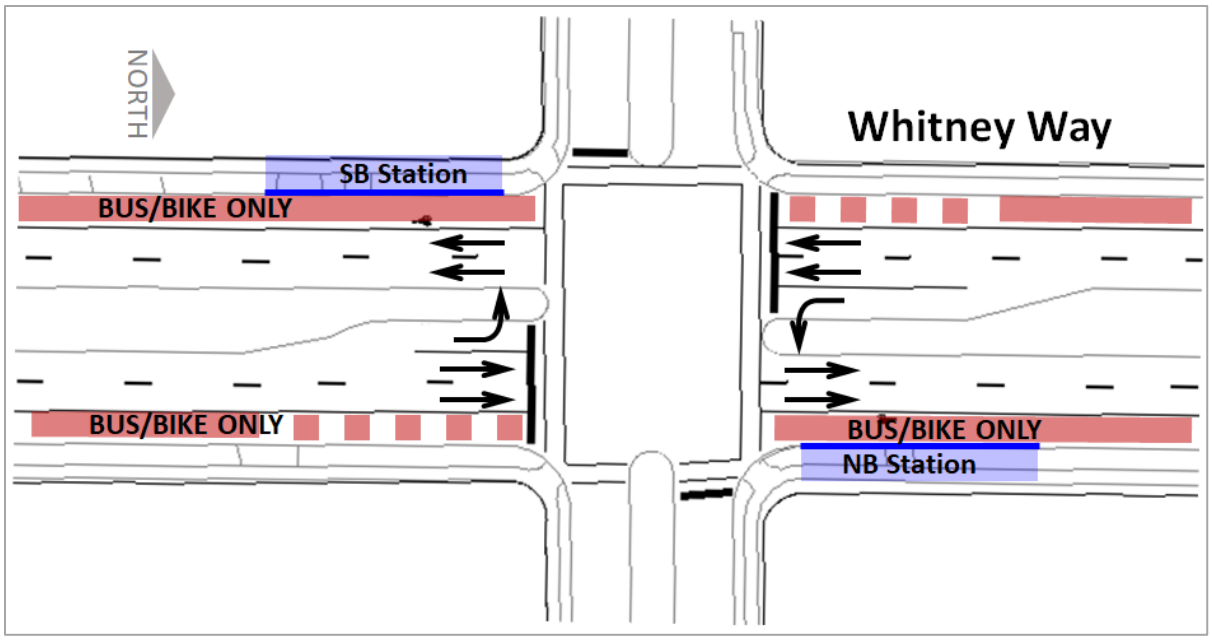


Figure 6.0-7 Alternative 2 Station Location

Alternative 3 - Center-running bus lanes

Alternative 3 has the buses running in the median lane, either in a dedicated lane (A) or in a mixed traffic lane (B). The parking/bike lane could maintain its shared parking/bike configuration or be converted to a buffered bike lane. This typical section is illustrated in Figure 6.0-8.

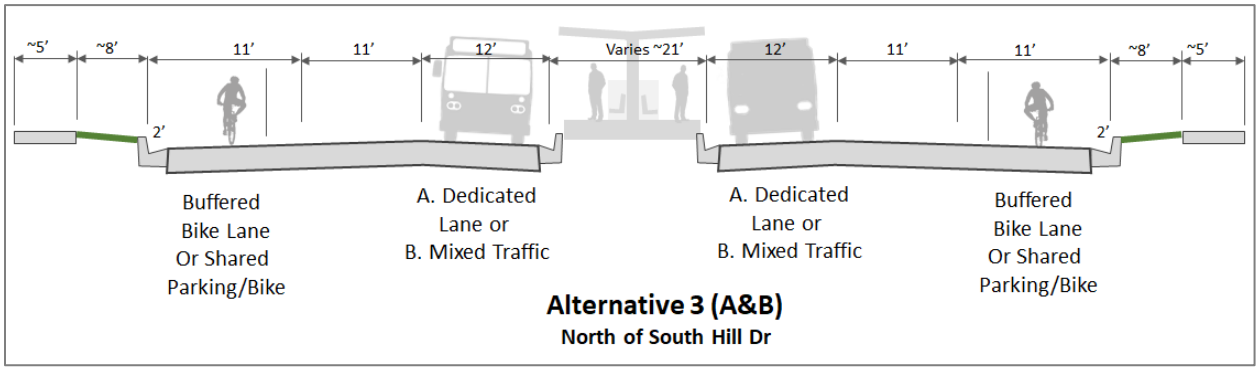


Figure 6.0-8 Alternative 3 Typical Section

For the center-running alternative, both northbound and southbound left turns at both Mineral Point Road and Regent Street would need to be maintained. Because there is a wider median on Whitney Way, there are two configurations that could do this. One provides a single station in the median while the other divides the station into northbound and southbound components.

Station Configuration A**:** A single two-sided platform is constructed on one side of intersection. In direction, buses travel along a back-and-forth chicane movement to go around the left turn bay. Both left turns would likely need to be protected only (red and green arrow). The advantage to this this configuration is that it is the lowest cost and provides one station area for people to go to.

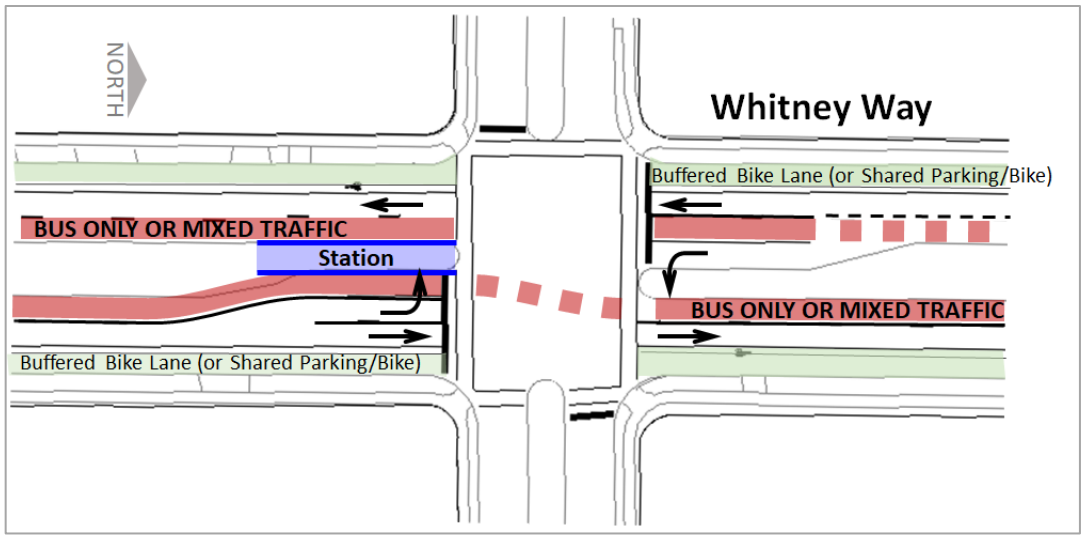


Figure 6.0-9 Alternative 3 Station Configuration A

Station Configuration B: Two single-sided stations are constructed on each side of the intersection. Although this option is more expensive and requires more ongoing maintenance, it eliminates the chicane movement in one direction. Further, it places both stations on the far sides of the intersection, allowing for better transit functionality, better use of transit signal priority, and potentially allowing for permissive (flashing yellow arrow) left turns.

