HOUSTON ENGINEERING INC.

Cooperative Planning and Environmental Report, Phase 1

52nd Avenue South, 45th Street to Sheyenne Street (CR 17)

Fargo-Moorhead Metro COG Project 2017-005

City of Fargo MS-17-AO

NDDOT SU 8-984 (164) PCN 22007

TECHNICAL MEMORANDUMS

HEI Project No. 6059-139

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A. TECHNICAL MEMORANDUM 1 - EXISTING AND FORECAST CONDITIONS

Memorandum

To: ***52nd Avenue South Study Review Committee From: Tony Heppelmann, P.E.***

Date: ***January 23, 2018***

Re: ***Technical Memo No. 1***

Existing and Forecast Conditions WSB Project No. 10745-000

Overview

The purpose of the 52nd Avenue South Study is to determine the improvements needed to 52nd Avenue South between 45th Street and Sheyenne Street in the City of Fargo. The 52nd Avenue South corridor is in a rapidly developing area of the City of Fargo. The section of the corridor under study is currently a two-lane rural section with left- and right-turn lanes at major intersections. East of 45th Street, 52nd Avenue South becomes a 4-lane divided arterial with the potential for dual left-turn lanes and right-turn lanes at the major intersections. It becomes a 6-lane section near I-29. The corridor has a wide right-of-way and access is primarily limited to other public streets. This study will determine the number of through and turn lanes needed on 52nd Avenue South, improvements that may be required on cross-streets and the required intersection control. This memo discusses the existing traffic conditions in the corridor, the forecast 2040 travel demand, and the alternatives to accommodate the forecast travel demand at an acceptable level of service.

Existing Conditions

Functional Classification

The Functional Classification map approved in 2008, classifies 52nd Avenue South as a Minor Arterial within the study area. East of I-29 52nd Avenue South becomes a Principal Arterial. 45th Street is a minor arterial between 52nd Avenue South and 32nd Avenue South. North of 32nd Avenue South, 45th Street is a Principal Arterial. 170th Avenue (Sheyenne Street) is the only other

Minor Arterial intersecting 52nd Avenue within the study corridor. Local roadways intersecting with 52nd Avenue in the study area include 47th Street, 53rd Street, Veterans Blvd, 53rd Avenue, 68th Street, 63rd Street and McMahon Estates Circle.

Arterial roadways are intended to provide the highest level of service at the greatest speed for the longest uninterrupted distance. Their primary function is mobility and therefore some access control is required. Local streets are intended to primarily serve as access to adjacent development.

Speeds

Figure 2 shows the posted speeds for the roadways within the study area. The posted speed on 52nd Avenue South within the study area is 45 mph.

Traffic Volumes—Maps and Tables

The 2015 ADT's are shown on Figure 3. The traffic volumes on 52nd Avenue South increase significantly from the west end of the corridor to the east end of the corridor. Currently heavy commercial traffic is about 4% of the total traffic on 52nd Avenue South.

Peak hour turning movement volumes were collected in September 2017 at all the intersecting roadways on 52nd Avenue South for both the am and pm peak hour. The counts were taken using a video recording of traffic on September 6 and 7, 2017. The peak hour turning movements are shown on Figure 4.

The existing lane configurations and intersection control at the intersections on 52nd Avenue South are shown on Figure 5. At the time the traffic counts were taken the only signalized intersection in the study area was at 45th Street and 52nd Avenue South. Since then a temporary traffic signal was installed at 63rd Street and 52nd Avenue South. The analysis of the existing conditions assumes an unsignalized intersection at 63rd Street and 52nd Avenue South. The intersection of Sheyenne Street and 52nd Avenue South is a roundabout. The other intersections have stop signs on the intersecting side streets.

Level of Service

A SimTraffic simulation of the existing traffic conditions (existing traffic volumes and traffic control) was completed for the study area. For the roundabout, Highway Capacity Manual 6th Edition procedure was used. The results of this analysis are summarized in Tables 1 and 2. Figure 6 provides a visual summary of the 2017 AM existing level of service. Figure 7 provides a visual summary of the 2017 PM existing level of service. In general, 52nd Avenue South is currently providing a high level of service for traffic on 52nd Avenue South. However, there are fairly long delays on some of the side streets during the peak hours at the unsignalized locations including the

northbound approach at 63rd Street, the northbound approach at Veterans Boulevard, and the southbound approach at 53rd Street. Since this analysis was completed a temporary traffic signal was installed at the intersection of 63rd Street and 52nd Avenue South.

Table 1: Existing 2017 Measures of Effectiveness (MOE) - AM Peak Hour

Control	Location	Appr	Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		Appr	Average & Maximum Traffic Queueing (feet)								
														Left-Turn			Through			Right-Turn		
			L	T	R	L	T	R	Delay	LOS	Delay	LOS		Ave	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						25	D	14	B	NB					208				
		WB							6	A			WB					25				
		SB							6	A			SB					26				
		EB							9	A			EB					57				
Thru-Stop	2: 63rd St & 52nd Avenue S	NB	86	71	78	F	F	F	79	F			NB				236	530				
		WB	6	1	0	A	A	A	2	A			WB	33	80	275						
		SB	20	0	4	C	A	A	11	B			SB				13	42		12	44	165
		EB	4	5	3	A	A	A	5	A			EB	5	40	300					4	300
Thru-Stop	3: 53rd Ave S & 52nd Avenue S	NB	27	0	14	D	A	B	15	C			NB	30	83							
		WB	8	1	0	A	A	A	2	A			WB	14	49	200						
		SB	0	0	0	A	A	A	0	A			SB									
		EB	0	2	1	A	A	A	2	A			EB									
Thru-Stop	4: Veterans Blvd & 52nd Avenue S	NB	0	44	8	A	E	A	14	B			NB				4	26				
		WB	9	2	1	A	A	A	2	A			WB	6	32	300				1	17	300
		SB	25	17	3	D	C	A	12	B			SB	21	64	200	4	28		20	52	200
		EB	4	2	1	A	A	A	2	A			EB	22	55	275						
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	19	25	17	C	D	C	19	C			NB				17	56				
		WB	10	2	2	B	A	A	2	A			WB	10	43	150						
		SB	34	25	62	D	D	F	34	D			SB				42	122				
		EB	4	3	1	A	A	A	3	A			EB	3	29	175					7	175
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	3	3	A	A	A	3	A			WB									
		SB	27	0	9	D	A	A	18	C			SB	44	111							
		EB	7	4	0	A	A	A	4	A			EB	8	34	125						
Signalized	7: 52nd Avenue S & 45th St	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	11	5	A	B	A	9	A	16	B	WB				79	165		42	87	250
		SB	25	0	5	C	A	A	22	C			SB	99	168					24	58	
		EB	30	16	0	C	B	A	18	B			EB	82	187	250	193	341				

*Roundabout MOE based on HCM 6th Edition. Roundabout Queues are 95th percentile. All other MOEs from SimTraffic

Table 2: Existing 2017 Measures of Effectiveness (MOE) - PM Peak Hour

Control	Location	Appr	Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		Appr	Average & Maximum Traffic Queueing (feet)								
														Left-Turn			Through			Right-Turn		
			L	T	R	L	T	R	Delay	LOS	Delay	LOS		Ave	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						5	A	9	A	NB					23				
		WB							10	A			WB					90				
		SB							10	A			SB					52				
		EB							7	A			EB					11				
Thru-Stop	2: 63rd St & 52nd Avenue S	NB	29	28	9	D	D	A	11	B			NB				49	130				
		WB	5	1	1	A	A	A	3	A			WB	49	117	275						
		SB	26	19	5	D	C	A	15	C			SB				18	60		10	31	165
		EB	5	2	1	A	A	A	2	A			EB	3	23	300					12	300
Thru-Stop	3: 53rd Ave S & 52nd Avenue S	NB	19	0	4	C	A	A	5	A			NB	24	55							
		WB	4	2	0	A	A	A	2	A			WB	6	30	200						
		SB	0	0	0	A	A	A	0	A			SB									
		EB	0	1	0	A	A	A	1	A			EB									
Thru-Stop	4: Veterans Blvd & 52nd Avenue S	NB	50	22	8	F	C	A	26	D			NB				13	43				
		WB	4	3	2	A	A	A	3	A			WB	2	28	300				1	11	300
		SB	47	28	15	E	D	C	27	D			SB	50	121	200	4	31		43	110	200
		EB	10	1	0	B	A	A	2	A			EB	26	85	275						
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	25	31	10	D	D	B	12	B			NB				29	73				
		WB	6	4	4	A	A	A	4	A			WB	7	28	150						
		SB	47	48	34	E	E	D	47	E			SB				62	163				
		EB	7	2	0	A	A	A	2	A			EB	6	29	175						
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	6	5	A	A	A	6	A			WB									
		SB	43	0	23	E	A	C	32	D			SB	43	102							
		EB	11	3	0	B	A	A	3	A			EB	10	33	125						
Signalized	7: 52nd Avenue S & 45th St	NB	0	0	0	A	A	A	0	A	28	C	NB									
		WB	0	40	23	A	D	C	35	D			WB				391	831		173	394	
		SB	31	0	23	C	A	C	28	C			SB	119	196					93	179	
		EB	27	8	0	C	A	A	11	B			EB	53	113	250	91	186				

*Roundabout MOE based on HCM 6th Edition. Roundabout Queues are 95th percentile. All other MOEs from SimTraffic

Safety

Figure 8 shows the crashes that have occurred in the corridor over the last 5 years from September 1, 2012 to August 31, 2017. Overall the crash rate on 52nd Avenue South is relatively low. The greatest number of crashes have occurred at the 52nd Avenue South and Sheyenne roundabout. Two-thirds of these crashes are property damage only and the remaining crashes involved minor injuries. There were no fatalities or serious injury crashes in the corridor.

Forecast Traffic Volumes

Future traffic volumes in this corridor are dependent on the level of development that occurs within the corridor travel shed as well as within the larger metropolitan area. A Travel Demand Model was developed for the Fargo-Moorhead Metropolitan area that models future travel demand based on forecasts of households and employment for the region. The current model was developed for the base year of 2010 and forecast traffic for 2040. The 2010 Base year model was calibrated to estimate 2010 traffic volumes on the 2010 roadway network using the 2010 household and employment information. To develop the 2040 Travel Demand Model, the base year calibrated 2010 model was modified to include 2040 household and employment forecasts and committed changes in the transportation network.

The Advanced Traffic Analysis Center (ATAC) is currently in the process of updating the Fargo-Moorhead Travel Demand Model to 2045. The updated model will have a calibrated base year model for 2015 and forecast demand for 2045. This new model was not available to meet the schedule for this project. However, the 2045 household and employment forecasts are complete and are used in developing 2040 forecasts for this corridor. The following discussion provides information regarding differences in the 2040 and 2045 household and employment data and how that affects traffic growth in this corridor.

Socio-Economic Data

Figure 9 compares the household and employment forecasts for 2040 and 2045 for the zones adjacent to the 52nd Avenue South Corridor. In some zones, the 2045 household and employment forecasts are higher and in other zones they are lower than the 2040 forecasts. Although the overall numbers are similar, the 2045 forecasts do represent another 5 years of growth in the region. Figure 10 compares the 2040 and 2045 trip generation for the same zones.

Table 3 shows a comparison of the 2040 and 2045 data for the entire Fargo-Moorhead metropolitan area. Again, the 2045 forecasts are higher than the 2040 forecasts, but because 2045 includes five more years of growth the actual 2045 annual growth rate is slightly lower than the 2040 annual growth rate.

Table 3: Comparison of Socio-Economic Data

Scenario	Households	Jobs
Year 2010	77,298	119,696
Year 2015	87,421	123,596
Year 2040 Forecast	112,553	163,889
Year 2045 Forecast	123,087	178,232

Model Outputs

2010 Model versus 2010 counts

Figure 11 compares the 2010 model assignments with the 2010 counts. This information indicates how well the model is calibrated to the base year data around 52nd Avenue South. As can be seen from the comparison the travel demand model for this area is calibrated very well to the actual counts.

2040 Model ADT versus 2045 Model ADT

WSB created a 2045 model run using the 2040 existing plus committed transportation network and the 2045 socio-economic data. Figure 12 compares the assigned daily traffic volumes from the 2045 model run with the assigned daily traffic volumes from the 2040 model on the existing plus committed transportation network. Although the 2045 assignments are slightly higher than the 2040 assignments, they also represent another 5 years of growth.

Figure 13 compares the annual growth rates in traffic for the same two models. This figure shows that the annual traffic growth rate in the 2045 model is slightly less than the annual traffic growth rate in the 2040 model. Figure 14 shows the annual traffic growth rates between 2010 and 2015 for the 52nd Avenue South corridor. As can be seen, the traffic growth rates over the last five years have been much greater than what the models are indicating as an annual growth rate through 2040 or 2045. This can be expected since as the area becomes more developed the traffic growth rate should decline relative to the traffic that is already present. In estimating the traffic volumes in 2040 or for interim years between today and 2040, WSB would recommend assuming a linear growth rate rather than a compounded annual growth rate. This will result in declining annual growth rates over time as the traffic volumes increase.

Existing Plus Committed network versus Roadway Vision Plan network

Significant changes in the transportation network are expected in this area of the City. Figure 15 shows the additional transportation improvements that have been identified in the 2014 Fargo Moorhead Long Range Transportation Plan (LRTP) in what is labeled in the LRTP as the Roadway Vision Plan. Changes in the transportation network included in the Roadway Vision Plan network include the extension of 45th Street south of 52nd Avenue South, the extension of Veterans Boulevard south of 52nd Avenue South, the upgrade and extension of 64th Avenue to the east across I-29, and the upgrade and extension of 76th Avenue to the east with an interchange at I-29. These improvements will have a significant impact on the traffic demand on the 52nd Avenue South corridor. Figure 16 shows the 2040 model assignments for this area with the existing plus committed network. Figure 17 shows 2040 Roadway Vision Plan model assignments. By comparing the two figures it can be seen that ADT's on 52nd Avenue South within the study area are significantly lower on the Roadway Vision Plan network versus the Existing Plus Committed

network. In other words, the other transportation facilities that are constructed in this area will have a significant impact on the forecasts for 52nd Avenue South.

Fiscally Constrained Network

The current Fargo-Moorhead Long Range Transportation Plan also includes a Fiscally Constrained network. Within the 52nd Avenue South study area this network includes some, but not all, of the improvements in the Roadway Vision Plan network. Figure 18 shows the fiscally constrained network. Some of the key differences from the Roadway Vision Plan network include:

45th Street and Veterans Boulevard are only extended to 64th Avenue versus 76th Avenue.

76th Avenue does not have an interchange with I-29.

The Long-Range Transportation Plan will be updated in 2018.

Based on discussions with the 52nd Avenue South Study Review Committee it was concluded that the fiscally constrained network is probably the most appropriate transportation network to use for developing the 2040 forecasts for the 52nd Avenue South corridor with the exception that it is not expected that Veteran's Boulevard will be extended south to 64th Avenue because of the cost of bridging over the drainage ditch.

2040 ADT Forecasts

Figure 19 shows the 2040 ADT forecasts for the corridor. These forecasts are based on the modified fiscally constrained network described above and are less than the ADT's forecast assuming just the existing plus committed network but more than the ADT's forecast with the Roadway Vision Plan network. The 2040 ADT forecasts shown on Figure 19 are based on the 2045 Model Assignments (2045 Socio-economic data) using the modified fiscally constrained network that have been adjusted to 2040 assuming straight line growth. The forecasts have also been adjusted based on the 2017 counts on the lower volume local streets.

Figure 20 shows 2040 am and pm peak hour turning movement forecasts for the intersections in the corridor based on the 2040 forecasts shown on Figure 19. These turning movement forecasts are based on general travel patterns obtained from existing turning movement counts and the travel model. For example, at Sheyenne Street and 52nd Avenue South there is a very heavy northbound to eastbound right-turn movement in the am peak hour and a similar heavy westbound to southbound left-turn movement in the pm peak hour. The 2040 turning movement forecasts reflect this same pattern based on the ADT growth on Sheyenne Street and 52nd Avenue South. Another

example is that existing turning movements and ADT's show a strong orientation towards I-29 with ADT's increasing on 52nd Avenue South from west to east and heavy northbound right-turn movements and southbound left-turn movements onto 52nd Avenue South. The forecast 2040 ADT's also show this same pattern, and this is reflected in the 2040 am and pm peak hour turning movement forecasts.

Future Traffic Operations

Overview of Analysis

Future traffic operations will depend on the improvements that are made in the corridor to accommodate the 2040 travel demand. Three alternatives were identified at the corridor level for analysis purposes. These alternatives include the No-build alternative, a 4-Lane Divided roadway with traffic signals, and a 4-lane Divided roadway with roundabouts. Based on the 2040 traffic forecasts there are two intersections in the corridor that are expected to meet warrants for a traffic signal; they are the intersections of 52nd Avenue South/63rd Street and 52nd Avenue South/Veteran's Boulevard. The 45th Street intersection is already signalized, and the Sheyenne Street intersection is currently a roundabout intersection. The 4-Lane Divided with Traffic Signals alternative would create a corridor where the major cross-street traffic is handled at signalized intersections. The 4-Lane Divided with Roundabouts would create a corridor where the major cross-street traffic is handled with roundabout intersections.

In between the major intersections of 63rd Street, Veterans Boulevard and 45th Street are three lower volume access intersections. These include the intersections of 52nd Avenue South at 53rd Avenue, 52nd Avenue South at 53rd Street and 52nd Avenue South at 47th Street. There are five options at each of these locations; full access, 3/4 access, RCUT, J-Turn, and Right-in, Right-out. The RCUT (Reduced Conflict U-Turn) has direct access for all moves except the north-south throughs and the left-turns from the minor street. These movements will have to take a right-turn and then use the U-turn intersection to go in the opposite direction and either make a right-turn at the intersection (north-south through's) or continue through the intersection (left turn from minor street). The J-Turn intersection is similar to the RCUT intersection except it does not allow the left-in to the minor street. These lefts must use the U-Turn intersection. The last option is to restrict the minor intersections to right-in, right-out. Left-turns and through traffic will have to go to the next intersection and either make a U-turn or use other local streets to access the adjacent development.

A SimTraffic simulation of the 2040 traffic operations with the 2040 forecast turning movements was completed for a No-Build and Build Alternatives for 52nd Avenue South. The roundabout at Sheyenne Street was analyzed using Highway Capacity Manual 6th Edition procedures. The No-

Build alternative assumes that no improvements are made in the 52nd Avenue South corridor except at 45th Street, which is assumed to be extended south to 64th Avenue as a four-lane divided roadway. The No-build alternative assumes a traffic signal at 63rd Street since a temporary signal has been installed at this location.

2040 No-Build Conditions

Tables 4 and 5 show the results of the traffic operations analysis for the No-build alternative for the 2040 forecast am and pm peak hours. Below is a discussion of the operations expected at each intersection moving from west to east.

Sheyenne Street and 52nd Avenue South – This roundabout is forecast to operate at LOS "F" in the am peak hour and LOS "E" in the pm peak hour. The worst approaches are the northbound approach in the am peak hour and the southbound and westbound approaches in the pm peak hour.

63rd Street and 52nd Avenue South – This is assumed to be a signalized intersection in the No-Build alternative. This intersection will operate at LOS "D" in the am peak hour and at LOS "B" in the pm peak hour.

53rd Avenue and 52nd Avenue South – This is a low volume unsignalized intersection in the No-Build alternative that will operate at an acceptable LOS "D" or better in the am and pm peak hours. It is possible that the north leg of this intersection could have higher volumes than forecast for 2040 if higher traffic generating commercial uses are developed on this currently undeveloped property.

Veteran's Boulevard and 52nd Avenue South – This is assumed to be an unsignalized intersection in the No-Build alternative and the southbound left turns are at LOS "F" in the am peak hour and the entire southbound approach is at LOS "F" in the pm peak hour.

53rd Street and 52nd Avenue South – This is assumed to be an unsignalized intersection in the No-Build alternative and thru and left-turn movements on the northbound and southbound approaches are at LOS "F" in the am and pm peak hour.

47th Street and 52nd Avenue South – This is assumed to be an unsignalized intersection in the No-Build alternative and the southbound approach is at LOS "F" in the am and pm peak hours. There is currently no south leg on this intersection but is planned to accommodate future development.

45th Street and 52nd Avenue South – This intersection is currently signalized and is forecast to operate at LOS “D” in the am and pm peak hours.

In general, significant side street delays as well as back-ups on 52nd Avenue South can be expected with 2040 traffic and no major improvements on 52nd Avenue South or side streets.

Table 4: No-Build 2040 Measures of Effectiveness (MOE) - AM Peak Hour

Intersection		Appr	Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		Appr	Average & Maximum Traffic Queueing (feet)								
Control	Location		L	T	R	L	T	R	Delay	LOS	Delay	LOS		Left-Turn			Through			Right-Turn		
														Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						245	F	114	F	NB					1281				
		WB							23	C			WB					158				
		SB							14	B			SB					124				
		EB							14	B			EB					73				
Signalized	2: 63rd St & 52nd Avenue S	NB	29	34	25	C	C	C	26	C	21	C	NB	35	86	100	13	59		156	323	
		WB	18	10	1	B	B	A	12	B			WB	62	144	275	84	218		2	17	275
		SB	32	0	6	C	A	A	17	B			SB	27	75	100	19	64				
		EB	16	26	8	B	C	A	24	C			EB	32	77	300	195	325		17	111	300
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	38	35	13	E	E	B	15	C			NB				27	88				
		WB	7	2	1	A	A	A	2	A			WB	18	55	200						
		SB	31	26	13	D	D	B	24	C			SB				22	69				
		EB	3	2	1	A	A	A	2	A			EB	13	33	250		4				
Thru-Stop	4: Veterans Blvd & 52nd Avenue S	NB	0	0	7	A	A	A	5	A			NB				3	22				
		WB	5	3	2	A	A	A	3	A			WB	8	33	300		4		3	24	300
		SB	111	31	9	F	D	A	47	E			SB	89	208		20	121		34	113	200
		EB	8	2	1	A	A	A	3	A			EB	40	98	275						
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	44	55	25	E	F	D	33	D			NB				27	76				
		WB	10	3	2	B	A	A	3	A			WB	18	48	150						
		SB	519	503	480	F	F	F	518	F			SB				441	557				
		EB	5	4	2	A	A	A	4	A			EB	5	30	175					3	175
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	6	5	A	A	A	6	A			WB									
		SB	164	0	134	F	A	F	148	F			SB									
		EB	11	5	0	B	A	A	5	A			EB									
Signalized	7: 45th St & 52nd Avenue S	NB	35	36	23	D	D	C	31	C	38	D	NB	92	208	300	162	264		135	285	300
		WB	69	91	48	E	F	D	72	E			WB	118	350		525	1133		211	394	
		SB	40	26	11	D	C	B	30	C			SB	113	204	500	105	173		37	88	
		EB	31	24	21	C	C	C	26	C			EB	83	150	250	157	252				

*Roundabout MOE based on HCM 6th Edition. Roundabout Queues are 95th percentile. All other MOEs from SimTraffic

Table 5: No-Build 2040 Measures of Effectiveness (MOE) - PM Peak Hour

Intersection			Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)			Average & Maximum Traffic Queueing (feet)								
Control	Location	Appr	L	T	R	L	T	R	Delay	LOS	Delay	LOS	Appr	Left-Turn			Through			Right-Turn		
														Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						11	B	49	E	NB					83				
		WB							35	E			WB					364				
		SB							100	F			SB					577				
		EB							17	C			EB					53				
Signalized	2: 63rd St & 52nd Avenue S	NB	23	20	6	C	C	A	8	A	10	B	NB	17	64	100	5	27		49	112	300
		WB	10	5	1	B	A	A	7	A			WB	82	174	275	56	144		6	29	275
		SB	33	21	7	C	C	A	19	B			SB	20	63	100	20	61				
		EB	13	18	7	B	B	A	16	B			EB	23	55	300	101	205		20	59	300
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	29	16	6	D	C	A	8	A			NB				25	66				
		WB	4	3	1	A	A	A	3	A			WB	6	28	200						
		SB	21	21	10	C	C	B	17	C			SB				15	45				
		EB	7	1	0	A	A	A	1	A			EB	13	51	250					8	250
Thru-Stop	4: Veterans Blvd & 52nd Avenue S	NB	110	140	33	F	F	D	75	F			NB				15	68				
		WB	5	4	2	A	A	A	4	A			WB	3	27	300				2	32	300
		SB	1060	727	686	F	F	F	824	F			SB	292	300		1584	2046		111	297	
		EB	19	2	1	C	A	A	5	A			EB	48	122	275		7				
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	34	41	12	D	E	B	15	C			NB				31	90				
		WB	6	4	3	A	A	A	4	A			WB	9	39	150						
		SB	484	497	472	F	F	F	484	F			SB				457	550				
		EB	9	2	1	A	A	A	2	A			EB	7	35	175						
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	8	6	A	A	A	8	A			WB							1	24	175
		SB	98	0	65	F	A	F	80	F			SB	74	188							
		EB	18	3	0	C	A	A	4	A			EB	13	46	125						
Signalized	7: 45th St & 52nd Avenue S	NB	37	38	11	D	D	B	28	C	34	C	NB	68	145	300	125	204		69	143	300
		WB	44	51	29	D	D	C	45	D			WB	180	350		391	1135		122	394	
		SB	37	33	22	D	C	C	32	C			SB	101	168	500	130	230		87	187	
		EB	29	26	18	C	C	B	24	C			EB	27	66	250	130	214				

*Roundabout MOE based on HCM 6th Edition. Roundabout Queues are 95th percentile. All other MOEs from SimTraffic

2040 Build Alternative Conditions

4-Lane Divided with Traffic Signals

The assumed intersection lane configuration for the 2040 4-Lane Divided with Traffic Signal alternative is shown on Figure 21. Tables 6 and 7 shows the results of the traffic operations analysis for this alternative for the 2040 forecast am and pm peak hours. Below is a discussion of the operations expected at each intersection moving from west to east.

Sheyenne Street and 52nd Avenue South – Because this roundabout is forecast to operate at LOS "F" and LOS "E" in the am and pm peak hours in 2040 under the No- build alternative, improvements to the roundabout were identified to provide acceptable traffic operations. The improvements required include making the north and south legs of the roundabout two-lane approaches with two lanes through the roundabout in the northbound and southbound directions. The northbound and southbound right lanes would be combined right-thru lanes and the left lanes would be combined left-thru lanes. The other improvement would be the addition of a right-only lane on the east approach to the

roundabout. With the improvements, the roundabout is expected to operate at LOS "A" in the am peak hour and LOS "A" in the pm peak hour.

63rd Street and 52nd Avenue South – This is assumed to be a signalized intersection in the Build alternative and is expected to operate at LOS "B" in the am and pm peak hours.

53rd Avenue and 52nd Avenue South – This is a low volume unsignalized intersection in this alternative. The southbound and northbound left-turns and throughs are expected to operate at an acceptable LOS "D" or better in the am and pm peak hours with the 2040 forecasts. However, any volumes higher than forecast are likely to result in unacceptable delays for the northbound and southbound left-turns and through movements.

Veteran's Boulevard and 52nd Avenue South – This is assumed to be a signalized intersection in the Build alternative and is expected to operate at LOS "B" in the am and pm peak hours.

53rd Street and 52nd Avenue South – This is assumed to be an unsignalized intersection in the Build alternative and the southbound approach is expected to operate at LOS "F" in the am and pm peak hours. The northbound through and left-turn movements are expected to operate at LOS "E" and "F".

47th Street and 52nd Avenue South – This is assumed to be an unsignalized intersection in the Build alternative and the southbound left-turn is LOS "F" in the am peak hour and LOS "E" in the pm peak hour. There is currently no south leg on this intersection but is planned to accommodate future development.

45th Street and 52nd Avenue South – This intersection is currently signalized and is forecast to operate at LOS “C” in the am and pm peak hours with this alternative.

Table 6: Build 2040 4-Lane Divided with Signals – Full Access - AM Peak Hour

Intersection		Appr	Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		Appr	Average & Maximum Traffic eing (feet)								
Control	Location													Left-Turn			Through			Right-Turn		
			L	T	R	L	T	R	Delay	LOS	Delay	LOS		Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						10	B	9	A	NB					146				
		WB							9	A			WB					46				
		SB							4	A			SB					32				
		EB							11	B			EB					57				
Signalized	2: 63rd St & 52nd Avenue S	NB	20	18	14	C	B	B	15	B	18	B	NB	31	77	150	8	38		113	250	300
		WB	21	17	2	C	B	A	18	B			WB	72	155	275	91	181		3	22	275
		SB	19	12	3	B	B	A	10	B			SB	24	62	165	1	16		14	38	150
		EB	14	23	4	B	C	A	21	C			EB	31	72	300	123	204		12	42	300
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	27	25	8	D	D	A	9	A			NB				4	28		21	65	150
		WB	10	4	3	B	A	A	4	A			WB	17	62	200						
		SB	23	31	4	C	D	A	16	C			SB				15	45		10	27	150
		EB	4	1	0	A	A	A	1	A			EB	14	54	250		2			2	250
Signalized	4: Veterans Blvd & 52nd Avenue S	NB	17	24	5	B	C	A	10	B	9	A	NB	1	16	100	3	25				
		WB	11	13	4	B	B	A	11	B			WB	11	44	300	70	164		32	81	300
		SB	21	15	6	C	B	A	12	B			SB	36	95	200	4	34		33	80	200
		EB	12	6	2	B	A	A	7	A			EB	54	122	275	51	116			7	275
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	35	39	10	E	E	B	18	C			NB				11	52		16	65	150
		WB	7	2	2	A	A	A	2	A			WB	13	47	150					5	150
		SB	156	154	45	F	F	E	154	F			SB				189	366		7	131	150
		EB	6	4	3	A	A	A	4	A			EB	4	27	175					7	175
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	5	4	A	A	A	5	A			WB								4	175
		SB	91	0	7	F	A	A	47	E			SB	69	184					35	104	150
		EB	7	2	0	A	A	A	2	A			EB	13	44	125						
Signalized	7: 45th St & 52nd Avenue S	NB	26	36	20	C	D	C	29	C	26	C	NB	71	154	300	158	260		120	242	300
		WB	25	30	15	C	C	B	23	C			WB	34	77	250	102	179		98	223	250
		SB	30	25	5	C	C	A	25	C			SB	105	175	500	104	174		26	65	
		EB	31	30	8	C	C	A	28	C			EB	85	165	250	162	255		24	60	250

*Roundabout MOE based on HCM 6th Edition. Roundabout Queues are 95th percentile. All other MOEs from SimTraffic

Table 7: Build 2040 4-Lane Divided with Signals – Full Access - PM Peak Hour

Intersection			Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		Appr	Average & Maximum Traffic eing (feet)								
Control	Location	Appr												Left-Turn			Through			Right-Turn		
			L	T	R	L	T	R	Delay	LOS	Delay	LOS		Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						4	A	8	A	NB					25				
		WB							11	B			WB					116				
		SB							8	A			SB					76				
		EB							12	B			EB					37				
Signalized	2: 63rd St & 52nd Avenue S	NB	21	18	7	C	B	A	9	A	14	B	NB	16	55	150	4	27		47	129	300
		WB	17	11	2	B	B	A	13	B			WB	128	271	275	106	208		10	43	275
		SB	22	25	4	C	C	A	14	B			SB	18	62	165	10	45		12	42	150
		EB	13	21	5	B	C	A	19	B			EB	23	58	300	67	121		14	55	300
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	31	36	4	D	E	A	7	A			NB				5	32		22	55	150
		WB	7	6	4	A	A	A	6	A			WB	5	28	200						
		SB	24	0	9	C	A	A	17	C			SB				13	30		7	27	150
		EB	8	1	0	A	A	A	1	A			EB	11	44	250						
Signalized	4: Veterans Blvd & 52nd Avenue S	NB	26	21	4	C	C	A	14	B	12	B	NB	5	32	100	4	25				
		WB	11	14	5	B	B	A	13	B			WB	5	33	300	116	235		26	60	300
		SB	24	22	13	C	C	B	17	B			SB	68	145	200	5	32		69	151	200
		EB	16	6	1	B	A	A	8	A			EB	50	111	275	39	115		1	12	275
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	28	44	7	D	E	A	11	B			NB				6	39		20	62	150
		WB	5	3	3	A	A	A	3	A			WB	8	44	150						
		SB	188	179	53	F	F	F	182	F			SB				240	442		25	178	
		EB	9	3	3	A	A	A	3	A			EB	5	24	175		2				
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	5	5	A	A	A	5	A			WB								11	175
		SB	32	0	8	D	A	A	19	C			SB	30	76					25	60	150
		EB	12	2	0	B	A	A	2	A			EB	14	52	125		8				
Signalized	7: 45th St & 52nd Avenue S	NB	24	29	10	C	C	B	22	C	24	C	NB	52	112	300	106	192		59	146	300
		WB	29	28	8	C	C	A	24	C			WB	104	184	250	144	243		48	138	250
		SB	26	26	9	C	C	A	23	C			SB	86	155	500	114	195		54	114	
		EB	24	35	11	C	D	B	27	C			EB	26	60	250	116	213		58	126	250

*Roundabout MOE based on HCM 6th Edition. Roundabout Queues are 95th percentile. All other MOEs from SimTraffic

RCUT or 3/4 Access at Intersections at Minor Streets

Tables 8 and 9 show the traffic operations results if RCUT's or 3/4 Access are constructed at the three minor street approaches rather than full access with side street stop conditions. The analysis assumes traffic signals at 63rd Street and at Veteran's Boulevard but the roundabout alternative would have similar results. These side street intersections would now operate at LOS "A". The RCUT intersection does create some additional travel time and distance since the minor street through and left turn movements need to travel about 1000 feet further. This would add approximately 25 seconds of additional travel time for these movements. However, this is more than offset by the reduced delay on the side street. With the 3/4 Access intersection the minor street throughs and left turns would have to travel to the next intersection to make a U- turn or take the local streets to a signalized intersection. The additional travel time related to using these routes will in many cases be greater than the delay that is forecast on the side street approach.

