DESIGN VEHICLE MEMORANDUM

TO: Jesse Vlaminck, MnDOT D8 Project Manager

FROM: Nikki Farrington, SEH Project Manger

Date: 9/9/2021

Subject: SP 4204-40 – TH 19 / College Drive Reconstruction - Design Vehicle Memo

Purpose

The purpose of this memo is to document the decision-making process and the design vehicles used in the development of the layout for the TH 19/College Drive reconstruction project in Marshall, Minnesota. The information in this memo will help guide the design of the fifteen intersections on TH 19/College Drive. This memo includes discussions on existing, 30%, 60% and final layout design turning movements.

Background

The Minnesota Department of Transportation is planning to reconstruct Trunk Highway 19, from 4th Street to Bruce Street.

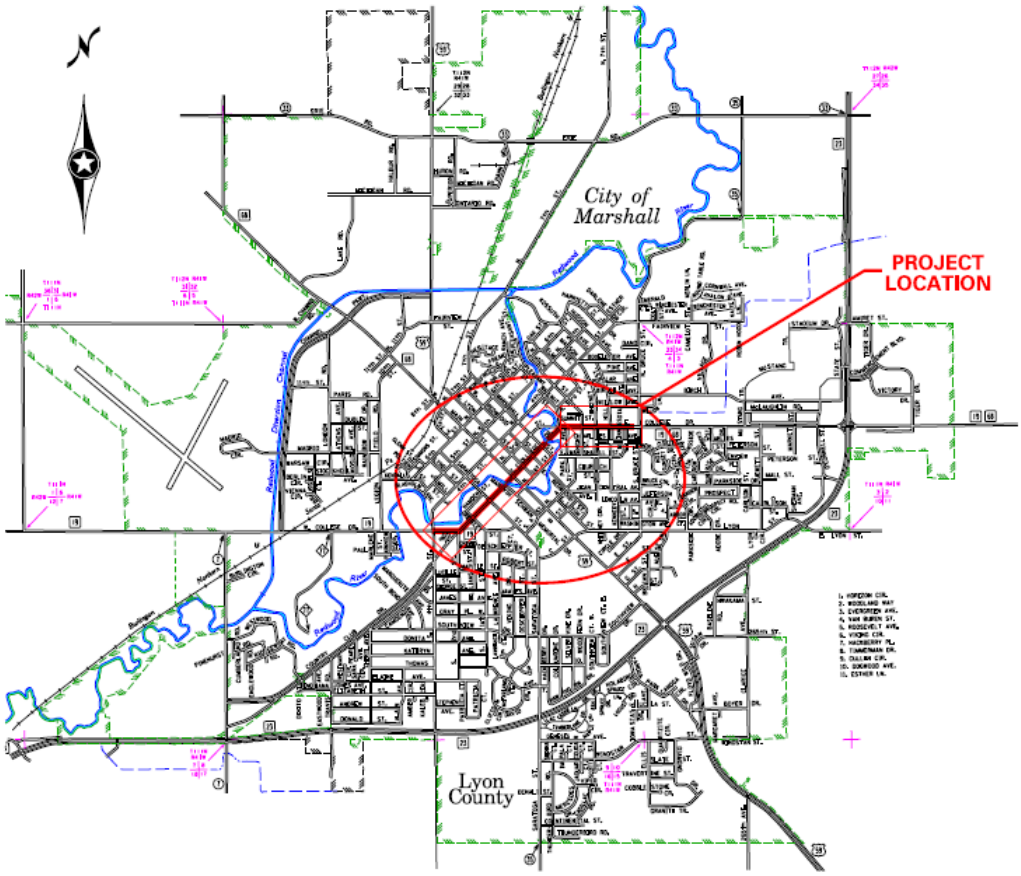


Figure 1 – Project Location

Methodology

The design vehicles most used for this corridor are the AASHTO 2018 S-BUS-36, AASHTO 2018 SU-40, and AASHTO 2018 WB-67 Mod. These vehicles represent the largest high frequency vehicles that travel through these intersections. Design information for each vehicle can be found in Figure 2 through 5.

The corridor also accommodates oversize overweight (OSOW) vehicles. A review of permits between 2014 and 2019 showed the intersections of TH 19/Main Street (US 59) and TH 19/Country Club Drive accommodate turning oversize overweight (OSOW) vehicles. For this analysis WisDOT's OSOW Wind Tower upper-Mid Section vehicle was used. Vehicle information can be found in Figure 6. More information on the permit and OSOW vehicle sizes can be found in Appendix A.

Table 1 - Design Vehicles Used for Layout

	AASHTO 2018 S-BUS-36 *(See Figure 2)*	*AASHTO 2018 WB-62* *(See Figure 3)*	*AASHTO 2018 WB-67 Mod* *(See Figure 4)*	*WisDOT OSOW Wind Turbine Upper-Mid Section 1 Transport Special* *(See Figure 5)*
4th Street	X			
Country Club Drive		X		X
Greeley Street	X			
Saratoga Street	X		X	
Marvin Schwan Drive	X			
Main Street (US 59)	X		X	X
Lyon Street	X		X	
Redwood Street	X			
Marshall Street	X			
N. 3rd Street	X			
Park Avenue	X			
High Street	X			
Whitney Street	X			
Hill Street	X			
Minnesota Street	X			

Figure 2: AASHTO 2018 S-BUS-36 vehicle diagram.

Figure 3: AASHTO 2018 WB-62 vehicle diagram.

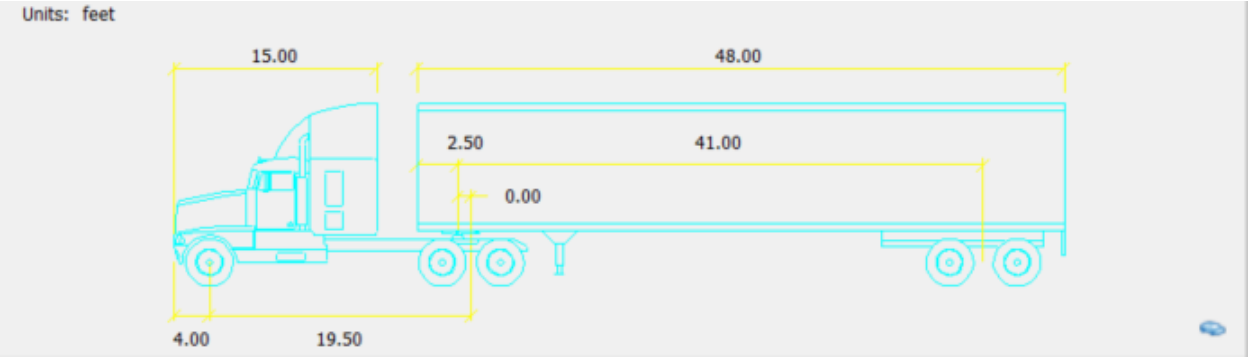


Figure 4: Modified AASHTO 2018 WB-67 vehicle diagram.

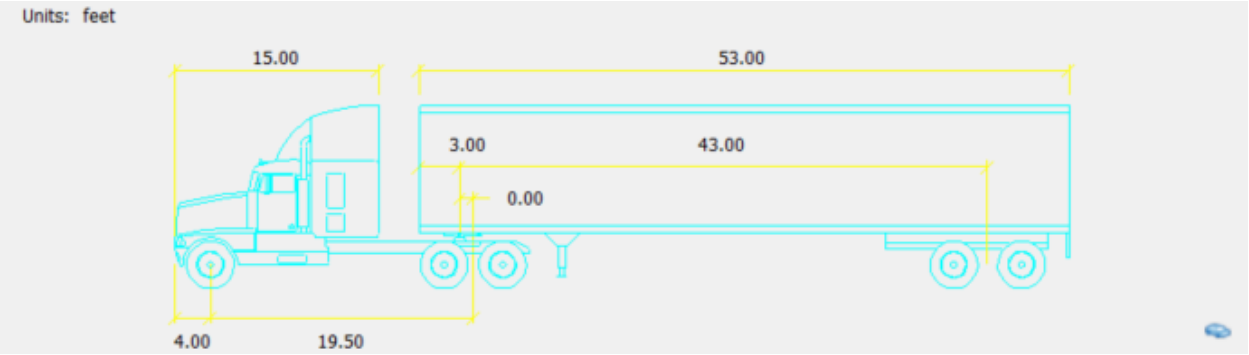


Figure 5: WisDOT OSOW Wind Tower upper-Mid Section vehicle diagram.

General Layout Updates

From Country Club Drive through to the transition at West Redwood St, the curb and lanes lines of TH 19 have been shifted one foot south. No changes were made to lane widths unless otherwise noted. This was done based on a comment to provide a more symmetrical boulevard of 6 feet on both sides of TH 19. The alignment has not shifted.

The sidewalk along the south side of TH 19 from Greely St east to Saratoga St. has been reduced from 8 ft to 6 ft. The sidewalk along the south side of TH 19 from Greely St. west to Country Club Drive was not reduced.

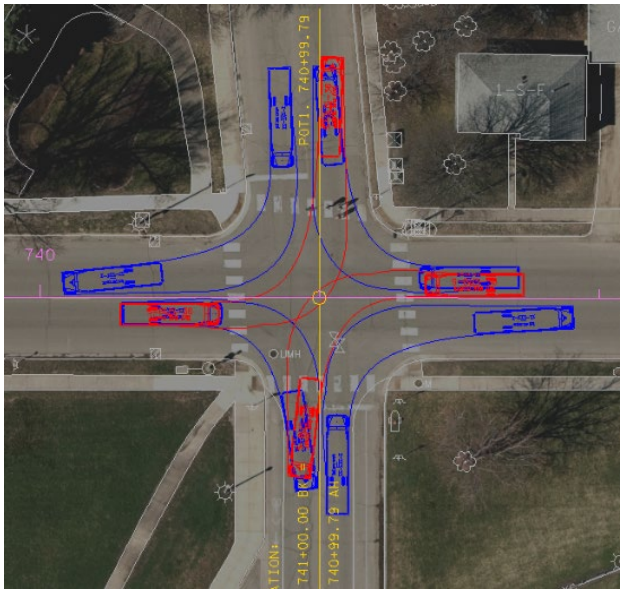
Rectangular symbols representing truncated domes have been added to the layout to represent approximate crosswalk locations.

The layout does not include geometric changes at the intersection of TH 19 and Bruce St., but the existing turning movements for the WB-67 MOD have been through this intersection have been added to the layout and this report.

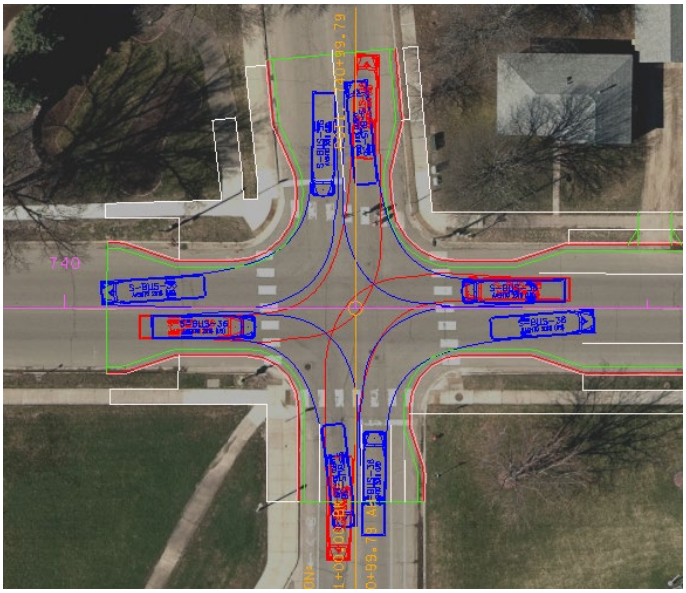
4TH STREET

The intersection of TH 19 and 4th Street used the design vehicle S-BUS-36. The 30% design showed the worst-case scenario of no overturn with vehicles crossing into the gutter pan. Based on comments received, the 60% design was updated to adjust the SB 4th St. to WB TH 19 movement to keep the design vehicle out of the curb lip. Along with adjusting the NB 4th St to EB TH19 and WB TH 19 to SB 4th St movements to allow for both movements to be completed without encroaching on each other. Striping for the parking east of the intersection was updated between 30% and 60% design. The width of the 4th Street approaches were widened from 32-feet to 38-feet in the final layout.

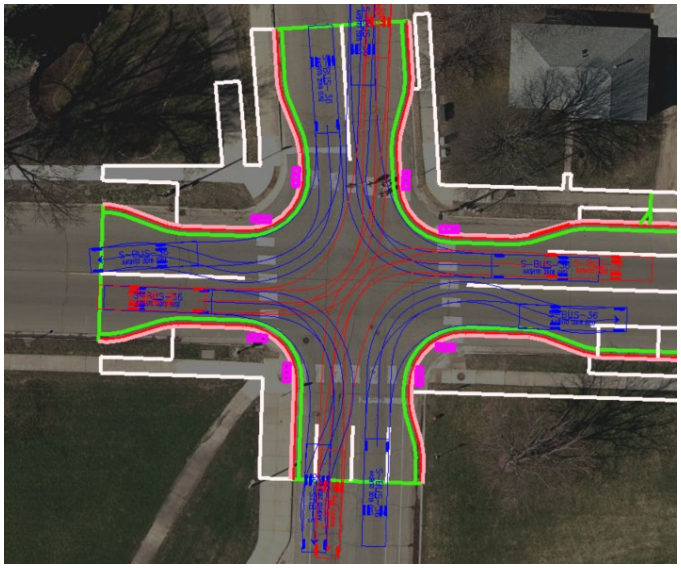
Figure 6 – 4th Street – S-BUS 36 Turning Movements



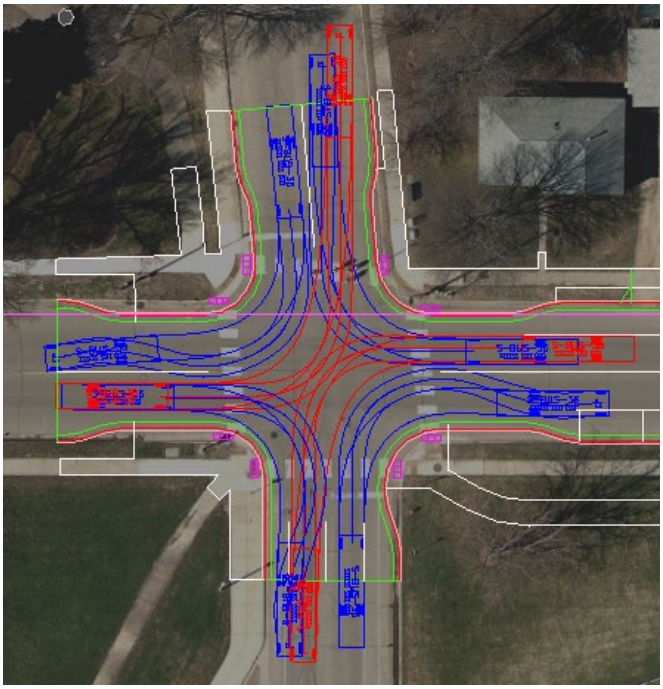
Existing Turn Movement – S-BUS 36



30% Proposed Turn Movement – S-BUS 36



60% Proposed Turn Movement – S-BUS 36

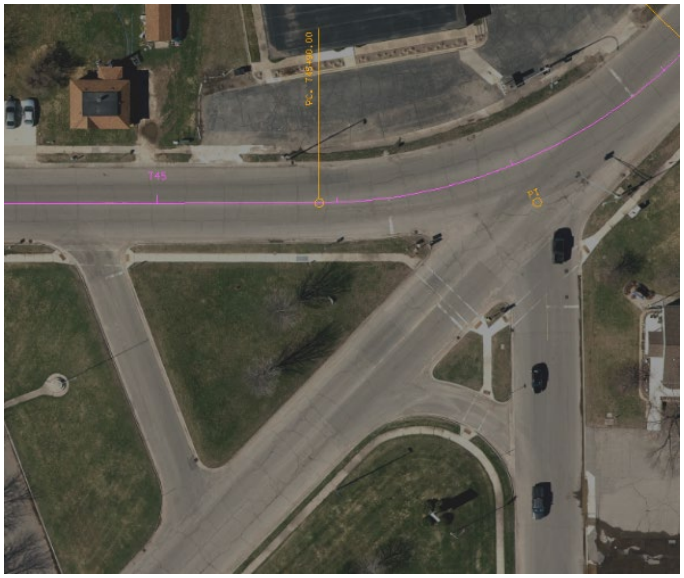


Final Proposed Turn Movement – S-BUS 36

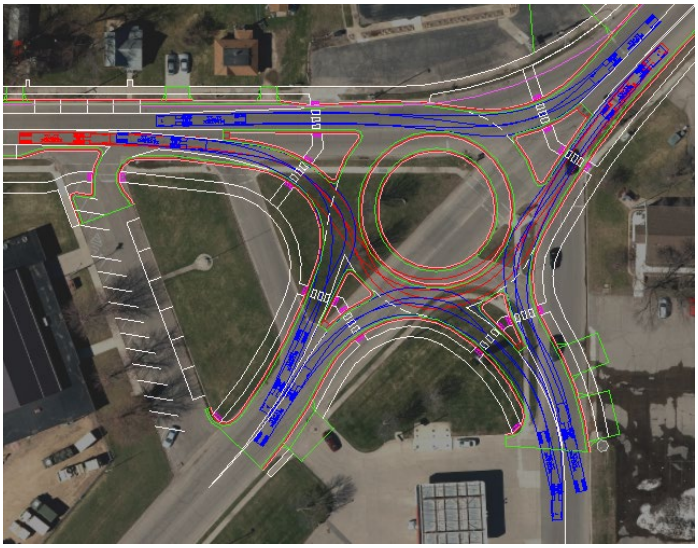
Country Club Drive

The intersection of TH 19 and Country Club Drive used the design vehicle WB-62 and the OSOW WisDOT Wind Blade. The existing conditions for the turn movement allows in-lane to in-lane movements, however the turn movements are very unusual and uncomfortable for vehicles and pedestrians.

