



MEMORANDUM

Date: 6/9/2023
To: Growth Holdings, LLC
From: Kevin Mackey PE, PTOE
Aaron Cook, PE
Subject: Madison & Dane Proposed Commercial Development: Traffic Impact Analysis
Project No.: 0M3128869

This traffic impact study was prepared to document analyses that were performed to understand potential traffic impacts associated with the Madison & Dane proposed commercial development.

Development Details

The site is located on the southwest quadrant of the intersection of Madison Avenue and Dane Street in Mankato, Minnesota. This analysis focuses on traffic impacts on the surrounding roadway network.

This analysis assumes the proposed commercial development will be a 1,660 SF coffee shop with a drive-through window.

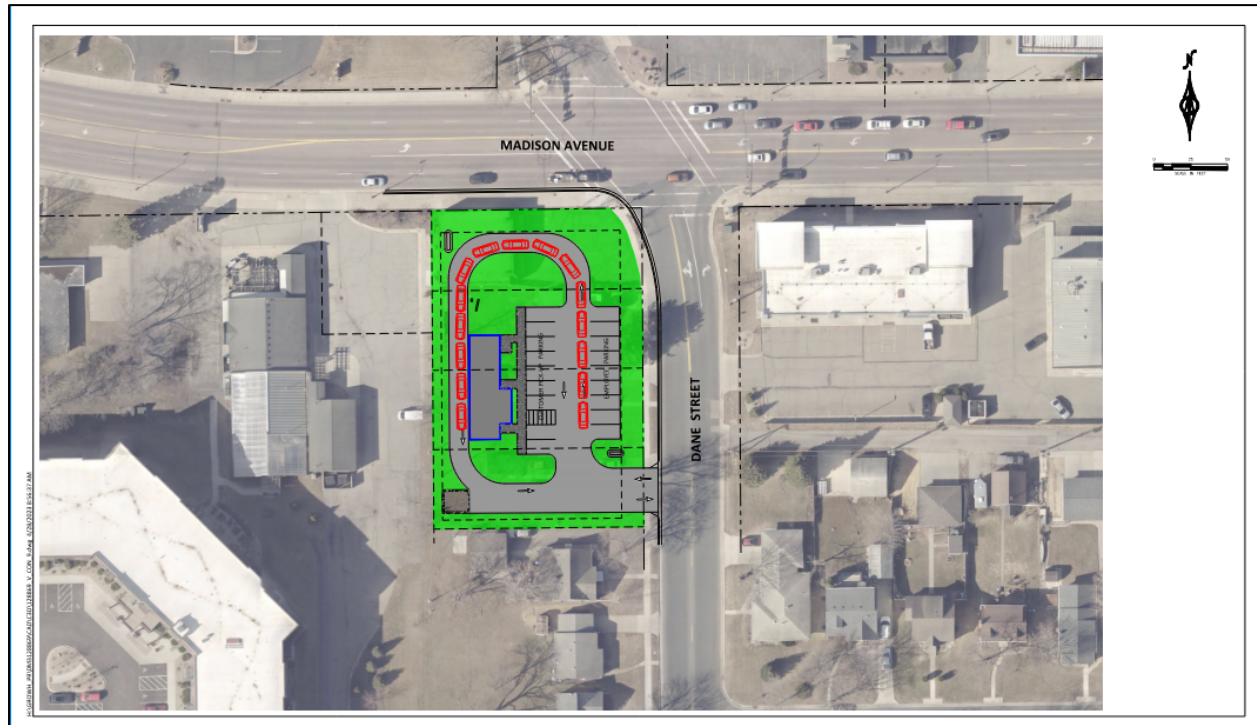
Access to the development is assumed to be a full access driveway along Dane Street. For the purposes of traffic impact study, it is assumed the development will be constructed in 2025. The development concept plan is shown in **Figure 1**.