Table 8: Build 2040 4-Lane Divided with Signals - RCUT or ¾ Access- AM Peak Hour

Intersection			Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)			Average & Maximum Traffic Queueing (feet)								
Control	Location	Appr	L	T	R	L	T	R	Delay	LOS	Delay	LOS	Appr	Left-Turn			Through			Right-Turn		
														Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						10	B	9	A	NB					146				
		WB							9	A			WB					46				
		SB							4	A			SB					32				
		EB							11	B			EB					57				
Signalized	2: 63rd St & 52nd Avenue S	NB	19	21	14	B	C	B	15	B	17	B	NB	31	79	150	10	34		110	257	300
		WB	20	16	2	C	B	A	17	B			WB	65	133	275	85	192		3	18	275
		SB	19	8	3	B	A	A	10	B			SB	23	60	165		7		14	40	150
		EB	15	21	4	B	C	A	19	B			EB	33	70	300	116	203		13	42	300
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	0	0	7	A	A	A	6	A			NB							23	47	
		WB	10	5	3	B	A	A	5	A			WB	18	65	200						
		SB	0	0	4	A	A	A	2	A			SB							18	49	
		EB	3	1	0	A	A	A	1	A			EB	11	47	250					4	250
Signalized	4: Veterans Blvd & 52nd Avenue S	NB	0	6	3	A	A	A	3	A	9	A	NB		4	100	2	21				
		WB	10	14	4	B	B	A	12	B			WB	11	37	300	73	153		34	72	300
		SB	21	17	6	C	B	A	12	B			SB	41	100	200	5	24		30	73	200
		EB	12	6	2	B	A	A	7	A			EB	56	142	275	51	128			5	275
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	0	0	7	A	A	A	5	A			NB							18	43	
		WB	7	1	0	A	A	A	1	A			WB	17	65	150						
		SB	0	0	6	A	A	A	0	A			SB							36	100	
		EB	3	1	0	A	A	A	1	A			EB	5	30	175		4			7	175
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	5	4	A	A	A	5	A			WB								4	175
		SB	0	0	7	A	A	A	4	A			SB							44	99	
		EB	6	1	0	A	A	A	1	A			EB	14	56	125		7				
Signalized	7: 45th St & 52nd Avenue S	NB	29	35	20	C	D	C	29	C	26	C	NB	72	152	300	154	253		124	274	300
		WB	22	29	14	C	C	B	22	C			WB	31	66	250	105	183		95	231	250
		SB	30	26	5	C	C	A	25	C			SB	103	191	500	111	193		25	69	
		EB	30	31	8	C	C	A	28	C			EB	81	153	250	162	281		24	64	250

Table 9: Build 2040 4-Lane Divided with Signals – RCUT or 3/4 Access - PM Peak Hour

Intersection			Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)			Average & Maximum Traffic eing (feet)								
Control	Location	Appr	L	T	R	L	T	R	Delay	LOS	Delay	LOS	Appr	Left-Turn			Through			Right-Turn		
														Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						4	A	8	A	NB					25				
		WB							11	B			WB					116				
		SB							8	A			SB					76				
		EB							12	B			EB					37				
Signalized	2: 63rd St & 52nd Avenue S	NB	21	19	6	C	B	A	8	A	14	B	NB	16	53	150	5	34		45	105	300
		WB	18	12	2	B	B	A	14	B			WB	121	259	275	96	192		10	37	275
		SB	22	23	3	C	C	A	14	B			SB	19	54	165	9	37		12	34	150
		EB	14	21	4	B	C	A	19	B			EB	25	62	300	64	127		13	50	300
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	0	0	4	A	A	A	4	A			NB							22	52	
		WB	7	6	4	A	A	A	6	A			WB	6	36	200		3			3	200
		SB	0	0	7	A	A	A	3	A			SB							12	35	
		EB	8	1	0	A	A	A	1	A			EB	11	50	250						
Signalized	4: Veterans Blvd & 52nd Avenue S	NB	27	30	4	C	C	A	16	B	13	B	NB	5	28	100	6	22				
		WB	12	14	4	B	B	A	13	B			WB	4	29	300	120	239		26	61	300
		SB	25	21	13	C	C	B	18	B			SB	69	149	200	7	31		71	167	200
		EB	16	7	2	B	A	A	9	A			EB	50	111	275	41	103		1	16	275
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	0	0	5	A	A	A	4	A			NB							21	62	
		WB	4	1	0	A	A	A	1	A			WB	9	37	150						
		SB	0	0	12	A	A	B	0	A			SB							51	114	
		EB	8	1	0	A	A	A	1	A			EB	7	34	175						
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	5	4	A	A	A	5	A			WB								7	175
		SB	0	0	9	A	A	A	5	A			SB							35	92	
		EB	11	0	0	B	A	A	0	A			EB	14	58	125	1	15				
Signalized	7: 45th St & 52nd Avenue S	NB	24	29	10	C	C	B	22	C	24	C	NB	51	129	300	106	189		59	143	300
		WB	28	28	8	C	C	A	24	C			WB	96	168	250	144	252		45	126	250
		SB	26	26	8	C	C	A	22	C			SB	84	149	500	119	184		49	110	

J-Turn Intersections at Minor Streets

Tables 10 and 11 show the traffic operations results if J-turns are constructed at the three minor street approaches rather than full access with side street stop conditions. The analysis assumes traffic signals at 63rd Street and at Veteran's Boulevard but the roundabout alternative would have similar results. These side street intersections operate at LOS "A" with J-turns. The J-turn intersection will create some additional travel time and distance for the left-turn in as well as for the minor street through and left turn movements. These movements will need to travel about 1000 feet further. This would add approximately 25 seconds of additional travel time for these movements. For the left-turn in at these intersections the additional travel distance and time would be greater than delay for this left-turn with the RCUT intersection. For the side street left-turns and through movements the additional travel distance and travel time is more than offset by the reduced delay on the side street.

Table 10: Build 2040 4-Lane Divided with Signals - J-Turn- AM Peak Hour

Intersection		Appr	Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		Appr	Average & Maximum Traffic Queueing (feet)								
Control	Location													Left-Turn			Through			Right-Turn		
			L	T	R	L	T	R	Delay	LOS	Delay	LOS		Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						10	B	9	A	NB					146				
		WB							9	A			WB					46				
		SB							4	A			SB					32				
		EB							11	B			EB					57				
Signalized	2: 63rd St & 52nd Avenue S	NB	21	20	13	C	C	B	14	B	17	B	NB	29	90	150	11	41		109	216	300
		WB	20	16	2	C	B	A	17	B			WB	67	145	275	84	177		3	17	275
		SB	17	13	3	B	B	A	9	A			SB	24	87	165		4		14	41	150
		EB	15	20	4	B	C	A	19	B			EB	38	102	300	119	223		10	42	300
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	0	0	7	A	A	A	7	A			NB							23	66	
		WB	0	3	3	A	A	A	3	A			WB									
		SB	0	0	4	A	A	A	4	A			SB							18	43	
		EB	0	1	0	A	A	A	1	A			EB									
Signalized	4: Veterans Blvd & 52nd Avenue S	NB	0	12	3	A	B	A	4	A	10	B	NB	1	4	100	3	22				
		WB	10	14	5	B	B	A	12	B			WB	11	33	300	81	153		39	85	300
		SB	24	21	7	C	C	A	14	B			SB	43	103	200	5	28		33	80	200
		EB	12	6	2	B	A	A	7	A			EB	71	143	275	57	116		1	13	275
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	0	0	6	A	A	A	6	A			NB							18	50	
		WB	0	1	0	A	A	A	1	A			WB									
		SB	0	0	6	A	A	A	6	A			SB							38	86	
		EB	0	1	1	A	A	A	1	A			EB									
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	4	4	A	A	A	4	A			WB									
		SB	0	0	7	A	A	A	7	A			SB							42	94	
		EB	0	1	0	A	A	A	1	A			EB									
Signalized	7: 45th St & 52nd Avenue S	NB	29	37	21	C	D	C	30	C	27	C	NB	76	184	300	158	252		126	274	300
		WB	24	31	15	C	C	B	24	C			WB	34	75	250	104	187		95	199	250
		SB	33	26	5	C	C	A	27	C			SB	113	201	500	106	190		24	67	
		EB	30	29	7	C	C	A	27	C			EB	95	184	250	159	268		24	80	250

Table 11: Build 2040 4-Lane Divided with Signals - J-Turn- PM Peak Hour

Intersection		Appr	Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		Appr	Average & Maximum Traffic Queueing (feet)								
														Left-Turn			Through			Right-Turn		
Control	Location		L	T	R	L	T	R	Delay	LOS	Delay	LOS		Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						4	A	8	A	NB					25				
		WB							11	B			WB					116				
		SB							8	A			SB					76				
		EB							12	B			EB					37				
Signalized	2: 63rd St & 52nd Avenue S	NB	20	20	7	C	C	A	9	A	14	B	NB	16	48	150	5	26		48	116	300
		WB	17	12	2	B	B	A	13	B			WB	128	261	275	96	202		10	38	275
		SB	21	20	4	C	C	A	13	B			SB	20	59	165	8	38		12	35	150
		EB	12	21	6	B	C	A	19	B			EB	21	58	300	69	135		16	51	300
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	0	0	4	A	A	A	4	A			NB							23	61	
		WB	0	4	4	A	A	A	4	A			WB									
		SB	0	0	9	A	A	A	9	A			SB							12	38	
		EB	0	1	0	A	A	A	1	A			EB									
Signalized	4: Veterans Blvd & 52nd Avenue S	NB	26	19	4	C	B	A	14	B	12	B	NB	4	26	100	6	30				
		WB	9	14	4	A	B	A	13	B			WB	5	33	300	129	234		28	65	300
		SB	27	22	13	C	C	B	18	B			SB	73	142	200	7	35		70	160	200
		EB	16	6	2	B	A	A	8	A			EB	55	124	275	43	99		1	12	275
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	0	0	5	A	A	A	5	A			NB							21	61	
		WB	0	1	0	A	A	A	1	A			WB					9				
		SB	0	0	11	A	A	B	11	B			SB							46	110	
		EB	0	1	0	A	A	A	1	A			EB									
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	4	5	A	A	A	4	A			WB									
		SB	0	0	9	A	A	A	9	A			SB							33	69	
		EB	0	0	0	A	A	A	0	A			EB									
Signalized	7: 45th St & 52nd Avenue S	NB	24	29	10	C	C	B	22	C	24	C	NB	54	115	300	105	172		58	147	300
		WB	29	29	8	C	C	A	25	C			WB	98	160	250	145	231		44	116	250
		SB	27	27	9	C	C	A	23	C			SB	86	139	500	117	217		58	130	
		EB	24	34	11	C	C	B	26	C			EB	34	64	250	118	208		56	136	250

Right-in, Right-out Intersections at Minor Streets

Tables 12 and 13 show the traffic operations results if right-in and right-out intersections are constructed at the three minor street approaches rather than full access with side street stop conditions. The analysis assumes traffic signals at 63rd Street and at Veteran's Boulevard but the roundabout alternative would have similar results. These side street intersections operate at LOS "A" with right-in and right-out intersections. The right-in and right-out intersection will create significant additional travel time and distance for the left-turn in as well as for the minor street through and left turn movements. These movements will need to travel to the next intersection to make a U-turn or take the local streets to a signalized intersection. The additional travel time related to using these routes will in many cases be greater than the delay that is forecast on the side street approach.

Table 12: Build 2040 4-Lane Divided with Signals - RIRO- AM Peak Hour

Intersection																								
Control	Location	Appr	Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		Appr	Average & Maximum Traffic Queueing (feet)									
			L	T	R	L	T	R	Delay	LOS	Delay	LOS		Left-Turn			Through			Right-Turn		
														Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						10	B	9	A	NB					146				
		WB							9	A			WB					46				
		SB							4	A			SB					32				
		EB							11	B			EB					57				
Signalized	2: 63rd St & 52nd Avenue S	NB	19	19	14	B	B	B	15	B	17	B	NB	28	69	150	8	34		108	229	300
		WB	20	15	2	C	B	A	16	B			WB	79	152	275	77	160		4	22	275
		SB	19	19	3	B	B	A	10	B			SB	23	72	165		8		15	42	150
		EB	14	22	4	B	C	A	20	C			EB	34	87	300	127	224		12	44	300
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	0	0	8	A	A	A	8	A			NB							24	60	
		WB	0	3	3	A	A	A	3	A			WB									
		SB	0	0	4	A	A	A	4	A			SB							17	37	
		EB	0	1	0	A	A	A	1	A			EB									
Signalized	4: Veterans Blvd & 52nd Avenue S	NB	19	15	5	B	B	A	9	A	13	B	NB		4	100	2	21				
		WB	14	13	4	B	B	A	12	B			WB	78	152	300	77	157		37	86	300
		SB	27	27	6	C	C	A	14	B			SB	44	122	200	6	39		32	70	200
		EB	13	13	3	B	B	A	13	B			EB	72	162	275	106	208		1	12	275
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	0	0	6	A	A	A	6	A			NB							19	51	
		WB	0	1	0	A	A	A	1	A			WB									
		SB	0	0	6	A	A	A	6	A			SB							35	86	
		EB	0	1	1	A	A	A	1	A			EB									
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	4	4	A	A	A	4	A			WB									
		SB	0	0	8	A	A	A	8	A			SB							45	101	
		EB	0	1	0	A	A	A	1	A			EB									
Signalized	7: 45th St & 52nd Avenue S	NB	28	37	21	C	D	C	30	C	27	C	NB	75	161	300	157	245		127	251	300
		WB	24	33	15	C	C	B	25	C			WB	33	73	250	115	189		91	212	250
		SB	31	26	5	C	C	A	26	C			SB	109	181	500	107	189		26	73	
		EB	31	28	8	C	C	A	27	C			EB	103	184	250	154	253		22	68	250

Table 13: Build 2040 4-Lane Divided with Signals - RIRO- PM Peak Hour

Intersection		Appr	Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		Appr	Average & Maximum Traffic eing (feet)								
														Left-Turn			Through			Right-Turn		
Control	Location		L	T	R	L	T	R	Delay	LOS	Delay	LOS		Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						4	A	8	A	NB					25				
		WB							11	B			WB					116				
		SB							8	A			SB					76				
		EB							12	B			EB					37				
Signalized	2: 63rd St & 52nd Avenue S	NB	22	23	7	C	C	A	9	A	14	B	NB	16	51	150	5	34		49	109	300
		WB	17	12	2	B	B	A	13	B			WB	127	261	275	87	181		11	50	275
		SB	22	20	4	C	C	A	14	B			SB	18	60	165	9	38		12	44	150
		EB	13	20	5	B	C	A	18	B			EB	22	58	300	66	126		13	42	300
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	0	0	4	A	A	A	4	A			NB							21	56	
		WB	0	4	3	A	A	A	4	A			WB									
		SB	0	0	7	A	A	A	7	A			SB							11	34	
		EB	0	0	0	A	A	A	0	A			EB									
Signalized	4: Veterans Blvd & 52nd Avenue S	NB	23	25	5	C	C	A	14	B	14	B	NB	5	29	100	5	29				
		WB	13	14	5	B	B	A	13	B			WB	61	127	300	122	255		28	66	300
		SB	27	24	12	C	C	B	18	B			SB	70	165	200	6	28		65	151	200
		EB	18	13	2	B	B	A	14	B			EB	64	130	275	73	164		1	15	275
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	0	0	5	A	A	A	5	A			NB							19	49	
		WB	0	1	0	A	A	A	1	A			WB					8				
		SB	0	0	11	A	A	B	11	B			SB							45	108	
		EB	0	1	0	A	A	A	1	A			EB									
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	4	4	A	A	A	4	A			WB									
		SB	0	0	10	A	A	B	10	B			SB							36	83	
		EB	0	0	0	A	A	A	0	A			EB									
Signalized	7: 45th St & 52nd Avenue S	NB	24	29	9	C	C	A	21	C	24	C	NB	54	117	300	104	180		53	130	300
		WB	29	29	8	C	C	A	25	C			WB	104	177	250	140	243		43	107	250
		SB	27	27	9	C	C	A	23	C			SB	83	146	500	117	193		52	130	
		EB	23	35	11	C	D	B	26	C			EB	39	100	250	114	193		59	150	250

4-Lane Divided with Roundabouts

Tables 14 and 15 shows the results of the traffic operations analysis for the 4-lane divided with roundabout alternative with the 2040 forecast am and pm peak hours. In general, this alternative operates like the 4-Lane Divided with Traffic Signals. The roundabouts are expected to result in slightly less delay and better level of service at 63rd Street and at Veterans Drive.

The three access intersections with side street stops would operate like the 4-lane divided with signals alternative. The RCUT, J-Turn and Right-In Right-Out options for minor intersections were also evaluated under this option and the MOE's were found to be like the signal scenario. The MOE's for these scenarios are shown in Tables 18 thru 23.

Table 14: Build 2040 4-Lane Divided with Roundabouts -Full Access- AM Peak Hour

Intersection		Appr	Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		Appr	Average & Maximum Traffic Queueing (feet)								
Control	Location													Left-Turn			Through			Right-Turn		
			L	T	R	L	T	R	Delay	LOS	Delay	LOS		Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						10	B	9	A	NB					146				
		WB							9	A			WB					46				
		SB							4	A			SB					32				
		EB							11	B			EB					57				
Roundabout	2: 63rd St & 52nd Avenue S	NB	N/A						23	C	9	A	NB					13			166	
		WB							3	A			WB					25				
		SB							6	A			SB					12				
		EB							5	A			EB					56				
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	36	25	6	E	D	A	8	A			NB				3	25		20	61	150
		WB	7	2	1	A	A	A	2	A			WB	15	48	200					2	200
		SB	24	23	4	C	C	A	16	C			SB				17	52		8	23	150
		EB	3	1	0	A	A	A	1	A			EB	12	45	250					4	250
Roundabout	4: Veterans Blvd & 52nd Avenue S	NB	N/A						8	A	5	A	NB					1				
		WB							4	A			WB					28				
		SB							7	A			SB					10			26	
		EB							5	A			EB					56				
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	32	54	9	D	F	A	20	C			NB				11	39		17	49	150
		WB	7	2	2	A	A	A	2	A			WB	14	46	150						
		SB	198	182	72	F	F	F	195	F			SB				232	415		9	131	150
		EB	5	2	2	A	A	A	2	A			EB	4	23	175					9	175
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	4	4	A	A	A	4	A			WB								7	175
		SB	64	0	7	F	A	A	34	D			SB	56	164					35	106	150
		EB	7	2	0	A	A	A	2	A			EB	15	56	125						
Signalized	7: 45th St & 52nd Avenue S	NB	28	38	21	C	D	C	31	C	27	C	NB	70	150	300	166	254		128	265	300
		WB	24	29	15	C	C	B	23	C			WB	36	75	250	99	173		94	197	250
		SB	33	26	5	C	C	A	27	C			SB	111	198	500	110	178		27	65	
		EB	30	30	8	C	C	A	28	C			EB	85	156	250	159	248		25	75	250

Table 15: Build 2040 4-Lane Divided with Roundabouts - Full Access- PM Peak Hour

Intersection			Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)			Average & Maximum Traffic Queueing (feet)								
														Left-Turn			Through			Right-Turn		
Control	Location	Appr	L	T	R	L	T	R	Delay	LOS	Delay	LOS	Appr	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						4	A	8	A	NB					25				
		WB							11	B			WB					116				
		SB							8	A			SB					76				
		EB							12	B			EB					37				
Roundabout	2: 63rd St & 52nd Avenue S	NB	N/A						7	A	5	A	NB					3			29	
		WB							5	A			WB					54				
		SB							9	A			SB					16				
		EB							4	A			EB					30				
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	17	10	4	C	B	A	5	A			NB				7	29		20	55	150
		WB	4	3	3	A	A	A	3	A			WB	5	24	200					1	200
		SB	24	18	5	C	C	A	16	C			SB				8	33		5	23	150
		EB	6	1	0	A	A	A	1	A			EB	9	38	250						
Roundabout	4: Veterans Blvd & 52nd Avenue S	NB	N/A						7	A	5	A	NB					2				
		WB							5	A			WB					56				
		SB							11	B			SB					37			25	
		EB							4	A			EB					32				
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	22	44	6	C	E	A	9	A			NB				8	32		18	50	150
		WB	5	3	4	A	A	A	3	A			WB	7	32	150						
		SB	141	141	33	F	F	D	137	F			SB				194	425		29	173	
		EB	9	2	1	A	A	A	2	A			EB	6	31	175		4			4	175
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	4	4	A	A	A	4	A			WB								11	175
		SB	44	0	8	E	A	A	24	C			SB	28	87					26	66	150
		EB	14	2	0	B	A	A	2	A			EB	16	59	125						
Signalized	7: 45th St & 52nd Avenue S	NB	24	29	10	C	C	B	22	C	24	C	NB	51	111	300	113	197		57	148	300
		WB	29	27	8	C	C	A	24	C			WB	100	174	250	137	228		46	108	250
		SB	27	27	9	C	C	A	23	C			SB	86	151	500	118	193		56	139	
		EB	24	33	11	C	C	B	26	C			EB	26	60	250	110	183		56	144	250

Summary of Traffic Operations for 2040 Build Alternatives

Table 16 summarizes the level of service results for each of the alternatives. In general, the table shows the deficiencies of the existing facility to serve the forecast 2040 traffic volumes. It also shows the poor level of service expected for the side streets with full access at the minor access intersections. The RCUT design addresses the delays expected for the minor street throughs and left-turns. This is also addressed by the J-Turn, 3/4 Access and Right-in and Right-out alternatives. However, these options do create additional travel distance and time without any noticeable reduction in delays.

Table 16: Summary of 2040 Intersection Levels of Service by Alternative

		Alternatives													
Intersection	Traffic Control	No-Build		4-Lane with Signals/Full Access		4-Lane with Signals /RCUT		4-Lane with Signals/3/4 Access		4-Lane with Signals/J-Turn		4-Lane with Signals/RI, RO		4-Lane with Roundabouts /Full Access	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Sheyenne Street	Roundabout	F	E	A	A	A	A	A	A	A	A	A	A	A	A
63rd Street	Signal or Roundabout	C	B	B	B	B	B	B	B	B	B	B	B	A	A
53rd Avenue	Full,RCUT,J-Turn, RI-RO	E 1/	D 1/	D 1/	E 1/	B 1/	A 1/	B 1/	A 1/	A 1/	A 1/	A 1/	A 1/	E 1/	C 1/
Veterans	Signal or Roundabout	F 1/	F 1/	A	B	A	B	A	B	B	B	B	B	A	A
53rd Street	Full,RCUT,J-Turn, RI-RO	F 1/	F 1/	F 1/	F 1/	A 1/	B 1/	A 1/	B 1/	A 1/	B 1/	A 1/	B 1/	F 1/	F 1/
47th Street	Full,RCUT,J-Turn, RI-RO	F 1/	F 1/	F 1/	D 1/	A 1/	A 1/	A 1/	A 1/	A 1/	A 1/	A 1/	B 1/	F 1/	E 1/
45th Street	Signal	D 2/	C 2/	C	C	C	C	C	C	C	C	C	C	C	C

At side street stop control intersections the reported Level of Service is for the worst side street approach

The westbound through movements are at LOS E and F with only one westbound lane.

Corridor Travel Times

The table below summarizes the delay, travel time and average speed in traveling the corridor between 45th Street and Sheyenne Street for the different alternatives. The analysis is based on full access at minor street intersections but the other alternatives for the minor street intersections would have similar results. In general, the roundabouts would have slightly more delay and higher travel times than the signal alternative since some of the 52nd Avenue South through traffic will be able to travel through the intersections at 63rd Street and Veteran's Boulevard without slowing or stopping in

the signal alternative. With roundabouts, all through traffic must slow to go through the intersection resulting in slightly lower average speeds on 52nd Avenue.

Table 17: Summary of Corridor Travel Times by Alternative (AM peak hour)

Alternative	Eastbound			Westbound		
	Delay (sec)	Total Travel Time (sec)	Average Speed (mph)	Delay (sec)	Total Travel Time (sec)	Average Speed (mph)
Existing	44.4	245	35	25.1	208.5	43
No-Build	97.8	289.6	30	93.1	282.6	32
4-Lane w/Signals	91.6	282.1	31	89.2	280.6	32
4-Lane w/Roundabouts	97.7	293.8	29	98.1	289.5	31

Safety

Roundabouts versus Signals

The most recent crash studies on roundabouts show that a 2-lane by 1-lane roundabout has about the same crash rate as a signalized intersection. However, the fatality and serious injury crash rate for a 2x1 roundabout is about 50% less than for a signalized intersection. This is based on the Federal Highway Crash Modification Factors Clearinghouse and consistent with a recently completed study of traffic safety at roundabouts in Minnesota.

R-CUT and J-Turn intersections versus full access side street stop intersections

The Federal Highway Crash Modification Factors Clearinghouse has several studies that indicate an RCUT intersection will reduce the crash rate at a full access side street stop intersection by about 30% and reduce the overall severity of crashes.

A similar study of the J-turn intersection indicated that the J-turn design resulted in about a 35% reduction in the overall crash rate with about a 50% reduction in the crash rate for injury and fatal crashes.

