Traffic Impact Study

GEWALT HAMILTON ASSOCIATES, INC.
CONSULTING ENGINEERS
625 Forest Edge Drive, Vernon Hills, IL 60061
Tel 847.478.9700 ▪ Fax 847.478.9701
www.gha-engineers.com

To: **Tom Meador**
Michigan Avenue Real Estate Group

Copy To: **John Schiess**
jcsa

From: Bill Grieve, P.E., PTOE
Senior Transportation Engineer

Antonio Maravillas, E.I.T.
Transportation Engineer

Date: October 31, 2019

Subject: ***Proposed Residential Development***
435 Madison Street – Oak Park, Illinois

Part I. Project Context and Summary Statement

Gewalt Hamilton Associates, Inc. (GHA) has conducted a Traffic Impact Study (TIS) for the above captioned project. As proposed, a 5-story residential building with 48 apartments would be constructed on the southeast corner of the Madison Street intersection with Gunderson Avenue in Oak Park, Illinois.

The following summarizes our TIS findings and provides various recommendations for your consideration. *Exhibits* and *Appendices* referenced are centrally located at the end of this document. Briefly summarizing, we believe that the development traffic can be accommodated on the adjacent streets. Reasons include:

- The site is served well by all modes of transportation, including major streets and Pace bus routes which provide easy accessibility to the CTA Green Line, the CTA Blue Line, and the Metra Union Pacific West Line.
- The nearly completed Madison Street "road diet" provides improved operational safety for bicyclists and encourages non-automobile travel.
- Per US Census data, the condominiums will generate a significant portion of non-auto trips, about 30%. This trip discount *was* not taken to help ensure that the maximum site traffic impacts were tested.
- Apartment traffic will have a very limited impact on current operations along Madison Street and Ridgeland Avenue and at their intersection.
- The parking supply of 48 indoor spaces meets the Village code requirement of 1.0 spaces per dwelling.

Part II. Background Information

Site Location Map, Existing Traffic Operations, and Roadway Inventory

Exhibit 1 provides a site location map, ***Exhibit 2*** illustrates the existing traffic operations, and ***Appendix A*** provides a photo inventory of the site vicinity. Pertinent comments regarding land-uses in the site vicinity and transportation components, both vehicular and non-auto mobility include:

Area Land Uses

- Madison Street predominately consists of commercial uses within the site area.
- Gunderson Avenue and Elmwood Avenue consist of single-family residential housing.
- A Jewel-Osco is located on the north side of Madison Street, directly across from the site.
- The site currently houses an upholstery store and an auto services shop.

Roadway Inventory

Madison Street

- Madison Street is an east-west route and is under the jurisdiction of the Village of Oak Park.
- Madison Street is classified as a "Minor Arterial" on the Illinois Department of Transportation (IDOT) functional classification map, with a posted speed limit of 30-miles per hour (mph).
- Madison Street is currently undergoing a "road diet" and provides an urban cross section with one travel lane in each direction and a two-way left turn lane. A 25-mph speed limit has been proposed with this road diet.
- A protected bicycle lane is provided in both directions with a parking lane separating bicyclists from vehicular traffic.
- 2-hour parking is allowed in the parking lane on both sides of the street between 9 AM – 5 PM.
- Madison Street provides separate left and right turn lanes on both approaches at its signalized intersection with Ridgeland Avenue. Right turns on red are prohibited between 7 AM – 7 PM at each leg of the intersection.
- Madison Street also provides a separate right turn lane at its intersection with Elmwood Avenue.

Gunderson Avenue

- Gunderson Avenue is a north-south street that is under local jurisdiction.
- Gunderson Avenue has a posted speed limit of 25-mph.
- Gunderson Avenue provides an urban cross section with one travel lane in each direction.
- 2-hour parking is allowed on both sides of the street between 9 AM – 5 PM, excluding a short section on the east side adjacent to the site, which is signed as 15-minute parking between 9 AM – 5 PM.
- Gunderson Avenue is stop controlled at its intersection with Madison Street.

Elmwood Avenue

- Elmwood Avenue is a north-south street that is under local jurisdiction.
- Elmwood Avenue has a posted speed limit of 25-mph.
- Elmwood Avenue provides an urban cross section with one travel lane in each direction.
- 2-hour parking is allowed on both sides of the street between 9 AM – 5 PM.
- Elmwood Avenue is stop controlled at its intersection with Madison Street.

Ridgeland Avenue

- Ridgeland Avenue is a north-south route and is under the jurisdiction of IDOT but is not classified as a Strategic Regional Arterial (SRA) route.
- Ridgeland Avenue is classified as a "Minor Arterial" on the IDOT functional classification map, with a posted speed limit of 30-mph.
- Ridgeland Avenue provides an urban cross section with one travel lane in each direction.
- A shared bicycle lane is marked in each direction.
- Parking is allowed on both sides of the street.
- Ridgeland Avenue provides separate left and through-right turn lanes on both approaches at its signalized intersection with Madison Street. Right turns on red are prohibited between 7 AM – 7 PM at each leg of the intersection.

Pedestrian Mobility

- Pace operates bus route #320 along Madison Street with stops at the northeast and southwest corners of the intersection with Ridgeland Avenue.
- Pace operates bus route #314 along Ridgeland Avenue with stops at the northwest and southeast corners of the intersection with Madison Street.
- Pedestrian crosswalks are striped on each approach of the Madison Street and Ridgeland Avenue intersection with pedestrian countdown signals at each crosswalk.
- Pedestrian crosswalks are also striped on the northbound approaches of the Madison Street intersections with Gunderson Avenue and Elmwood Avenue.
- Sidewalks are provided on both sides of the street for all roadways in the site vicinity.
- The CTA Green Line runs parallel to Madison Street about 1/2 mile north of the site. The closest station (Ridgeland) is located at Ridgeland Avenue.
- The CTA Blue Line is located about 1 mile south of the site, along I-290.
- The Metra Union Pacific West Line runes alongside the CTA Green Line in Oak Park, with the Oak Park station located at 1115 W. North Boulevard, about 1 ½ miles to the north.

Existing Traffic

GHA conducted weekday morning (6 AM – 9 AM) and evening (4 PM – 7 PM) peak period traffic counts on Wednesday, October 23, 2019 at the Madison Street intersections with Gunderson Avenue, Elmwood Avenue, and Ridgeland Avenue.

No unusual activity (e.g. road construction, severe weather, or extensive emergency vehicle activity) occurred during the counts that would have impacted the traffic volumes or travel patterns. ***Exhibit 3*** illustrates the existing Weekday Morning and Evening Peak Hour traffic volumes which occurred from 7:15-8:15 AM and 5:00-6:00 PM, and the Annual Average Daily Traffic (AADT) volumes obtained from the IDOT Website gettingaroundillinois.com. The traffic count summary sheets are provided in ***Appendix B***.

Part III. Project Traffic Characteristics

Site Plan

Per the site plan prepared by Space Architects + Planners dated October 18, 2019, (see ***Exhibit 4***), the existing commercial building at the site is to be razed, and a new 5-story building is to be constructed with 48 apartments. The pedestrian entrance will be on Madison Street. Parking will be provided via a first-floor parking garage with 48 parking spaces along with dedicated space for 44 bikes. Vehicular access to the garage will be provided on Gunderson Avenue.

Discussion Point. Based on input at the resident meeting, the access drive will be designed and signed to discourage vehicular use of Gunderson Avenue south of the site.

Traffic Generations and Trip Distribution

Exhibit 5 – Part A summarizes the weekday morning and evening peak hour and daily auto trip generations for the apartments that were based on rate information published by the Institute of Transportation Engineers (ITE) *Trip Generation Manual* – 10th Edition **(**see ***Appendix C*****).**

Discussion Point. The trip generations do not reflect the various non-auto travel mode alternatives. US Census data for Oak Park indicates that about 30% of trips are non-auto oriented. Thus, the volumes shown on ***Exhibit 5 – Part A*** are probably overestimated.

Exhibit 5 – Part B lists the anticipated trip distribution and reflects the anticipated travel patterns. As anticipated, the majority of apartment trips will be oriented to/from the Madison street / Ridgeland Avenue intersection.

Part IV – Traffic and Parking Evaluation

Traffic Assignments

IDOT and other agencies generally require that the existing volumes be increased to reflect other growth in the area for a "Buildout + 5 year" analysis. Assuming a buildout year of 2021, the analysis would be for the Year 2026. The Chicago Metropolitan Agency for Planning (CMAP) was contacted and provided Year 2050 traffic projections (see ***Appendix D***). As can be seen, both Madison Street and Ridgeland Avenue are projected to experience very minimal growth. A 1% increase was applied to the existing volumes on both streets to provide for a conservative analysis.

Site traffic was assigned to the adjacent streets based on the project characteristics (see ***Exhibit 5***) and is illustrated in ***Exhibit 6***. Site traffic and the existing volumes (see ***Exhibit 3***) adjusted for growth and were added to produce the Year 2026 total traffic assignment, which is illustrated in ***Exhibit 7***.

Discussion Point. The available 30% multi-modal trip discount was **not** taken for site traffic. In addition, traffic generated by the existing businesses was not subtracted. Thus, the Year 2026 Total Traffic volumes (see ***Exhibit 7***) are probably overstated.

Intersection Capacity and Queue Analyses

Capacity analyses are a standard measurement in the transportation industry that identifies how an intersection operates. ***Exhibit 8 – Part A*** lists the analysis parameters, as published in the Transportation Research Board's (TRB) Highway Capacity Manual – 6th Edition, 2016 (HCM). They are measured in terms of level of service (LOS). LOS A is the best rating, with LOS F being the worst. LOS C is considered appropriate for "design" purposes and LOS D is usually considered as providing the lower threshold of "acceptable" operations. LOS E and F are usually considered unacceptable.

Exhibit 8 - Part B summarizes the intersection capacity and queue analysis results. The capacity analysis summary printouts are provided in ***Appendix E***. As can be seen from ***Exhibit 8***, site traffic will have a minimal impact on operations at all intersections tested, with all results at or better than the "design" LOS C or better. In fact, the additional morning and evening peak hour delays at the Madison Street / Ridgeland Avenue intersection will be less than one second.

Traffic Impact Discussion

Apartment traffic will represent the following volumes traveling through the Madison Street intersection with Ridgeland Avenue:

- During the weekday morning peak hour (see ***Exhibit 3***), there are currently about 2,450 vehicles or about 41 vehicles per minute. The apartments would add only 11 trips or about 1 trip every 5-6 minutes.
- During the weekday evening peak hour, there are currently about 2,550 vehicles or about 42 vehicles per minute. The apartments would add only 14 trips or about 1 trip every 4-5 minutes.

Key Finding. Based on the above, it can be concluded that no street or intersection improvements would be necessary to specifically accommodate site traffic. Thus, our recommendations focus on the on-site planning elements (e.g. access operations and parking) and on enhancing pedestrian mobility.

On-Site Planning Elements

Site Access

- One drive will be provided to access the parking garage on Gunderson Avenue. It will be located about 140 feet south of Madison Street and will have one inbound and one outbound lane.
- Exiting site traffic should have Stop control at Gunderson Avenue.
- The drive should be designed so as to physically and visually keep apartment traffic from entering or exiting the garage on Gunderson Avenue south of the site, including signage and curb bump-outs.
- Due to the close proximity of the garage door to the sidewalk, a pedestrian warning (audible and/or visual) indicator should be considered, similar to many other urban buildings.
- Any disrupted sidewalk along the site should be replaced.

Parking

- It is our understanding that Village Code requires 1.0 parking spaces per unit for a total of 48 spaces. Per the Space site plan, 48 spaces are to be provided, 2 of which will be ADA compliant.
- Indoor parking for 44 bicycles will also be provided to encourage non-auto travel.

Part V. Technical Addendum

The following *Exhibits* and *Appendices* were previously referenced. They provide technical support for our observations, findings, and recommendations discussed in the text.

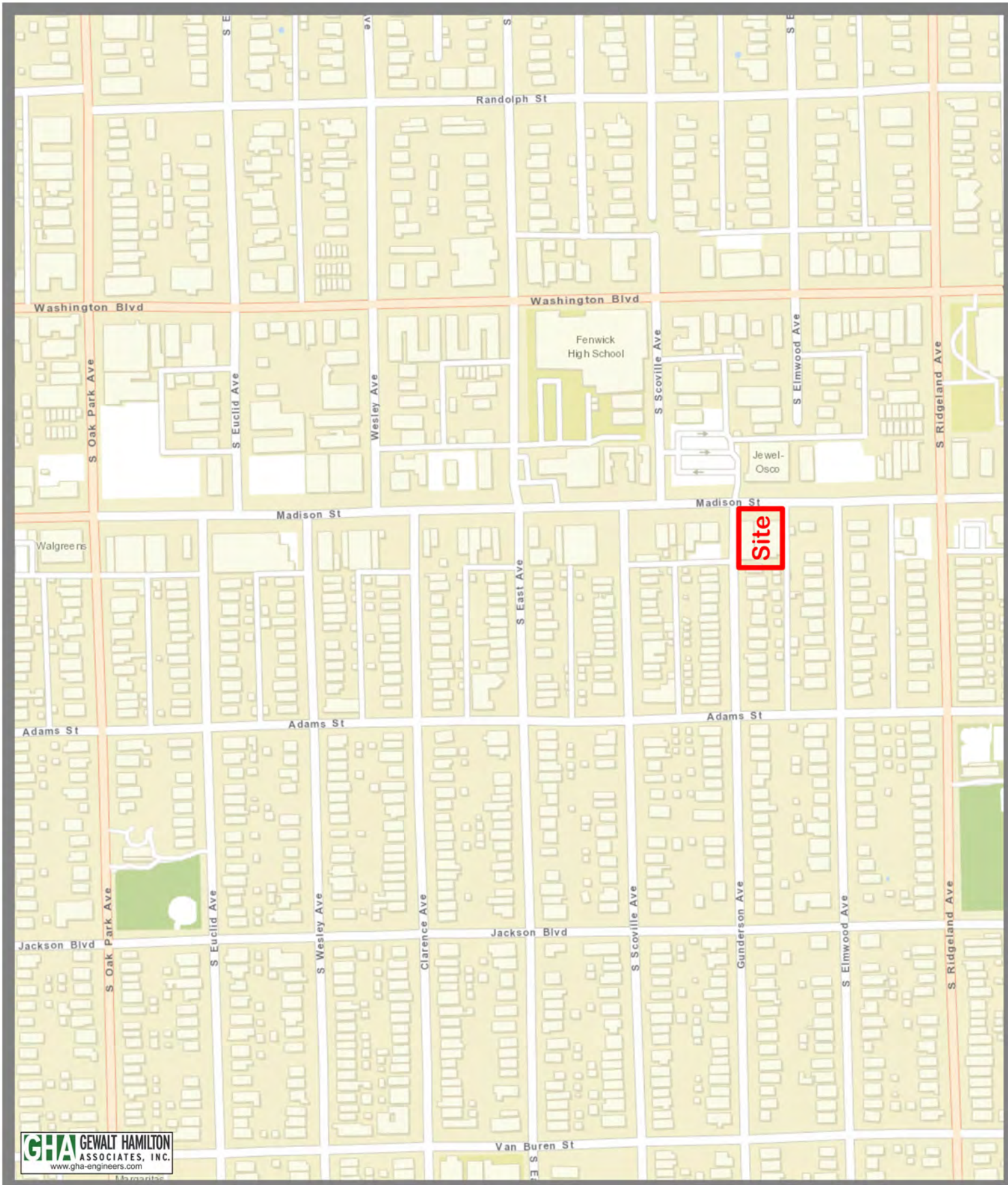
Exhibits

1. Site Location Map
2. Existing Traffic Operations
3. Existing Traffic and Pedestrians
4. Site Plan
5. Project Traffic Characteristics
6. Site Traffic
7. Total Traffic – Year 2026
8. Intersection Capacity Analyses

Appendices

A. Photo Inventory
B. Traffic Count Summary Sheets
C. ITE Trip Generation Excerpts
D. CMAP Correspondence
E. Capacity Analysis Worksheets