Study Intersections

Traffic impacts from development-related traffic were evaluated at the following intersections:

- Madison Avenue and Dane Street / Swiss Street (Signalized)
- Dane Street and Belle Avenue (unsignalized)
- Dane Street and Marsh Street (unsignalized)
- Dane Street and Proposed Site Access (unsignalized)

Figure 1: Concept Plan



Existing Traffic Volumes

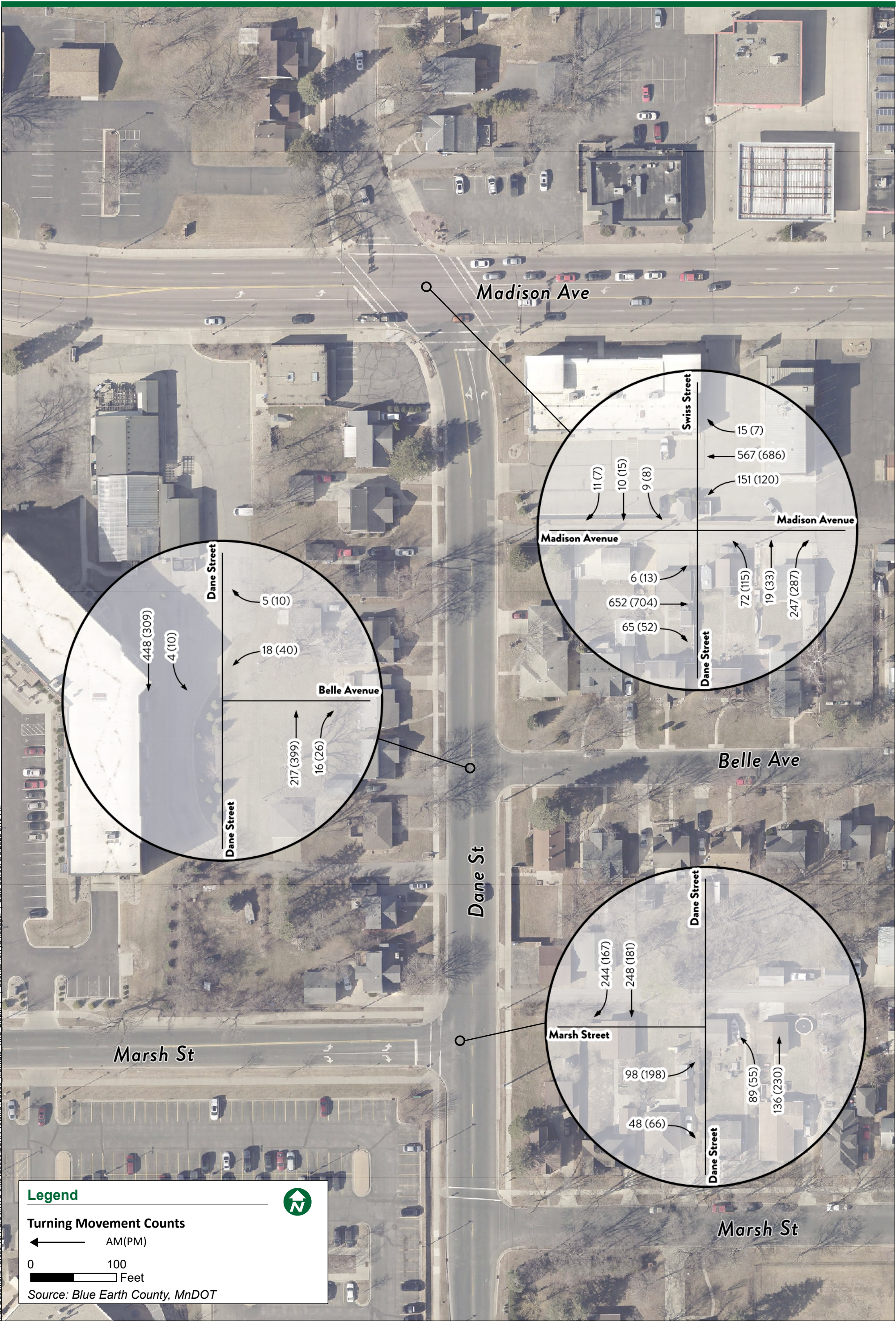
Table 1 provides a summary of the existing roadway characteristics.