Figure 1: Functional Classification Map

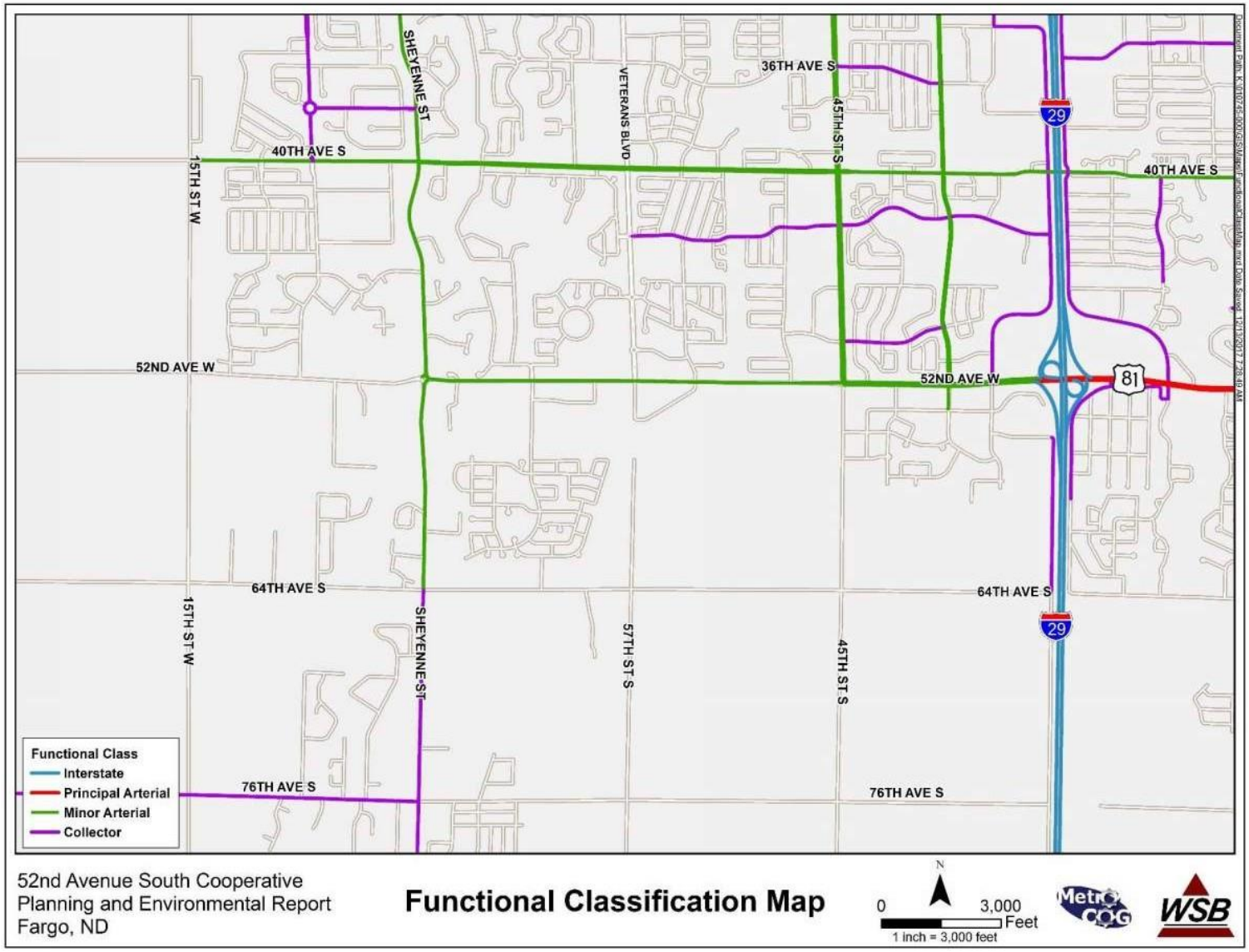


Figure 2: Posted Speeds

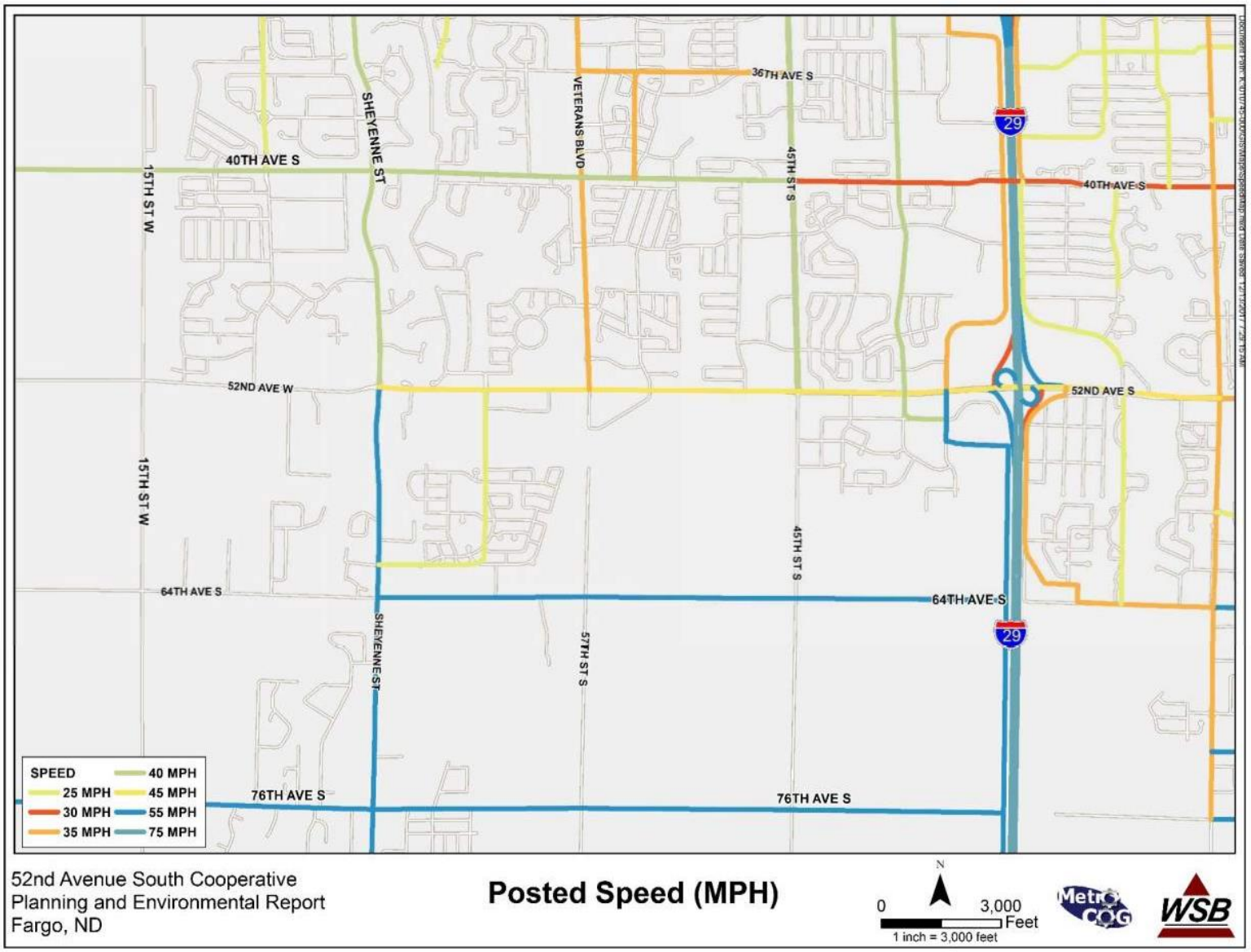


Figure 3: 2015 ADT's

Figure 4: 2017 Turning Movements Counts

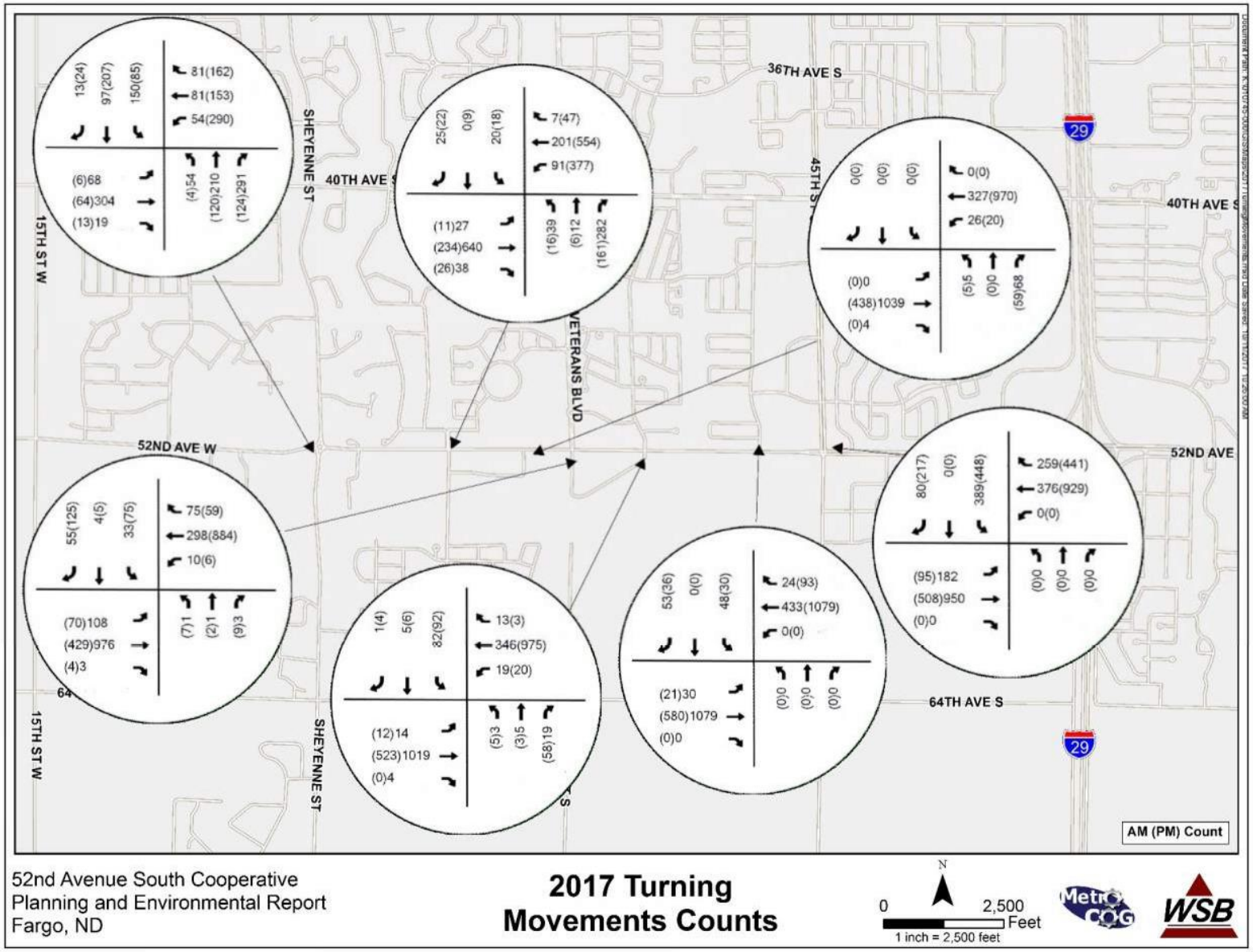


Figure 5: Existing Intersection Lane Configurations and Control Types

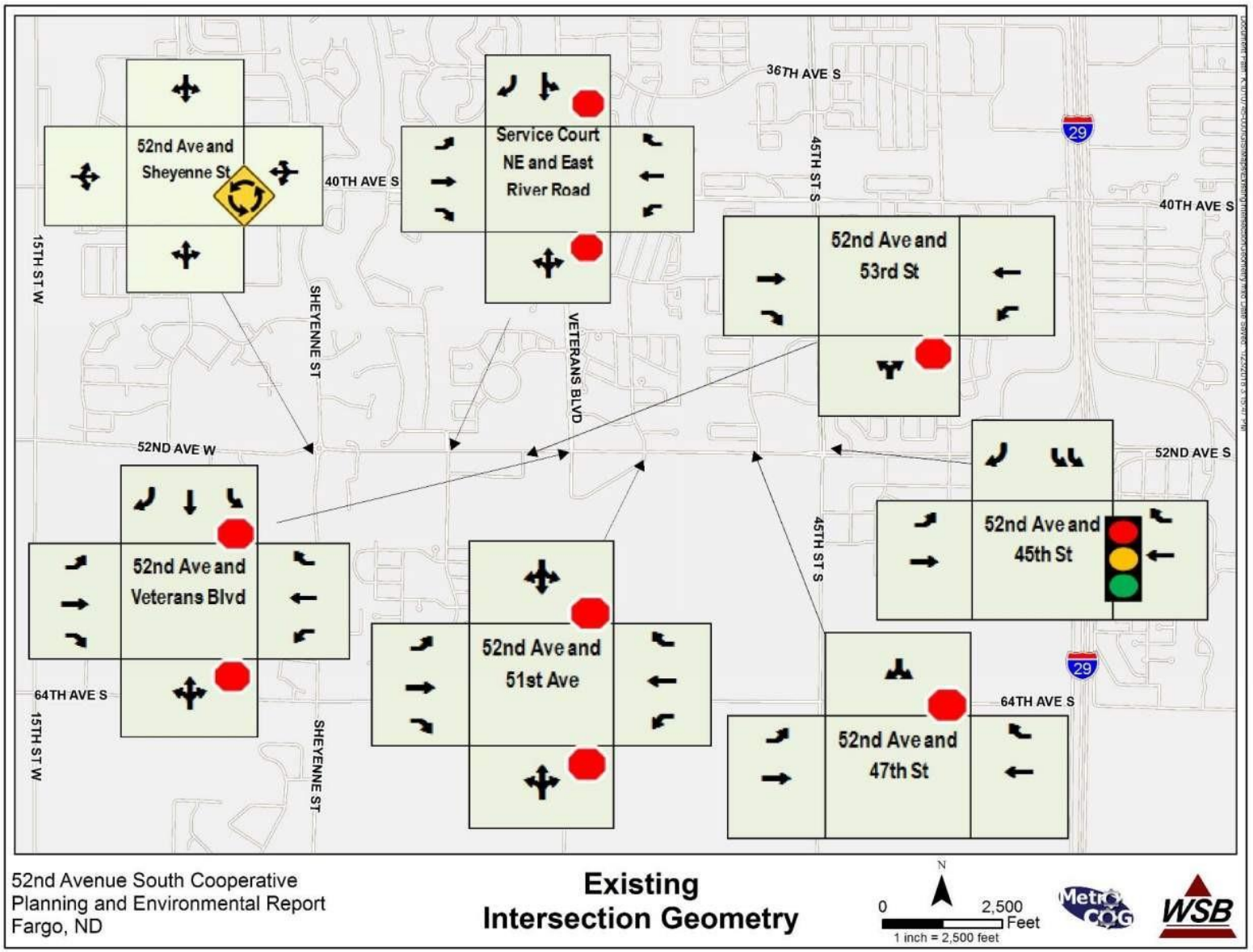


Figure 6: 2017 AM Existing Level of Service

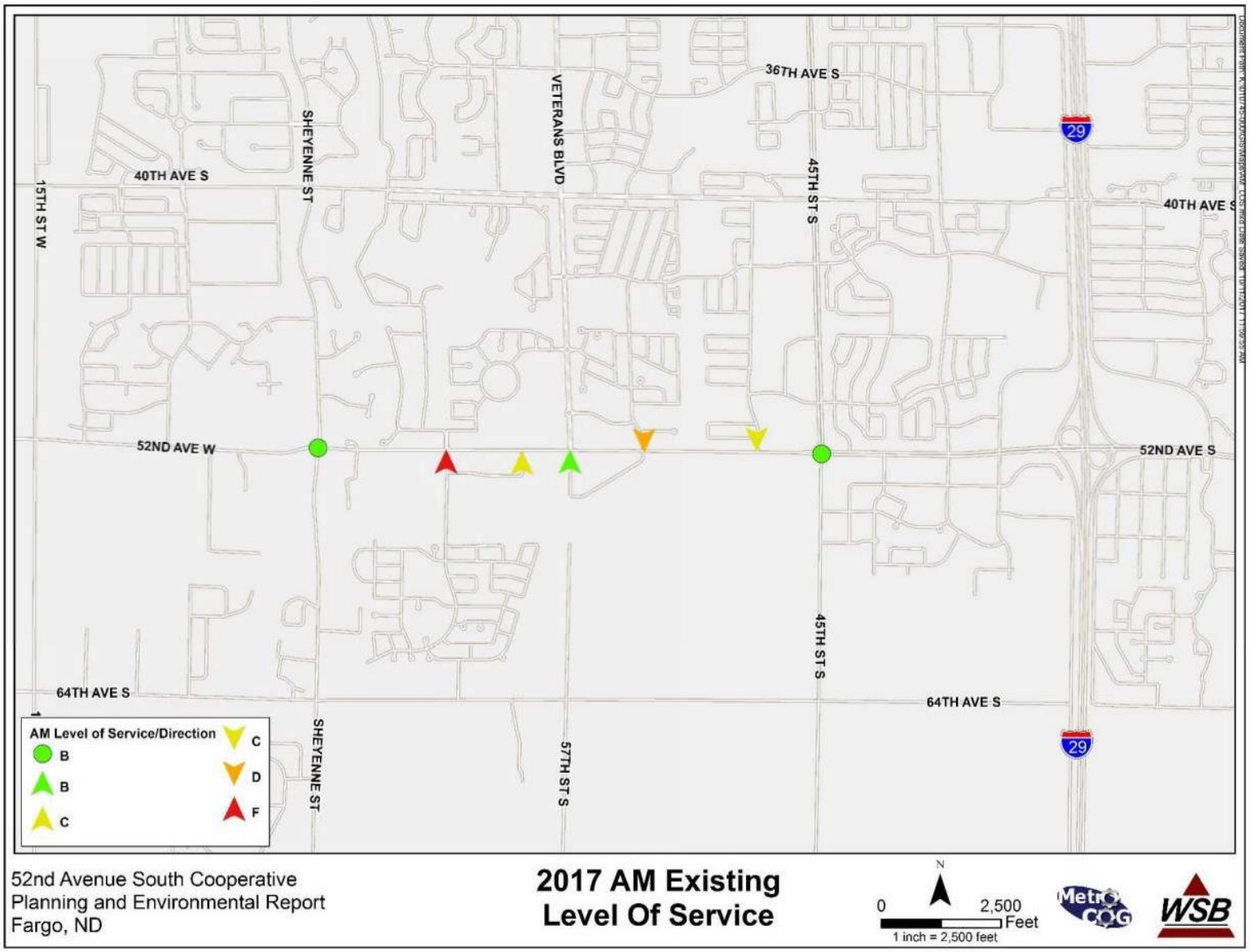


Figure 7: 2017 PM Existing Level of Service

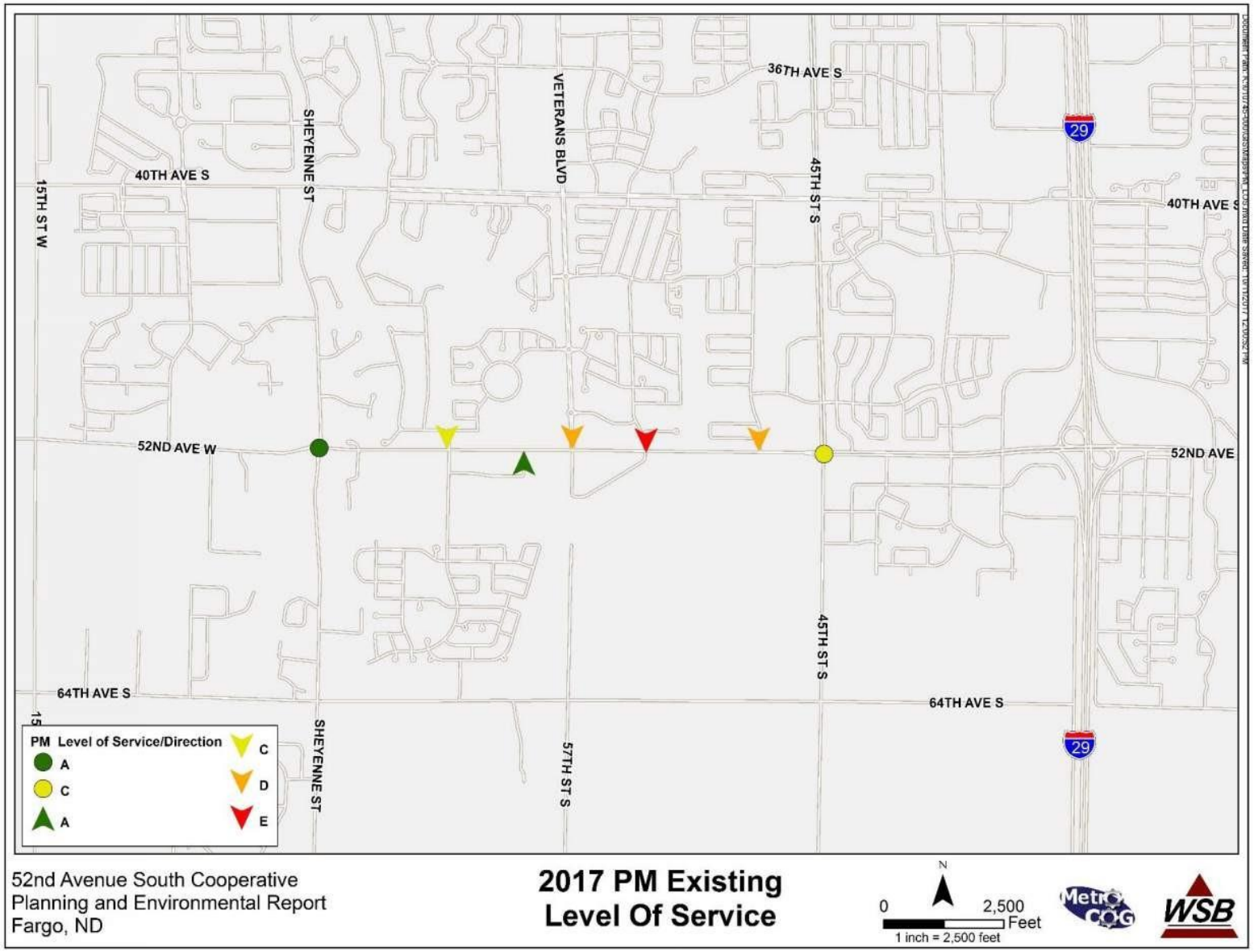


Figure 8: Crashes September 2012 to August 2017

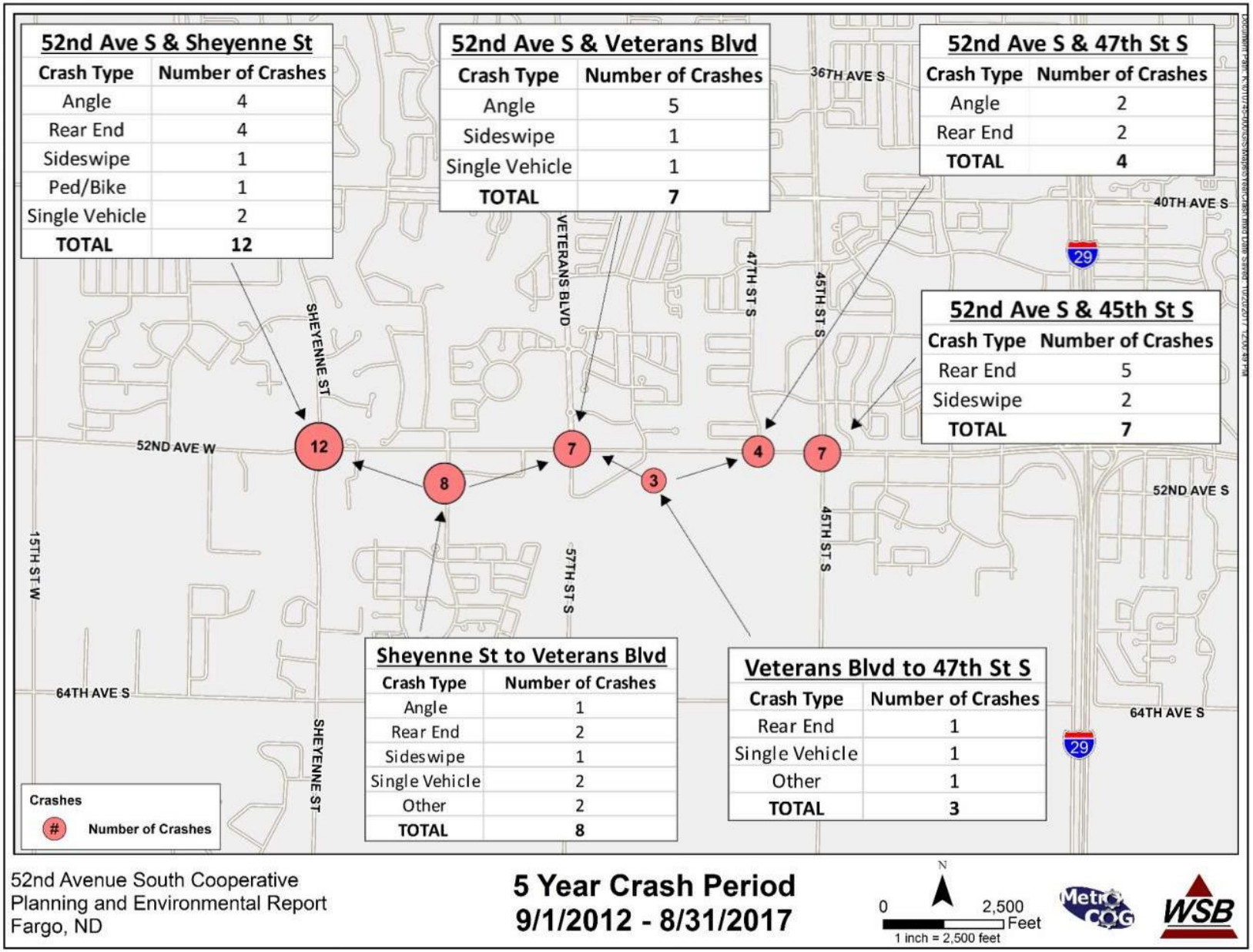


Figure 9: Forecast Households and Jobs - 2040 vs 2045

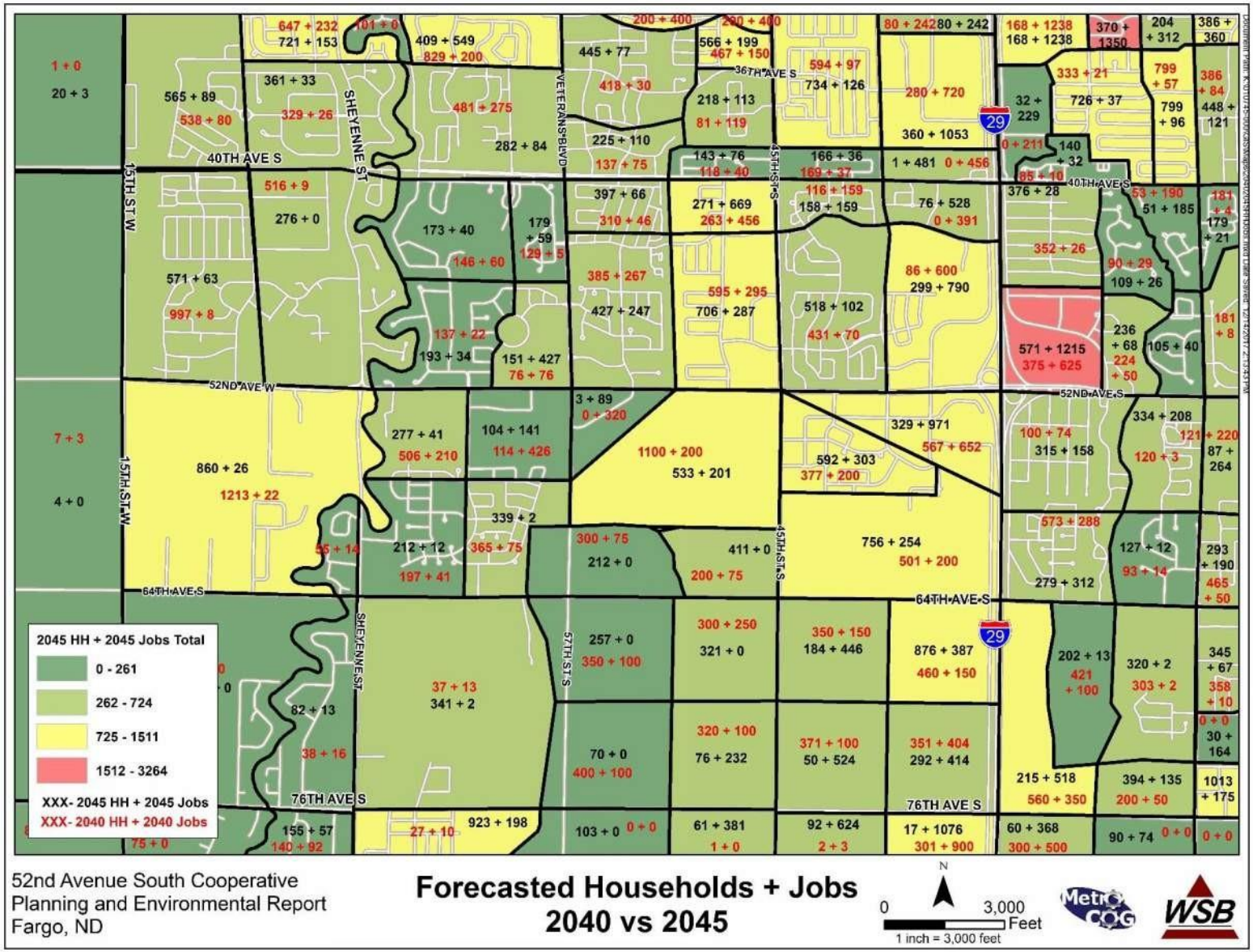


Figure 10: Forecasted Productions and Attractions – 2040 vs 2045

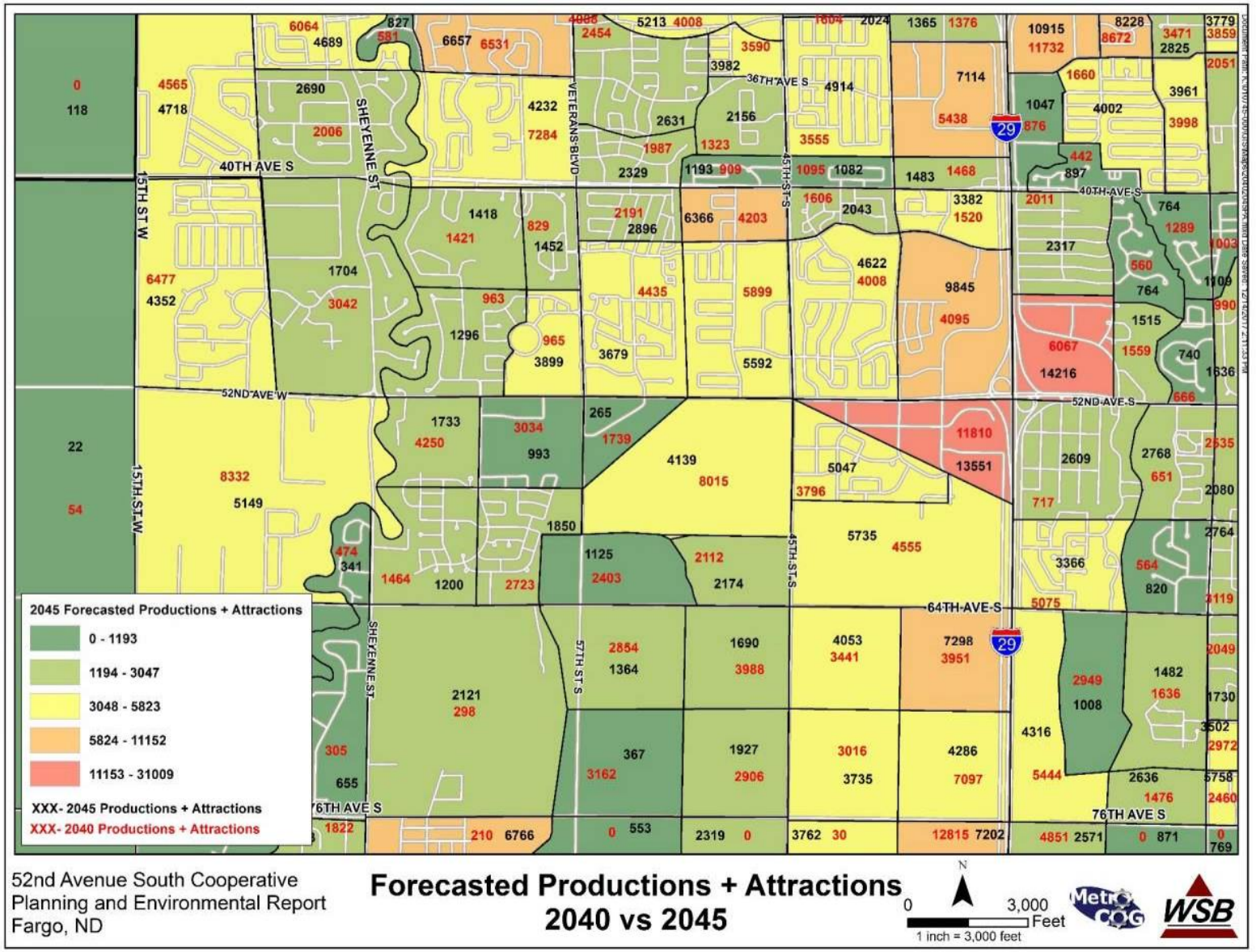


Figure 11: Comparison of Actual 2010 ADT vs 2010 Model ADT

Figure 12: Comparison of 2040 vs 2045 ADT Assignments on Existing Plus Committed Transportation Network