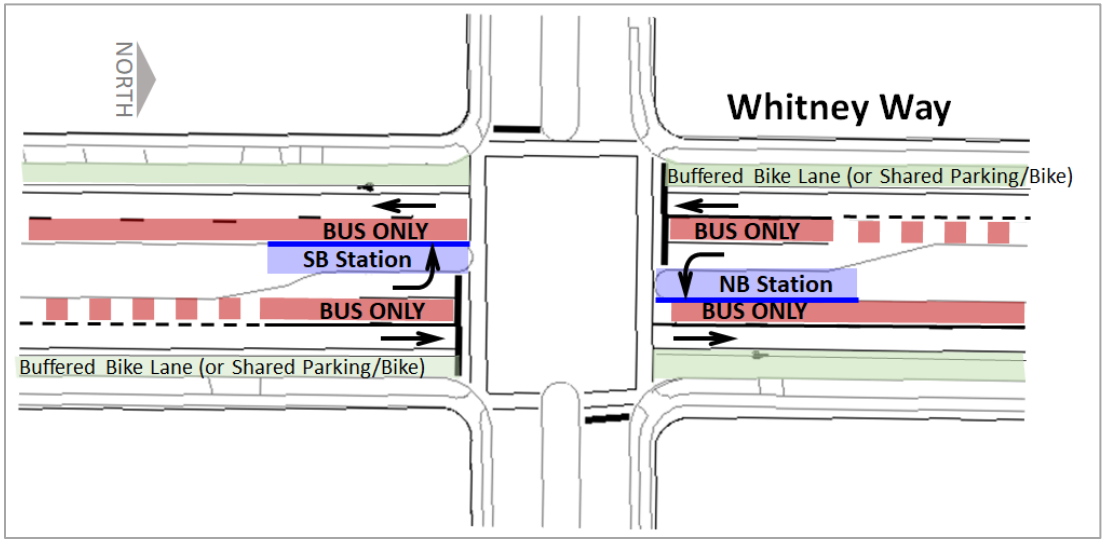


Figure 6.0-10 Alternative 3 Station Configuration B

C. Alternatives South of South Hill Drive

Alternatives 1 and 2 convert the right lanes to bus, bike, and right turn only between South Hill Drive and Tokay Boulevard. Alternative 3A converts the median lane to bus only between South Hill Drive and Tokay Boulevard. With Alternative 3A (BRT dedicated lane), cyclists would have to continue to use the general purpose lane. With Alternative 3B (BRT in mixed traffic), the right most lane could be converted to a buffered bike lane. Figure 6.0-11 illustrates these typical sections.

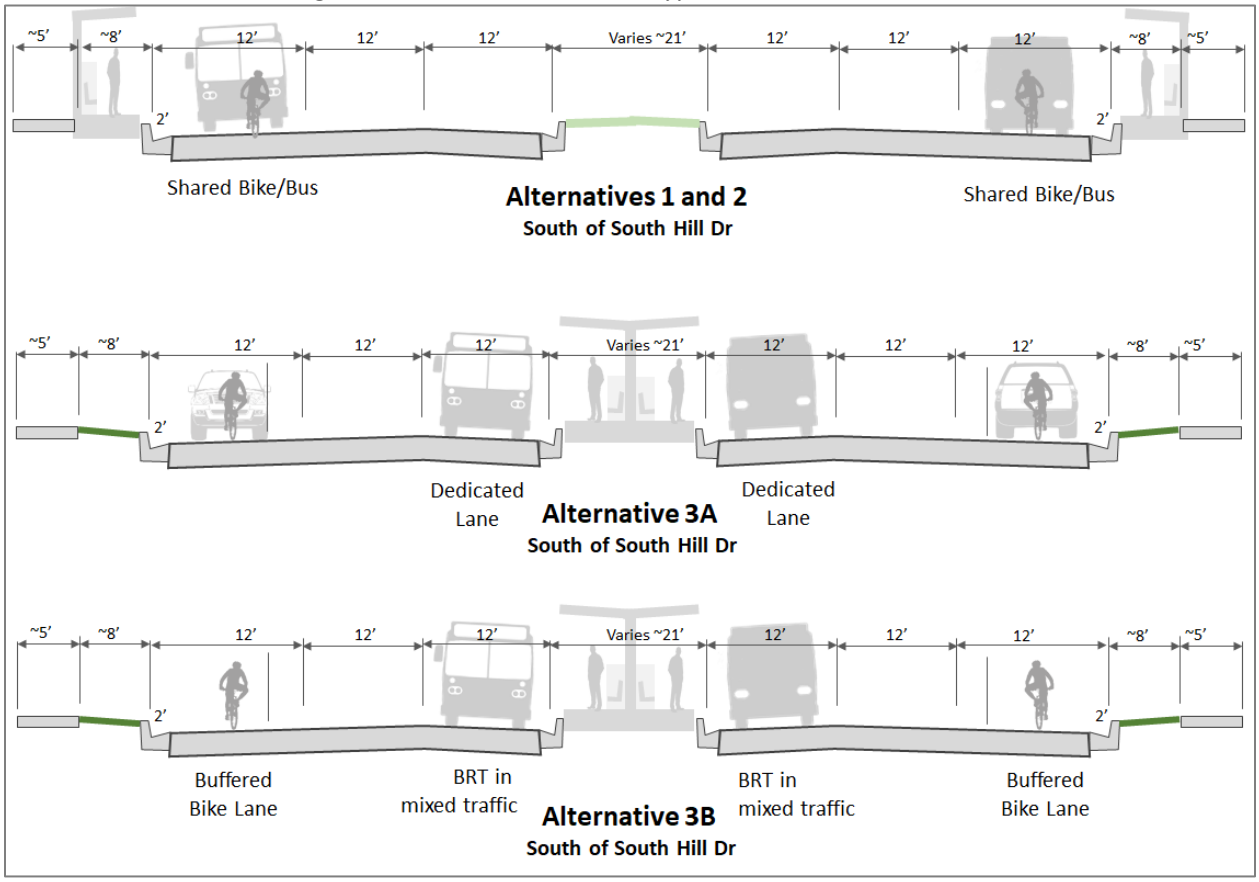


Figure 6.0-11 Alternative 1, 2 and 3 Typical Section South of South Hill Drive

D. Evaluation

Table 6.0-1 compares the three alternatives regarding key measurements. The following paragraphs provide discussion on these evaluation criteria.

