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Subject: Traffic Signal Warrants Analysis
Superior Street from 6th Avenue West to 4th Avenue East

Introduction

As requested, SRF has completed a traffic signal warrants analysis covering Superior Street from 6th Avenue West to 4th Avenue East in downtown Duluth. The purpose of this analysis is to provide recommendations for intersection traffic control associated with a planned 2015 street reconstruction project. Hourly vehicular approach and pedestrian volumes for this analysis were gathered by SRF Consulting Group, Inc. during the week of October 21, 2013. Field observations were also conducted to identify roadway characteristics within the study area (i.e., roadway geometry, posted speed limits, on-street parking types and locations, sightlines, locations of transit stops, etc.).

Existing Conditions

The following intersections along the subject corridor are currently signalized:

- Superior Street W/6th Avenue W
- Superior Street W/5th Avenue W
- Superior Street W/4th Avenue W
- Superior Street W/3rd Avenue W
- Superior Street W/2nd Avenue W
- Superior Street W/1st Avenue W
- Superior Street/Lake Avenue
- Superior Street E/1st Avenue E
- Superior Street E/2nd Avenue E
- Superior Street E/3rd Avenue E

Two additional intersections, Superior Street East at Michigan Street and Superior Street East at 4th Avenue East, are currently side-street stop sign controlled. Based on traffic volumes, operational analysis, and evidence that there has not been a significant crash problem with current intersection control, it is recommended that these two intersections remain controlled by stop signs on the cross-street. Traffic signal warrants analysis herein focuses on the ten currently signalized intersections noted above.

Signal Warrants Analysis

Below is a summary of vehicle volume-based traffic signal warrants analysis for each of the currently signalized intersections. Only one intersection, Superior Street at Lake Avenue, meets any of these warrants.

Traffic Signal Warrants Analysis Summary – Hours Meeting Warrant

	Warrant 1A (8 hours required)	Warrant 1B (8 hours required)	Warrant 1C (8 hours required)	Warrant 2 (4 hours required)	Warrant 3 (1 hour required)
Superior St W/6th Ave W	3	0	1	1	0
Superior St W/5th Ave W	1	0	0	0	0
Superior St W/4th Ave W	0	0	0	0	0
Superior St W/3rd Ave W	0	0	0	0	0
Superior St W/2nd Ave W	3	0	0	0	0
Superior St W/1st Ave W	0	0	0	0	0
Superior St/Lake Ave	11*	1	8*	7*	3*
Superior St E/1st Ave E	0	3	1	1	0
Superior St E/2nd Ave E	0	0	0	0	0
Superior St E/3rd Ave E	0	1	0	0	0

*** = warrant met**

In addition to the vehicular volume warrants, each intersection was examined against the pedestrian volume warrant. Although there are significant pedestrian and bicycle volumes along the Superior Street corridor, as would be expected in a downtown area, the combination of vehicle and pedestrian volumes is not high enough at any of the subject intersections to satisfy the requirements of that warrant. Therefore, only one intersection, Superior Street at Lake Avenue, is warranted based on meeting traffic signal warrants.

Signal Justification

Despite the inability to meet volume-based signal warrants, there are other conditions unique to downtown Duluth, and the Superior Street corridor in particular, that warrant consideration when evaluating the subject intersections for the appropriate type of intersection control. Conditions that apply to the entire corridor from 6th Avenue West through 3rd Avenue East include:

- All of the intersections are currently signalized, operate at a high level of service, and provide a safe environment for allocating right-of-way to the various users of the corridor.
- The existence of on-street parking, in particular angled parking, necessitates significant gaps in mainline traffic in order to allow drivers to safely make parking maneuvers. Traffic signals can create these gaps.
- Cross-street profile grades are significant in Duluth. An uphill vehicle needs a larger gap in mainline traffic to cross or turn onto Superior Street than if the grades were flatter, especially in winter.
- With hospitals and a police station in close proximity to the corridor, traffic signals with emergency vehicle preemption are a valuable asset to help emergency vehicles move safely and efficiently across and along Superior Street.
- The city desires to attract more pedestrian and bicycle traffic to the Superior Street corridor. Traffic signals create a safer environment for accommodating these forms of transportation in a downtown area, where there are numerous distractions to motorists.
- Although volume warrants were not met on an October weekday, volumes are expected to be higher in the summer, on some weekends and when festivals, conventions, concerts or sporting events are in town.
- Superior Street is the key transit corridor in downtown Duluth, with numerous transit stops that encourage pedestrian traffic. When the new Duluth Transit Authority transit hub on Michigan Street is completed, there will be some rerouting of buses in downtown Duluth. The likely result will be more buses turning onto and off of Superior Street. These bus maneuvers will be more easily and safely made with signalized control at the intersections along Superior Street.

Sightline constraints unique to each intersection are as follows:

- Superior Street W/6th Avenue W – building corner in SE quadrant, street furniture in NE quadrant, retaining walls in SW and NW quadrants
- Superior Street W/5th Avenue W – on-street parking in SW quadrant, street landscaping in NE quadrant

- Superior Street W/4th Avenue W – building corners all four quadrants, on-street parking in SW and NE quadrants
- Superior Street W/3rd Avenue W – building corners and on-street parking all four quadrants, street furniture in SE quadrant
- Superior Street W/2nd Avenue W – on-street parking in NW and NE quadrants, street furniture in NW quadrant, loading zone in NE quadrant
- Superior Street W/1st Avenue W – building corners in SW and SE quadrants, on-street parking in SW quadrant
- Superior Street E/1st Avenue E – building corners all four quadrants, on-street parking in SW and NE quadrants, bus stop shelter in SE quadrant
- Superior Street E/2nd Avenue E – building corners in SW, NE and NW quadrants, on-street parking in SE, NW and NE quadrants
- Superior Street E/3rd Avenue E – building corners and on-street parking in all four quadrants

CONCLUSION

Because of the conditions common to all of the subject intersections, as well as the intersection-specific sightline constraints listed above, and because the existing traffic signal operations have demonstrated a high level of service and a relatively safe environment for all transportation modes, continued signalization is justified at each intersection along Superior Street from 6th Avenue West through 3rd Avenue East. Further, it is recommended that the Superior Street East intersections with Michigan Street and 4th Avenue East continue to be operated with side-street stop sign control.