EXHIBITS



N

1 inch = 530 Feet

Exhibit 1 - Location Map

Proposed Residential Development
435 Madison Street, Oak Park, IL

Map Center: 87.78945°W 41.87862°N

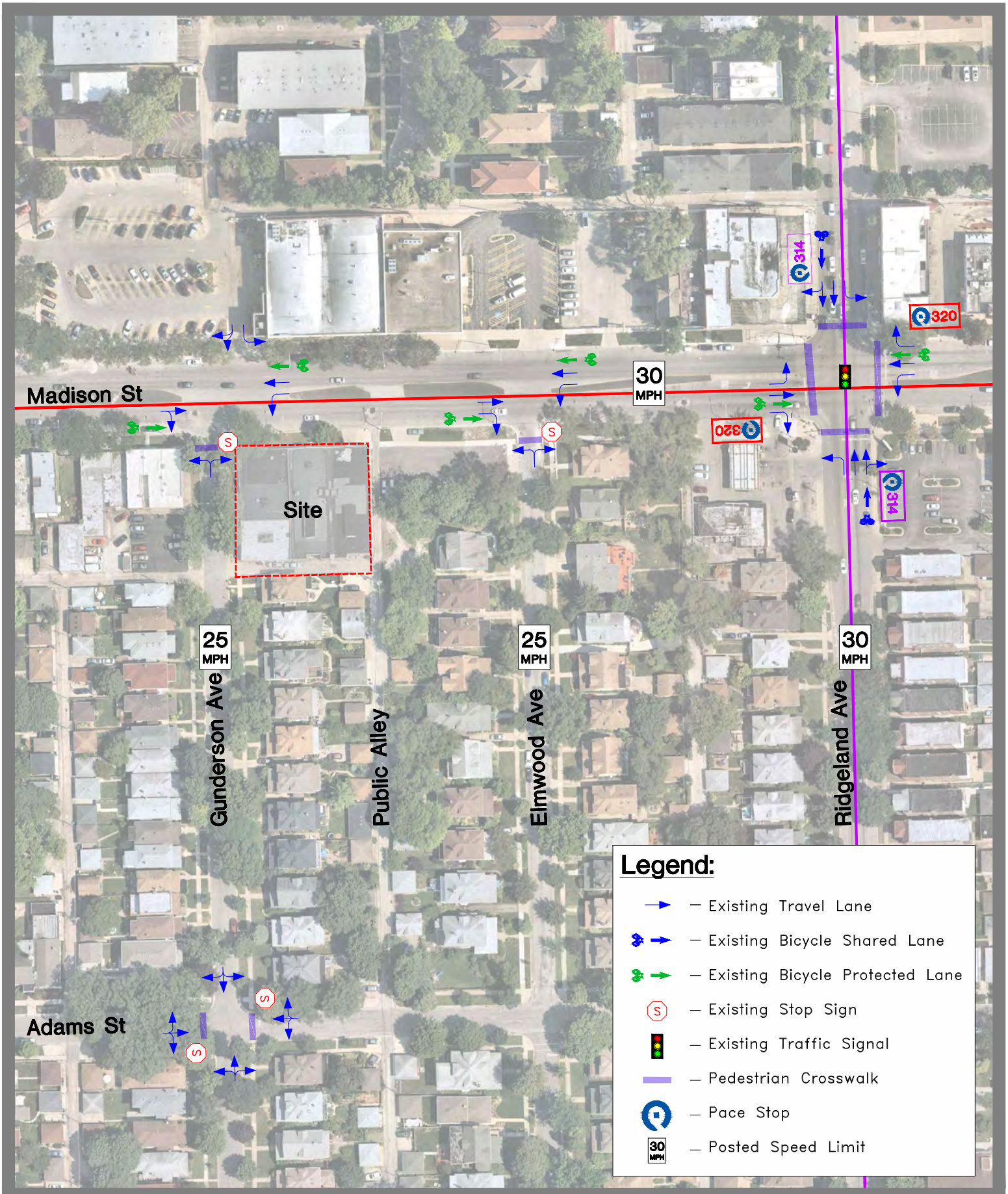


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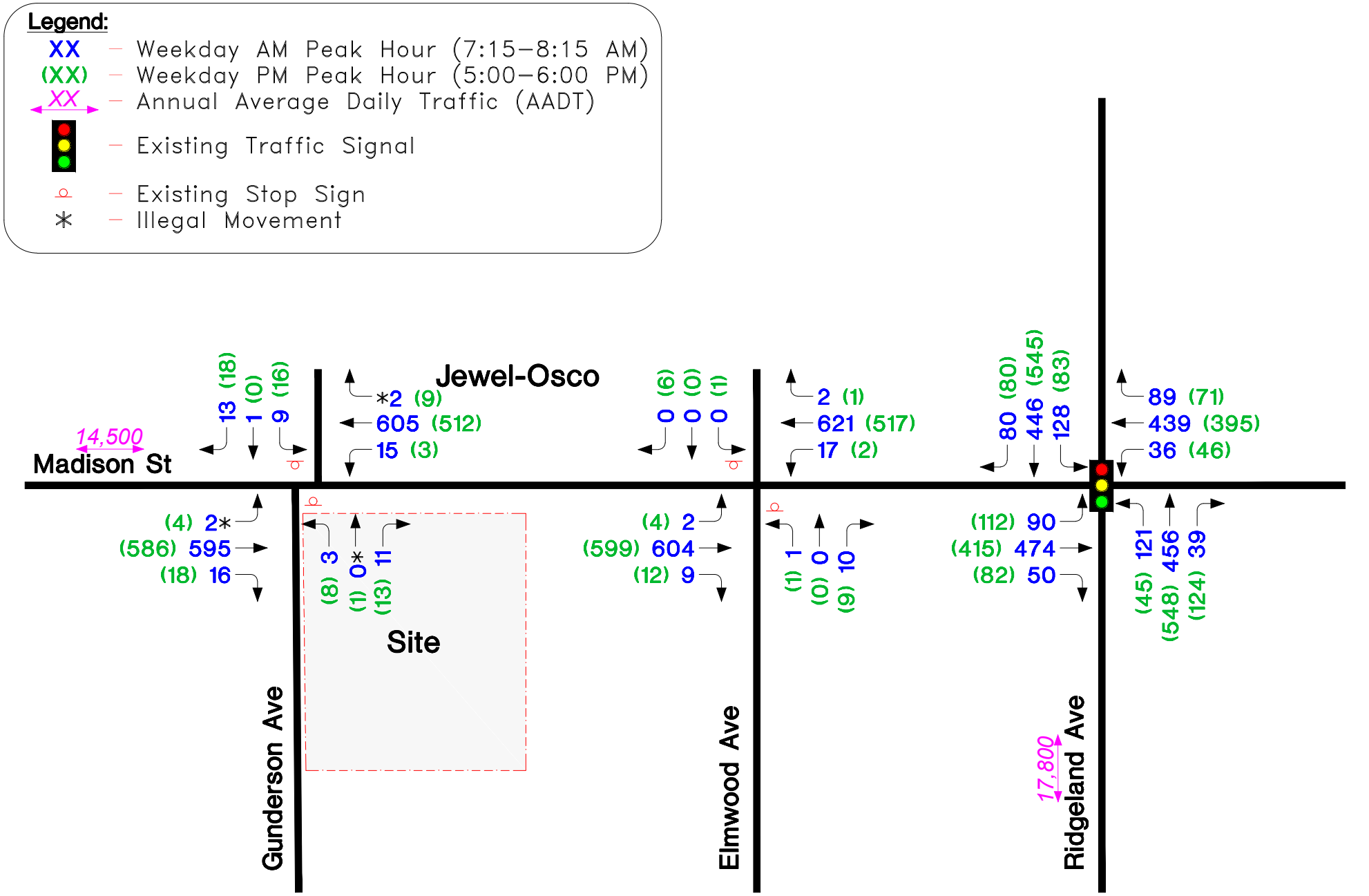
Exhibit 2
Existing Traffic Operations



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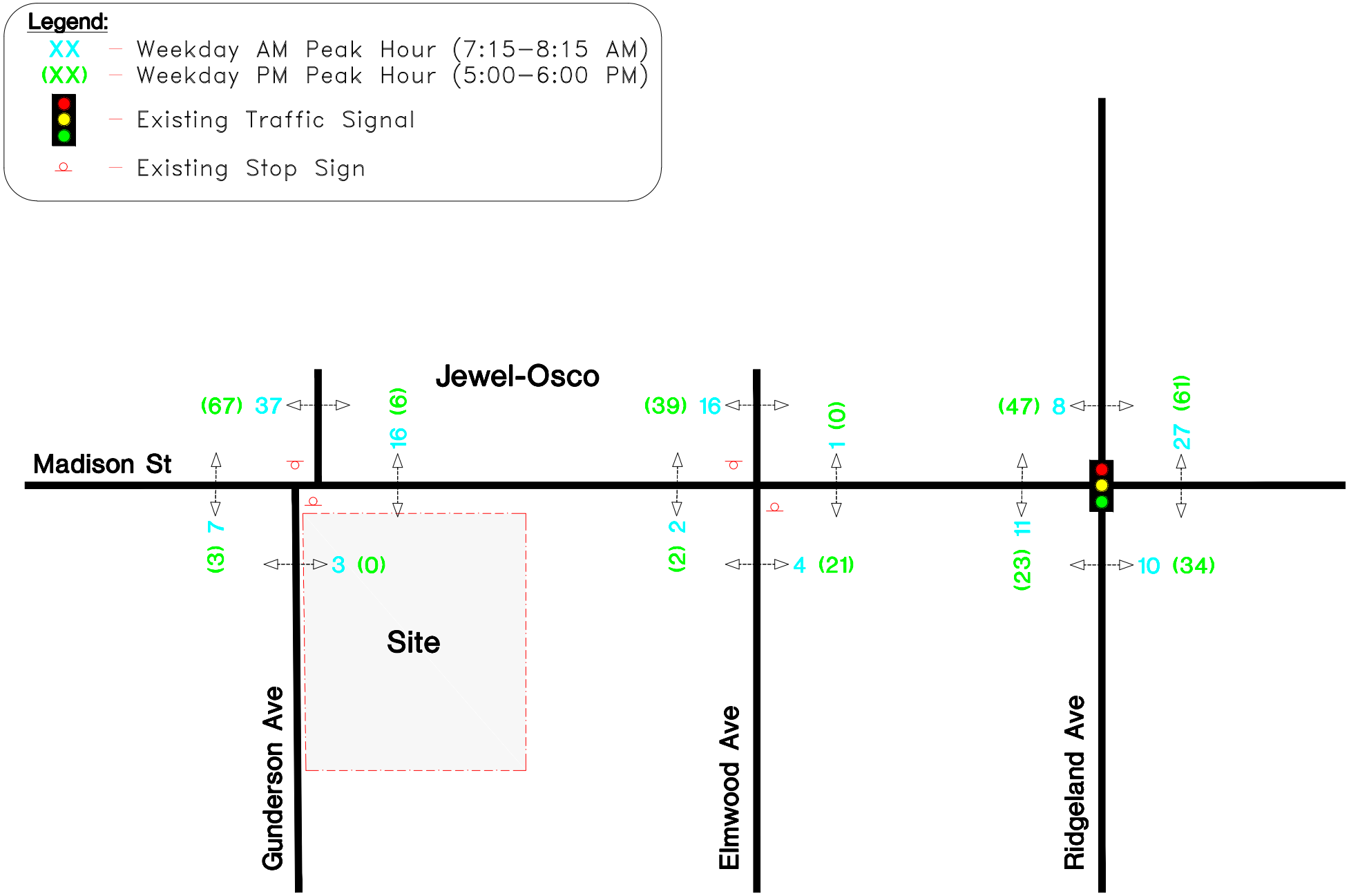
Not to Scale

Exhibit 3A
Existing Traffic

Sources: 1) GHA October, 2019 2) IDOT 2018 AADT



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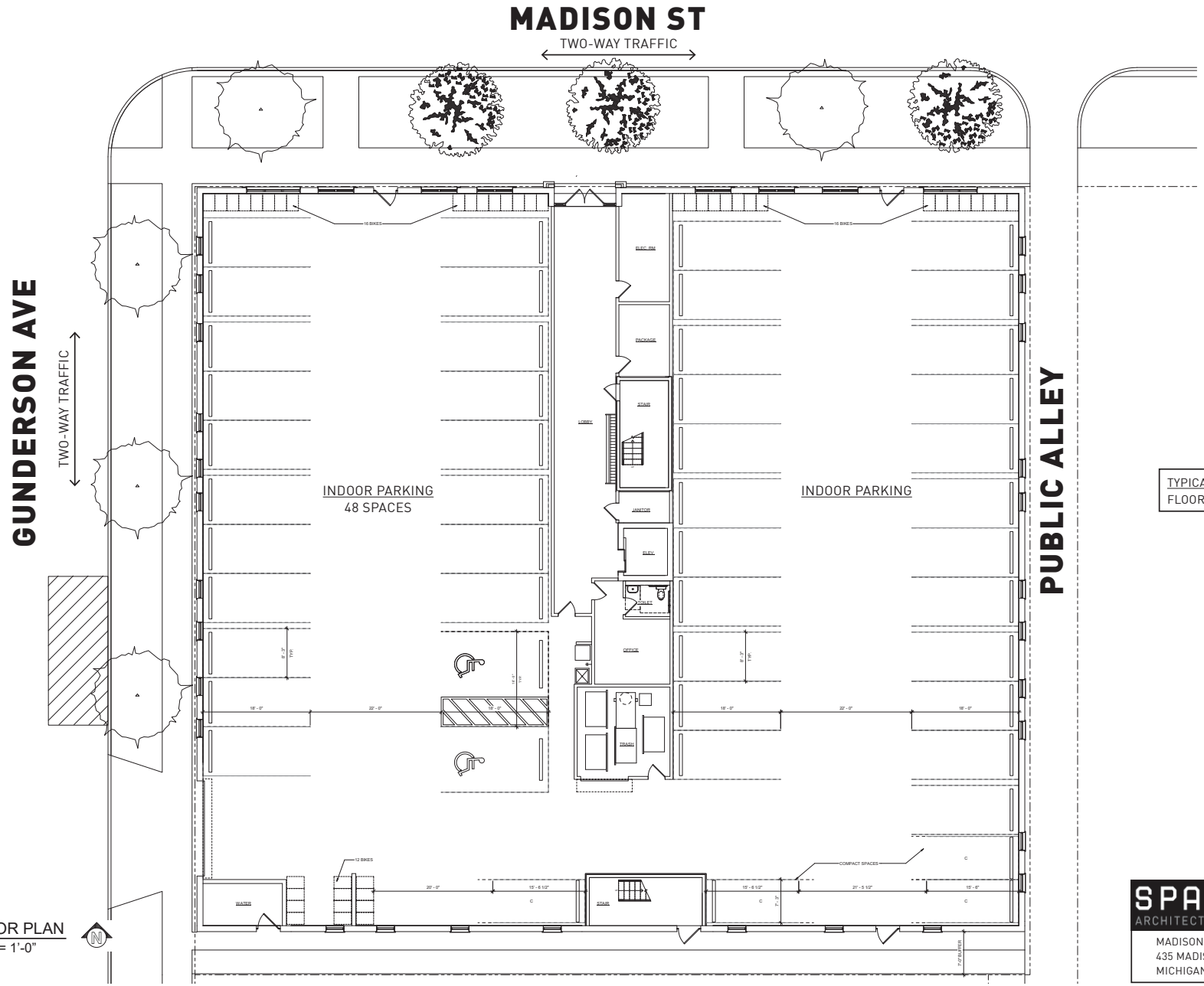
Not to Scale

Exhibit 3B
Existing Pedestrians
Source: GHA October, 2019



1 FIRST FLOOR PLAN
SCALE: 1/16" = 1'-0"

TYPICAL FLOOR AREA
FLOOR 1 ~ 17,348 SF

SPACE ARCHITECTS + PLANNERS
A1.0
10.18.19
MADISON GUNDERSON PLACE
435 MADISON ST. OAK PARK, IL
MICHIGAN AVE. R.E. GROUP

Exhibit 4
Site Plan

Exhibit 5
Project Traffic Characteristics
Proposed Residential Development - Oak Park, Illinois

Part A. Traffic Generation Calculations

			Weekday Peak Hours						
		ITE	Morning Peak Hour			Evening Peak Hour			Daily
Land Use	Size	Code	In	Out	Sum	In	Out	Sum	Sum
Multifamily Housing (Mid-Rise)	48 Dwelling Units	#221	4	13	17	13	9	22	260
Multi-Modal Reduction @ 30% =			3	9	12	9	6	15	182

Discussion: The discount for non-auto trips was <u>not</u> taken, to help ensure that the maximum site traffic imapcts are tested.

Notes:

1) Source: Institute of Transportation Engineers (ITE) Trip Generation Manual (10th Edition).

2) Per 2017 US Census for Oak Park, about 30% of residents take public transportation, bike, or walk.

Part B. Trip Distribution

Route & Direction	Percent Use To/From Site
Madison Street	
- West of Gunderson Avenue	40%
- East of Ridgeland Avenue	25%
Ridgeland Avenue	
- North of Madison Street	15%
- South of Madison Street	20%
Jewel- Osco	
- North of Madison Street	<5%
Gunderson Avenue	
- South of Site	negligible
Totals =	100%

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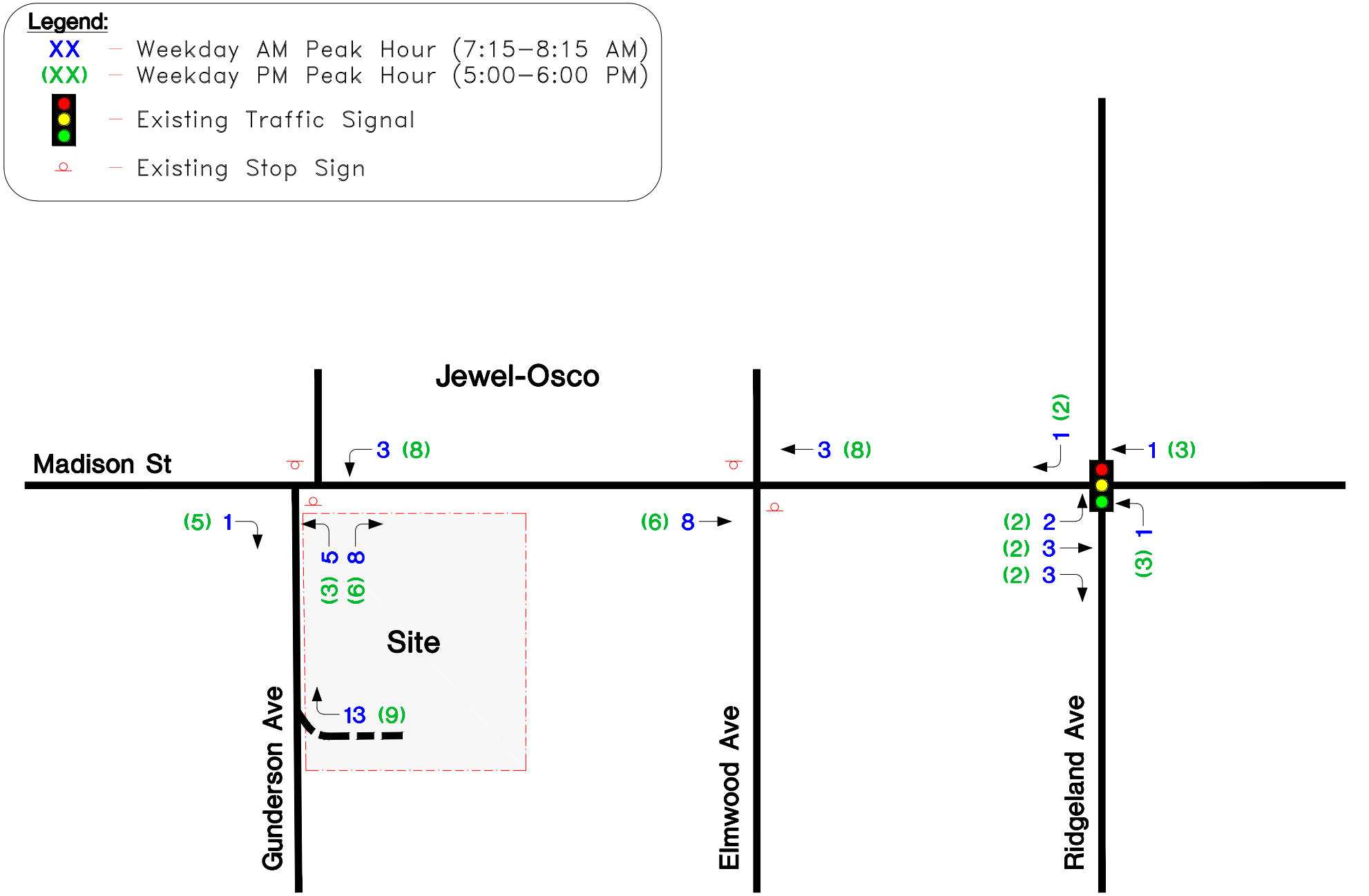

