H. 45th BAT Lane Memorandum

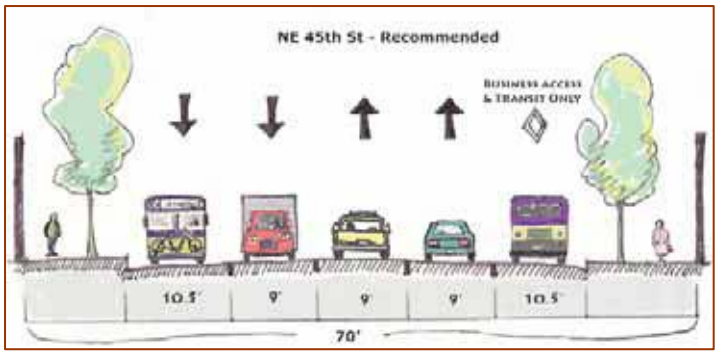
MEMORANDUM

To:	Tony Mazzella, SDOT
From:	John Davies and Howard Wu
Subject:	NE 45th Street BAT Westbound Lanes
Date:	January 4, 2008

The City of Seattle is considering creating a westbound business access/transit (BAT) lane on NE 45th Street as part of the University Area Transportation Action Strategy (UATAS). This memo reviews the issues related to the BAT lane configuration and the implications on traffic operation.

Westbound BAT Concept

The proposed BAT lane concept envisioned in the UATAS Action strategy provides a westbound BAT lane starting west of the intersection of University Way/NE 45th Street and ending at the current bus pullout, west of the 7th Avenue NE/NE 45th Street intersection. The purpose of the BAT lane is to improve transit operations along the NE 45th Street corridor by providing for a transit and right turn lane in the westbound direction.



The choice of the westbound direction for the BAT lane reflects the peak direction of bus service during the PM peak hour. King County Metro, Community Transit and Sound Transit all provide peak hour service from the University of Washington during the PM peak hour. The BAT lane would extend along NE 45th Street from University Way NE to 7th Avenue NE (Northbound I-5 Ramps). The concept would provide a westbound BAT lane in addition to two eastbound lanes and two westbound lanes. The BAT lane would be restricted to buses and vehicles turning right at intersections. Left turns would be eliminated along the corridor at all intersections. Special routes and wayfinding signs could be integrated into the concept such as a route to the University Bridge that sends vehicles north on 11th Avenue NE, west on NE 47th Street and south on Roosevelt Way NE.

Some of the benefits of the project include:

- Transit, right-turn and business access lane for westbound travel is consistent with the City's goals to improve travel times and speeds.
- Simpler signal phasing by eliminating left turn phasing would result in better intersection and corridor performance.
- Right turning vehicles would no longer share through lanes increasing corridor capacity for moving through trips.

Existing Conditions

NE 45th Street is the major east-west arterial through the University District connecting Laurelhurst to the east and Wallingford to the west. During an average weekday, the corridor carries between 26,700 (east of 15th Avenue NE) to close to 36,000 (west of Roosevelt Way NE). It also provides a connection to I-5, a regional facility, and runs through the commercial center of the University District. In addition, NE 45th Street is a major transit corridor serving riders to and from the University of Washington and the business district, with stops located every other block along NE 45th Street.

Within the University District, the roadway is striped with two lanes in each direction with a center two-way, left-turn lane or left-turn pockets at most cross streets. The right-of-way is narrow with nine-foot center and travel lanes, ten-foot curb lanes. Signals are provided at all cross streets from I-5 to 15th Avenue NE except at 8th and 9th Avenue NE. There are left-turn restrictions for the eastbound direction at 11th Avenue NE/NE 45th Street and for all directions at the intersection of University Way NE/NE 45th Street.

Existing Traffic Operations

During the peak periods, the traffic along NE 45th Street is highly congested. In the AM period, traffic is heavy on both directions of NE 45th Street with westbound volumes of approximately 900 vehicles per hour and eastbound volumes of approximately 1,000 vehicles per hour. However, the overall congestion is worse in the PM peak period when volumes on NE 45th Street are between 900 and 1,200 vehicles per hour per direction. There is considerable "friction" along the corridor, with buses stopping within the travel lanes, and through traffic sharing the curb lane with right turning vehicles. In addition, congestion on NE 45th Street can be aggravated by congestion on I-5 or events at the University. Historic traffic data collected by SDOT indicates that traffic volumes have remained fairly stable on NE 45th Street since 1991.