Figure 7 –Country Club Drive– WB-62 Turning Movement

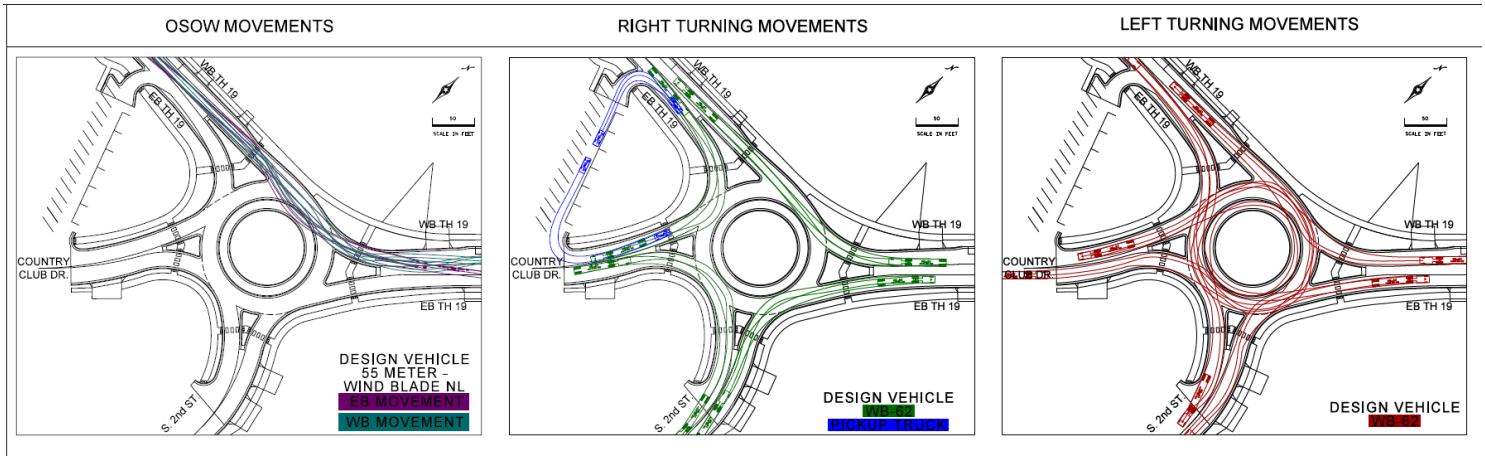


Existing Intersection Geometry



30% and 60% Proposed Turn Movement – WB-62

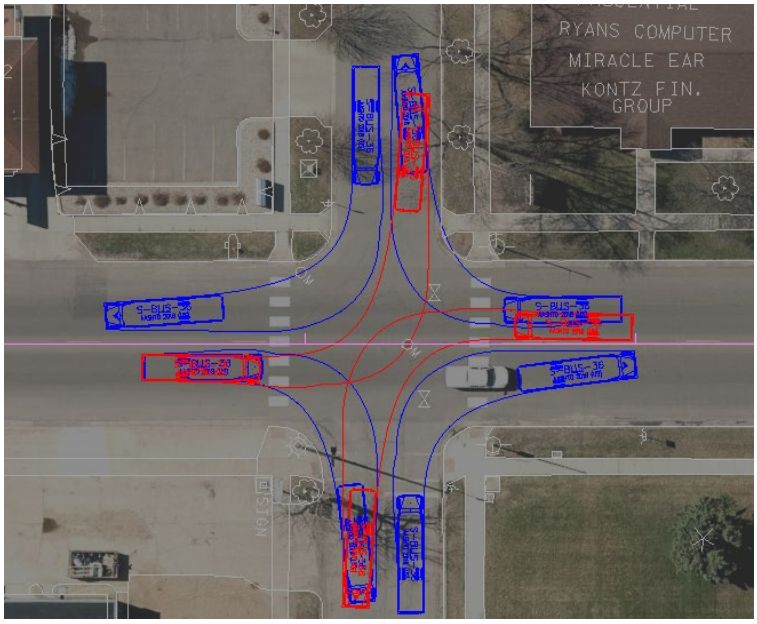
Figure 8 –Country Club Drive– Final Turning Templates



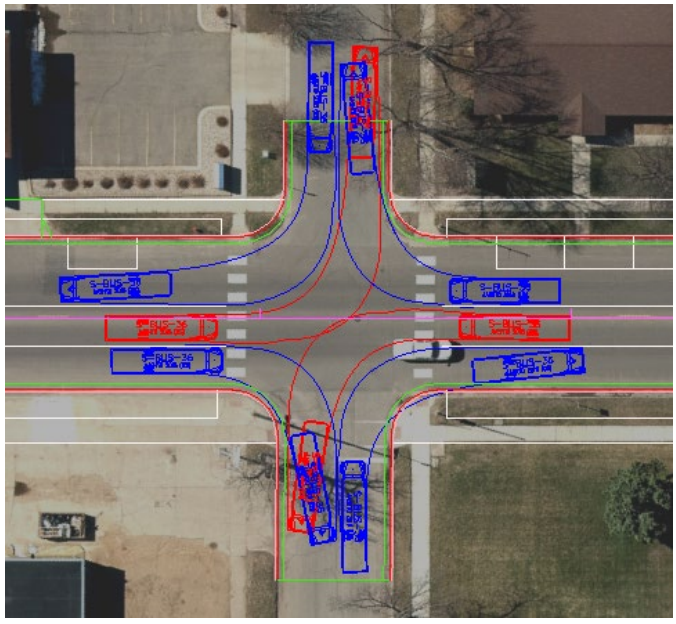
Greeley Street

The intersection of TH 19 and Greeley Street used the design vehicle S-BUS-36, see Figure 2 for the design vehicle diagram. The existing conditions for the turn movement allows in-lane to in-lane movements. The 30% design showed the worst-case scenario of no overturn with vehicles crossing into the gutter pan. Based on comments received, bump outs were added on the north (WB) side of TH 19. Turning movements were adjusted to allow for overturn into the adjacent lanes to prevent the design vehicle from crossing the gutter pan. The north side Greeley approach was widened from 33-feet to 36-feet from 60% to final layout.

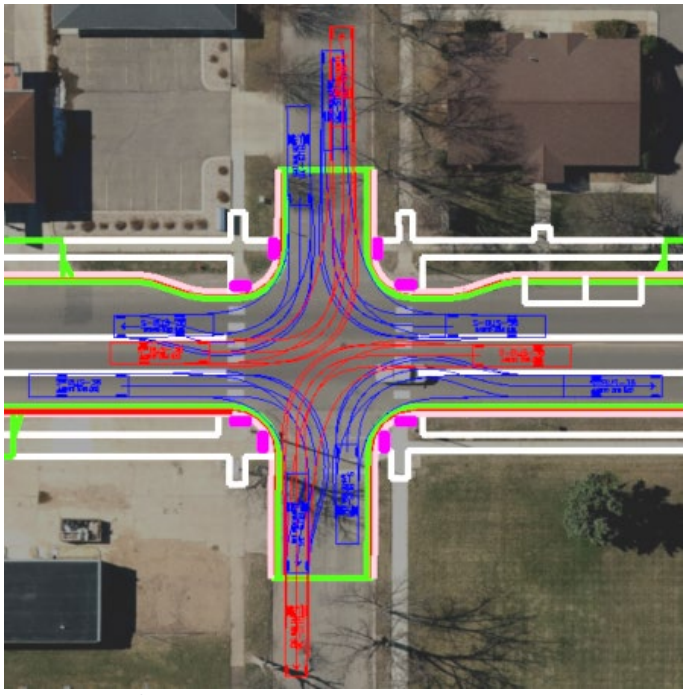
Figure 9 – Greeley Street – S-BUS 36 Turning Movement



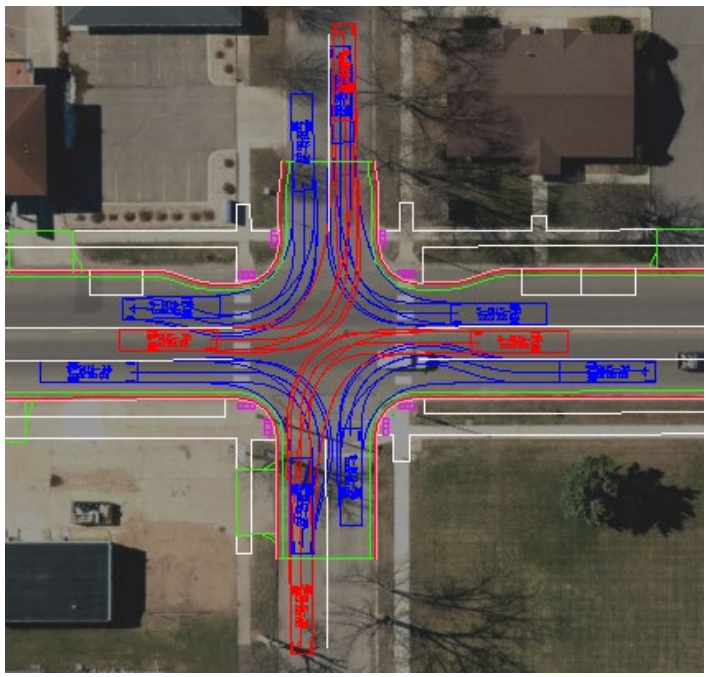
Existing Turn Movement – S-BUS 36



30% Proposed Turn Movement – S-BUS 36



60% Proposed Turn Movement – S-BUS 36

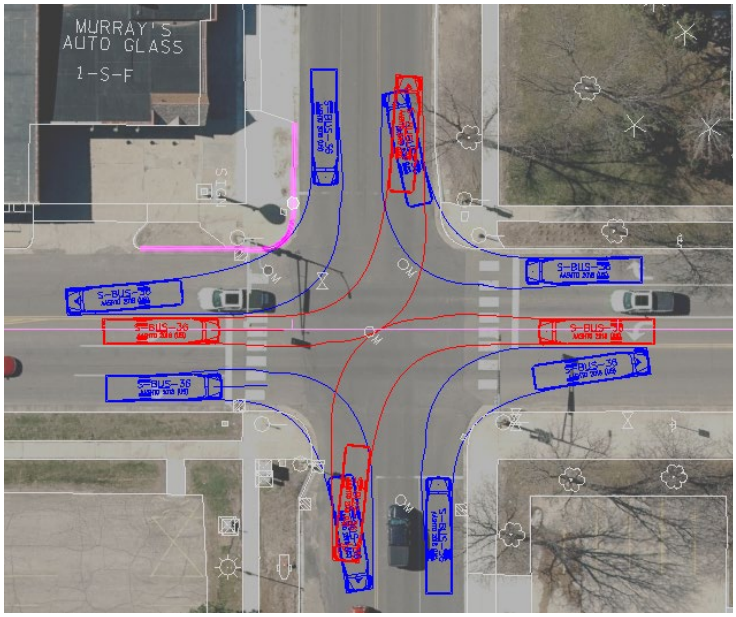


Final Proposed Turn Movement – S-BUS 36

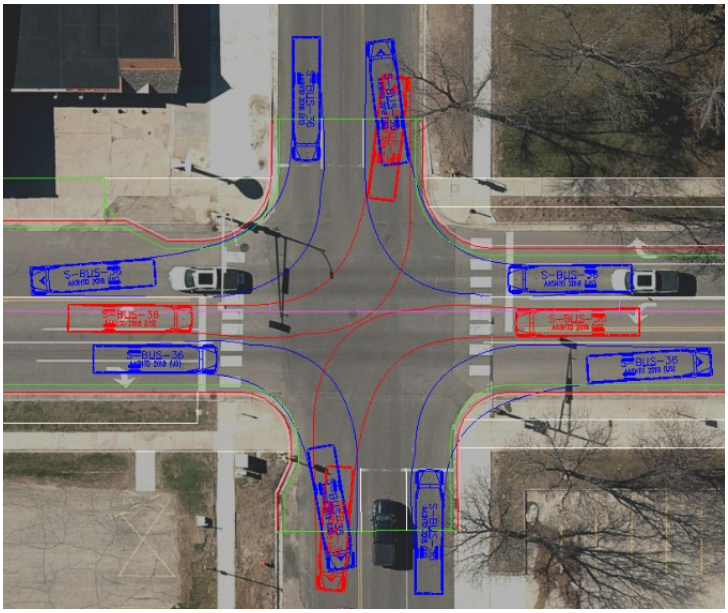
Saratoga Street

The intersection of TH 19 and Saratoga Street used the design vehicles S-BUS-36 and WB-67 MOD. The 30% design showed the worst-case scenario of no overturn with vehicles crossing into the gutter pan. The 30% design also used the SU-40 design vehicle rather than the WB-67 MOD. Based on comments received, the bump out on southbound Saratoga St in the southwest quadrant was removed to better accommodate the turning movements. Per ADA, the signal has crossing in all four directions, so the northbound Saratoga lane has been tapered to better align the north crossing. Between 60% and final, the radius were adjusted and to better accommodate both bus and truck templates. The through lane on TH 19 for eastbound traffic was widened by a foot to help with northbound right turning vehicles.

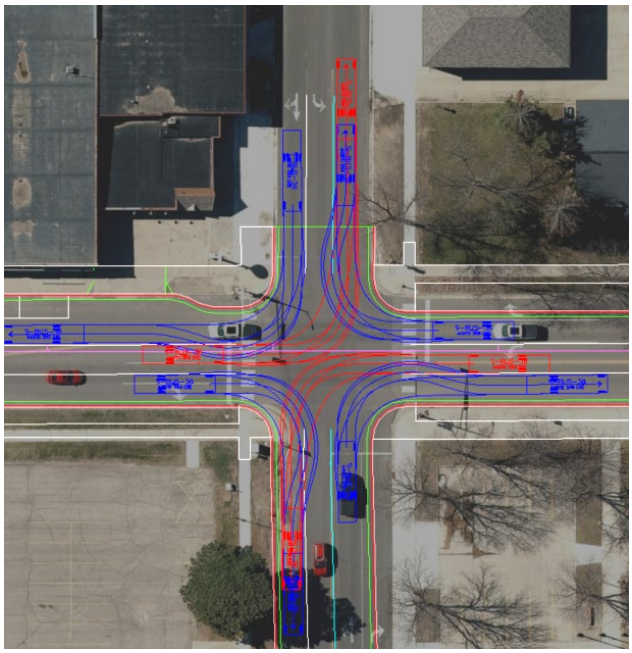
Figure 10 – Saratoga Street – S-BUS 36 Turning Movement



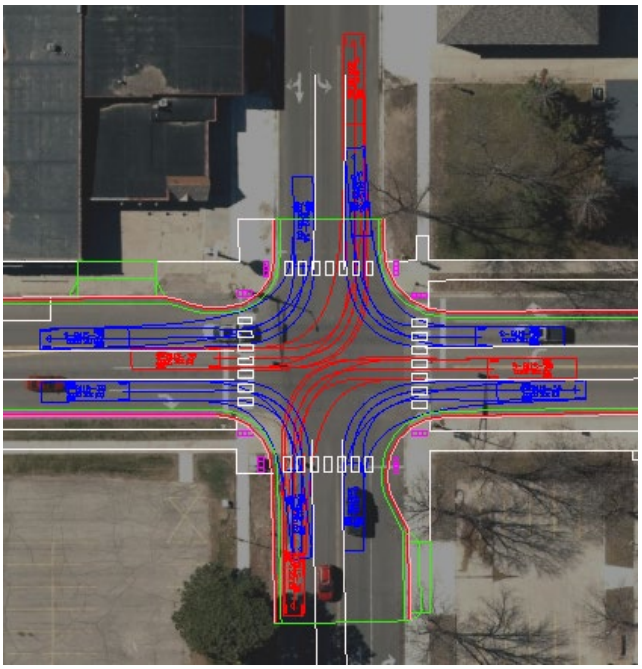
Existing Turn Movement – S-BUS 36



30% Proposed Turn Movement – S-BUS 36



60% Proposed Turn Movement – S-BUS 36

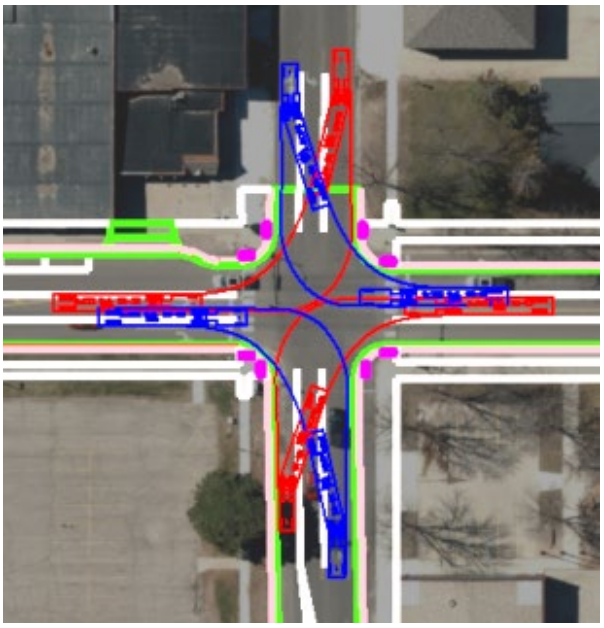


Final Proposed Turn Movement – S-BUS 36

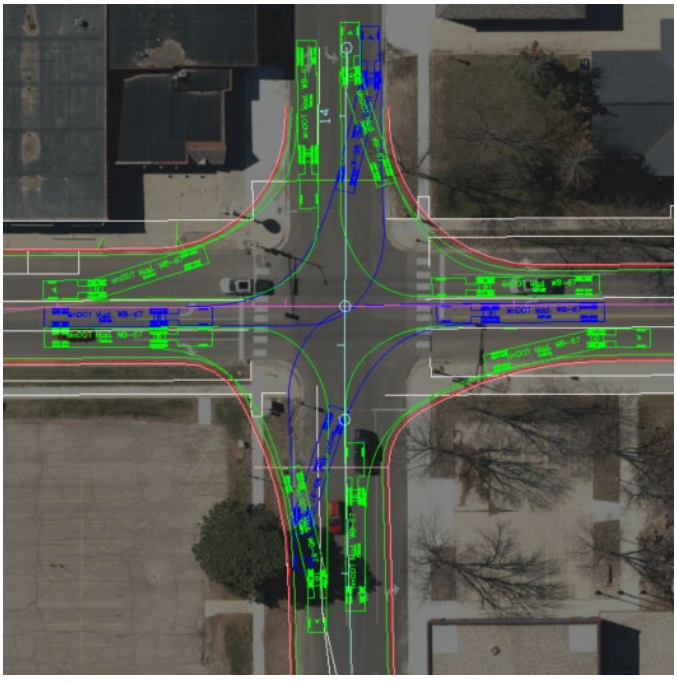
The existing condition for the WB-67 MOD turn movement does not allow for in-lane to in-lane movements. The existing turn movement figure shows the extent to which the WB-67 MOD would encroach on the existing sidewalk in order to complete in-lane to in-lane movements. The proposed WB-67 MOD design vehicle also is unable to complete in lane to in lane movements within the proposed geometry.

Figure 11 – Saratoga Street – WB-67 MOD Turning Movement

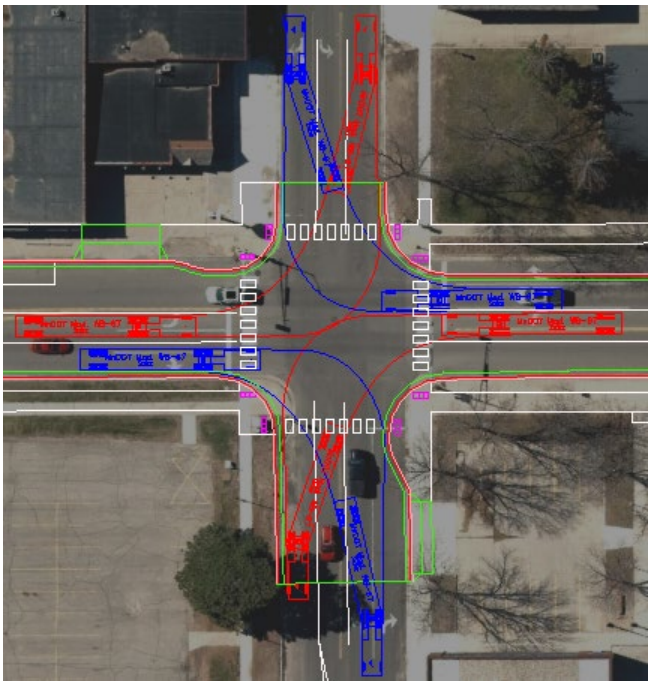
Existing Turn Movement – WB-67 MOD.



60% Proposed Turn Movement – WB-67 MOD.



60% Alternate Turn Movement – WB-67 MOD.

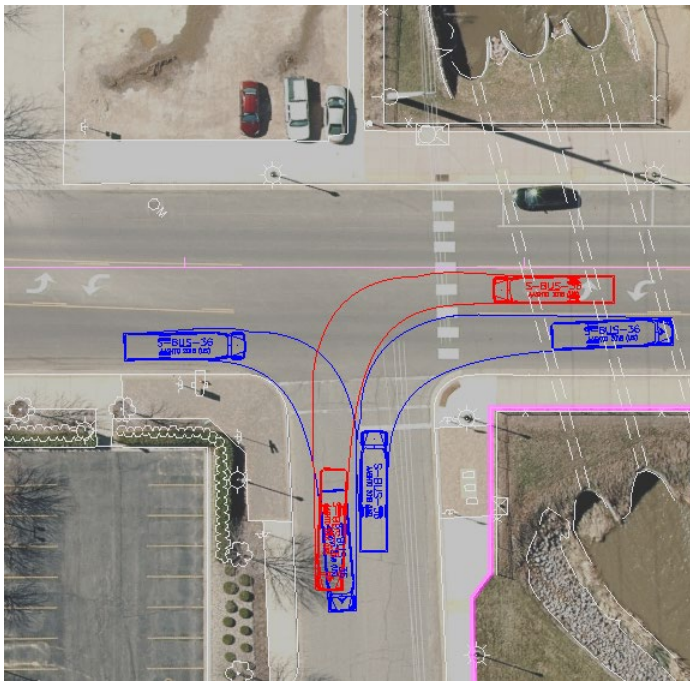


Final Turn Movement – WB-67 MOD.

