

East Bank Traffic Study #1 Updated Washington Avenue VISSIM Analysis – February 8, 2008

Introduction

VISSIM computer simulation modeling has been developed for two alternatives along Washington Avenue through the East Bank area. The limits of the modeling are the Washington Avenue bridge, immediately west of the Washington Avenue/Church Street intersection to the University Avenue/25th Avenue intersection. This report summarizes the inputs to the model, the modifications to the model from that presented on January 31, 2008, and the model results for Alternative 17 (Modified).

At the January 31, 2008 issues meeting, the analysis results of two alternatives were reviewed. The two alternatives were:

- Alternative 12 – light rail in a tunnel alignment from west of Church Street to north of University Avenue at 23rd Avenue. The roadway configuration of Washington Avenue remains as it currently exists, generally two lanes in each direction without separate turn lanes at the intersections.
- Alternative 17 – light rail operates at-grade along Washington Avenue. Washington Avenue from Church Street through Oak Street provides one travel lane in each direction with exclusive left turn lanes at the intersections. From Oak Street to Huron Boulevard, Washington Avenue is a single lane in each direction without separate left turn lanes at Ontario Street. Walnut Street is converted to one-way southbound with access modifications behind the hotel for local circulation.

Alternative 12 is operating similar to today's conditions. The operations for Alternative 17 are impacted by the pedestrian volume and more aggressive crossing behavior coded into the model. The results of the analysis indicate the strong influence of pedestrian activity on intersection level of service on Washington Avenue. Five intersections have level of service and delay results that require additional evaluation.

The results of the analysis are shown below in Table 1.

Table 1 – Intersection Level of Service and Delay

Intersection	Alternative 12		Alternative 17	
	Delay (s)	LOS	Delay (s)	LOS
Washington / Church	B	12.6	C	31.5
Washington / Union	E	64.6	F	84.1
Washington / Harvard	B	16.3	E	55.9
Washington / Walnut	B	18.9	C	33.2
Washington / Oak	B	19.7	E	76.3
Washington / Ontario	B	13.6	F	85.3
Washington / Huron	D	41.6	E	64.0
University / Oak	B	16.2	C	31.2
University / Huron	C	20.6	D	48.6
University / 25th	B	15.9	B	16.3

The next step will be to modify Alternative 17 to improve vehicle operations and provide safe pedestrian access at the intersections. The Alternative 17 (Modified) will be evaluated using the VISSIM software with the same base inputs.

Updates to the VISSIM Model for Alternative 17 (Modified)

The following is a summary of the modifications or VISSIM analysis for Alternative 17 (Modified).

- Union Street will be closed to vehicle traffic south of the parking ramp access. No vehicle access will be available to and from Washington Avenue. Pedestrian access will be maintained and opportunities available for enhanced pedestrian access at the platforms.
- A one-way access road is proposed to connect Harvard/Beacon to Walnut Street. Modifications to the hotel parking lot will be required. This is similar to the original modifications, with the exception of the two-lane roadway.
- Proposed traffic diversions are assumed in the model for vehicles turning right (westbound) and left (eastbound) on Washington Avenue from Union Street. Right turning vehicles are assumed to travel on the access road behind the hotel to Walnut Street to access westbound Washington. Left turning vehicles are assumed to divert as follows: two thirds of the left turning vehicles will take the new access road Walnut Street north to University Avenue. The remaining third are assumed to take the access road behind the hotel to Walnut Street south to access eastbound Washington Avenue.
- A southbound right turn lane will be added on Oak Street. This will result in three southbound lanes at the intersection, through/left, through, and right only lane.

- The left turn lane from westbound Washington Avenue to southbound Oak Street is extended for the entire block between Oak Street and Ontario Street.
- The eastbound left turn movement on Washington Avenue at Huron has been removed. The new lane configuration at the intersection will be a through and through/right. The left turns (estimated 43) are expected to continue on Washington to University and turn left at 25th Street.

Inputs

VISSIM Videos

- The videos are 16 minutes and 7 seconds in length (real time).
- Simulation runs are at two times the speed of real time.
- Videos start at 25 minutes into the simulation.

Geometry

- The lane geometries were coded into the model based on the Alternative 12 and Alternative 17 Preliminary Draft layouts which are attached. This includes lanes, track location, medians and other applicable features.

Signal Operations

- The typical signal cycle length used is 100 seconds. The exception is the Washington/Huron and University/Huron intersections where 155 seconds is used (with a 43 second exclusive LRT clearance phase).
- In the model, the intersections of Washington/Huron and University/Huron are operated by one signal controller to optimize operations and assure safe clearance of the LRV through both intersections.

Traffic Volumes

- PM peak hour input volumes for vehicular traffic are from the SRF VISSIM model. The 2005 turning movement counts at the intersections are adjusted to 2014 by the factor of 0.25% per year compounded.
- VISSIM outputs served volumes at each intersection. Served volumes are the actual number of vehicles served at each intersection and will differ slightly from the input volumes. The differences are due to residual queuing in the network and the stochastic nature of vehicle routing in the VISSIM software.

- Origin/destination data was from the regional model and calibrated against the existing turning movement counts as included in the SRF VISSIM model. The base model includes a 10% through traffic diversion from Washington Avenue.
- Heavy vehicles were assumed to be 2.5%.

Pedestrian Volumes

- Pedestrian volumes are based on actual recent counts for the PM peak hour from the SRF VISSIM model.
- The average pedestrian walking speed was set to 4.0 feet per second.

LRV Priority

- Partial priority is provided based upon the detection of the train at a loop placed 5 to 10 seconds upstream. If the train is on imminent approach and the compatible through phase is green, the signal will be held by granting extensions to the existing phase; otherwise the time allocated to non-compatible phases will be reduced down to the required minimum so that the LRV compatible phase is brought up as soon as possible.
- The average LRV operating speed in this area is 15 mph (not changed from the original model).

Analysis Results for Alternative 17 (Modified)

The following tables provide a comparison the analysis results for Alternative 12, Alternative 17, and Alternative 17 (Modified). The VISSIM modeling identified a level of service F at the Walnut Street intersection. Additional modifications are being tested in the model with the goal of improving the cross street operations associated with the parking ramp operation.

Table 2 is the intersection level of service (LOS) and delay for each alternative as analyzed from the VISSIM modeling. The results are based on five independent model runs.