Figure 13: Comparison of Annualized Traffic Growth Rate – 2040 vs 2045

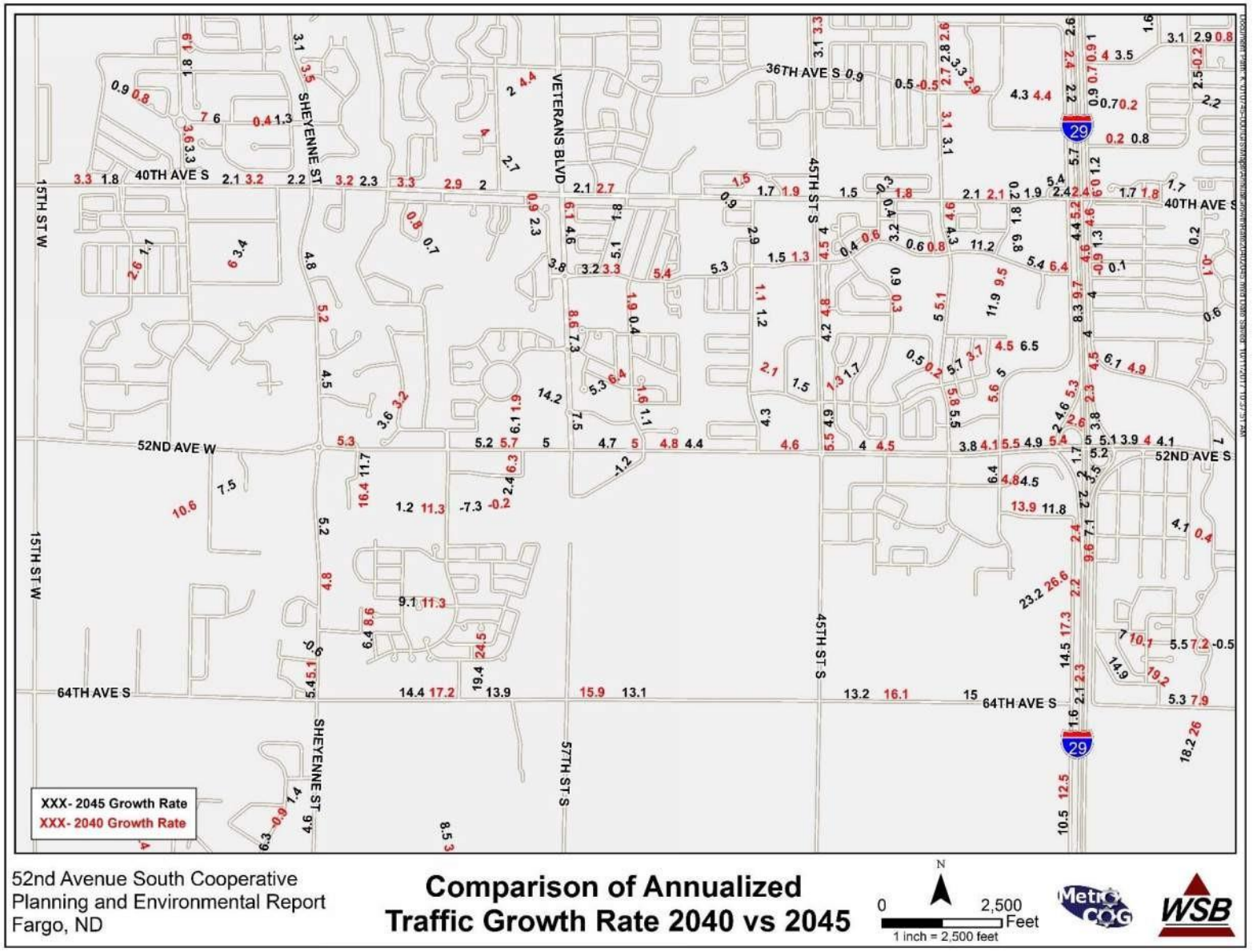
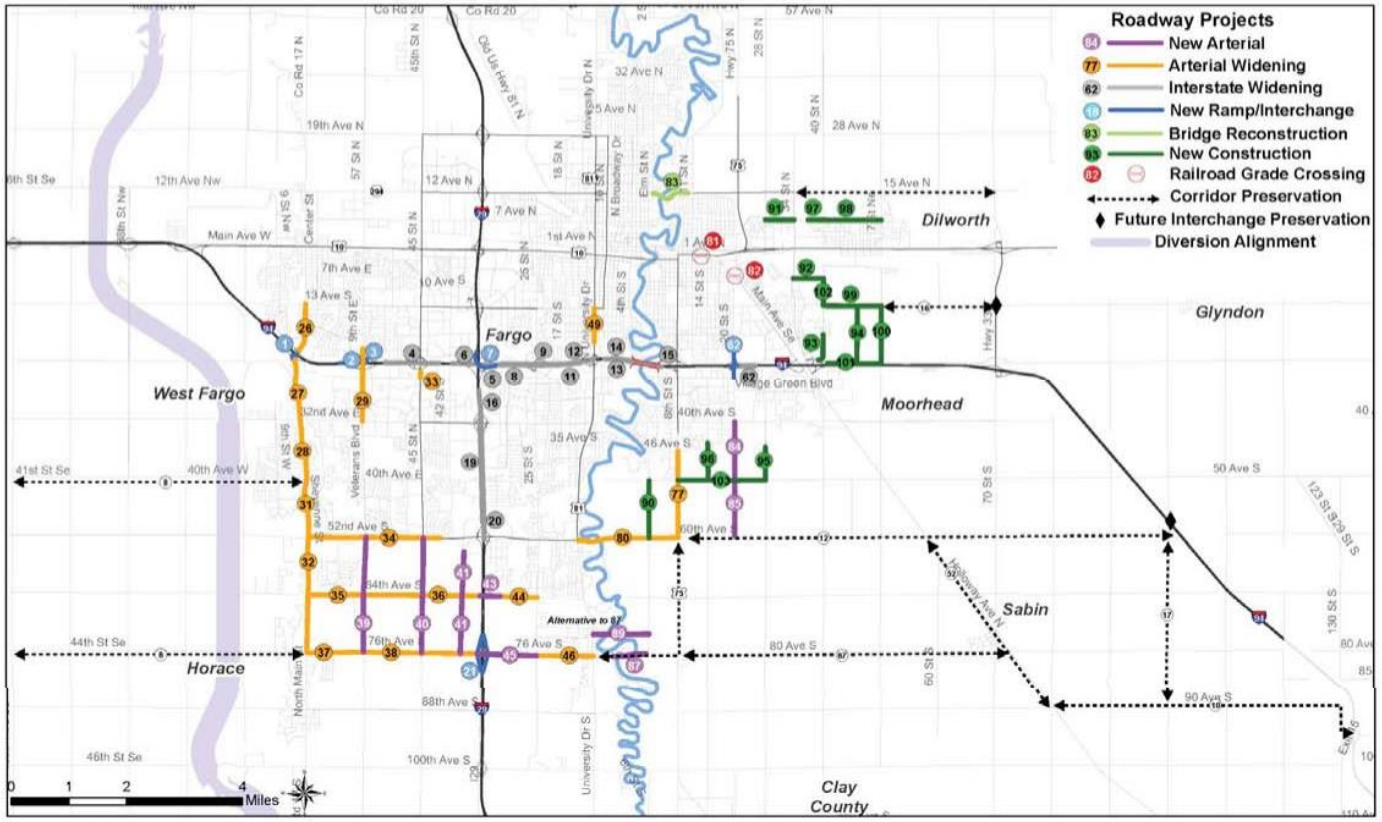


Figure 14: Annualized Traffic Growth Rate – 2010 to 2015

Figure 15: Roadway Vision Plan Improvements

CHAPTER 10 – TRANSPORTATION VISION PLAN

FIGURE 10-1: ROADWAY VISION PLAN



Source: Metro COG

Figure 16: 2040 EC Model Assignments

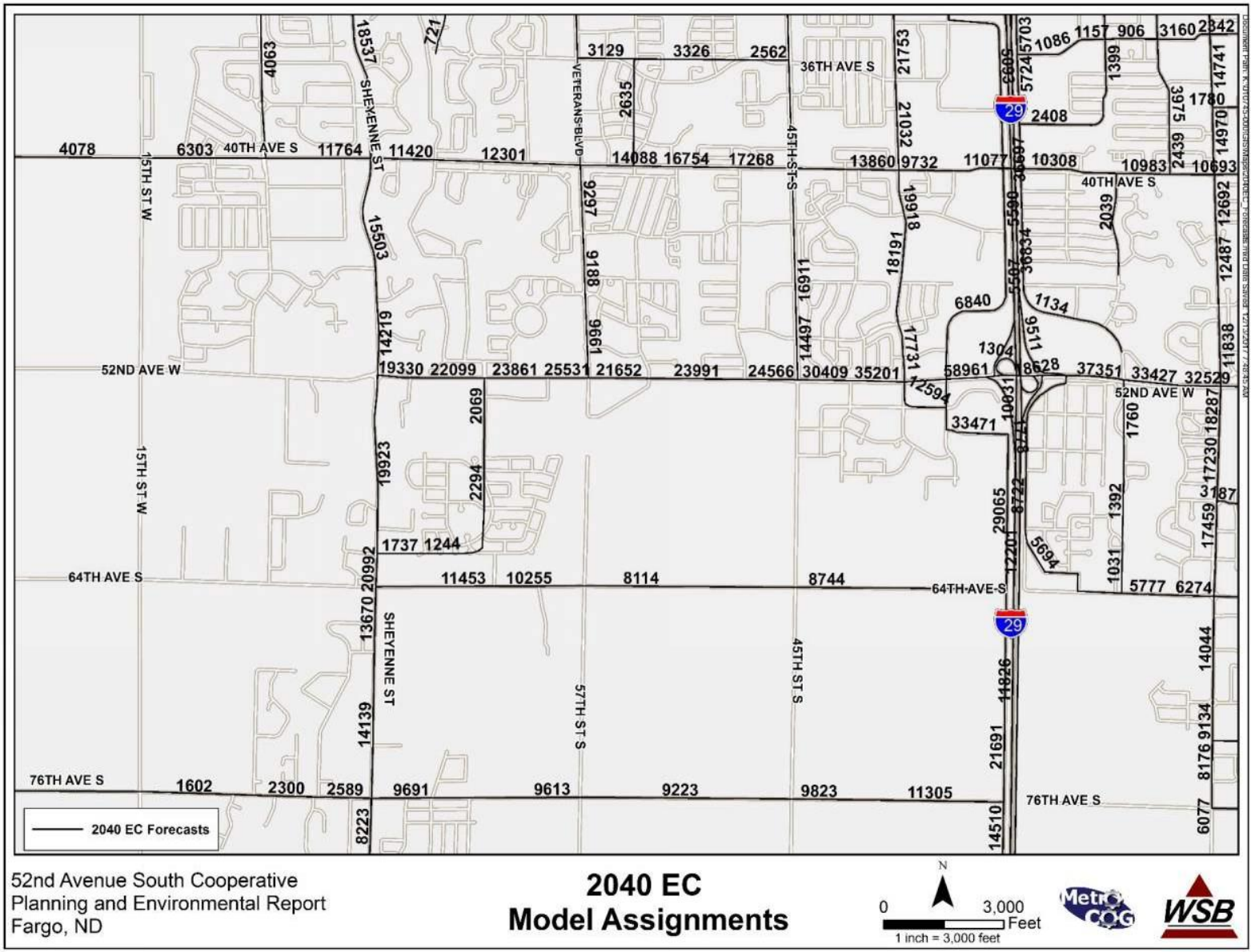


Figure 17: 2040 Roadway Vision Plan Model Assignments

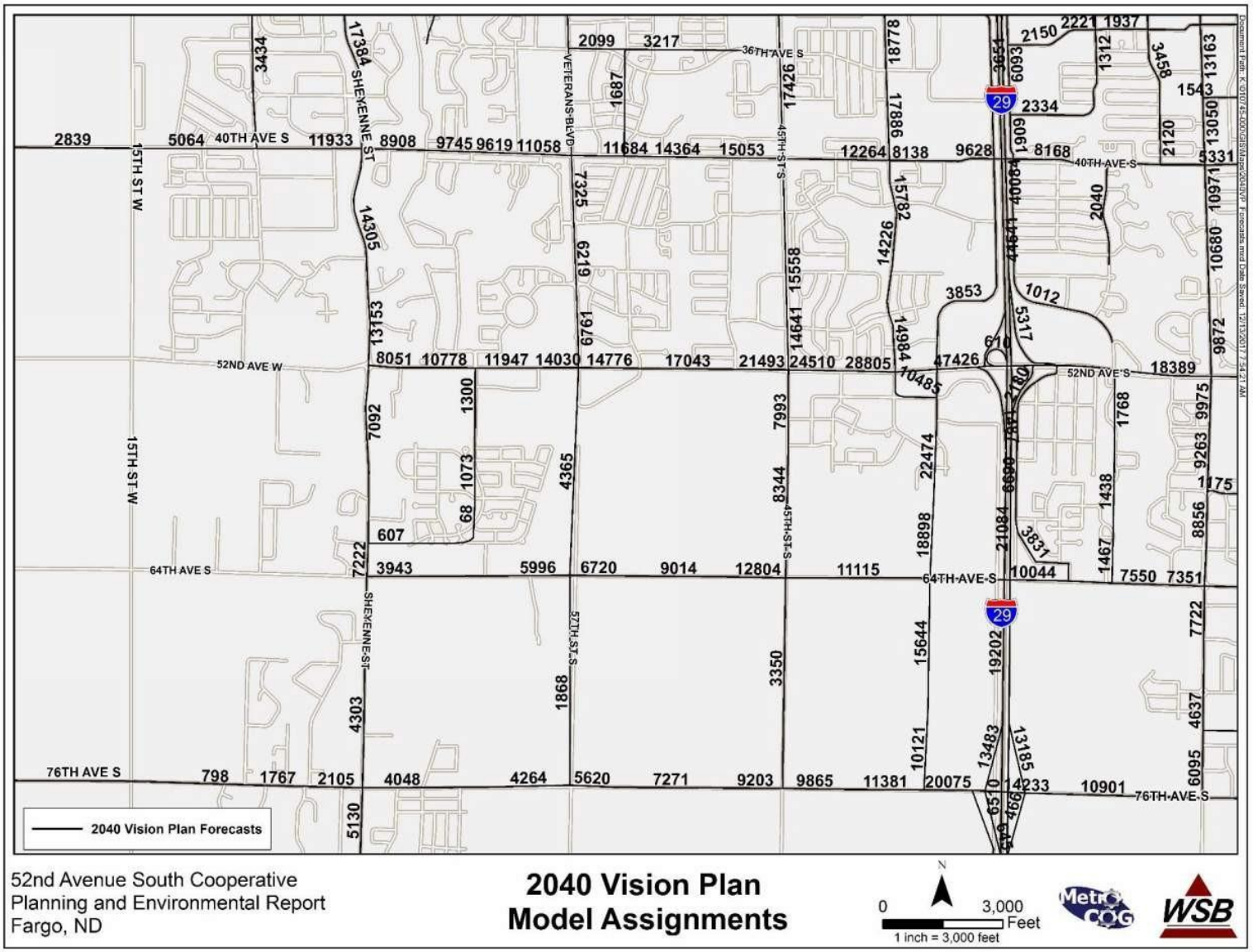
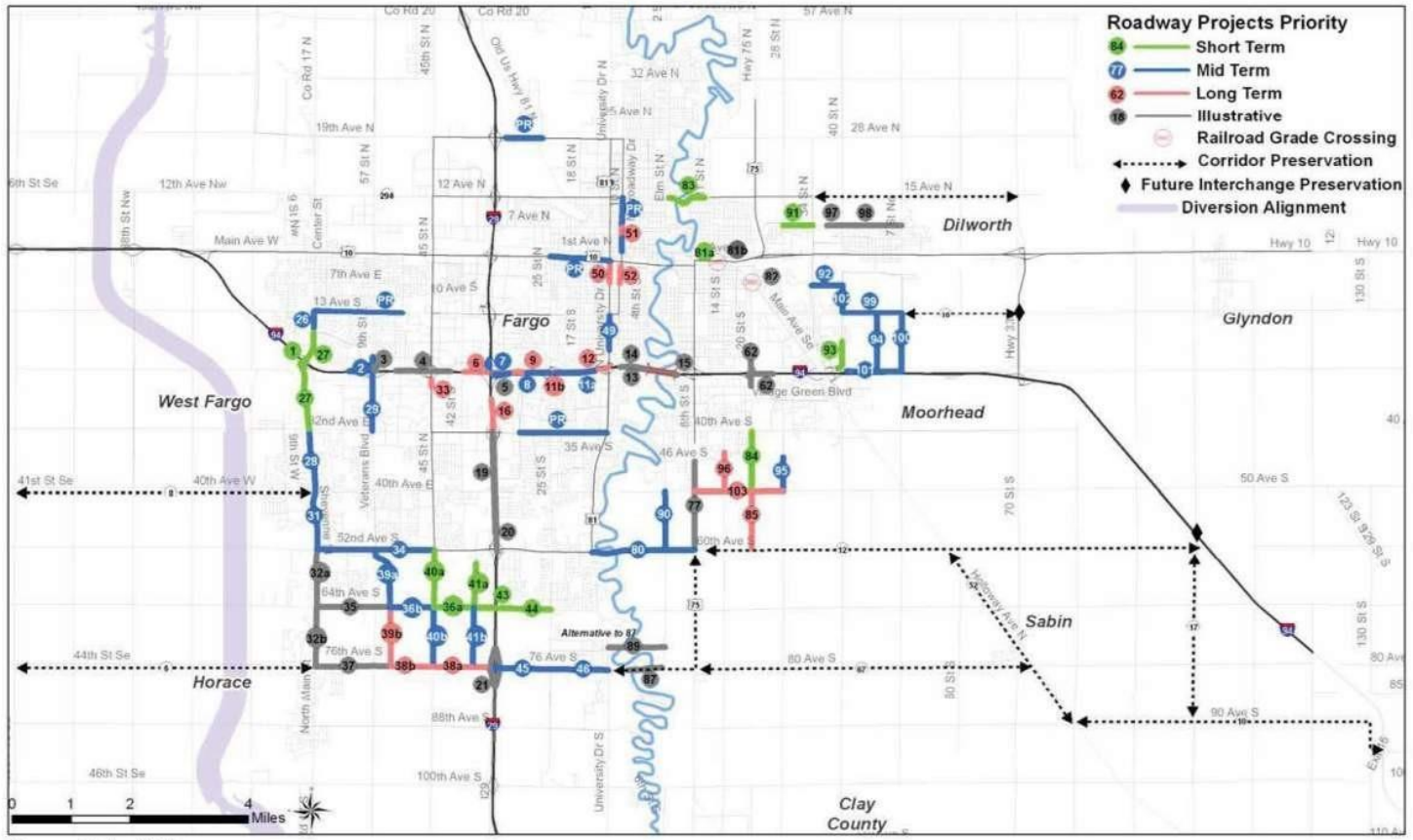


