

TECHNICAL MEMORANDUM

Date: March 10, 2021

To: David De Angelis
Village of Elm Grove

From: Tammi Czewski, P.E., PTOE and John Bieberitz, P.E., PTOE
Traffic Analysis & Design, Inc.

Subject: **Review of the “School Sisters of Notre Dame Development Traffic Impact Study Supplement Number 2.”**
Elm Grove, WI

INTRODUCTION

TADI completed a detailed review of the traffic volumes, analysis, and recommendations presented in the January 11, 2021 “School Sisters of Notre Dame Development Traffic Impact Study Supplement Number 2” report. When found, discrepancies were noted and corrected in the analysis models for a revised reporting of peak hour delays and queues expected from full buildout of the School Sisters of Notre Dame (SSND) development and other off-site developments evaluated in the traffic impact study (TIS) report.

DATA SOURCES

The SSND #2 TIS report was an update of previous TIS reports for the SSND site. The January 11, 2021 update was prepared to evaluate the traffic impacts of the SSND site based on the most recent site Mandel development site plan, which includes 240 multi-family units with one access to Watertown Plank Road, 15 single-family homes with one access to Green Meadow Place, and 11 single-family units with individual driveway access to Stephen Place and Red Barn Lane. The following lists the data sources used to evaluate the SSND #2 TIS.

- January 11, 2021 “School Sisters of Notre Dame Development Traffic Impact Study Supplement Number 2”
- September 23, 2020 “School Sisters of Notre Dame Development Traffic Impact Study”
- Turning movement traffic counts for all study intersections

- Signal timing and phasing plans for the signalized study intersections
- Wisconsin Motor Vehicle Crash Reports along the Watertown Plank Road corridor
- Synchro traffic analysis models for the year 2028 traffic scenarios

YEAR 2028 TRAFFIC VOLUMES REVIEW

The SSND #2 TIS evaluates the Year 2028 AM and PM peak hours for three traffic volume scenarios. These are:

- Year 2028 Background Traffic
- Year 2028 Background Traffic with Updated Mandel Residential Development (herein referred to as the “Year 2028 Build Traffic”)
- Year 2028 Background Traffic Updated Mandel Residential Development Plan and Village Downtown Corridor Master Plan Multi-Family Trips (herein referred to as the “Year 2028 Total Traffic”)

Year 2028 Background Traffic

The Year 2028 Background traffic was generated by increasing turning movements at the Watertown Plank Road intersections with Elm Grove Road (all movements) and 124th Street (all movements but those to/from the south on 124th Street), and all through movements on Watertown Plank Road by a growth rate of 0.5% per year. TADI agrees with the conservatively estimated growth rate given that historical traffic patterns on Watertown Plank Road show slightly declining trends since 2006.

The peak hours selected for this study occurred from 7:15-8:15 a.m. (AM peak hour) and from 4:30-5:30 p.m. (PM peak hour). A review of the traffic counts for these peak hours showed that incorrect volumes (by 5-10 vehicles) were input for the AM peak hour southbound left turn and westbound right turn movements at the Watertown Plank Road intersection with 124th Street.

The existing traffic volumes in the SSND #2 TIS report were balanced along the corridor, where sensible. Due to the presences of other driveways and roadways, no balancing was added between Elm Grove Road and the SSND West driveway. When the original SSND TIS report was completed, Longwood Avenue was not included as a study intersection and therefore no balancing was completed for the AM peak hour. For the PM peak hour, however, 25 vehicles were added to the eastbound through movement at the Watertown Plank Road intersection to balance traffic between Blue Ridge Boulevard and 124th Street. For consistency with the AM peak hour balancing methodology, no balancing should also have been completed for the PM peak hour. TADI revised the existing traffic volumes with the corrected AM peak hour volumes and PM peak hour balancing removal at the Watertown Plank Road/124th Street intersection.

A 0.5% growth rate was applied to the revised existing peak hour traffic volumes as described in the SSND #2 TIS report to generate the revised Year 2028 Background traffic volumes. The revised Year 2028 Background traffic volumes were balanced between intersections, ensuring that the traffic volume increases also balance consistently along the

corridor. This method of balancing was not completed in the SSND #2 TIS report. The revised Year 2028 Background traffic volumes were input into the corresponding Synchro analysis models.