Table 2 – Intersection Level of Service and Delay

Intersection	Alternative 12		Alternative 17		Alternative 17 (Modified)	
	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)
Washington / Church	B	12.6	C	31.5	C	22.8
Washington / Union	E	64.6	F	84.1	B	12.2
Washington / Harvard	B	16.3	E	55.9	D	51.5
Washington / Walnut	B	18.9	C	33.2	F	81.1
Washington / Oak	B	19.7	E	76.3	D	53.0
Washington / Ontario	B	13.6	F	85.3	E	77.2
Washington / Huron	D	41.6	E	64.0	D	46.3
University / Oak	B	16.2	C	31.2	C	21.9
University / Huron	C	20.6	D	48.6	D	47.6
University / 25th	B	15.9	B	16.3	B	17.1

Table 3 provides an average travel time comparison, eastbound and westbound from the Washington Avenue bridge through the University/25th Avenue intersection. The results are presented in average travel time through the system and average speed (including stopped time) based on five independent model runs.

Table 3 – Travel Time Comparison

Measure	Direction	Alt 12 Tunnel	Alt 17 – At-Grade	Alt 17 At-Grade (MOD)
Average Travel Time	Eastbound	3.2 min	6.9 min	5.4 min
	Westbound	4.2 min	6.6 min	6.6 min
Average Speed	Eastbound	15.0 mph	6.9 mph	8.7 mph
	Westbound	12.0 mph	7.5 mph	7.4 mph

East Bank Traffic Study #1 Updated Washington Avenue VISSIM Analysis – February 21, 2008

Introduction

VISSIM computer simulation modeling has been developed for two alternatives along Washington Avenue through the East Bank area. The limits of the modeling are the Washington Avenue bridge, immediately west of the Washington Avenue/Church Street intersection to the University Avenue/25th Avenue intersection.

Results Presented at the January 31, 2008 Meeting

At the January 31, 2008 meeting, the analysis results of two alternatives were reviewed. This included Alternative 12 with the LRT in tunnel and Alternative 17 with LRT at-grade on Washington Avenue.

The operations for Alternative 17 were impacted by the pedestrian volume and more aggressive crossing behavior coded into the model. The results of the analysis indicated the strong influence of pedestrian activity on intersection level of service on Washington Avenue. Five intersections had level of service and delay results that required additional evaluation (LOS E or F).

The next steps included testing revisions to the geometry and operation of the roadway to improve level of service at the intersections of concern.

Results Presented at the February 8, 2008 Meeting

At the February 8, 2008 meeting, a modification of Alternative 17 was presented that modified Alternative 17 to improve vehicle operations and provide safe pedestrian access at the intersections. The base VISSIM inputs were maintained. Modifications included: closing Union Street to vehicle traffic at Washington Avenue (open for pedestrians), constructing a one-way access road to connect Harvard/Beacon to Walnut Street, and some minor adjustments to the geometry.

The VISSIM modeling identified a level of service F at the Walnut Street intersection and E at Ontario Street as a result of side-street traffic delays. While this modification represents an operational improvement, the two locations at LOS E/F present a concern in providing acceptable operation in the corridor.

The next steps included testing additional modifications in the model with the goal of improving the cross street operations associated with the Washington Avenue parking ramp operation.

Current Analysis Results and VISSIM Model Updates for Alternative 17 (2/21/08)

The following is a summary of the modifications and VISSIM analysis for Alternative 17 (2/21/08).

- Union Street is modified to provide a southbound right turn to access Washington Avenue. Vehicle access will also be provided to the parking ramp by exclusive lane. Pedestrian access will be maintained and opportunities available for enhanced pedestrian access at the platforms. The crosswalk is located to avoid conflict with vehicles turning right onto Washington Avenue.
- Harvard Street south of Washington Avenue is converted to one-way southbound.
- A one-way access road is proposed to connect Harvard/Beacon to Walnut Street northbound. Modifications to the hotel parking lot will be required, which will include methods to eliminate cut-through traffic.
- Walnut Street will be closed to through traffic north of the hotel parking lot. Walnut Street south of Washington Avenue is converted to one-way southbound.
- Proposed traffic diversions are assumed in the model for vehicles previously turning right (westbound) and left (eastbound) on Washington Avenue from Union Street. Right turning vehicles are assumed split at the access road with 50% turning right on Washington and 50% driving north on Union. Left turning vehicles are assumed to divert with all the left turning vehicles taking the new access road Walnut Street north to University Avenue.
- A southbound right turn lane is added on Oak Street.
- The left turn lane from westbound Washington Avenue to southbound Oak Street is extended for the entire block between Oak Street and Ontario Street.
- The eastbound left turn movement on Washington Avenue at Huron has been removed.
- Ontario Street is converted to right-in, right-out on the north and south legs of the intersection. A traffic signal will be in place to provide safe pedestrian crossing with the LRT.

Analysis Results for Alternative 17 (2/21/08)

The following tables provide a comparison the analysis results for Alternative 17 (2/21/08) based on the following conditions:

- Alternative 17 (2/21/08) with a 10% reduction in through traffic on Washington Avenue with 2014 traffic.
- Alternative 17 (2/21/08) with a 10% reduction in through traffic on Washington Avenue with 2030 traffic.

Table 1 – Intersection Level of Service and Delay

<i>Intersection</i>	<i>Alternative 17 (2/21/08) 2014 Traffic</i>		<i>Alternative 17 (2/21/08) 2030 Traffic</i>	
	<i>LOS</i>	<i>Delay (s)</i>	<i>LOS</i>	<i>Delay (s)</i>
Washington / Church	C	24.2	C	25.1
Washington / Union	B	10.3	B	12.3
Washington / Harvard	C	28.3	C	29.2
Washington / Walnut	B	17.9	B	18.8
Washington / Oak	D	46.1	D	52.9
Washington / Ontario	B	13.7	C	21.2
Washington / Huron	C	25.4	C	31.8
University / Oak	C	24.2	C	28.0
University / Huron	D	36.9	D	46.6
University / 25th	B	17.3	B	18.2

Table 1 is the intersection level of service (LOS) and delay for each alternative as analyzed from the VISSIM modeling. The results are based on five independent model runs. This is currently being optimized in the VISSIM model.