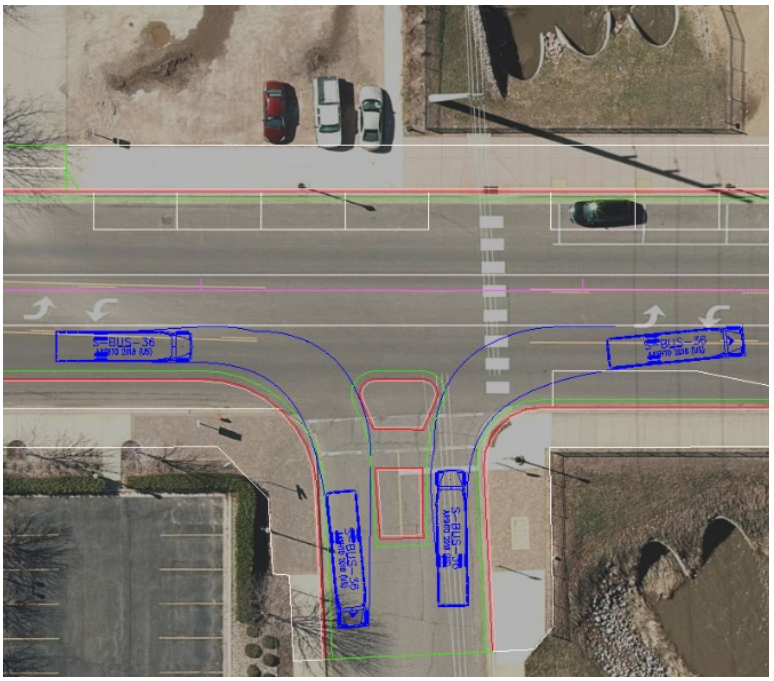
Marvin Schwan Memorial Drive

The intersection of TH 19 and Marvin Schwan Memorial Drive used the design vehicle S-BUS-36. The design intent at this intersection is for Marvin Schwan Memorial Drive to serve as a right in right out only. The width of the median has been reduced from the 30% design to accommodate the design vehicle. The radius on the southeast corner has been increased to mirror the southwest and reduce the crosswalk distance. Parking along WB TH 19 in this area has been reduced and the sidewalk/boulevard expanded. ADA has requested a crosswalk be provided on both sides of this intersection.

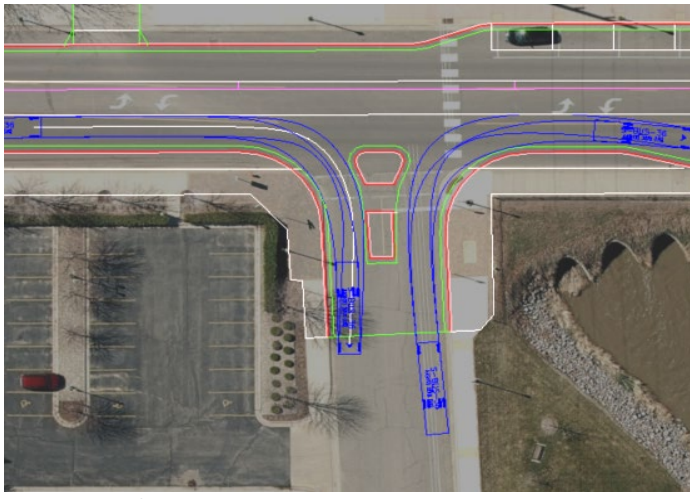
Figure 12 – Marvin Schwan Memorial Drive – S-BUS 36 Turning Movement



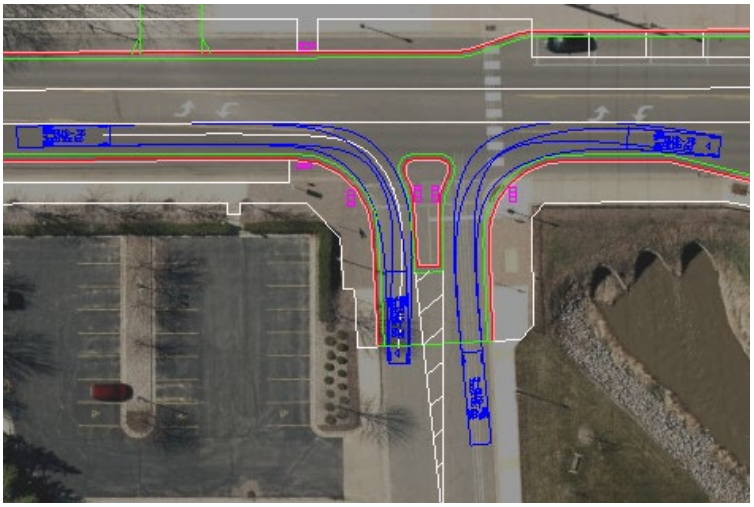
Existing Turn Movement – S-BUS 36



30% Proposed Turn Movement – S-BUS 36



60% Proposed Turn Movement – S-BUS 36

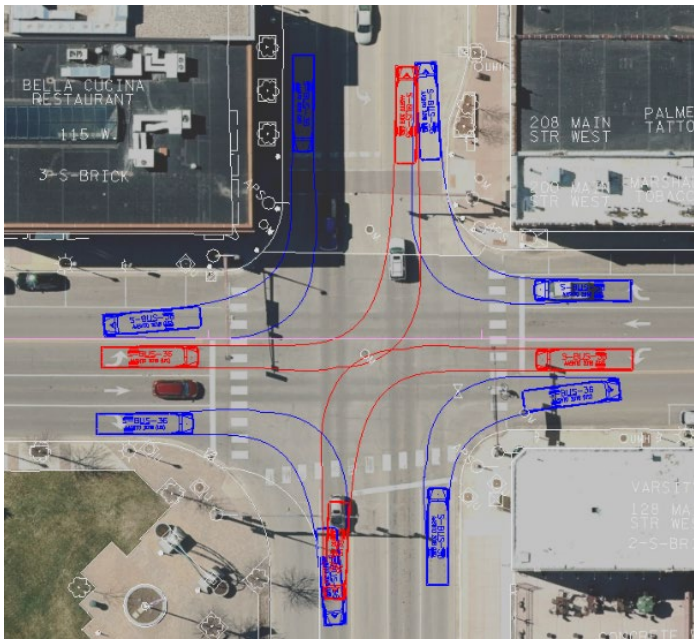


Final Proposed Turn Movement – S-BUS 36

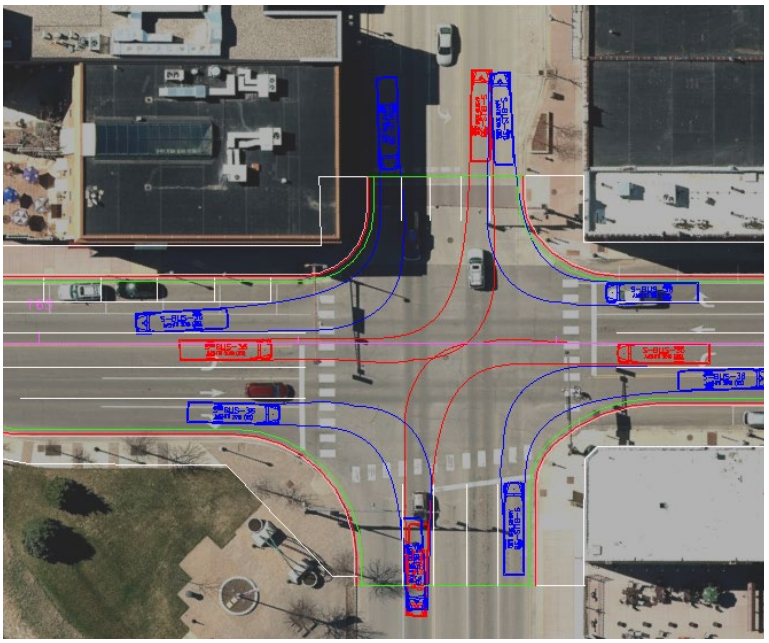
Main Street (US 59)

The intersection of TH 19 and Main Street used the design vehicle S-BUS-36, WB-67 Mod., and the OSOW WisDOT Wind Tower. The existing conditions for the turn movement allows in-lane to in-lane movements for the S-BUS-36, other design vehicles would have some lane encroachment. During 60% design a bump out was considered in the northwest quadrant, but was determined inefficient and removed between 60% and final. Lane widths were redistributed between 60% and final.

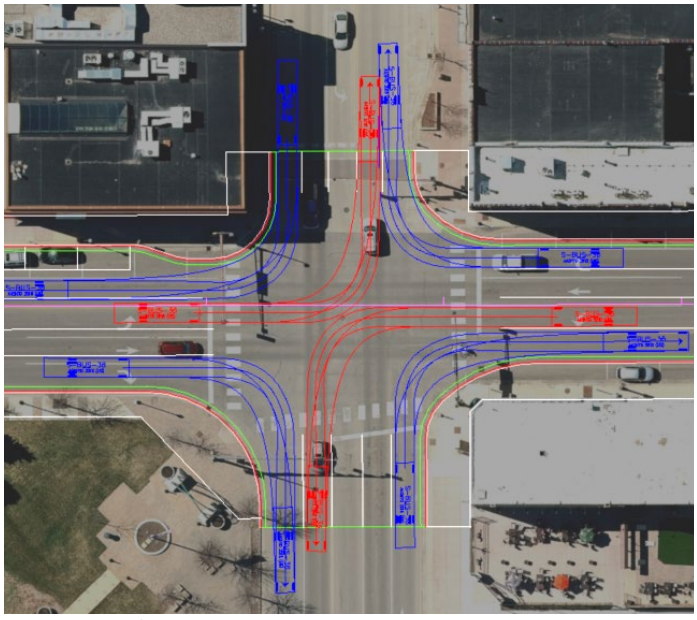
Figure 13 – Main Street (US 59) – S-BUS 36 Turning Movement



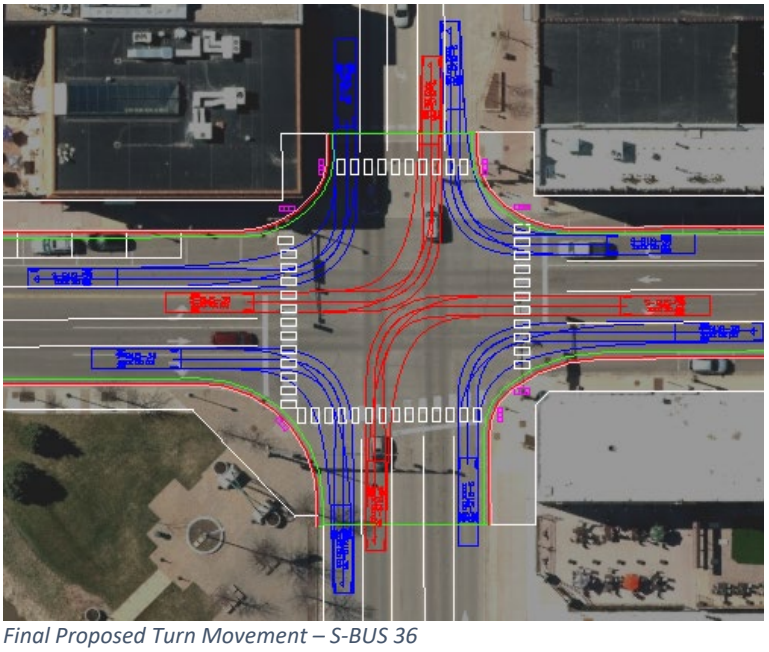
Existing Turn Movement – S-BUS 36



30% Proposed Turn Movement – S-BUS 36



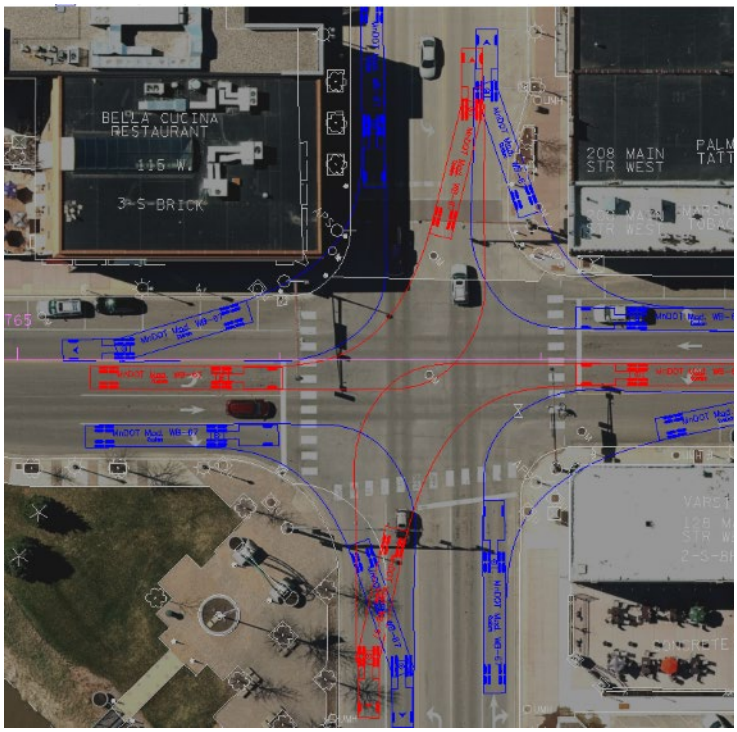
60% Proposed Turn Movement – S-BUS 36



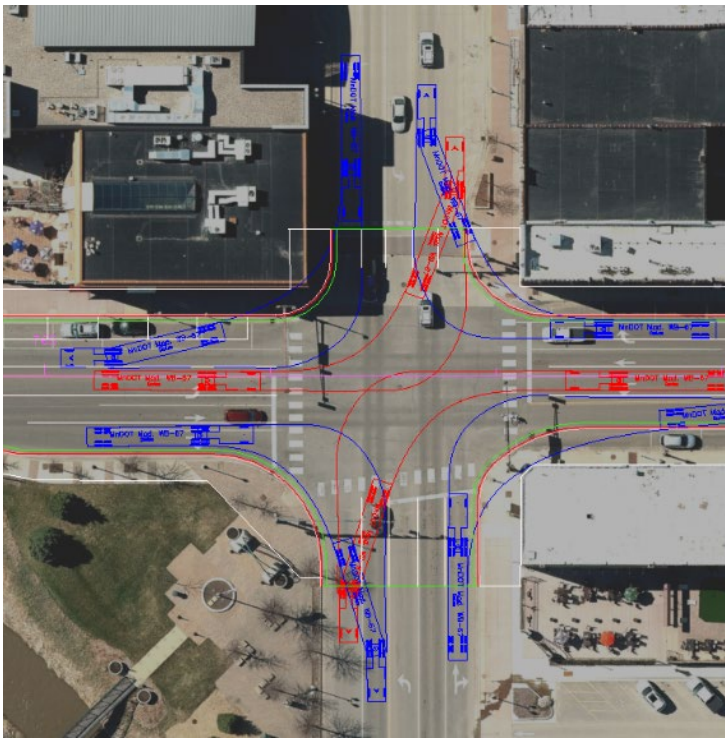
Final Proposed Turn Movement – S-BUS 36

The existing conditions and 30% design showed the worst-case scenario of no overturn into the adjacent lanes and vehicles crossing the sidewalk. The 60% design was updated to show the design vehicles overturning into adjacent lanes in order to stay out of the gutter pan.

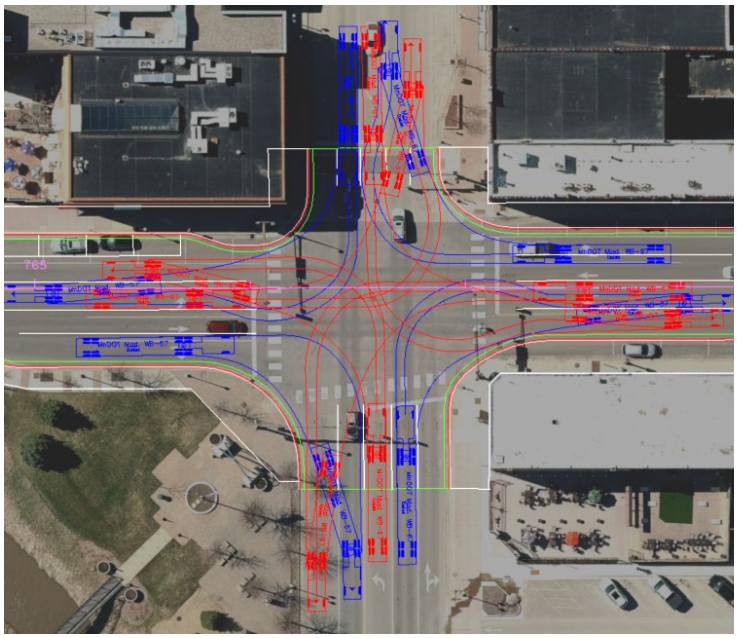
Figure 14 – Main Street (US 59) – WB-67 Mod. Turning Movement



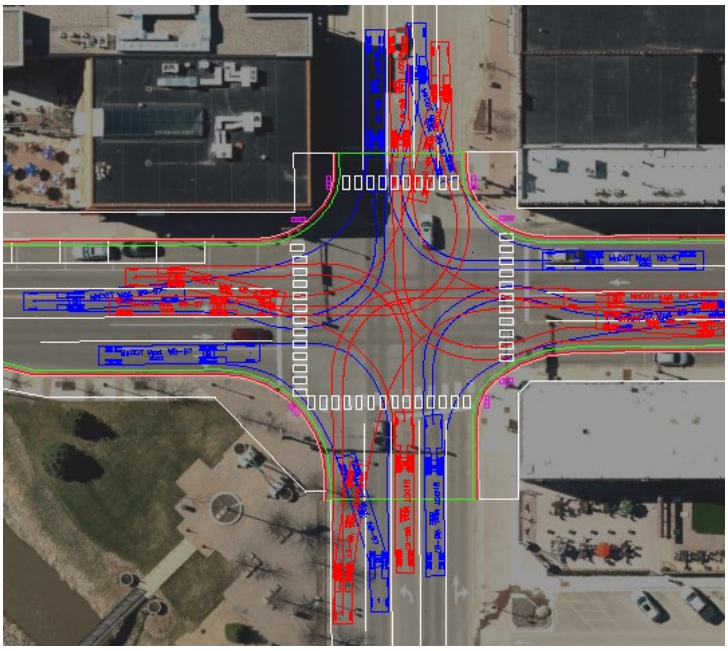
Existing Turn Movement - WB 67 Mod.



30% Proposed Turn Movement –WB-67 Mod.