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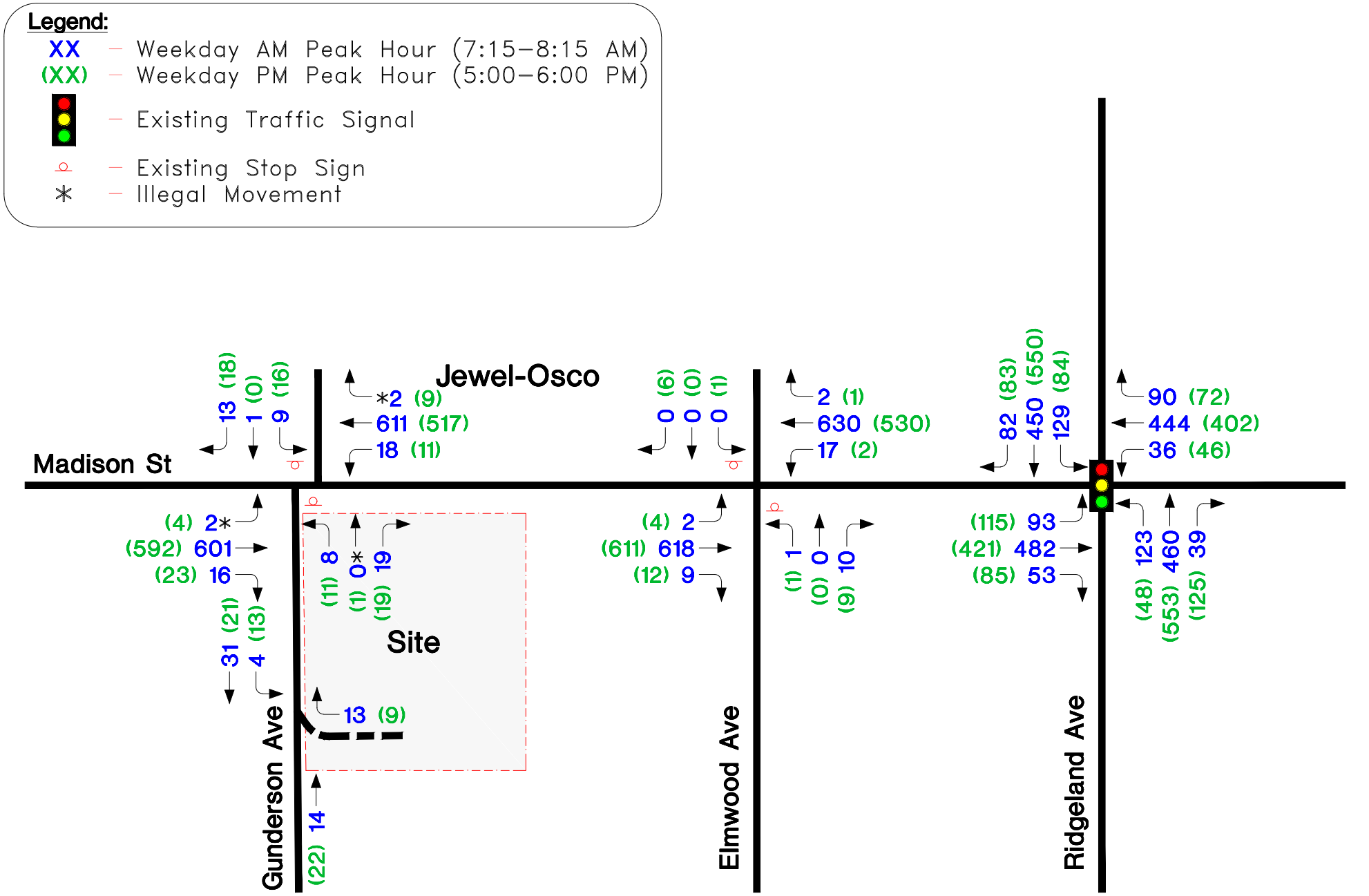
Not to Scale

Exhibit 6
Site Traffic



Note: Per CMAP, includes 1% growth on Madison St and Ridgeland Ave

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Not to Scale

Exhibit 7
Year 2026 Total Traffic

Exhibit 8
Intersection Capacity and Queue Analyses

Proposed Residential Development - 435 Madison St, Oak Park, Illinois

Part A. Parameters - Type of Traffic Control *(Source: Highway Capacity Manual 6th Edition)*

I. Traffic Signals

LOS	Delay (sec / veh)	Description
A	<10	All signal phases clear waiting vehicles without delay
B	>10 and < 20	Minimal delay experienced on select signal phases
C	>20 and < 35	Some delay experienced on several phases; often used as design criteria
D	>35 and < 55	Usually considered as the acceptable delay standard
E	>55 and < 80	Very long delays experienced during the peak hours
F	>80	Unacceptable delays experienced throughout the peak hours

II. Stop Sign

LOS	
A	< 10
B	>10 and < 15
C	>15 and < 25
D	>25 and < 35
E	>35 and < 50
F	>50

Part B. Results

	Roadway Conditions	LOS Per Movement By Approach (> = Shared Lane; - = Non Critical or not Allowed Movement)												Intersection / Approach	
		Eastbound			Westbound			Northbound			Southbound			Delay	
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	(sec / veh)	LOS
1. Madison St & Ridgeland Ave	**Signalized**													**Intersection Delay**	
A. Weekday Morning Peak Hour															
Existing Traffic (See *Exhibit 3A*)	• Current	C	D	C	C	D	C	B	B	<	B	B	<	28.1	C
	• 95th Queue Length (ft)	68	439	37	28	432	71	63	131	-	68	144	-	-	-
2026 Total Traffic (See *Exhibit 7*)	• Current	C	D	C	C	D	C	B	B	<	B	B	<	28.6	C
	• 95th Queue Length (ft)	70	450	39	28	440	72	65	133	-	69	147	-	-	-
B. Weekday Evening Peak Hour															
Existing Traffic (See Exhibit 3A)	• Current	C	D	C	D	D	C	B	B	<	B	B	<	25.6	C
	• 95th Queue Length (ft)	84	382	64	52	379	58	23	183	-	42	156	-	-	-
2026 Total Traffic (See Exhibit 7)	• Current	C	D	C	C	D	C	B	B	<	B	B	<	25.1	C
	• 95th Queue Length (ft)	85	378	66	35	388	58	24	187	-	42	161	-	-	-
2. Madison St & Elmwood Ave	**TWSC - NB/SB Stops**													**NB Approach Delay**	
A. Weekday Morning Peak Hour															
Existing Traffic (See *Exhibit 3A*)	• Current	A	-	-	A	-	-	>	B	<	>	A	<	13.2	B
	• 95th Queue Length (ft)	0	-	-	3	-	-	-	3	-	-	0	-	-	-
2026 Total Traffic (See *Exhibit 7*)	• Current	A	-	-	A	-	-	>	B	<	>	B	<	14.0	B
	• 95th Queue Length (ft)	0	-	-	3	-	-	-	3	-	-	3	-	-	-
B. Weekday Evening Peak Hour															
Existing Traffic (See Exhibit 3A)	• Current	A	-	-	A	-	-	>	B	<	>	A	<	13.3	B
	• 95th Queue Length (ft)	0	-	-	0	-	-	-	3	-	-	0	-	-	-
2026 Total Traffic (See Exhibit 7)	• Current	A	-	-	A	-	-	>	B	<	>	B	<	13.2	B
	• 95th Queue Length (ft)	0	-	-	0	-	-	-	3	-	-	0	-	-	-

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Part B. Results

	Roadway Conditions	LOS Per Movement By Approach												Intersection / Approach	
		> = Shared Lane						- = Non Critical or not Allowed Movement							
		Eastbound			Westbound			Northbound			Southbound			Delay	
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	(sec / veh)	LOS
3. Madison St & Gunderson Ave	**TWSC - NB/SB Stops**													**SB Approach Delay**	
A. Weekday Morning Peak Hour															
Existing Traffic (See *Exhibit 3A*)	• Current	>	A	-	>	A	-	>	B	<	>	C	<	17.8	C
	• 95th Queue Length (ft)	-	0	-	-	3	-	-	3	-	-	8	-	-	-
2026 Total Traffic (See *Exhibit 7*)	• Current	>	A	-	>	A	-	>	C	<	>	C	<	18.2	C
	• 95th Queue Length (ft)	-	0	-	-	3	-	-	8	-	-	8	-	-	-
B. Weekday Evening Peak Hour															
Existing Traffic (See Exhibit 3A)	• Current	>	A	-	>	A	-	>	C	<	>	C	<	16.6	C
	• 95th Queue Length (ft)	-	0	-	-	0	-	-	5	-	-	8	-	-	-
2026 Total Traffic (See Exhibit 7)	• Current	>	A	-	>	A	-	>	C	<	>	C	<	17.1	C
	• 95th Queue Length (ft)	-	0	-	-	0	-	-	8	-	-	10	-	-	-
4. Gunderson Ave & Site Access	**TWSC - WB Stops**													**WB Approach Delay**	
A. Weekday Morning Peak Hour															
2026 Total Traffic (See *Exhibit 7*)	• As Planned	-	-	-	-	-	A	-	-	-	A	-	-	8.4	A
	• 95th Queue Length (ft)	-	-	-	-	-	0	-	-	-	0	-	-	-	-
B. Weekday Evening Peak Hour															
2026 Total Traffic (See *Exhibit 7*)	• As Planned	-	-	-	-	-	A	-	-	-	A	-	-	8.4	A
	• 95th Queue Length (ft)	-	-	-	-	-	0	-	-	-	0	-	-	-	-

APPENDIX A
Photo Inventory

Northbound Gunderson Ave
(Madison St intersection)

Southbound Jewel-Osco Drive
(Madison St intersection)

Eastbound Madison St
(East of Gunderson Ave)

Westbound Madison St
(West of Gunderson Ave)

Northbound Elmwood Ave
(Madison St intersection)

Southbound Elmwood Ave
(South of Madison St)

Eastbound Madison St
(Elmwood Ave intersection)

Westbound Madison St
(Elmwood Ave intersection)

Northbound Ridgeland Ave
(Madison St intersection)

Southbound Ridgeland Ave
(Madison St intersection)

Eastbound Madison St
(Ridgeland Ave intersection)

Westbound Madison St
(Ridgeland Ave intersection)

Northbound Gunderson Ave
(South of Private Alley, West of Site)

Southbound Gunderson Ave
(South of Madison St, West of Site)

Eastbound Private Alley
(East of Gunderson Ave, South of Site)

Northbound Public Alley
(South of Madison St, East of Site)

Northbound Gunderson Ave
(Adams St intersection)

Southbound Gunderson Ave
(Adams St intersection)

Eastbound Adams St
(Gunderson Ave intersection)

Westbound Adams St
(Gunderson Ave intersection)

Parking Restriction Signage on Gunderson Ave (East side of street, between Madison St and Private Alley)

Parking Restriction Signage on Gunderson Ave (West side of street, between Madison St and Private Alley)

Parking Restriction Signage along both sides of Gunderson Ave (between Private Alley and Adams St) and Madison St (Between East Ave and Ridgeland Ave)

APPENDIX B

Traffic Count Summary Sheets

Gewalt Hamilton Associates Inc.
625 Forest Edge Drive

Vernon Hills, Illinois, United States 60061
(847) 478-9700 poster@gha-engineers.com

Count Name: Madison Street & Gunderson Avenue
Site Code:
Start Date: 10/23/2019

Turning Movement Data

Start Time	Jewel Southbound						Madison Westbound						Gunderson Northbound						Madison Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
6:00 AM	1	0	0	0	6	1	2	67	0	0	0	69	1	0	1	0	2	2	0	69	0	0	2	69	141
6:15 AM	1	0	2	0	3	3	0	94	0	0	1	94	1	0	0	0	0	1	0	83	0	0	0	83	181
6:30 AM	1	0	3	0	6	4	0	113	1	0	0	114	1	0	1	0	0	2	3	119	0	0	0	122	242
6:45 AM	1	0	3	0	3	4	0	159	1	0	2	160	0	0	0	0	0	0	1	140	0	0	0	141	305
Hourly Total	4	0	8	0	18	12	2	433	2	0	3	437	3	0	2	0	2	5	4	411	0	0	2	415	869
7:00 AM	0	0	3	0	3	3	2	138	0	0	1	140	2	0	0	0	0	2	2	129	0	0	2	131	276
7:15 AM	5	1	2	0	14	8	0	161	0	0	5	161	3	0	0	0	0	3	1	147	0	0	2	148	320
7:30 AM	5	0	2	0	8	7	0	147	2	0	6	149	1	0	1	0	0	2	7	148	1	0	5	156	314
7:45 AM	1	0	2	0	12	3	2	156	8	0	5	166	3	0	2	0	3	5	8	169	1	0	0	178	352
Hourly Total	11	1	9	0	37	21	4	602	10	0	17	616	9	0	3	0	3	12	18	593	2	0	9	613	1262
8:00 AM	2	0	3	0	3	5	0	148	5	0	0	153	4	0	0	0	0	4	0	160	0	0	0	160	322
8:15 AM	2	0	2	0	1	4	1	145	2	0	1	148	4	0	1	0	0	5	1	155	0	1	1	157	314
8:30 AM	3	0	2	0	2	5	0	148	2	0	0	150	4	0	2	0	1	6	3	121	1	0	1	125	286
8:45 AM	1	0	1	0	4	2	0	127	1	1	2	129	3	0	1	0	1	4	1	142	0	0	0	143	278
Hourly Total	8	0	8	0	10	16	1	568	10	1	3	580	15	0	4	0	2	19	5	578	1	1	2	585	1200
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4:00 PM	2	0	4	0	7	6	1	145	1	0	0	147	3	0	1	0	0	4	2	152	1	0	0	155	312
4:15 PM	4	1	2	0	7	7	0	132	1	1	7	134	0	0	2	0	0	2	6	147	0	0	0	153	296
4:30 PM	2	1	7	0	11	10	1	141	2	0	0	144	3	0	1	0	3	4	4	128	1	0	0	133	291
4:45 PM	4	0	5	0	7	9	1	144	2	1	0	148	0	0	0	0	0	0	8	138	0	0	1	146	303
Hourly Total	12	2	18	0	32	32	3	562	6	2	7	573	6	0	4	0	3	10	20	565	2	0	1	587	1202
5:00 PM	3	0	5	0	23	8	2	149	1	0	3	152	1	0	2	0	0	3	6	130	1	0	3	137	300
5:15 PM	4	0	3	0	15	7	1	143	1	0	1	145	3	1	2	0	0	6	3	151	3	0	0	157	315
5:30 PM	7	0	4	0	13	11	3	144	0	0	1	147	5	0	3	0	0	8	4	162	1	1	0	168	334
5:45 PM	3	0	5	0	16	8	1	162	1	0	1	164	2	0	0	0	0	2	6	144	0	0	0	150	324
Hourly Total	17	0	17	0	67	34	7	598	3	0	6	608	11	1	7	0	0	19	19	587	5	1	3	612	1273
6:00 PM	4	0	4	0	23	8	4	141	1	1	0	147	3	0	3	0	0	6	5	143	0	0	0	148	309
6:15 PM	2	1	4	0	11	7	2	110	0	0	1	112	1	0	0	0	0	1	4	157	0	1	1	162	282
6:30 PM	4	0	8	0	13	12	1	160	1	0	1	162	0	0	1	0	0	1	3	179	1	0	0	183	358
6:45 PM	3	0	4	0	15	7	2	137	1	1	3	141	2	0	1	0	0	3	1	168	0	0	1	169	320
Hourly Total	13	1	20	0	62	34	9	548	3	2	5	562	6	0	5	0	0	11	13	647	1	1	2	662	1269
Grand Total	65	4	80	0	226	149	26	3311	34	5	41	3376	50	1	25	0	10	76	79	3381	11	3	19	3474	7075
Approach %	43.6	2.7	53.7	0.0	-	-	0.8	98.1	1.0	0.1	-	-	65.8	1.3	32.9	0.0	-	-	2.3	97.3	0.3	0.1	-	-	-
Total %	0.9	0.1	1.1	0.0	-	2.1	0.4	46.8	0.5	0.1	-	47.7	0.7	0.0	0.4	0.0	-	1.1	1.1	47.8	0.2	0.0	-	49.1	-
Lights	61	4	80	0	-	145	26	3243	33	5	-	3307	49	1	24	0	-	74	79	3289	11	3	-	3382	6908
% Lights	93.8	100.0	100.0	-	-	97.3	100.0	97.9	97.1	100.0	-	98.0	98.0	100.0	96.0	-	-	97.4	100.0	97.3	100.0	100.0	-	97.4	97.6
Mediums	1	0	0	0	-	1	0	61	1	0	-	62	1	0	1	0	-	2	0	83	0	0	-	83	148
% Mediums	1.5	0.0	0.0	-	-	0.7	0.0	1.8	2.9	0.0	-	1.8	2.0	0.0	4.0	-	-	2.6	0.0	2.5	0.0	0.0	-	2.4	2.1

Articulated Trucks	3	0	0	0	-	3	0	7	0	0	-	7	0	0	0	0	-	0	0	9	0	0	-	9	19
% Articulated Trucks	4.6	0.0	0.0	-	-	2.0	0.0	0.2	0.0	0.0	-	0.2	0.0	0.0	0.0	-	-	0.0	0.0	0.3	0.0	0.0	-	0.3	0.3
Bicycles on Crosswalk	-	-	-	-	21	-	-	-	-	-	0	-	-	-	-	-	3	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	9.3	-	-	-	-	-	0.0	-	-	-	-	-	30.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	205	-	-	-	-	-	41	-	-	-	-	-	7	-	-	-	-	-	19	-	-
% Pedestrians	-	-	-	-	90.7	-	-	-	-	-	100.0	-	-	-	-	-	70.0	-	-	-	-	-	100.0	-	-

Gewalt Hamilton Associates Inc.
625 Forest Edge Drive

Vernon Hills, Illinois, United States 60061
(847) 478-9700 poster@gha-engineers.com

Count Name: Madison Street & South Elmwood Avenue
Site Code:
Start Date: 10/23/2019