Table 6.0-1 Alternative Comparison

	Alternative 1 Side Running	Alternative 2 Side Running 3-lane	Alternative 3 Median Running
BRT Efficiency	A. Good - dedicated lane. B. Satisfactory – bus travels in lane with mixed traffic.	Satisfactory – dedicated lane shared with bikes and right turns.	A. Good – dedicated lane. Some bus merging movements at ends of Whitney Way B. Satisfactory – bus travels in lane with mixed traffic.
Potential Turning Restrictions*	None	None	None

Table 6.0-1 Alternative Comparison

	Alternative 1 Side Running	Alternative 2 Side Running 3-lane	Alternative 3 Median Running
Station Efficiency	4 stations needed	4 stations needed	2 to 4 stations needed
Bike Accommodations	North of South Hill Drive With parking – satisfactory With buffered bike lane – good South of South Hill Drive Poor – bikes share lane with buses, which come every 7.5 to 15 minutes	North of South Hill Drive Poor – bikes share lane with buses South of South Hill Drive Poor – bikes share lane with buses, which come every 7.5 to 15 minutes	North of South Hill Drive With parking – satisfactory With buffered bike lane – good South of South Hill Drive A. Very Poor – bikes share lane with automobiles B. Good – bikes have a buffered bike lane.
Pedestrian Accommodations	Slight improvement. Bumpouts at Regent Street lower crossing times	Similar to existing. The parking buffer between traffic and the sidewalk is removed.	Similar to existing
Traffic Operations	A. Fair – a dedicated bus lane will reduce capacity on Whitney Way B. Good – buses in mixed traffic does not reduce capacity	Good – number of general purpose lanes maintained.	A. Fair – a dedicated bus lane will reduce capacity on Whitney Way B. Good – buses in mixed traffic does not reduce capacity
Parking	If parking is maintained, then there is no parking loss. If buffered bike lanes are provided, parking will be lost.	All parking is removed.	If parking is maintained, then there is no parking loss. If buffered bike lanes are provided, parking will be lost.
Right of Way Acquisition	No right of way anticipated.	Right of way will be needed for 2 stations	No right of way anticipated.

1. BRT Efficiency

All alternatives operate well for BRT since traffic volumes are at moderate levels. Mixed traffic options provide some delay to buses, but the delay may not be significant. Alternative 3 will require that buses merge right on both ends to turn right which is not a preferred situation; however, there should be enough space to make this movement. Southbound, the bus lane would effectively end at Research Park Boulevard where buses would be moving toward the right lane to turn right. For side-running alternatives, the southbound bus lane would continue for the full length.

Alternative 1A - Buses operate in dedicated right lanes both north and south of South Hill Drive. Buses are not inhibited by turning vehicles or curbside deliveries. Buses do not have to merge.

Alternative 1B – Buses operate in mixed traffic. Buses are not inhibited by right turning vehicles or curbside deliveries. All stations are in lane. Although buses are in mixed traffic, traffic delays are light because of moderate traffic volumes at the one signalized intersection. Buses do not have to merge.

Alternative 2 - Buses operate in semi-dedicated curbside lanes for the entire stretch, but bike and right turn volumes are low. Several large overhanging trees on Whitney Way could present operational hazards and ongoing maintenance. Buses do not have to merge.

Alternative 3A - Buses operate in dedicated median lane for the entire stretch. Buses are not inhibited by turning vehicles or curbside deliveries. Buses merge right across one lane to turn right northbound and across two lanes to turn right southbound.

Alternative 3B - Buses operate in mixed traffic, yet moderate traffic volumes probably do not create substantial delay. Buses are not inhibited by turning vehicles or curbside deliveries. Buses merge right across one lane to turn right northbound and across two lanes to turn right southbound.

2. Potential Turn Restrictions

With Alternatives 1 and 2 (side running) there would be no turn restrictions. Because Whitney Way has a wider median, the center running alternative (Alternative 3) can be arranged so that left turns are preserved.

3. Station Efficiency

Side running alternatives (Alternative 1 and 2) would need four stations each. Alternative 3, center running, has the opportunity to need only two stations, since center stations can serve both directions. However, depending on the method used for preserving left turn lanes, up to four stations could be needed.

4. Bicyclists

Figure 6.0-12 shows the low stress bike network with most of the BRT route on Whitney Way being either moderate stress or high stress. North of South Hill Drive there is a bike lane, whereas south of South Hill Drive there are no bicycle accommodations. There are few parallel through low stress routes. The BRT improvements on the corridor may present an opportunity to improve bike accommodations along the corridor.

For Alternatives 1 and 2, south of South Hill Drive, bicyclists benefit from a side-running BRT system with shared lanes, where no facility exists today. With Alternative 3A (dedicated BRT lane), cyclists would not be able to share the BRT median running lane. With Alternative 3B (BRT in mixed traffic), cyclists would have a buffered bike lane.

Alternative 1A and B: Slight improvement south of South Hill Drive with the shared bus, bike, and right turn lane. With parking there is no significant change north of South Hill Drive. With buffered bike lanes, which require the elimination of parking, bike accommodations improve substantially north of South Hill Drive.

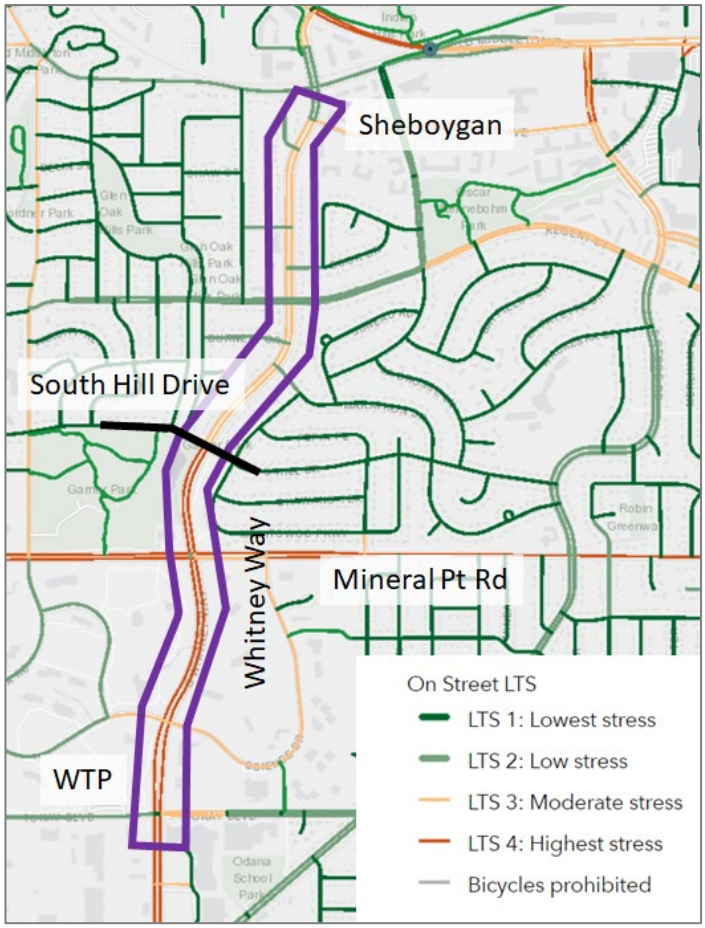


Figure 6.0-12 Whitney Way Bicycle Stress

Alternative 2: Slight improvement south of South Hill Drive with the shared bus, bike, and right turn lane. Slightly worse north of South Hill Drive with the existing bike lanes converted to a shared bus, bike, and right turn lane.

Alternative 3A: South of South Hill Drive, bus lanes would be on the left, and cyclists would not be able to share the bus lane. Consequently, bikes would continue to use a travel lane, a poor arrangement that exists today. North of South Hill Drive, if parking is maintained there is no significant change. With buffered bike lanes, which require the elimination of parking, bike accommodations improve substantially north of South Hill Drive.