Year 2028 Build Traffic

The “Build” traffic volumes add the expected net new trips for the new residential development for the SSND site as shown on the Mandel development plan. The net new trips include the new trips from the Mandel development plan minus the existing trips counted at the SSND site driveways to Watertown Plank Road and Stephen Place. Although the SSND TIS reports do not specify this, the existing SSND traffic was removed from the West SSND driveway and Stephen Place intersections with Watertown Plank Road. However, these volumes were not removed throughout the rest of the corridor, resulting in higher traffic volumes than should be expected for the Year 2028 Build traffic condition.

Trip generation for the proposed residential developments on the SSND site were reported to total 115 (30 in/85 out) in the AM peak hour and 135 (85 in/80 out) in the PM peak hour based on trip rates published in the Institute of Transportation Engineers *Trip Generation Manual, 10th Edition*. Based on a review of the trips calculated for the individual land uses in the SSND report, it was determined that the trips were rounded differently than expected per industry standards. Per the ITE *Trip Generation Manual*, a 240-unit mid-rise multi-family development generates 81 trips (rounded to 80) in the AM peak hour and not 85. Likewise, 11 units of single-family residential generates 12 trips (rounded to 10) in the PM peak hour and not 15. While the trip generation presented in the SSND #2 is a more conservative estimate of trips for the site, the rounding was corrected for the revised traffic assignments.

As stated in the SSND #2 TIS report, the development traffic assignments (identified as distributions in the TIS report) show a greater number of trips entering and exiting the site than what is shown in the trip generation table. Per industry standards, the traffic assignments should be adjusted so that they equal the trips shown in the trip generation table.

The revised Year 2028 Build traffic volumes include the corrected or adjusted SSND traffic removals, trip generation calculations, and traffic assignment of the new site trips. The revised Year 2028 Build traffic volumes also correct the addition errors found when adding the Year 2028 Background traffic volumes plus the site traffic assignment volumes from the SSND #2 TIS report. The revised Year 2028 Build traffic volumes were input into the corresponding Synchro analysis models.

Year 2028 Total Traffic

The “Total” traffic volumes add the expected new trips for potential “off-site” development of 243 mid-rise multi-family apartments between Elm Grove Road and Legion Drive as identified in the *Village of Elm Grove Downtown Corridor Plan*. Similar to the trip generation for the SSND site, the trip generation was rounded differently than expected per industry standards. Per the ITE *Trip Generation Manual*, a 243-unit mid-rise multi-family development generates 82 trips (rounded to 80) in the AM peak hour rather than 85 as

show in the SSND #2 TIS report. Although this difference is very minor, it was adjusted for the revised Year 2028 Total traffic volumes.

The SSND #2 TIS report assigns the PM peak hour off-site development trips incorrectly for the westbound left-turn and through movements at the Watertown Plank Road intersection with Elm Grove Road. The SSND #2 TIS report shows 25 trips for each movement instead of 10 trips.

The revised Year 2028 Total traffic volumes include the trip generation calculations and corrected traffic assignment of the off-site trips. The revised Year 2028 Total traffic volumes also correct the addition errors found when adding the Year 2028 Build traffic volumes plus the off-site traffic assignment volumes from the SSND #2 TIS report. The revised Year 2028 Total traffic volumes were input into the corresponding Synchro analysis models.

YEAR 2028 TRAFFIC ANALYSIS REVIEW

TADI reviewed the Synchro analysis models developed for each traffic volume scenario. The peak hour factors, heavy vehicle percentages, right-turn-on-red factors, lane geometrics, traffic control type, and signal timing parameters were reviewed against the data collected for this study. Changes were made as necessary to correct field conditions and timing plans provided for each intersection. In addition to updating each model with the revised traffic volumes, the following changes were made:

- The Legion Drive southbound protected left-turn phase was removed. Per the traffic signal timing plans, no separate phase time is provided for the southbound left-turn only movement and field observations verified that the phase did not activate in the peak hour.
- The Legion Drive signal offset for the PM peak hour was corrected to match the traffic signal timing plans.
- The Legion Drive eastbound protected left-turn phase was changed to a protected-permitted left-turn phase. Field verification indicates that this is a lagging left-turn phase.
- The 124th Street split times were changed to reflect the Max Green time plus clearance time as shown on the timing plans.
- The approach directions at the Watertown Plank Road/Juneau Drive intersection were renamed to cardinal directions (e.g. from “southwest” to “west”) so that HCM 6th Edition output could be reported.
- The speed limit for the gas station driveway across from Legion Street was raised from 10 mph to 25 mph so that HCM 6th Edition output could be reported.
- The phasing numbers at the Elm Grove Road signal and the 124th Street signal were renamed in the Synchro model so that HCM 6th Edition output could be reported.