Turning Movement Data

Start Time	Jewel Southbound						Madison Westbound						Elmwood Northbound						Madison Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
6:00 AM	1	0	0	0	5	1	0	71	0	0	0	71	0	0	0	0	1	0	0	71	0	0	0	71	143
6:15 AM	0	0	0	0	2	0	0	97	0	0	0	97	1	0	1	0	0	2	1	80	1	0	0	82	181
6:30 AM	0	0	0	0	2	0	0	116	0	0	0	116	0	0	0	0	0	0	2	119	0	0	0	121	237
6:45 AM	0	0	0	0	3	0	1	150	1	0	2	152	1	0	0	0	1	1	1	140	0	0	0	141	294
Hourly Total	1	0	0	0	12	1	1	434	1	0	2	436	2	0	1	0	2	3	4	410	1	0	0	415	855
7:00 AM	0	0	0	0	3	0	0	139	0	0	1	139	0	0	0	0	6	0	0	132	0	0	0	132	271
7:15 AM	0	0	0	0	6	0	0	163	2	0	0	165	2	0	0	0	1	2	3	148	0	0	1	151	318
7:30 AM	0	0	0	0	1	0	1	156	3	0	1	160	4	0	1	0	0	5	2	146	1	0	1	149	314
7:45 AM	0	0	0	0	6	0	0	162	4	0	0	166	1	0	0	0	2	1	4	163	1	0	0	168	335
Hourly Total	0	0	0	0	16	0	1	620	9	0	2	630	7	0	1	0	9	8	9	589	2	0	2	600	1238
8:00 AM	0	0	0	0	3	0	1	146	8	0	0	155	3	0	0	0	1	3	0	168	0	0	0	168	326
8:15 AM	0	0	0	0	1	0	2	146	1	0	0	149	4	0	0	0	5	4	2	145	1	0	0	148	301
8:30 AM	0	0	0	0	3	0	0	150	1	0	0	151	4	0	0	0	14	4	3	128	0	0	0	131	286
8:45 AM	0	0	0	0	3	0	1	129	0	0	0	130	0	0	0	0	4	0	5	138	0	0	0	143	273
Hourly Total	0	0	0	0	10	0	4	571	10	0	0	585	11	0	0	0	24	11	10	579	1	0	0	590	1186
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4:00 PM	2	0	1	0	6	3	1	137	1	0	0	139	2	0	2	0	10	4	4	141	1	0	2	146	292
4:15 PM	0	0	0	0	10	0	0	141	0	0	0	141	1	0	0	0	10	1	3	153	0	1	1	157	299
4:30 PM	1	0	0	0	9	1	1	144	0	0	1	145	3	0	1	0	3	4	4	130	1	0	1	135	285
4:45 PM	2	0	1	0	9	3	2	149	0	0	0	151	1	0	1	0	3	2	6	143	0	0	0	149	305
Hourly Total	5	0	2	0	34	7	4	571	1	0	1	576	7	0	4	0	26	11	17	567	2	1	4	587	1181
5:00 PM	0	0	1	0	13	1	1	155	1	0	0	157	0	0	1	0	7	1	5	134	0	0	2	139	298
5:15 PM	0	0	0	0	4	0	1	145	0	0	0	146	1	0	0	0	5	1	2	151	1	0	0	154	301
5:30 PM	0	0	2	0	12	2	3	145	1	0	0	149	0	0	0	0	6	0	1	164	0	0	0	165	316
5:45 PM	0	0	0	0	10	0	2	158	0	0	0	160	0	0	1	0	3	1	2	153	0	0	0	155	316
Hourly Total	0	0	3	0	39	3	7	603	2	0	0	612	1	0	2	0	21	3	10	602	1	0	2	613	1231
6:00 PM	2	0	0	1	13	3	0	139	1	0	0	140	4	0	0	0	2	4	3	149	0	0	0	152	299
6:15 PM	2	0	0	0	7	2	0	115	0	0	0	115	3	0	0	0	4	3	3	157	1	0	0	161	281
6:30 PM	2	0	1	0	5	3	1	161	0	1	0	163	1	0	0	0	5	1	3	182	3	0	0	188	355
6:45 PM	0	0	0	0	5	0	0	139	1	0	0	140	1	0	1	0	2	2	3	176	0	0	0	179	321
Hourly Total	6	0	1	1	30	8	1	554	2	1	0	558	9	0	1	0	13	10	12	664	4	0	0	680	1256
Grand Total	12	0	6	1	141	19	18	3353	25	1	5	3397	37	0	9	0	95	46	62	3411	11	1	8	3485	6947
Approach %	63.2	0.0	31.6	5.3	-	-	0.5	98.7	0.7	0.0	-	-	80.4	0.0	19.6	0.0	-	-	1.8	97.9	0.3	0.0	-	-	-
Total %	0.2	0.0	0.1	0.0	-	0.3	0.3	48.3	0.4	0.0	-	48.9	0.5	0.0	0.1	0.0	-	0.7	0.9	49.1	0.2	0.0	-	50.2	-
Lights	12	0	6	1	-	19	18	3285	25	1	-	3329	36	0	9	0	-	45	62	3327	11	1	-	3401	6794
% Lights	100.0	-	100.0	100.0	-	100.0	100.0	98.0	100.0	100.0	-	98.0	97.3	-	100.0	-	-	97.8	100.0	97.5	100.0	100.0	-	97.6	97.8
Mediums	0	0	0	0	-	0	0	63	0	0	-	63	1	0	0	0	-	1	0	75	0	0	-	75	139
% Mediums	0.0	-	0.0	0.0	-	0.0	0.0	1.9	0.0	0.0	-	1.9	2.7	-	0.0	-	-	2.2	0.0	2.2	0.0	0.0	-	2.2	2.0

Articulated Trucks	0	0	0	0	-	0	0	5	0	0	-	5	0	0	0	0	-	0	0	9	0	0	-	9	14
% Articulated Trucks	0.0	-	0.0	0.0	-	0.0	0.0	0.1	0.0	0.0	-	0.1	0.0	-	0.0	-	-	0.0	0.0	0.3	0.0	0.0	-	0.3	0.2
Bicycles on Crosswalk	-	-	-	-	20	-	-	-	-	-	0	-	-	-	-	-	10	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	14.2	-	-	-	-	-	0.0	-	-	-	-	-	10.5	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	121	-	-	-	-	-	5	-	-	-	-	-	85	-	-	-	-	-	8	-	-
% Pedestrians	-	-	-	-	85.8	-	-	-	-	-	100.0	-	-	-	-	-	89.5	-	-	-	-	-	100.0	-	-

Gewalt Hamilton Associates Inc.
625 Forest Edge Drive

Vernon Hills, Illinois, United States 60061
(847) 478-9700 poster@gha-engineers.com

Count Name: Madison Street & South Ridgeland Avenue
Site Code:
Start Date: 10/23/2019

Turning Movement Data

Start Time	Ridgeland Southbound						Madison Westbound						Ridgeland Northbound						Madison Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
6:00 AM	8	48	6	0	7	62	9	51	3	0	3	63	6	58	10	0	0	74	8	52	9	0	0	69	268
6:15 AM	13	75	12	0	0	100	6	70	6	0	2	82	3	77	9	0	0	89	10	57	7	0	0	74	345
6:30 AM	17	70	15	0	2	102	12	90	8	0	4	110	8	93	9	0	0	110	8	99	12	0	1	119	441
6:45 AM	20	90	11	0	1	121	18	111	10	0	4	139	10	132	28	0	2	170	14	100	16	0	2	130	560
Hourly Total	58	283	44	0	10	385	45	322	27	0	13	394	27	360	56	0	2	443	40	308	44	0	3	392	1614
7:00 AM	18	103	37	0	2	158	24	95	6	0	3	125	14	100	25	0	6	139	11	103	13	0	3	127	549
7:15 AM	20	116	32	0	5	168	21	109	8	0	4	138	5	126	33	0	5	164	15	111	17	0	4	143	613
7:30 AM	17	116	35	0	1	168	29	103	7	0	5	139	10	113	40	0	1	163	13	110	23	0	1	146	616
7:45 AM	22	119	33	0	2	174	21	116	12	0	8	149	12	94	27	0	1	133	13	118	20	0	4	151	607
Hourly Total	77	454	137	0	10	668	95	423	33	0	20	551	41	433	125	0	13	599	52	442	73	0	12	567	2385
8:00 AM	21	95	28	0	0	144	18	111	9	0	10	138	12	123	21	0	3	156	9	135	30	0	2	174	612
8:15 AM	25	98	27	0	8	150	16	112	11	0	59	139	11	130	20	0	6	161	8	120	24	0	3	152	602
8:30 AM	20	90	20	0	29	130	15	107	9	0	204	131	15	105	21	0	30	141	10	99	29	0	30	138	540
8:45 AM	15	82	30	0	10	127	14	91	15	0	76	120	13	101	26	0	11	140	15	107	22	0	5	144	531
Hourly Total	81	365	105	0	47	551	63	421	44	0	349	528	51	459	88	0	50	598	42	461	105	0	40	608	2285
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4:00 PM	21	137	24	0	14	182	11	101	12	0	61	124	14	120	25	0	10	159	20	95	19	0	5	134	599
4:15 PM	13	115	13	0	8	141	20	97	8	0	30	125	10	146	30	0	19	186	19	117	23	0	5	159	611
4:30 PM	22	153	15	0	12	190	20	104	19	0	42	143	11	128	31	0	12	170	21	97	16	0	5	134	637
4:45 PM	18	137	17	0	6	172	16	101	16	0	11	133	14	148	30	0	2	192	16	116	12	0	6	144	641
Hourly Total	74	542	69	0	40	685	67	403	55	0	144	525	49	542	116	0	43	707	76	425	70	0	21	571	2488
5:00 PM	19	138	22	1	20	180	15	97	13	0	27	125	11	136	29	0	10	176	16	96	24	0	6	136	617
5:15 PM	23	139	17	0	4	179	23	95	11	0	9	129	12	136	28	0	3	176	18	105	29	0	7	152	636
5:30 PM	15	139	22	0	17	176	13	100	14	0	16	127	9	141	28	0	10	178	25	109	29	0	7	163	644
5:45 PM	23	129	22	0	6	174	20	103	8	0	9	131	13	135	39	0	11	187	23	105	30	0	3	158	650
Hourly Total	80	545	83	1	47	709	71	395	46	0	61	512	45	548	124	0	34	717	82	415	112	0	23	609	2547
6:00 PM	27	147	24	0	8	198	20	77	9	0	9	106	11	127	21	0	4	159	16	102	29	0	2	147	610
6:15 PM	9	140	18	0	9	167	21	83	16	0	12	120	13	137	23	0	4	173	25	104	35	0	7	164	624
6:30 PM	16	122	20	0	4	158	20	109	15	0	5	144	10	113	34	0	3	157	21	125	35	0	5	181	640
6:45 PM	17	114	25	0	7	156	21	88	15	0	8	124	7	142	16	0	2	165	27	103	45	0	3	175	620
Hourly Total	69	523	87	0	28	679	82	357	55	0	34	494	41	519	94	0	13	654	89	434	144	0	17	667	2494
Grand Total	439	2712	525	1	182	3677	423	2321	260	0	621	3004	254	2861	603	0	155	3718	381	2485	548	0	116	3414	13813
Approach %	11.9	73.8	14.3	0.0	-	-	14.1	77.3	8.7	0.0	-	-	6.8	76.9	16.2	0.0	-	-	11.2	72.8	16.1	0.0	-	-	-
Total %	3.2	19.6	3.8	0.0	-	26.6	3.1	16.8	1.9	0.0	-	21.7	1.8	20.7	4.4	0.0	-	26.9	2.8	18.0	4.0	0.0	-	24.7	-
Lights	434	2669	518	1	-	3622	415	2264	253	0	-	2932	244	2816	598	0	-	3658	373	2426	533	0	-	3332	13544
% Lights	98.9	98.4	98.7	100.0	-	98.5	98.1	97.5	97.3	-	-	97.6	96.1	98.4	99.2	-	-	98.4	97.9	97.6	97.3	-	-	97.6	98.1
Mediums	5	40	7	0	-	52	5	51	3	0	-	59	10	39	4	0	-	53	8	47	14	0	-	69	233
% Mediums	1.1	1.5	1.3	0.0	-	1.4	1.2	2.2	1.2	-	-	2.0	3.9	1.4	0.7	-	-	1.4	2.1	1.9	2.6	-	-	2.0	1.7

Articulated Trucks	0	3	0	0	-	3	3	6	4	0	-	13	0	6	1	0	-	7	0	12	1	0	-	13	36
% Articulated Trucks	0.0	0.1	0.0	0.0	-	0.1	0.7	0.3	1.5	-	-	0.4	0.0	0.2	0.2	-	-	0.2	0.0	0.5	0.2	-	-	0.4	0.3
Bicycles on Crosswalk	-	-	-	-	13	-	-	-	-	-	42	-	-	-	-	-	10	-	-	-	-	-	10	-	-
% Bicycles on Crosswalk	-	-	-	-	7.1	-	-	-	-	-	6.8	-	-	-	-	-	6.5	-	-	-	-	-	8.6	-	-
Pedestrians	-	-	-	-	169	-	-	-	-	-	579	-	-	-	-	-	145	-	-	-	-	-	106	-	-
% Pedestrians	-	-	-	-	92.9	-	-	-	-	-	93.2	-	-	-	-	-	93.5	-	-	-	-	-	91.4	-	-

APPENDIX C

ITE Trip Generation Excerpts

Chicago Metropolitan Agency for Planning

233 South Wacker Drive
Suite 800
Chicago, Illinois 60606

312 454 0400
www.cmap.illinois.gov

October 25, 2019

Antonio Maravillas
Transportation Engineer
Gewalt Hamilton Associates
625 Forest Edge Drive
Vernon Hills, IL 60061

Subject: Madison Street @ Ridgeland Avenue
IDOT

Dear Mr. Maravillas:

In response to a request made on your behalf and dated October 25, 2019, we have developed year 2050 average daily traffic (ADT) projections for the subject location.

ROAD SEGMENT	Current Volumes	Year 2050 ADT
Madison St from East Ave to Ridgeland Ave	19,100	20,900
Ridgeland Ave from Washington Bld to Madison St	17,800	18,200

Traffic projections are developed using existing ADT data provided in the request letter and the results from the March 2019 CMAP Travel Demand Analysis. The regional travel model uses CMAP 2050 socioeconomic projections and assumes the implementation of the ON TO 2050 Comprehensive Regional Plan for the Northeastern Illinois area. The provision of this data in support of your request does not constitute a CMAP endorsement of the proposed development or any subsequent developments.

If you have any questions, please call me at (312) 386-8806.

Sincerely,

Jose Rodriguez, PTP, AICP
Senior Planner, Research & Analysis

cc: Quigley (IDOT)
S:\AdminGroups\ResearchAnalysis\2019_ForecastsTraffic\OakPark\ck-138-19\ck-138-19.docx

APPENDIX D

CMAP Correspondence

Land Use: 221
Multifamily Housing (Mid-Rise)

Description

Mid-rise multifamily housing includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have between three and 10 levels (floors). Multifamily housing (low-rise) (Land Use 220), multifamily housing (high-rise) (Land Use 222), off-campus student apartment (Land Use 225), and mid-rise residential with 1st-floor commercial (Land Use 231) are related land uses.

Additional Data

In prior editions of *Trip Generation Manual*, the mid-rise multifamily housing sites were further divided into rental and condominium categories. An investigation of vehicle trip data found no clear differences in trip making patterns between the rental and condominium sites within the ITE database. As more data are compiled for future editions, this land use classification can be reinvestigated.

For the six sites for which both the number of residents and the number of occupied dwelling units were available, there were an average of 2.46 residents per occupied dwelling unit.

For the five sites for which the numbers of both total dwelling units and occupied dwelling units were available, an average of 95.7 percent of the total dwelling units were occupied.

Time-of-day distribution data for this land use are presented in Appendix A. For the eight general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 7:00 and 8:00 a.m. and 4:45 and 5:45 p.m., respectively.

For the four dense multi-use urban sites with 24-hour count data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 7:15 and 8:15 a.m. and 4:15 and 5:15 p.m., respectively. For the three center city core sites with 24-hour count data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 6:45 and 7:45 a.m. and 5:00 and 6:00 p.m., respectively.

For the six sites for which data were provided for both occupied dwelling units and residents, there was an average of 2.46 residents per occupied dwelling unit.

For the five sites for which data were provided for both occupied dwelling units and total dwelling units, an average of 95.7 percent of the units were occupied.

The average numbers of person trips per vehicle trip at the five center city core sites at which both person trip and vehicle trip data were collected were as follows:

- 1.84 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 7 and 9 a.m.
- 1.94 during Weekday, AM Peak Hour of Generator
- 2.07 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.
- 2.59 during Weekday, PM Peak Hour of Generator

The average numbers of person trips per vehicle trip at the 32 dense multi-use urban sites at which both person trip and vehicle trip data were collected were as follows:

- 1.90 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 7 and 9 a.m.
- 1.90 during Weekday, AM Peak Hour of Generator
- 2.00 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.
- 2.08 during Weekday, PM Peak Hour of Generator

The average numbers of person trips per vehicle trip at the 13 general urban/suburban sites at which both person trip and vehicle trip data were collected were as follows:

- 1.56 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 7 and 9 a.m.
- 1.88 during Weekday, AM Peak Hour of Generator
- 1.70 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.
- 2.07 during Weekday, PM Peak Hour of Generator

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Alberta (CAN), British Columbia (CAN), California, Delaware, District of Columbia, Florida, Georgia, Illinois, Maryland, Massachusetts, Minnesota, New Hampshire, New Jersey, Ontario, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Utah, Virginia, and Wisconsin.

Source Numbers

168, 188, 204, 305, 306, 321, 357, 390, 436, 525, 530, 579, 638, 818, 857, 866, 901, 904, 910, 912, 918, 934, 936, 939, 944, 947, 948, 949, 959, 963, 964, 966, 967, 969, 970

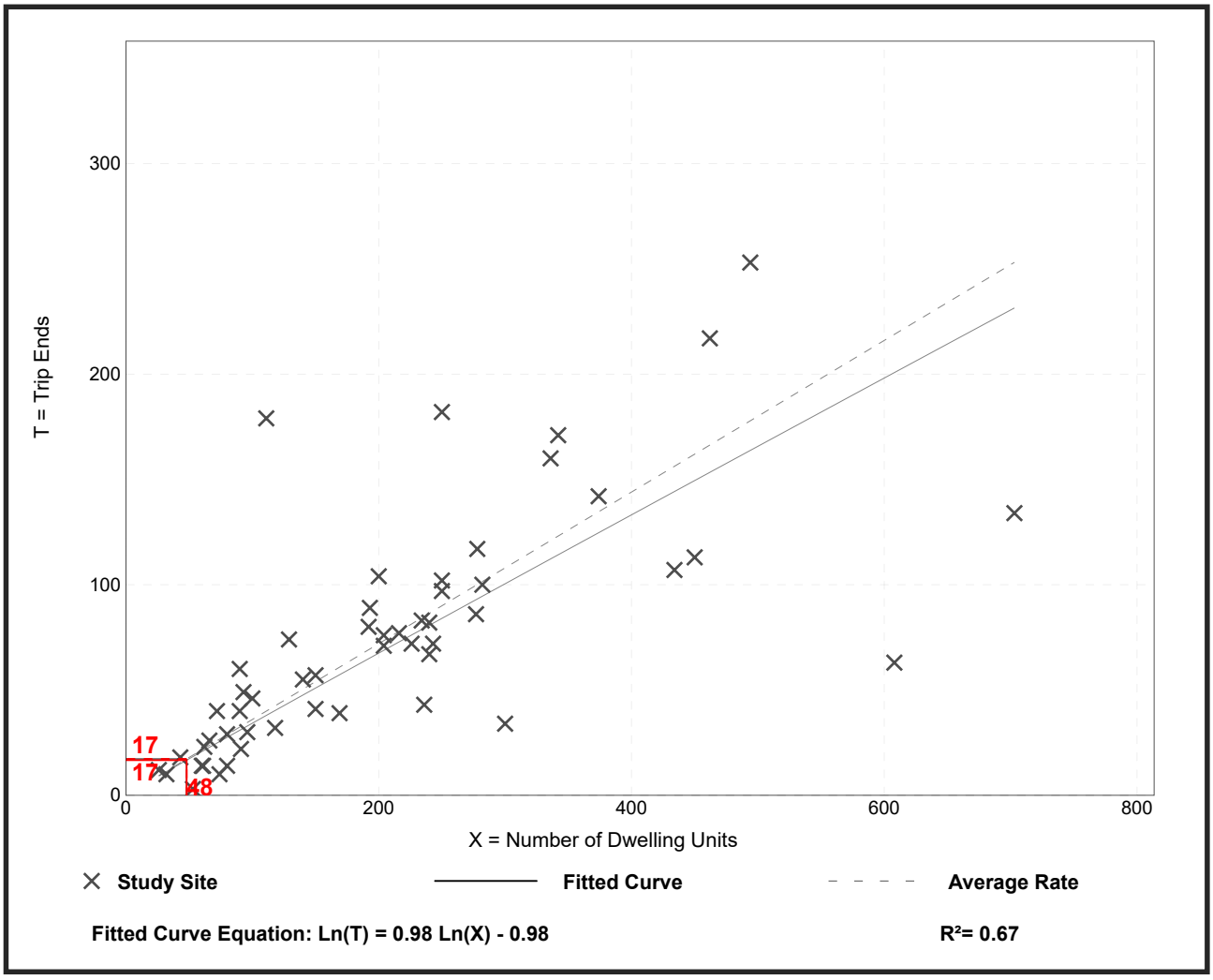
Multifamily Housing (Mid-Rise)
(221)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 53
Avg. Num. of Dwelling Units: 207
Directional Distribution: 26% entering, 74% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.36	0.06 - 1.61	0.19

