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Subject: Northern Superior – Winter Street Traffic Signal and Railroad Operations

INTRODUCTION

The purpose of this technical memorandum is to summarize the conditions and traffic operations at several intersections proximate to the at-grade railroad crossing in north Superior. Analysis and investigation was focused on the area around Tower Avenue (SH 35) and Hammond Avenue where they intersect Broadway Street, Winter Street (N 9th Street) and at-grade railroad tracks (see Figure 1).

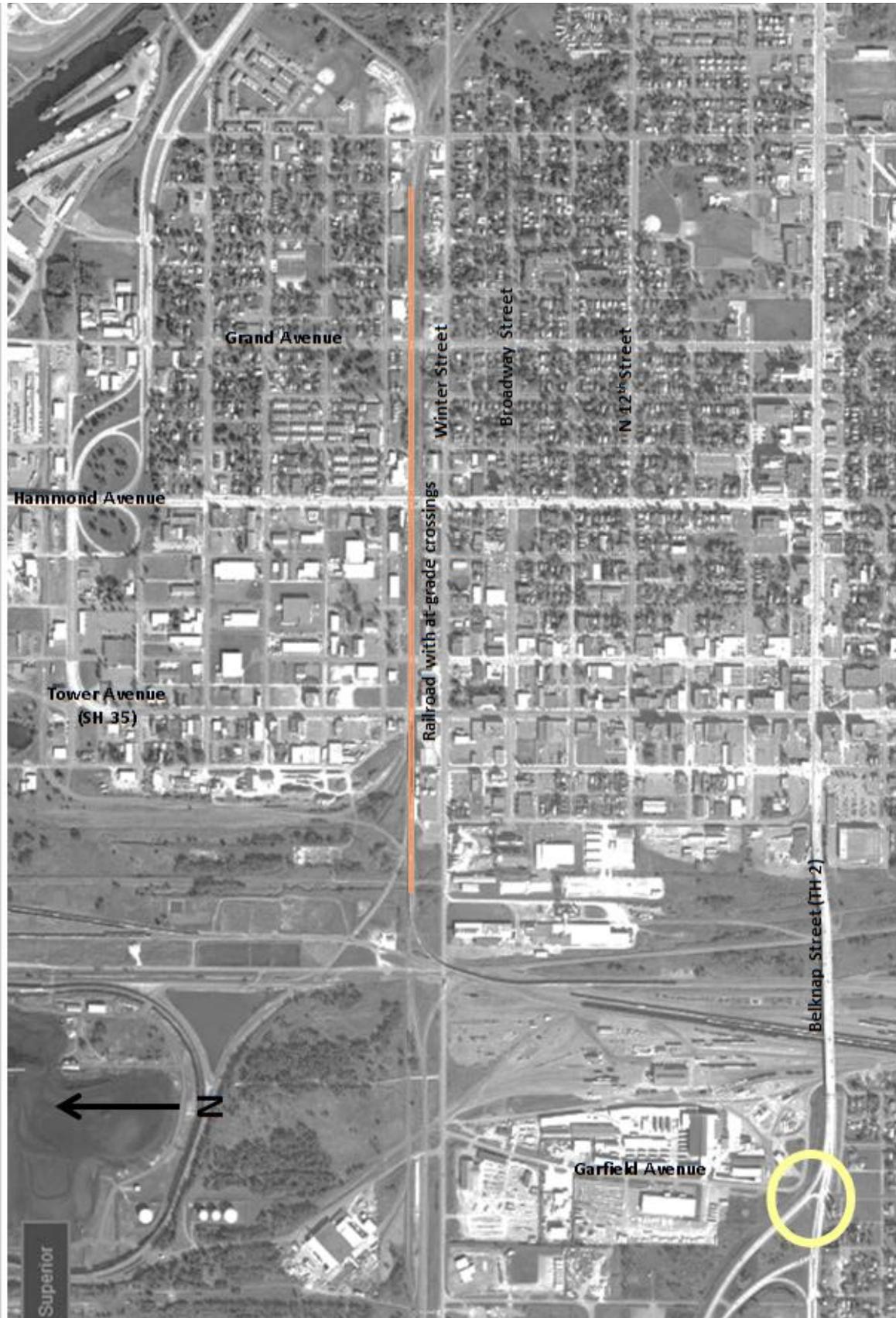
There is a pair of railroad tracks that runs east-west across the northern half of Superior from the major rail operations on the west side to the ports on the east, and farther on to the east and south. These tracks have at-grade crossings with the primary north-south streets of Tower Avenue, Ogden Avenue, Hammond Avenue, Grand Avenue and Catlin Avenue. USH 53 (East 2nd Street) has the only grade separated crossing of railroad tracks north of Winter Street. The crossings at Tower and Hammond are controlled with flashing lights and gates, whereas the crossings at Ogden, Grand and Catlin only use flashing lights. Winter Streets crossing with the tracks as the head to the southeast are controlled only by flashing lights as well.