The AM and PM peak hour level of service (LOS), delays, and 95th percentile queues were documented from the revised Year 2028 Background, Build, and Total traffic conditions.

These tables are located at the end of this report. As shown in the tables, all study intersections are expected to operate acceptably at LOS D or better with the existing geometrics and traffic control for all Year 2028 traffic volume scenarios. As the Watertown Plank Road intersection with Legion Drive is not expected to operate with unacceptable traffic operations as reported in the SSND #2 TIS report, no adjustments to the signal timing or phasing is required to accommodate future Year 2028 Build or Year 2028 Total traffic volumes.

PEDESTRIAN SAFETY REVIEW

The number of pedestrians crossing the Watertown Plank Road intersections with Crescent Drive and Blue Ridge Boulevard/Stephen Place were reviewed from the turning movement traffic count files provided to TADI. Although the crossing numbers in the count files do not match what is presented in the SSND #2 TIS report, it is agreed that pedestrians crossing Watertown Plank Road or the minor streets near the SSND driveway are relatively low during the peak traffic periods during the day (6:00-9:00 a.m. and 3:00-6:00 p.m.).

TADI obtained crash data for the years 2015 through 2019 and compared it to the “Watertown Plank Road Intersection Crash History” and “Watertown Plank Road Collision Patterns” tables in the SSND TIS report. TADI found that although the actual number of trips at Elm Grove Road (15 total) and Legion Drive (12 total) are lower than reported, the differences are not expected to impact recommendations for those intersection locations. If the number of crashes at these intersections continues to increase, then countermeasures such as retro-reflective backplates and overhead, trombone arm-signals would help mitigate rear-end and right-angle crashes.

TRAIN CROSSING REVIEW

The SSND #2 TIS report indicates that there are approximately 32 trains per day crossing Watertown Plank Road between Elm Grove Road and Legion Street, and that typical train crossings last between 3-5 minutes.

TADI observed train crossing activity for the 6:00-9:00 a.m. (AM) and 3:00-6:00 p.m. (PM) time periods on February 24 (afternoon only), February 25, February 26, and March 1, 2021 (Table 1). Two train crossings were recorded each AM time period, and 1-3 train crossings were recorded during each PM time period, for an average of 0-1 (0.67) train crossings per hour. The average train crossing was about three minutes long (the range was 13 seconds to nearly eight minutes).

For an average three-minute train, eastbound queues on Watertown Plank Road typically reach Elm Grove Road, but the queues don't build up until after the train has blocked traffic for two minutes or more. After the trains pass, the queues quickly dissipate after the railroad gates are up and the Watertown Plank Road signals turn green for eastbound/westbound traffic flow. Westbound queues for a three-minute train typically back up to or past Elm Grove Street.

Similar to what was presented in the SSND #2 TIS, the net new trips (new residential trips minus existing SSND trips) for the proposed residential development on the SSND site is

expected to result in 0.17- 0.83 new trips per minute. Using the same development traffic assignments used in the SSND #2 TIS, this results in 1-3 additional vehicles in the queue for a three-minute AM train (one eastbound and three westbound) and 1-3 additional vehicles in the queue for a three-minute PM train (three eastbound and one westbound). These additional vehicles are expected to increase queues by up to 75 feet (assuming a 25-foot spacing per vehicle), and therefore are not expected to significantly impact the typical train queue lengths on Watertown Plank Road.

Although much less frequent, longer 7-8 minute trains occasionally occur across Watertown Plank Road in the PM time period resulting in eastbound traffic queues that extend past Morningside Lane and westbound traffic queues that extend past the SSND West driveway. In both directions, it takes a few minutes after the train passes for the queues to fully clear as the traffic signals at Elm Grove Road and Legion Street cycle every 80 seconds. For a 7-8 minute PM train, the Mandel development would add up to six additional eastbound vehicles (about 150 feet) and two additional westbound vehicles (about 50 feet) to the train crossing traffic queues on Watertown Plank Road.