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.98 Ln(X) - 0.98

R^2= 0.67

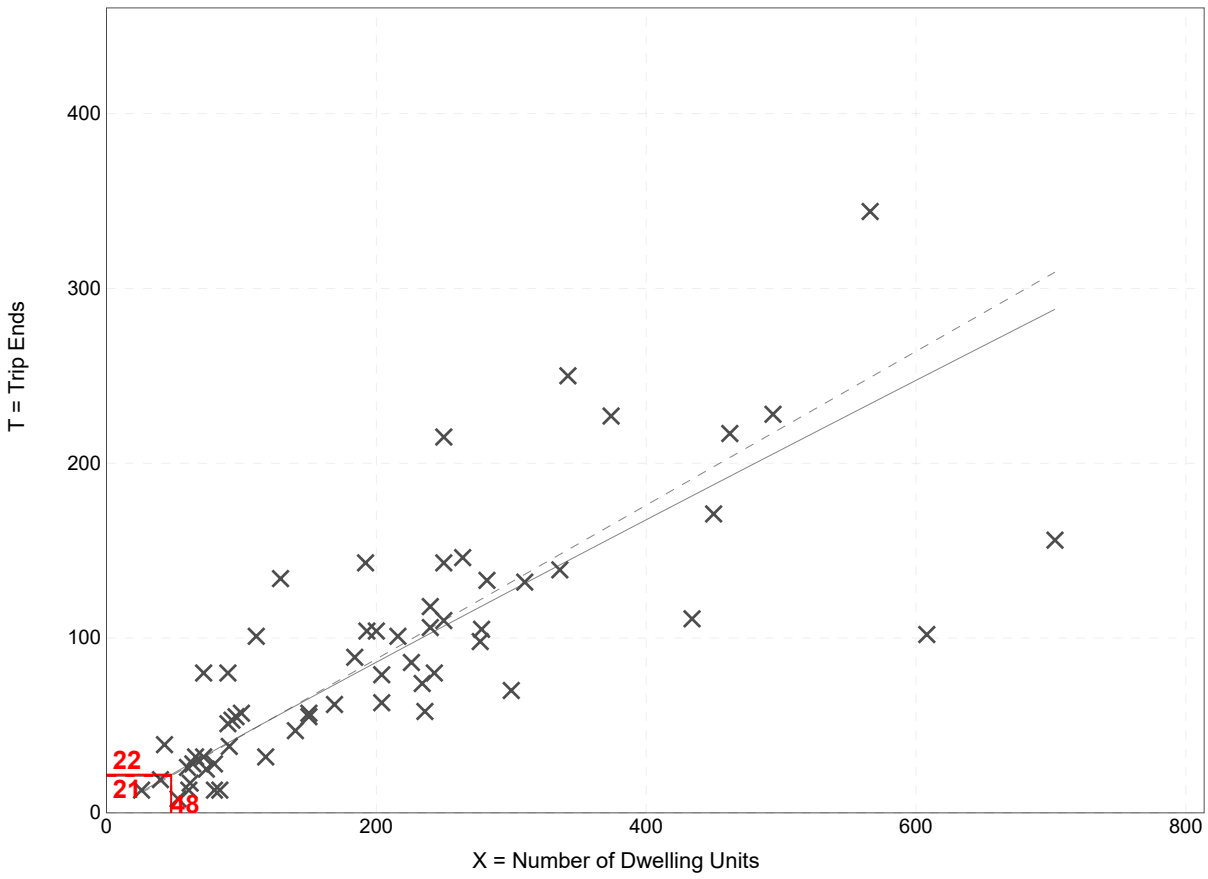
Multifamily Housing (Mid-Rise)
(221)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 60
Avg. Num. of Dwelling Units: 208
Directional Distribution: 61% entering, 39% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.44	0.15 - 1.11	0.19

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.96 Ln(X) - 0.63

R^2= 0.72

Multifamily Housing (Mid-Rise)
(221)

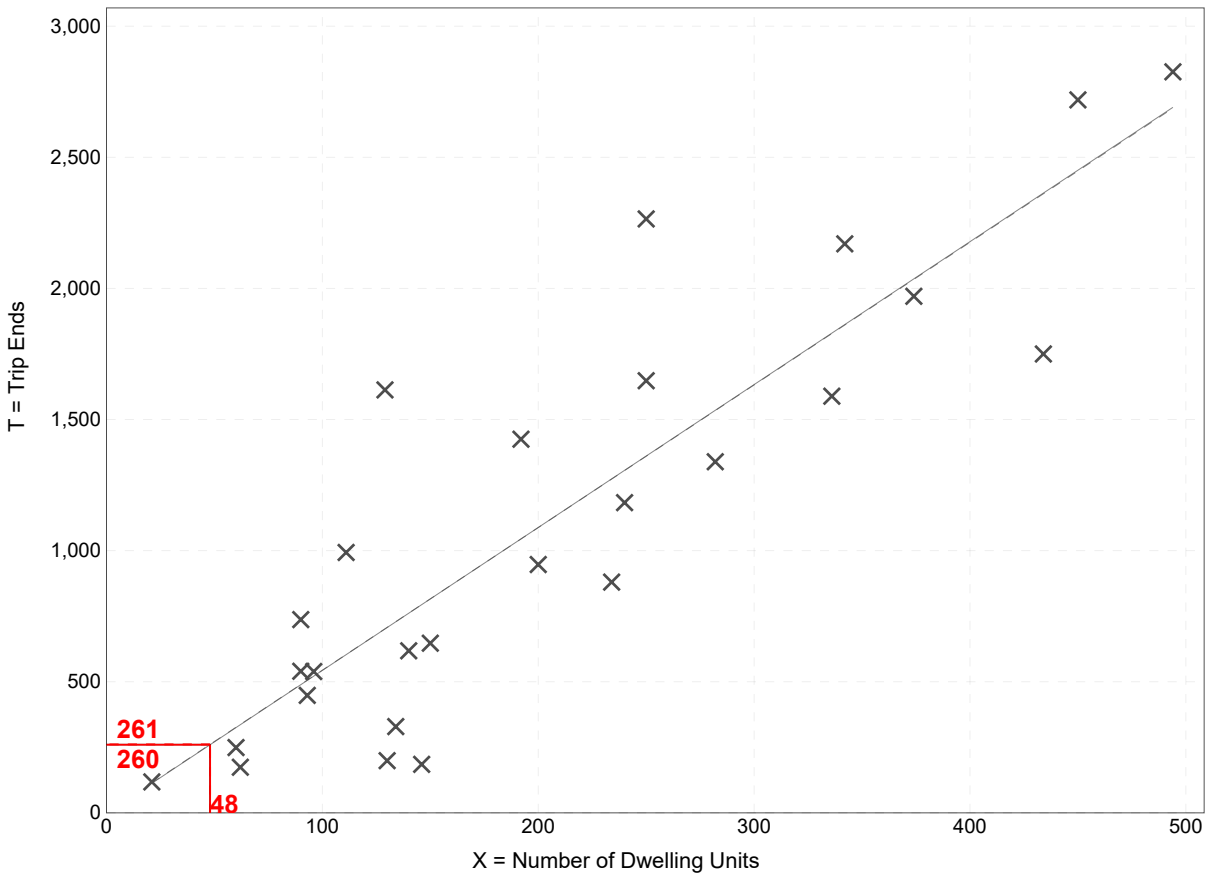
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 27
Avg. Num. of Dwelling Units: 205
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
5.44	1.27 - 12.50	2.03

Data Plot and Equation



Fitted Curve Equation: T = 5.45(X) - 1.75

R^2= 0.77

APPENDIX E

Capacity Analysis Worksheets

HCS7 Two-Way Stop-Control Report

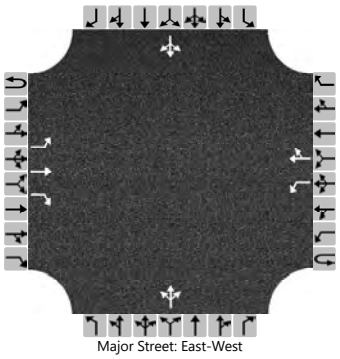
General Information

Analyst	JTO
Agency/Co.	GHA
Date Performed	10/31/2019
Analysis Year	2019
Time Analyzed	EX AM
Intersection Orientation	East-West
Project Description	5244.925

Site Information

Intersection	Madison St & Elmwood Ave
Jurisdiction	Local
East/West Street	Madison St
North/South Street	Elmwood Ave
Peak Hour Factor	0.97
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	1	0	1	1	0		0	1	0		0	1	0
Configuration		L	T	R		L		TR			LTR				LTR	
Volume (veh/h)		2	604	9		17	621	2		1	0	10		0	0	0
Percent Heavy Vehicles (%)		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized		No														
Median Type | Storage		Left + Thru								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.10				4.10				7.10	6.50	6.20		7.10	6.50	6.20
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.20				2.20				3.50	4.00	3.30		3.50	4.00	3.30

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		2				18					11				0	
Capacity, c (veh/h)		925				954					451					
v/c Ratio		0.00				0.02					0.03					
95% Queue Length, Q_{95} (veh)		0.0				0.1					0.1					
Control Delay (s/veh)		8.9				8.8					13.2					
Level of Service (LOS)		A				A					B					
Approach Delay (s/veh)		0.0				0.2				13.2						
Approach LOS										B						

HCS7 Two-Way Stop-Control Report

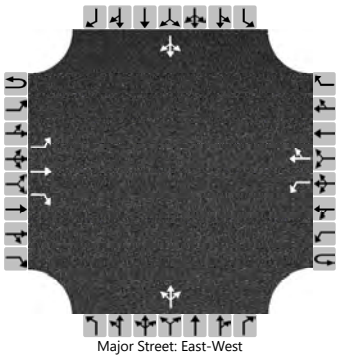
General Information

Analyst	JTO
Agency/Co.	GHA
Date Performed	10/31/2019
Analysis Year	2019
Time Analyzed	EX PM
Intersection Orientation	East-West
Project Description	5244.925

Site Information

Intersection	Madison St & Elmwood Ave
Jurisdiction	Local
East/West Street	Madison St
North/South Street	Elmwood Ave
Peak Hour Factor	0.89
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	1	0	1	1	0		0	1	0		0	1	0
Configuration		L	T	R		L		TR			LTR				LTR	
Volume (veh/h)		4	599	12		2	517	1		1	0	9		1	0	6
Percent Heavy Vehicles (%)		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized		No														
Median Type | Storage		Left + Thru								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.10				4.10				7.10	6.50	6.20		7.10	6.50	6.20
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.20				2.20				3.50	4.00	3.30		3.50	4.00	3.30

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		4				2					11				8	
Capacity, c (veh/h)		933				882					411				421	
v/c Ratio		0.00				0.00					0.03				0.02	
95% Queue Length, Q_{95} (veh)		0.0				0.0					0.1				0.1	
Control Delay (s/veh)		8.9				9.1					14.0				13.7	
Level of Service (LOS)		A				A					B				B	
Approach Delay (s/veh)		0.1				0.0				14.0				13.7		
Approach LOS										B				B		

HCS7 Two-Way Stop-Control Report

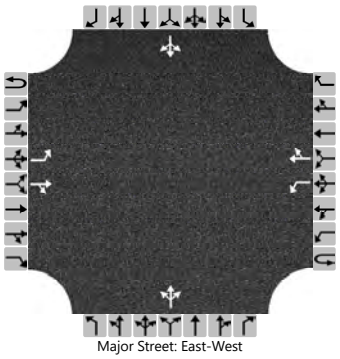
General Information

Analyst	JTO
Agency/Co.	GHA
Date Performed	10/31/2019
Analysis Year	2019
Time Analyzed	EX AM
Intersection Orientation	East-West
Project Description	5244.925

Site Information

Intersection	Madison St & Gunderson Av
Jurisdiction	Local
East/West Street	Madison St
North/South Street	Gunderson Ave
Peak Hour Factor	0.93
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	1	1	0		0	1	0		0	1	0
Configuration		L		TR		L		TR			LTR				LTR	
Volume (veh/h)		2	595	16		15	605	2		3	0	11		9	1	13
Percent Heavy Vehicles (%)		0				0				0	0	0		0	0	23
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized																
Median Type | Storage		Left + Thru								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.10				4.10				7.10	6.50	6.20		7.10	6.50	6.43
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.20				2.20				3.50	4.00	3.30		3.50	4.00	3.51

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		2				16					15				25	
Capacity, c (veh/h)		882				935					386				305	
v/c Ratio		0.00				0.02					0.04				0.08	
95% Queue Length, Q_{95} (veh)		0.0				0.1					0.1				0.3	
Control Delay (s/veh)		9.1				8.9					14.7				17.8	
Level of Service (LOS)		A				A					B				C	
Approach Delay (s/veh)	0.0				0.2				14.7				17.8			
Approach LOS									B				C			

HCS7 Two-Way Stop-Control Report

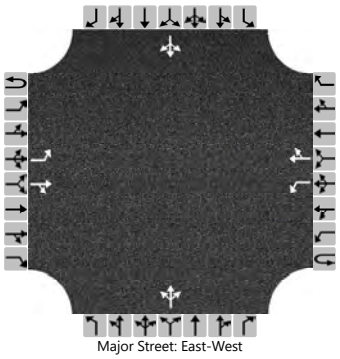
General Information

Analyst	JTO
Agency/Co.	GHA
Date Performed	10/31/2019
Analysis Year	2019
Time Analyzed	EX PM
Intersection Orientation	East-West
Project Description	5244.925

Site Information

Intersection	Madison St & Gunderson Av
Jurisdiction	Local
East/West Street	Madison St
North/South Street	Gunderson Ave
Peak Hour Factor	0.96
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	1	1	0		0	1	0		0	1	0
Configuration		L		TR		L		TR			LTR				LTR	
Volume (veh/h)		4	586	18		3	512	9		8	1	13		16	0	18
Percent Heavy Vehicles (%)		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized																
Median Type | Storage			Left + Thru								1					

Critical and Follow-up Headways

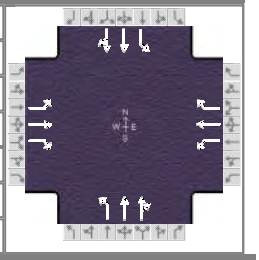
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.10				4.10				7.10	6.50	6.20		7.10	6.50	6.20
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.20				2.20				3.50	4.00	3.30		3.50	4.00	3.30

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		4				3					23				35	
Capacity, c (veh/h)		916				963					381				344	
v/c Ratio		0.00				0.00					0.06				0.10	
95% Queue Length, Q_{95} (veh)		0.0				0.0					0.2				0.3	
Control Delay (s/veh)		8.9				8.8					15.0				16.6	
Level of Service (LOS)		A				A					C				C	
Approach Delay (s/veh)		0.1				0.1				15.0				16.6		
Approach LOS										C				C		

HCS7 Signalized Intersection Input Data

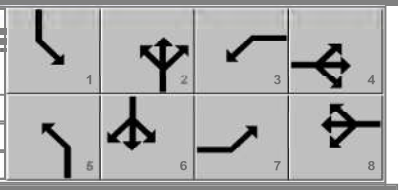
General Information				Intersection Information	
Agency	GHA			Duration, h	0.250
Analyst	JTO	Analysis Date	10/31/2019	Area Type	Other
Jurisdiction	Local	Time Period	EX AM	PHF	0.99
Urban Street	Madison St & Ridgeland…	Analysis Year	2019	Analysis Period	1> 7:00
Intersection	Madison St & Ridgeland…	File Name	Madison & Ridgeland EX AM.xus		
Project Description	EX AM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	90	474	50	36	439	89	121	456	39	128	446	80

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.6	0.3	36.6	3.4	2.1	23.1						
Yellow	3.5	0.0	4.5	3.5	0.0	4.5						
Red	0.0	0.0	1.5	0.0	0.0	1.5						



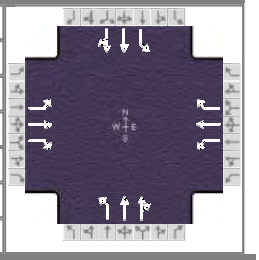
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	90	474	50	36	439	89	121	456	39	128	446	80
Initial Queue (Q_b), veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Base Saturation Flow Rate (s_o), veh/h	1900	2000	1900	1900	2000	1900	1900	2000	1900	1900	2000	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %	7	2	2	8	3	3	1	3		3	2	
Ped / Bike / RTOR, /h	11	0	0	27	0	0	10	0	0	8	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)	3	3	3	3	3	3	3	4	3	3	4	3
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (*W*), ft	11.0	11.0	11.0	10.0	11.0	11.0	10.0	10.0		10.0	10.0	
Turn Bay Length, ft	100	0	80	65	0	50	80	0		80	0	
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h	30	30	30	30	30	30	30	30	30	30	30	30

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s	12.0	27.0	12.0	27.0	12.0	39.0	12.0	39.0
Yellow Change Interval (*Y*), s	3.5	4.5	3.5	4.5	3.5	4.5	3.5	4.5
Red Clearance Interval (R_c), s	0.0	1.5	0.0	1.5	0.0	1.5	0.0	1.5
Minimum Green (G_{min}), s	3	8	3	8	3	15	3	15
Start-Up Lost Time (*lt*), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (*e*), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (*PT*), s	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
Recall Mode	Off	Off	Off	Off	Off	Min	Off	Min
Dual Entry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

HCS7 Signalized Intersection Results Summary

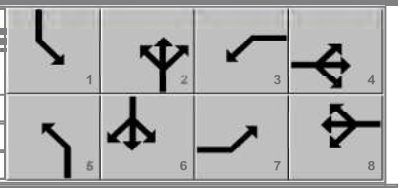
General Information				Intersection Information	
Agency	GHA			Duration, h	0.250
Analyst	JTO	Analysis Date	10/31/2019	Area Type	Other
Jurisdiction	Local	Time Period	EX AM	PHF	0.99
Urban Street	Madison St & Ridgeland…	Analysis Year	2019	Analysis Period	1> 7:00
Intersection	Madison St & Ridgeland…	File Name	Madison & Ridgeland EX AM.xus		
Project Description	EX AM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	90	474	50	36	439	89	121	456	39	128	446	80