A study of the travel times along NE 45th Street between 7th and 15th Avenue NE indicated that the average speed in the eastbound direction during the PM peak hour is less than 10 mph and approximately 11 mph in the westbound direction.

BAT Lane Analysis

Using the existing volumes for the NE 45th Street corridor, the analysis estimated the impact of the BAT lane for autos and transit. Using the intersection delays as calculated by the Synchro traffic analysis program, we estimated the corridor travel times and speeds with and without the BAT lanes. Results were post-processed to field-observed travel time data collected in April 2007.

Traffic Shifts

The completion of the BAT lane would likely cause some shifts in traffic flows due to the left turn restriction. Based on existing counts, the proposed project would impact 242 westbound and 154 eastbound left-turning vehicles during the PM peak hour. To evaluate the shifts, the City of Seattle's Traffic Model was used to evaluate the changes in link volumes caused by the left-turn restrictions on NE 45th Street. Post-processing of model volumes were made to account for travel patterns and model loading points. **Figure 1** shows the redistribution of PM peak hour traffic as a result of the BAT lane.

With the left-turn restrictions along NE 45th Street, some traffic would be diverted off the corridor. Most of the PM peak hour eastbound traffic on NE 45th Street would most likely loop around a block to cross NE 45th Street. For diverted westbound traffic, the most significant movement occurred on 11th Avenue NE and Roosevelt Way NE. Traffic that would normally make westbound left-turns off NE 45th Street on to Roosevelt Way NE would now make a right on to 11th Avenue NE, left on to NE 47th Street and finally a left on to Roosevelt Way NE.

The highest increases in traffic were on 11th Avenue NE, NE 47th Street, Roosevelt Way NE as a result of traffic looping back towards the University Bridge. A signed route would be desirable to encourage this route. During the PM peak hour, less than 100 vehicles per hour shifts occurred on NE 50th Street, NE 43rd Street, Brooklyn Avenue NE and 15th Avenue NE.

Travel Times

With the BAT lane, transit travel times are reduced by more than one minute in the westbound direction during the PM peak hour. There are also benefits for eastbound and westbound auto traffic. **Table 1** compares auto and transit travel times for existing conditions and with the BAT lane.

Table 1. PM Peak Hour Travel Times for Existing Conditions and with BAT Lane

	Travel Time in Seconds		Travel Time Change	
	Existing	With BAT	Seconds	Percent
Auto – Westbound	166	114	-52	-31%
Auto – Eastbound	196	179	-17	-9%
Transit – Westbound	166	98	-67	-41%
Transit – Eastbound	196	179	-17	-9%

Travel Speeds

Average travel speeds along the corridor are also expected to improve for both autos and transit vehicles. The move elimination of left turn signal phases and the separation of right turns and bus traffic from the through lanes will increase the capacity of the road, improving travel speeds for westbound traffic by 5 mph during the PM peak hour. For transit, the BAT lane will increase the average travel speed by nearly 70 percent. Eastbound vehicles will also see improved PM peak hour travel speeds along the corridor by about 8 percent. **Table 3** shows the change in PM peak hour travel speeds between existing and the with BAT lane options.

Table 2. PM Peak Hour Travel Speeds for Existing Conditions and with BAT Lane

	Mile per Hour		Change	
	Existing	With BAT	MPH	Percent
Auto – Westbound	11.1	16.1	5.0	45%
Auto – Eastbound	9.4	10.2	0.8	8%
Transit – Westbound	11.1	18.8	7.7	69%
Transit – Eastbound	9.4	10.2	0.8	8%

Intersections Operation

Using the HCM Level of Service (LOS) methodology for arterial units, the analysis calculated that the corridor intersection operations would improve with the BAT lane concept due to the elimination of left-turns and separation of right turn movements from through movements. With the BAT lane, intersection delay would improve at all intersections except for 15th Avenue NE/NE 45th Street which would experience an increase of delay associated with increased eastbound and westbound left turn movements.