East Bank Traffic Study #2 Washington Avenue Shortened Tunnel – February 8, 2008

Introduction

The purpose of the Washington Avenue (Shortened) Tunnel Alternative Study is to determine impacts to Washington Avenue and adjacent intersections resulting from various tunnel alternatives for the Central Corridor LRT project. The study will determine the expected level of service (LOS) at intersections along Washington Avenue and in the immediate area for various geometric configurations of Washington Avenue between Oak Street and Huron Boulevard associated with a shortened tunnel section through campus between the river bridge and Oak Street.

The results of this traffic study can be used by project partners to evaluate the shortened tunnel alternatives and will summarize impacts and possible modifications to the nearby intersections.

Study Methodology

The proposed Washington Avenue tunnel alternatives were evaluated using Synchro traffic analysis software. Synchro analysis software uses Highway Capacity Manual (HCM) procedures to evaluate traffic signal and urban street operations in a static condition. With Synchro, a model is built to accurately reflect the urban street scenario of an alternative. This analysis was chosen to allow for a series of alternatives to be evaluated and compared in a short time frame.

The following are inputs to the modeling:

- 2005 turning movement counts that were inputs in the VISSIM model are used in the analysis. These counts were supplemented by data from the City of Minneapolis and new intersection turning movement counts,
- The turning movement counts were adjusted across the system. All counts were adjusted to 2014 based on the factor of 0.25% per year compounded.
- The existing geometric configuration is assumed for the base roadway system and “existing” analysis.
- A second left turn lane on westbound University Avenue to Oak Street is assumed in the base analysis.
- Traffic diversions are assumed for Alternatives 8, 20, 21, 22, and 24 where access to and from Washington Avenue is impacted by the location of the LRT tunnel section.

Description of Alternatives

The following is a description of the alternatives to be evaluated for the PM Peak Hour traffic operations.

Existing Geometric Conditions

- The current roadway system in the University area will be modeled using existing geometrics.
- The 2005 turning movement counts at the intersections, that are adjusted to 2014 by the factor of 0.25% per year compounded, will be the baseline for comparison to the alternatives.
- The following intersections on Washington Avenue will be analyzed: Church, Union, Harvard, Walnut, Oak, Ontario and Huron.
- The following intersections on University Avenue will be analyzed: Oak, Huron/23rd, and 25th.
- Adjacent intersections will be added to establish a baseline for evaluating the traffic distribution. These intersections include: Oak/Delaware, Oak/Fulton, Fulton/Erie, Fulton/Huron, and Huron/Essex.

Alternative 8

- Alternative 8 presents a shortened tunnel design on Washington Avenue with a pedestrian mall between Oak and Huron.
- Traffic was redistributed as follows:
 - Northbound Huron Boulevard to westbound Washington Avenue rerouted to westbound Fulton Street and northbound Oak Street.
 - Southbound Huron Boulevard to westbound Washington Avenue (including traffic from the southbound through movement on 23rd Avenue S at University Avenue) rerouted to westbound University Avenue and southbound Oak Street.
 - Northbound Ontario Street at Washington Avenue rerouted to southbound Ontario Street. Northbound through and right-turn volume routed on Ontario to eastbound Essex Street to Huron Boulevard. Northbound left-turn volume routed on Ontario to westbound Fulton Street and northbound Oak Street.
 - Southbound through and right-turn volume on Ontario Street at Washington Avenue rerouted to westbound Beacon Street and southbound Oak Street. Southbound left-turn volume routed on northbound Ontario to University Avenue.
 - Eastbound through traffic on Washington Avenue at Oak Street rerouted to northbound or southbound Oak Street based on existing percentage of left and right turns (approximately 2/3 left turns and 1/3 right turns). Left

turns from eastbound Washington Avenue to Ontario rerouted to northbound Oak and eastbound Beacon. Right turns from eastbound Washington Avenue to Ontario rerouted to southbound Oak and eastbound Essex.

- The following intersections on Washington Avenue will be analyzed: Church, Union, Harvard, Walnut, Oak, and Huron.
- The following intersections on University Avenue will be analyzed: Oak, Huron/23rd, and 25th.
- Adjacent intersections will be added to evaluate the impacts of the traffic distribution. These intersections include: Oak/Delaware, Oak/Fulton, Fulton/Erie, Fulton/Huron, and Huron/Essex.

Alternative 20

- Alternative 20 presents a short tunnel alternative with one lane, one way eastbound operation on the north side of Washington Avenue between Oak and Huron.
- Traffic was redistributed as follows:
 - Northbound Huron Boulevard to westbound Washington Avenue rerouted to westbound Fulton Street and northbound Oak Street.
 - Southbound Huron Boulevard to westbound Washington Avenue (including traffic from the southbound through movement on 23rd Avenue S at University Avenue) rerouted to westbound University Avenue and southbound Oak Street.
 - Northbound Ontario Street at Washington Avenue rerouted to southbound Ontario Street. Northbound through and right-turn volume routed on Ontario to eastbound Essex Street to Huron Boulevard. Northbound left-turn volume routed on Ontario to westbound Fulton Street and northbound Oak Street.
 - Southbound through and right-turn volume on Ontario Street at Washington Avenue rerouted to westbound Beacon Street and southbound Oak Street.
 - Right turns from eastbound Washington Avenue to Ontario Street rerouted to southbound Oak Street and eastbound Essex Street.
- The following intersections on Washington Avenue will be analyzed: Church, Union, Harvard, Walnut, Oak, Ontario and Huron.
- The following intersections on University Avenue will be analyzed: Oak, Huron/23rd, and 25th.
- Adjacent intersections will be added to evaluate the impacts of the traffic distribution. These intersections include: Oak/Delaware, Oak/Fulton, Fulton/Erie, Fulton/Huron, and Huron/Essex.