Alternative 3B: South of South Hill Drive, buses would be center running in mixed traffic. This frees up the right-most lane which could be converted to a buffered bike lane.

5. Pedestrians

Alternative 1: There would be a slight improvement. The bumpouts at Regent Street would lower crossing times, but the intersection is signalized and relatively easy to cross as it is.

Alternative 2: The parking buffer between traffic and the sidewalk is removed.

Alternative 3: There is no significant change.

Pedestrians will have fairly similar experiences with all alternatives.

6. Traffic Operations

Whitney Way has four to six total through lanes. Whitney Way currently carries from 18,000 to 21,000 vehicles per day. This volume is at the upper limit of what a two-lane roadway can handle with a road diet. The Covid 19 pandemic has reduced traffic volumes throughout the nation. Traffic counts in the fall of 2020 show that Whitney Way currently carries 12,000 vpd, about a third less than the 18,000 vpd it normally carries. It is unclear how Covid19 will affect long-term travel patterns. South of South Hill Road, all alternatives maintain 4 travel lanes for general traffic, which is sufficient for the existing traffic volumes. North of South Hill Drive, the following paragraphs outline the differences.

Alternatives 1A and 3A - One lane is removed south of South Hill Drive with likely no impact. One travel lane is removed between South Hill Drive and Old Middleton Road. This change could have some impacts on traffic operations at the Regent Street and Old Middleton Road intersections.

Alternatives 1B and 3B – One lane is removed south of South Hill Drive with likely no impact. BRT travels in mixed traffic north of South Hill drive, limiting the impact to traffic operations.

Alternative 2 - One lane is removed south of South Hill Drive with likely no impact. North of South Hill Drive the number of general-purpose lanes are maintained in both directions, with no impact on traffic operations.

7. Parking

Parking utilization is extremely low on Whitney Way; however, the residents may rely on it for short-term parking, deliveries, and special occasions. While most homes have sufficient off-street parking, there is some on-street use near Sheboygan Ave where employment land uses exist. Figure 6.0-14 illustrates typical parking use on Whitney Way. A parking occupancy survey performed in the fall of 2020 showed only 2 percent parking occupancy in the mid-morning, and only 3 percent parking occupancy during mid-afternoon.

Alternatives 1 and 3: If the shared parking and bike lane is maintained, there would be no change. If a buffered bike lane is implemented, all parking along Whitney Way would be removed.

Alternative 2: All parking is lost along Whitney Way.

With Alternatives 1 and 3, parking could be maintained with the existing bike accommodations. If buffered bike lanes are installed, all street parking north of South Hill Drive would be removed.

Figure 6.0-14 Parking Demand

E. Draft Recommendation

North of South Hill Drive.

Alternative 3A, center running in a dedicated lane, is staff's recommendation. This Alternative:

- Provides good BRT operations, providing a dedicated lane for BRT operation.
- Has the potential to reduce costs associated with station construction.
- Reduces potential complaints from residents near the stations.

With the currently reduced traffic volumes which are only 70 percent of normal, a dedicated median running lane should be initially be implemented. If traffic volumes increase, the BRT lane could be converted to mixed traffic, providing more capacity.

As a different action separate from the BRT project, staff recommend eliminating on-street parking north of South Hill Drive and installing buffered bike lanes because of the low parking utilization. If public interaction indicates that on-street parking continues to be needed, the existing bike lanes adjacent to parking may be maintained where it is needed. Center running BRT is accommodated with either parking/bike lane or a buffered bike lane.

South of South Hill Drive

Alternative 3B, center running in mixed traffic, is staff's recommendation. This Alternative:

- Provides acceptable BRT operations.
- Has the potential to reduce costs associated with station construction.
- Reduces potential complaints from residents near the stations.
- Provides the opportunity to install a buffered bike lane for the 0.75 miles from South Hill Drive to Tokay Blvd.

As a different action separate from the BRT project, staff recommend converting the right most lane to a buffered bike lane. This recommendation would continue the lower stress bikeway from South Hill Drive to Tokay Blvd. Center running BRT is accommodated with either a general purpose lane on the outside lane, or a buffered bike lane.

7.0 Mineral Point Road

A. Introduction

The BRT line will travel about 2.5 miles on Mineral Point Road from Whitney Way (or Rosa Rd) to Big Sky Drive. Mineral Point Road is a divided street with 3 lanes in both directions, with the outside lane being designated for buses and bikes. The median for Mineral Point Road varies, with it being about 21 feet in many locations. It is classified as a principal arterial and carries between 28,000 to 32,000 vehicles per day. The current routing being considered travels down Whitney Way to the West Transfer Point, and then westward (probably through Whitney Way) to High Point Road. The BRT route will then return, possibly via a loop using Big Sky Drive and High Point Road. Figure 7.0-1 illustrates proposed BRT routing on Mineral Point Road. Figure 7.0-2 illustrates a typical cross section along Mineral Point Road.

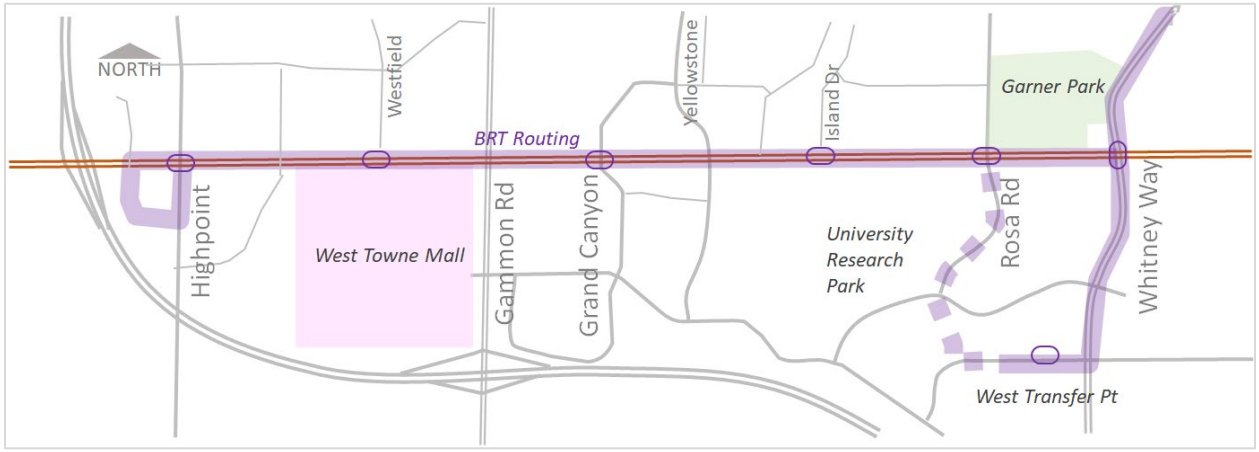


Figure 7.0-1 BRT Running Routing Along Mineral Point Road

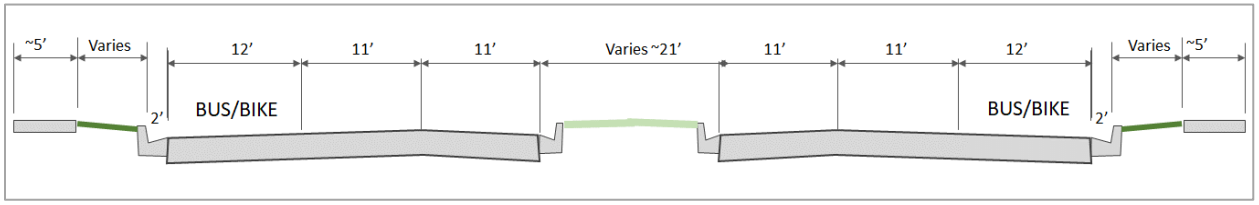


Figure 7.0-2 Existing Typical Section on Mineral Point Road

Despite sharing a bus lane, the bicycle accommodations on Mineral Point Road are poor. Figure 7.0-3 shows the low stress bicycle network along Mineral Point Road, with Mineral Point Road having the highest level stress.