Figure 18: Fiscal Constrained Network Improvements

CHAPTER 12 – FISCAL CONSTRAINED TRANSPORTATION PLAN

FIGURE 12-2: FISCAL CONSTRAINED PLAN



Source: Metro COG

Figure 19: 2040 ADT Forecasts

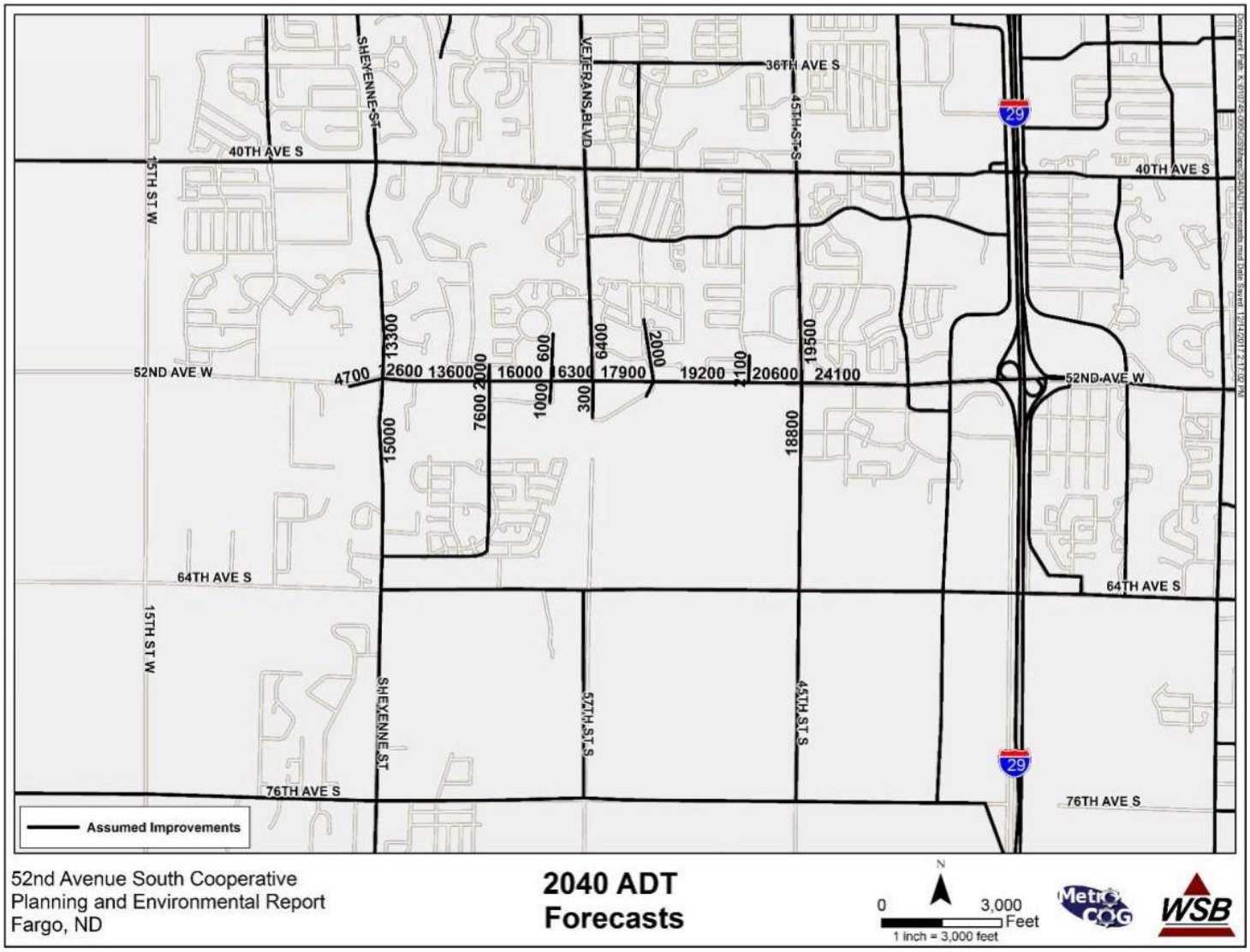


Figure 20: 2040 AM & PM Peak Hour Turning Movements

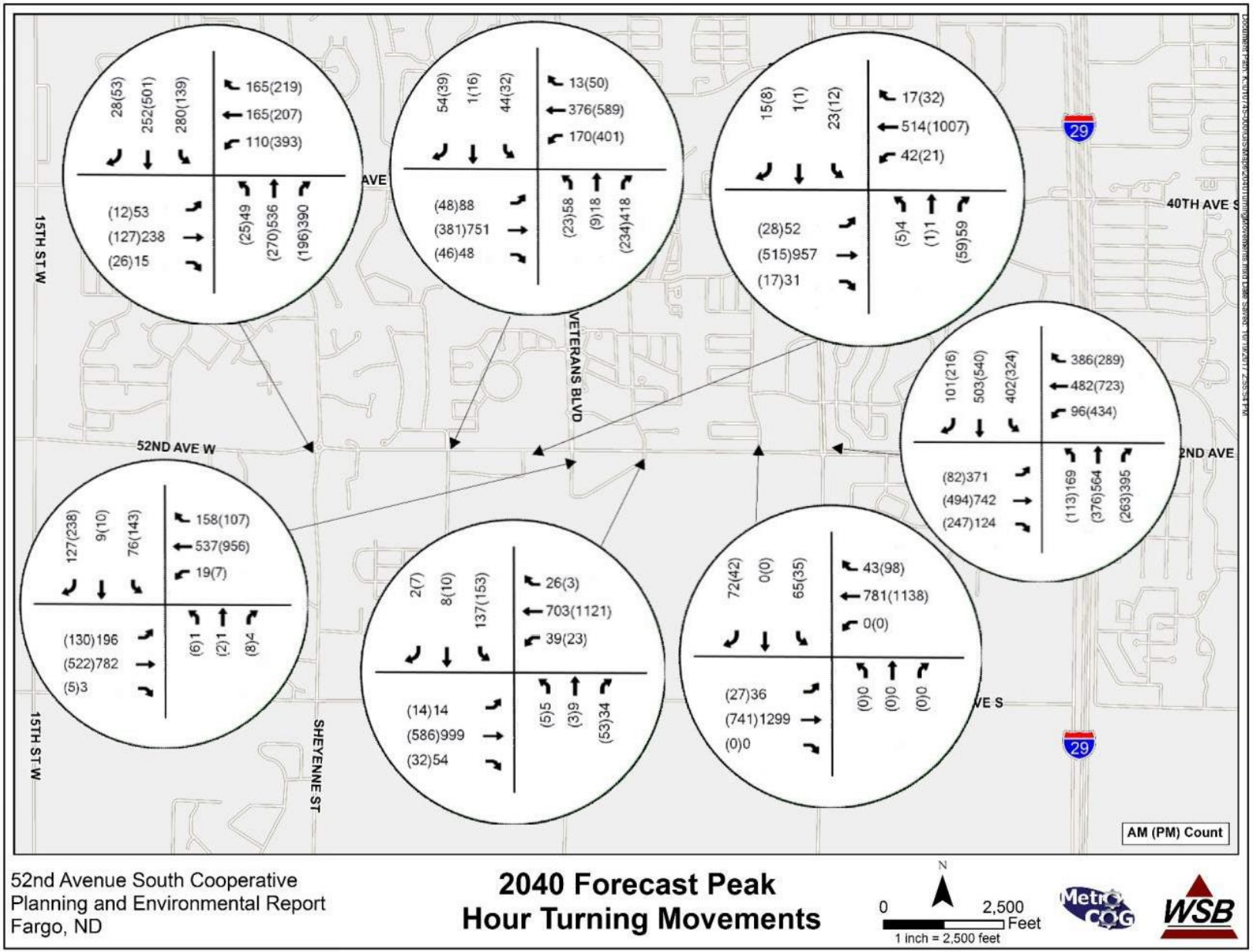


Figure 21: 2040 Build Alternative Intersection Lane Configurations

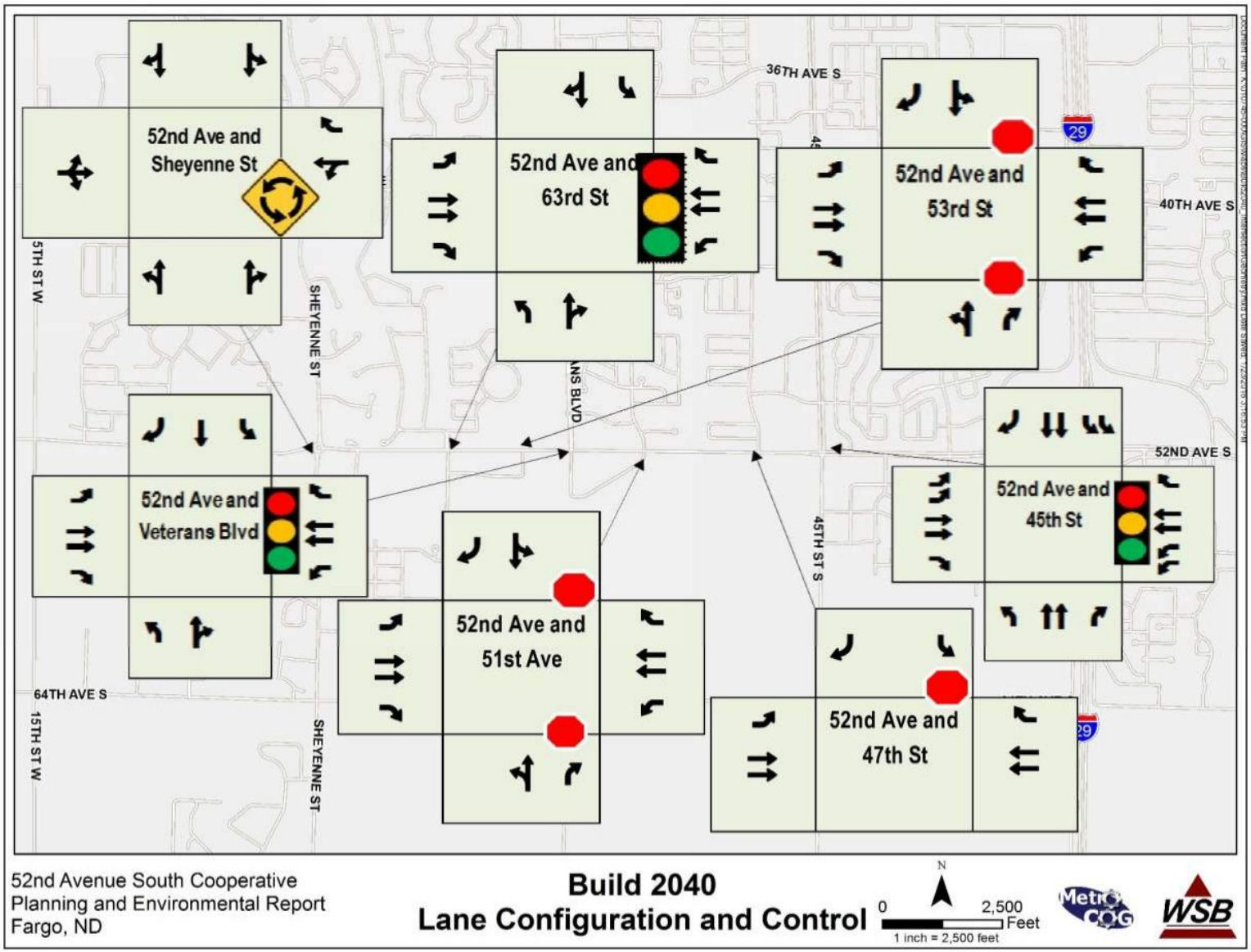


Figure 22: 2040 No-Build AM Level of Service

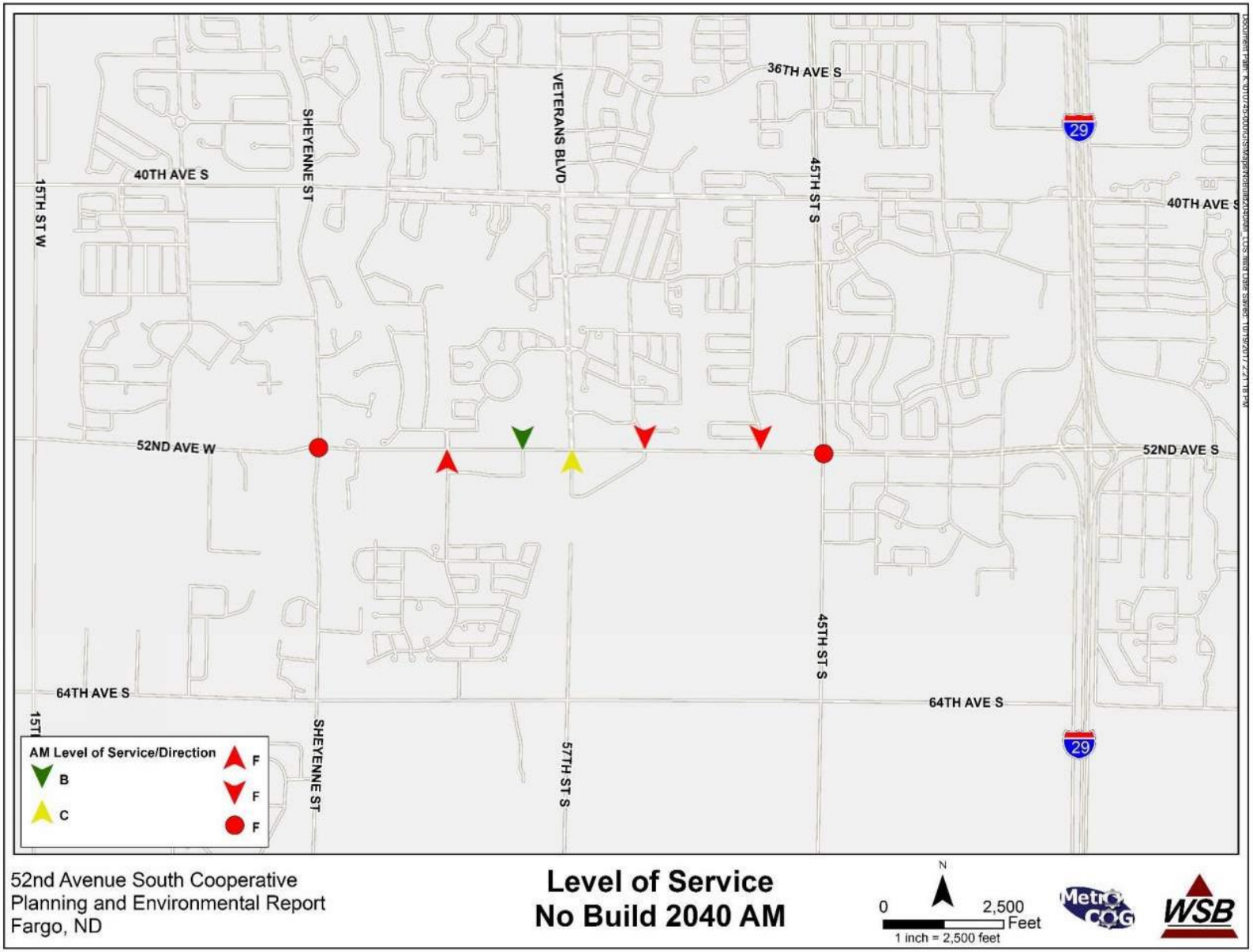


Figure 23: 2040 No-Build PM Level of Service

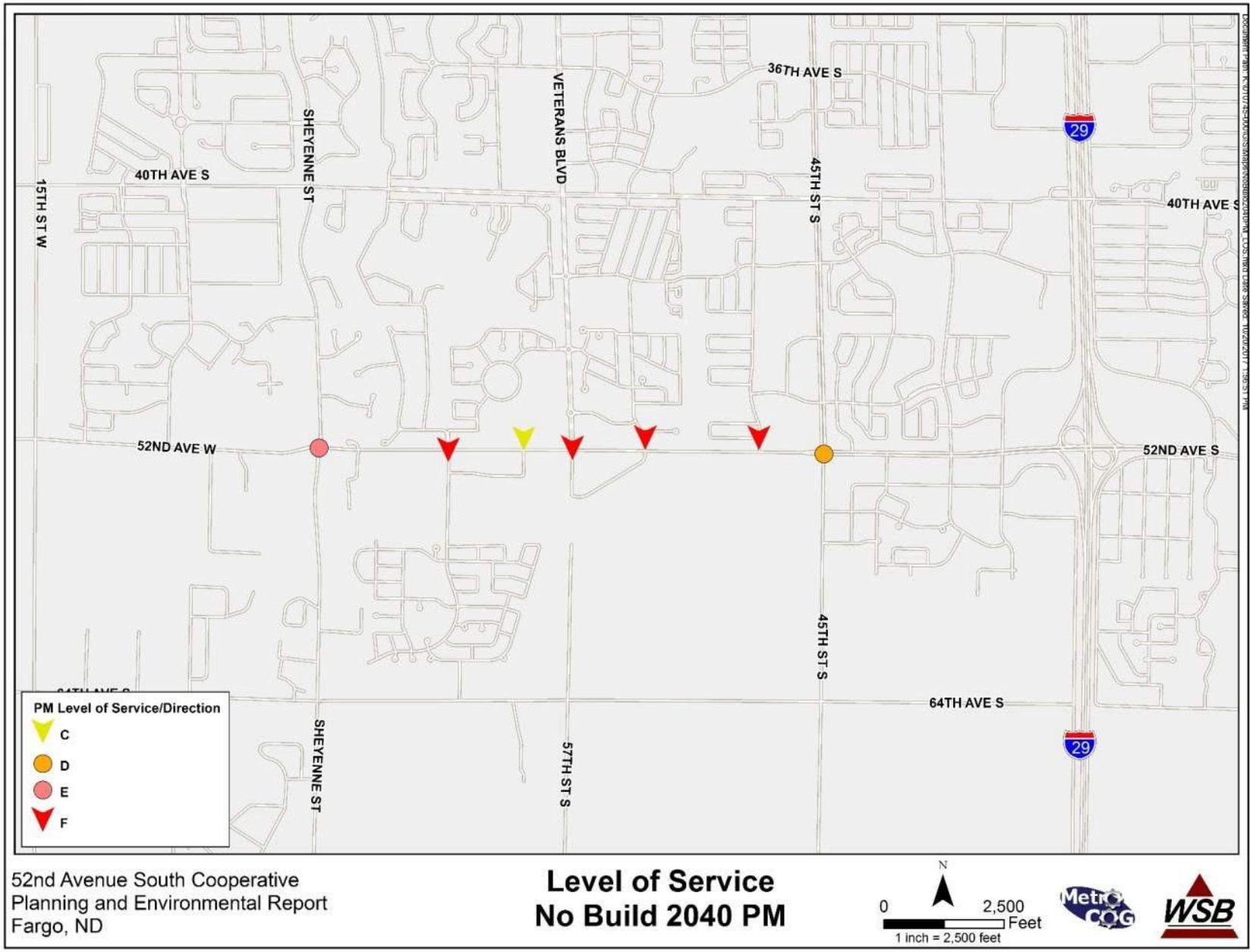


Figure 24: 2040 Build AM Level of Service

Figure 25: 2040 Build PM Level of Service

Table 18: Build 2040 4-Lane Divided with Roundabouts -RCUT- AM Peak Hour

Intersection		Appr	Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Int	Appr	Average & Maximum Traffic Queueing (feet)								
													Left-Turn			Through			Right-Turn		
Control	Location		L	T	R	L	T	R	Delay	LOS			Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						10	B	A	NB					146				
		WB							9	A		WB					46				
		SB							4	A		SB					32				
		EB							11	B		EB					57				
Roundabout	2: 63rd St & 52nd Avenue S	NB	N/A						23	C	A	NB					13			166	
		WB							3	A		WB					25				
		SB							6	A		SB					12				
		EB							5	A		EB					56				
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	0	0	7	A	A	A	6	A		NB							20	44	
		WB	25	2	1	D	A	A	4	A		WB	35	73	200						
		SB	0	0	2	A	A	A	1	A		SB							15	24	
		EB	4	9	0	A	A	A	8	A		EB	13	53	250	47	290		1	39	250
Roundabout	4: Veterans Blvd & 52nd Avenue S	NB	N/A						8	A	A	NB					1				
		WB							4	A		WB					28				
		SB							7	A		SB					10			26	
		EB							5	A		EB					56				
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	0	0	7	A	A	A	5	A		NB							21	46	
		WB	8	1	0	A	A	A	1	A		WB	17	70	150						
		SB	0	0	4	A	A	A	0	A		SB							29	64	
		EB	5	1	0	A	A	A	1	A		EB	5	25	175				1	22	175
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A		NB									
		WB	0	5	4	A	A	A	5	A		WB									
		SB	0	0	6	A	A	A	3	A		SB							44	79	
		EB	4	1	0	A	A	A	1	A		EB	11	62	125						
Signalized	7: 45th St & 52nd Avenue S	NB	29	37	21	C	D	C	30	C	C	NB	70	133	300	155	261		127	235	300
		WB	23	29	13	C	C	B	22	C		WB	40	103	250	98	172		86	168	250
		SB	29	24	4	C	C	A	24	C		SB	95	171	500	95	171		20	47	
		EB	26	31	7	C	C	A	27	C		EB	73	149	250	159	297		21	59	250

Table 19: Build 2040 4-Lane Divided with Roundabouts -RCUT- PM Peak Hour

Intersection			Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)			Average & Maximum Traffic Queueing (feet)								
														Left-Turn			Through			Right-Turn		
Control	Location	Appr	L	T	R	L	T	R	Delay	LOS	Delay	LOS	Appr	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						4	A	8	A	NB					25				
		WB							11	B			WB					116				
		SB							8	A			SB					76				
		EB							12	B			EB					37				
Roundabout	2: 63rd St & 52nd Avenue S	NB	N/A						7	A	5	A	NB					3			29	
		WB							5	A			WB					54				
		SB							9	A			SB					16				
		EB							4	A			EB					30				
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	0	0	3	A	A	A	3	A			NB							20	48	
		WB	3	2	1	A	A	A	2	A			WB	6	28	200						
		SB	0	0	6	A	A	A	2	A			SB							12	31	
		EB	6	0	0	A	A	A	0	A			EB	13	49	250						
Roundabout	4: Veterans Blvd & 52nd Avenue S	NB	N/A						7	A	5	A	NB					2				
		WB							5	A			WB					56				
		SB							11	B			SB					37			25	
		EB							4	A			EB					32				
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	0	0	5	A	A	A	4	A			NB							21	49	
		WB	4	1	0	A	A	A	1	A			WB	9	43	150						
		SB	0	0	12	A	A	B	0	A			SB							53	136	
		EB	8	1	0	A	A	A	1	A			EB	8	37	175						
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	5	5	A	A	A	5	A			WB							1	15	175
		SB	0	0	9	A	A	A	5	A			SB							33	72	
		EB	11	0	0	B	A	A	0	A			EB	16	55	125		15				
Signalized	7: 45th St & 52nd Avenue S	NB	25	29	10	C	C	B	22	C	24	C	NB	51	101	300	109	196		59	128	300
		WB	30	29	8	C	C	A	25	C			WB	99	173	250	143	236		45	121	250
		SB	25	26	8	C	C	A	22	C			SB	83	166	500	116	204		55	118	
		EB	21	35	11	C	D	B	26	C			EB	24	55	250	115	212		56	121	250

Table 20: Build 2040 4-Lane Divided with Roundabouts -J-Turn- AM Peak Hour

Intersection		Appr	Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		Appr	Average & Maximum Traffic Queueing (feet)								
														Left-Turn			Through			Right-Turn		
Control	Location		L	T	R	L	T	R	Delay	LOS	Delay	LOS		Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						10	B	9	A	NB					146				
		WB							9	A			WB					46				
		SB							4	A			SB					32				
		EB							11	B			EB					57				
Roundabout	2: 63rd St & 52nd Avenue S	NB	N/A						23	C	9	A	NB					13			166	
		WB							3	A			WB					25				
		SB							6	A			SB					12				
		EB							5	A			EB					56				
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	0	0	6	A	A	A	6	A			NB							22	57	
		WB	0	1	1	A	A	A	1	A			WB									
		SB	0	0	4	A	A	A	4	A			SB							17	38	
		EB	0	1	0	A	A	A	1	A			EB									
Roundabout	4: Veterans Blvd & 52nd Avenue S	NB	N/A						8	A	5	A	NB					1				
		WB							4	A			WB					28				
		SB							7	A			SB					10			26	
		EB							5	A			EB					56				
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	0	0	6	A	A	A	6	A			NB							17	44	
		WB	0	1	0	A	A	A	1	A			WB									
		SB	0	0	5	A	A	A	5	A			SB							34	83	
		EB	0	1	1	A	A	A	1	A			EB									
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	4	4	A	A	A	4	A			WB									
		SB	0	0	7	A	A	A	7	A			SB							45	96	
		EB	0	1	0	A	A	A	1	A			EB									
Signalized	7: 45th St & 52nd Avenue S	NB	27	37	21	C	D	C	30	C	27	C	NB	75	167	300	157	261		126	266	300
		WB	24	32	14	C	C	B	24	C			WB	32	76	250	104	194		93	198	250
		SB	30	27	4	C	C	A	26	C			SB	105	195	500	111	198		23	66	
		EB	29	31	8	C	C	A	28	C			EB	88	154	250	169	310		29	158	250

Table 21: Build 2040 4-Lane Divided with Roundabouts -J-Turn- PM Peak Hour

Intersection			Total Delay			LOS by Movement			LOS by Approach				Average & Maximum Traffic Queueing (feet)								
													Left-Turn			Through			Right-Turn		
Control	Location		L	T	R	L	T	R	Delay	LOS	Delay	LOS		Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						4	A	8	A	NB					25				
		WB							11	B			WB					116				
		SB							8	A			SB					76				
		EB							12	B			EB					37				
Roundabout	2: 63rd St & 52nd Avenue S	NB	N/A						7	A	5	A	NB					3			29	
		WB							5	A			WB					54				
		SB							9	A			SB					16				
		EB							4	A			EB					30				
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	0	0	4	A	A	A	4	A			NB							22	53	
		WB	0	2	2	A	A	A	2	A			WB									
		SB	0	0	5	A	A	A	5	A			SB							11	30	
		EB	0	0	0	A	A	A	0	A			EB									
Roundabout	4: Veterans Blvd & 52nd Avenue S	NB	N/A						7	A	5	A	NB					2				
		WB							5	A			WB					56				
		SB							11	B			SB					37			25	
		EB							4	A			EB					32				
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	0	0	5	A	A	A	5	A			NB							20	61	
		WB	0	1	0	A	A	A	1	A			WB									
		SB	0	0	12	A	A	B	12	B			SB							47	123	
		EB	0	1	0	A	A	A	1	A			EB									
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	4	4	A	A	A	4	A			WB									
		SB	0	0	8	A	A	A	8	A			SB							33	66	
		EB	0	0	0	A	A	A	0	A			EB									
Signalized	7: 45th St & 52nd Avenue S	NB	25	29	10	C	C	B	22	C	24	C	NB	48	118	300	108	195		57	120	300
		WB	28	30	8	C	C	A	25	C			WB	95	173	250	151	247		45	109	250
		SB	25	26	8	C	C	A	22	C			SB	82	135	500	118	202		52	108	
		EB	24	32	11	C	C	B	25	C			EB	32	67	250	109	192		57	122	250

Table 22: Build 2040 4-Lane Divided with Roundabouts -RIRO- AM Peak Hour

Intersection		Appr	Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		Appr	Average & Maximum Traffic Queueing (feet)								
Control	Location		L	T	R	L	T	R	Delay	LOS	Delay	LOS		Left-Turn			Through			Right-Turn		
														Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						10	B	9	A	NB					146				
		WB							9	A			WB					46				
		SB							4	A			SB					32				
		EB							11	B			EB					57				
Roundabout	2: 63rd St & 52nd Avenue S	NB	N/A						23	C	9	A	NB					13			166	
		WB							3	A			WB					25				
		SB							6	A			SB					12				
		EB							5	A			EB					56				
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	0	0	6	A	A	A	6	A			NB							22	49	
		WB	0	1	1	A	A	A	1	A			WB									
		SB	0	0	4	A	A	A	4	A			SB							19	56	
		EB	0	1	0	A	A	A	1	A			EB									
Roundabout	4: Veterans Blvd & 52nd Avenue S	NB	N/A						8	A	5	A	NB					1				
		WB							4	A			WB					28				
		SB							7	A			SB					10			26	
		EB							5	A			EB					56				
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	0	0	6	A	A	A	6	A			NB							18	52	
		WB	0	1	0	A	A	A	1	A			WB									
		SB	0	0	7	A	A	A	7	A			SB							37	98	
		EB	0	1	0	A	A	A	1	A			EB									
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	4	4	A	A	A	4	A			WB									
		SB	0	0	8	A	A	A	8	A			SB							44	82	
		EB	0	1	0	A	A	A	1	A			EB									
Signalized	7: 45th St & 52nd Avenue S	NB	29	38	20	C	D	C	30	C	28	C	NB	72	147	300	161	264		117	220	300
		WB	25	31	15	C	C	B	24	C			WB	34	70	250	102	187		93	185	250
		SB	34	27	5	C	C	A	28	C			SB	113	205	500	109	196		24	70	
		EB	31	31	8	C	C	A	29	C			EB	98	185	250	172	275		23	84	250

Table 23: Build 2040 4-Lane Divided with Roundabouts -RIRO- PM Peak Hour

Intersection		Appr	Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		Appr	Average & Maximum Traffic Queueing (feet)								
														Left-Turn			Through			Right-Turn		
Control	Location		L	T	R	L	T	R	Delay	LOS	Delay	LOS		Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB							4	A	8	A	NB					25				
		WB	N/A						11	B			WB					116				
		SB							8	A			SB					76				
		EB							12	B			EB					37				
Roundabout	2: 63rd St & 52nd Avenue S	NB							7	A	5	A	NB					3			29	
		WB	N/A						5	A			WB					54				
		SB							9	A			SB					16				
		EB							4	A			EB					30				
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	0	0	4	A	A	A	4	A			NB							23	47	
		WB	0	2	2	A	A	A	2	A			WB									
		SB	0	0	6	A	A	A	6	A			SB							6	24	
		EB	0	1	0	A	A	A	1	A			EB									
Roundabout	4: Veterans Blvd & 52nd Avenue S	NB							7	A	5	A	NB					2				
		WB	N/A						5	A			WB					56				
		SB							11	B			SB					37			25	
		EB							4	A			EB					32				
Thru-Stop	5: 53rd St & 52nd Avenue S	NB	0	0	5	A	A	A	5	A			NB							24	59	
		WB	0	1	0	A	A	A	1	A			WB									
		SB	0	0	12	A	A	B	12	B			SB							47	155	
		EB	0	1	0	A	A	A	1	A			EB									
Thru-Stop	6: 47th St & 52nd Avenue S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	4	5	A	A	A	4	A			WB									
		SB	0	0	10	A	A	B	10	B			SB							32	95	
		EB	0	0	0	A	A	A	0	A			EB									
Signalized	7: 45th St & 52nd Avenue S	NB	24	29	9	C	C	A	21	C	25	C	NB	57	92	300	109	198		57	107	300
		WB	29	32	9	C	C	A	27	C			WB	103	172	250	158	214		44	111	250
		SB	28	26	9	C	C	A	23	C			SB	92	177	500	102	170		50	89	
		EB	23	35	10	C	D	B	26	C			EB	38	89	250	110	189		57	117	250

B TECHNICAL MEMORANDUM 2 – PUBLIC INPUT SUMMARY

Subject: Technical Memorandum 2 - 52nd Ave S Public Input Summary
Date: January 24, 2018
Project: FM MetroCOG – 2017-0057
City of Fargo – MS-17-A0
NDDOT – SU-8-984(164), PCN 22007

1) INTRODUCTION

The purpose of the 52nd Ave S Study is to determine a proactive plan for the improvements needed for 52nd Ave S between 45th St S in the City of Fargo and Sheyenne Street in the City of West Fargo to serve as an important link in the multimodal transportation system. Thereby, accommodating the long-term growth and development in the project area by addressing future capacity and safety needs.

The section of the corridor under study is currently a two-lane rural section with left and right turn lanes at major intersections. East of 45th St S, 52nd Ave S becomes a 4-lane divided arterial with the potential for dual left turn lanes and right turn lanes at the major intersections. 52nd Ave S becomes a 6-lane section near Interstate 29.

Alternatives under consideration include No-Build and Reconstruct to a 4-lane urban corridor. Several intersection options are being studied including: traffic signals, roundabouts, full access stop controlled, ¾ access, J-turn and R-cut (reduced conflict) intersections, as well as median closures at lower volume intersections.

Three public input meetings are planned throughout the study. The first two meetings were held as part of the planning process on October 26, 2017 and December 21, 2017. The third and final meeting will be held as part of the environmental document phase of the project and is planned for February 2018. This technical memorandum covers Public Input Meetings 1 and 2. Public Input Meeting 3 will be included in the project Documented Categorical Exclusion (DCE).

2) PUBLIC INPUT MEETING #1

2.1 MEETING DETAILS

Public Input Meeting #1 was held at the Calvary United Methodist Church, 4575 45th Street South, Fargo, ND, on October 26, 2017 from 5:00 PM to 7:00 PM. The meeting was an open house format, with large format aerial

photos of the existing project corridor and side boards showing existing and projected traffic volumes, intersection level of service (LOS) and possible intersection configurations.

The meeting was held to inform the public about the upcoming project as well as gather input on existing issues and proposed improvements.

2.2 ATTENDEES

The meeting had a total of 29 attendees including the project team. The project team was represented by Houston Engineering, Inc. (Jeremy McLaughlin, Jeff Lansink and Adam Ruud), WSB and Associates (Tony Heppelman), City of Fargo (Jeremy Gordon and Mark Bittner), FM MetroCOG (Dan Farnsworth), and Cass County (Jason Benson). 22 members of the public attended the meeting. No special interest groups were represented.

2.3 COMMENTS RECEIVED

Four comments were received via email and mailed comment cards after the Public Input Meeting. All comments were related to concerns with access to 52nd Avenue from side streets.

Topic	Comments	Response
Access / Roundabouts	I attended public input meeting on Oct. 26th and I have some question (s) remaining. I am concerned about the possibility of constructing a "Roundabout" at the intersection of 63rd St S and 52nd Ave S. Traffic is only going to continue to grow and I believe a "roundabout" would only cause traffic jams. Traffic lights would be a	Various intersection configurations are being considered as part of the planning study. At major intersections like 63rd St S both roundabouts and traffic signals are being considered. Further analysis, including intersection LOW, will assist in determining the appropriate intersection configuration.
Access	Concerned with limiting of movements at 53rd Avenue and 52nd Avenue intersection. See Appendix E for full comment.	At the intersection of 53rd Ave S and 52nd Ave S, five intersection alternatives are being considered with varying access control. A full access, ¾ access, J-turn, R-cut and right in / right out are currently being considered. A
Access	I would like to request an access to my street as you travel from west to east on 52nd Avenue. When I came to the public Input Meeting on Oct 26th I saw the turn possibilities. I am sure the folks living on the street on the southside of 52nd Avenue would also appreciate having access also. The greatest solution would be to have no center	A full access intersection is one of alternate intersection configurations being considered for the McMahon Estates Circle intersection as well as 68th St S intersection.
Access	Would prefer full access intersection at 53rd Avenue and 52nd Street. See Appendix E for full comment.	At the intersection of 53rd Ave S and 52nd Ave S, five intersection alternatives are being considered with varying access control. A full access, ¾ access, J-turn, R-cut and right in / right

2.4 PUBLIC CONCERNS

There were no controversial issues stated by the public. Concerns about the proposed project were related to the preferred intersection configurations serving commercial and residential developments.

3) PUBLIC INPUT MEETING #2

3.1 MEETING DETAILS

Public Input Meeting #2 was held at the Faith Journey Lutheran Church, 420 40th Avenue South, West Fargo, ND, on December 21, 2017 from 5:00 PM to 7:00 PM. The meeting was an open house format, with large format aerial photos of the proposed project corridor and side boards showing proposed intersection alternatives.

The meeting was held to inform the public about alternatives being considered for the upcoming project as well as gather input on existing issues and proposed improvements.

3.2 ATTENDEES

The meeting had a total of seven attendees including the project team. The project team was represented by Houston Engineering, Inc. (Jeff Lansink and Adam Ruud), WSB and Associates (Tony Heppelman), The City of Fargo (Jeremy Gordon and Mark Bittner), and FM MetroCOG (Dan Farnsworth). One member of the public attended the meeting. No special interest groups were represented.

FINAL

701 Xenia Avenue South | Suite 300 | Minneapolis, MN 55416 | (763) 541-4800

Memorandum

To: ***52nd Avenue Study Review Committee***

From: ***Tony Heppelmann, P.E.***
Adam Smith, AICP

Date: ***January 9, 2018***

Re: ***Technical Memo No. 3***
Identification of Issues and Project Purpose & Need
WSB Project No. 10745-000

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1) PROJECT PURPOSE

The purpose of the project is to proactively prepare for long-term growth and development in the project area by addressing future capacity and safety needs and improving 52nd Avenue to serve as an important link in the multimodal transportation system. The project is located along 52nd Avenue between 45th Street and Sheyenne Street in the City of Fargo. See **Figure 1** for a map showing the project corridor. **Figures 2a and 2b** show aerial images of the project corridor.

The goals associated with this project are as follows:

- Enable the 52nd Avenue corridor to fulfill its intended transportation role as a minor arterial in the roadway network and its role as an Active Living Street east of Veterans Boulevard consistent with the Go2030 Fargo Comprehensive Plan.
- Provide adequate capacity to carry forecasted 2040 traffic volumes at an acceptable level of service (LOS “D” or better), minimizing travel delays.
- Minimize the potential for crashes in the corridor.
- Provide for safe and comfortable movement of non-motorized transportation users (e.g.

pedestrians and bicyclists) along and across the corridor consistent with Go2030. This includes guidelines associated with the Active Living Streets and City-Wide Trail Loop catalyst projects as well as initiatives focused on bicycle and pedestrian infrastructure, complete streets, and the tree canopy.

- Support orderly and efficient economic development in the project area consistent with local and regional plans including the Go2030 initiative to invest in amenities and beautification as an economic development tool.
- Maintain 52nd Avenue and associated structures in a state of good repair over the life of the project.

The sections that follow describe the existing conditions along the project corridor, the needs for the project, and measurable outcomes associated with the project goals.

2) EXISTING CONDITIONS SUMMARY

Within the project corridor, 52nd Avenue is currently a two-lane rural section with left- and right-turn lanes at major intersections. East of 45th Street, 52nd Avenue becomes a 4-lane divided arterial and it becomes a 6-lane section near I-29. The section of 52nd Avenue included in this project is classified as a minor arterial in the approved functional classification plan and the Fargo-Moorhead 2014 Long Range Transportation Plan. In the approved functional classification plan 52nd Avenue becomes a principal arterial east of I-29. Other minor arterials intersecting with 52nd Avenue include 45th Street and 170th Avenue (Sheyenne Street). See **Figure 3** for the approved functional classification map. The only existing signalized intersection in the project corridor is at 45th Street and 52nd Avenue.[1] The intersection of Sheyenne Street and 52nd Avenue is a roundabout. The other intersections have stop signs on the intersecting side streets.

The posted speed on 52nd Avenue within the study area is 45 mph. As shown in **Figure 4**, the existing traffic volumes range from 5,845 (average daily traffic) on the west end of the project corridor at Sheyenne Street to 11,840 on the east end of the project corridor, as 52nd Avenue nears the I-29 interchange. Currently heavy commercial traffic is about 4 percent of the total traffic on 52nd Avenue.

The corridor has a wide right-of-way and access is primarily limited to other public streets. North of 52nd Avenue within the project corridor, land uses are primarily residential and commercial. To the south of 52nd Avenue, there are currently commercial and undeveloped agricultural land uses, with the Deer Creek residential neighborhood located further to the south along 63rd Street. The undeveloped portions of the 52nd Avenue corridor are guided for a future land use mix of primarily commercial and residential (low to high density) uses based on current land use plans.

The only existing dedicated bicycle/pedestrian facilities along the corridor are a section of multiuse trail along the north side of 52nd Avenue between 47th Street and 45th Street, and marked crosswalks and pedestrian ramps at the intersections of 52nd Avenue with 45th Street and Sheyenne Street. Several side streets within the corridor have sidewalks that terminate at or near 52nd Avenue. No fixed-route transit services are currently provided along the project corridor.

The project corridor includes two bridges: Bridge 09-139-30.0 over the Sheyenne River at the west end of the corridor, and Bridge 09-140-30.0 over County Drain 27 west of 45th Street. Bridge 09-139-30.0 over the Sheyenne River is a three-span prestressed concrete bridge with two travel lanes and a deck width of 33.1 feet. Bridge 09-140-30.0 over Drain 27 is a single span prestressed concrete bridge with two travel lanes and a deck width of 39.4 feet.

Go2030, the Fargo Comprehensive Plan, designates a number of “catalyst projects” with associated initiatives and design recommendations. Two of these projects are located partially within the project corridor. First, the segment of 52nd Avenue between Veterans Boulevard and 45th Street is designated as an Active Living Street, which is described in Go2030 as a key corridor within the city with the potential to support multiple modes of transportation, incorporate green stormwater infrastructure, and become a great public space with attractive streetscapes. Additionally, the alignment of County Drain 27, which crosses 52nd Avenue, is identified as part of the All Season City-Wide Trail Loop in the comprehensive plan, which is intended to connect neighborhoods and walkable mixed use centers for users who are walking, biking, and potentially cross-country skiing. These projects are identified in **Figure 1**.

[1] Temporary signals were recently installed at the intersection of 63rd Street and 52nd Avenue. However, traffic volumes and operational data presented in this memo were collected prior to installation of these temporary signals and therefore reflect operations for a side stop-controlled intersection at this location.

3) NEEDS FOR THE PROJECT

There are six needs for the 52nd Avenue project: system linkages, capacity, long-term safety, non-motorized transportation, economic development, and long-term pavement and structure conditions.

3.1 SYSTEM LINKAGES

As the project area develops and other planned transportation improvements are made based on the Fargo-Moorhead Long Range Transportation Plan (including, for example, the extension of 45th Street to 64th Avenue), 52nd Avenue will gain a more important role in the transportation network. 52nd Avenue is classified as a minor arterial within the project corridor and becomes a principal arterial east of I-29, which has an interstate highway classification. It is approximately two miles to the north to 32nd Avenue, which is a parallel east-west arterial with access to I-29 and it is approximately 4 miles to the south to a parallel roadway with access to I-29 (Cass County Road 14). The primary purpose of a minor arterial is to provide mobility for medium to longer trips within the region.

The planned future construction of collector and local roadways to the south and west of the 52nd Avenue corridor will provide connections to 52nd Avenue increasing the utility of the corridor as an east-west arterial providing access to I-29. The current design of 52nd Avenue as an undivided two-lane roadway is inconsistent with its role in the transportation network as an arterial roadway intended to provide safe mobility for medium and longer trips within the region.

The segment of 52nd Avenue between Veterans Boulevard and 45th Street is also designated as part of a network of Active Living Streets in the City of Fargo's Go2030 plan, which includes recommendations to include features that support all modes of transportation, including non-motorized facilities, transit, streetscape elements and other amenities such as natural stormwater features.[2] The existing corridor currently lacks many of these features.

