



MEMORANDUM

Date: August 15, 2023

To: Route 40 TPMC Project File

From: Andrew Natzel, PE, SDOT Transportation Engineer

Subject: Fremont PBL and Bus Zone Traffic Analysis

Fremont Ave Protected Bike Lane

The Route 40 TPMC project will create an improved corridor between South Lake Union and Northgate Transit Center via the King County Metro Route 40 for transit travel time and reliability. Along the corridor in Fremont, the need to repave both the street and sidewalks on Fremont Ave between N 34th St and N 35th St was identified. At 30% design, SDOT's Complete Streets Steering Committee recommended that the project team further consider options to better achieve SDOT's modal plan recommendations on this segment, including evaluating filling in a gap in the bicycle network, as identified in SDOT's Bike Master Plan (2014). For 60% design, the project included a northbound Protected Bike Lane (PBL) from N 34th St to N 36th St, connecting to the existing minor-separation bike lane north of N 36th St.

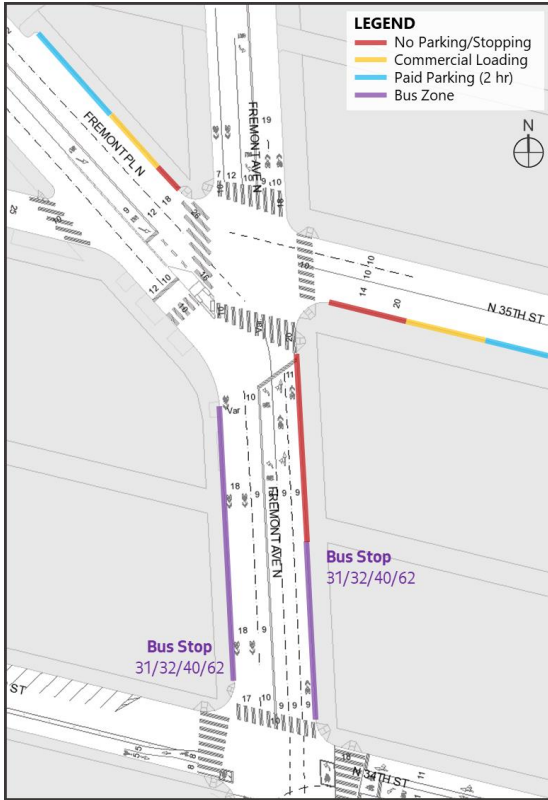
PBL Traffic Analysis

Four options were initially evaluated in May 2022 to determine the travel time changes and operational impacts due to the Route 40 TPMC project and the potential addition of a PBL between N 34th St and N 35th St.

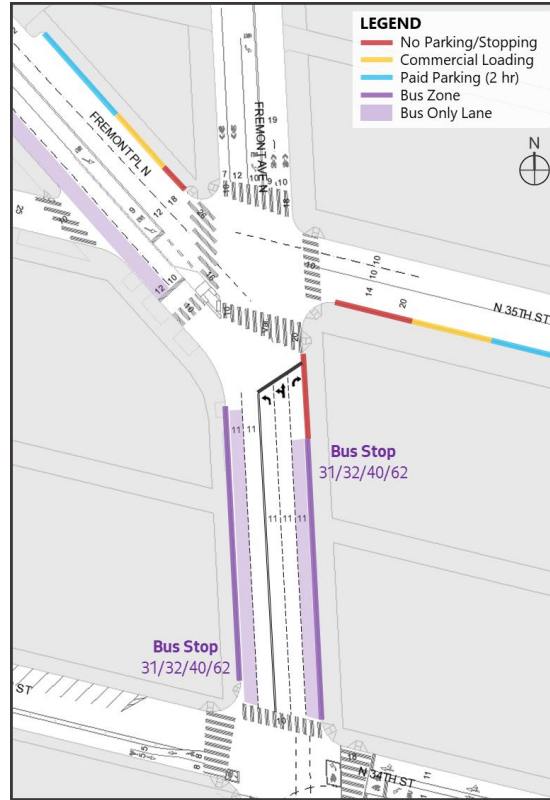
In addition to Existing Conditions, the options were:

- Option 1: Route 40 TPMC 30% Design
- Option 2: PBL with Lane Reduction
- Option 3A: PBL with Lane Reduction with Bus Stop Relocation (out-of-lane bus stop)
- Option 3B: PBL with Lane Reduction with Bus Stop Relocation (in-lane bus stop)

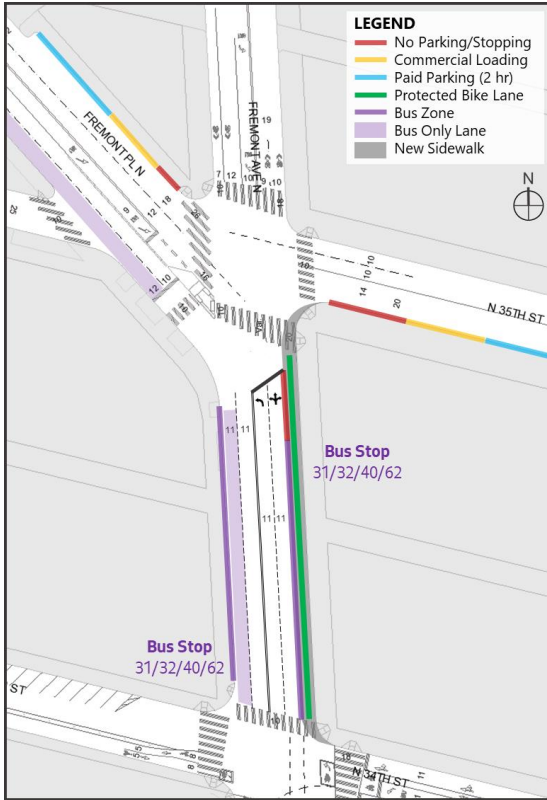
A visual layout of each of these options is shown in the following figures.