Figure 2 shows a more detailed picture of the study area, including the location where the new roundabout will be constructed at Belknap Street (USH 2) and Garfield Avenue.

Figure 1. Superior, WI Area Overview



Figure 2. Project Area



INTERSECTION ANALYSIS

The primary change in the study area is the installation of traffic signals at the intersection of Tower Avenue and Hammond Avenue with Winter Street. Currently, the intersections of Tower Avenue and Hammond Avenue and Broadway Street, one block to the south, are traffic signal controlled. These traffic signals will be removed, leaving the Broadway intersections as minor-approach (Broadway Street) stop controlled. One of the primary purposes for the 'movement' of these traffic signals is to coordinate the traffic signal controlled intersections with the railroad operations, which is also supplemented by the benefits of having the designated truck route signal controlled.

For the purpose of this study, intersection analyses were performed for the Broadway and Winter Street intersections with both Tower and Hammond Avenues. The analyses were performed using Synchro7, a traffic operations analysis software package that implements the methodologies of the Highway Capacity Manual (HCM).

Intersection counts were collected in 2010. As in previous studies in the Superior area, a zero growth factor was applied to the counts based on historical and expected growth rates.

The findings of the intersection analyses showed that under the existing control all approaches of the traffic signal controlled Broadway Street intersections operate at LOS B or better. The minor approach stop controlled Winter Street intersections operate at LOS C or better. The analyses showed that when the traffic signals are moved to Winter Street and the Broadway Street intersections return to minor-approach stop control, the operations were reversed as well; LOS B or better for the Winter Street intersections, and LOS C for the stop controlled Broadway Street approaches.

There is a great deal of reserve capacity at the Winter Street intersections, so that even doubling or tripling the Winter Street traffic volumes, the intersection would still operate at acceptable conditions. This shows that if there is redistribution of traffic due to the movement of the signal, or changes in traffic patterns due to the addition of the Garfield and Belknap roundabout, the traffic signal controlled Winter Street intersections will still perform in satisfactorily.