52nd Avenue is also recognized as a prominent regional facility in the Fargo-Moorhead 2040 Long Range Transportation Plan, Metro 2040. Between Sheyenne Street and 45th Street, 52nd Avenue is identified as a truck route in the regional freight network. Between Veterans Boulevard and 45th Street, 52nd Avenue is identified as a route for potential future transit coverage by 2040. Additionally, the entire project corridor is identified as part of the Regionally Significant Transportation Infrastructure (RSTI) network. The RSTI is comprised of regional arterial roadways that are highly contiguous across multiple jurisdictions and intended to operate efficiently on a day-to-day basis but could also serve as emergency detours or evacuation routes during disasters (e.g. flood events).

A goal of this project is to improve 52nd Avenue consistent with the role as a minor arterial in the roadway network and its role as an Active Living Street east of Veterans Boulevard.

Measurable outcomes associated with this need include the following:

- The facility accommodates medium-to-long trips (a majority of trips are longer than five miles)
- Design speed is 40 to 45 miles per hour
- Access density is minimized to the extent feasible
- Turn lanes and/or medians are provided to the extent feasible
- Design enables addition of future transit service
- Linkages are provided for non-motorized transportation users

3.2 CAPACITY

Another goal for this project is to provide adequate capacity to carry the 2040 forecast traffic at an acceptable level of service (LOS "D" or better).[3] A simulation of existing traffic conditions was developed using SimTraffic. Under existing conditions (2017 traffic volumes and traffic control), 52nd Avenue is generally providing a high level of service; however, there are fairly long delays at some side streets with unsignalized intersections, including the northbound approach at 63rd Street, the northbound approach at Veterans Boulevard, and the southbound approach at 53rd Avenue. Each of these intersections had at least one movement at LOS "F" in either the AM or PM peak hour. **Tables 1 and 2** summarize the results of this analysis for the AM and PM peak hours for 2017 conditions.

[2] Some features associated with the Active Living Streets plan may not be feasible as part of this project. For example, land use design guidelines such as setbacks or building orientation are outside of the scope of this project. Similarly, as the corridor does not have existing transit service, consideration of dedicated transit lanes may not be appropriate.

Table 1: Existing 2017 Measures of Effectiveness (MOE) - AM Peak Hour

Intersection		Appr	Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		Appr	Average & Maximum Traffic eing (feet) Queu								
Control	Location		L	T	R	L	T	R	Delay	LOS	Delay	LOS		Left-Turn			Through			Right-Turn		
														Ave Queue	Max Que	Storage	Ave Queue	Max Que	Storage	Ave Queue	Max Que	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						25	D	14	B	NB					208				
		WB							6	A			WB					25				
		SB							6	A			SB					26				
		EB							9	A			EB					57				
Thru-Stop	2: 63rd St & 52nd Avenue S	NB	86	71	78	F	F	F	79	F			NB				236	530				
		WB	6	1	0	A	A	A	2	A			WB	33	80	275						
		SB	20	0	4	C	A	A	11	B			SB				13	42		12	44	165
		EB	4	5	3	A	A	A	5	A			EB	5	40	300					4	300
Thru-Stop	3: 53rd Ave S & 52nd Avenue S	NB	27	0	14	D	A	B	15	C			NB	30	83							
		WB	8	1	0	A	A	A	2	A			WB	14	49	200						
		SB	0	0	0	A	A	A	0	A			SB									
		EB	0	2	1	A	A	A	2	A			EB									
Thru-Stop	4: 53rd Ave S/Veterans Blvd & 52nd Avenue S	NB	0	44	8	A	E	A	14	B			NB				4	26				
		WB	9	2	1	A	A	A	2	A			WB	6	32	300				1	17	300
		SB	25	17	3	D	C	A	12	B			SB	21	64	200	4	28		20	52	200
		EB	4	2	1	A	A	A	2	A			EB	22	55	275						
Thru-Stop	5: 53rd St/51st Ave & 52nd Avenue S	NB	19	25	17	C	D	C	19	C			NB				17	56				
		WB	10	2	2	B	A	A	2	A			WB	10	43	150						
		SB	34	25	62	D	D	F	34	D			SB				42	122				
		EB	4	3	1	A	A	A	3	A			EB	3	29	175					7	175
Thru-Stop	6: 52nd Avenue S & 47th St S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	3	3	A	A	A	3	A			WB									
		SB	27	0	9	D	A	A	18	C			SB	44	111							
		EB	7	4	0	A	A	A	4	A			EB	8	34	125						
Signalized	7: 52nd Avenue S & 45th St	NB	0	0	0	A	A	A	0	A	16	B	NB									
		WB	0	11	5	A	B	A	9	A			WB				79	165		42	87	250
		SB	25	0	5	C	A	A	22	C			SB	99	168					24	58	
		EB	30	16	0	C	B	A	18	B			EB	82	187	250	193	341				

*Roundabout MOE based on HCM 6th Edition. Roundabout Queues are 95th percentile. All other MOEs from SimTraffic

[3] Level of Service (LOS) is a measure of traffic operations ranging from LOS “A” to LOS “F,” where LOS “A” represents free-flowing traffic and LOS “F” represents consistent, substantial delays.

Table 2: Existing 2017 Measures of Effectiveness (MOE) - PM Peak Hour

Intersection		Appr	Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		Appr	Average & Maximum Traffic eing (feet)								
														Left-Turn			Through			Right-Turn		
Control	Location		L	T	R	L	T	R	Delay	LOS	Delay	LOS		Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						5	A	9	A	NB					23				
		WB							10	A			WB					90				
		SB							10	A			SB					52				
		EB							7	A			EB					11				
Thru-Stop	2: 63rd St & 52nd Avenue S	NB	29	28	9	D	D	A	11	B			NB				49	130				
		WB	5	1	1	A	A	A	3	A			WB	49	117	275						
		SB	26	19	5	D	C	A	15	C			SB				18	60		10	31	165
		EB	5	2	1	A	A	A	2	A			EB	3	23	300					12	300
Thru-Stop	3: 53rd Ave S & 52nd Avenue S	NB	19	0	4	C	A	A	5	A			NB	24	55							
		WB	4	2	0	A	A	A	2	A			WB	6	30	200						
		SB	0	0	0	A	A	A	0	A			SB									
		EB	0	1	0	A	A	A	1	A			EB									
Thru-Stop	4: 53rd Ave S/Veterans Blvd & 52nd Avenue S	NB	50	22	8	F	C	A	26	D			NB				13	43				
		WB	4	3	2	A	A	A	3	A			WB	2	28	300				1	11	300
		SB	47	28	15	E	D	C	27	D			SB	50	121	200	4	31		43	110	200
		EB	10	1	0	B	A	A	2	A			EB	26	85	275						
Thru-Stop	5: 53rd St/51st Ave & 52nd Avenue S	NB	25	31	10	D	D	B	12	B			NB				29	73				
		WB	6	4	4	A	A	A	4	A			WB	7	28	150						
		SB	47	48	34	E	E	D	47	E			SB				62	163				
		EB	7	2	0	A	A	A	2	A			EB	6	29	175						
Thru-Stop	6: 52nd Avenue S & 47th St S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	6	5	A	A	A	6	A			WB									
		SB	43	0	23	E	A	C	32	D			SB	43	102							
		EB	11	3	0	B	A	A	3	A			EB	10	33	125						
Signalized	7: 52nd Avenue S & 45th St	NB	0	0	0	A	A	A	0	A	28	C	NB									
		WB	0	40	23	A	D	C	35	D			WB				391	831		173	394	250
		SB	31	0	23	C	A	C	28	C			SB	119	196					93	179	
		EB	27	8	0	C	A	A	11	B			EB	53	113	250	91	186				

*Roundabout MOE based on HCM 6th Edition. Roundabout Queues are 95th percentile. All other MOEs from SimTraffic

2040 Travel Demand Forecasts were developed for the corridor using the Fargo-Moorhead Council of Governments (FM COG) Travel Demand Model and household and employment forecasts. The 2040 Forecast ADTs are shown on **Figure 5**. The 2040 ADT forecasts show an increase of 6,755 vehicles per day on the west end of the corridor and 8,760 vehicles per day on the east end of the corridor.

A simulation of the future traffic conditions with no improvements to 52nd Avenue was developed using SimTraffic (including no intersection improvements). Based on modeling of traffic operations under the future no build scenario, vehicle delays are anticipated to increase substantially, with many additional approaches with delays at LOS "F." **Tables 3 and 4** summarize the results of this analysis for the future no build AM and PM peak hours. Below is a discussion of the operations expected at each intersection moving from west to east.

- Sheyenne Street and 52nd Avenue – This roundabout is forecast to operate at LOS "F" in the am peak hour and LOS "E" in the pm peak hour. The worst approaches are the northbound approach in the am peak hour and the southbound and westbound approaches in the pm peak hour.
- 63rd Street and 52nd Avenue – The northbound and southbound approaches of this intersection are forecast to operate at LOS "F" in the am and pm peak hour.
- 53rd Avenue and 52nd Avenue – This intersection is forecast to operate at an acceptable LOS "D" or better in the am and pm peak hours.
- Veteran's Boulevard and 52nd Avenue – The northbound and southbound approaches of this intersection are forecast to operate at LOS "F" in the am and pm peak hour.

- 53rd Street and 52nd Avenue – The northbound and southbound approaches of this intersection are forecast to operate at LOS “F” in the am and pm peak hour.
- 47th Street and 52nd Avenue – The southbound approach of this intersection is forecast to operate at LOS “F” in the am and pm peak hours. There is currently no south leg on this intersection, but it is planned to accommodate future development.
- 45th Street and 52nd Avenue – This intersection is currently signalized and is forecast to operate at LOS “D” in the am and pm peak hours.

Table 3: 2040 No-Build Measures of Effectiveness (MOE) - AM Peak Hour

Intersection		Appr	Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		Appr	Average & Maximum Traffic Queueing (feet)								
														Left-Turn			Through			Right-Turn		
Control	Location		L	T	R	L	T	R	Delay	LOS	Delay	LOS		Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						245	F	114	F	NB					1281				
		WB							23	C			WB					158				
		SB							14	B			SB					124				
		EB							14	B			EB					73				
Thru-Stop	2: 63rd St & 52nd Avenue S	NB	698	639	698	F	F	F	696	F			NB				1588	1668				
		WB	9	1	0	A	A	A	3	A			WB	52	124	275					4	275
		SB	53	24	6	F	C	A	27	D			SB				32	79		19	55	165
		EB	6	7	4	A	A	A	7	A			EB	14	43	300		5		1	10	300
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	20	13	6	C	B	A	7	A			NB				22	49				
		WB	5	2	1	A	A	A	2	A			WB	17	47	200						
		SB	19	16	7	C	C	A	14	B			SB				21	56				
		EB	3	2	0	A	A	A	2	A			EB	12	36	250						
Thru-Stop	4: 53rd Ave S/Veterans Blvd & 52nd Avenue S	NB	16	0	8	C	A	A	8	A			NB				4	25				
		WB	5	3	2	A	A	A	3	A			WB	7	32	300		4		2	24	300
		SB	57	26	7	F	D	A	26	D			SB	57	158	200	5	28		34	89	200
		EB	7	2	1	A	A	A	3	A			EB	36	97	275						
Thru-Stop	5: 53rd St/51st Ave & 52nd Avenue S	NB	42	53	25	E	F	D	32	D			NB				33	102				
		WB	8	3	2	A	A	A	3	A			WB	17	44	150						
		SB	314	314	310	F	F	F	314	F			SB				325	490				
		EB	6	3	1	A	A	A	3	A			EB	5	28	175		3			7	175
Thru-Stop	6: 52nd Avenue S & 47th St S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	6	5	A	A	A	6	A			WB									
		SB	87	0	72	F	A	F	79	F			SB	121	322							
		EB	10	4	0	B	A	A	4	A			EB	14	46	125						
Signalized	7: 45th St & 52nd Avenue S	NB	34	36	21	C	D	C	30	C	36	D	NB	89	177	300	164	262		130	267	300
		WB	60	80	43	E	F	D	63	E			WB	95	350	250	464	1021		215	394	250
		SB	44	26	11	D	C	B	32	C			SB	124	230	500	110	192		33	87	
		EB	29	22	17	C	C	B	24	C			EB	74	130	250	131	204				

*Roundabout MOE based on HCM 6th Edition. Roundabout Queues are 95th percentile. All other MOEs from SimTraffic

Table 4: 2040 No-Build Measures of Effectiveness (MOE) - PM Peak Hour

Intersection		Appr	Total Delay by Movement			LOS by Movement			LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		Appr	Average & Maximum Traffic Queueing (feet)								
Control	Location													Left-Turn			Through			Right-Turn		
			L	T	R	L	T	R	Delay	LOS	Delay	LOS		Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage	Ave Queue	Max Queue	Storage
Roundabout	1: Sheyenne St & 52nd Avenue S (Based on HCM)	NB	N/A						11	B	49	E	NB					83				
		WB							35	E			WB					364				
		SB							100	F			SB					577				
		EB							17	C			EB					53				
Thru-Stop	2: 63rd St & 52nd Avenue S	NB	168	177	136	F	F	F	140	F			NB				319	693				
		WB	7	1	1	A	A	A	3	A			WB	66	136	275		9			4	275
		SB	88	59	6	F	F	A	46	E			SB				42	118		17	51	165
		EB	5	5	2	A	A	A	5	A			EB	14	47	300				1	19	300
Thru-Stop	3: 53rd Ave S/New 53rd Ext & 52nd Avenue S	NB	28	19	6	D	C	A	8	A			NB				26	69				
		WB	4	3	1	A	A	A	3	A			WB	6	32	200						
		SB	22	32	11	C	D	B	18	C			SB				14	49				
		EB	6	1	0	A	A	A	1	A			EB	11	42	250						
Thru-Stop	4: 53rd Ave S/Veterans Blvd & 52nd Avenue S	NB	98	74	21	F	F	C	57	F			NB				13	58				
		WB	5	4	2	A	A	A	4	A			WB	3	32	300				3	31	300
		SB	1123	765	782	F	F	F	906	F			SB	293	300	200	1621	2058		92	274	200
		EB	20	2	1	C	A	A	6	A			EB	53	136	275						
Thru-Stop	5: 53rd St/51st Ave & 52nd Avenue S	NB	39	66	10	E	F	B	15	C			NB				27	70				
		WB	5	4	4	A	A	A	4	A			WB	8	32	150						
		SB	505	448	542	F	F	F	503	F			SB				479	555				
		EB	11	2	1	B	A	A	2	A			EB	6	27	175						
Thru-Stop	6: 52nd Avenue S & 47th St S	NB	0	0	0	A	A	A	0	A			NB									
		WB	0	7	6	A	A	A	7	A			WB								11	175
		SB	105	0	80	F	A	F	91	F			SB	77	186							
		EB	21	3	0	C	A	A	4	A			EB	15	54	125						
Signalized	7: 45th St & 52nd Avenue S	NB	39	39	11	D	D	B	29	C	35	D	NB	72	149	300	128	200		68	134	300
		WB	45	53	29	D	D	C	46	D			WB	164	350	250	408	1124		126	394	250
		SB	34	33	23	C	C	C	31	C			SB	95	155	500	131	217		95	210	
		EB	28	27	18	C	C	B	24	C			EB	23	65	250	125	219				

*Roundabout MOE based on HCM 6th Edition. Roundabout Queues are 95th percentile. All other MOEs from SimTraffic

A goal of this project is to provide adequate capacity for the forecasted 2040 traffic volumes to maintain an acceptable level of service in the corridor (including the crossings of the Sheyenne River and County Drain 27). The measurable outcome associated with this goal is that all intersections in the corridor operate at LOS “D” or better and no individual movement is worse than LOS “D” and that roadway capacity provided at bridge crossings is consistent with the remainder of the corridor.

3.3 SAFETY

Over a five-year period between 2012 and 2017, 41 crashes have occurred in the corridor, including 26 at three of the intersections within the corridor (Sheyenne Street, Veterans Boulevard, and 45th Street). Two-thirds of the crashes were property damage only and the remaining crashes involved minor injuries, and overall, the crash rate on 52nd Avenue is relatively low. However, based on the projected growth in traffic volumes and the presence of five unsignalized intersections along the project corridor, there are concerns that, as delays on the side streets increase with growing traffic volumes, motorists will take more chances when turning onto 52nd Avenue or traveling across 52nd Avenue at these locations.

A goal of this project is to minimize the potential for crashes in the corridor following project completion. The measurable outcome associated with this goal is that the five-year average crash rate for segments and intersections should not exceed the statewide averages for similar facilities (the actual rate may vary by alternative facilities).

Non-motorized Transportation

There are limited bicycle/pedestrian facilities along the corridor under existing conditions (see **Figures 2a and 2b**). As the project corridor continues to develop, demand for safe non-motorized access along and across 52nd Avenue will increase. Osgood Park is located north of 52nd Avenue and includes an existing shared-use path that leads to 52nd Avenue, terminating just north of the roadway. Legacy Elementary School is located less than one mile west of the project corridor. Several side streets within the corridor have sidewalks that terminate at or near 52nd Avenue, including 63rd Street, Veterans Boulevard, 51st Avenue, and 47th Street.

The Go2030 plan includes Active Living Streets and City-Wide Trail Loop catalyst projects as well as initiatives focused on bicycle and pedestrian infrastructure, complete streets, and the tree canopy. The segment of 52nd Avenue between Veterans Boulevard and 45th Street is designated as part of a network of Active Living Streets, and the City-Wide Trail Loop follows an alignment that crosses the 52nd Avenue corridor along County Drain 27. The facilities and amenities associated with these initiatives are currently absent from most of the project corridor.

A goal associated with this project is to provide for the safe and comfortable movement of non-motorized transportation users along and across the corridor consistent with Go2030 catalyst projects and initiatives. The measurable outcomes associated with this need include the presence of bicycle and pedestrian facilities on both north and south sides of 52nd Avenue, multiple crossings so that pedestrians do not need to walk more than 0.5 mile to cross 52nd Avenue (including a crossing for the City-Wide Trail Loop and consideration of grade-separated crossings), crossing distances and vehicle speeds that are minimized to the extent feasible, and incorporation of landscaping and vegetation that contribute to pedestrian/bicyclist safety and comfort.

Economic Development

The southwestern portion of Fargo is experiencing rapid development along I-29, including the 52nd Avenue corridor. As a result, the city anticipates increases in traffic volumes on 52nd Avenue due to new development south and west of the project corridor. Current land use plans guide the undeveloped area south of the project corridor for commercial uses and a mix of lower to higher density residential uses.

The Go2030 plan includes an initiative focusing on the use of amenities and beautification as an economic development tool. Recommendations associated with this initiative include prioritizing pedestrian and bicycle streetscape improvements when upgrading infrastructure and investing in trails, parks, and other public spaces. These features are currently limited along the project corridor.

Additionally, the Fargo Moorhead Long Range Transportation Plan (LRTP) identifies additional future transportation improvements in the project area. As part of these assumed improvements,

changes in the transportation network include the proposed widening of Sheyenne Street and the proposed extension of 45th Street south of 52nd Avenue. These improvements, along with the concurrent development that is anticipated, will have a substantial impact on the traffic demand along the 52nd Avenue corridor.

A goal of this project is to support orderly and efficient economic development in the project area consistent with local and regional plans, including the Go2030 initiative to invest in amenities and beautification as an economic development tool. The measurable outcomes associated with this need include accommodating access from the planned roadway improvements that will serve future development along 52nd Avenue (including infill development) and the inclusion of streetscape and/or public realm design characteristics that will help attract businesses and residents to the area.

Long-term Pavement and Structure Condition

Overall, the existing pavement along 52nd Avenue is in relatively good condition. The International Roughness Index (IRI), which serves as a proxy for ride quality, ranges from 88.7 inches per mile (in/mi) to 175.5 in/mi within the project corridor. A “Good” IRI value is less than 95 in/mi, while an IRI of less than 170 in/mi is considered “Acceptable.” Therefore, there is at least one segment of the project corridor with an IRI higher than what would be considered acceptable (between 45th Street and 44th Street), and, as pavement condition deteriorates in the future, other segments will also approach an unacceptable level.

The Ride Quality Index (RQI), which is an alternative measure of pavement roughness, quantifying what the typical motorist feels when driving on a roadway, ranges from 72.32 to 85.99 within the project corridor (out of 100). The Pavement Quality Index (PQI), which is used to quantify the overall condition of pavement (including the level of pavement distress and visible defects such as cracks, patches, and ruts), ranges from 78.6 to 92.99 on 52nd Avenue (out of 100). These ratings indicate that the current pavement condition ranges from “satisfactory” to “good.”

Neither of the bridges along the project corridor is deficient. Bridge 09-139-30.0 over the Sheyenne River has an overall sufficiency rating of 82.20. Bridge 09-140-30.0 over Drain 27 has an overall sufficiency rating of 100 and has a skew of 20 degrees.

As project alternatives are considered, asset management considerations should account for the current and long-term future pavement and bridge conditions along 52nd Avenue. Allowing IRI, RQI, PQI to deteriorate too low will make the ride for motorists unpleasant, potentially limiting mobility and creating vehicle damage. Allowing bridge conditions to deteriorate over the long-term could also result in an unpleasant riding experience along with potential safety concerns.

A goal of this project is to maintain 52nd Avenue and associated structures in a state of good repair over the life of the project. The measurable outcome associated with this need includes maintaining a “good” PQI (above 60) for all segments throughout the life of the project and ensuring that the bridges maintain a sufficient rating throughout the life of the project.

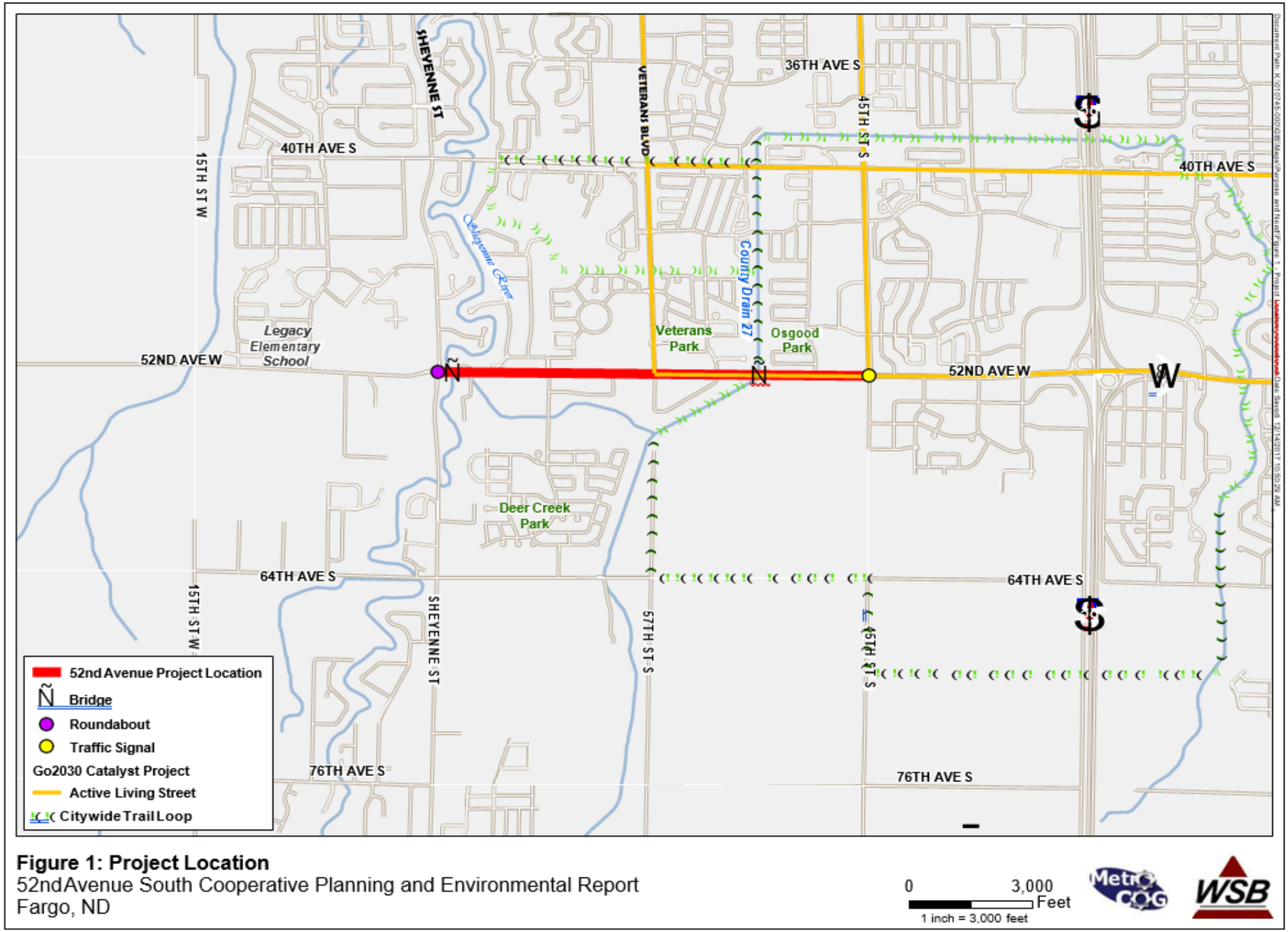


Figure 1: Project Location
52nd Avenue South Cooperative Planning and Environmental Report
Fargo, ND


SEND AVENUE
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Document Path: K:\0107\45-000\GIS\Mxds\Purpose and Need\Figure 2b - Aerial east.mxd Date Saved: 11/17/2017 11:17:03 AM

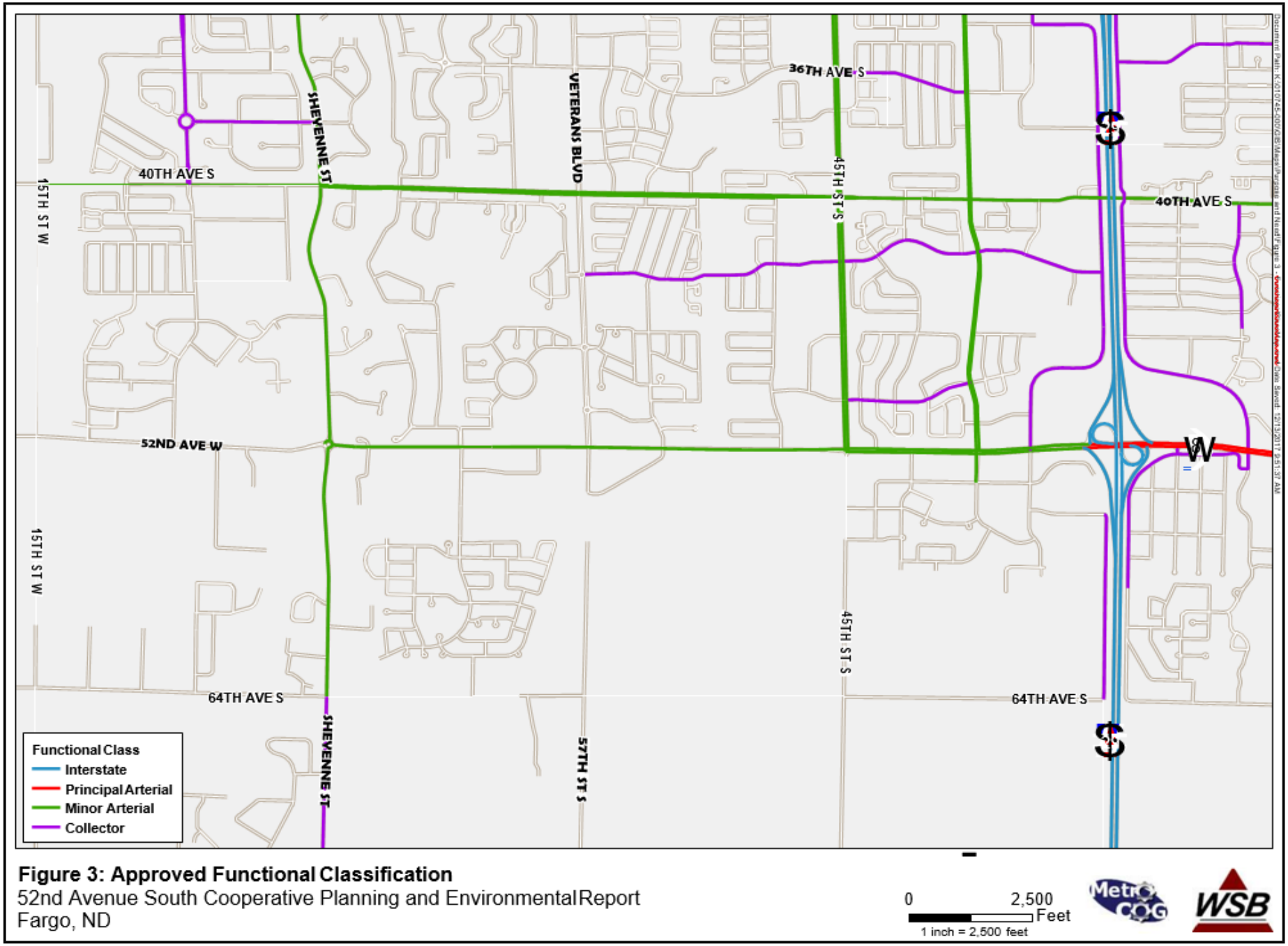


Figure 3: Approved Functional Classification
52nd Avenue South Cooperative Planning and Environmental Report
Fargo, ND