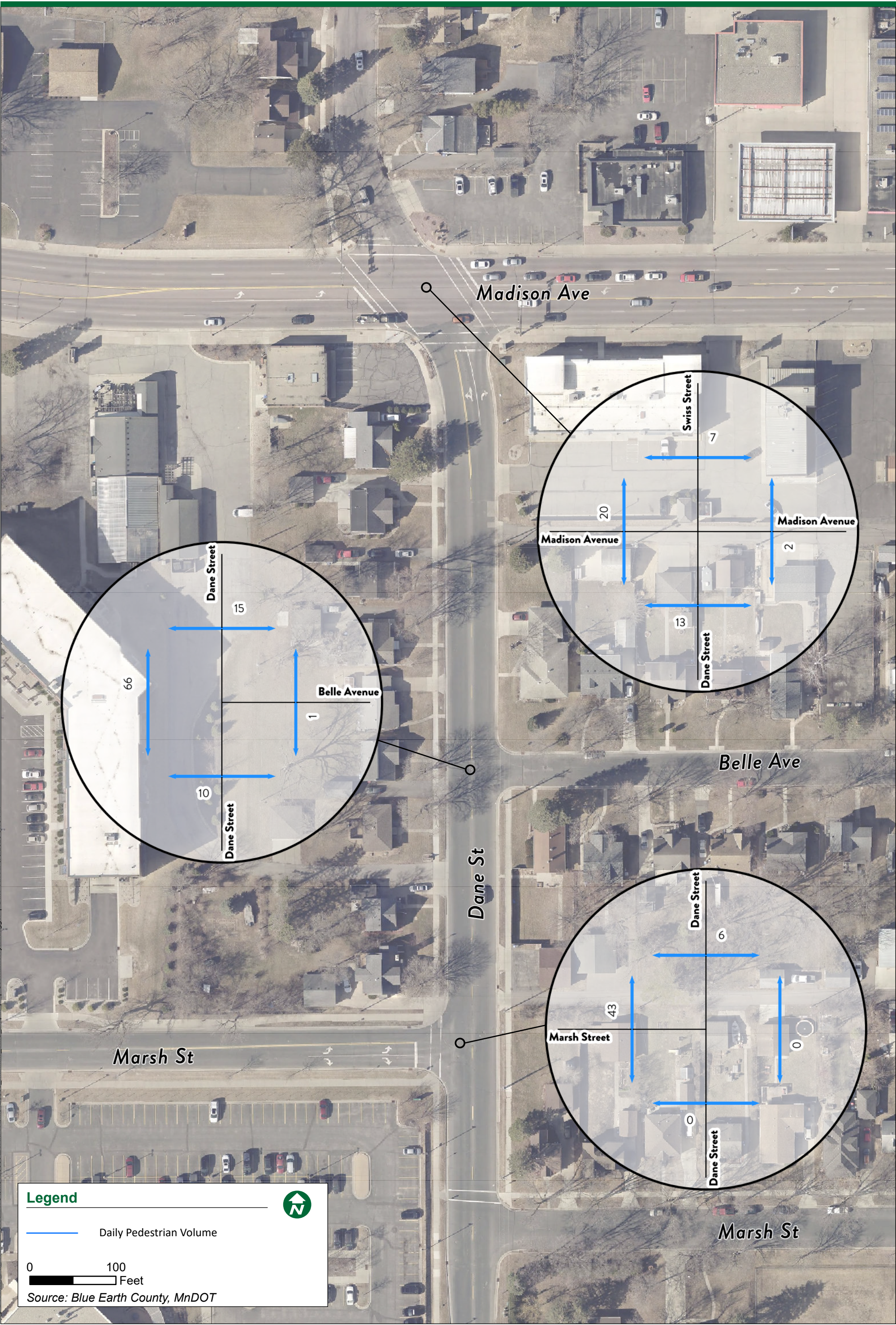
Table 1: Existing Roadway Inventory

Road Name	Typical Cross Section	Speed Limit
Madison Avenue	4-lane divided	35 mph
Dane Street / Swiss Street	2-lane undivided	Not Posted*
Belle Avenue	2-lane undivided	Not Posted*
Marsh Street	2-lane undivided	Not Posted*