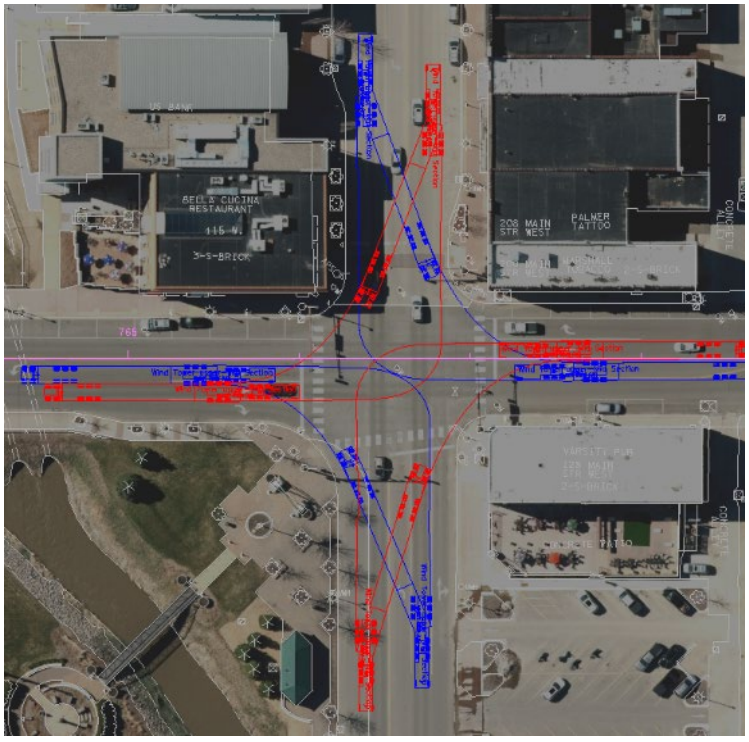
60% Proposed Turn Movement –WB-67 Mod



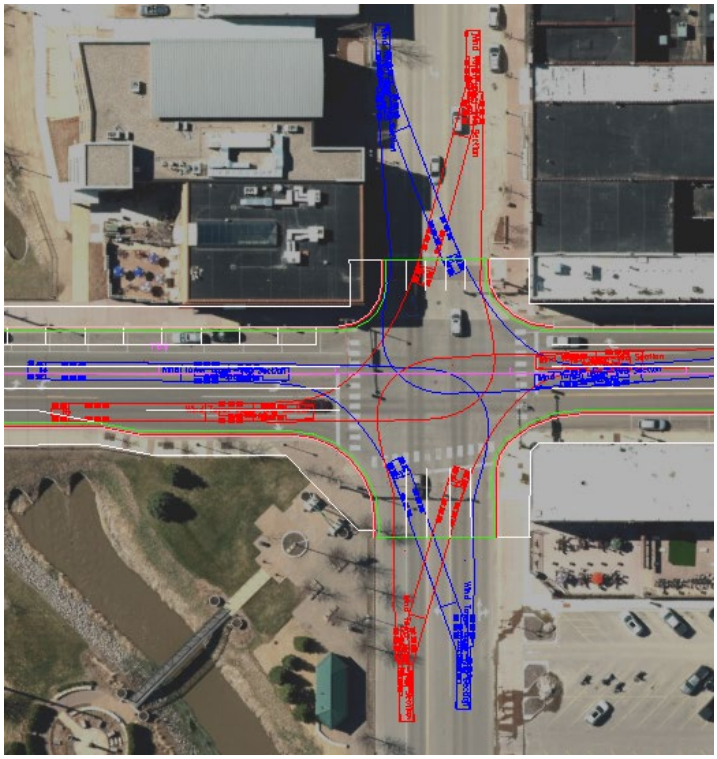
Final Proposed Turn Movement –WB-67 Mod.

The wind tower design vehicle requires crossing multiple lanes of traffic in the existing and proposed scenarios in order to complete the turning movements.

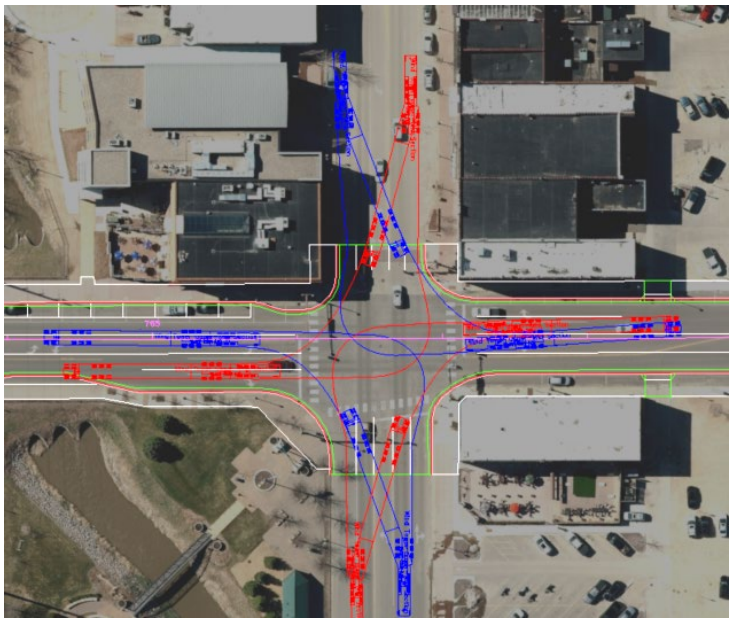
Figure 15 – Main Street (US 59) – WisDOT OSOW Wind Tower Turning Movement



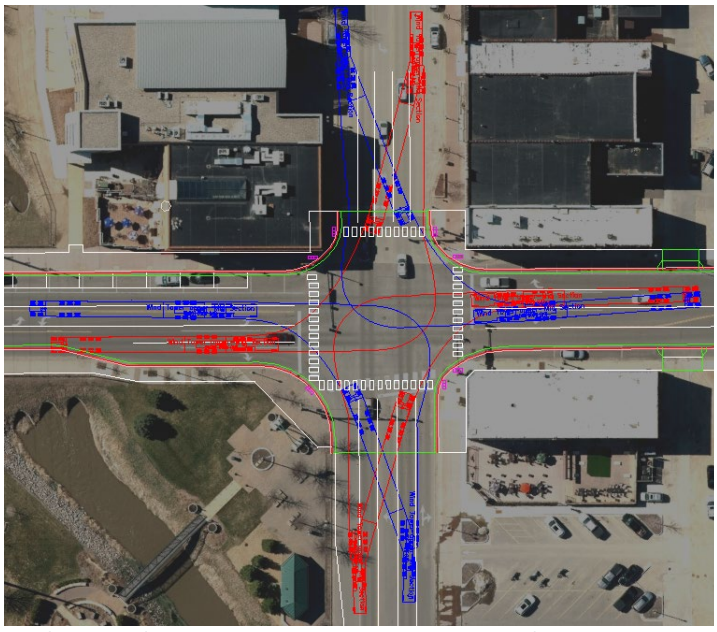
Existing Turn Movement – WisDOT OSOW Wind Tower



30% Proposed Turn Movement – WisDOT OSOW Wind Tower



60% Proposed Turn Movement – WisDOT OSOW Wind Tower

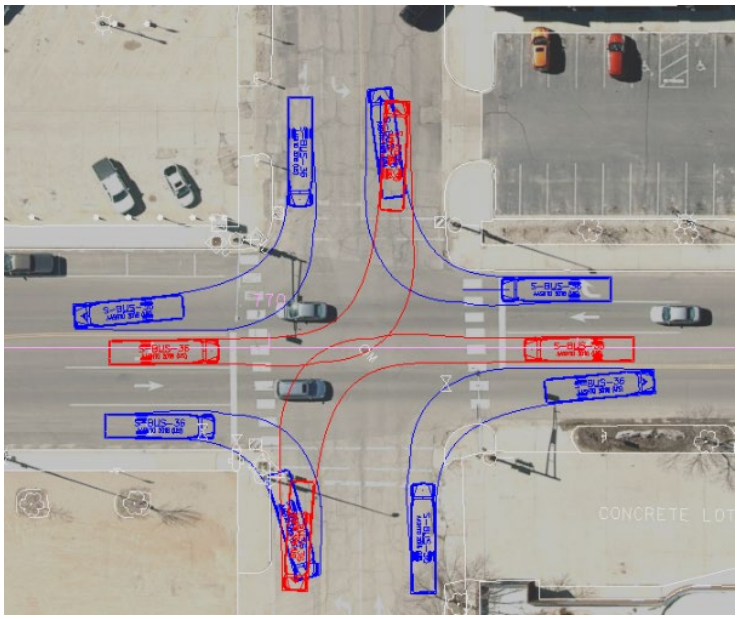


Final Proposed Turn Movement – WisDOT OSOW Wind Tower

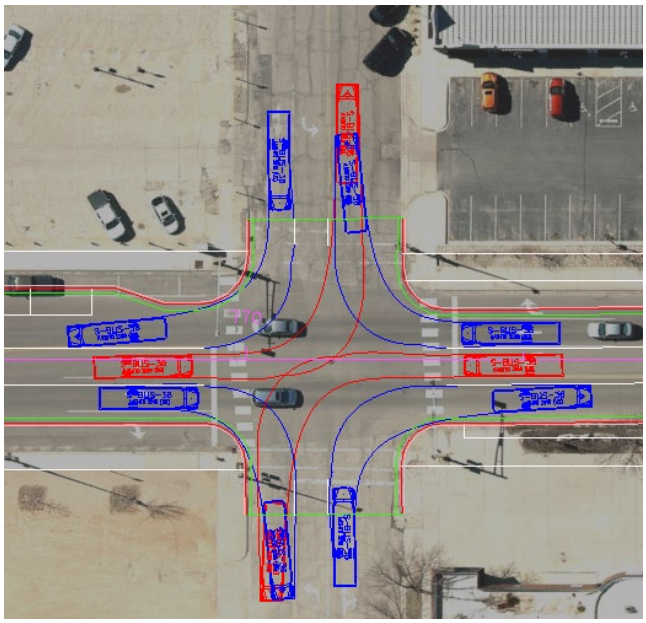
Lyon Street

The intersection of TH 19 and Lyon Street used the design vehicles S-BUS-36 and WB-67 Mod. The existing conditions for the turn movement allows in-lane to in-lane movements for the S-BUS-36, however the WB-67 Mod. has some lane encroachment. The geometry of this intersection has been updated to include bump outs in the northeast, northwest, southeast quadrants. The turning movements have been updated to include overturn. Between 60% and final layout the lane widths were widened on all approaches.

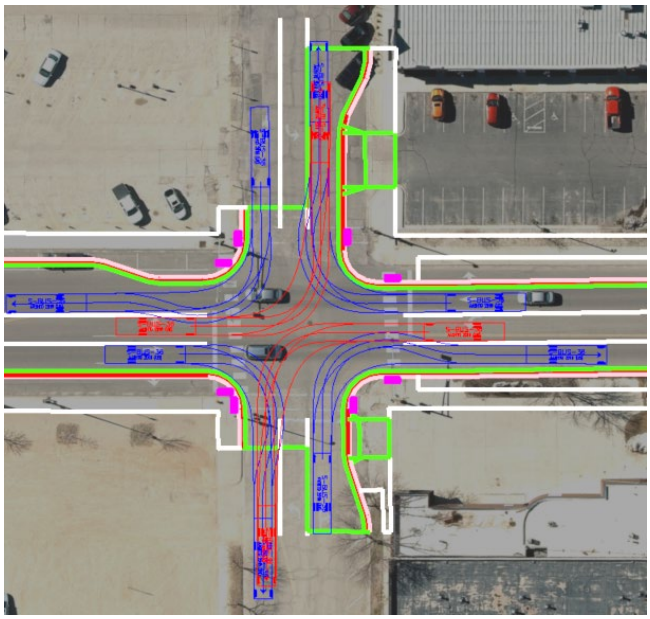
Figure 16 – Lyon Street – S-BUS 36 Turning Movement



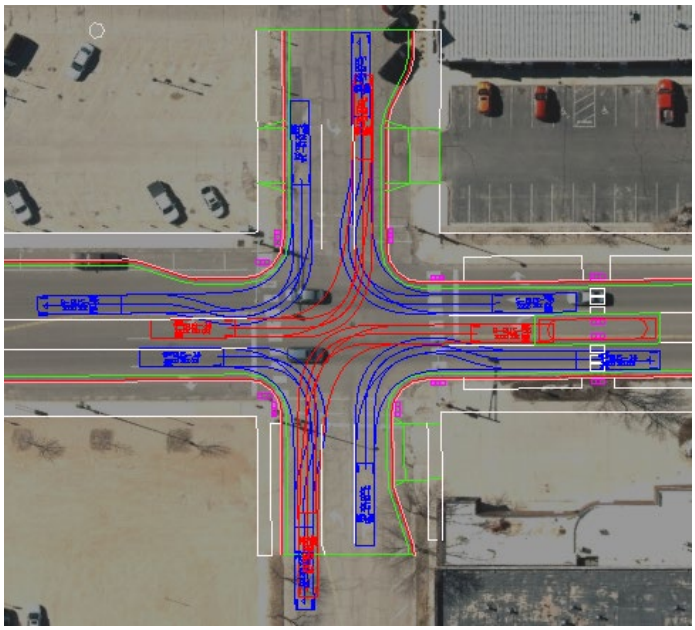
Existing Turn Movement – S-BUS 36



30% Proposed Turn Movement – S-BUS 36

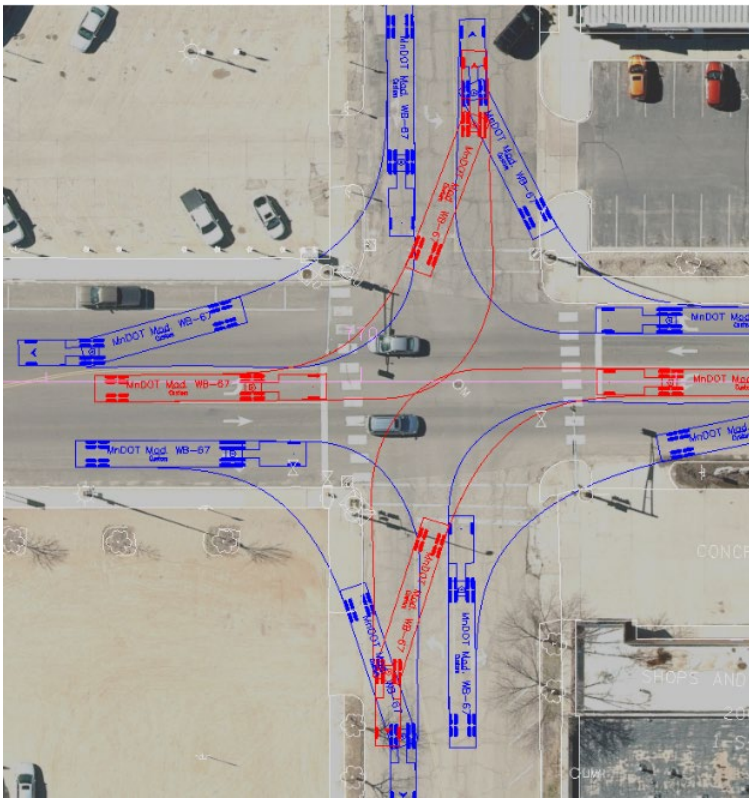


60% Proposed Turn Movement – S-BUS 36

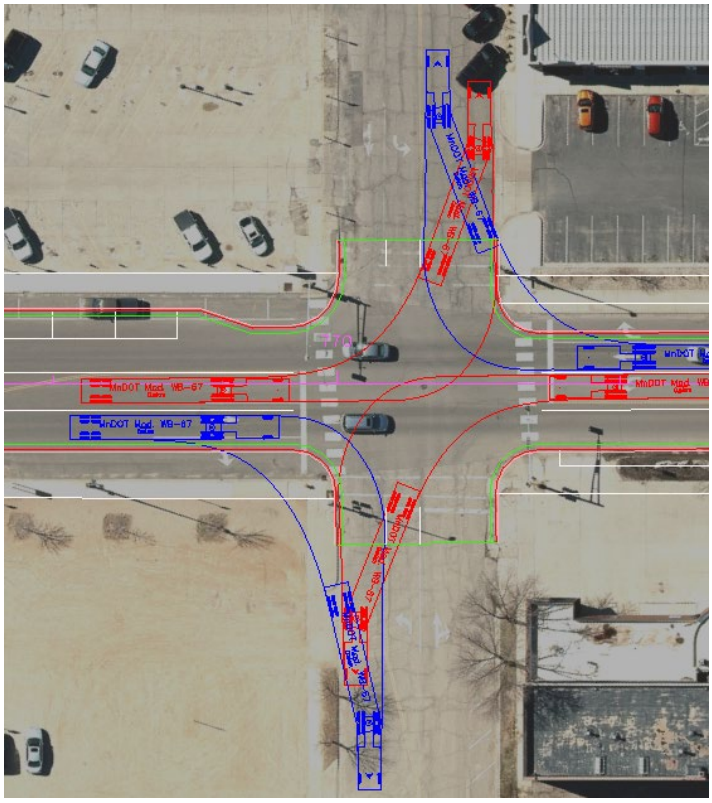


Final Proposed Turn Movement – S-BUS 36

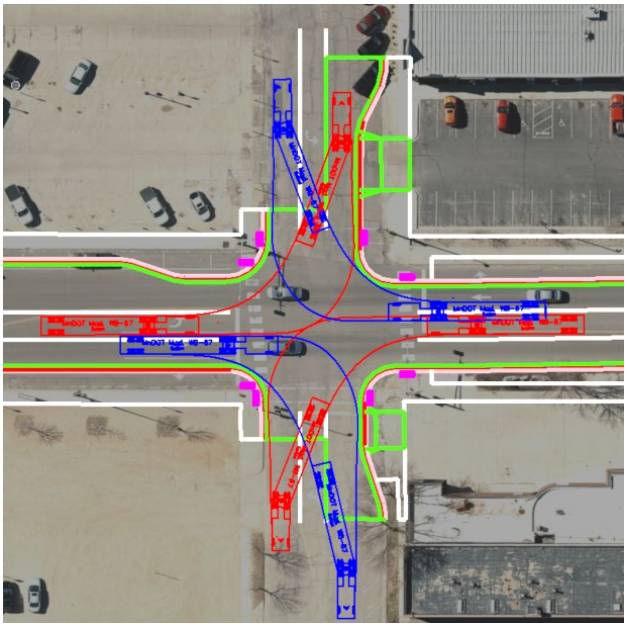
Figure 17 – Lyon Street – WB-67 Mod. Turning Movement



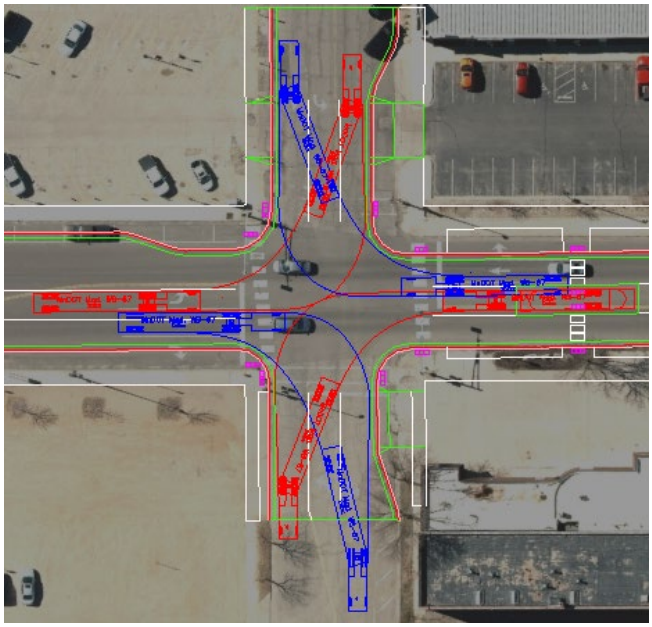
Existing Turn Movement – WB-67 Mod.



30% Proposed Turn Movement – WB-67 Mod.



60% Proposed Turn Movement – WB-67 Mod.