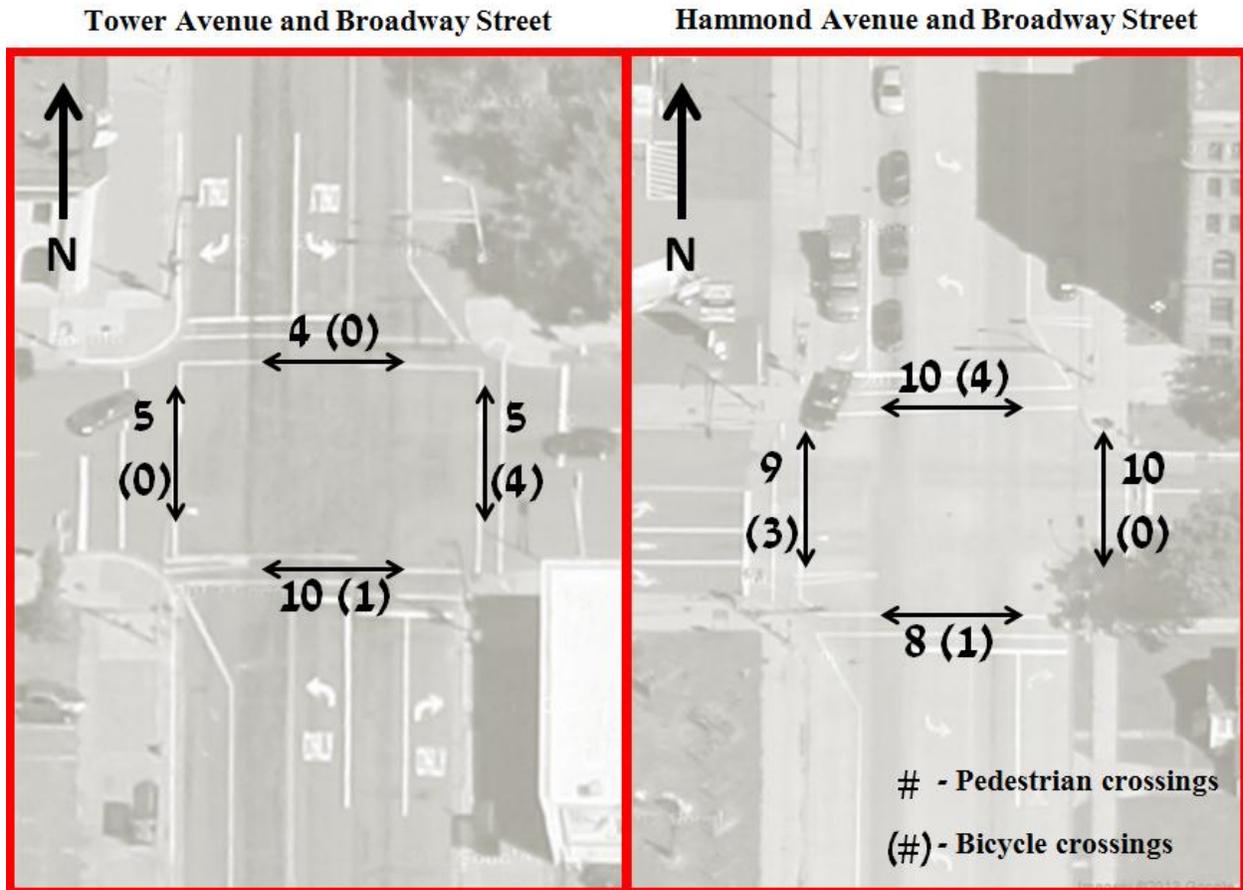
PEDESTRIAN AND BICYCLE OPERATIONS

One concern with the movement of the traffic signals, and thus controlled crossings of both Tower and Hammond Avenues, is that the pedestrian and bicycle movements will be disrupted. Pedestrian and bicycle counts were collected at the Broadway Street intersections during the p.m. peak hour in June 2012. These counts are shown in Figure 3.

The pedestrian movements are not high, and did not affect signal operations at the Broadway Street intersection, nor will they at Winter Street. The concern however, is whether those pedestrians used to crossing at Broadway will now cross Tower and Hammond Avenues at the Winter Street signals. If not, there is the possibility that these pedestrians will cross mid-block, or at intersections without painted crosswalks.

Tower Avenue currently has painted crosswalks at every minor cross-street, though it will be undergoing reconstruction in the near future. Hammond Avenue has painted crosswalks at minor cross-streets every two blocks (not at 8th, 11th and 13th Streets).

Figure 3. P.M. Peak Hour Pedestrian and Bicycle Volumes



RAILROAD OPERATIONS

One of the primary concerns with the proximity of the traffic signal controlled Winter Street intersections to the railroad tracks to the north is coordination of the signal with the railroad signals, and queuing of vehicles. With proper coordination, the north approach of the intersections will be cleared at the time the crossing gates are lowered to eliminate any queue that may conflict with the oncoming train. Eastbound and westbound thru traffic will be allowed to proceed while the gates are down, with the exception of eastbound left turns and westbound right turns.