Table 1. Train Crossing Activity

Date	Start	End	Duration
2/24/2021	3:27:48	3:30:23	0:02:35
2/24/2021	5:24:50	5:29:02	0:04:12
2/25/2021	6:20:30	6:24:41	0:04:11
2/25/2021	7:53:20	7:56:22	0:03:02
2/25/2021	4:08:34	4:08:48	0:00:14
2/25/2021	5:34:30	5:41:53	0:07:23
2/26/2021	7:38:09	7:40:58	0:02:49
2/26/2021	8:39:26	8:40:45	0:01:19
2/26/2021	4:08:57	4:16:50	0:07:53
3/1/2021	7:02:58	7:04:22	0:01:24
3/1/2021	7:27:52	7:30:25	0:02:33
3/1/2021	3:20:40	3:23:13	0:02:33
3/1/2021	4:08:21	4:08:34	0:00:13
3/1/2021	5:39:43	5:41:02	0:01:19

SUMMARY/CONCLUSIONS

TADI fully reviewed the traffic count data, trip generation, volume exhibits, and analysis models provided for the SSND #2 TIS report. Using procedures and practices consistent with the Institute of Transportation Engineers and the Wisconsin Department of Transportation Traffic Impact Analysis Guidelines, TADI found that actual turning movement volumes at each study intersection should be anywhere from +5 vph to -35 vph than what was reported in the SSND #2 TIS. Furthermore, signal timing and phasing errors found in the analysis models showed that intersection capacity at some intersections is

actually greater than what was reported in the SSND #2 TIS LOS tables. TADI made the necessary corrections to the traffic volumes and signal timings and provided revised LOS tables. The revised tables show that with full buildout of the proposed Mandel residential development and the potential off-site residential development, all study intersections are expected to operate acceptably at LOS D or better during the peak hours with no necessary changes to intersection geometrics or traffic control.

TADI observed queue formation from trains crossing Watertown Plank Road in February 2021. Observations were made for three-hour blocks in the AM and PM peak time periods that correspond to the peak traffic volume hours on Watertown Plank Road. During these times, an average of about one train crossed per hour with an average duration of about three-minutes. Queues for the average train typically extended between Elm Grove Road and Elm Grove Street. The Mandel development traffic is expected to add only about 1-3 vehicles (25-75 feet) to these queues, which is not expected to significantly impact the queues or intersection operations on Watertown Plank Road.

Occasionally, seven or eight-minute trains cross Watertown Plank Road, creating queues that extend well past Morningside Lane and the SSND West driveway. Although impactful to traffic operations on Watertown Plank Road, these longer trains are expected to be infrequent occurrences during the peak traffic hours.

TADI also reviewed the crash history at the study intersections along Watertown Plank Road and found that five fewer crashes occurred than what was reported in the SSND TIS report. TADI confirmed that only one pedestrian-related crash occurred at Elm Grove Road during this time period and agrees that the Mandel residential development traffic is not expected to impact safety for the St. Mary's School pedestrians.

The SSND #2 TIS report recommends general improvements to Watertown Plank Road crosswalk markings and the installation of Rectangular Rapid Flashing Beacons (RRFB) at both Elm Grove Road and Church Street. While these measures have positive impacts to safety, it is recommended instead that a separate pedestrian crash risk assessment be completed to prioritize safety improvements using science-based methodology for evaluating crash risk.

Year 2028 Background Traffic Operations & Queues - Existing Geometrics & Traffic Control