Alternative 21

- Alternative 21 presents a short tunnel alternative with one lane, one way eastbound operation on the south side of Washington Avenue between Oak and Huron.
- Traffic was redistributed as follows:
 - Northbound Huron Boulevard to westbound Washington Avenue rerouted to westbound Fulton Street and northbound Oak Street.
 - Southbound Huron Boulevard to westbound Washington Avenue (including traffic from the southbound through movement on 23rd Avenue S at University Avenue) rerouted to westbound University Avenue and southbound Oak Street.
 - Northbound through and left-turn volume on Ontario Street at Washington Avenue rerouted to southbound Ontario Street. Northbound through volume routed on Ontario to eastbound Essex Street to Huron Boulevard. Northbound left-turn volume routed on Ontario to westbound Fulton Street and northbound Oak Street.
 - Southbound through and right-turn volume on Ontario Street at Washington Avenue rerouted to westbound Beacon Street and southbound Oak Street. Southbound left-turn volume routed on northbound Ontario to University Avenue.
 - Left turns from eastbound Washington Avenue to Ontario Street rerouted to northbound Oak Street and eastbound Beacon Street.
- The following intersections on Washington Avenue will be analyzed: Church, Union, Harvard, Walnut, Oak, Ontario and Huron.
- The following intersections on University Avenue will be analyzed: Oak, Huron/23rd, and 25th.
- Adjacent intersections will be added to evaluate the impacts of the traffic distribution. These intersections include: Oak/Delaware, Oak/Fulton, Fulton/Erie, Fulton/Huron, and Huron/Essex.

Alternative 22

- Alternative 22 presents a short tunnel alternative with two lane (eastbound and westbound) operation on the south side of Washington Avenue between Oak and Huron.
- Traffic was redistributed as follows:
 - Northbound through volume on Ontario Street at Washington Avenue rerouted to southbound Ontario Street, eastbound Essex Street, and Huron Boulevard.
 - Southbound through and right-turn volume on Ontario Street at Washington Avenue rerouted to westbound Beacon Street and southbound Oak Street. Southbound left-turn volume routed on northbound Ontario to University Avenue.

- Left turns from eastbound Washington Avenue to Ontario Street rerouted to northbound Oak Street and eastbound Beacon Street.
- Right turns from westbound Washington Avenue to Ontario Street rerouted to westbound University.
- The following intersections on Washington Avenue will be analyzed: Church, Union, Harvard, Walnut, Oak, Ontario and Huron.
- The following intersections on University Avenue will be analyzed: Oak, Huron/23rd, and 25th.
- Adjacent intersections will be added to evaluate the impacts of the traffic distribution. These intersections include: Oak/Delaware, Oak/Fulton, Fulton/Erie, Fulton/Huron, and Huron/Essex.

Alternative 24

- Alternative 24 presents a short tunnel alternative with two lane (eastbound and westbound) operation on Washington Avenue between Oak and Huron. The eastbound and westbound lanes will be split around the tunnel boat section.
- Traffic was redistributed as follows:
 - Northbound Ontario Street at Washington Avenue rerouted to southbound Ontario Street. Northbound through volume routed on Ontario to eastbound Essex Street to Huron Boulevard. Northbound left-turn volume routed on Ontario to westbound Fulton Street and northbound Oak Street.
 - Southbound through volume on Ontario Street at Washington Avenue rerouted to westbound Beacon Street and southbound Oak Street. Southbound left-turn volume routed on northbound Ontario to University Avenue.
 - Left turns from eastbound Washington Avenue to Ontario rerouted to northbound Oak and eastbound Beacon.
 - Left turns from westbound Washington Avenue to Ontario Street rerouted to southbound Huron.
- The following intersections on Washington Avenue will be analyzed: Church, Union, Harvard, Walnut, Oak, Ontario and Huron.
- The following intersections on University Avenue will be analyzed: Oak, Huron/23rd, and 25th.

Alternative Analysis Results

The overall evaluation of the Short tunnel alternatives in Study 2 resulted in acceptable levels of service at most locations in the system. There are a few locations where the intersection level of service and delay is at E or F and would require additional needs assessment, if the alternative moves forward in the design process. The following table presents a summary of findings and needs assessment for each alternative.

Summary of Findings – Needs Assessment and Recommendations

2014 Existing Geometry	
<i>2014 Analysis Findings</i>	<i>Needs Assessment</i>
<ul style="list-style-type: none"> • Intersection LOS acceptable 	<ul style="list-style-type: none"> • Some intersection movements will need review
2014 Alternative 8	
<i>2014 Analysis Findings</i>	<i>Needs Assessment</i>
<ul style="list-style-type: none"> • University Avenue and Oak Street intersection is LOS F 	<ul style="list-style-type: none"> • The following individual movements are at LOS F: <ul style="list-style-type: none"> ○ EB left, through, and right ○ WB left turn ○ SB left turn and through • Turn lane modifications and/or traffic signal operational modifications may be needed
2014 Alternative 20	
<i>2014 Analysis Findings</i>	<i>Needs Assessment</i>
<ul style="list-style-type: none"> • Washington Avenue and Huron Boulevard intersection is LOS F 	<ul style="list-style-type: none"> • The following individual movements are at LOS F: <ul style="list-style-type: none"> ○ EB left, through, and right • Turn lane modifications and/or traffic signal operational may be needed
2014 Alternative 21	
<i>2014 Analysis Findings</i>	<i>Needs Assessment</i>
<ul style="list-style-type: none"> • Washington Avenue and Huron Boulevard intersection is LOS E 	<ul style="list-style-type: none"> • The following individual movements are at LOS F: <ul style="list-style-type: none"> ○ EB left, through, and right • Turn lane modifications and/or traffic signal operational may be needed

2014 Alternative 22	
<i>2014 Analysis Findings</i>	<i>Needs Assessment</i>
<ul style="list-style-type: none"> • Intersection LOS acceptable 	<ul style="list-style-type: none"> • Some intersection movements will need review
2014 Alternative 24	
<i>2014 Analysis Findings</i>	<i>Needs Assessment</i>
<ul style="list-style-type: none"> • Intersection LOS acceptable 	<ul style="list-style-type: none"> • Some intersection movements will need review