Table 3. Intersection PM Peak Hour Levels of Service and Average Intersection Delay for Existing Conditions and with BAT Lane

	Existing		With BAT	
	LOS	Delay	LOS	Delay
7th Ave NE/NE 45th St	F	92	D	39
Roosevelt Way NE/NE 45th St	D	52	C	24
11th Ave NE/NE 45th St	D	37	C	29
12th Ave NE/NE 45th St	A	8	A	5
Brooklyn Ave NE/NE 45th St	D	49	C	26
University Way NE/NE 45th St	C	17	C	24
15th Ave NE/NE 45th St	E	60	E	71

2030 Traffic Operations

A similar analysis of future travel conditions was completed using the Seattle Model's forecast of 2030 traffic conditions. Results of the analysis found future average speeds between 5 and 7 mph along NE 45th Street without the BAT lane. **Tables 4-6** show the results of the 2030 analysis. The addition of the BAT lane would:

- Improve westbound general purpose traffic operation from 7 mph to 14 mph. Transit travel times would improve to 16 mph.
- Increase eastbound travel speeds from 5 mph to 8 mph during the PM peak hour with the BAT lane.
- Improves the LOS operation at NE 45th Street intersections during the PM peak hour with no intersection operating at worse than LOS E.

Areas for Further Work

This analysis was focused on identifying the likely impact of the NE 45th Street concept promoted by UATAS. SDOT's transit speed and reliability concept applied for under the Bridging the Gap funding promotes a similar corridor except that the BAT lane would start at 15th Avenue NE (rather than University Way NE). Further analysis would need to be conducted to investigate the advantages and disadvantages of extending the BAT lane which would preclude the eastbound left turn lane at 15th Avenue NE/NE 45th Street.

Conclusions

The concept of a westbound BAT lane using existing right-of-way appears to an inexpensive way to benefit transit and overall NE 45th Street corridor traffic operation. The BAT lane would improve the PM peak hour travel times and speeds for both east and westbound traffic by separating out the westbound bus and right turn movements out of the main flow of traffic and by eliminating the delay caused by left turn signal phases. The concept would support the City's goals for improving transit speed and reliability.


NE 53rd St
NE 52nd St
NE 50th St
NE 47th St
NE 45th St
NE 43rd St
NE 42nd St
NE 41st St
NE 40th St
Campus Parkway
5
8th Ave NE
9th Ave NE
Roosevelt Way NE
11th Ave NE
12th Ave NE
Brooklyn Ave NE
University Way NE
15th Ave NE
7th Ave NE
+82
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+20
N
Not To Scale
Legend
x Negative Change
x Positive Change

Table 4. PM Peak Hour Travel Times for 2030 No Action and with BAT Lane

	Travel Time in Seconds		Travel Time Change	
	No Action	With BAT	Seconds	Percent
Auto – Westbound	278	130	-148	-53%
Auto – Eastbound	364	227	-137	-38%
Transit – Westbound	278	115	-163	-59%
Transit – Eastbound	364	227	-137	-38%

Table 5. PM Peak Hour Travel Speeds for 2030 No Action and with BAT Lane

	Mile per Hour		Change	
	No Action	With BAT	MPH	Percent
Auto – Westbound	6.6	14.1	7.5	113%
Auto – Eastbound	5.0	8.1	3.1	62%
Transit – Westbound	6.6	15.9	9.3	141%
Transit – Eastbound	5.0	8.1	3.1	62%

Table 6. Intersection PM Peak Hour Levels of Service and Average Intersection Delay for 2030 No Action and with BAT Lane

	No Action		With BAT	
	LOS	Delay	LOS	Delay
7th Ave NE/NE 45th St	F	106	D	53
Roosevelt Way NE/NE 45th St	F	83	C	22
11th Ave NE/NE 45th St	F	126	E	66
12th Ave NE/NE 45th St	A	0	A	0
Brooklyn Ave NE/NE 45th St	F	108	C	23
University Way NE/NE 45th St	D	39	D	54
15th Ave NE/NE 45th St	F	99	E	73