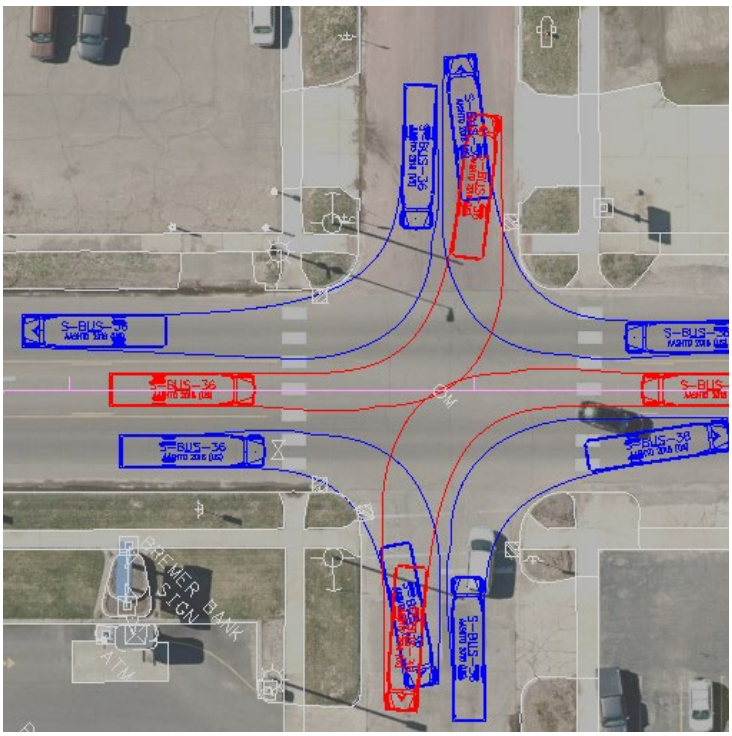


Final Proposed Turn Movement – WB-67 Mod.

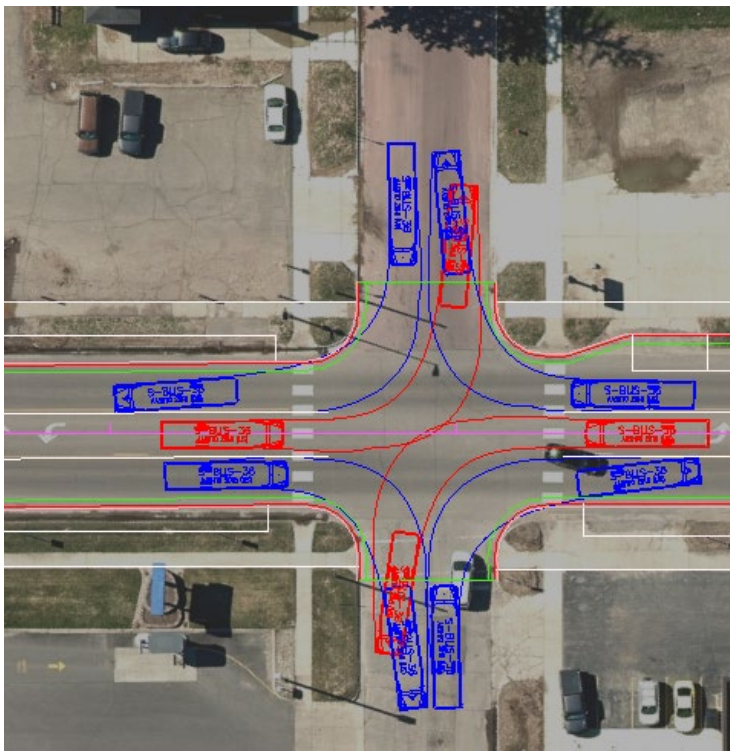
Redwood Street

The intersection of TH 19 and Redwood Street used the design vehicle S-BUS-36. The existing conditions for the turn movement allows in-lane to in-lane movements. The length of the northeast bump out was extended to the east in 60%. Between 60% and final layout the widths of the local street approaches were narrowed.

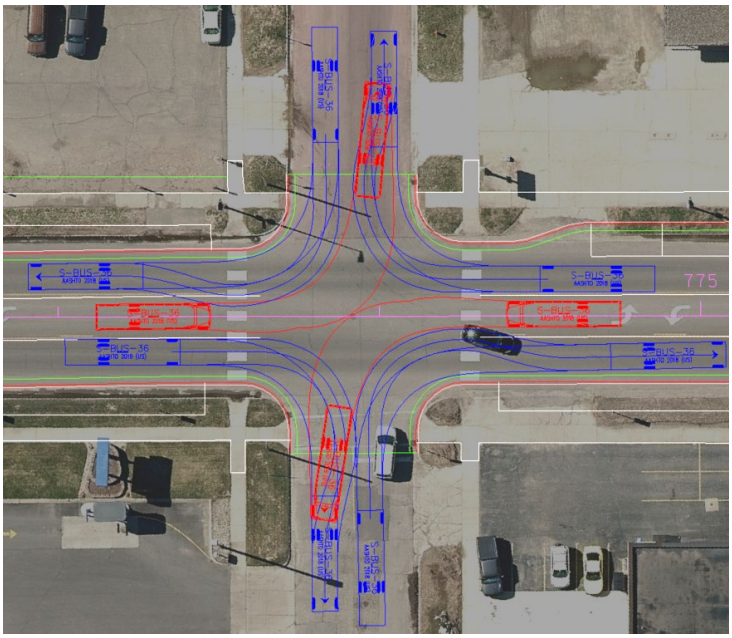
Figure 18 – Redwood Street – S-BUS 36 Turning Movement



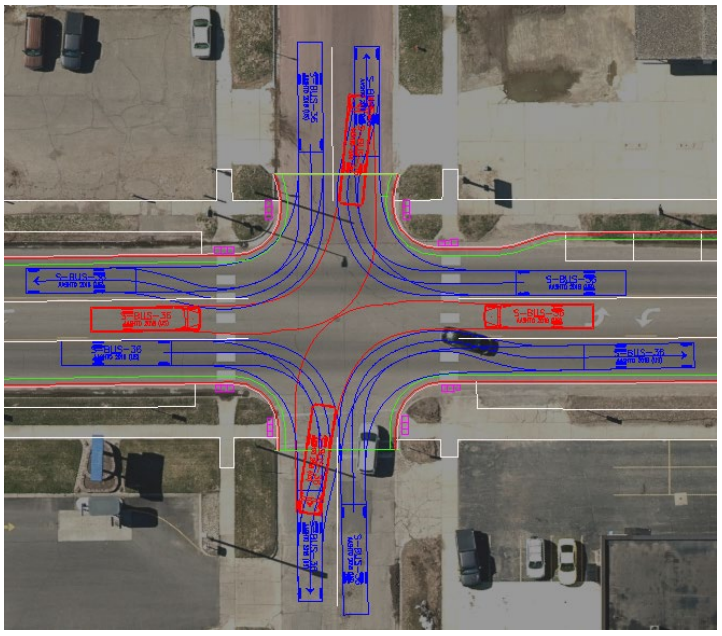
Existing Turn Movement – S-BUS 36



30% Proposed Turn Movement – S-BUS 36



60% Proposed Turn Movement – S-BUS 36

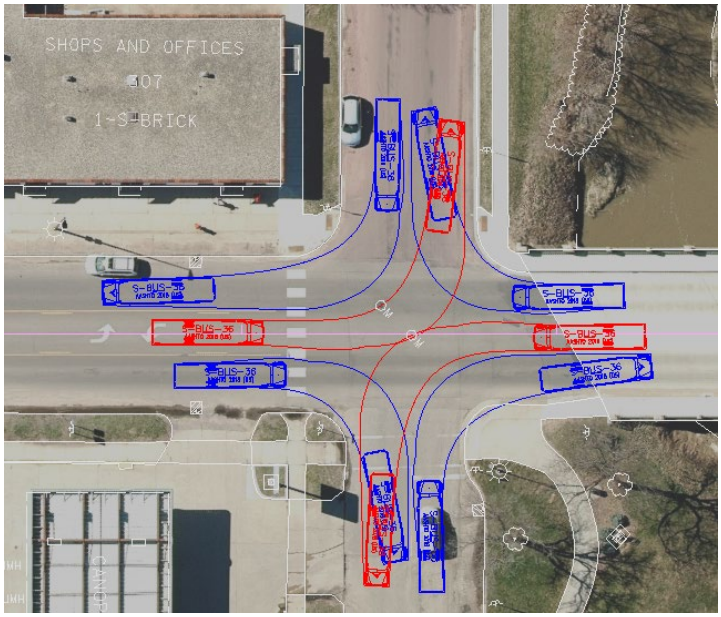


Final Proposed Turn Movement – S-BUS 36

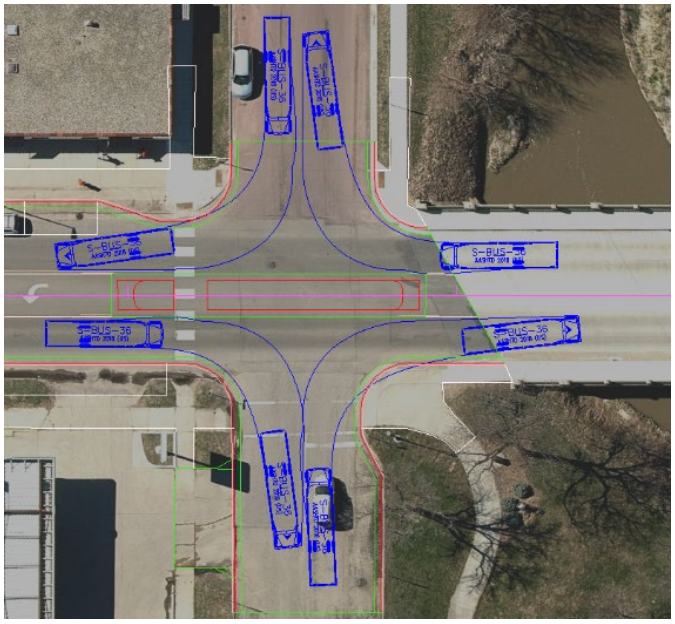
Marshall Street

The intersection of TH 19 and Marshall Street used the design vehicle S-BUS-36. The existing conditions for the turn movement allows in-lane to in-lane movements. The width of the median has been reduced to better accommodate the design vehicle. A bump out has been added at the northeast quadrant to align with the southeast, this bump out aligns the western curb line along Marshall Street. The parking along the west side of southbound Marshall was removed to accommodate the turning movement and reduce the crosswalk length. Between 60% and final the width of the south Marshall Street approach was narrowed by 1.5-feet.

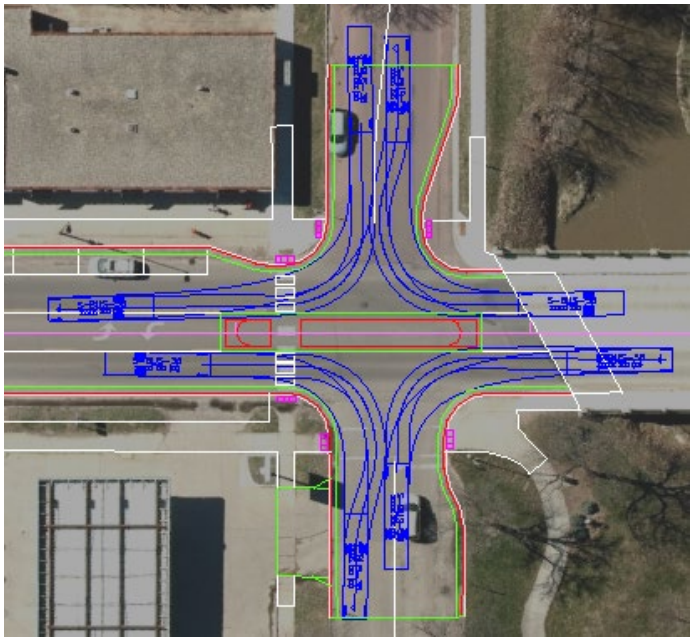
Figure 19 – Marshall Street – S-BUS 36 Turning Movement



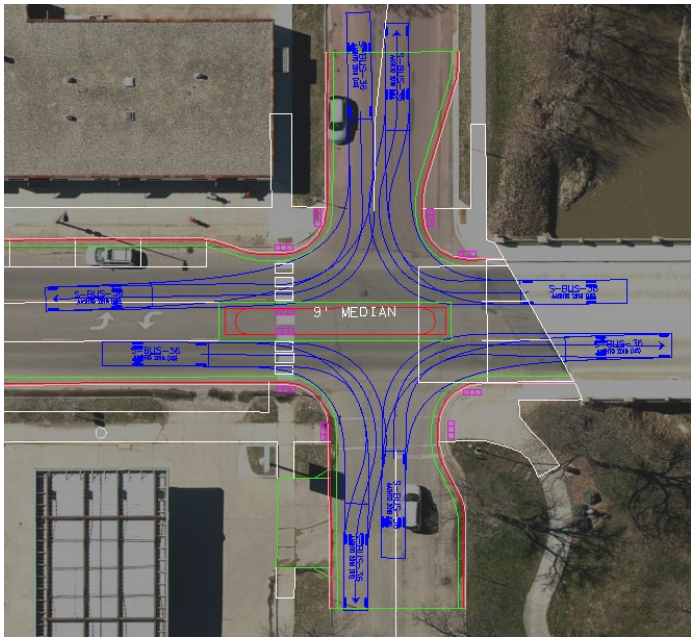
Existing Turn Movement – S-BUS 36



30% Proposed Turn Movement – S-BUS 36



60% Proposed Turn Movement – S –BUS 36

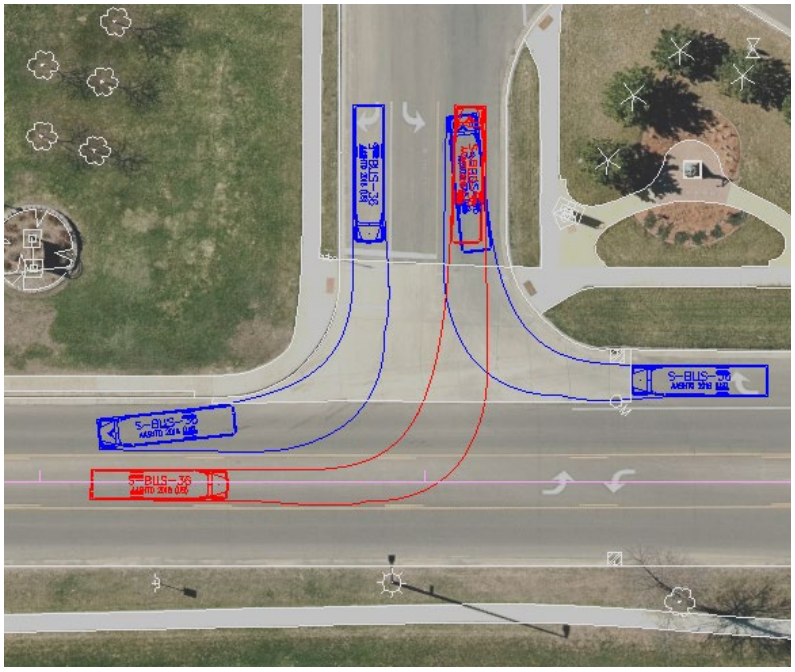


Final Proposed Turn Movement – S –BUS 36

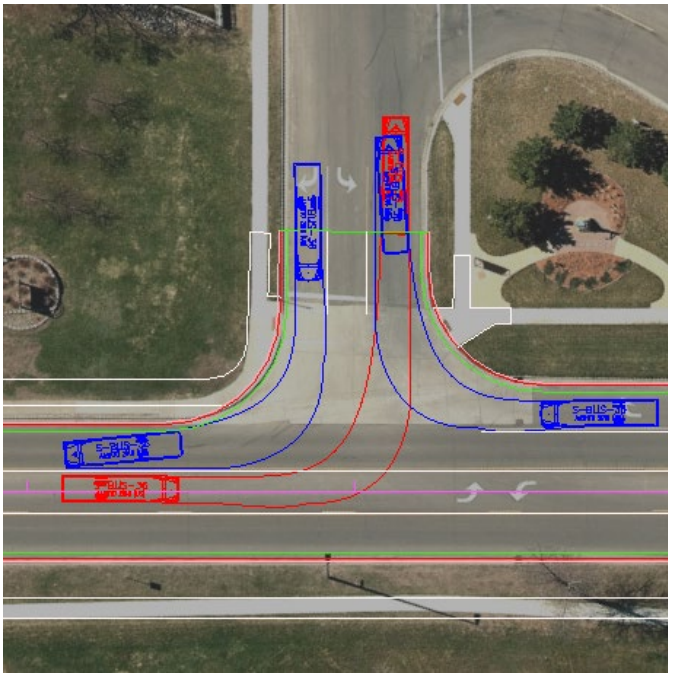
N. 3rd Street

The intersection of TH 19 and N. 3rd Street used the design vehicle S-BUS-36. The existing conditions for the turn movement allows in-lane to in-lane movements. A median was added to College Drive/TH 19 in the 60% plan. No changes were made between 60% and final layout.