**EAST BANK TRAFFIC STUDY #2
WASHINGTON AVENUE (SHORTENED) ALTERNATIVE**

Intersection	Traffic Control	2014 Existing Geometry			2014 Alternative 8			2014 Alternative 20			2014 Alternative 21			Alternative 22			Alternative 24		
		LOS	Delay	Notes	LOS	Delay	Notes	LOS	Delay	Notes	LOS	Delay	Notes	LOS	Delay	Notes	LOS	Delay	Notes
Delaware St / Oak St	Traffic Signal	A	9.7		B	13.6	EBL LOS E	B	10.7		B	17.7	EBL LOS E	B	11.0		B	10.8	
Washington Ave / Church St	Traffic Signal	C	21.1		B	14.3	NBL LOS E	B	15.7		B	13.4		B	14.1		B	14.4	
Washington Ave / University Ave	Traffic Signal	A	8.8		B	14.8		A	9.1		B	15.1		B	16.0		B	12.1	
Washington Ave / Union St	Traffic Signal	B	13.0		B	13.1	SBL LOS E	A	8.5		A	8.6		A	9.0		A	8.4	
Washington Ave / Harvard St	Traffic Signal	B	12.5		B	12.2	NBL, NBT LOS E	B	11.3		A	9.3		A	9.4		A	9.2	
Washington Ave / Oak St	Traffic Signal	B	16.9		D	38.8	EBL, EBR, NBL LOS E	C	28.5	NBL LOS F	C	22.8	NBL LOS F	B	14.9		B	15.2	
University Ave / Oak St	Traffic Signal	C	28.6	WBL LOS E SBL LOS F	F	93.6	EBL, EBT, EBR, WBL, SBL, SBT LOS F	D	35.4	WBL, SBL LOS F	D	36.9	WBL, SBT LOS E SBL LOS F	C	32.7	SBL, SBT LOS F	C	25.9	SBL LOS F
Washington Ave / Huron Blvd	Traffic Signal	C	25.0	NBL LOS E	A	3.0		F	172.6	EBL, EBT, EBR LOS F	E	74.7	EBL, EBT, EBR LOS F	C	30.6	NBL LOS E	C	26.4	NBL LOS E
University Ave / Huron Blvd	Traffic Signal	C	25.3	EBL LOS E	D	49.1	NBT, NBR, SBL, SBT LOS E EBL, WBL LOS F	B	17.3	WBL LOS E EBL LOS F	D	39.5	EBL, WBL, SBL LOS E	D	42.5	EBL LOS E WBL LOS F	C	33.7	WBL LOS F
Washington Ave / Walnut	New Traffic Signal	A	3.4		C	32.9	WBL LOS E	D	46.3	NBL, NBR, SBL, SBT, SBR LOS F	C	25.2		C	23.5		C	24.1	
Huron Blvd / Essex St	Traffic Signal	B	15.8		C	26.6	EBL LOS E WBL LOS F	B	18.2	WBL LOS E	B	18.1		B	15.4	WBL LOS E	B	16.4	
Fulton St / Oak St	Traffic Signal	B	17.7		C	32.7	EBL, EBT, WBL, WBT LOS E	B	19.1	NBL LOS E	C	25.3		C	20.2		B	18.7	
Huron Blvd / Fulton St	Traffic Signal	B	13.7		C	23.1	WBL LOS E	B	16.6		B	16.1	WBL LOS E	B	11.0	WBL, WBT LOS E	B	10.9	
Fulton St / Erie St	Traffic Signal	C	20.0		B	12.7	SBL LOS E	A	9.9		B	10.8		B	10.6		B	10.7	
Washington Ave / Ontario St	Differs	B	12.5					B	18.5	N LEG LOS F	D	34.7	S LEG LOS F	A	5.6	S LEG LOS D	A	1.2	N LEG & S LEG LOS A
University Ave / 25th St	Traffic Signal	C	20.1		D	36.8	WBL, WBT, NBT, SBL, SBT LOS E	B	13.3		B	16.0		B	18.8		B	13.4	

East Bank Traffic Study #3 East Bank Area Traffic Study – February 8, 2008

Introduction

The purpose of the area-wide traffic study is to understand the impacts at major intersections in the vicinity of the East Bank if it is proposed to create a pedestrian/transit mall on Washington Avenue and close a section of the street to traffic. This is a fast track study designed to provide stakeholders a review opportunity with the other ongoing analyses.

The results of this traffic study can be used by the project partners to evaluate potential impacts to key intersections in the area if Washington Avenue is converted to a pedestrian/transit mall.

Study Methodology

The following assumptions for the pedestrian/transit mall alternative were developed at a scoping meeting on January 24, 2008. The base analysis included the vehicle lane configurations of Alternative 17, which was also analyzed in Traffic Study 1.

- LRT runs at-grade down the center of Washington Avenue from the Washington Avenue bridge to Huron Blvd.
- Washington Avenue is closed to all vehicle traffic, except emergency vehicles, west of Church Street to Oak Street.
- One lane of traffic each way on Washington Avenue from Oak Street to Huron Blvd.
- Eastbound traffic from the Washington Avenue bridge is diverted to East River Road.
- Westbound traffic on Washington Avenue from Pleasant Street is allowed.
- Church Street is open to the north of Washington Avenue as a 2-way roadway. Church Street traffic is allowed to cross Washington Avenue. The study will also look at impacts if Church Street north of Washington Avenue stays closed.

- Union Street remains a one way street as it exists today, except that it is closed to all traffic from just south of the entrance of the Washington Avenue Parking Structure to Washington Avenue.
- Harvard Street becomes a 2-way roadway north of Washington Avenue. Harvard Street traffic is allowed to cross Washington Avenue.
- Walnut Street traffic is allowed to cross Washington Avenue.

Study Tasks and Evaluation

The following tasks were completed by the CCPO team based on the scoping meeting assumptions.

Task 1 - Define Study Limits

The study area is defined by the following intersections.

- Franklin Avenue/TH280
- University Avenue/TH280
- SE 15th Avenue/Como Avenue
- SE 4th Street/I-35W
- University Avenue/I-35W
- Washington Avenue/I-35W
- Cedar Avenue/Riverside Avenue
- Riverside Avenue/I-94
- East River Road/Franklin Avenue

The study area included identifying key intersections for analysis in the study. A total of 48 intersections were identified for evaluation within the study area.