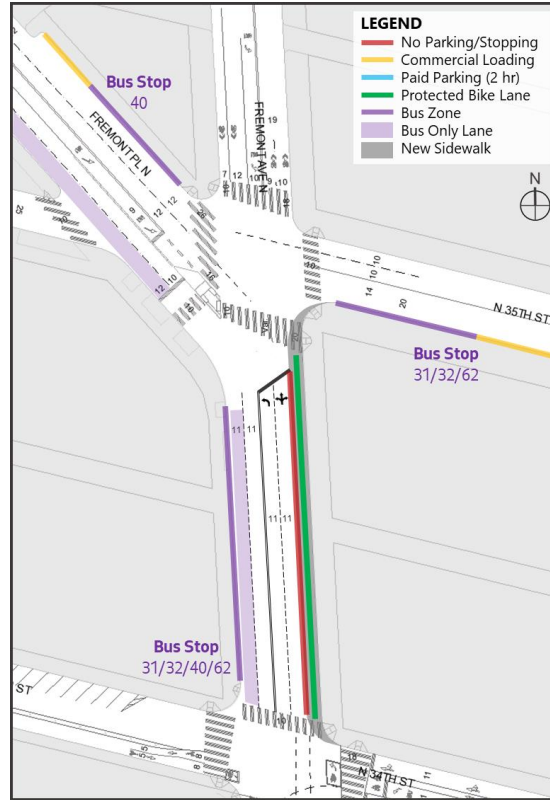
Existing Conditions



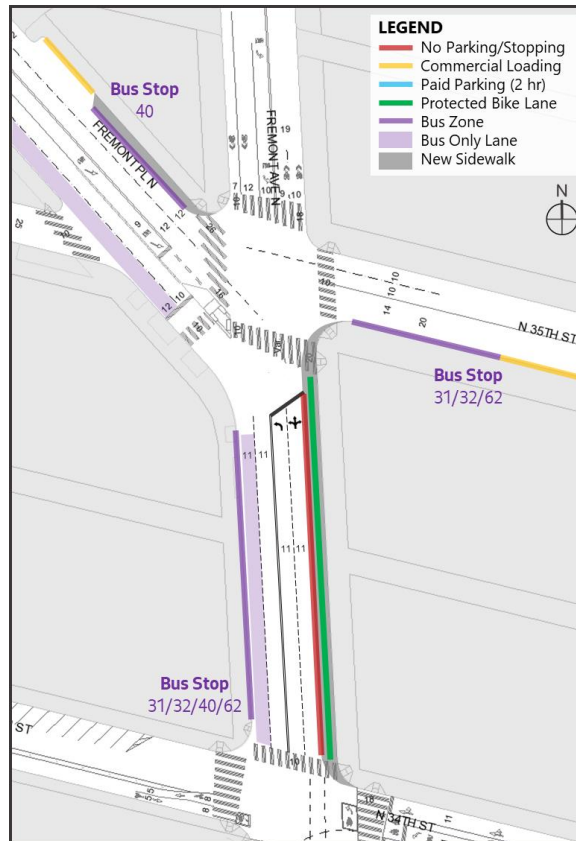
Option 1: 30% Design proposal



- Option 2: PBL with Lane Reduction



Option 3A: PBL with Lane Reduction with Bus Stop Relocation (out-of-lane bus stop)



Option 3B: PBL with Lane Reduction with Bus Stop Relocation (in-lane bus stop)

For Option 2: PBL with Lane Reduction, in order to provide both a PBL and a bus zone on Fremont Ave N, a raised bicycle lane with markings to indicate the area is a mixing zone with pedestrians would need to be provided, as shown in the example for NE 65th St at 16th Ave NE, below.



Options 3A and 3B would provide a northbound concrete-separated bike lane on the block between N 34th and N 35th St. An example from 7th Ave downtown Seattle is shown below.



All of these options were modeled using Vissim (v11.00-10), a microsimulation traffic software tool, which can reflect the complexities of traffic in the Fremont area. This includes interactions between general purpose (GP) vehicles, transit, bicycles, and pedestrians, along with detailed modeling of signal operations. Only the PM peak hour was modeled since that time period has the highest vehicle volumes and observed congestion. The model extents include the Route 40 pathway from the Westlake Ave/Nickerson Ave intersection through the Dayton Ave N/N 36th St intersection.

Analysis Results

The model-estimated corridor travel times and average vehicle queue lengths are shown in Table 1 and Table 2, respectively. Northbound travel times are along the segment from the Westlake Ave/Nickerson Ave intersection through the Dayton Ave N/N 36th St intersection and vice versa for southbound travel times.

Table 1: Travel Time (minutes) in PM Peak - Between Westlake Ave & Dayton Ave

	Existing Conditions	Option 1	Option 2	Option 3A	Option 3B
Route 40 (including dwell time)					
Northbound	4.7	4.6	6.7	4.9	4.8
Southbound	4.9	4.0	4.2	4.2	4.3
General Purpose Vehicles					
Northbound	2.8	2.9	4.2	2.9	2.9
Southbound	3.4	2.9	2.9	2.9	2.9

All options improve southbound transit travel times over Existing Conditions, and to a lesser degree, GP vehicle travel times due to the combination of improved signal progression and the addition of a southbound bus lane.

Northbound transit and general-purpose travel time are relatively unchanged from Existing Conditions with the Options 1, 3A, and 3B, though a slight improvement could occur with transit for Option 1 due to the addition of a short segment of northbound bus lane. Option 2 is estimated to have a significant change in northbound travel times for both transit and GP vehicles due to the combination of a motor vehicle lane reduction and maintaining the current bus stop location. Relocating the northbound bus stop to Fremont Pl N, as in the case of Option 3A and 3B, mitigates the loss of a lane on Fremont Ave N by improving the efficiency of that block of Fremont Ave N while reducing the number of buses stopping and moving the bus stop to a street with lower vehicle volumes.