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.6	0.3	36.6	3.4	2.1	23.1	
Yellow	3.5	0.0	4.5	3.5	0.0	4.5	
Red	0.0	0.0	1.5	0.0	0.0	1.5	



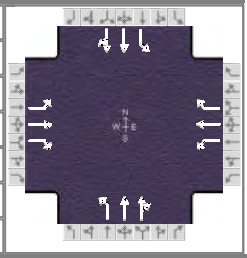
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	9.0	31.1	6.9	29.1	9.1	42.6	9.4	42.9
Change Period, (*Y+R c*), s	3.5	6.0	3.5	6.0	3.5	6.0	3.5	6.0
Max Allow Headway (*MAH*), s	4.1	5.1	4.1	5.1	4.1	0.0	4.1	0.0
Queue Clearance Time (*g s*), s	5.4	22.8	3.4	21.7	5.5		5.8	
Green Extension Time (*g e*), s	0.1	1.9	0.0	1.4	0.1	0.0	0.1	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	1.00	0.26	1.00	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	91	479	51	36	443	90	122	253	247	129	272	260
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1711	1969	1566	1697	1953	1523	1795	1953	1894	1767	1969	1858
Queue Service Time (*g s*), s	3.4	20.8	2.2	1.4	19.7	4.2	3.5	6.5	6.8	3.8	6.9	7.5
Cycle Queue Clearance Time (*g c*), s	3.4	20.8	2.2	1.4	19.7	4.2	3.5	6.5	6.8	3.8	6.9	7.5
Green Ratio (*g/C*)	0.32	0.28	0.28	0.29	0.26	0.26	0.47	0.41	0.41	0.47	0.41	0.41
Capacity (*c*), veh/h	218	550	437	166	501	390	459	794	770	491	806	761
Volume-to-Capacity Ratio (*X*)	0.416	0.871	0.115	0.219	0.886	0.230	0.266	0.318	0.321	0.264	0.337	0.341
Back of Queue (*Q*), ft/ln (95 th percentile)	67.5	439.4	37	27.6	431.6	71.2	63.4	130.1	130.6	68	138.4	143.6
Back of Queue (*Q*), veh/ln (95 th percentile)	2.6	17.3	1.5	1.0	16.9	2.8	2.5	5.1	5.2	2.7	5.5	5.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.67	0.00	0.46	0.42	0.00	1.42	0.79	0.00	0.00	0.85	0.00	0.00
Uniform Delay (*d 1*), s/veh	24.3	30.9	24.2	25.4	32.2	26.4	14.2	13.7	14.4	13.8	13.6	15.1
Incremental Delay (*d 2*), s/veh	1.3	13.9	0.2	0.7	16.7	0.4	0.3	1.1	1.1	0.3	1.1	1.2
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	25.5	44.8	24.3	26.1	48.9	26.9	14.5	14.8	15.5	14.1	14.8	16.3
Level of Service (LOS)	C	D	C	C	D	C	B	B	B	B	B	B
Approach Delay, s/veh / LOS	40.3	D		44.0	D		15.0	B		15.2	B	
Intersection Delay, s/veh / LOS	28.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.28	B	2.29	B	2.10	B	2.10	B
Bicycle LOS Score / LOS	1.51	B	1.43	A	1.00	A	1.03	A

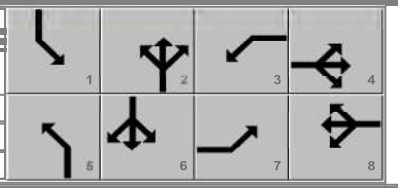
HCS7 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	GHA			Duration, h	0.250
Analyst	JTO	Analysis Date	10/31/2019	Area Type	Other
Jurisdiction	Local	Time Period	EX AM	PHF	0.99
Urban Street	Madison St & Ridgeland…	Analysis Year	2019	Analysis Period	1> 7:00
Intersection	Madison St & Ridgeland…	File Name	Madison & Ridgeland EX AM.xus		
Project Description	EX AM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	90	474	50	36	439	89	121	456	39	128	446	80

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.6	0.3	36.6	3.4	2.1	23.1						
Yellow	3.5	0.0	4.5	3.5	0.0	4.5						
Red	0.0	0.0	1.5	0.0	0.0	1.5						

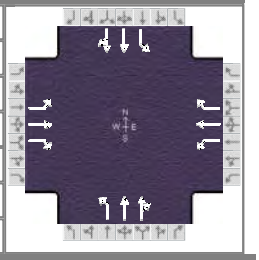
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	0.945	0.984	0.984	0.938	0.977	0.977	0.992	0.977	1.000	0.977	0.984	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.952	0.000		0.952	0.000		0.952	0.000		0.952	0.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.847		0.000	0.847		0.970	0.970		0.944	0.944
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	0.990			0.996			0.996			0.994		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			0.988			0.968			0.988			0.990
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	1711	1969	1566	1697	1953	1523	1795	3546	302	1767	3248	579
Proportion of Vehicles Arriving on Green (P)	0.06	0.28	0.28	0.04	0.26	0.26	0.06	0.54	0.41	0.07	0.55	0.41
Incremental Delay Factor (k)	0.11	0.39	0.15	0.11	0.40	0.15	0.11	0.50	0.50	0.11	0.50	0.50

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)	3.5	6.0	3.5	6.0	3.5	6.0	3.5	6.0
Green Ratio (g/C)	0.32	0.28	0.29	0.26	0.47	0.41	0.47	0.41
Permitted Saturation Flow Rate (s_p), veh/h/ln	909	0	872	0	879	0	891	0
Shared Saturation Flow Rate (s_{sh}), veh/h/ln								
Permitted Effective Green Time (g_p), s	23.6	0.0	23.1	0.0	36.6	0.0	36.6	0.0
Permitted Service Time (g_u), s	3.4	0.0	2.3	0.0	27.3	0.0	29.8	0.0
Permitted Queue Service Time (g_{ps}), s	2.2		0.9		1.5		1.1	
Time to First Blockage (g_f), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln		0		0				
Protected Right Effective Green Time (g_R), s		0.0		0.0				

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.557	0.000	1.557	0.000	1.389	0.000	1.389	0.000
Pedestrian F_s / F_{delay}	0.000	0.126	0.000	0.129	0.000	0.111	0.000	0.110
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	558.46	23.38	512.64	24.89	813.17	15.85	819.03	15.69
Bicycle F_w / F_v	-3.64	1.02	-3.64	0.94	-3.64	0.51	-3.64	0.55

HCS7 Signalized Intersection Results Graphical Summary

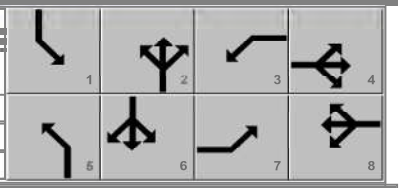
General Information				Intersection Information	
Agency	GHA			Duration, h	0.250
Analyst	JTO	Analysis Date	10/31/2019	Area Type	Other
Jurisdiction	Local	Time Period	EX AM	PHF	0.99
Urban Street	Madison St & Ridgeland…	Analysis Year	2019	Analysis Period	1> 7:00
Intersection	Madison St & Ridgeland…	File Name	Madison & Ridgeland EX AM.xus		
Project Description	EX AM				



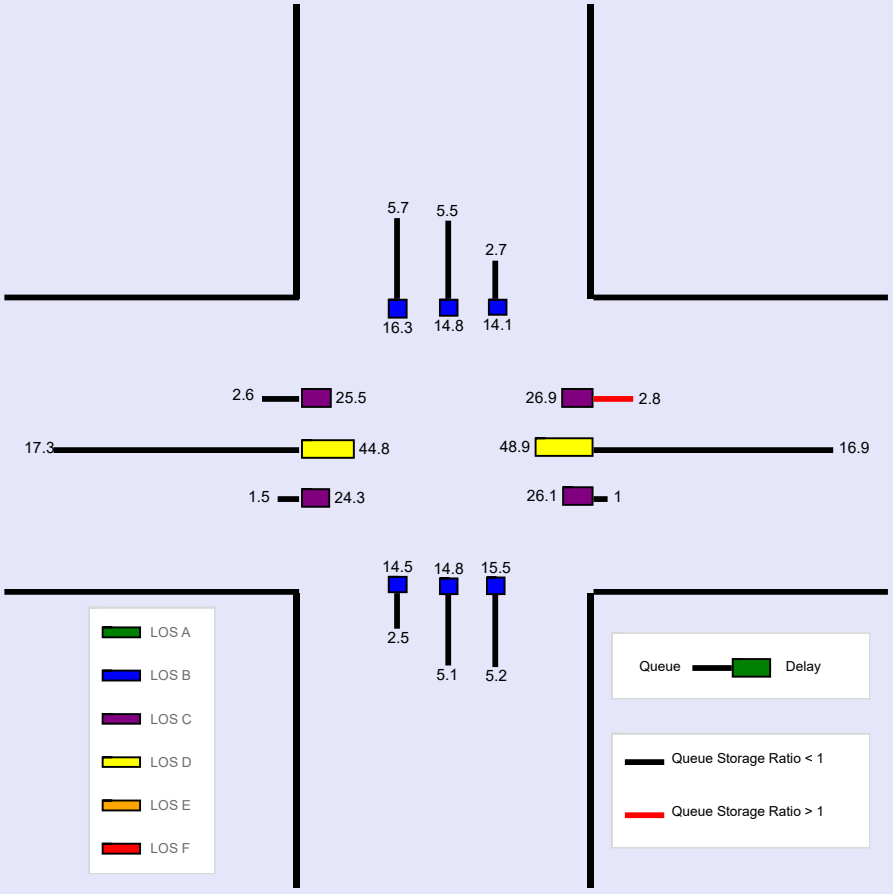
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	90	474	50	36	439	89	121	456	39	128	446	80

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.6	0.3	36.6	3.4	2.1	23.1	
Yellow	3.5	0.0	4.5	3.5	0.0	4.5	
Red	0.0	0.0	1.5	0.0	0.0	1.5	



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)	67.5	439.4	37	27.6	431.6	71.2	63.4	130.1	130.6	68	138.4	143.6
Back of Queue (*Q*), veh/ln (95 th percentile)	2.6	17.3	1.5	1.0	16.9	2.8	2.5	5.1	5.2	2.7	5.5	5.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.67	0.00	0.46	0.42	0.00	1.42	0.79	0.00	0.00	0.85	0.00	0.00
Control Delay (*d*), s/veh	25.5	44.8	24.3	26.1	48.9	26.9	14.5	14.8	15.5	14.1	14.8	16.3
Level of Service (LOS)	C	D	C	C	D	C	B	B	B	B	B	B
Approach Delay, s/veh / LOS	40.3	D		44.0	D		15.0	B		15.2	B	
Intersection Delay, s/veh / LOS	28.1						C					



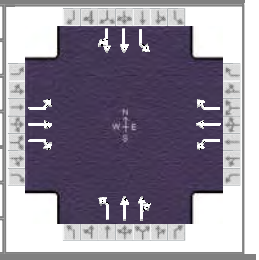
--- Messages ---

WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

--- Comments ---

HCS7 Signalized Intersection Input Data

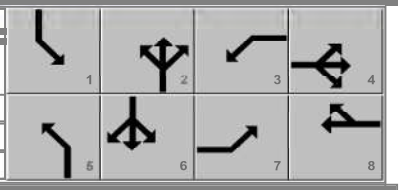
General Information				Intersection Information	
Agency	GHA			Duration, h	0.250
Analyst	JTO	Analysis Date	10/31/2019	Area Type	Other
Jurisdiction	Local	Time Period	EX PM	PHF	0.98
Urban Street	Madison St & Ridgeland…	Analysis Year	2019	Analysis Period	1> 5:00
Intersection	Madison St & Ridgeland…	File Name	Madison & Ridgeland EX PM.xus		
Project Description	EX PM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	112	415	82	46	395	71	45	548	124	83	545	80

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	3.3	1.1		38.9	4.3	2.0	21.4					
Yellow	3.5	0.0		4.5	3.5	0.0	4.5					
Red	0.0	0.0		1.5	0.0	0.0	1.5					



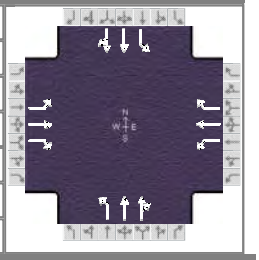
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	112	415	82	46	395	71	45	548	124	83	545	80
Initial Queue (Q_b), veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Base Saturation Flow Rate (s_o), veh/h	1900	2000	1900	1900	2000	1900	1900	2000	1900	1900	2000	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %	2	2	1	2	1	1	0	1		0	1	
Ped / Bike / RTOR, /h	23	0	0	61	0	0	34	0	0	47	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)	3	3	3	3	3	3	3	4	3	3	4	3
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (*W*), ft	11.0	11.0	11.0	10.0	11.0	11.0	10.0	10.0		10.0	10.0	
Turn Bay Length, ft	100	0	80	65	0	50	80	0		80	0	
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h	30	30	30	30	30	30	30	30	30	30	30	30

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s	12.0	27.0	12.0	27.0	12.0	39.0	12.0	39.0
Yellow Change Interval (*Y*), s	3.5	4.5	3.5	4.5	3.5	4.5	3.5	4.5
Red Clearance Interval (R_c), s	0.0	1.5	0.0	1.5	0.0	1.5	0.0	1.5
Minimum Green (G_{min}), s	3	8	3	8	3	15	3	15
Start-Up Lost Time (*lt*), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (*e*), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (*PT*), s	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
Recall Mode	Off	Off	Off	Off	Off	Min	Off	Min
Dual Entry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

HCS7 Signalized Intersection Results Summary

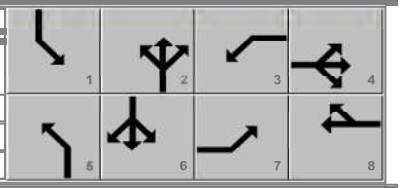
General Information				Intersection Information	
Agency	GHA			Duration, h	0.250
Analyst	JTO	Analysis Date	10/31/2019	Area Type	Other
Jurisdiction	Local	Time Period	EX PM	PHF	0.98
Urban Street	Madison St & Ridgeland…	Analysis Year	2019	Analysis Period	1> 5:00
Intersection	Madison St & Ridgeland…	File Name	Madison & Ridgeland EX PM.xus		
Project Description	EX PM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	112	415	82	46	395	71	45	548	124	83	545	80

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	3.3	1.1	38.9	4.3	2.0	21.4
Yellow	3.5	0.0	4.5	3.5	0.0	4.5
Red	0.0	0.0	1.5	0.0	0.0	1.5



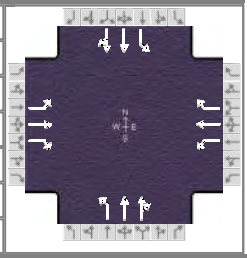
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	2.0	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	9.8	29.4	7.8	27.4	6.8	44.9	7.9	46.0
Change Period, (*Y+R c*), s	3.5	6.0	3.5	6.0	3.5	6.0	3.5	6.0
Max Allow Headway (*MAH*), s	4.1	5.1	4.1	5.1	4.1	0.0	4.1	0.0
Queue Clearance Time (*g s*), s	6.2	20.3	4.3	19.5	3.2		4.3	
Green Extension Time (*g e*), s	0.1	2.5	0.0	2.0	0.0	0.0	0.1	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	1.00	0.91	1.00	0.02		0.15	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	114	423	84	47	403	72	46	356	330	85	328	310
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1969	1555	1781	1984	1475	1810	1984	1825	1810	1984	1864
Queue Service Time (*g s*), s	4.2	18.3	3.8	2.3	17.5	3.5	1.2	9.0	10.0	2.3	7.8	8.4
Cycle Queue Clearance Time (*g c*), s	4.2	18.3	3.8	2.3	17.5	3.5	1.2	9.0	10.0	2.3	7.8	8.4
Green Ratio (*g/C*)	0.31	0.26	0.26	0.05	0.24	0.24	0.47	0.43	0.43	0.48	0.44	0.44
Capacity (*c*), veh/h	248	512	404	86	473	351	410	857	788	415	881	828
Volume-to-Capacity Ratio (*X*)	0.461	0.827	0.207	0.546	0.853	0.206	0.112	0.415	0.418	0.204	0.372	0.374
Back of Queue (*Q*), ft/ln (95 th percentile)	83.9	381.8	64.3	51.9	378.9	57.6	22.6	173.8	183.3	41.5	150	156.1
Back of Queue (*Q*), veh/ln (95 th percentile)	3.3	15.0	2.6	2.0	15.0	2.3	0.9	6.9	7.3	1.7	6.0	6.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.84	0.00	0.80	0.80	0.00	1.15	0.28	0.00	0.00	0.52	0.00	0.00
Uniform Delay (*d 1*), s/veh	24.7	31.4	26.0	41.9	32.8	27.5	13.6	12.7	14.6	13.4	11.8	13.1
Incremental Delay (*d 2*), s/veh	1.3	10.2	0.4	5.3	13.0	0.4	0.1	1.5	1.6	0.2	1.2	1.3
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	26.0	41.6	26.4	47.2	45.8	27.9	13.7	14.2	16.3	13.6	13.0	14.4
Level of Service (LOS)	C	D	C	D	D	C	B	B	B	B	B	B
Approach Delay, s/veh / LOS	36.7	D		43.4	D		15.1	B		13.6	B	
Intersection Delay, s/veh / LOS	25.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	2.29	B	2.10	B	2.09	B
Bicycle LOS Score / LOS	1.51	B	1.35	A	1.09	A	1.08	A

HCS7 Signalized Intersection Intermediate Values

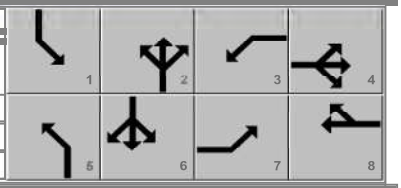
General Information				Intersection Information	
Agency	GHA			Duration, h	0.250
Analyst	JTO	Analysis Date	10/31/2019	Area Type	Other
Jurisdiction	Local	Time Period	EX PM	PHF	0.98
Urban Street	Madison St & Ridgeland…	Analysis Year	2019	Analysis Period	1> 5:00
Intersection	Madison St & Ridgeland…	File Name	Madison & Ridgeland EX PM.xus		
Project Description	EX PM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	112	415	82	46	395	71	45	548	124	83	545	80

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	3.3	1.1		38.9	4.3	2.0		21.4				
Yellow	3.5	0.0		4.5	3.5	0.0		4.5				
Red	0.0	0.0		1.5	0.0	0.0		1.5				