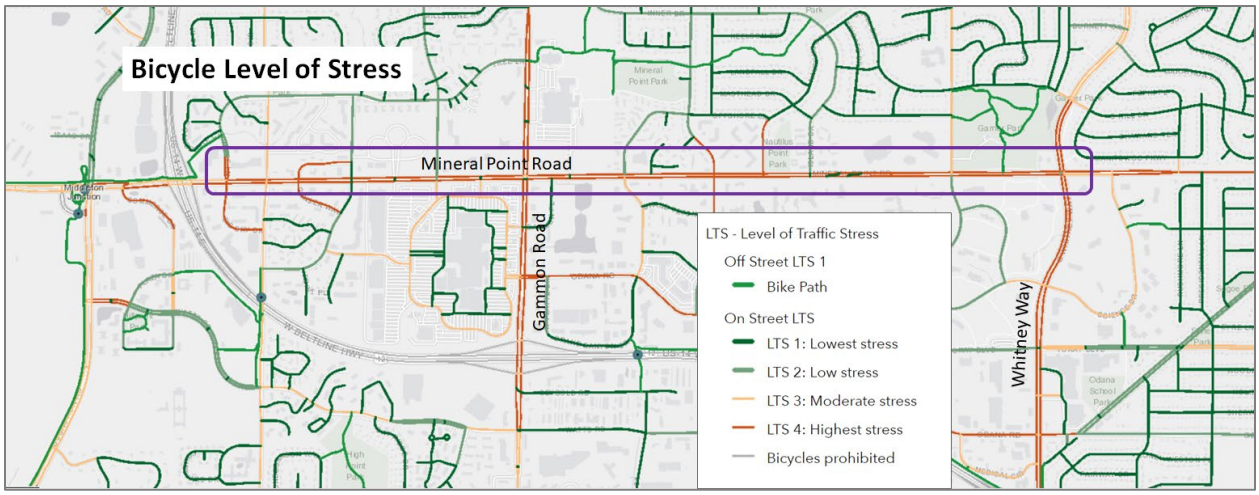


Figure 7.0-3 Bicycle Level of Stress on Mineral Point Road

B. Alternatives

The same benefits listed in Section 3.0 for side running and median running also apply to Mineral Point Road. Deliveries stopping and blocking a side running BRT lane are a slightly less of a concern on Mineral Point Road. Cost savings associated with single BRT stations (median running) vs dual BRT stations (side running) are still applicable to this corridor.

There are three main alternatives for Mineral Point Road.

Alternative 1 keeps the existing typical section, with BRT buses and bicyclists sharing a dedicated lane adjacent to the curb. While not optimal, this alternative maintains the bicycle accommodations that currently exist, with BRT buses using the lane every 15 minutes.

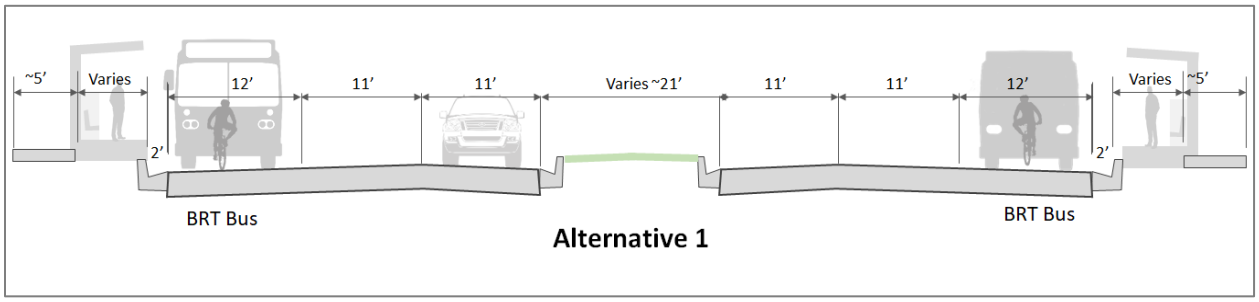


Figure 7.0-4 Mineral Point Road Alternative 1 (Existing Typical Section)

Alternative 2 relocates the dedicated bus lane to the median to allow for center running stations (Figure 7.0-5). Cyclists would no longer share a lane with buses, but instead would need to use a general travel lane. As with other locations, it is likely that left turns would be removed from several intersections to accommodate BRT stations. Figure 7.0-6 illustrates a median running BRT station installed within a left-turn lane.[7] Because Mineral Point Road has a wider median, it may be possible to preserve left turns by installing two stations in the median, as shown in Figure 7.0-7. This diminishes the cost effectiveness of center running, but preserves left turn capabilities. Left turns could also be preserved by weaving the BRT lane towards the median, and creating a separate signal phase for left turns. Figure 7.0-8 illustrates where left turns may need to be removed to support median running. Note that Rosa Road's left would be replaced with a U-turn and a right.

[7] Note that for Mineral Point Road, it may be possible to preserve left turns by installing two center running stations. This eliminates many of the cost benefits associated with median running BRT.