* Assumed to be 30 mph based on Minnesota Statutory Speed Limit

13 hours of intersection turning movement data was collected at the existing study area intersections on May 16th, 2023. Detailed information from this traffic count is provided in the **Appendix**. The peak hour for each intersection was analyzed as a conservative approach. The peak hours for the Madison Avenue and Dane street intersection were 11:00-12:00 (AM peak) and 3:45-4:45 (PM peak). For the remaining intersections the peak hours were 7:15 – 8:15 (AM peak) and 2:00-3:00 (PM peak) The existing weekday AM and PM peak hour traffic volumes are shown in **Figure 2**. Pedestrian traffic volumes were also collected at the study intersections. The daily pedestrian volumes are shown on **Figure 3**.





2025 No-Build Traffic Volumes

Using information from the 2045 Mankato Area Planning Organization (MAPO) Long Range Transportation Plan (LRTP), this traffic impact study assumes an annual traffic growth rate of 1%. This was determined based on the expected growth in the area between 2025 and 2035. While the growth rates ranged depending on the point along the study area roadway network, 1% provides a conservative approach to the future year analysis. The 1% growth rate was applied to the 2023 existing traffic volumes to project the 2025 No-Build traffic volumes.

Proposed Development Traffic Volumes

The amount of traffic generated by the residential development was estimated using data from the Institute of Transportation Engineers' (ITE) *Trip Generation Manual* (11th Edition). The *Trip Generation Manual* is an industry standard for estimating traffic volumes associated with new developments. The trip generation for this proposed development is summarized in **Table 2**.

Table 2: Trip Generation Estimates for Proposed Development

ITE Code (Land Use)	Variable	Square Feet	Weekday				
			Daily Trips	AM Enter	AM Exit	PM Enter	PM Exit
Coffee / Donut Shop with Drive-Through Window (937)	1,000 sq. ft	1,660	886	73	70	32	33
Total Trips			886	73	70	32	33
<i>Pass-By Trips:</i> (50% AM, 55% PM)*			--	-36	-36	-17	-17
Total Primary Trips			--	37	34	15	16

*Pass-by rates from Land Use 934 (Fast-Food Restaurant with Drive-Through Window) were used, as Land Use 937 does not have published pass-by rates.

Trip distribution percentages used in assigning site traffic for this development were estimated based on a combination of existing traffic patterns, population centers adjacent to the study area, and engineering judgment.

It is estimated that the site trips will be regionally distributed as follows:

- 40% to/from the west via Madison Avenue
- 35% to/from the east via Madison Avenue
- 10% to/from the south via Dane Street
- 5% to/from the east via Belle Avenue
- 10% to/from the west via Marsh Street

The pass-by trips were deducted from the primary trips and assigned to the network separately. A pass-by trip is a trip that was already on the roadway network but would now stop at the proposed coffee shop prior to continuing to their destination.

Build Traffic Volumes (With Proposed Development)

The site trip distribution percentages listed above were applied to the trip generation in **Table 2** to determine the site trip assignment. The site trip assignment was then added to 2025 No-Build traffic volumes to determine the 2025 Build traffic volumes. The AM peak hour No-Build, site trip assignment, and Build volumes are shown in **Figure 4**. The PM peak hour No-Build, site trip assignment, and Build volumes are shown in **Figure 5**.