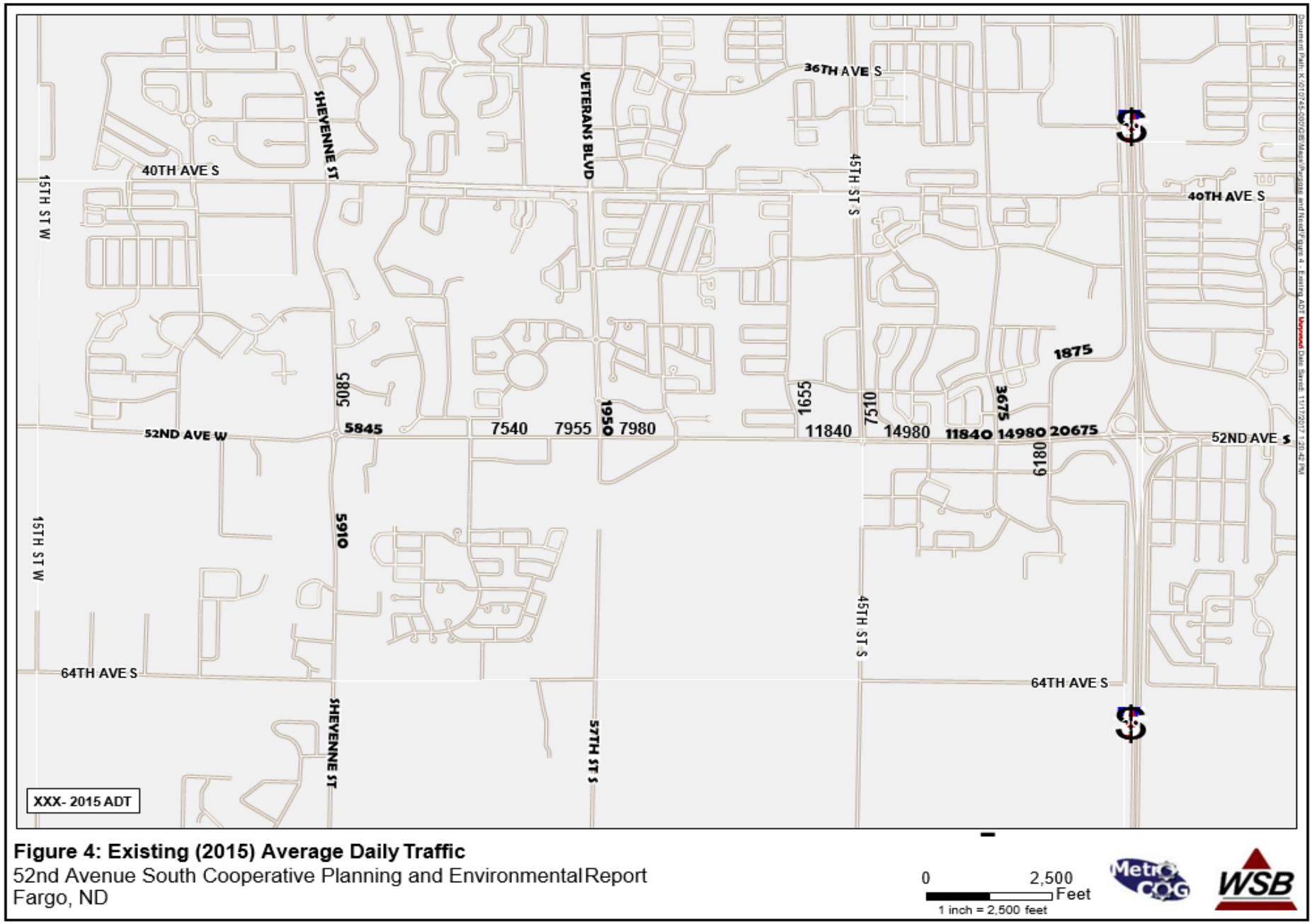


Figure 4: Existing (2015) Average Daily Traffic
52nd Avenue South Cooperative Planning and Environmental Report
Fargo, ND

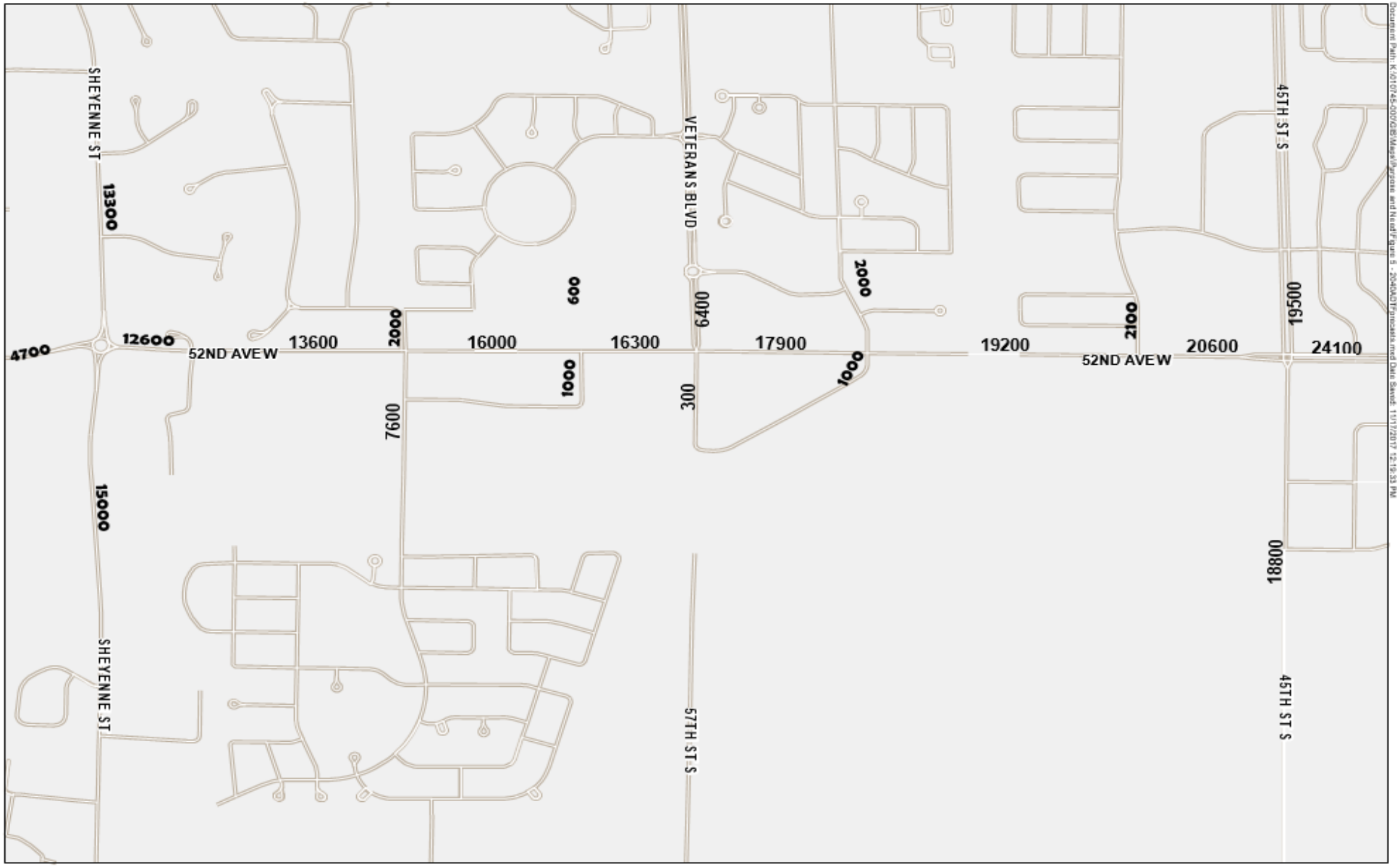


Figure 5: Future (2040) Average Daily Traffic Forecasts
52nd Avenue South Cooperative Planning and Environmental Report
Fargo, ND

0 1,200 Feet
1 inch = 1,200 feet

Topic	Comments	Response
Pedestrian Crossing	Consider a pedestrian underpass near the proposed school site for the safety of children trying to cross 52nd Ave from North & South from Rocking Horse and McMahon Estates.	Creating a corridor meeting the needs for all forms of transportation is a key project objective. Feasibility and location of pedestrian underpasses will be considered in the environmental document.
Access	Concerned with restricting northbound to westbound turn movements from 53rd Avenue. See Appendix J for full comment.	At the intersection of 53rd Ave S and 52nd Ave S, five intersection alternatives are being considered with varying access control. A full access, ¾ access, J-turn, R-cut and right in / right out are currently being considered. A project is also planned for 2018 to pave 53rd Ave S.
Access	We are concerned about the ability to access 52nd Ave from our location to go both east and west with truck traffic. Most of our traffic is large semi traffic. We are requesting a full access intersection at 52 Ave / 53 Ave. Please put us on record that we are opposed to all options except the full access option and 52nd and 53rd Aves. See Appendix J for full comment.	At the intersection of 53rd Ave S and 52nd Ave S, five intersection alternatives are being considered with varying access control. A full access, ¾ access, J-turn, R-cut and right in / right out are currently being considered. A project is also planned for 2018 to pave 53rd Ave S.

4) PUBLIC CONCERNS

There were no controversial issues stated by the public. Concerns about the proposed project were related to grade separated pedestrian crossings of 52nd Ave S and preferred intersection configurations serving a commercial area.

Technical Memorandum 4 – Evaluation of Project Alternatives

Subject: Technical Memorandum 4 – Evaluation of Project Alternatives
Date: February 14, 2018
Project: FM MetroCOG Project 2017-0057
City of Fargo Project MS-17-A0
NDDOT Project SU-8-984(164), PCN 22007
HEI Project 6631-006

1) INTRODUCTION

The purpose of the 52nd Ave S Study is to determine a proactive plan for the improvements needed for 52nd Ave S between Sheyenne Street in the City of West Fargo and 45th St S in the City of Fargo to serve as an important link in the multimodal transportation system. Thereby, accommodating the long-term growth and development in the project area by addressing future capacity and safety needs.

The corridor segment under study is currently a two-lane rural section with left and right turn lanes at major intersections. East of 45th St S, 52nd Ave S becomes a four-lane divided arterial with the potential for dual left turn lanes and right turn lanes at the major intersections. 52nd Ave S becomes a 6-lane section near Interstate 29.

This memo discusses the evaluation of project alternatives related to:

- Geometrics
- Traffic Operations/Access Control
- Structural Requirements
- Utility Impacts
- Pedestrian Facilities
- Right of Way
- Environmental Impacts
- Anticipated Construction Costs

2) ANALYSIS

2.1 ALTERNATIVE A – NO-BUILD

The No-Build Alternative would leave the corridor in its current condition with no improvements. This Alternative does not address the existing deficiencies within the project corridor, including poor intersection level of service (LOS) and deteriorating pavement conditions. Traffic volumes are expected to nearly double by the year 2040, resulting in decreased LOS throughout the corridor, as well as continued maintenance measures to maintain the functionality of the roadway.

This Alternative would maintain the existing geometrics of the two-lane rural corridor with left and right turn lanes at the major intersections. Existing pedestrian facilities would continue to terminate at the corridor right of way limits, prohibiting connectivity and reducing functionality of the trail systems. As no modifications would be made to the project corridor, the existing structures would remain in place but would require replacement in the future as they continue to deteriorate and become structurally deficient. This option will have no utility, right-of- way or environmental impacts. The probable cost to construct Alternative A is $0.

2.2 ALTERNATIVE B – 4 LANE URBAN SECTION

The Build Alternative would reconstruct 52nd Ave S from Sheyenne St east to 45th St S to a four lane, urban section, accommodating long term growth and development in the project area. The improved corridor would meet a design speed of 45 mph and increase traffic capacity while providing pedestrian facility connectivity to promote an active, living corridor. The base alternative consists of a combination of signalized and full access intersections for comparison purposes. The final Build Alternative may be a combination of the additional intersection configurations presented following the base option discussion.

Roadway Geometrics

52nd Ave S would be realigned to be centered within the existing right of way. Lane transitions will be made over a distance determined by multiplying the design speed (45 mph) and the width of the transition meeting current AASHTO standards. The typical section would consist of two 11’ wide eastbound thru lanes and two 11’ wide westbound thru lanes. The eastbound and westbound roadways would be separated by a raised median that varies in width from approximately 4’ (where a left turn lane is present) up to 15’. See Figure 1 for a typical layout. See Figure 2 for the proposed typical section.

Figure 1 – Full Access Intersection Layout

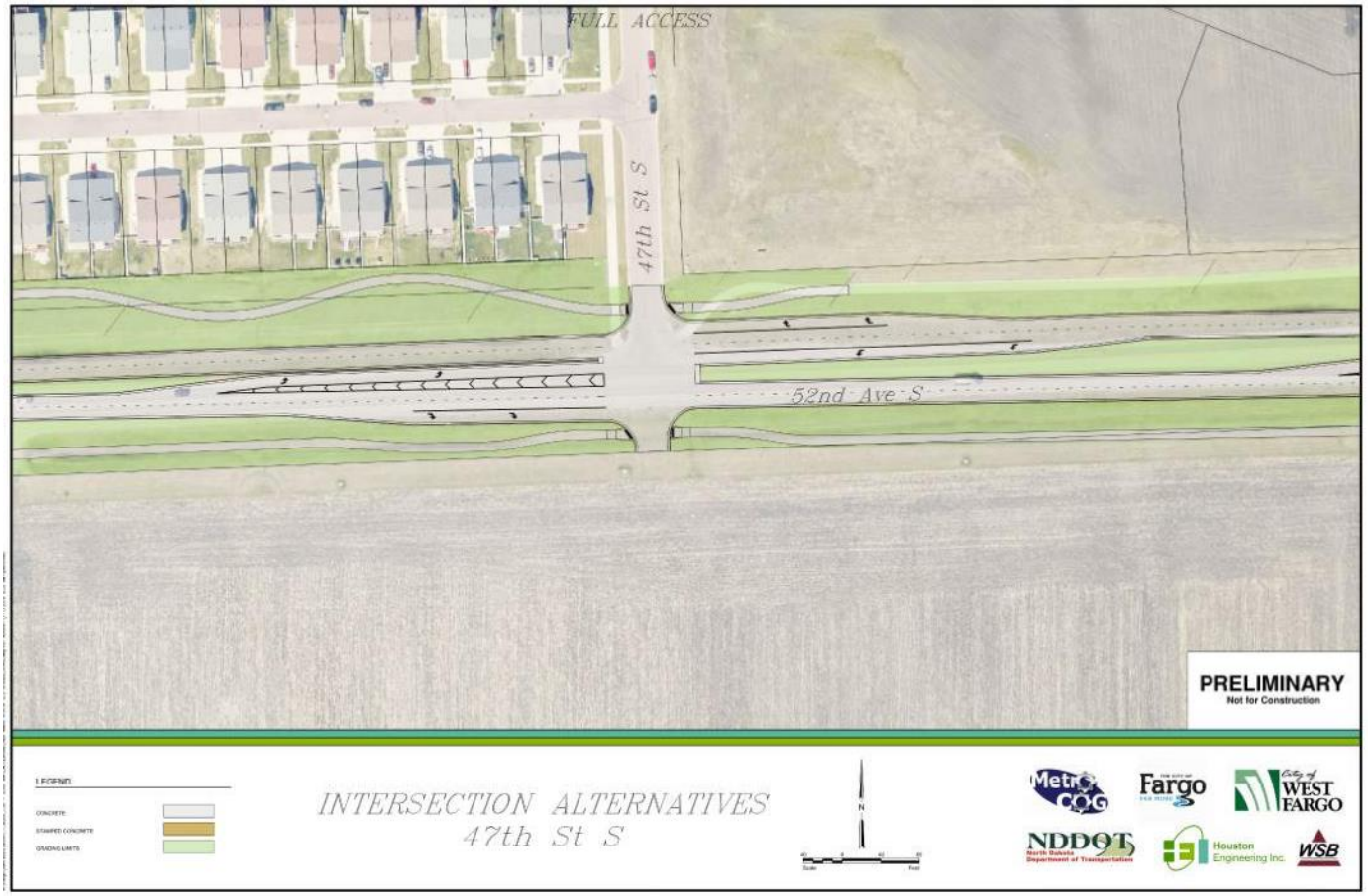
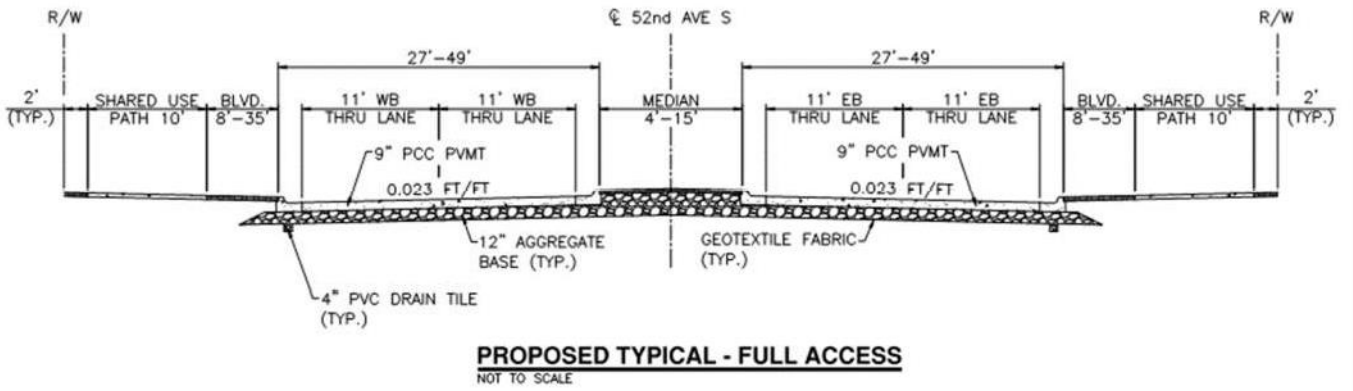


Figure 2 – Full Access Intersection Typical Section



A 10’ wide shared use path would be constructed along the north and south right-of-way limits separated from 52nd Ave S by a grass boulevard varying in width from approximately 8’ up to 35’. To improve intersection pedestrian crossing safety and vehicular sight distances, the boulevard width

will be reduced to a minimum 6' wide grass boulevard immediately adjacent to all intersections within the corridor.

Right and left turn lanes would also be implemented at the following locations along the eastbound and westbound roadways.

- 68th St S
  - Eastbound Right Turn Lane
  - Westbound Left Turn Lane
- 63rd St S
  - Eastbound Right Turn Lane
  - Eastbound Left Turn Lane
  - Westbound Right Turn Lane
  - Westbound Left Turn Lane
- 53rd Ave S
  - Eastbound Right Turn Lane
  - Eastbound Left Turn Lane
  - Westbound Right Turn Lane
  - Westbound Left Turn Lane
- Veterans Blvd
  - Eastbound Right Turn Lane
  - Eastbound Left Turn Lane
  - Westbound Right Turn Lane
  - Westbound Left Turn Lane
- 51st Ave S
  - Eastbound Right Turn Lane
  - Eastbound Left Turn Lane
  - Westbound Right Turn Lane
  - Westbound Left Turn Lane
- 47th St S
  - Eastbound Right Turn Lane
  - Eastbound Left Turn Lane
  - Westbound Right Turn Lane
  - Westbound Left Turn Lane
- 45th St S
  - Eastbound Right Turn Lane
  - Eastbound Left Turn Lane
  - Westbound Right Turn Lane
  - Westbound Left Turn Lane

Turn lane lengths will be designed to meet NDDOT Standards for Traffic Operations as well as deceleration and queue lengths.

Due to the roadway widening and shared use paths, it is anticipated the existing roadway ditches will be eliminated. To maintain local drainage, it is anticipated that 52nd Ave S will be lowered to the

extent possible to allow drainage within the right of way to drain toward the roadway. Snow drifting will also be considered when determining the elevation of the roadway. To prevent drifting, portions of the roadway will likely need to be set higher and inlets installed within the boulevard to maintain drainage.

During detailed design, an option utilizing a wider median with narrower boulevards may be considered. However, this will result in an increased pavement width and project cost to provide a maximum of 6' negative offset between left turn lanes.

The probable cost to construct Alternative B is $20,780,000.

3) TRAFFIC OPERATIONS/ACCESS CONTROL

Corridor travel times for Alternative B, utilizing signalized and full access intersections, are expected to be approximately 280.6 seconds with an average speed of 31 mph. With 2040 traffic projections, this Alternative results in the following intersection LOS. The LOS shown for the signalized and roundabout intersections (Sheyenne St, 63rd Street and Veterans Blvd) are for the overall intersection. The LOS shown for the approach road stop condition (53rd Avenue, 51st Avenue and 47th Street) is the worst leg of the intersection:

- Sheyenne St: A (am) A (pm)
- 63rd Street: B (am) B (pm)
- 53rd Avenue: D (am, SB Leg) E (pm, NB Leg)
- Veterans Blvd: A (am) B (pm)
- 51st Avenue: F (am, SB Leg) F (pm, SB Leg)
- 47th Street: F (am, SB Leg) D (pm, SB Leg)
- 45th Street: C (am) C (pm)

Without modifications to the roundabout at the Sheyenne Street and 52nd Avenue S intersection, the roundabout is forecasted to operate at LOS F and LOS E in the am and pm peak hours in 2040. Currently the roundabout operates at a LOS D. It is projected the roundabout will operate at a LOS F by the year 2030 if no improvements are made. Therefore, recommended improvements include making the northbound and southbound legs of the roundabout 2-lane approaches with two lanes through the roundabout in the northbound and southbound directions. The other improvement would be an additional right only lane on the east approach of the roundabout.

4) STRUCTURAL REQUIREMENTS

Due to the reconstruction of 52nd Ave S from a two-lane rural section to a four-lane urban section, the existing structures crossing the Sheyenne River and Drain 27 will be impacted. The existing Sheyenne River crossing is a 110', three span, prestressed concrete structure, with a clear width of

30.8'. The sufficiency rating of the structure was 82.20 in 2016. The south side of the bridge substructure also functions as a flood control structure equipped with two 4' x 16' gates and a weir wall.

In order, to accommodate the four-lane section and 10' wide shared use path north and south of 52nd Ave S, the bridge will need to be widened to approximately 90'. Alternatives are being considered to widen the existing structure in place to avoid impacts to the existing control structure or to reconstruct the existing bridge and modify the control structure as needed. In addition, an option to widen the bridge to accommodate the four-lane section with separate, adjacent pedestrian facilities is being considered.

The existing Drain 27 crossing is a 66', single span, prestressed concrete structure with a clear width of 36.7'. The sufficiency rating of the structure in 2016 was 100.00. Similar to the Sheyenne River crossing, the Drain 27 crossing will require approximately a 90' wide deck to accommodate the four-lane section and improved pedestrian facilities. Due to the width requirement and the desire to provide a pedestrian crossing underneath the bridge, a full reconstruct of the bridge is recommended. The structure is anticipated to be approximately 140' long and 90' wide. To reduce project costs due to the extra deck width resulting from the median, an additional option constructing two separate structures for eastbound and westbound traffic is being considered. The structure is anticipated to be a 3-span structure with piers oriented to allow for a pedestrian grade separated crossing beneath the structure.

5) UTILITIES

Within the project corridor there are existing underground fiber optic, gas, electric, television, water, and sanitary sewer lines that parallel and cross 52nd Ave S in several locations. There are also overhead power lines that parallel the north and south right of way limits. Due to the lowering of the roadway as discussed above, it is anticipated underground utilities may be impacted as part of the project depending on existing depths. It is anticipated this alternative can be constructed with minimal to no impacts to the overhead power facilities.

6) PEDESTRIAN FACILITIES

This alternative will construct a 10' wide shared use path north and south of 52nd Ave S. The shared use path will be separated by a grass boulevard up to 35' wide. At the intersections, the width of the grass boulevard will be reduced to a minimum of 6' to improve pedestrian crossing safety as well as vehicular sight distances. At grade north/south pedestrian crossings of 52nd Ave S will be provided at Sheyenne St, 63rd St S, Veterans Boulevard and 45th St S. A grade separated crossing will be provided along the west side of Drain 27 between 51st St S and 47th St S. Connections will be established to existing pedestrian facilities that terminate at the project corridor. Additional grade separated crossing locations will be evaluated as part of the design phase of the project.

7) ENVIRONMENTAL IMPACTS

Within the corridor limits, ten wetlands and two Other Waters (OW) areas were identified. All wetlands were identified to be artificial ditch wetlands, while the other waters are the Sheyenne River and Drain 27. Due to elimination of the existing ditch system it is anticipated the project will permanently remove the existing wetlands created by shallow ditch grades. As these wetlands were identified as artificial, wetland mitigation is only anticipated for jurisdictional impacts greater than 0.10 acres. Mitigation requirements are pending a USACE jurisdictional determination.

It is anticipated this alternative can be constructed within the existing right of way. Temporary construction easements may be needed for sidewalk construction and grading near the right of way limits.

8) ALTERNATE INTERSECTION CONFIGURATIONS

Additional alternate intersection configurations are being considered to balance the operations of the corridor, environmental impacts and project cost while meeting the purpose and need of the project. The alternate configurations considered by intersection are:

- 63rd St S
  - Roundabout
- 53rd Ave S
  - ¾ Access
  - Right In / Right Out
  - J-Turn
  - R-Cut
- Veterans Boulevard
  - Roundabout
- 51st Ave S
  - ¾ Access
  - Right In / Right Out
  - J-Turn
  - R-Cut
- 47th St S
  - ¾ Access
  - Right In / Right Out
  - J-Turn
  - R-Cut

1. ***¾ ACCESS ALTERNATE INTERSECTION CONFIGURATION***

This alternate intersection configuration will restrict the thru and left turn movement along the local

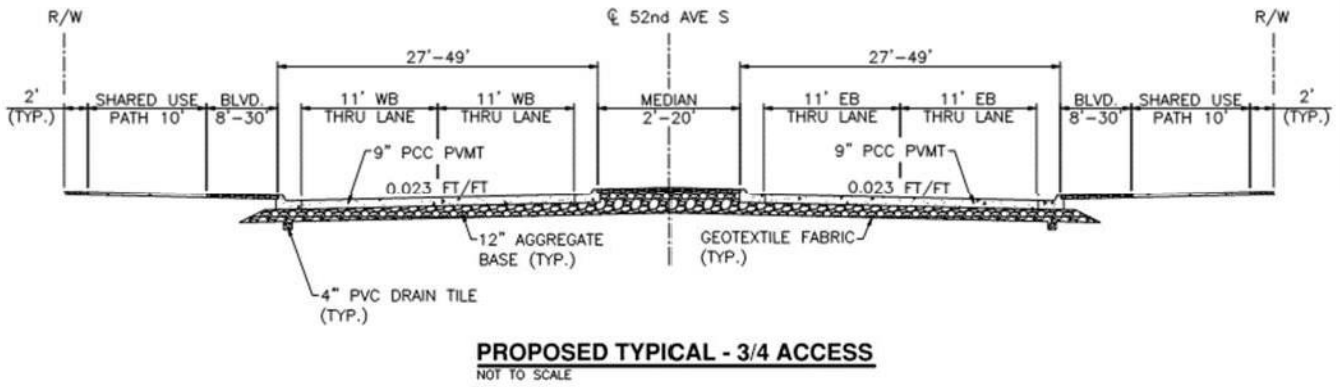
roadways approaching 52nd Ave S, reducing the number of intersection conflict points. However, due to the elimination of the thru movement as well as left turn movements from the approach roadways onto 52nd, alternate routes may be needed. The ¾ access configuration is being considered at 53rd Ave S, 51st Ave S and 47th St S. See Figure 3 for the proposed layout. The additional probable cost to construct this Alternate is $280,000 per intersection compared to Alternative B.

Figure 3 – ¾ Access Intersection Layout

The typical section of this alternate will consist of two 11' wide eastbound and westbound thru traffic lanes separated by a 2' to 20' wide median (see Figure 4). The increased median width, when compared to the full access intersection, is required to provide the additional left turn lane offset needed to construct the center island restricting the approach road thru and left turn movements. Left and right turn lanes will be implemented at major intersections as described under the base alternative.

Due to the wider median required to construct this alternate, the boulevard width separating 52nd Ave S from the 10' wide shared use path north and south of the corridor will be reduced from approximately 35' to approximately 30'. All remaining components of the pedestrian facilities will match the base alternative.

Figure 4 – ¾ Access Intersection Typical Section



The ¾ access alternate results in an improved LOS for all approach legs of the 53rd Avenue, 51st Avenue and 47th St intersections. The LOS listed below is for the worst leg of the approach roadway.

- 53rd Avenue: B (am, WB Leg) A (pm)
- 51st Avenue: A (am) B (pm, SB Leg)
- 47th St S: A (am) A (pm)

When compared to Alternative B, the ¾ access alternate intersection configuration will create significant additional travel time and distance for the approach roadway through and left turn movements. Both movements will need to travel to the next intersection to make a u-turn or take the local streets to a signalized intersection. The additional travel time will in many cases be greater than the delay encountered at the approach roadway under Alternative B.

With this alternate intersection configuration, the modifications to the Sheyenne River crossing will remain the same as described above under Alternative B. However, the additional median width required to construct the
¾ access will require an approximately 98' wide bridge deck as opposed to 90'.

Existing utilities may require relocation as described above in Alternative B. The wider roadway section is anticipated to have minimal additional utility impacts when compared to the full access intersection. This alternate is also not anticipated to have any additional environmental or right of way impacts beyond the full access intersection alternate.

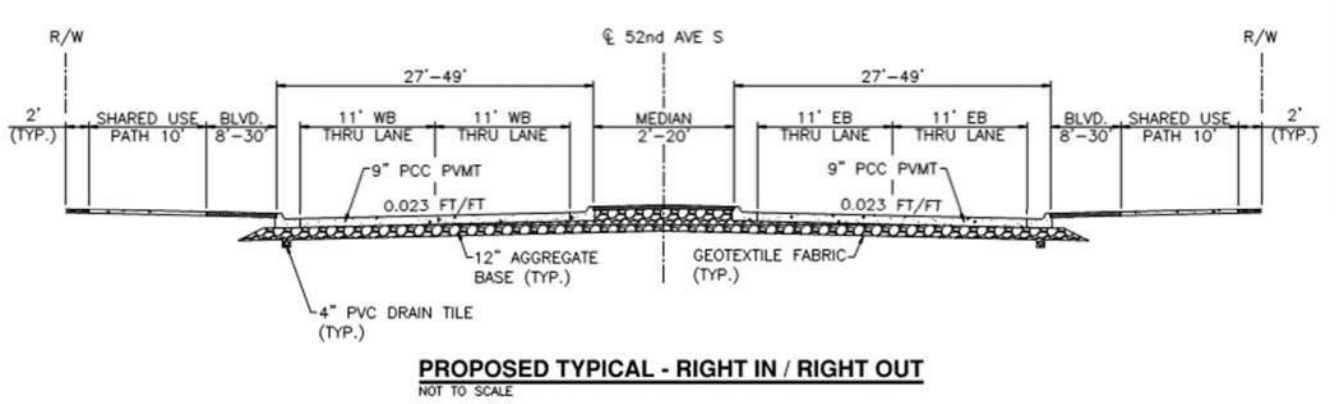
Right In / Right Out Alternate Intersection Configuration

The right in / right out alternate intersection configuration restricts all thru and left turn movements from the approach roadways as well as left turn movements from 52nd Ave S. Similar to the ¾ access alternate, by eliminating the turning movements, the number of intersection conflict points can be reduced. However, alternate routes will be needed to access the local roadways. The right in / right out intersection configuration is being considered at 53rd Ave S, 51st Ave S and 47th St S. See Figure 5 for the proposed layout. The probable cost to construct this Alternate is $200,000 per intersection less than Alternative B.

Figure 5 – Right In / Right Out Intersection Layout

The typical section for this alternate consists of two 11' wide eastbound and westbound thru traffic lanes separated by a 4' to 15' wide raised median (see Figure 6). A 10' wide shared use path would be constructed north and south of 52nd Ave S separated by an approximately 35' wide boulevard. This configuration matches the typical section of the full access intersection.

Figure 6 – Right In / Right Out Intersection Typical Section



The right in / right out alternate results in an improved LOS for all approach legs of the 53rd Avenue, 51st Avenue and 47th St intersections. The LOS listed below is for the worst leg of the approach roadway.

- 53rd Avenue: A (am) A (pm)
- 51st Avenue: A (am) B (pm, SB Leg)
- 47th St S: A (am) B (pm, SB Leg)

When compared to Alternative B, the right in / right out alternate intersection configuration will create significant additional travel time and distance for the left turn movement from 52nd Avenue S as well as for the approach roadway through and left turn movements. These movements will need to travel to the next intersection to make a u-turn or take the local streets to a signalized intersection. The additional travel time will in many cases be greater than the delay encountered at the approach roadway under Alternative B.