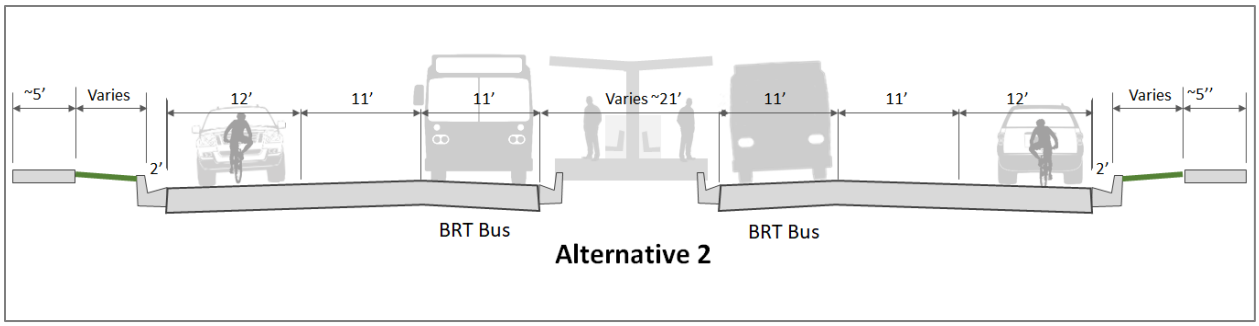


Figure 7.0-5 Mineral Point Road Alternative 2

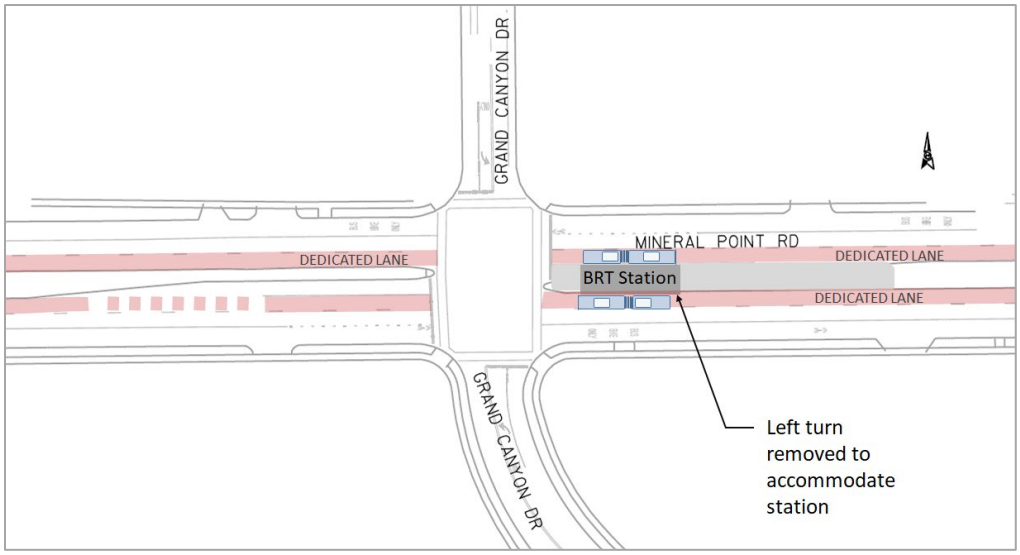


Figure 7.0-6 BRT Station in Median

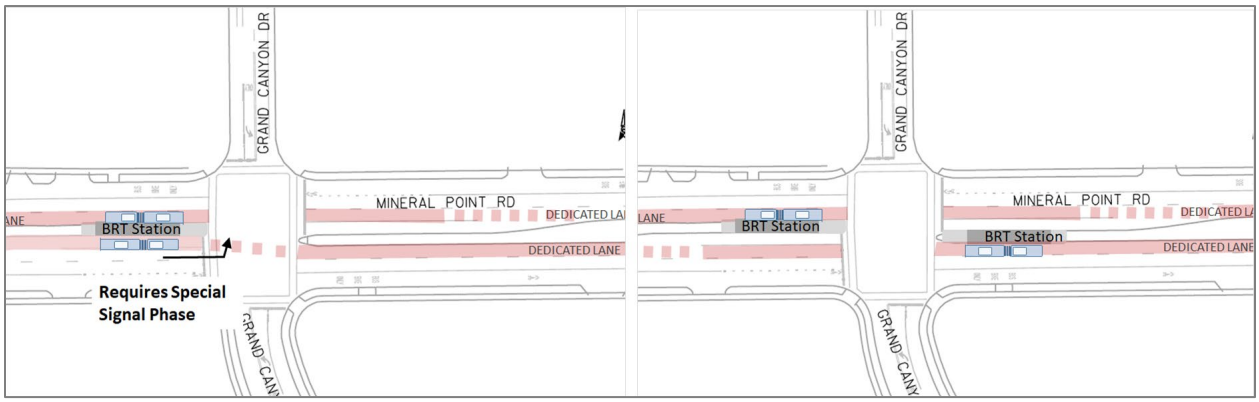


Figure 7.0-7 BRT Station in Median – Station Configurations Preserving Left Turn Lanes

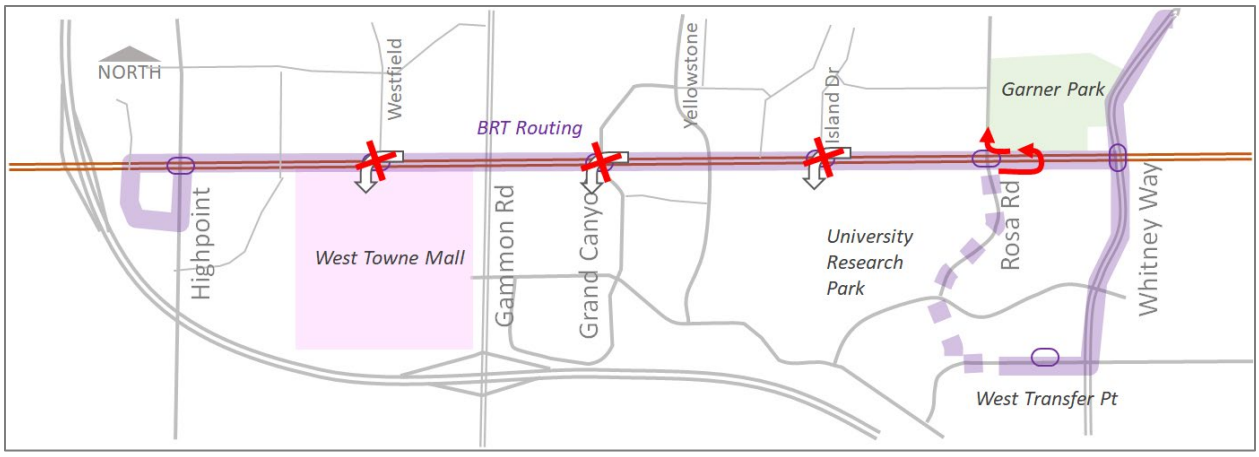


Figure 7.0-8 Possible Left Turn Restrictions Associated with Median Running BRT

Alternative 3 would have the same median running BRT lane allocation as Alternative 2, but it increases the width of the north sidewalk to 8-feet to accommodate both pedestrians and cyclist in a separated protected facility. The sidewalk/path widening will require right of way acquisition from about 30 parcels on the north side. In most areas, it is not possible to widen the sidewalk by narrowing the terrace because of the many trees, driveways, and other things in the terrace. It is likely that sidewalk widening would be constructed with a separate project which may be let on a timetable that is delayed a year from BRT implementation. Figure 7.0-9 illustrates the typical section associated with Alternative 3.

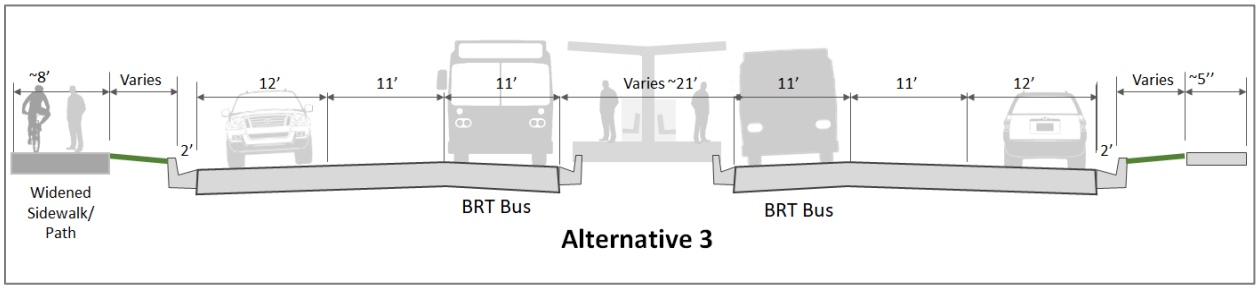


Figure 7.0-9 Alternative 3 Typical Section

C. Evaluation

Different than East Washington Ave, a dedicated bus lane on Mineral Point Road is already established. Effects of the alternatives are therefore primarily limited to BRT efficiency, turning restrictions, cost effectiveness of building fewer stations, and bike accommodations. Figure 7.0-10 summarizes the effects of each of the three alternatives.