Capacity Analysis

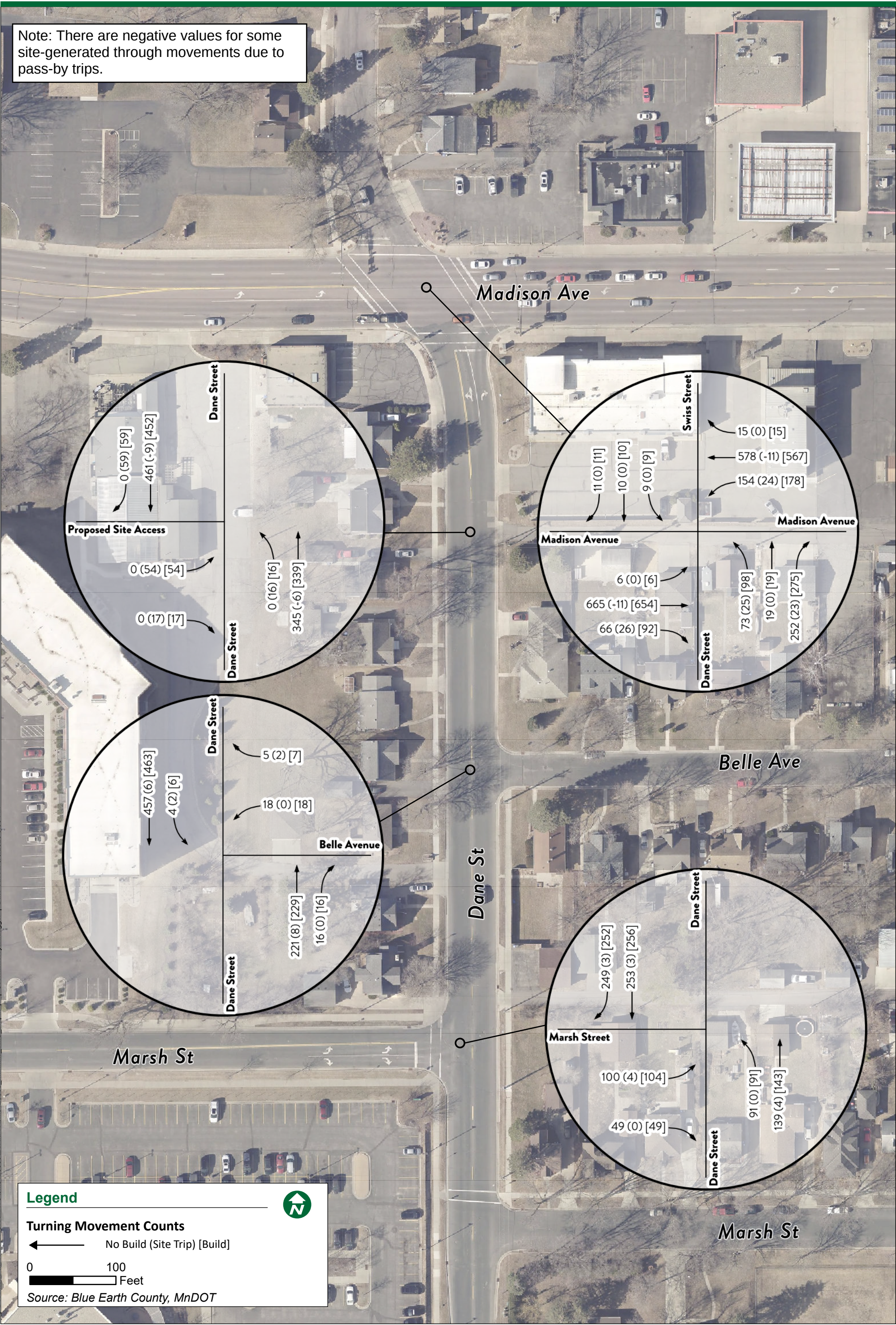
Weekday AM and PM peak hour intersection level of service was estimated using the Synchro/SimTraffic 11 analysis software. This analysis will consider operations at LOS “E” or worse deficient and in need of some type of mitigation to improve traffic flow.

Table 3 below summarizes the 2023 Existing operations. All intersection approaches currently operate at LOS C or better under existing traffic conditions.