Table 2: Average Queue Length (feet) in PM Peak

	Existing Conditions	Option 1	Option 2	Option 3A	Option 3B
Fremont Ave N & N 34th St					
Northbound	275	155	610	210	205
Southbound	145	75	85	80	80
Westbound	95	240	265	250	245
Fremont Ave N & N 35th St/Fremont Pl N					
Northbound	65	110	175	105	105
Southbound	35	40	45	45	45
Eastbound	25	130	115	105	105
Westbound	140	65	80	80	80

Model-estimated queues would vary moderately across the options, through Option 2 would create average northbound queues extending to the moveable part of the Fremont Bridge. It would not be uncommon for queues to reach beyond the Westlake Ave N/Nickerson St intersection at times throughout a typical PM peak period with Option 2.

Recommendation

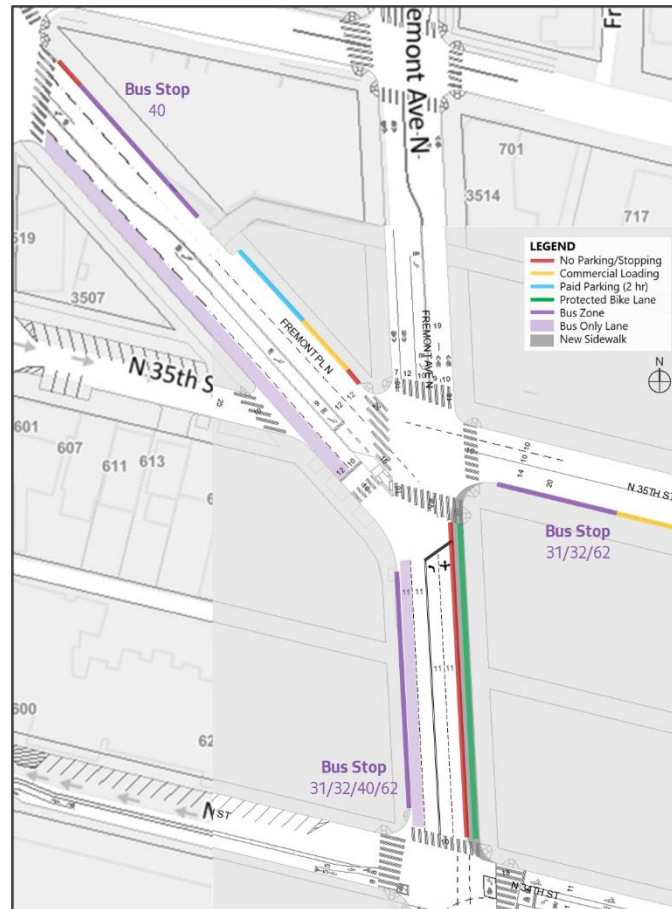
Based on the traffic analysis and discussions with SDOT and King County Metro, it was determined that a northbound PBL could be accommodated if the northbound bus stop was relocated and split (Route 40 on Fremont Pl N west of Fremont Ave N and Route 31/32/62 on N 35th St east of Fremont Ave N). While the proposed design will increase transit transfer distance and remove some parking, it will create an all ages and abilities bike connection, continue to maintain and/or improve transit travel times, and maintain all commercial loading zones. The 60% design reflected Option 3B, including a bus bulb for the Route 40 bus stop on Fremont Pl to facilitate in-lane stop operations and provide a larger passenger waiting area and sidewalk.

Bus Zone Location on Fremont Place N

Based on stakeholder feedback, an analysis was conducted to evaluate the feasibility of locating the westbound bus stop just east of the Evanston Ave N/N 36th St/Fremont Pl N signal (Lenin Statue).