1. University Ave/Huron Blvd
2. University Ave/Washington Ave
3. Washington Ave/Huron Blvd
4. Washington Ave/Ontario St
5. Washington Ave/Oak St
6. Washington Ave/Walnut St
7. Washington Ave/Harvard St
8. Washington Ave/Union St
9. Washington Ave/Church St
10. E River Rd/Washington Ave EB ramp
11. Huron Blvd/Fulton St
12. University Ave/27th Ave
13. University Ave/Eustis St

14. University Ave/Cromwell Ave
15. Franklin Ave/Eustis St
16. Franklin Ave/Cromwell Ave
17. Franklin Ave/E River Rd/27th Ave
18. Riverside Ave/9th St S/I-94 EB ramp
19. Riverside Ave/Butler Pl/I-94 WB ramp
20. 25th Ave S/9th St S/I-94 EB ramp
21. 25th Ave S/Butler Pl/I-94 WB ramp
22. Riverside Ave/25th Ave S
23. Riverside Ave/20th Ave S
24. Riverside Ave/19th Ave S
25. Riverside Ave/Cedar Ave
26. Cedar Ave/Washington Ave EB ramp
27. Cedar Ave/Washington Ave WB ramp
28. Cedar Ave/Washington Ave/15th Ave S (Seven Corners)
29. Washington Ave/I-35W NB ramp
30. Washington Ave/I-35W SB ramp
31. Washington Ave/19th Ave S/10th Ave SE
32. University Ave/I-35W NB ramp
33. University Ave/I-35W SB ramp
34. University Ave/10th Ave SE
35. University Ave/14th Ave SE
36. University Ave/15th Ave SE
37. University Ave/17th Ave SE
38. University Ave/Oak St
39. 4th St SE/Oak St
40. 4th St SE/17th Ave SE
41. 4th St SE/15th Ave SE
42. 4th St SE/14th Ave SE
43. 4th St SE/10th Ave SE
44. 4th St SE/I-35W SB ramp
45. 4th St SE/I-35W NB ramp
46. 15th Ave SE/Rollins Ave
47. 15th Ave SE/Como Ave SE
48. 15th Ave SE/5th Street

Task 2 - Data Collection

Data from previous East Bank traffic studies was used as the basis of this study. Additional data was obtained from other studies within the area, the City of Minneapolis, or additional data collection (if needed). The following is a list of data that was compiled for this study.

- Historic ADTs from the City (with I-35W Bridge in place).

- Existing PM Peak Hour counts (from SRF data or the City, with I-35W Bridge in place).
- 2005 SRF football stadium Synchro Model.
- Existing lane Configurations.
- Minneapolis/Hennepin County Capital Improvement Plans.

The traffic count data was assembled and reviewed within the study area for consistency. Some balancing of counts was required given the different time periods in which the data was collected.

Task 3 - 2030 Modeling and Volume Projections

The traffic volumes used for the study were projected 2030 intersection turning movement volumes. These volumes were developed based on data from the regional travel demand model. The following information was obtained to develop the 2030 intersection turning movement volumes.

- Base map of existing turning movement counts for the study area (part of Task 2).
- Average daily traffic volumes from study data and City of Minneapolis (part of Task 2).
- 2000 PM Peak Period network (2:30 to 6:00 PM) from the regional model.
- 2030 PM Peak Period base network (2:30 to 6:00 PM) from the regional model.
- 2030 PM Peak Period network (2:30 to 6:00 PM) with Ped/Transit Mall from the regional model.

Intersection turning movement volumes were developed from existing conditions to the 2030 design year. This provides a baseline for comparison of any proposed roadway modification plans.

The regional model produced assignments for a year 2030 average weekday PM peak period (from 2:30 to 6:00 PM) for the study area. This data was reviewed and developed into PM peak hour volumes based on “k” values from tube counts on the area roadway system. The average k value for the PM peak hour was 0.33 of the PM peak period generated in the travel demand model.

The 2030 PM peak hour volumes were then reviewed against existing tube and turning movement counts on the roadway network. There were several significant inconsistencies between the current traffic patterns volumes and the 2030 model projections. To determine whether this was due to future changes in the roadway network or traffic generation in the model, the results of the 2000 PM peak period from the regional travel demand model were also evaluated. After reviewing the results, the methodology to develop the 2030 PM peak hour volumes was developed as follows:

- Link volumes from the 2000 PM peak period and 2030 PM peak period were used to develop growth rates for each roadway link in the study area.
- The calculated growth rates were applied to each roadway link in the existing network.
- Projected turning movement volumes for 2030 were developed based on the growth rates and the existing turning movement counts to reflect existing traffic patterns.
- The regional travel demand model was not very refined in the East Bank area, so several links (e.g., Church St, Union St, Harvard St, Walnut St) were not included in the model. A 0.25% per year growth rate was assumed for these links.
- Turning movement volumes required balancing at some locations to account for differences in growth rates on adjacent links or to account for a link that was not in the regional travel demand model.

The travel demand model provided 2030 PM Peak period link volumes for an alternative with Washington Avenue closed to all vehicle traffic from west of Church Street to west of Oak Street. For the Ped/Transit Mall alternative, the following was assumed for the travel demand model:

- All vehicle traffic was removed from Washington Avenue from west of Church Street to west of Oak Street. The travel demand model rerouted these trips to other links on the network.
- For this traffic study, it was assumed that all buses were rerouted with the passenger vehicles. (This will require more detailed evaluation at a later date).

Task 4 - 2030 Base Analysis

The 2030 Base model for the East Bank area was evaluated using Synchro traffic analysis software. Synchro analysis software uses Highway Capacity Manual (HCM) procedures to evaluate traffic signal and urban street operations in a static condition. With Synchro, a model is built to accurately reflect the urban street scenario of an alternative. This analysis was chosen to allow for a large number of intersections to be evaluated in a short time frame.

The following is a listing of inputs into the Synchro model for the 2030 Base Analysis:

- 2030 Base key intersection turning movement volumes with Alternative 17 geometrics.
- The signal timings for this evaluation were assumed to be optimized. A 3.5 second yellow and 2.0 seconds all red were assumed at each intersection consistent with standard City of Minneapolis timing.
- Time in the signal cycle is allocated on Washington Avenue to provide for LRT movement. At the University Ave/Washington Ave/Huron Blvd intersections, this requires a 43-second phase in which only the eastbound through and right-turn

movements from Washington Avenue have a green indication concurrent with the LR T phase.

Task 5 – 2030 Design Year Analysis with Pedestrian/Transit Mall (Washington Avenue Closed)

The 2030 Ped/Transit Mall alternative for the East Bank area was evaluated using Synchro traffic analysis software. The assumptions listed in the study methodology section were included in this model. In addition, the following inputs were included in the Synchro model:

- 2030 Ped/Transit Mall intersection turning movement volumes (with diversion for Washington Avenue closure).
- The signal timings for this evaluation were assumed to be optimized. A 3.5 second yellow and 2.0 seconds all red are assumed at each intersection, consistent with standard City of Minneapolis timing.
- Time in the signal cycle was allocated on Washington Avenue to provide for LRT movement. At the University Ave/Washington Ave/Huron Blvd intersections, this required a 43-second phase in which only the eastbound through and right-turn movements from Washington Avenue have a green signal indication concurrent with the LRT phase.
- Evaluation with Church Street open to traffic.