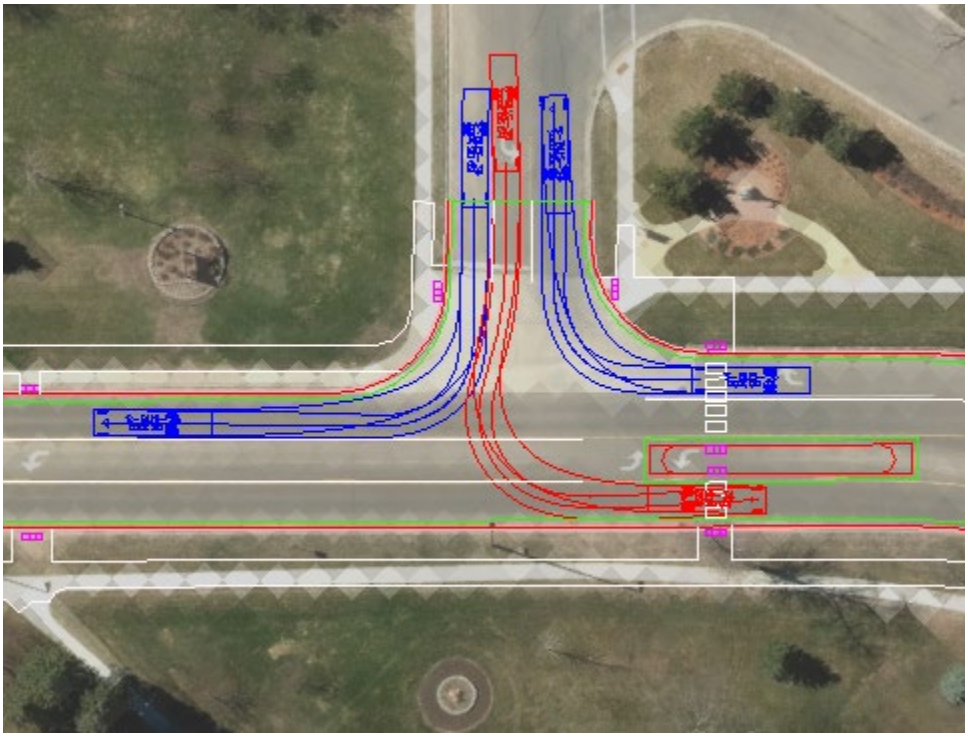
Figure 20 – N. 3rd Street – S-BUS 36 Turning Movement



Existing Turn Movement – S-BUS 36



30% Proposed Turn Movement – S-BUS 36

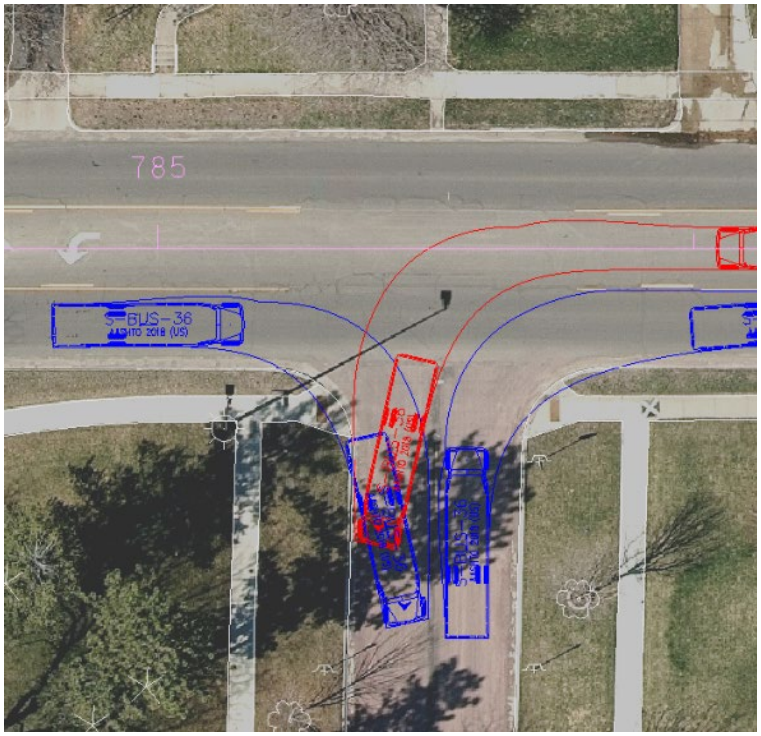


60% Proposed Turn Movement – S –BUS 36

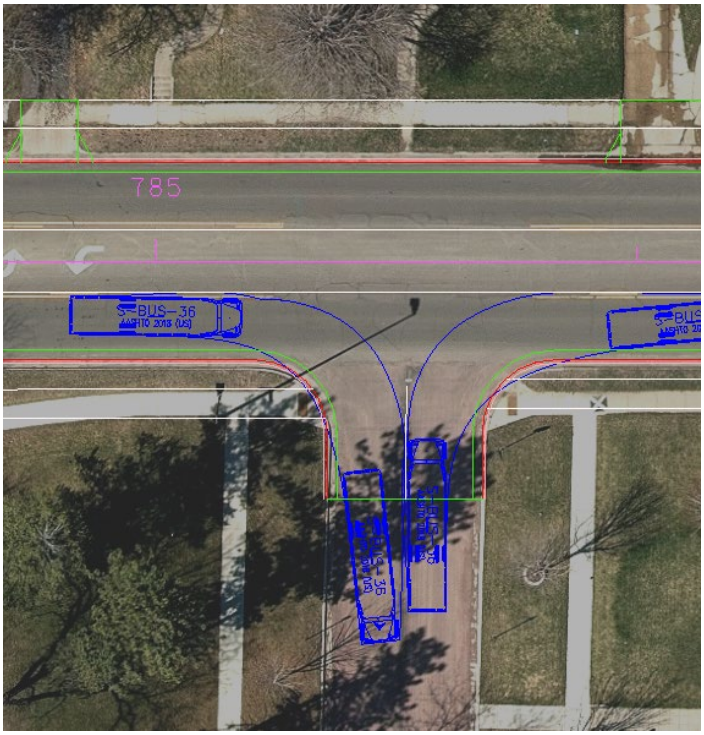
Park Avenue

The intersection of TH 19 and Park Avenue used the design vehicle S-BUS-36. The existing conditions for the turn movement allows in-lane to in-lane movements. A median was added to the 60% plan and turning movements for the residential access to the north were added. No changes were made between 60% and final layout.

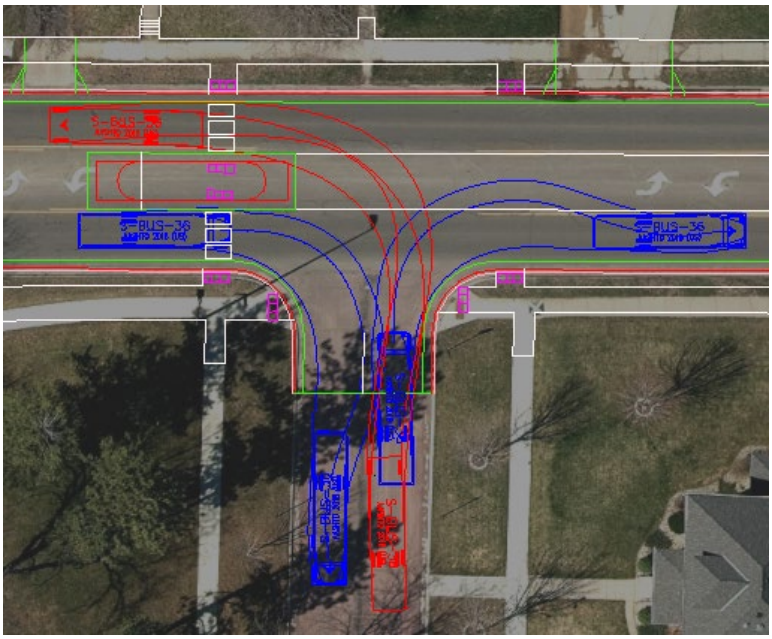
Figure 21 – Park Avenue – S-BUS 36 Turning Movement



Existing Turn Movement – S-BUS 36



30% Proposed Turn Movement – S-BUS 36

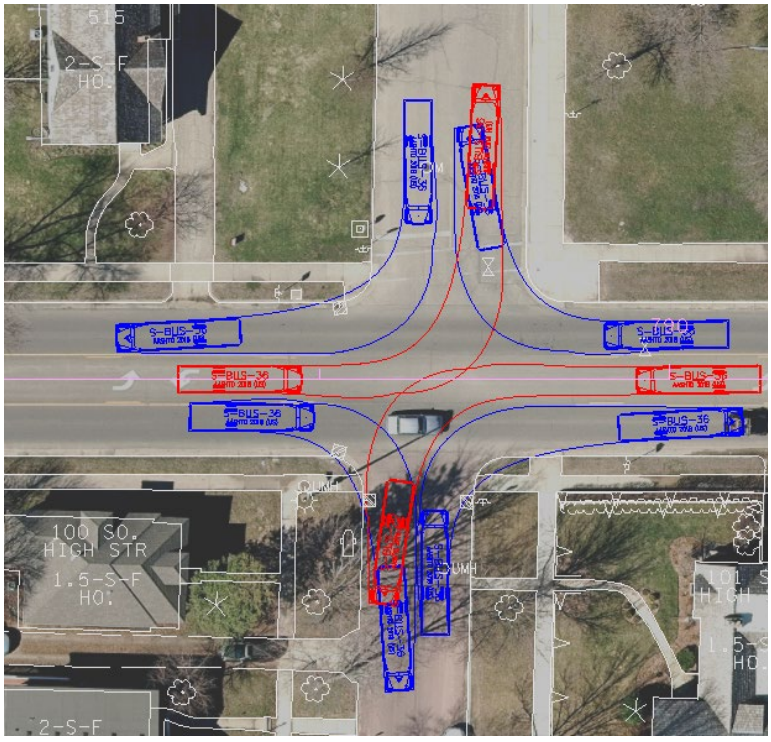


60% Proposed Turn Movement – S –BUS 36

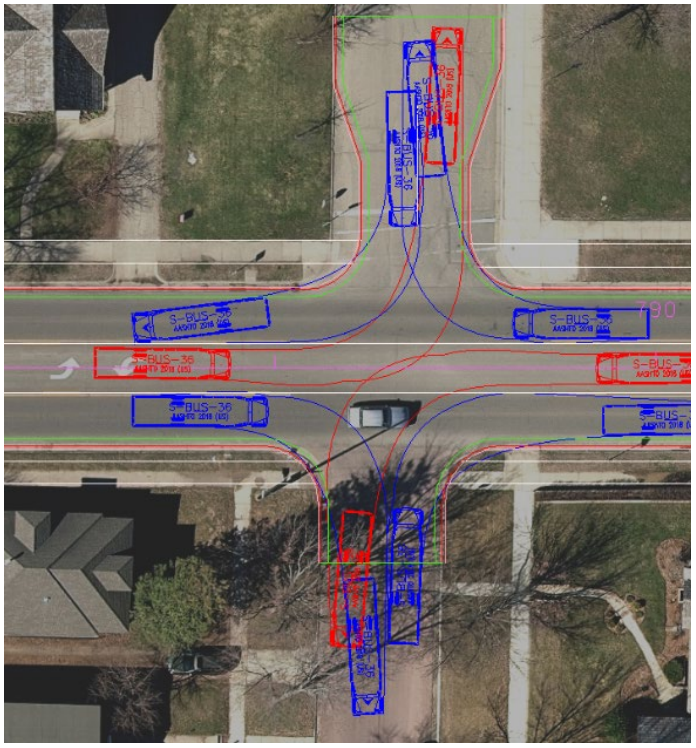
High Street

The intersection of TH 19 and High Street used the design vehicle S-BUS-36. The existing conditions for the turn movement allows in-lane to in-lane movements. A median was considered to the east of the High Street intersection due to pedestrian traffic at the nearby school. The roadway width of the High Street approaches were widened between 60% and final layout.

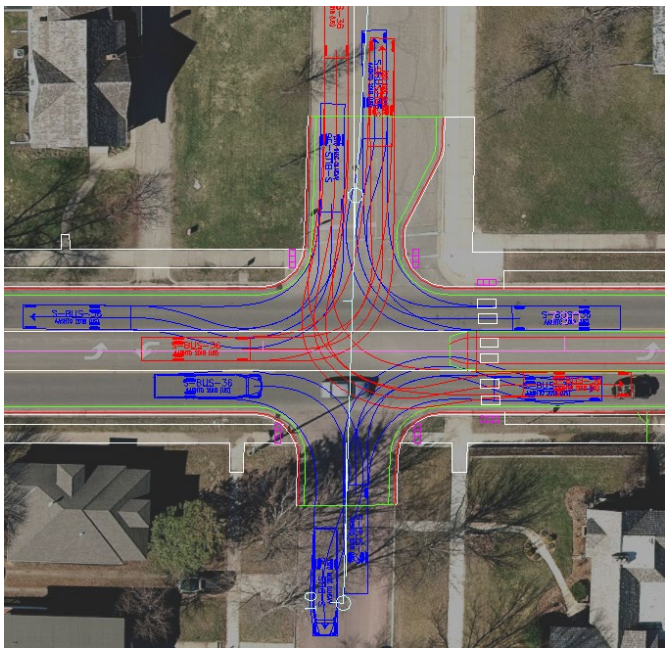
Figure 22 – High Street – S-BUS 36 Turning Movement



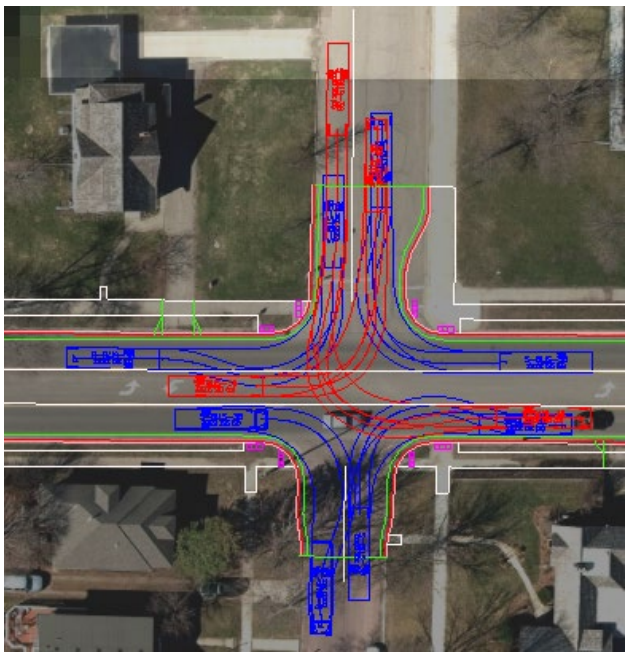
Existing Turn Movement – S-BUS 36



30% Proposed Turn Movement – S-BUS 36



60% Proposed Turn Movement – S –BUS 36

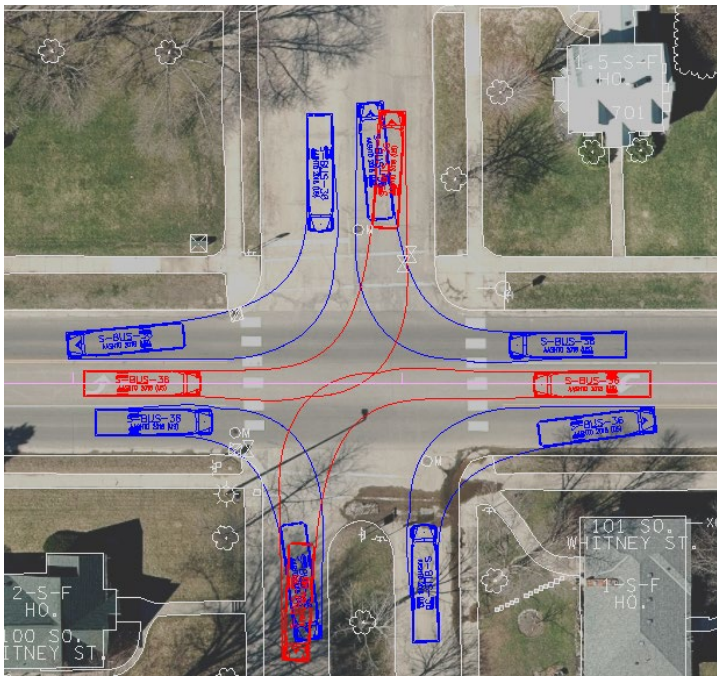


Final Proposed Turn Movement – S –BUS 36

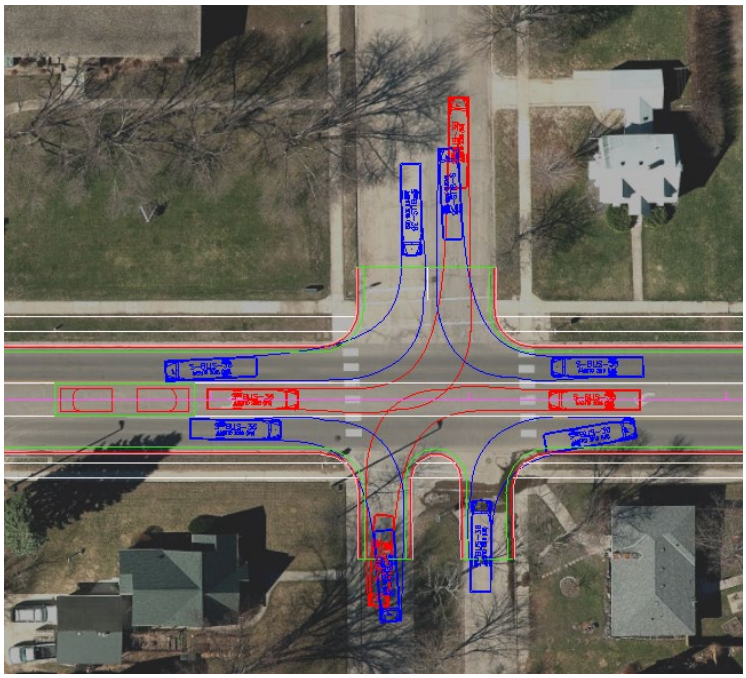
Whitney Street

The intersection of TH 19 and Whitney Street used the design vehicle S-BUS-36. The existing conditions for the turn movement allows in-lane to in-lane movements. The parking along Whitney Street near the intersection was removed to in order to narrow the roadway. This provides shorter crosswalk distances while still accommodating the design vehicle. The existing median was shifted further south as part of this update. The roadway width of the Whitney Street approaches were widened between 60% and final layout.

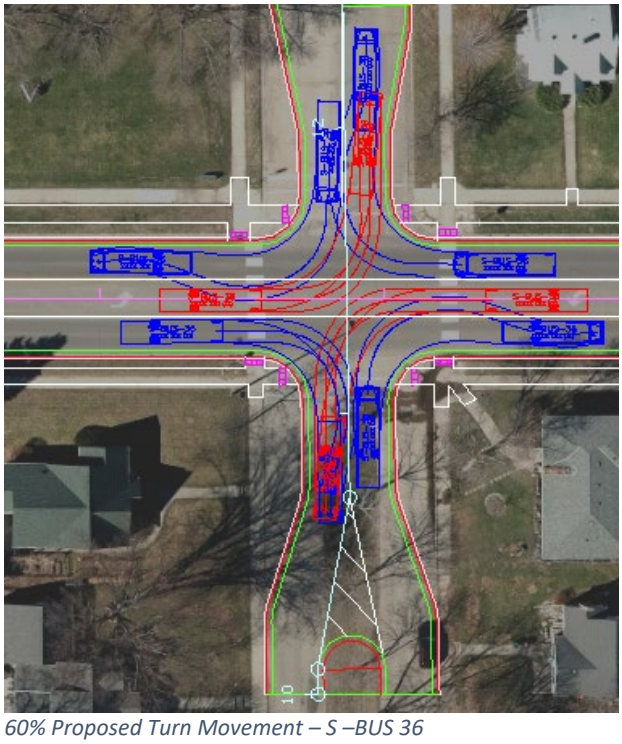
Figure 23 – Whitney Street – S-BUS 36 Turning Movement



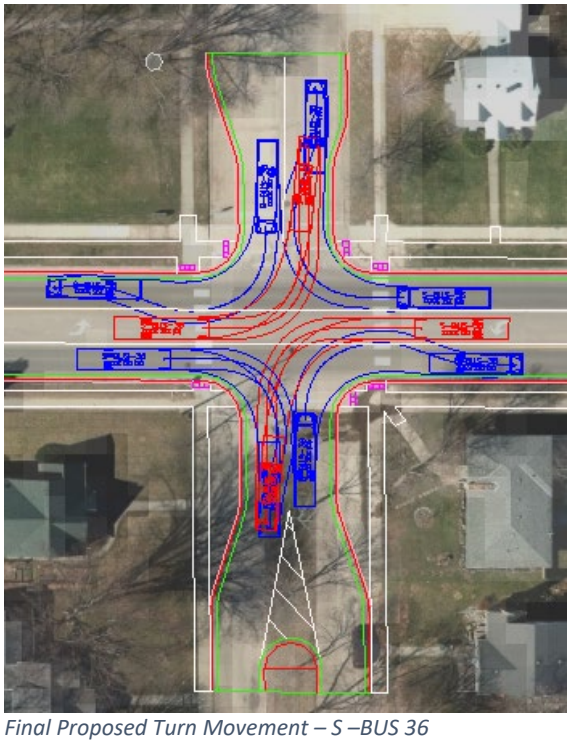
Existing Turn Movement – S-BUS 36



30% Proposed Turn Movement – S-BUS 36



60% Proposed Turn Movement – S –BUS 36

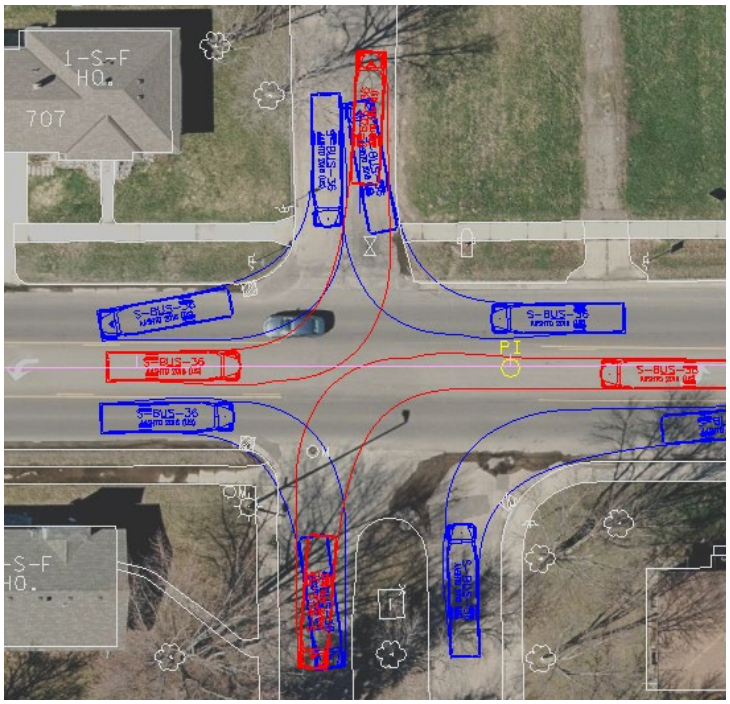


Final Proposed Turn Movement – S –BUS 36

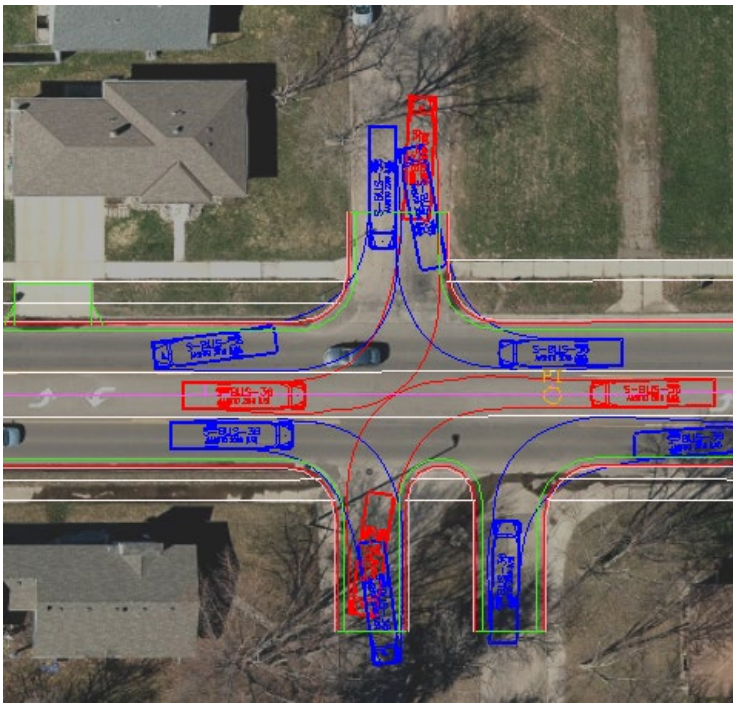
Hill Street

The intersection of TH 19 and Hill Street used the design vehicle S-BUS-36. The existing conditions for the turn movement allows in-lane to in-lane movements. The parking along Hill Street near the intersection was removed to in order to narrow the roadway. This provides shorter crosswalk distances while still accommodating the design vehicle. The existing median was shifted further south as part of the update between 30% and 60%. The roadway width of the Hill Street approaches were widened between 60% and final layout.