- Option 3C: PBL with Lane Reduction with Bus Stop Relocation to Evanston (in-lane bus stop)

Option 3C would be similar to Options 3B, which both had a bus stop on Fremont Pl, but instead of the bus stop being located just west of Fremont Ave N, this in-lane bus stop would be located just east of the Evanston Ave N/N 36th St/Fremont Pl N signal. See figure below.



Option 3C

Similar to the other options, the effects of Option 3C were modeled using Vissim 11. This analysis was performed in summer of 2023.

Analysis Results

The model-estimated corridor travel times and average vehicle queue lengths for Options 3B and 3C are shown Table 3 and Table 4, respectively.

Table 3: Travel Time (minutes) in PM Peak - Between Westlake Ave & Dayton Ave

	Option 3B	Option 3C
Route 40 (including dwell time)		
Northbound	4.8	5.3
Southbound	4.3	4.2
General Purpose Vehicles		
Northbound	2.9	3.1
Southbound	2.9	2.9

With the bus stop located just east of Evanston Ave N in Option 3C, both northbound transit and GP traffic are estimated to have longer travel times than with the bus stop closer to Fremont Ave N. The near-side location of the bus stop increases the likelihood that the bus would not be able to fully access the bus stop because of cars waiting at a red signal. And with the relatively long dwell times caused by the number of passengers getting on and off the bus, the bus would occasionally not get through the first green signal once fully at the stop. Since this added delay caused by the near-side bus stop in Option 3C is not consistent from trip to trip, this option also decreases reliability relative to Option 3B.

Table 4: Average Queue Length (feet) in PM Peak

	Option 3B	Option 3C
Fremont Ave N & N 34th St		
Northbound	205	245
Southbound	80	75
Westbound	245	240
Fremont Ave N & N 35th St/Fremont PI N		
Northbound	105	110
Southbound	45	45
Eastbound	105	100
Westbound	80	80
Evanston Ave N & N 36th St/Fremont PI N		
Northbound	55	55
SW-bound	30	25
Eastbound	55	55
NW-bound	50	80

Recommendation

Option 3B continues to provide a pathway to maintain and improve transit travel times while adding a new protected bike lane on Fremont Ave N. Option 3C increases travel times for riders on the bus and decreases reliability for the bus along the length of the route. Further, as described in the following section, it would also increase travel times and walking distances for transferring passengers compared to all other options.

Transfer Environment

With the relocation of the northbound bus stops, there will be a change in the bus passenger transfer environment. Based on a review of ridership data, roughly 130 (about 7%) of the weekday bus riders who board the bus at either the northbound or southbound stop are transferring from another route and would be impacted by the bus stop relocation.

The distance between bus stops can increase the amount of time to transfer between bus stops. Table 5 provides the existing and proposed data for the bus transfers, which includes the walking distance

between transfer points, the number of crosswalks needed, and the change between the existing and proposed transfer points.

Table 5: Bus Transfer Types and Walking Distances

Transfer Type	Weekday Transfers	Existing		Proposed (Options 2, 3A, 3B)		Change	
		Walking Distance (ft)	# of Crossings	Walking Distance (ft)	# of Crossings	Walking Distance (ft)	# of Crossings
NB 40 to/from NB 31/32/62	44	0	0	350	2	+350	+2
NB 40 to/from NB 31/32/62	36	200	1	450	2	+250	+1
SB 40 to/from NB 31/32/62	50	200	1	450	1-2	+250	No Change or +1
SB 40 to/from SB 31/32/62	58	0	0	0	0	No Change	No Change

Of the four types of transfers that occur at this bus stop pair, three will be affected by the proposed bus stop relocations. However, the most common transfer between southbound Route 40 buses and southbound Route 31, 32, or 62 buses will not change.

For the other three transfers, walking distances will increase 250 to 350 feet, depending on the transfer and path taken.

Option 3C, with the bus stop located at near-side of Evanston Ave N along Fremont Pl N, would further increase the walking distances for these three transfers by an additional 250 feet. This would cause approximately an additional minute of transfer time for these passengers, though this additional time could be longer for those with mobility needs.