The following models were developed and analyzed using Synchro software. A summary of the level of service and delay for the 48 key intersections is included in the attached table for the following alternatives:

- 2030 Base Analysis
- 2030 Pedestrian/Transit Mall (with Church Street open)

Task 6 - Evaluation of Impacts

This task included reviewing results of the analysis and identify intersections of concern, based on changes between 2030 Base and 2030 Pedestrian/Transit Mall. The impact evaluation included the following subtasks:

- Prepare a summary of the Synchro analysis for the 2030 Base Analysis. This included a presentation of the overall intersection level of service for each of the study area intersections. Each intersection was evaluated to include individual movement LOS and delay and other measures of effectiveness evaluated by Synchro software.

- Prepare a summary of the Synchro analysis for the 2030 Ped/Transit Mall alternative. This included a presentation of the overall intersection level of service for each of the study area intersections.
- Identify intersection where the level of service has deteriorated and determine if it has become an “intersection of concern” (see below for details).

Alternative Analysis Results

A summary table of the results of all alternatives with the intersection level of service and delay for each study area intersection is attached (Table 3). The needs assessment for the key intersections was determined by comparing the intersection LOS for the 2030 Ped/Transit Mall with the intersection LOS 2030 Base and this resulted in identifying intersections of concern (Table 2). The following principles were used for the intersection needs assessment (Table 1):

Table 1 - Principles for Evaluating 2030 Impacts

<i>Intersection LOS</i>		<i>Action/Next Steps</i>
<i>2030 Base</i>	<i>2030 Ped/Transit Mall</i>	
A, B, or C	A, B, or C	None – good to excellent LOS
A, B, or C	D	None – Acceptable LOS in peak hour
D	D	None – Acceptable LOS in peak hour
A, B, C, or D	E or F	Needs assessment to be completed and may require additional evaluation
E	E	None – LOS is not degraded by Transit Mall
F	F	None – LOS is not degraded by Transit Mall
E	F	Needs assessment to be completed and may require additional evaluation

Table 2 - Intersections of Concern

<i>Intersection</i>	<i>2030 Base Analysis LOS</i>	<i>2030 Ped/Transit Mall LOS</i>
Franklin Ave/Cromwell Ave	C	F
Riverside Ave/20 th Avenue S	D	F
Riverside Ave/19 th Avenue S	D	E
Riverside Ave/Cedar Ave	D	F

**Table 3
East Bank Alignment Area Wide Traffic Study
Key Intersection Level of Service and Delay - February 8, 2008**

**Central Corridor
Light Rail Transit**

<i>Intersection</i>			<i>2030 Base Analysis</i>		<i>2030 Ped/Transit Mall Church Street Open</i>	
			LOS	Delay	LOS	Delay
1	University Avenue	Huron Blvd	D	40.2	C	27.3
2	University Avenue	Washington Avenue	B	13.2	A	4.8
3	Washington Avenue	Huron Blvd	B	15.2	B	18.4
4	Washington Avenue	Ontario Street	B	16.8	B	10.7
5	Washington Avenue	Oak Street	C	22.6	B	16.6
6	Washington Avenue	Walnut Street	B	11.4	A	1.1
7	Washington Avenue	Harvard Street	C	22.8	A	1.5
8	Washington Avenue	Union Street	B	10.7		
9	Washington Avenue	Church Street	B	11.8	A	1.5
10	East River Road	Washington Ave EB Ramp	A	2.1	C	21.6
11	Huron Blvd	Fulton Street	B	17.3	B	19.4
12	University Avenue	27th Avenue	C	24.8	B	16.6
13	University Avenue	Eustis Street	D	41.3	D	36.2
14	University Avenue	Cromwell Avenue	C	21.1	C	22.1
15	Franklin Avenue	Eustis Street	B	18.0	C	24.4
16	Franklin Avenue	Cromwell Avenue	C	34.5	F	93.7
17	Franklin Avenue	East River Rd/27th Ave	F	200+	F	200+
18	Riverside Avenue	9th St/I-94 EB Ramp	C	20.9	C	21.5
19	Riverside Avenue	Butler Pl/I-94 WB Ramp	D	48.8	D	52.1
20	25th Avenue S	9th St/I-94 EB Ramp	B	19.8	C	21.9
21	25th Avenue S	Butler Pl/I-94 WB Ramp	B	14.7	C	23.2
22	Riverside Avenue	25th Avenue S	D	39.3	C	33.1
23	Riverside Avenue	20th Avenue S	D	54.8	F	97.1
24	Riverside Avenue	19th Avenue S	D	38.5	E	75.7
25	Riverside Avenue	Cedar Avenue	D	36.4	F	89.8
26	Cedar Avenue	Washington Ave EB Ramp	B	19.4	C	33.6
27	Cedar Avenue	Washington Ave WB Ramp	C	34.4	B	18.0
28	Cedar Avenue	Washington Ave/15th Ave S	F	123.4	E	65.9
29	Washington Avenue	I-35W NB Ramp	F	200+	F	200+
30	Washington Avenue	I-35W SB Ramp	F	200+	F	200+
31	Washington Avenue	19th Ave S/10th Ave SE	C	27.1	C	25.3
32	University Avenue	I-35W NB Ramp	B	12.3	B	13.9
33	University Avenue	I-35W SB Ramp	C	20.3	C	24.7
34	University Avenue	10th Avenue SE	F	200+	F	200+

Table 3
East Bank Alignment Area Wide Traffic Study
Key Intersection Level of Service and Delay - February 8, 2008