52nd Ave S will occupy the same footprint under this alternate intersection configuration as the full access intersection. Therefore, there will be no additional modifications to the structures crossing the Sheyenne River and Drain 27, utilities, wetlands, or right of way when compared to Alternative B.

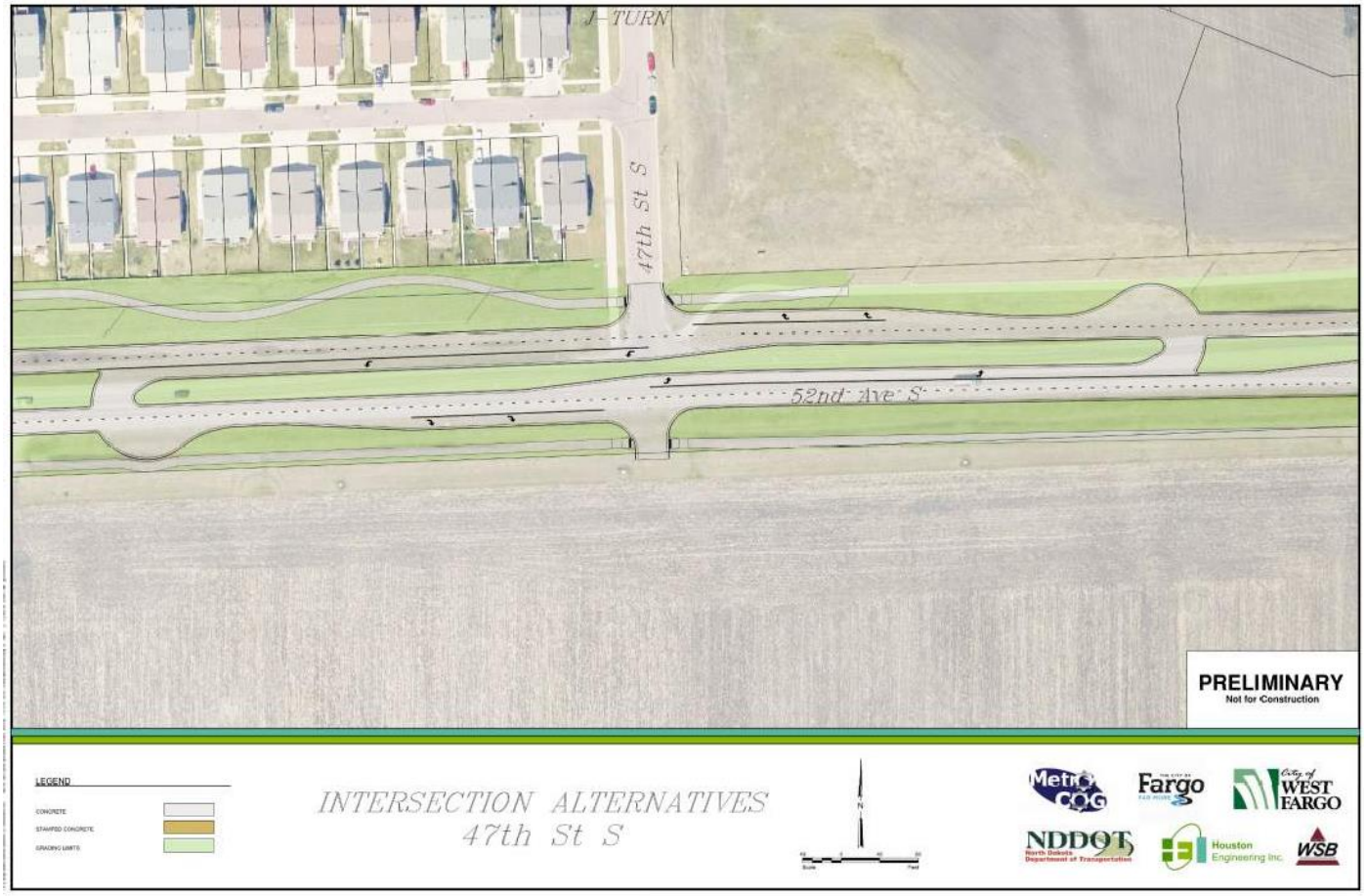
Due to the access limitations of the Right In / Right Out alternate with minimal benefit to the corridor, this option is considered undesirable and unwarranted for this corridor.

J-TURN ALTERNATE INTERSECTION CONFIGURATION

This alternate intersection configuration relocates the eastbound and westbound 52nd Ave S left turn maneuvers approximately 500' beyond the intersection. To complete a left turn maneuver from

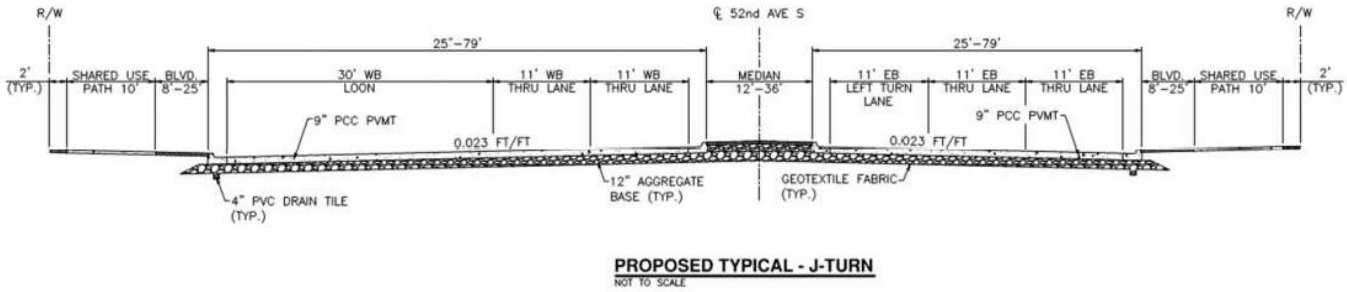
52nd Ave S to the side street, vehicles would perform a u-turn to access the approach roadway. A semi-circular full depth pavement section (loon) would be implemented to allow a WB-62 to complete the turning movement. The location of the left turn bay and loon would be designed to provide a minimum of 50' separation between the loon and 52nd Ave S right turn lane. As the thru and left turn movements from the approach roadways would also be restricted, the left turn bay along 52nd Ave S would be extended through the intersection. The longer turn lane bay allows for northbound to westbound, southbound to eastbound, northbound thru and southbound thru traffic to cross two 52nd Ave S thru lanes and enter the turn lane directly. This eliminates the weaving maneuvers required to complete the desired turning movements. This alternate results in decreased intersection conflict points when compared to a full access intersection, with minimal access restrictions to the local roadways. The J-Turn alternate intersection configuration is being considered at 53rd Ave S, 51st Ave S, and 47th St S. Due to the spacing of 53rd Ave S and Veterans Boulevard, the 52nd Ave S eastbound left turn movement at 53rd Ave S would be restricted. See Figure 7 for the proposed layout. The additional probable cost to construct this Alternate is $70,000 per intersection compared to Alternative B.

Figure 7 – J-Turn Intersection Layout



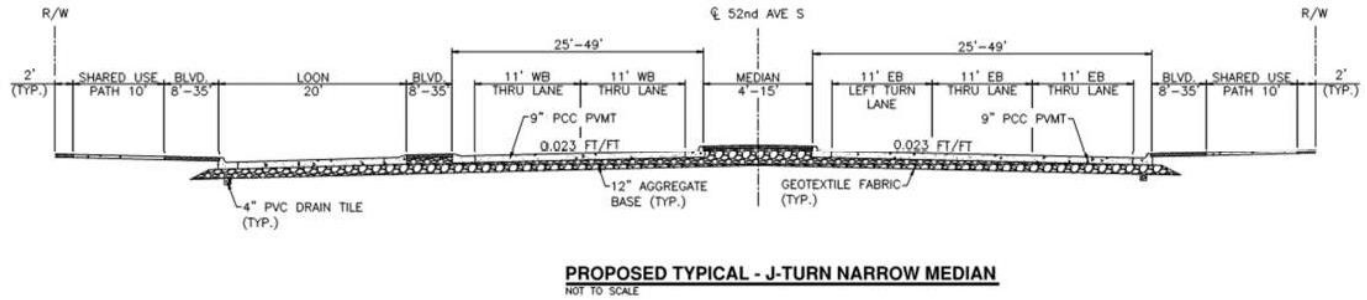
The typical section consists of two 11' wide eastbound and westbound thru traffic lanes separated by a 12' to 36' wide median (see Figure 8). To allow for a WB-62 to complete the u-turn maneuver within the J-Turn, a loon will be constructed. The loon utilizes approximately a 57' radius and widens the adjacent roadway up to 30'. A narrower and wider median option were evaluated when determining the appropriate width for this alternate.

Figure 8 – J-Turn Intersection Typical Section



The narrower median option maintained the 4’ to 15’ wide median matching the full access intersection configuration. However, to accommodate the wheel path of a WB-62, the loon widened the adjacent roadway by up to 60’. Due to the amount of widening, a mountable curb and truck apron were implemented to delineate the thru roadway from the turning movement (see Figure 9). The 52nd Ave S right turn lane was extended to the loon and striped as a drop lane to allow acceleration prior to entering the thru traffic lanes. This option was eliminated from consideration due to potential driver confusion associated with left turning traffic leaving the roadway and the associated weaving maneuver required to reenter the thru traffic lanes.

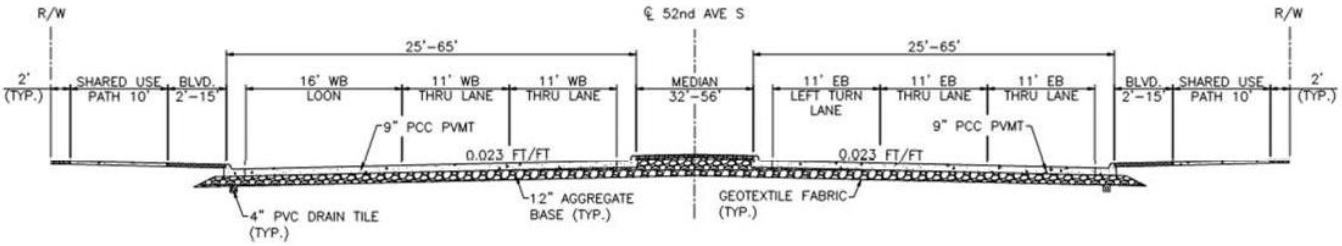
Figure 9 – J-Turn Intersection Typical Section, Narrow Median



PROPOSED TYPICAL - J-TURN NARROW MEDIAN
NOT TO SCALE

The wider median option utilized a 32’ to 56’ wide median, minimizing the additional widening needed to accommodate a WB-62. With this option, the loon widened the adjacent roadway by approximately 16’. However, the additional roadway widening resulted in boulevard widths of 2’ adjacent to the 10’ wide shared use path to minimize right of way acquisition. As the narrow boulevard provides minimal separation of pedestrian and vehicular traffic it does not meet the desire of the project to serve as an important link in the multimodal transportation system. Therefore, this option was eliminated from consideration. See Figure 10 for the proposed J-Turn typical section with wide median.

Figure 10 – J-Turn Intersection Typical Section, Wide Median



PROPOSED TYPICAL - J-TURN WIDE MEDIAN
NOT TO SCALE

The J-Turn alternate results in an improved LOS for all approach legs of the 53rd Avenue, 51st Avenue and 47th St intersections. The LOS listed below is for the worst leg of the approach roadway.

- 53rd Avenue: A (am) A (pm)
- 51st Avenue: A (am) B (pm, SB Leg)
- 47th St S: A (am) A (pm)

When compared to Alternative B, the J-Turn alternate intersection would increase corridor travel time and distance since the left turn from 52nd Avenue as well as minor street through and left turn movements need to travel about 1,000 additional feet to complete the maneuver. The additional distance is anticipated to increase travel times by approximately 25 seconds for the approach traffic. For the left turn movement from 52nd Avenue S, the increased travel time will be greater than the delay for the left turn movement under Alternative B. However, the increased travel time is more than offset by the reduced delay encountered at the approach roadway.

Previous studies completed on J-Turn intersections indicated that the J-Turn design results in approximately a 35% reduction in overall crash rate with approximately 50% reduction in the crash rate for injury and fatal crashes when compared to a full access intersection.

Under this alternate, the corridor width will remain unchanged at the Sheyenne River crossing when compared to the full access interchange. Therefore, no additional modifications will be required to the structure. To accommodate the J-Turn at 51st Ave S and 47th St S, the median width crossing Drain 27 will be widened to 36'. Due to the additional widening, it is anticipated two separate structures, each approximately 40' wide, would be constructed for eastbound and westbound traffic in order to reduce project costs related to the superstructure and substructure.

The additional roadway width is also likely to increase the utility relocations required throughout the corridor. In addition to impacts to the underground facilities depending on existing cover, this option is likely to impact the overhead power distribution lines that parallel the corridor. The J-Turn intersection configuration is not anticipated to increase wetland impacts. However, permanent right of way acquisition, approximately 15' wide and 100' long, are anticipated for the construction of the loons at each location.

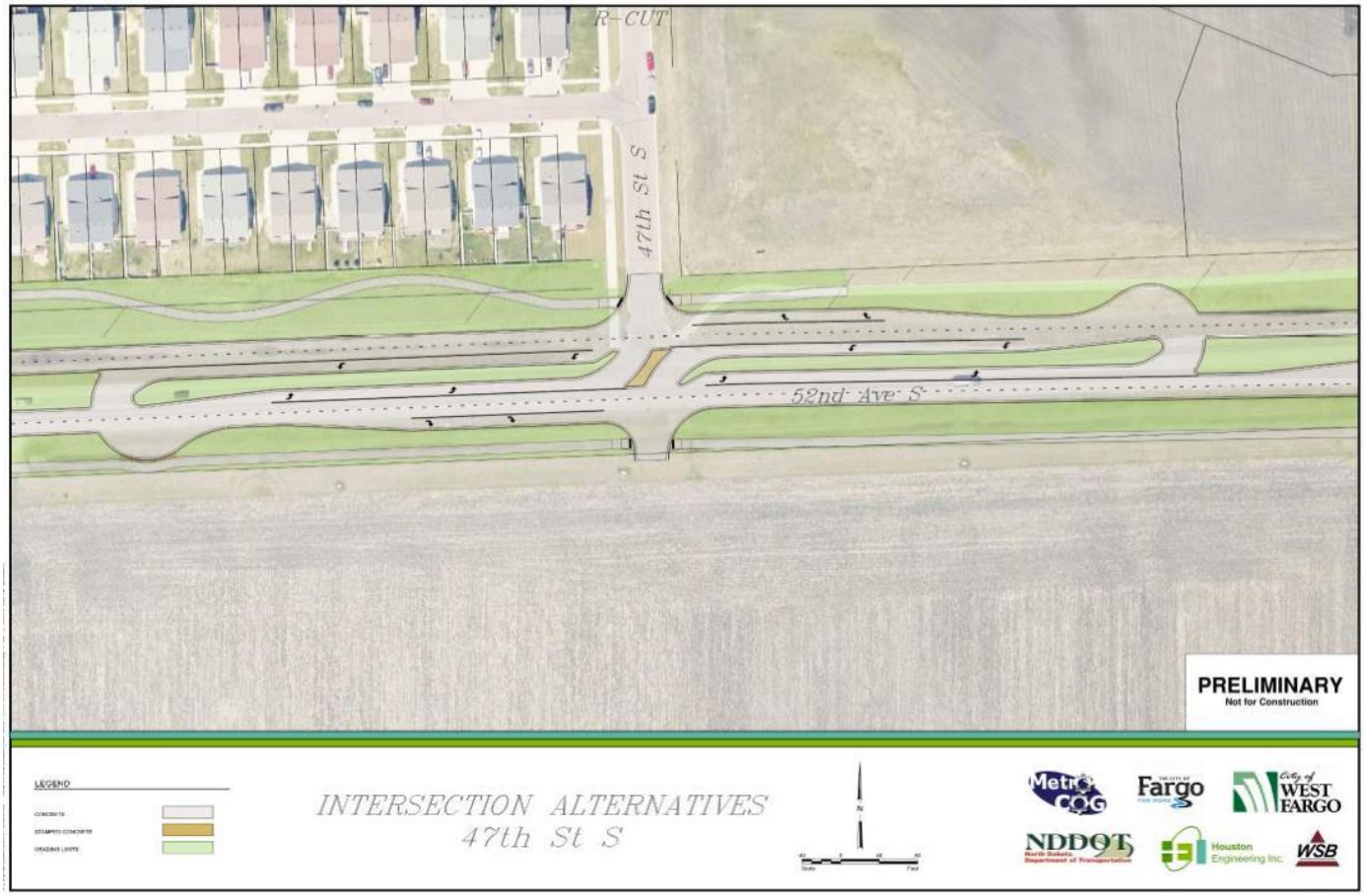
Due to the access limitations when compared to the full access and R-Cut alternate intersection

configurations, the J-Turn was determined to be an undesirable intersection option for this corridor.

R-CUT ALTERNATE INTERSECTION CONFIGURATION

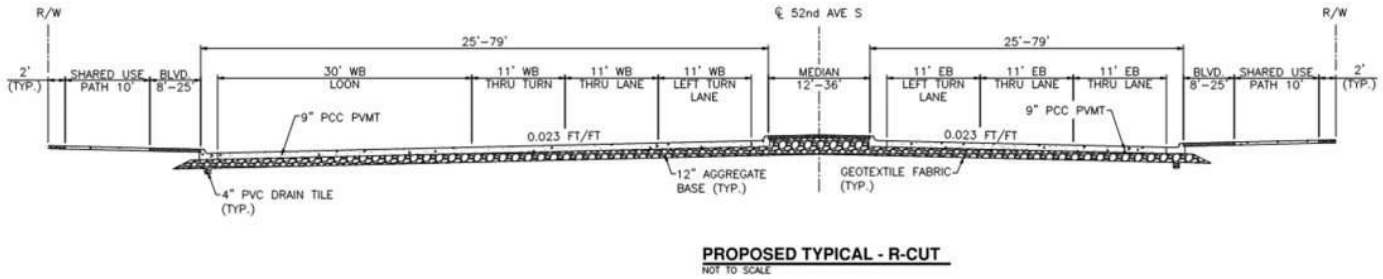
The R-Cut (Reduced Conflict U-Turn) alternate intersection configuration is similar to the J-Turn alternate. However, a ¾ access is provided at the intersection to allow eastbound and westbound 52nd Ave S left turn movements to side streets. Under this alternate, the J-Turn will be utilized for northbound to westbound, southbound to eastbound, northbound thru and southbound thru movements only. As the J-Turn will be utilized by vehicles entering from the approach roadway only, the turn lanes will be extended to the ¾ access, the taper length decreased, and the approach roadway radius increased to allow approach traffic to enter the turn lane by crossing the two 52nd Ave S thru lanes (see Figure 11). Thus, eliminating the weaving maneuver and potential conflict points along 52nd Ave S. This alternate intersection is being considered at 53rd Ave S, 51st Ave S and 47th St S. The additional probable cost to construct this Alternate is $230,000 per intersection compared to Alternative B.

Figure 11 – R-Cut Intersection Layout



Similar to the J-Turn alternate intersection configuration, the typical section will consist of two 11' wide eastbound and westbound thru lanes separated by a 12' to 36' wide median. To allow for a WB-62 to complete the u-turn maneuver within the J-Turn, a 57' radius loon will be constructed. The loon widens the adjacent roadway up to 30'. See Figure 12 for the proposed typical section. As was done for the J-Turn alternate, a narrower and wider median option were also evaluated when determining the appropriate width for this alternate.

Figure 12 – R-Cut Intersection Typical Section



The R-Cut alternate results in an improved LOS for all approach legs of the 53rd Avenue, 51st Avenue and 47th St intersections. The LOS listed below is for the worst leg of the approach roadway.

- 53rd Avenue: B (am, WB Leg) A (pm)
- 51st Avenue: A (am) B (pm, SB Leg)
- 47th St S: A (am) A (pm)

When compared to Alternative B, the R-Cut alternate intersection would increase corridor travel time and distance since the minor street through and left turn movements need to travel about 1,000 additional feet to complete the maneuver. The additional distance is anticipated to increase travel times by approximately 25 seconds for the approach traffic. However, the increased travel time is more than offset by the reduced delay encountered at the approach roadway.

The Federal Highway Crash Modification Factors Clearinghouse has several studies that indicate an R-Cut intersection will reduce the crash rate when compared to a full access intersection by approximately 30% as well as reduce the overall severity of the crashes.

Due to the 36' wide median at the Drain 27 crossing, it is anticipated the 90' wide single structure will be replaced with two separate 40' wide structures for eastbound and westbound traffic. At the Sheyenne River crossing, the roadway width will remain unchanged when compared to Alternative B. Therefore, no change to the 90' wide structure described in Alternative B is anticipated.

As the R-Cut alternate will occupy the same footprint as the J-Turn, additional utility and right of way impacts are anticipated when compared to the full access intersection. Due to the wider median and loons, impacts to the overhead power distribution lines are anticipated. In addition, permanent right of way acquisition, approximately 15' wide and 100' long are anticipated for the construction of the loons.

2. ***ROUNDABOUT ALTERNATE INTERSECTION CONFIGURATION***

This alternate intersection configuration replaces the signalized intersections at 63rd St S and Veterans Boulevard with multilane roundabouts. The roundabout provides two eastbound and westbound thru lanes with a single northbound and southbound thru lane and consists of a 180' diameter inscribed circle, 96' diameter center island and 8' wide mountable truck apron. The roundabout approach and exit legs will be designed to meet current design practices to achieve the desired approach speed and avoid vehicular path overlap. At grade pedestrian facilities as well as east/west and north/south crossings will be maintained within the intersection. Due to the size of inscribed circle, additional environmental and right of way impacts are anticipated when compared to a signalized intersection. See Figures 13 and 14 for the proposed layout and typical section. The probable cost to construct this Alternate is $160,000 per intersection less than Alternative B due to reduced pavement area within the intersection.

Figure 13 – Roundabout Intersection Layout

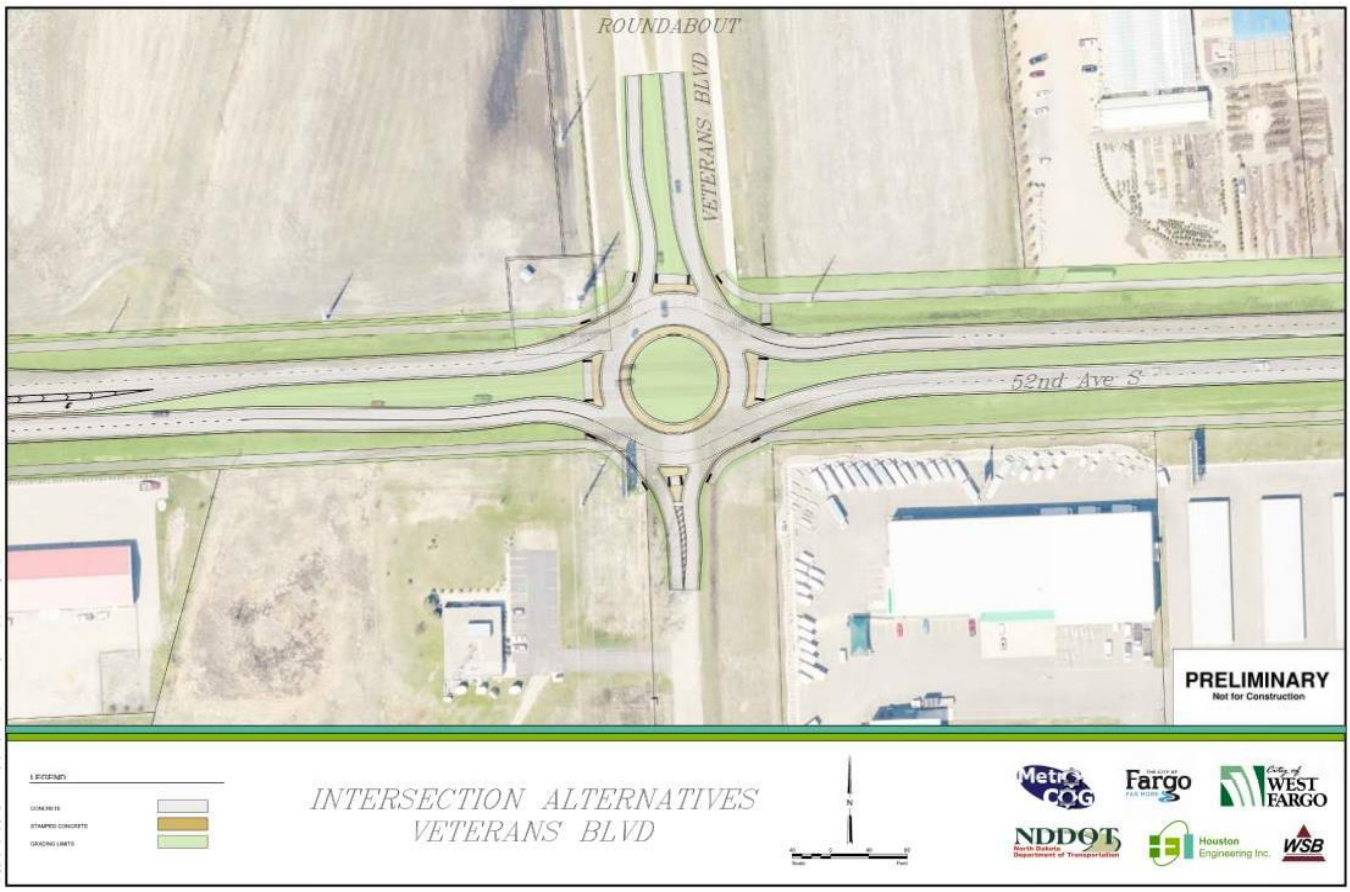
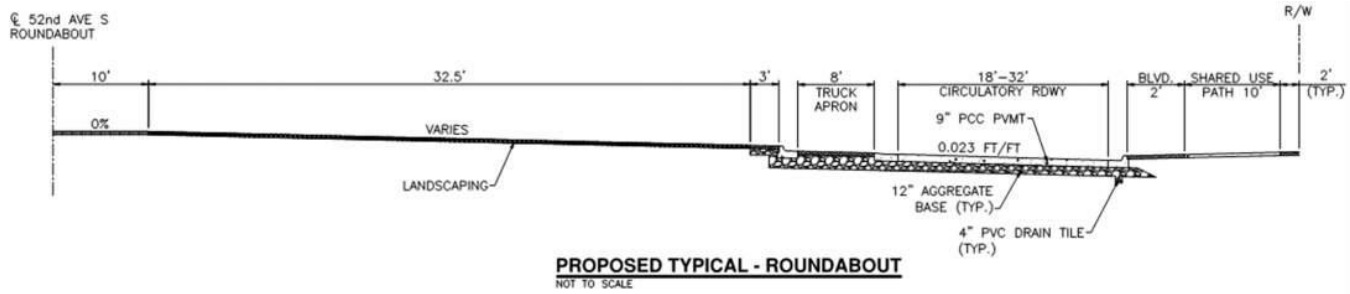


Figure 14 – Roundabout Intersection Typical Section



The roundabout alternate results in an improved LOS for the 63rd St and Veterans Boulevard intersections. The 63rd Street intersection is expected to operate at a LOS A during the am and pm peak hour. At Veterans Boulevard, the intersection is expected to operate at a LOS A during the am and pm peak hour.

Generally, the roundabout alternate operates similar to Alternative B. The roundabouts are expected to slightly decrease delay and increase the LOS at 63rd Street and Veterans Boulevard. Intersection alternates described above for the approach roadways at 53rd Avenue, 51st Avenue, and 47th Street are expected to operate similarly whether a signalized intersection or roundabout are utilized at 63rd Street and Veterans Boulevard. Corridor travel times are expected to be approximately 9 seconds longer (289.5 seconds, with average speed of 29 mph) with the roundabout alternate.

According to the most recent studies, a 2-lane by 1-lane roundabout has about the same crash rate as a signalized intersection. However, the fatality and serious injury crash rates for this roundabout configuration is approximately 50% less than a signalized intersection. This is based on the Federal Highway Crash Modification Factors Clearinghouse and consistent with a recently completed study of traffic safety at roundabouts in Minnesota.

As this alternate will not impact the corridor outside of the 63rd St S and Veterans Boulevard intersections, modifications to the Sheyenne River and Drain 27 crossing are anticipated to match those described under Alternative B. It is anticipated both structures will be replaced or modified to provide a 90' wide bridge deck.

As the roundabout increases the footprint of the 63rd St S and Veterans Boulevard intersections when compared to a signalized intersection, it is anticipated this alternate will result in increased utility impacts to the overhead power distribution lines. In addition, permanent right of way acquisition is anticipated within each quadrant of the intersections.

See Table 1 for a summary of each alternate intersection configuration.

Location	Traffic Operations					Crashes		Probable Construction Cost (In Addition to Alt B)
	Intersection LOS	Access	Average Speed (MPH)	Intersection Delay (Sec)	Additional Travel Distance (Ft)	Rate	Severity	
Sheyenne St								
Roundabout	A	Full	31	9	-	Unchanged	Reduced 50%	-
McMahon Estates Circle								
Full Access	-	Full	-	-	-	-	-	-
Right In / Right Out	-	Limited	-	-	-	Reduced 30%	Reduced	-$200,000.00
68th St S								
Full Access	-	Full	-	-	-	-	-	-
63rd St S								
Signalized	B	Full	32	18	-	-	-	-
Roundabout	A	Full	31	9	-	Unchanged	Reduced 50%	-$160,000.00
53rd Ave S								
Full Access	E	Full	-	16	-	-	-	-
¾ Access	B	Partial	-	6	2,000-3,000	Reduced 30%	Reduced	$280,000.00
Right In / Right Out	A	Limited	-	8	2,000-3,000	Reduced	Reduced	-$200,000.00
J-Turn	A	Full	-	9	600	Reduced 35%	Reduced 50%	$70,000.00
R-Cut	B	Full	-	6	600	Reduced 30%	Reduced	$230,000.00
Veterans Blvd								
Signalized	B	Full	32	12	-	-	-	-
Roundabout	A	Full	31	5	-	Unchanged	Reduced 50%	-$160,000.00
53rd St S								
Full Access	F	Full	-	182	-	-	-	-
¾ Access	B	Partial	-	5	3,000-6,000	Reduced 30%	Reduced	$280,000.00
Right In / Right Out	B	Limited	-	11	3,000-6,000	Reduced	Reduced	-$200,000.00
J-Turn	B	Full	-	11	600	Reduced 35%	Reduced 50%	$70,000.00
R-Cut	B	Full	-	5	600	Reduced 30%	Reduced	$230,000.00
47th St S								
Full Access	F	Full	-	47	-	-	-	-
¾ Access	A	Partial	-	5	3,000-6,000	Reduced 30%	Reduced	$280,000.00
Right In / Right Out	B	Limited	-	10	3,000-6,000	Reduced	Reduced	-$200,000.00
J-Turn	A	Full	-	9	600	Reduced 35%	Reduced 50%	$70,000.00
R-Cut	A	Full	-	5	600	Reduced 30%	Reduced	$230,000.00
45th St S								
Signalized	C	Full	32	26	-	-	-	-