Intersection	Peak Hour	Level of Service per Movement by Approach												Intersection Level of Service	
		Eastbound			Westbound			Northbound			Southbound				
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
Watertown Plank Road & Elm Grove Road (Traffic Signal Control)	AM	LOS	-	A	A	A	A	-	B	-	C	-	-	-	A
		Delay	-	8	7	1	1	-	20	-	23	-	-	-	
		Queue	-	100	20	45	40	-	35	-	105	-	-	-	
	PM	LOS	-	A	A	C	B	-	C	-	C	-	-	-	B
		Delay	-	9	7	27	18	-	21	-	23	-	-	-	
		Queue	-	115	20	170	165	-	90	-	120	-	-	-	
Watertown Plank Road & Legion Drive (Traffic Signal Control)	AM	LOS	B	A	-	B	A	-	C	-	C	C	C	B	
		Delay	14	8	-	13	9	-	22	-	22	24	24		
		Queue	25	135	-	145	5	-	5	-	10	65	65		
	PM	LOS	B	A	-	B	A	-	C	-	C	C	C	B	
		Delay	17	9	-	14	9	-	22	-	22	26	26		
		Queue	25	125	-	210	10	-	25	-	20	100	100		
Watertown Plank Road & SSND West Driveway (Stop Sign Control)	AM	LOS	-	*	-	A	-	-	-	B	-	-	-	A	
		Delay	-	*	-	8	-	-	-	10	-	-	-		
		Queue	-	*	-	0	-	-	-	0	-	-	-		
	PM	LOS	-	*	-	A	-	-	-	-	C	-	-	A	
		Delay	-	*	-	8	-	-	-	15	-	-	-		
		Queue	-	*	-	0	-	-	-	5	-	-	-		
Watertown Plank Road & Juneau Boulevard (Stop Sign Control)	AM	LOS	A	*	-	-	-	-	-	-	-	C	-	A	
		Delay	8	*	-	-	-	-	-	-	-	20	-		
		Queue	0	*	-	-	-	-	-	-	-	35	-		
	PM	LOS	A	*	-	-	-	-	-	-	-	D	-	A	
		Delay	8	*	-	-	-	-	-	-	-	26	-		
		Queue	0	*	-	-	-	-	-	-	-	30	-		
Watertown Plank Road & Crescent Drive (Stop Sign Control)	AM	LOS	A	*	-	-	-	-	-	-	-	C	-	A	
		Delay	8	*	-	-	-	-	-	-	-	16	-		
		Queue	5	*	-	-	-	-	-	-	-	20	-		
	PM	LOS	A	*	-	-	-	-	-	-	-	C	-	A	
		Delay	8	*	-	-	-	-	-	-	-	16	-		
		Queue	5	*	-	-	-	-	-	-	-	10	-		
Watertown Plank Road & Blue Ridge Blvd./Stephen Pl. (Stop Sign Control)	AM	LOS	-	A	-	A	-	-	-	C	-	B	-	A	
		Delay	-	7	-	8	-	-	-	18	-	14	-		
		Queue	-	0	-	0	-	-	-	10	-	5	-		
	PM	LOS	-	A	-	A	-	-	-	-	C	-	C	-	A
		Delay	-	8	-	8	-	-	-	23	-	15	-		
		Queue	-	0	-	0	-	-	-	15	-	5	-		
Watertown Plank Road & Longwood Avenue (Stop Sign Control)	AM	LOS	-	A	-	A	-	-	-	B	-	B	-	A	
		Delay	-	7	-	8	-	-	-	13	-	12	-		
		Queue	-	0	-	0	-	-	-	5	-	5	-		
	PM	LOS	-	A	-	A	-	-	-	-	B	-	C	-	A
		Delay	-	8	-	8	-	-	-	12	-	22	-		
		Queue	-	0	-	0	-	-	-	5	-	5	-		
Watertown Plank Road & 124th Street (Traffic Signal Control)	AM	LOS	-	B	-	B	-	-	-	C	-	B	B	B	
		Delay	-	13	-	11	-	-	-	24	-	17	15		
		Queue	-	145	-	75	-	-	-	50	-	135	65		
	PM	LOS	-	B	-	B	-	-	-	-	C	-	B	B	B
		Delay	-	14	-	12	-	-	-	26	-	16	15		
		Queue	-	145	-	135	-	-	-	35	-	145	90		

(-) movement that isn't available or allowed; (*) Free-flow movement.

Delay value shown in seconds, Queue value is 95th percentile, shown in feet.

Operations at Watertown Plank Rd./124th St. are reported from the HCM 2000 instead of HCM 6th Edition due to phasing/geometry conflicts.

Year 2028 Build Traffic Operations & Queues - Existing Geometrics & Traffic Control