Table 3: 2023 Existing Conditions Analysis Results

				AM Peak Hour		PM Peak Hour	
				Traffic Delay (sec/veh)		Traffic Delay (sec/veh)	
Intersection	Alternative	Control	Approach	Approach (Delay - LOS)	Intersection (Delay - LOS)	Approach (Delay - LOS)	Intersection (Delay - LOS)
Dane Street/Swiss Street & Madison Avenue	Existing	Signalized	EB	23 - C	16 - B	24 - C	18 - B
			WB	15 - B		17 - B	
			NB	11 - B		14 - B	
			SB	14 - B		14 - B	
Belle Avenue & Dane Street	Existing	Stop	EB	-	1 - A	-	2 - A
			WB	7 - A		10 - B	
			NB	1 - A		1 - A	
			SB	2 - A		2 - A	
Dane Street & Marsh Street	Existing	Stop	EB	10 - B	4 - A	12 - B	4 - A
			WB	-		-	
			NB	5 - A		3 - A	
			SB	2 - A		2 - A	

Note: There are negative values for some site-generated through movements due to pass-by trips.



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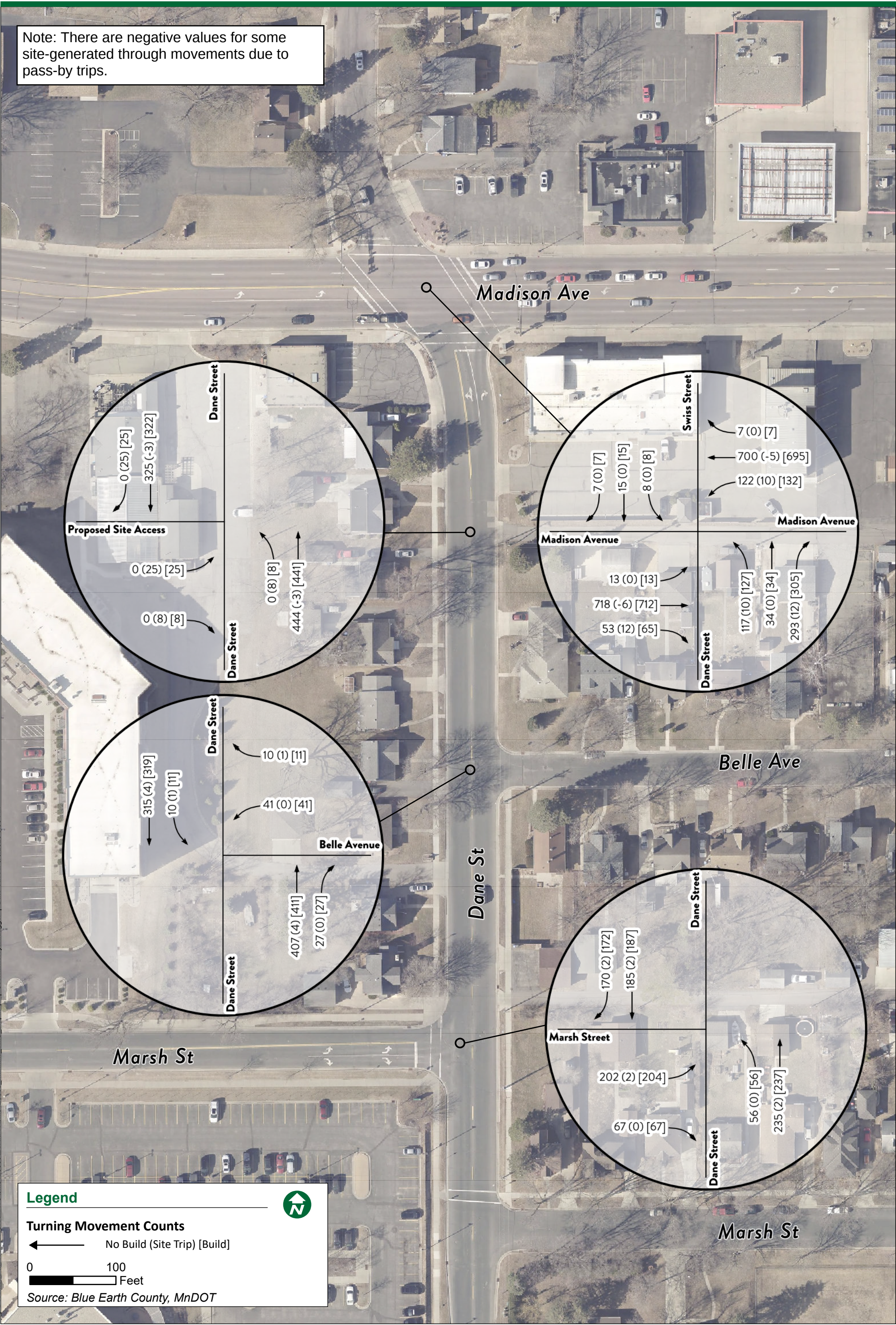