Figure 7.0-10 Alternative Comparison

	Alternative 1 Existing Typ Section	Alternative 2 Median Running	Alternative 3 Median Running with widened sidewalk
BRT Efficiency	Good efficiency with modest delays due to right turning vehicles.	Better efficiency with limited to no delays associated with right turning vehicles	Better efficiency with limited to no delays associated with right turning vehicles
Potential Turning Restrictions*	None	WB left – Westfield WB left – Grand Canyon WB left – Island	WB left – Westfield WB left – Grand Canyon WB left – Island

Figure 7.0-10 Alternative Comparison

	Alternative 1 Existing Typ Section	Alternative 2 Median Running	Alternative 3 Median Running with widened sidewalk
			Rosa – replaced with U-turn and right
Station Efficiency	10 stations needed	5-10 stations needed	5-10 stations needed
Pedestrian Accommodations	Similar to existing	Similar to existing	Pedestrians share north sidewalk with cyclists
Bike Accommodations	Poor – bicycles share a lane with buses	Very poor – there are no bicycle accommodations	Good – widened sidewalk provides a shared path
Right of Way Acquisition	Up to 10 parcels associated with Station construction	Limited to no right of way acquisition	Strip right of way needed for almost 2.5 miles. About 30 parcels required.
Costs+	Base	Possibly reduce costs by $3 million due to station reductions	Possibly increase costs by $1 million due to widened sidewalk
* Modifications might be made to preserve these left turning movements, yet may require construction of stations on both sides of the station intersection, reducing cost efficiency. + Costs in this section of the BRT routing could be covered by TID 46, which has capacity to accommodate increased costs.			

D. Draft Recommendation

Alternative 3, median running with expanded sidewalk on the north side, should be strongly considered for implementation. Reasons for this recommendation include:

- It provides a higher level BRT, with running way that will have fewer impedances from turning vehicles.
- The median running option will reduce station costs.
- The widened sidewalk/path on the north side replaces the lost shared bike/bus accommodation with a better protected facility. This would provide an all ages and abilities facility along a corridor which has few alternate routes for cyclists.

With this draft recommendation, it is acknowledged that the sidewalk expansion component would likely have to be let in a separate project that is constructed a year after BRT begins revenue service.

8.0 Other BRT Segments

Several segments of the BRT routing will remain side running. The following paragraphs briefly describe these segments and the rational for continuing side running.

A. East Washington Ave from Mendota Street to East Springs Drive.
This BRT segment is proposed to remain side running in a dedicated bus/right turn lane. Reasons for this recommendation include:

- In order to make the U-turn at East Springs Drive, the bus turning radii requires that buses start in the right-most lane, and turn into the right most lane.
- Since this is the end of the line, it is likely that charging equipment will be needed to rapid charge the electric BRT buses. Room greater than the median width will be needed to house the charging equipment.

- Westbound BRT will have to turn right at either Mendota or Stoughton Rd, requiring that BRT buses are in the right lane.
- The eastbound right turn lane is already occupied by mostly right turning vehicles. So designating a shared bus/right turn lane is unlikely to reduce roadway capacity.

Figure 8.0-1 illustrates the section of East Washington where side running is proposed.

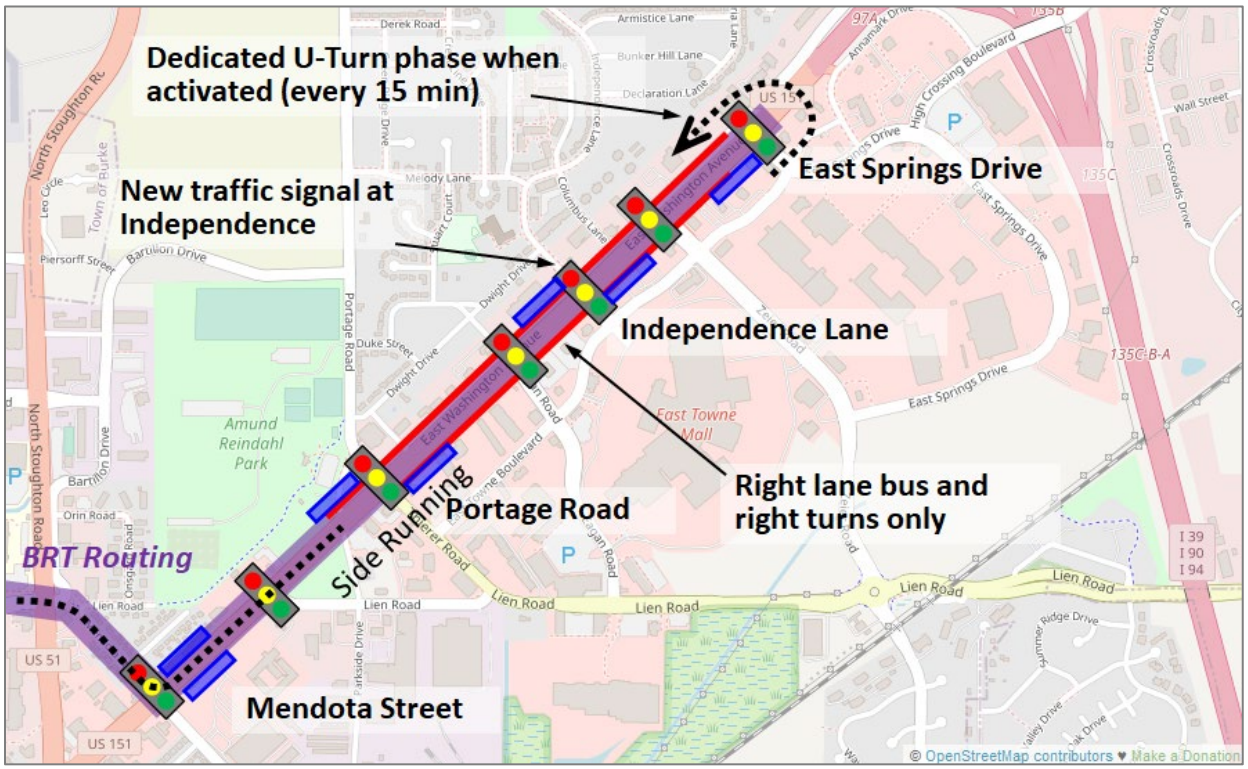


Figure 8.0-1 East BRT Endpoint

From this BRT endpoint, local service may be extended via High Crossing Blvd and US 151 to access destinations beyond East Towne.

B. Madison College

Side running is proposed for the BRT routing that accesses Madison College. There is only one station pair along this routing directly adjacent to the college. Side running is proposed for Wright Street, Anderson Street, and possibly Mendota Street in mixed traffic. Reasons supporting this include:

- With the exception of the east end of Anderson St., these streets do not have medians where a BRT station could easily be installed.
- These streets have lower volumes and are relatively uncongested. Because of this, there are relatively few advantages associated with center running.
- Because portions of Wright and all of Mendota Street are two-lane roadways, it is not possible to dedicate bus running way without eliminating motor vehicle access.