Intersection	Peak Hour	Level of Service per Movement by Approach												Intersection Level of Service	
		Eastbound			Westbound			Northbound			Southbound				
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
Watertown Plank Road & Elm Grove Road (Traffic Signal Control)	AM	LOS	-	A	A	A	A	-	B	-	C	-	-	-	A
		Delay	-	8	7	2	1	-	20	-	23	-	-	-	
		Queue	-	100	20	45	45	-	35	-	105	-	-	-	
	PM	LOS	-	A	A	C	B	-	C	-	C	-	-	-	B
		Delay	-	9	7	29	18	-	21	-	24	-	-	-	
		Queue	-	125	20	185	155	-	90	-	130	-	-	-	
Watertown Plank Road & Legion Drive (Traffic Signal Control)	AM	LOS	B	A	-	B	A	-	C	-	C	C	C	B	
		Delay	15	8	-	13	9	-	22	-	22	24	24		
		Queue	30	140	-	170	5	-	5	-	10	65	65		
	PM	LOS	B	A	-	B	A	-	C	-	C	C	C	B	
		Delay	17	9	-	14	9	-	22	-	22	26	26		
		Queue	25	135	-	220	10	-	25	-	20	100	100		
Watertown Plank Road & SSND West Driveway (Stop Sign Control)	AM	LOS	-	*	-	A	-	-	-	B	-	-	-	A	
		Delay	-	*	-	8	-	-	-	14	-	-	-		
		Queue	-	*	-	0	-	-	-	15	-	-	-		
	PM	LOS	-	*	-	A	-	-	-	-	C	-	-	A	
		Delay	-	*	-	8	-	-	-	20	-	-	-		
		Queue	-	*	-	5	-	-	-	5	-	-	-		
Watertown Plank Road & Juneau Boulevard (Stop Sign Control)	AM	LOS	A	*	-	-	-	-	-	-	-	C	-	A	
		Delay	8	*	-	-	-	-	-	-	-	20	-		
		Queue	0	*	-	-	-	-	-	-	-	35	-		
	PM	LOS	A	*	-	-	-	-	-	-	-	D	-	A	
		Delay	8	*	-	-	-	-	-	-	-	28	-		
		Queue	0	*	-	-	-	-	-	-	-	35	-		
Watertown Plank Road & Crescent Drive (Stop Sign Control)	AM	LOS	A	*	-	-	-	-	-	-	-	C	-	A	
		Delay	8	*	-	-	-	-	-	-	-	17	-		
		Queue	5	*	-	-	-	-	-	-	-	20	-		
	PM	LOS	A	*	-	-	-	-	-	-	-	C	-	A	
		Delay	9	*	-	-	-	-	-	-	-	16	-		
		Queue	5	*	-	-	-	-	-	-	-	10	-		
Watertown Plank Road & Blue Ridge Blvd./Stephen Pl. (Stop Sign Control)	AM	LOS	-	A	-	A	-	-	-	C	-	C	-	A	
		Delay	-	7	-	8	-	-	-	19	-	15	-		
		Queue	-	0	-	0	-	-	-	15	-	5	-		
	PM	LOS	-	A	-	A	-	-	-	-	C	-	C	-	A
		Delay	-	8	-	8	-	-	-	24	-	15	-		
		Queue	-	0	-	0	-	-	-	10	-	5	-		
Watertown Plank Road & Longwood Avenue (Stop Sign Control)	AM	LOS	-	A	-	A	-	-	-	B	-	B	-	A	
		Delay	-	7	-	8	-	-	-	13	-	12	-		
		Queue	-	0	-	0	-	-	-	5	-	5	-		
	PM	LOS	-	A	-	A	-	-	-	-	B	-	C	-	A
		Delay	-	8	-	8	-	-	-	12	-	23	-		
		Queue	-	0	-	5	-	-	-	5	-	5	-		
Watertown Plank Road & 124th Street (Traffic Signal Control)	AM	LOS	-	B	-	B	-	-	-	C	-	B	B	B	
		Delay	-	14	-	11	-	-	-	24	-	18	16		
		Queue	-	155	-	75	-	-	-	50	-	135	65		
	PM	LOS	-	B	-	B	-	-	-	-	C	-	B	B	B
		Delay	-	14	-	12	-	-	-	27	-	16	15		
		Queue	-	150	-	140	-	-	-	35	-	145	95		

(-) movement that isn't available or allowed; (*) Free-flow movement.

Delay value shown in seconds, Queue value is 95th percentile, shown in feet.

Operations at Watertown Plank Rd./124th St. are reported from the HCM 2000 instead of HCM 6th Edition due to phasing/geometry conflicts.