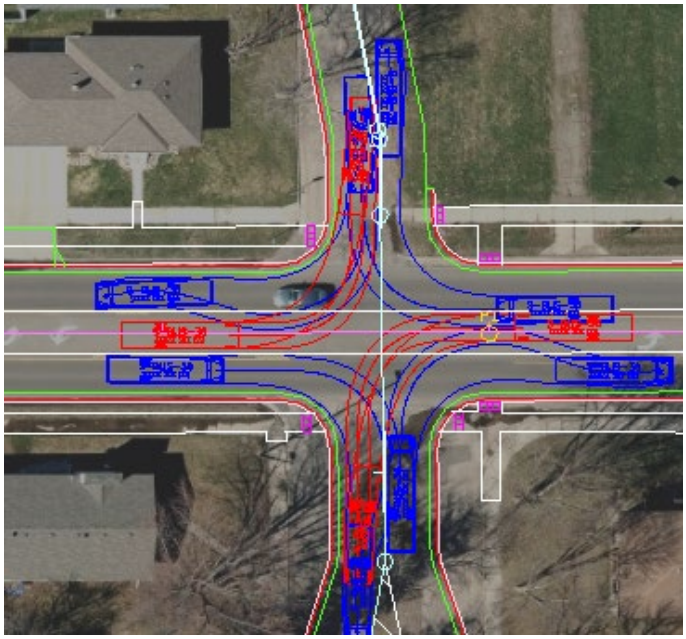
Figure 24 – Hill Street – S-BUS 36 Turning Movement



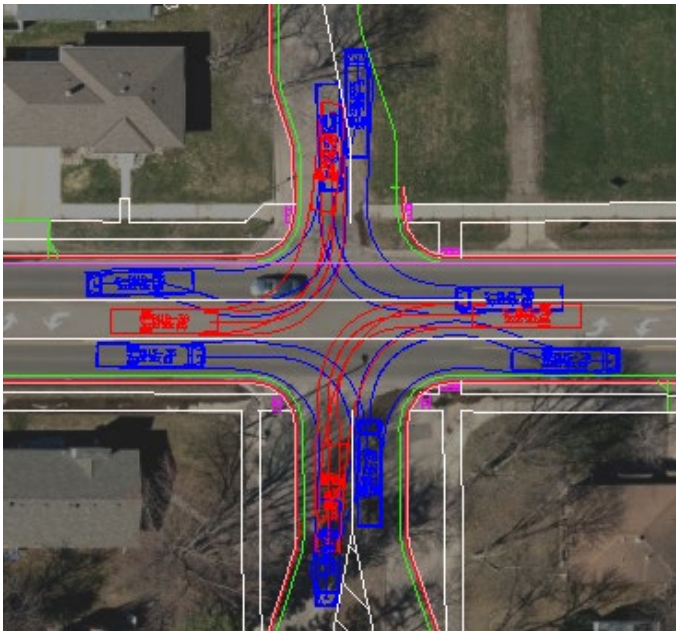
Existing Turn Movement – S-BUS 36



30% Proposed Turn Movement – S-BUS 36



60% Proposed Turn Movement – S –BUS 36

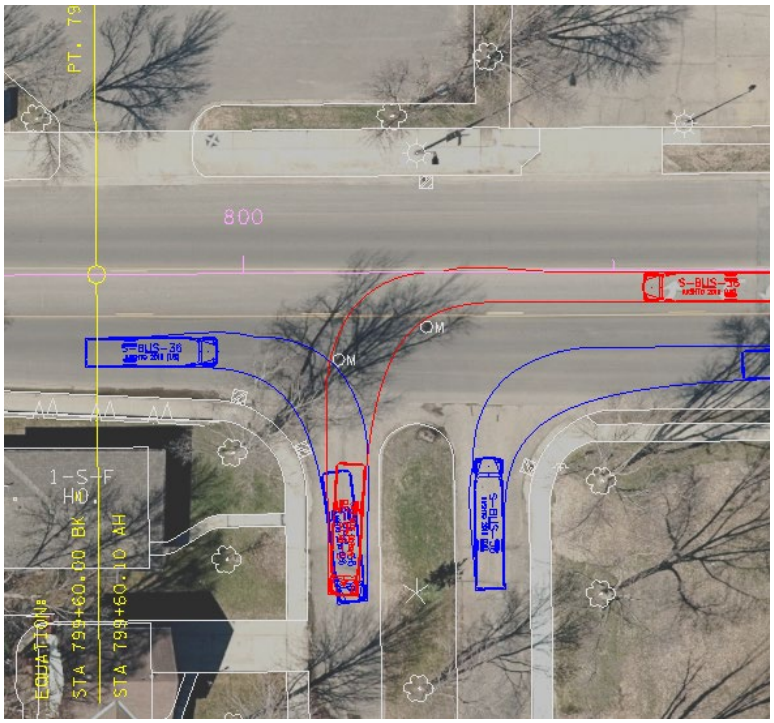


Final Proposed Turn Movement – S –BUS 36

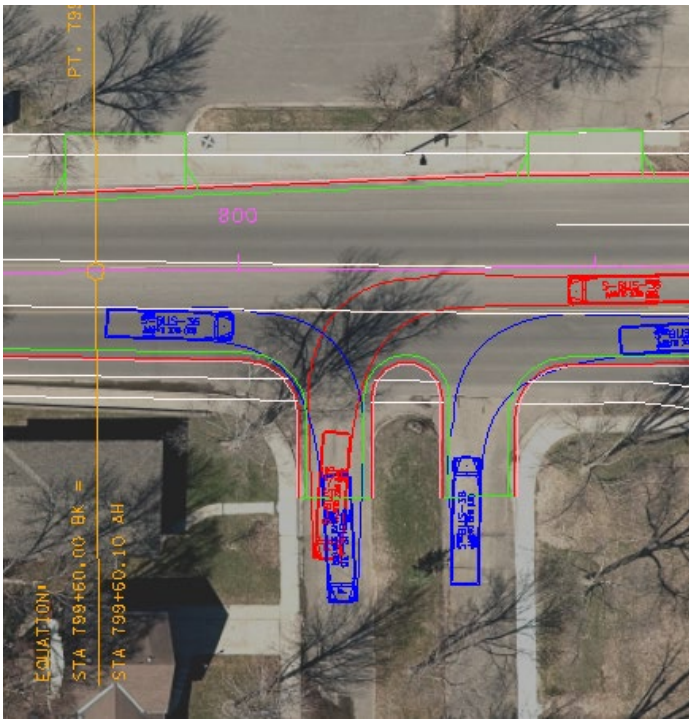
Minnesota Street

The intersection of TH 19 and Minnesota Street used the design vehicle S-BUS-36. The existing conditions for the turn movement allows in-lane to in-lane movements. The parking along Minnesota Street near the intersection was removed to in order to narrow the roadway. This provides shorter crosswalk distances while still accommodating the design vehicle. The existing median is shifted further south as part of this update. The roadway width of the Minnesota Street approach were widened between 60% and final layout.

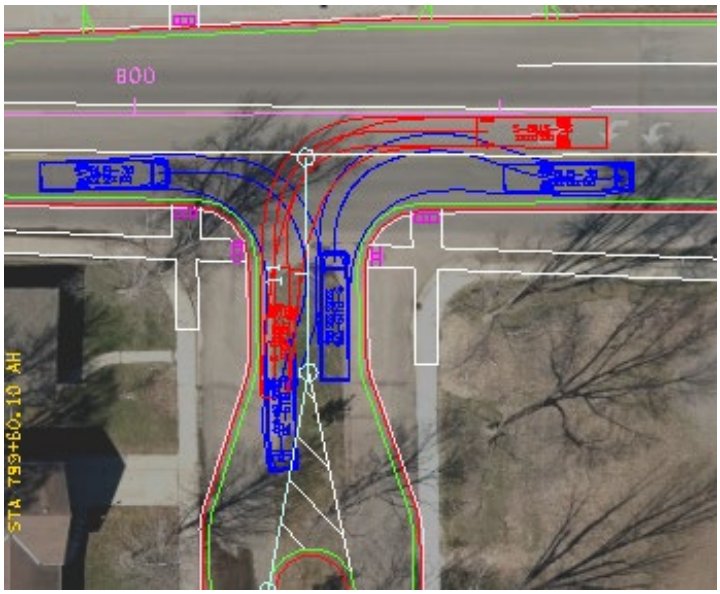
Figure 25 – Minnesota Street – S-BUS 36 Turning Movement



Existing Turn Movement – S-BUS 36



30% Proposed Turn Movement – S-BUS 36

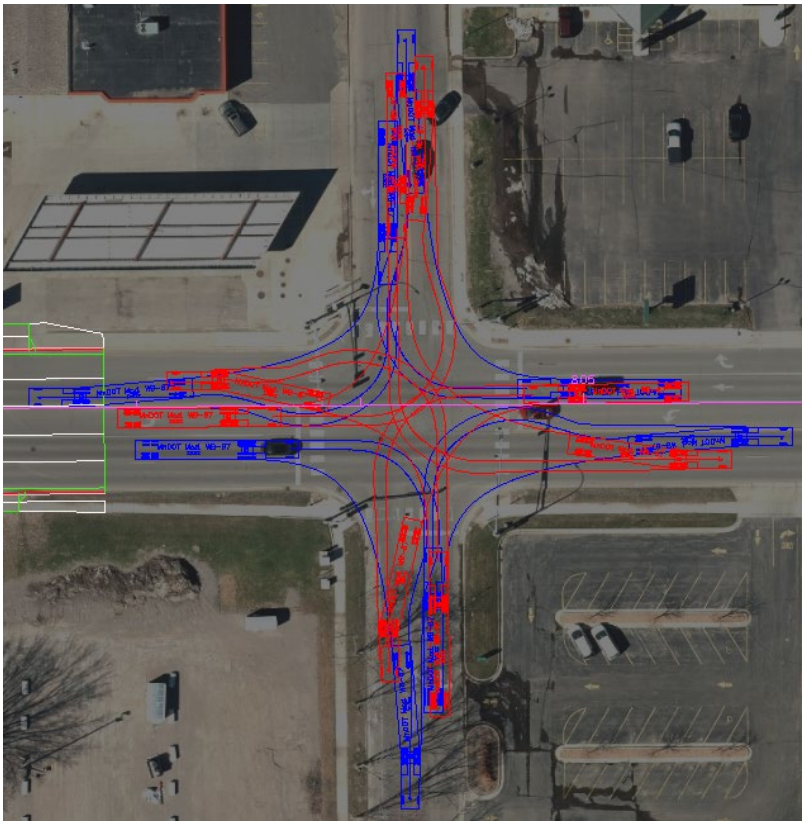


Final Proposed Turn Movement – S –BUS 36

Final Proposed Turn Movement – S –BUS 36

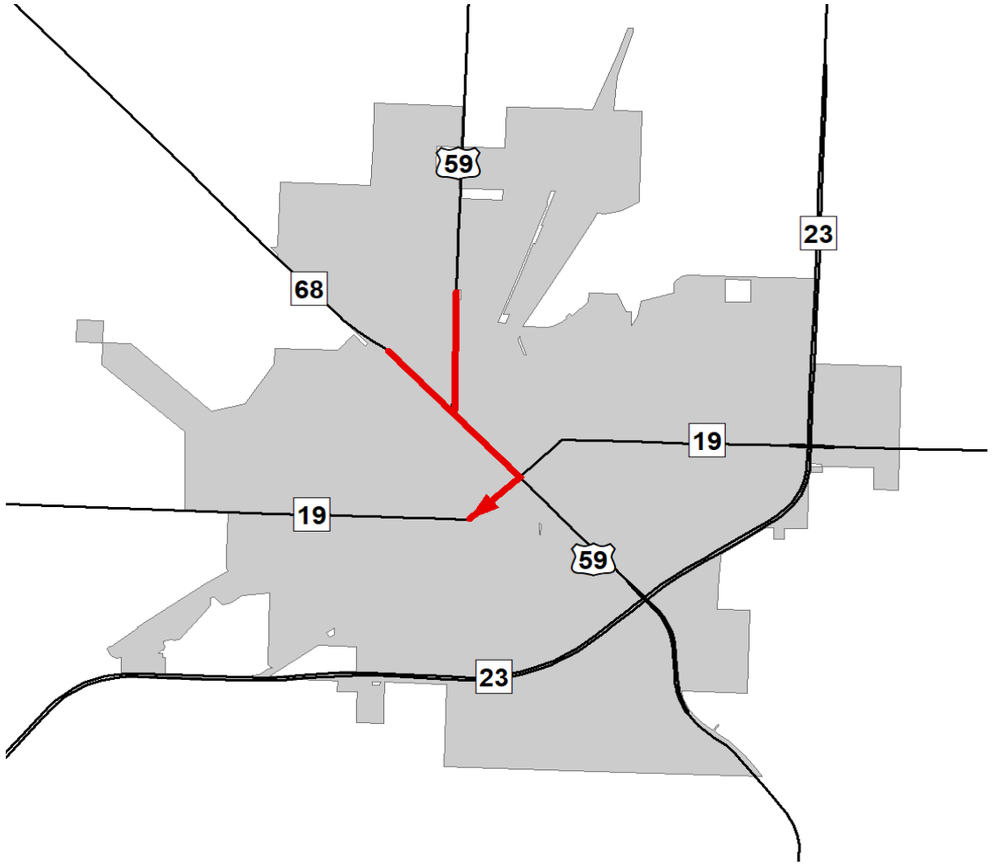
Bruce Street

No work is currently proposed at the intersection of TH 19 and Bruce Street. Turning movements provided for information only.



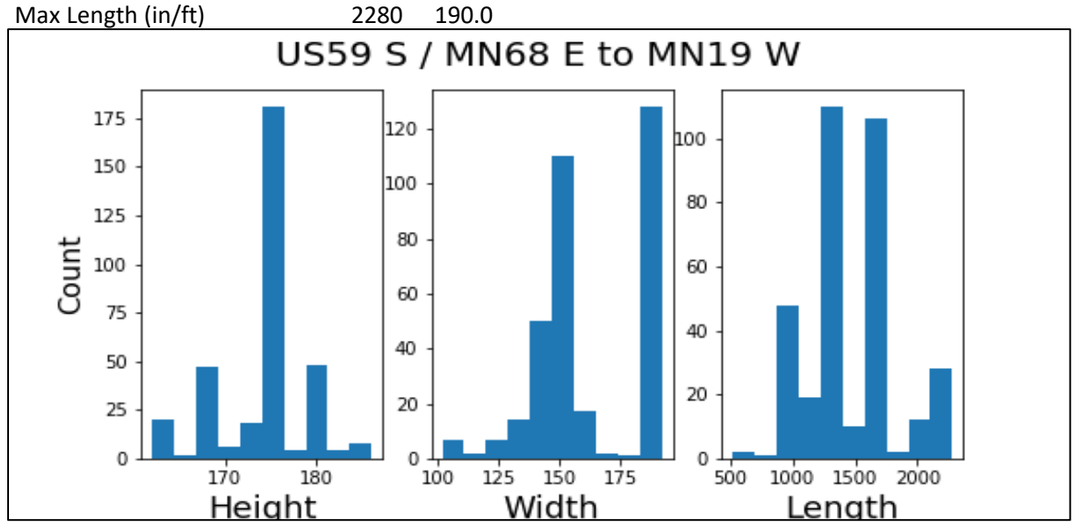
Existing Turn Movement – WB-67 Mod.