Central Corridor
Light Rail Transit

<i>Intersection</i>			<i>2030 Base Analysis</i>		<i>2030 Ped/Transit Mall Church Street Open</i>	
			LOS	Delay	LOS	Delay
35	University Avenue	14th Avenue SE	B	14.2	B	10.6
36	University Avenue	15th Avenue SE	B	14.7	B	17.3
37	University Avenue	17th Avenue SE	B	16.6	D	53.4
38	University Avenue	Oak Street	C	24.4	C	33.0
39	4th Street SE	Oak Street	B	17.1	B	13.2
40	4th Street SE	17th Avenue SE	C	20.8	C	32.6
41	4th Street SE	15th Avenue SE	B	19.7	B	20.0
42	4th Street SE	14th Avenue SE	B	13.4	C	20.9
43	4th Street SE	10th Avenue SE	F	195.7	F	198.6
44	4th Street SE	I-35W SB Ramp	B	14.4	B	15.6
45	4th Street SE	I-35W NB Ramp	C	20.6	C	21.9
46	15th Avenue SE	Rollins Avenue	C	24.6	C	25.0
47	15th Avenue SE	Como Avenue SE	D	44.4	D	39.5
48	15th Avenue SE	5th Street	C	23.7	C	25.1

East Bank Area Traffic Study #3.1 East River Road Traffic Volume Projections

Introduction

The purpose of this study is to use select results from the East Bank area-wide traffic study and focus on impacts to East River Parkway. The evaluation is based on existing and 2030 traffic volume projections for the following conditions.

- (1) Existing Average Daily Traffic Volumes (2005) on East River Parkway.
- (2) 2030 Baseline volume projections without project (using growth rates from the regional travel demand model generated under East Bank Traffic Study #3).
- (3) 2030 Base traffic without project (using City of Minneapolis historic 0.5% per year growth rate).
- (4) 2030 LRT with pedestrian/transit mall from Pleasant Avenue to Oak Street.
- (5) 2030 LRT with pedestrian/transit mall from Cedar Avenue to Oak Street.

Proposed Study Tasks

1. Traffic Counts will be obtained at the following locations:

a. Tube Counts (for development of Average Daily Traffic volumes)

- East River Pkwy between Washington Ave and Arlington St
- East River Pkwy between Washington Ave and Harvard St

Existing City tube counts on East River Pkwy between Franklin Ave and Superior St and between Fulton St and Oak St will also be used.

b. PM Peak Hour turn movement counts

- East. River Pkwy/Harvard St.
- East. River Pkwy/Fulton St.
- East. River Pkwy/Oak St.

Existing City turn movement counts on East River Pkwy at Arlington St and Washington Ave EB ramp will also be used.

2. Project Traffic volumes to 2030

Projected 2030 PM peak hour and Average Daily Traffic (ADT) volumes for conditions (2) 2030 Baseline and (4) 2030 LRT with pedestrian/transit mall from Pleasant Avenue to Oak Street will be used from the East Bank Traffic Study #3 (data projected from the regional travel demand model).

Projected 2030 PM peak hour and ADT volumes for condition (3) Base will be projected based on City of Minneapolis historic growth rate of 0.5% per year. The results of these projections will be used as a comparison to (2) 2030 Baseline data from the regional travel demand model.

Projected 2030 PM peak hour and ADT volumes for condition (5) LRT with pedestrian/transit mall from Cedar Avenue to Oak Street will be projected based on data from an additional run of the regional travel demand model with Washington Ave removed from Cedar Ave to Oak Street.

3. Average Daily Traffic Map

An ADT map will be created as an exhibit to provide information on changes in traffic volumes on East River Pkwy under the five conditions listed above.

The results of this traffic study can be used by the project partners to evaluate potential impacts to East River Parkway under scenarios where Washington Avenue is converted to a pedestrian/transit mall.

East Bank Area Traffic Study #4 U of M Traffic Circulation Study

Introduction

The purpose of the U of M Traffic Circulation traffic study is to continue the work of the East Bank Traffic Study #3 by evaluating the impacts to local intersections within the U of M East Bank campus area. The evaluation is based on a pedestrian/transit mall on Washington Avenue from Pleasant Avenue to Oak Street.

The following assumptions are included in the roadway network:

- LRT runs at-grade down the center of Washington Avenue from the Washington Avenue bridge to Huron Blvd.
- Washington Avenue is closed to all vehicle traffic, except emergency vehicles and buses, from west of Church Street to Oak Street.
- One lane of traffic in each direction on Washington Avenue from Oak Street to Huron Blvd.
- Eastbound traffic from the Washington Avenue bridge is diverted to East River Parkway.
- Westbound traffic from Pleasant Street to Washington Avenue is allowed.
- Church Street is open to traffic north of Washington Avenue as a 2-way roadway. Church Street traffic is allowed to cross Washington Avenue
- Union Street remains a one-way southbound street as it exists today, except that it is closed to all traffic just south of the entrance to the Washington Avenue Parking Ramp.
- Harvard Street becomes a 2-way roadway north of Washington Avenue. Harvard Street traffic is allowed to cross Washington Avenue.
- Walnut Street traffic is allowed to cross Washington Avenue.
- Oak Street traffic is allowed to cross Washington Avenue.
- Ontario Street is converted to right-in, right-out on the north and south legs of the intersection.

Proposed Study Tasks

1. Additional turn movement counts will be obtained for the PM peak hour at the following intersections:

- University Ave SE/14th Ave SE
- University Ave SE/15th Ave SE (Pleasant Ave)
- University Ave SE/Church St (17th Ave SE)
- 4th Ave SE/17th Ave SE
- University Ave/Walnut St (extension)
- Pleasant Ave/Arlington St
- Church St/Pillsbury Dr
- Union St/Beacon St
- Harvard St/Delaware Ave

The PM peak hour counts collected for Traffic Study #3.1 will also be used as part of this study.

2. Existing Conditions

- A summary of the existing PM peak hour turning movement counts will be prepared.

3. Existing Roadway Network (adjusted for closure of Washington Avenue)

- Turn movement counts will be adjusted or rerouted to account for changes in traffic patterns under a pedestrian/transit mall scenario on Washington Avenue.
- Changes in approach volumes will be reviewed for capacity and safety with areas of concern identified.
- If needed, a Synchro analysis will be performed at intersections of concern.

4. 2030 Traffic Analysis (if needed based on the existing evaluation)

- 2030 PM peak hour turning movement volumes will be projected from existing volumes (Baseline and LRT with pedestrian/transit mall).
- Changes in approach volumes will be reviewed and areas of concern identified.
- If needed, a Synchro analysis will be performed at intersections of concern.

The results of this traffic study can be used by the project partners to evaluate potential impacts to local intersections on the U of M East Bank campus area if Washington Avenue is converted to a pedestrian/transit mall.