Table 4 below summarizes the 2025 No-Build and Build conditions operations. Minimal impacts to intersection operations are expected with the addition of site traffic. All intersection approaches will continue to operate at LOS C or better. The eastbound approach of the proposed driveway is expected to operate at LOS B during both peak hours.

The northbound queue at the intersection of Madison Avenue and Dane Street has potential to extend beyond the proposed driveway during the peak hours; however, with the intersection expected to operate at LOS B, the northbound queue will clear during each signal cycle. On average the northbound queue at the signalized intersection is 75 feet during the AM peak hour and 100 feet during the PM peak hour which are both shorter than the 175 feet of storage space between Madison Avenue and the proposed site driveway. Tables summarizing the queues at the study intersections are provided in the appendix.

Table 4: 2025 No-Build and Build Conditions Analysis Results

Intersection	Alternative	Control	Approach	AM Peak Hour		PM Peak Hour	
				Traffic Delay (sec/veh)		Traffic Delay (sec/veh)	
				Approach (Delay - LOS)	Intersection (Delay - LOS)	Approach (Delay - LOS)	Intersection (Delay - LOS)
Dane Street/Swiss Street & Madison Avenue	No Build	Signalized	EB	24 - C	17 - B	24 - C	18 - B
			WB	15 - B		17 - B	
			NB	12 - B		12 - B	
			SB	14 - B		13 - B	
	Build	Signalized	EB	24 - C	17 - B	24 - C	18 - B
			WB	15 - B		17 - B	
			NB	12 - B		13 - B	
			SB	13 - B		15 - B	
Belle Avenue & Dane Street	No Build	Stop	EB	-	1 - A	-	1 - A
			WB	7 - A		9 - A	
			NB	1 - A		1 - A	
			SB	2 - A		1 - A	
	Build	Stop	EB	-	1 - A	-	1 - A
			WB	8 - A		10 - B	
			NB	1 - A		1 - A	
			SB	2 - A		2 - A	
Dane Street & Marsh Street	No Build	Stop	EB	11 - B	4 - A	11 - B	4 - A
			WB	-		-	
			NB	5 - A		3 - A	
			SB	2 - A		2 - A	
	Build	Stop	EB	12 - B	4 - A	12 - B	5 - A
			WB	-		-	
			NB	5 - A		3 - A	
			SB	2 - A		2 - A	
Dane Street & Proposed Site Access	No Build	Stop	EB	-	1 - A	-	1 - A
			WB	-		-	
			NB	1 - A		1 - A	
			SB	1 - A		1 - A	
	Build	Stop	EB	12 - B	2 - A	12 - B	1 - A
			WB	-		-	
			NB	2 - A		2 - A	
			SB	1 - A		1 - A	

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Summary of Analyses and Recommendations

Based on traffic impact analysis described in this report, it is not expected that the proposed development will introduce operations deficiencies that require intersection geometry or traffic control improvements. The northbound queue at the intersection of Madison Avenue and Dane Street may extend beyond the proposed site access during the peak periods of congestion, but for the majority of the peak hours, vehicles will be able to turn left out of the site unimpeded.