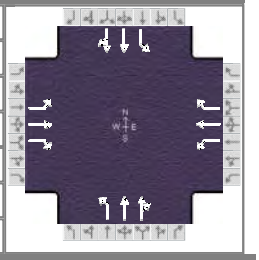
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	0.984	0.984	0.992	0.984	0.992	0.992	1.000	0.992	1.000	1.000	0.992	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.952	0.000		0.952	0.000		0.952	0.000		0.952	0.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.847		0.000	0.847		0.919	0.919		0.939	0.939
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	0.975			1.000			0.980			0.987		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			0.973			0.923			0.961			0.947
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	1781	1969	1555	1781	1984	1475	1810	3109	700	1810	3357	491
Proportion of Vehicles Arriving on Green (P)	0.07	0.26	0.26	0.05	0.24	0.24	0.04	0.58	0.43	0.05	0.59	0.44
Incremental Delay Factor (k)	0.11	0.34	0.15	0.11	0.35	0.15	0.11	0.50	0.50	0.11	0.50	0.50

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)	3.5	6.0	3.5	6.0	3.5	6.0	3.5	6.0
Green Ratio (g/C)	0.31	0.26	0.05	0.24	0.47	0.43	0.48	0.44
Permitted Saturation Flow Rate (s_p), veh/h/ln	982	0	0	0	803	0	768	0
Shared Saturation Flow Rate (s_{sh}), veh/h/ln								
Permitted Effective Green Time (g_p), s	21.9	0.0	0.0	0.0	38.9	0.0	38.9	0.0
Permitted Service Time (g_u), s	4.0	0.0	0.0	0.0	29.5	0.0	28.9	0.0
Permitted Queue Service Time (g_{ps}), s	2.4				0.6		1.2	
Time to First Blockage (g_f), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln		0		0				
Protected Right Effective Green Time (g_R), s		0.0		0.0				

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.557	0.000	1.557	0.000	1.389	0.000	1.389	0.000
Pedestrian F_s / F_{delay}	0.000	0.129	0.000	0.131	0.000	0.107	0.000	0.106
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	519.87	24.65	476.45	26.11	863.98	14.52	888.40	13.90
Bicycle F_w / F_v	-3.64	1.03	-3.64	0.86	-3.64	0.60	-3.64	0.60

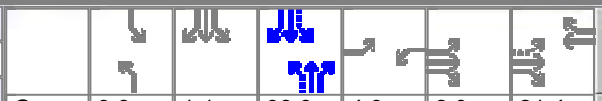
HCS7 Signalized Intersection Results Graphical Summary

General Information				Intersection Information	
Agency	GHA			Duration, h	0.250
Analyst	JTO	Analysis Date	10/31/2019	Area Type	Other
Jurisdiction	Local	Time Period	EX PM	PHF	0.98
Urban Street	Madison St & Ridgeland…	Analysis Year	2019	Analysis Period	1> 5:00
Intersection	Madison St & Ridgeland…	File Name	Madison & Ridgeland EX PM.xus		
Project Description	EX PM				

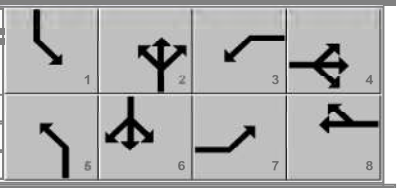


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	112	415	82	46	395	71	45	548	124	83	545	80

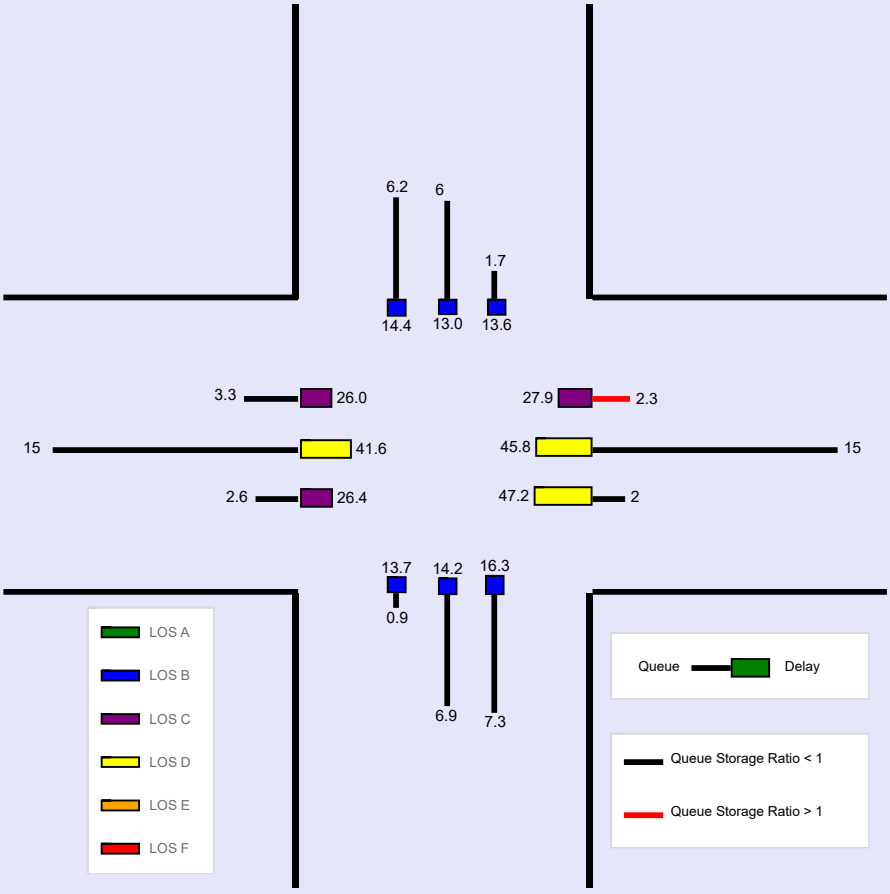
Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	3.3	1.1		38.9	4.3	2.0	21.4					
Yellow	3.5	0.0		4.5	3.5	0.0	4.5					
Red	0.0	0.0		1.5	0.0	0.0	1.5					



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)	83.9	381.8	64.3	51.9	378.9	57.6	22.6	173.8	183.3	41.5	150	156.1
Back of Queue (*Q*), veh/ln (95 th percentile)	3.3	15.0	2.6	2.0	15.0	2.3	0.9	6.9	7.3	1.7	6.0	6.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.84	0.00	0.80	0.80	0.00	1.15	0.28	0.00	0.00	0.52	0.00	0.00
Control Delay (*d*), s/veh	26.0	41.6	26.4	47.2	45.8	27.9	13.7	14.2	16.3	13.6	13.0	14.4
Level of Service (LOS)	C	D	C	D	D	C	B	B	B	B	B	B
Approach Delay, s/veh / LOS	36.7	D		43.4	D		15.1	B		13.6	B	
Intersection Delay, s/veh / LOS	25.6						C					



--- Messages ---

WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

--- Comments ---

HCS7 Two-Way Stop-Control Report

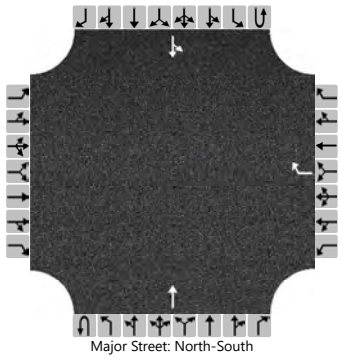
General Information

Analyst	JTO
Agency/Co.	GHA
Date Performed	10/31/2019
Analysis Year	2026
Time Analyzed	2026 TOTAL AM
Intersection Orientation	North-South
Project Description	5244.925

Site Information

Intersection	Gunderson Ave & Site
Jurisdiction	Local
East/West Street	Site Access
North/South Street	Gunderson Ave
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	1	0	0	0	1	0
Configuration								R			T			LT		
Volume (veh/h)								13			14			4	31	
Percent Heavy Vehicles (%)								0						0		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized						No										
Median Type | Storage						Undivided										

Critical and Follow-up Headways

Base Critical Headway (sec)								6.2						4.1		
Critical Headway (sec)								6.20						4.10		
Base Follow-Up Headway (sec)								3.3						2.2		
Follow-Up Headway (sec)								3.30						2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								14						4		
Capacity, c (veh/h)								1070						1616		
v/c Ratio								0.01						0.00		
95% Queue Length, Q_{95} (veh)								0.0						0.0		
Control Delay (s/veh)								8.4						7.2		
Level of Service (LOS)								A						A		
Approach Delay (s/veh)						8.4								0.8		
Approach LOS						A										

HCS7 Two-Way Stop-Control Report

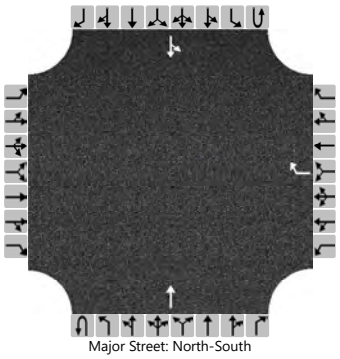
General Information

Analyst	JTO
Agency/Co.	GHA
Date Performed	10/31/2019
Analysis Year	2026
Time Analyzed	2026 TOTAL PM
Intersection Orientation	North-South
Project Description	5244.925

Site Information

Intersection	Gunderson Ave & Site
Jurisdiction	Local
East/West Street	Site Access
North/South Street	Gunderson Ave
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	1	0	0	0	1	0
Configuration								R			T			LT		
Volume (veh/h)								9			22			13	21	
Percent Heavy Vehicles (%)								0						0		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized						No										
Median Type | Storage						Undivided										

Critical and Follow-up Headways

Base Critical Headway (sec)								6.2						4.1		
Critical Headway (sec)								6.20						4.10		
Base Follow-Up Headway (sec)								3.3						2.2		
Follow-Up Headway (sec)								3.30						2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								10						14		
Capacity, c (veh/h)								1058						1604		
v/c Ratio								0.01						0.01		
95% Queue Length, Q_{95} (veh)								0.0						0.0		
Control Delay (s/veh)								8.4						7.3		
Level of Service (LOS)								A						A		
Approach Delay (s/veh)						8.4								2.8		
Approach LOS						A										

HCS7 Two-Way Stop-Control Report

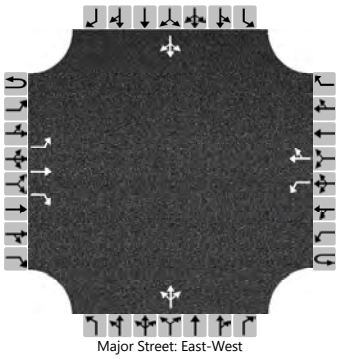
General Information

Analyst	JTO
Agency/Co.	GHA
Date Performed	10/31/2019
Analysis Year	2026
Time Analyzed	2026 TOTAL AM
Intersection Orientation	East-West
Project Description	5244.925

Site Information

Intersection	Madison St & Elmwood Ave
Jurisdiction	Local
East/West Street	Madison St
North/South Street	Elmwood Ave
Peak Hour Factor	0.97
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	1	0	1	1	0		0	1	0		0	1	0
Configuration		L	T	R		L		TR			LTR				LTR	
Volume (veh/h)		2	618	9		17	630	2		1	0	10		0	0	0
Percent Heavy Vehicles (%)		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized		No														
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.10				4.10				7.10	6.50	6.20		7.10	6.50	6.20
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.20				2.20				3.50	4.00	3.30		3.50	4.00	3.30

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		2				18					11				0	
Capacity, c (veh/h)		918				942					443					
v/c Ratio		0.00				0.02					0.03					
95% Queue Length, Q_{95} (veh)		0.0				0.1					0.1					
Control Delay (s/veh)		8.9				8.9					13.3					
Level of Service (LOS)		A				A					B					
Approach Delay (s/veh)		0.0				0.2				13.3						
Approach LOS										B						

HCS7 Two-Way Stop-Control Report

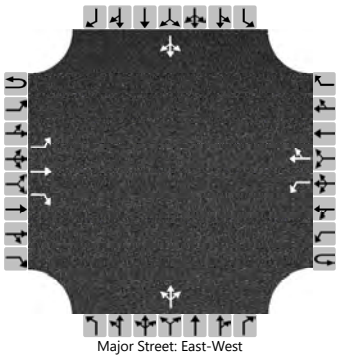
General Information

Analyst	JTO
Agency/Co.	GHA
Date Performed	10/31/2019
Analysis Year	2026
Time Analyzed	2026 TOTAL PM
Intersection Orientation	East-West
Project Description	5244.925

Site Information

Intersection	Madison St & Elmwood Ave
Jurisdiction	Local
East/West Street	Madison St
North/South Street	Elmwood Ave
Peak Hour Factor	0.97
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	1	0	1	1	0		0	1	0		0	1	0
Configuration		L	T	R		L		TR			LTR				LTR	
Volume (veh/h)		4	611	12		2	530	1		1	0	9		1	0	6
Percent Heavy Vehicles (%)		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized		No														
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.10				4.10				7.10	6.50	6.20		7.10	6.50	6.20
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.20				2.20				3.50	4.00	3.30		3.50	4.00	3.30

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		4				2					10				7	
Capacity, c (veh/h)		1003				945					451				465	
v/c Ratio		0.00				0.00					0.02				0.02	
95% Queue Length, Q_{95} (veh)		0.0				0.0					0.1				0.0	
Control Delay (s/veh)		8.6				8.8					13.2				12.9	
Level of Service (LOS)		A				A					B				B	
Approach Delay (s/veh)		0.1				0.0				13.2				12.9		
Approach LOS										B				B		

HCS7 Two-Way Stop-Control Report

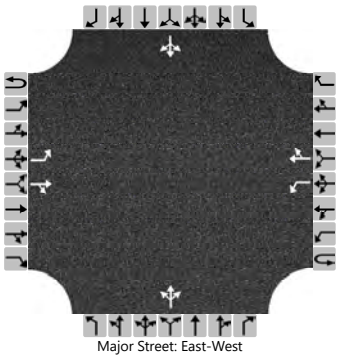
General Information

Analyst	JTO
Agency/Co.	GHA
Date Performed	10/31/2019
Analysis Year	2026
Time Analyzed	2026 TOTAL AM
Intersection Orientation	East-West
Project Description	5244.925

Site Information

Intersection	Madison St & Gunderson Av
Jurisdiction	Local
East/West Street	Madison St
North/South Street	Gunderson Ave
Peak Hour Factor	0.93
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	1	1	0		0	1	0		0	1	0
Configuration		L		TR		L		TR			LTR				LTR	
Volume (veh/h)		2	601	16		18	611	2		8	0	19		9	1	13
Percent Heavy Vehicles (%)		0				0				0	0	0		0	0	23
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized																
Median Type | Storage		Left + Thru								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.10				4.10				7.10	6.50	6.20		7.10	6.50	6.43
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.20				2.20				3.50	4.00	3.30		3.50	4.00	3.51

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		2				19					29				25	
Capacity, c (veh/h)		877				930					361				298	
v/c Ratio		0.00				0.02					0.08				0.08	
95% Queue Length, Q_{95} (veh)		0.0				0.1					0.3				0.3	
Control Delay (s/veh)		9.1				9.0					15.8				18.2	
Level of Service (LOS)		A				A					C				C	
Approach Delay (s/veh)	0.0				0.3				15.8				18.2			
Approach LOS									C				C			

HCS7 Two-Way Stop-Control Report

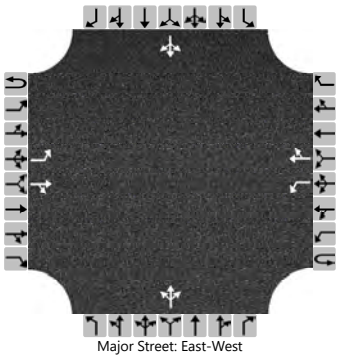
General Information

Analyst	JTO
Agency/Co.	GHA
Date Performed	10/31/2019
Analysis Year	2026
Time Analyzed	2026 TOTAL PM
Intersection Orientation	East-West
Project Description	5244.925

Site Information

Intersection	Madison St & Gunderson Av
Jurisdiction	Local
East/West Street	Madison St
North/South Street	Gunderson Ave
Peak Hour Factor	0.96
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	1	1	0		0	1	0		0	1	0
Configuration		L		TR		L		TR			LTR				LTR	
Volume (veh/h)		4	592	23		11	517	9		11	1	19		16	0	18
Percent Heavy Vehicles (%)		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized																
Median Type | Storage		Left + Thru								1						

Critical and Follow-up Headways

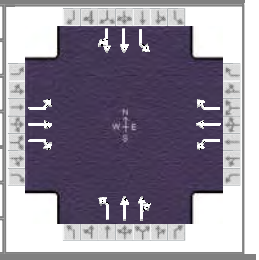
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.10				4.10				7.10	6.50	6.20		7.10	6.50	6.20
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.20				2.20				3.50	4.00	3.30		3.50	4.00	3.30

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		4				11					32				35	
Capacity, c (veh/h)		912				953					378				333	
v/c Ratio		0.00				0.01					0.09				0.11	
95% Queue Length, Q_{95} (veh)		0.0				0.0					0.3				0.4	
Control Delay (s/veh)		9.0				8.8					15.4				17.1	
Level of Service (LOS)		A				A					C				C	
Approach Delay (s/veh)		0.1				0.2				15.4				17.1		
Approach LOS										C				C		

HCS7 Signalized Intersection Input Data

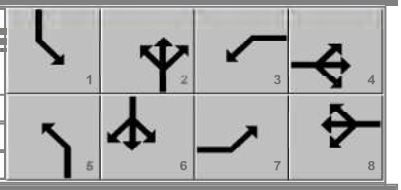
General Information				Intersection Information	
Agency	GHA			Duration, h	0.250
Analyst	JTO	Analysis Date	Oct 31, 2019	Area Type	Other
Jurisdiction	Local	Time Period	2026 TOTAL AM	PHF	0.99
Urban Street	Madison St & Ridgeland…	Analysis Year	2026	Analysis Period	1> 7:00
Intersection	Madison St & Ridgeland…	File Name	Madison & Ridgeland 2026 TOTAL AM.xus		
Project Description	2026 TOTAL AM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	93	482	53	36	444	90	123	460	39	129	450	82

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.7	0.2	36.4	3.4	2.2	23.1						
Yellow	3.5	0.0	4.5	3.5	0.0	4.5						
Red	0.0	0.0	1.5	0.0	0.0	1.5						



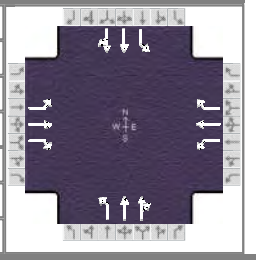
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	93	482	53	36	444	90	123	460	39	129	450	82
Initial Queue (Q_b), veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Base Saturation Flow Rate (s_o), veh/h	1900	2000	1900	1900	2000	1900	1900	2000	1900	1900	2000	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %	7	2	2	8	3	3	1	3		3	2	
Ped / Bike / RTOR, /h	11	0	0	27	0	0	10	0	0	8	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)	3	3	3	3	3	3	3	4	3	3	4	3
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (*W*), ft	11.0	11.0	11.0	10.0	11.0	11.0	10.0	10.0		10.0	10.0	
Turn Bay Length, ft	100	0	80	65	0	50	80	0		80	0	
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h	30	30	30	30	30	30	30	30	30	30	30	30