Year 2028 Total Traffic Operations & Queues - Existing Geometrics & Traffic Control

Intersection	Peak Hour	Level of Service per Movement by Approach												Intersection Level of Service	
		Eastbound			Westbound			Northbound			Southbound				
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
Watertown Plank Road & Elm Grove Road (Traffic Signal Control)	AM	LOS	-	A	A	A	A	-	B	-	C	-	-	-	A
		Delay	-	9	7	2	1	-	20	-	23	-	-	-	
		Queue	-	105	20	50	50	-	35	-	110	-	-	-	
	PM	LOS	-	A	A	C	B	-	C	-	C	-	-	-	B
		Delay	-	9	7	30	18	-	21	-	24	-	-	-	
		Queue	-	135	20	200	160	-	90	-	135	-	-	-	
Watertown Plank Road & Legion Drive (Traffic Signal Control)	AM	LOS	B	A	-	B	A	-	C	-	C	C	C	B	
		Delay	15	8	-	14	9	-	22	-	22	24	24		
		Queue	30	150	-	180	5	-	5	-	10	65	65		
	PM	LOS	B	A	-	B	A	-	C	-	C	C	C	B	
		Delay	18	9	-	14	9	-	22	-	22	26	26		
		Queue	25	135	-	235	10	-	25	-	20	100	100		
Watertown Plank Road & SSND West Driveway (Stop Sign Control)	AM	LOS	-	*	-	A	-	-	-	C	-	-	-	A	
		Delay	-	*	-	8	-	-	-	15	-	-	-		
		Queue	-	*	-	0	-	-	-	15	-	-	-		
	PM	LOS	-	*	-	A	-	-	-	-	C	-	-	A	
		Delay	-	*	-	8	-	-	-	21	-	-	-		
		Queue	-	*	-	5	-	-	-	15	-	-	-		
Watertown Plank Road & Juneau Boulevard (Stop Sign Control)	AM	LOS	A	*	-	-	*	-	-	-	-	C	-	A	
		Delay	8	*	-	-	*	-	-	-	-	22	-		
		Queue	0	*	-	-	*	-	-	-	-	40	-		
	PM	LOS	A	*	-	-	*	-	-	-	-	D	-	A	
		Delay	8	*	-	-	*	-	-	-	-	30	-		
		Queue	0	*	-	-	*	-	-	-	-	35	-		
Watertown Plank Road & Crescent Drive (Stop Sign Control)	AM	LOS	A	*	-	-	*	-	-	-	-	C	-	A	
		Delay	8	*	-	-	*	-	-	-	-	18	-		
		Queue	5	*	-	-	*	-	-	-	-	20	-		
	PM	LOS	A	*	-	-	*	-	-	-	-	C	-	A	
		Delay	9	*	-	-	*	-	-	-	-	17	-		
		Queue	5	*	-	-	*	-	-	-	-	10	-		
Watertown Plank Road & Blue Ridge Blvd./Stephen Pl. (Stop Sign Control)	AM	LOS	-	A	-	A	-	-	-	C	-	C	-	A	
		Delay	-	8	-	8	-	-	-	20	-	15	-		
		Queue	-	0	-	0	-	-	-	15	-	5	-		
	PM	LOS	-	A	-	A	-	-	-	-	D	-	C	-	A
		Delay	-	8	-	8	-	-	-	25	-	16	-		
		Queue	-	0	-	0	-	-	-	10	-	5	-		
Watertown Plank Road & Longwood Avenue (Stop Sign Control)	AM	LOS	-	A	-	A	-	-	-	B	-	B	-	A	
		Delay	-	7	-	8	-	-	-	14	-	12	-		
		Queue	-	0	-	0	-	-	-	5	-	5	-		
	PM	LOS	-	A	-	A	-	-	-	-	B	-	C	-	A
		Delay	-	8	-	8	-	-	-	12	-	24	-		
		Queue	-	0	-	5	-	-	-	5	-	10	-		
Watertown Plank Road & 124th Street (Traffic Signal Control)	AM	LOS	-	B	-	B	-	-	-	C	-	B	B	B	
		Delay	-	14	-	11	-	-	-	25	-	18	16		
		Queue	-	165	-	75	-	-	-	50	-	135	65		
	PM	LOS	-	B	-	B	-	-	-	-	C	-	B	B	B
		Delay	-	14	-	12	-	-	-	27	-	16	15		
		Queue	-	160	-	145	-	-	-	35	-	145	95		

(-) movement that isn't available or allowed; (*) Free-flow movement.

Delay value shown in seconds, Queue value is 95th percentile, shown in feet.

Operations at Watertown Plank Rd./124th St. are reported from the HCM 2000 instead of HCM 6th Edition due to phasing/geometry conflicts.