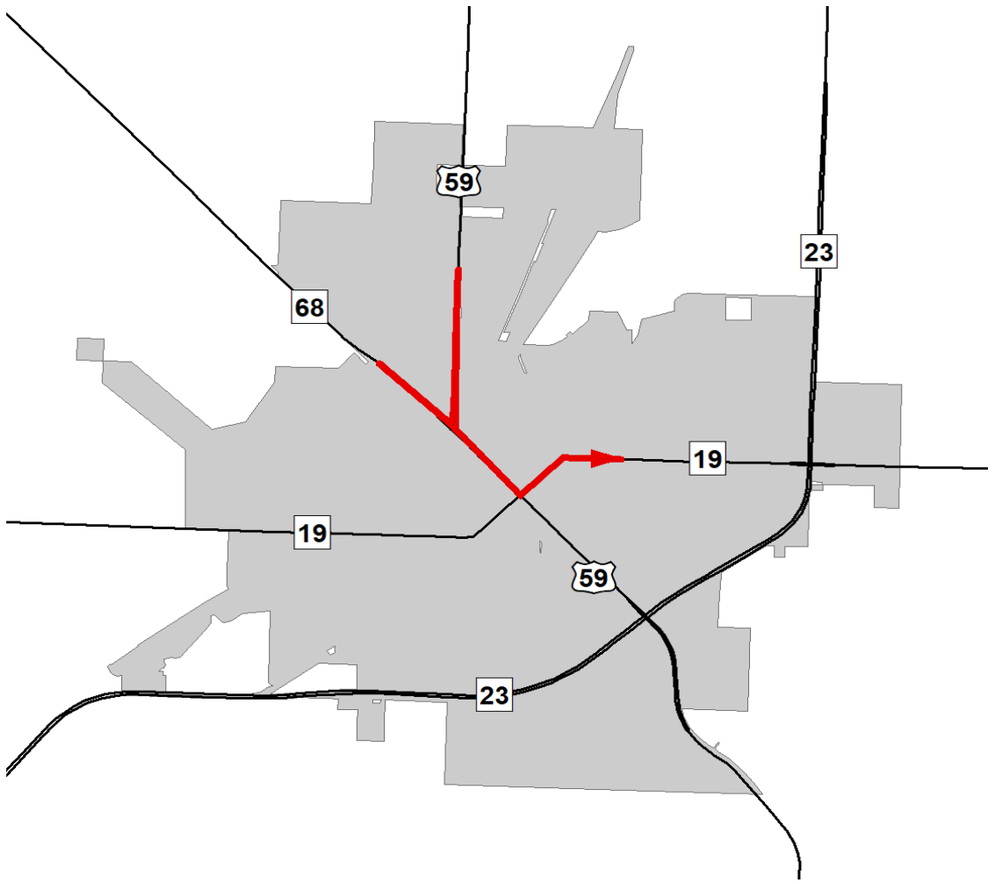
Appendix



Oversize/Overweight Vehicles - City of Marshall, MN
Southbound/Eastbound US 59/MN 68 to Westbound MN 19

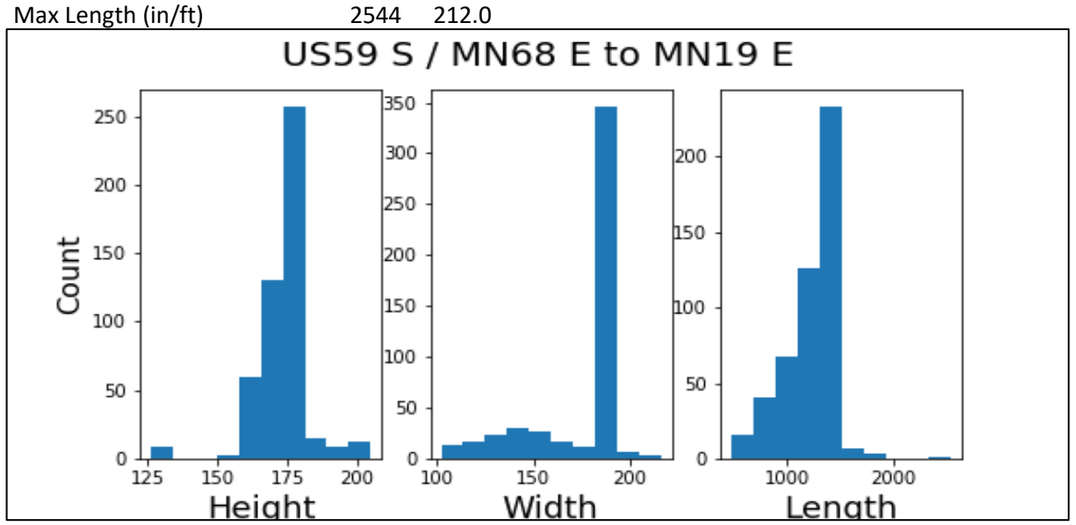
Permit Count	338	
Date range	Mar 2014-Nov 2019	
Max Height (in/ft)	186	15.5
Max Width (in/ft)	192	16.0
Max Length (in/ft)	2280	190.0

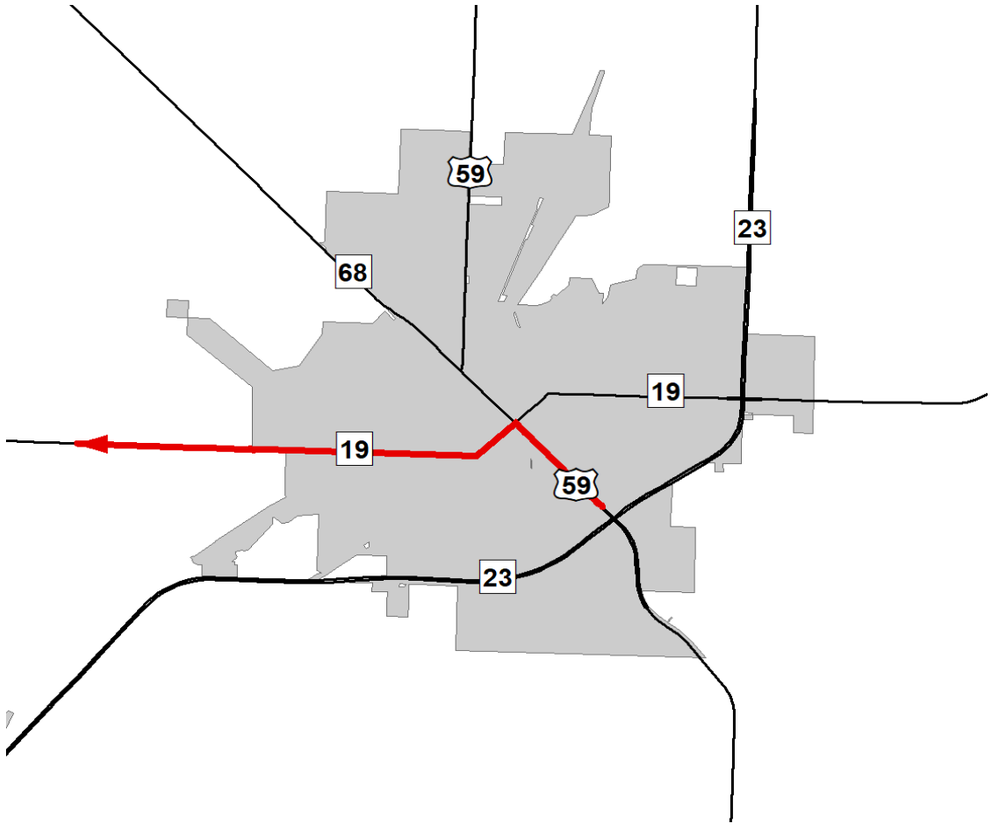




Oversize/Overweight Vehicles - City of Marshall, MN
Southbound/Eastbound US 59/MN 68 to Eastbound MN 19

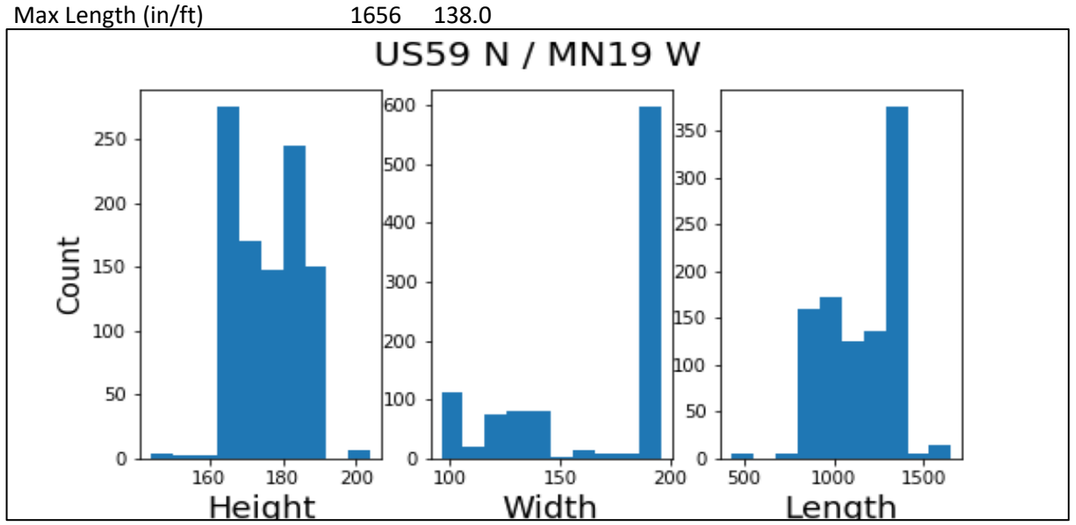
Permit Count	493	
Date range	Nov 2014-Oct 2019	
Max Height (in/ft)	205	17.1
Max Width (in/ft)	216	18.0
Max Length (in/ft)	2544	212.0

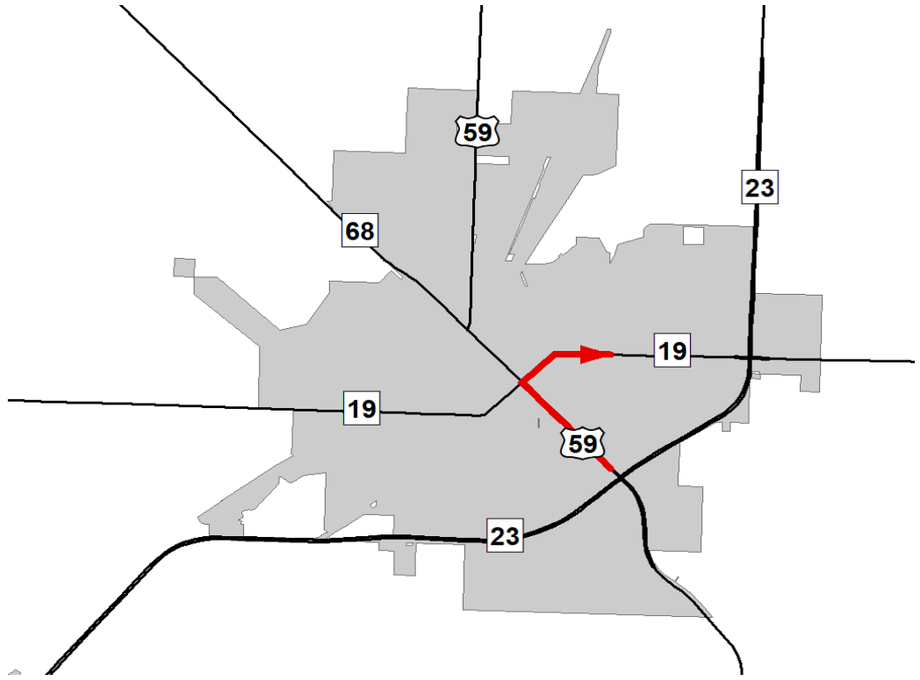




Oversize/Overweight Vehicles - City of Marshall, MN Northbound
US 59 to Westbound MN 19

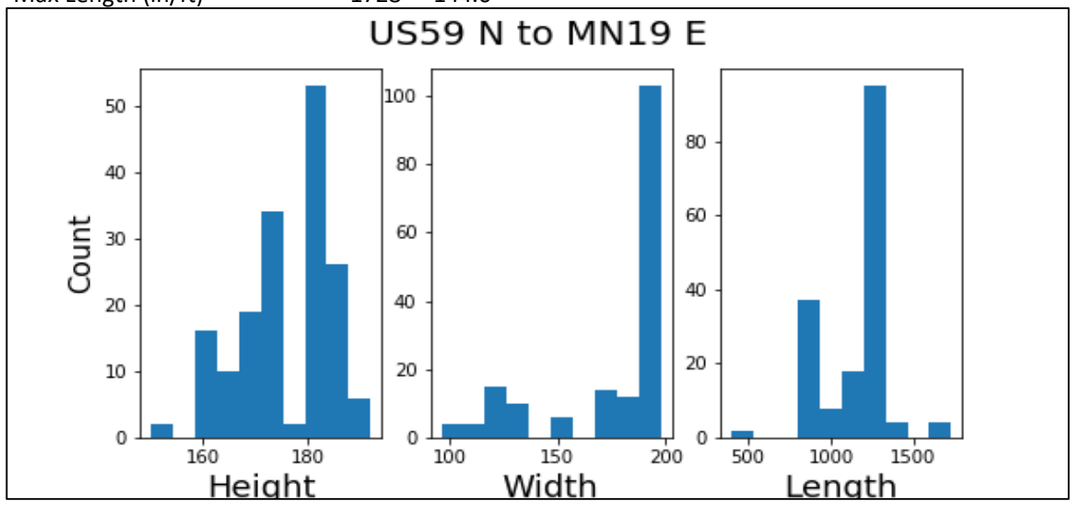
Permit Count	1003	
Date range	Apr 2014-Dec 2019	
Max Height (in/ft)	204	17.0
Max Width (in/ft)	196	16.3
Max Length (in/ft)	1656	138.0

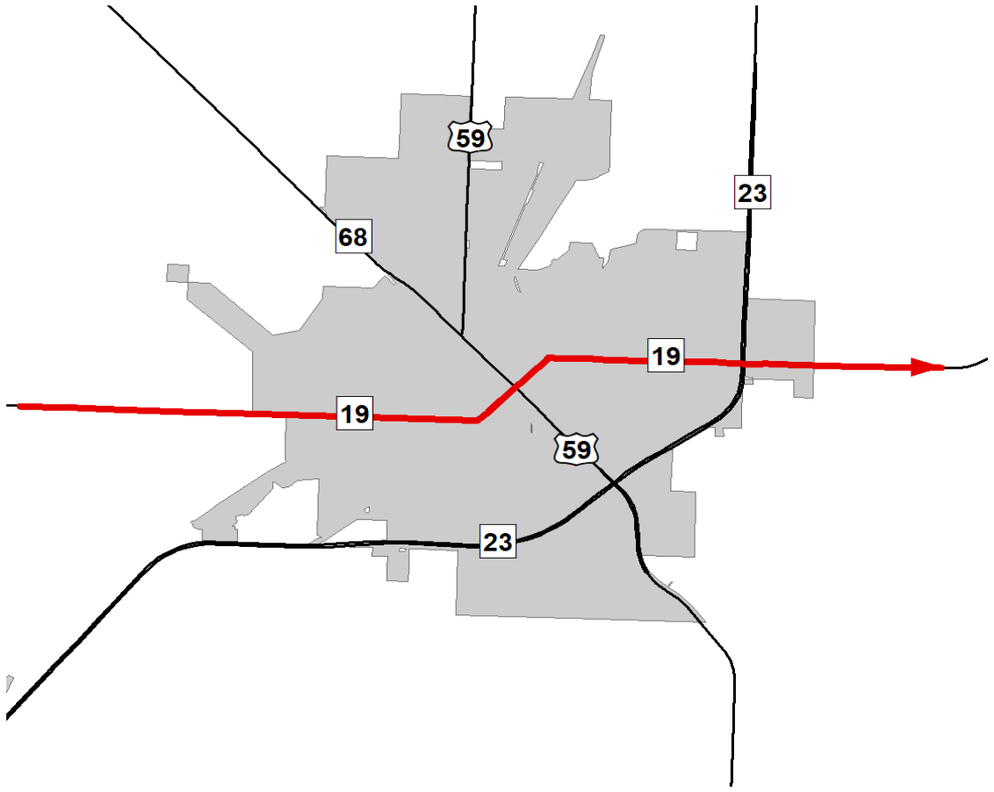




Oversize/Overweight Vehicles - City of Marshall, MN Northbound
US 59 to Eastbound MN 19

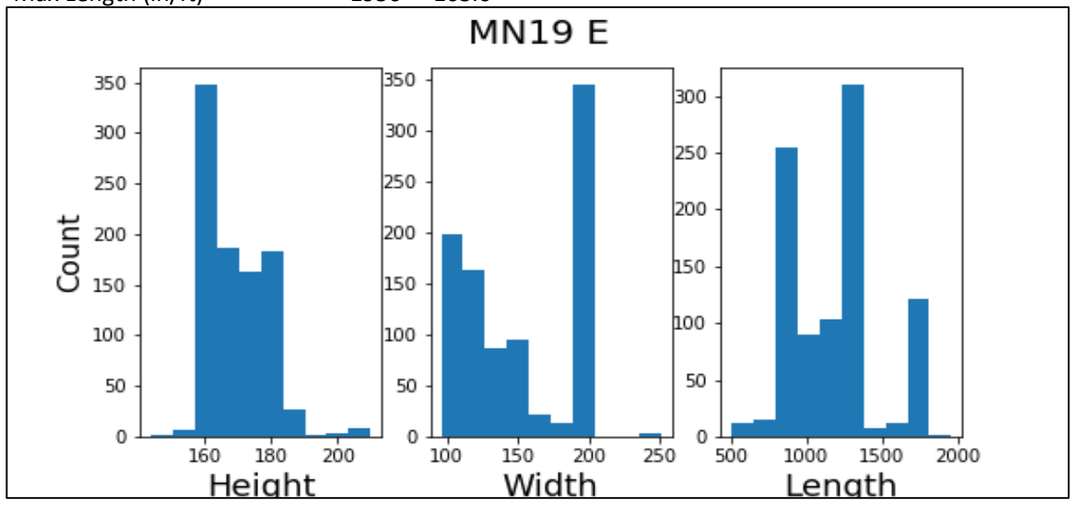
Permit Count	168	
Date range	Apr 2015-Sep 2019	
Max Height (in/ft)	192	16.0
Max Width (in/ft)	198	16.5
Max Length (in/ft)	1728	144.0

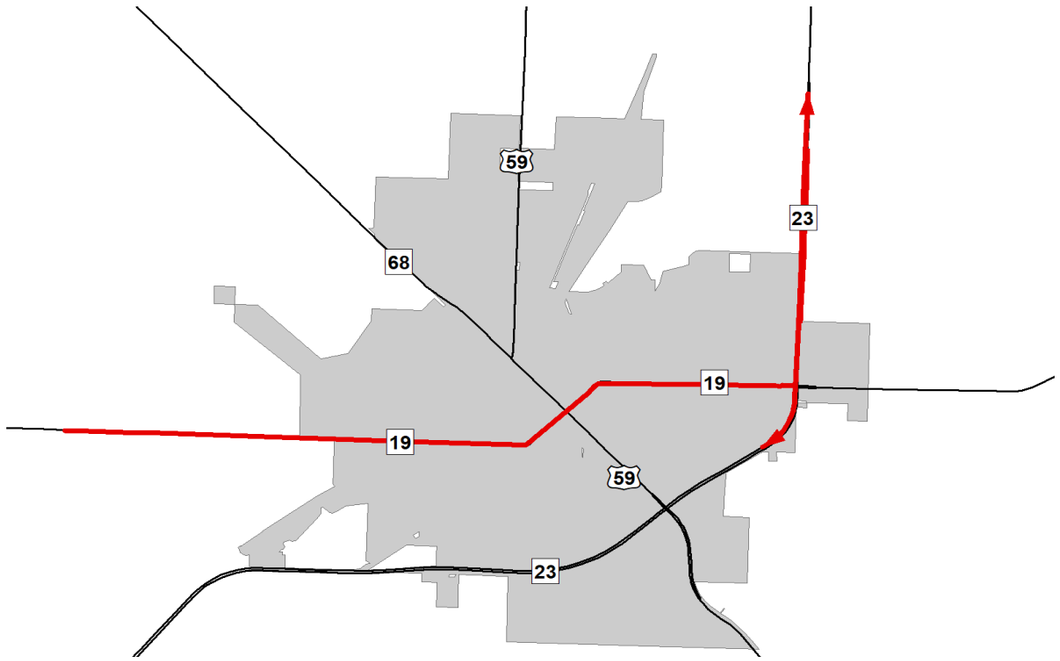




Oversize/Overweight Vehicles - City of Marshall, MN Eastbound MN
19

Permit Count	928	
Date range	Mar 2014-Dec 2019	
Max Height (in/ft)	210	17.5
Max Width (in/ft)	251	20.9
Max Length (in/ft)	1956	163.0





Oversize/Overweight Vehicles - City of Marshall, MN Eastbound MN 19 to MN 23 (either direction)

Permit Count	871	
Date range	Jan 2014-Dec 2019	
Max Height (in/ft)	198	16.5
Max Width (in/ft)	216	18.0
Max Length (in/ft)	2544	212.0