Problems will arise if there is not storage space for vehicles waiting to make these movements. It is recommended, if there is room on Winter Street, to provide exclusive turn lanes for eastbound left turns and westbound right turns. In order to do this, some parking restriction may need to be posted near the intersection as well. If these storage bays are not in place, a stopped vehicle could block other traffic on Winter Street, and create additional unnecessary queuing and/or unsafe conditions of motorists trying to pass stopped vehicles.

OTHER POTENTIAL ENHANCEMENTS

In order to warn motorists of stopped or slowing conditions, and to give advanced warning to those whose route continues to the southeast, a Dynamic Message Signs (DMS) may be useful to provide safer less congested conditions. Potential locations for DMS may be on southbound I-535 approaching Hammond Avenue from Duluth, and USH 2/USH 53 on the southeast side of the city south of Belknap). Simple signs could be blank out type signs that are activated when trains are

crossing. Larger DMS could notify motorists of trains crossing north Superior and expected delays, or have messages instructing through motorists to use USH 53 to bypass delays. The latter type of message may be tricky, as it would only be directed at motorists whose destination is to the southeast, and not in or around downtown Superior.

SUMMARY AND CONSIDERATIONS

Intersection Operation with Change of Traffic Signal Location

- As was the condition at the traffic signal controlled Broadway Street intersections, Winter Street will operate acceptably with a great deal of reserve capacity when traffic signals are installed at the Tower Avenue and Hammond Avenue intersections.
- Broadway Street will operate acceptable with minor approach stop control at the Tower Avenue and Hammond Avenue intersections.
- Monitoring of the coordination between the traffic signals and railroad signals may be useful in determining the appropriate operation of the traffic signals to minimize delay and queuing, and to provide the safest conditions for motorists and trains.

Pedestrians and Bicycle Operations

- The pedestrian and bicycle movements collected at the Broadway Street intersections are fairly minor, and will be of little to no effect of signal operations if the move to the traffic signal controlled Winter Street intersections.
- Concerns arise if these movements do not move to the Winter Street intersection, and the pedestrians (primarily) cross at unmarked or mid-block locations.
- It is recommended to monitor the pedestrian movements across Tower Avenue and Hammond Avenue.
 - If there becomes a high volume of pedestrians crossing Tower and Hammond Avenues at uncontrolled locations, there may be basis for investigating the use of pedestrian activated flashers to provide a safer crossing.

Potential ITS Enhancement

- With only one grade separated roadway crossing (USH 53 east of Catlin Avenue) Dynamic Message Signs (DMS) may be a solution to alert traffic of an expected queue on Hammond and Tower Avenues and impeding delays at the north-south crossings of the railroad tracks.
 - Some type of DMS on Southbound I-535 approaching Hammond Avenue will alert motorists to slow down, be aware of delays and queuing and/or notify them of an alternate route.
 - Another potential location for DMS could be on USH 2/USH 53 on the southeast side of Superior south of Belknap Street.

Heavy Vehicle Operations

- Winter Street is the designated truck route across northern Superior. The addition of the roundabout at Garfield Avenue and USH 2 on the west side of superior at the terminus of the Bong Bridge may increase the volume of heavy vehicles on Winter Street.
- It may be useful to monitor volumes of trucks on Winter Street vs. Belknap following the installation of the Garfield roundabout and the movement of the traffic signals as an increase may influence the queuing at the Tower and Hammond Avenue intersections during train crossings, as well as vehicular/pedestrian movements in the area.

Additional Information

- The *Superior Bong-Blatnik Bridge Traffic Analysis* (submitted to WisDOT September, 2010) included an analysis of Hammond Avenue crossing the railroad tracks, and what the expected delays and queuing are based on different durations of trains crossing Hammond Avenue.