Appendix

Intersection	Alternative	Control	Approach	AM Peak Hour									PM Peak Hour								
				Traffic Queuing (feet)									Traffic Queuing (feet)								
				Left Turn			Through			Right Turn			Left Turn			Through			Right Turn		
				Storage	Avg	Max	Link Length	Avg	Max	Storage	Avg	Max	Storage	Avg	Max	Link Length	Avg	Max	Storage	Avg	Max
Dane Street/Swiss Street & Madison Avenue	Existing	Signalized	EB	150	25	25	1703	150	225	-	125	225	150	25	50	1703	150	250	-	150	250
			WB	125	75	150	1183	100	200	-	75	175	125	75	150	1183	150	225	-	100	200
			NB	-	75	175	319	75	175	60	75	100	-	100	250	319	100	250	60	75	100
			SB	-	25	75	1115	25	75	-	25	75	-	25	50	1115	25	50	-	25	50
	No Build	Signalized	EB	150	25	50	1703	150	225	-	150	225	150	25	100	1703	150	250	-	150	250
			WB	125	75	150	1184	100	200	-	75	150	125	50	150	1184	125	225	-	100	225
			NB	-	75	150	161	75	150	60	75	100	-	100	175	161	100	175	60	75	100
			SB	-	25	75	1115	25	75	-	25	75	-	25	50	1115	25	50	-	25	50
	Build	Signalized	EB	150	25	50	1703	150	250	-	150	250	150	25	75	1703	150	250	-	150	250
			WB	125	75	150	1184	100	175	-	75	150	125	75	150	1184	125	225	-	100	175
			NB	-	75	175	161	75	175	60	75	100	-	100	175	161	100	175	60	75	100
			SB	-	25	75	1115	25	75	-	25	75	-	25	50	1115	25	50	-	25	50
Belle Avenue & Dane Street	Existing	Stop	EB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			WB	-	25	50	-	-	-	-	25	50	-	50	75	-	-	-	-	50	75
			NB	-	-	-	-	-	-	-	-	-	-	-	-	160	0	25	-	0	25
			SB	-	25	25	319	25	25	-	-	-	-	25	75	319	25	75	-	-	-
	No Build	Stop	EB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			WB	-	25	50	-	-	-	-	25	50	-	50	75	-	-	-	-	50	75
			NB	-	-	-	-	-	-	-	-	-	-	-	-	160	25	25	-	25	25
			SB	-	0	25	104	0	25	-	-	-	-	25	50	104	25	50	-	-	-
	Build	Stop	EB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			WB	-	25	50	-	-	-	-	25	50	-	50	75	-	-	-	-	50	75
			NB	-	-	-	160	0	25	-	0	25	-	-	-	160	25	25	-	25	25
			SB	-	25	50	104	25	50	-	-	-	-	25	50	104	25	50	-	-	-
Dane Street & Marsh Street	Existing	Stop	EB	-	50	100	-	-	-	90	25	75	-	75	175	-	-	-	90	50	75
			WB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			NB	-	50	125	1046	50	125	-	-	-	-	25	100	1046	25	100	-	-	-
			SB	-	-	-	160	25	50	-	25	50	-	-	-	160	25	25	-	25	25
	No Build	Stop	EB	-	50	100	-	-	-	90	25	75	-	75	150	-	-	-	90	50	100
			WB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			NB	-	50	150	1046	50	150	-	-	-	-	25	100	1046	25	100	-	-	-
			SB	-	-	-	160	25	50	-	25	50	-	-	-	160	25	25	-	25	25
	Build	Stop	EB	-	50	100	-	-	-	90	25	75	-	75	150	-	-	-	90	50	75
			WB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			NB	-	50	125	1046	50	125	-	-	-	-	25	100	1046	25	100	-	-	-
			SB	-	-	-	160	25	50	-	25	50	-	-	-	160	25	25	-	25	25
Dane Street & Proposed Site Access	No Build	Stop	EB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			WB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			NB	-	25	50	104	25	50	-	-	-	-	25	100	104	25	100	-	-	-
			SB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Build	Stop	EB	-	50	100	-	-	-	-	50	100	-	25	75	-	-	-	-	25	75
			WB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			NB	-	25	100	104	25	100	-	-	-	-	25	100	104	25	100	-	-	-
			SB	-	-	-	161	0	25	-	0	25	-	-	-	161	0	25	-	0	25