Figure 8.0-2 illustrates the BRT routing that accesses Madison College.

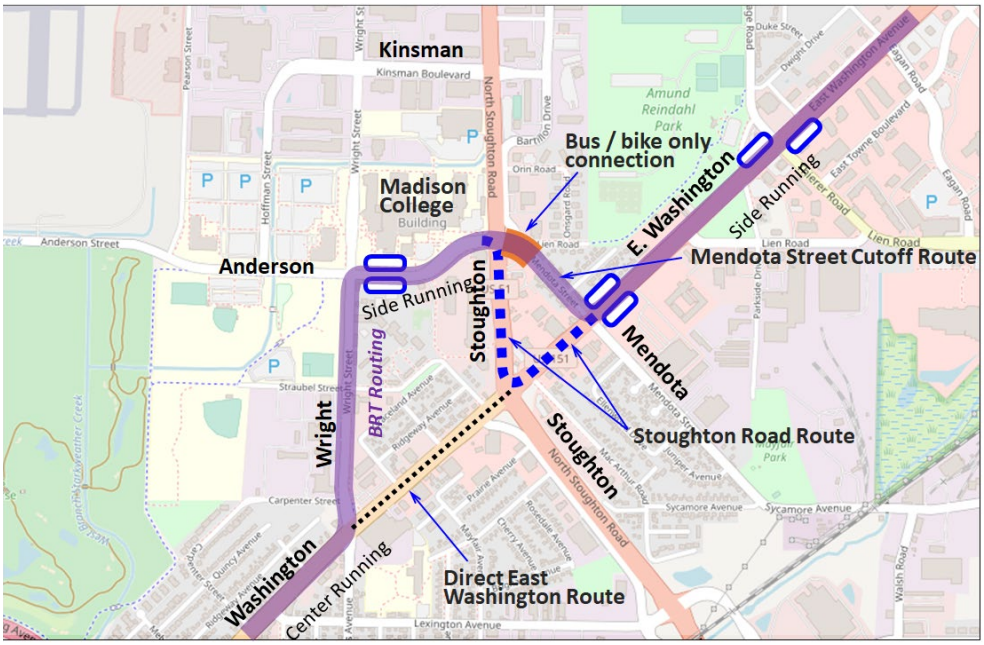


Figure 8.0-2 Madison College BRT Routing

C. Capitol Square and State Street

The downtown BRT routing report details the evaluation of routing alternatives. BRT around the square is proposed to be side running. Reasons supporting this recommendation include:

- Since the square is a grid of one-way streets, there are few operational advantages to left side running vs right side running.
- The Capitol grounds, including the parking surrounding the Capitol grounds, are under the jurisdiction of the state. It is unlikely that the state would allow the relocation of the existing bus lane to the left side, as it would eliminate parking. A previous effort to install a contra-flow bike lane also wasn't implemented because of objections voiced by legislators.
- The Capitol Square hosts numerous events on the Capitol grounds. Right side running BRT provides a little bit of distance from these events.

State Street is also proposed to be side running since:

- It is an existing side running transit way – which may still require some local buses routed on it.
- It is narrow, without the opportunity to install median stations.

Figure 8.0-3 illustrates the proposed downtown routing, all with side running.

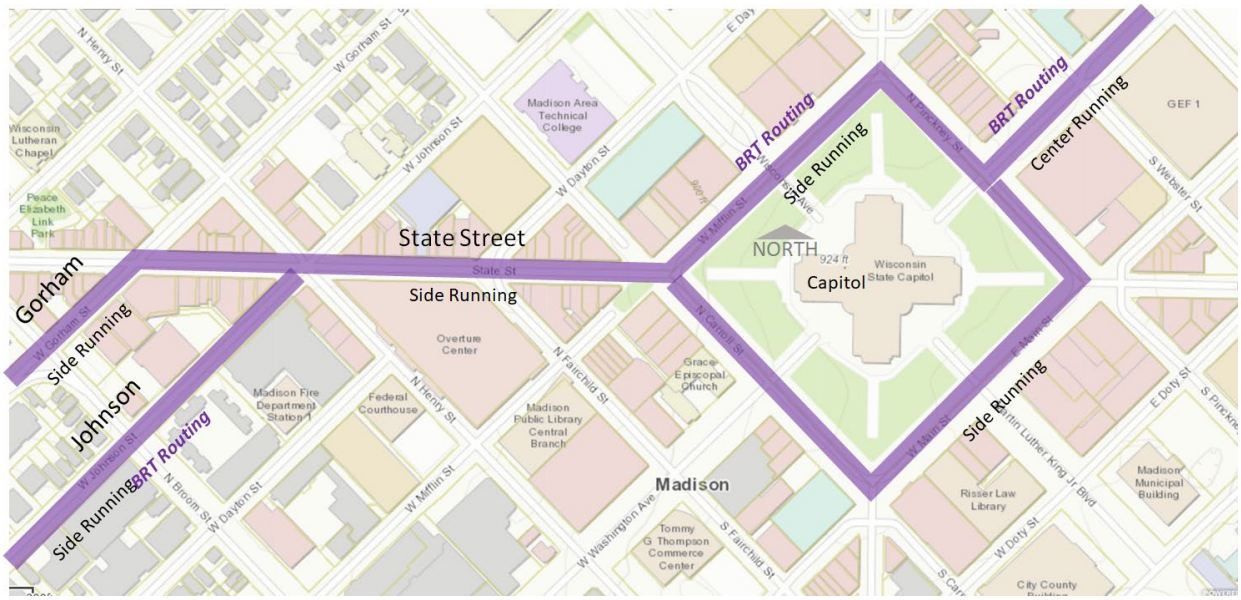


Figure 8.0-3 Capitol Square and State Street BRT Routing

D. Gorham/University Ave. and Johnson St.

University Avenue and Johns Street are both one-way streets, again where the advantages of left side (center) running are more limited. Both are proposed to continue to be right-side running for the following reasons:

- A dedicated bus lane already exists on westbound University Ave.
- Left-side running on University Ave could require removal or significant alterations to a protected contra-flow bike lane, which is not desirable.
- The right-side lane on Johnson Street already is largely used by metro transit and

Figure 8.0-4 Gorham, University Ave., Johnson St. BRT Routing

E. Segoe Road and Sheboygan Ave.

The BRT route leaves University Ave at Segoe Road (4-lane for 0.15 miles) and joins Whitney Way via Sheboygan Ave (2-lane for 0.4 miles). Because of the closely spaced turns and the need to maintain general traffic, side-running BRT in mixed traffic is proposed for this segment. To improve transit operations, several improvements will be made:

- A new traffic signal will be added at Sheboygan Avenue and Whitney Way
- A new traffic signal will be added at Sheboygan Avenue and Segoe Road

- The southbound right lane on Segoe Road will be dedicated to right turns at Sheboygan Avenue
- The station at Eau Claire Avenue will be in-lane and not require buses to merge back into traffic. Since buses have left side doors, it could be placed in the middle or side of the street.