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s	12.0	27.0	12.0	27.0	12.0	39.0	12.0	39.0
Yellow Change Interval (*Y*), s	3.5	4.5	3.5	4.5	3.5	4.5	3.5	4.5
Red Clearance Interval (R_c), s	0.0	1.5	0.0	1.5	0.0	1.5	0.0	1.5
Minimum Green (G_{min}), s	3	8	3	8	3	15	3	15
Start-Up Lost Time (*lt*), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (*e*), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (*PT*), s	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
Recall Mode	Off	Off	Off	Off	Off	Min	Off	Min
Dual Entry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

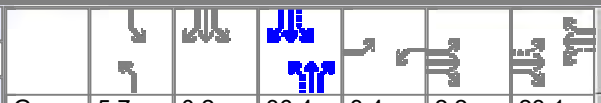
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	GHA			Duration, h	0.250
Analyst	JTO	Analysis Date	Oct 31, 2019	Area Type	Other
Jurisdiction	Local	Time Period	2026 TOTAL AM	PHF	0.99
Urban Street	Madison St & Ridgeland…	Analysis Year	2026	Analysis Period	1> 7:00
Intersection	Madison St & Ridgeland…	File Name	Madison & Ridgeland 2026 TOTAL AM.xus		
Project Description	2026 TOTAL AM				

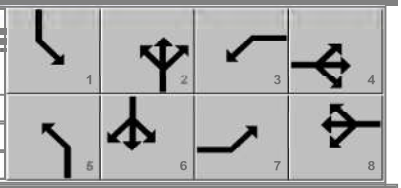


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	93	482	53	36	444	90	123	460	39	129	450	82

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.7	0.2		36.4	3.4	2.2	23.1					
Yellow	3.5	0.0		4.5	3.5	0.0	4.5					
Red	0.0	0.0		1.5	0.0	0.0	1.5					



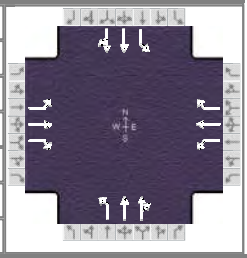
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	9.1	31.3	6.9	29.1	9.2	42.4	9.4	42.6
Change Period, (*Y+R c*), s	3.5	6.0	3.5	6.0	3.5	6.0	3.5	6.0
Max Allow Headway (*MAH*), s	4.1	5.1	4.1	5.1	4.1	0.0	4.1	0.0
Queue Clearance Time (*g s*), s	5.5	23.3	3.4	21.9	5.6		5.8	
Green Extension Time (*g e*), s	0.1	1.7	0.0	1.2	0.1	0.0	0.1	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	1.00	0.25	1.00	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	94	487	54	36	448	91	124	255	249	130	275	262
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1711	1969	1566	1697	1953	1523	1795	1953	1895	1767	1969	1856
Queue Service Time (*g s*), s	3.5	21.3	2.3	1.4	19.9	4.2	3.6	6.6	6.9	3.8	7.1	7.7
Cycle Queue Clearance Time (*g c*), s	3.5	21.3	2.3	1.4	19.9	4.2	3.6	6.6	6.9	3.8	7.1	7.7
Green Ratio (*g/C*)	0.33	0.28	0.28	0.30	0.26	0.26	0.47	0.40	0.40	0.47	0.41	0.41
Capacity (*c*), veh/h	218	554	441	164	502	392	455	789	766	487	801	755
Volume-to-Capacity Ratio (*X*)	0.430	0.879	0.121	0.222	0.893	0.232	0.273	0.323	0.325	0.268	0.343	0.347
Back of Queue (*Q*), ft/ln (95 th percentile)	69.6	450	39.1	27.6	440.1	71.8	64.8	132.5	132.8	68.7	141.5	146.9
Back of Queue (*Q*), veh/ln (95 th percentile)	2.6	17.7	1.5	1.0	17.2	2.8	2.6	5.2	5.3	2.7	5.6	5.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.70	0.00	0.49	0.42	0.00	1.44	0.81	0.00	0.00	0.86	0.00	0.00
Uniform Delay (*d 1*), s/veh	24.2	30.9	24.1	25.4	32.2	26.4	14.3	13.9	14.6	14.0	13.8	15.3
Incremental Delay (*d 2*), s/veh	1.3	14.8	0.2	0.7	17.7	0.4	0.3	1.1	1.1	0.3	1.2	1.3
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	25.6	45.7	24.2	26.1	49.9	26.8	14.6	15.0	15.7	14.3	15.0	16.6
Level of Service (LOS)	C	D	C	C	D	C	B	B	B	B	B	B
Approach Delay, s/veh / LOS	40.9	D		44.8	D		15.2	B		15.5	B	
Intersection Delay, s/veh / LOS	28.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.28	B	2.29	B	2.10	B	2.10	B
Bicycle LOS Score / LOS	1.53	B	1.44	A	1.01	A	1.04	A

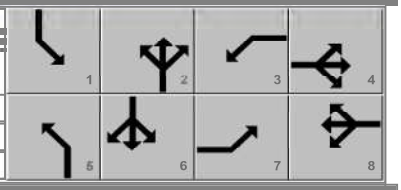
HCS7 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	GHA			Duration, h	0.250
Analyst	JTO	Analysis Date	Oct 31, 2019	Area Type	Other
Jurisdiction	Local	Time Period	2026 TOTAL AM	PHF	0.99
Urban Street	Madison St & Ridgeland…	Analysis Year	2026	Analysis Period	1> 7:00
Intersection	Madison St & Ridgeland…	File Name	Madison & Ridgeland 2026 TOTAL AM.xus		
Project Description	2026 TOTAL AM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	93	482	53	36	444	90	123	460	39	129	450	82

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.7	0.2	36.4	3.4	2.2	23.1						
Yellow	3.5	0.0	4.5	3.5	0.0	4.5						
Red	0.0	0.0	1.5	0.0	0.0	1.5						

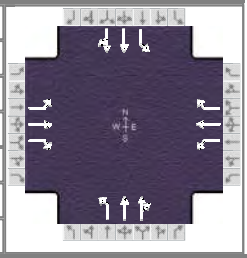
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	0.945	0.984	0.984	0.938	0.977	0.977	0.992	0.977	1.000	0.977	0.984	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.952	0.000		0.952	0.000		0.952	0.000		0.952	0.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.847		0.000	0.847		0.970	0.970		0.943	0.943
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	0.991			0.996			0.996			0.994		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			0.988			0.969			0.988			0.990
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	1711	1969	1566	1697	1953	1523	1795	3548	300	1767	3239	586
Proportion of Vehicles Arriving on Green (P)	0.06	0.28	0.28	0.04	0.26	0.26	0.06	0.54	0.40	0.07	0.54	0.41
Incremental Delay Factor (k)	0.11	0.40	0.15	0.11	0.41	0.15	0.11	0.50	0.50	0.11	0.50	0.50

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)	3.5	6.0	3.5	6.0	3.5	6.0	3.5	6.0
Green Ratio (g/C)	0.33	0.28	0.30	0.26	0.47	0.40	0.47	0.41
Permitted Saturation Flow Rate (s_p), veh/h/ln	904	0	866	0	874	0	888	0
Shared Saturation Flow Rate (s_{sh}), veh/h/ln								
Permitted Effective Green Time (g_p), s	23.8	0.0	23.1	0.0	36.4	0.0	36.4	0.0
Permitted Service Time (g_u), s	3.2	0.0	2.1	0.0	26.9	0.0	29.5	0.0
Permitted Queue Service Time (g_{ps}), s	2.4		0.9		1.6		1.2	
Time to First Blockage (g_f), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln		0		0				
Protected Right Effective Green Time (g_R), s		0.0		0.0				

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.557	0.000	1.557	0.000	1.389	0.000	1.389	0.000
Pedestrian F_s / F_{delay}	0.000	0.126	0.000	0.129	0.000	0.111	0.000	0.111
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	562.58	23.24	514.40	24.83	808.16	15.98	813.39	15.84
Bicycle F_w / F_v	-3.64	1.05	-3.64	0.95	-3.64	0.52	-3.64	0.55

HCS7 Signalized Intersection Results Graphical Summary

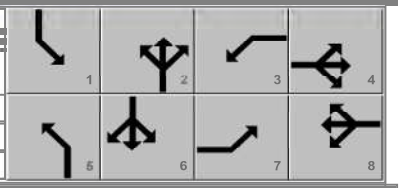
General Information				Intersection Information	
Agency	GHA			Duration, h	0.250
Analyst	JTO	Analysis Date	Oct 31, 2019	Area Type	Other
Jurisdiction	Local	Time Period	2026 TOTAL AM	PHF	0.99
Urban Street	Madison St & Ridgeland…	Analysis Year	2026	Analysis Period	1> 7:00
Intersection	Madison St & Ridgeland…	File Name	Madison & Ridgeland 2026 TOTAL AM.xus		
Project Description	2026 TOTAL AM				



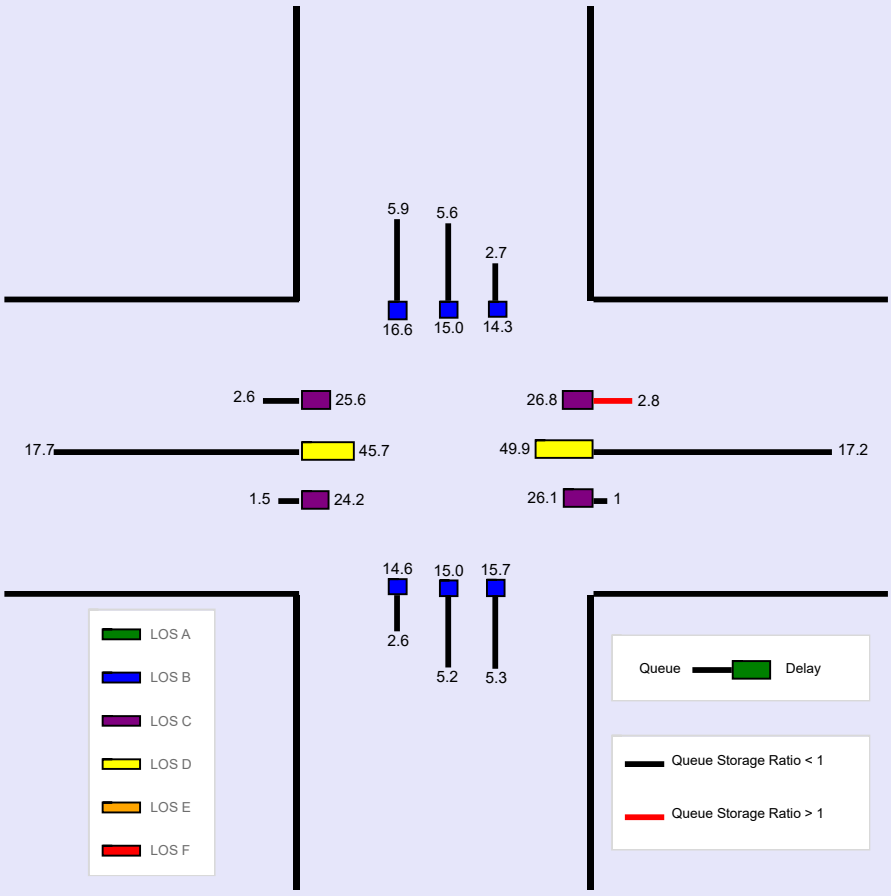
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	93	482	53	36	444	90	123	460	39	129	450	82

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.7	0.2	36.4	3.4	2.2	23.1	
Yellow	3.5	0.0	4.5	3.5	0.0	4.5	
Red	0.0	0.0	1.5	0.0	0.0	1.5	



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)	69.6	450	39.1	27.6	440.1	71.8	64.8	132.5	132.8	68.7	141.5	146.9
Back of Queue (*Q*), veh/ln (95 th percentile)	2.6	17.7	1.5	1.0	17.2	2.8	2.6	5.2	5.3	2.7	5.6	5.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.70	0.00	0.49	0.42	0.00	1.44	0.81	0.00	0.00	0.86	0.00	0.00
Control Delay (*d*), s/veh	25.6	45.7	24.2	26.1	49.9	26.8	14.6	15.0	15.7	14.3	15.0	16.6
Level of Service (LOS)	C	D	C	C	D	C	B	B	B	B	B	B
Approach Delay, s/veh / LOS	40.9	D		44.8	D		15.2	B		15.5	B	
Intersection Delay, s/veh / LOS	28.6						C					



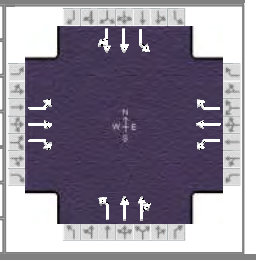
--- Messages ---

WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

--- Comments ---

HCS7 Signalized Intersection Input Data

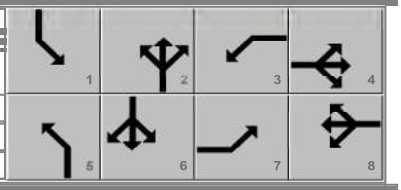
General Information				Intersection Information	
Agency	GHA			Duration, h	0.250
Analyst	JTO	Analysis Date	10/31/2019	Area Type	Other
Jurisdiction	Local	Time Period	2026 TOTAL PM	PHF	0.98
Urban Street	Madison St & Ridgeland…	Analysis Year	2026	Analysis Period	1> 5:00
Intersection	Madison St & Ridgeland…	File Name	Madison & Ridgeland 2026 TOTAL PM.xus		
Project Description	2026 TOTAL PM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	115	421	85	46	402	72	48	553	125	84	550	83

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	3.4	1.0	38.6	3.8	2.6	21.6						
Yellow	3.5	0.0	4.5	3.5	0.0	4.5						
Red	0.0	0.0	1.5	0.0	0.0	1.5						



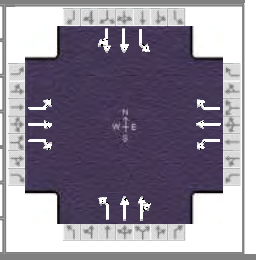
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	115	421	85	46	402	72	48	553	125	84	550	83
Initial Queue (Q_b), veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Base Saturation Flow Rate (s_o), veh/h	1900	2000	1900	1900	2000	1900	1900	2000	1900	1900	2000	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %	2	2	1	2	1	1	0	1		0	1	
Ped / Bike / RTOR, /h	23	0	0	61	0	0	34	0	0	47	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)	3	3	3	3	3	3	3	4	3	3	4	3
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (*W*), ft	11.0	11.0	11.0	10.0	11.0	11.0	10.0	10.0		10.0	10.0	
Turn Bay Length, ft	100	0	80	65	0	50	80	0		80	0	
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h	30	30	30	30	30	30	30	30	30	30	30	30

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s	12.0	27.0	12.0	27.0	12.0	39.0	12.0	39.0
Yellow Change Interval (*Y*), s	3.5	4.5	3.5	4.5	3.5	4.5	3.5	4.5
Red Clearance Interval (R_c), s	0.0	1.5	0.0	1.5	0.0	1.5	0.0	1.5
Minimum Green (G_{min}), s	3	8	3	8	3	15	3	15
Start-Up Lost Time (*lt*), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (*e*), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (*PT*), s	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
Recall Mode	Off	Off	Off	Off	Off	Min	Off	Min
Dual Entry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Walk (*Walk*), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

HCS7 Signalized Intersection Results Summary

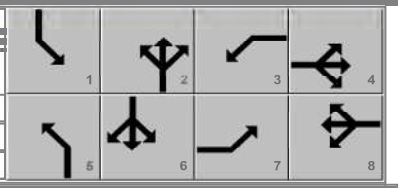
General Information				Intersection Information	
Agency	GHA			Duration, h	0.250
Analyst	JTO	Analysis Date	10/31/2019	Area Type	Other
Jurisdiction	Local	Time Period	2026 TOTAL PM	PHF	0.98
Urban Street	Madison St & Ridgeland…	Analysis Year	2026	Analysis Period	1> 5:00
Intersection	Madison St & Ridgeland…	File Name	Madison & Ridgeland 2026 TOTAL PM.xus		
Project Description	2026 TOTAL PM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	115	421	85	46	402	72	48	553	125	84	550	83

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	3.4	1.0	38.6	3.8	2.6	21.6	
Yellow	3.5	0.0	4.5	3.5	0.0	4.5	
Red	0.0	0.0	1.5	0.0	0.0	1.5	



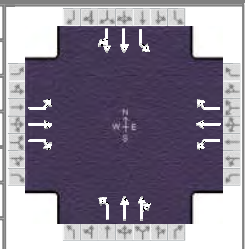
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	9.9	30.2	7.3	27.6	6.9	44.6	7.9	45.6
Change Period, ($Y+R_c$), s	3.5	6.0	3.5	6.0	3.5	6.0	3.5	6.0
Max Allow Headway (*MAH*), s	4.1	5.1	4.1	5.1	4.1	0.0	4.1	0.0
Queue Clearance Time (g_s), s	6.3	20.4	3.7	19.8	3.3		4.3	
Green Extension Time (g_e), s	0.1	2.7	0.0	1.8	0.0	0.0	0.1	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	0.97	0.44	1.00	0.04		0.20	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	117	430	87	47	410	73	49	359	333	86	332	314
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1969	1557	1781	1984	1476	1810	1984	1824	1810	1984	1861
Queue Service Time (g_s), s	4.3	18.4	3.9	1.7	17.8	3.6	1.3	9.2	10.2	2.3	8.0	8.7
Cycle Queue Clearance Time (g_c), s	4.3	18.4	3.9	1.7	17.8	3.6	1.3	9.2	10.2	2.3	8.0	8.7
Green Ratio (*g/C*)	0.32	0.27	0.27	0.28	0.24	0.24	0.47	0.43	0.43	0.48	0.44	0.44
Capacity (*c*), veh/h	247	530	419	196	477	355	404	851	782	410	874	819
Volume-to-Capacity Ratio (*X*)	0.475	0.811	0.207	0.240	0.860	0.207	0.121	0.422	0.425	0.209	0.380	0.383
Back of Queue (*Q*), ft/ln (95 th percentile)	84.8	377.9	65.8	34.6	388	58.2	24.3	177.7	187	42.3	154.6	160.7
Back of Queue (*Q*), veh/ln (95 th percentile)	3.3	14.9	2.6	1.4	15.4	2.3	1.0	7.1	7.5	1.7	6.1	6.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.85	0.00	0.82	0.53	0.00	1.16	0.30	0.00	0.00	0.53	0.00	0.00
Uniform Delay (d_1), s/veh	24.3	30.8	25.5	25.7	32.7	27.3	13.7	13.0	14.9	13.5	12.0	13.4
Incremental Delay (d_2), s/veh	1.4	8.9	0.3	0.6	13.9	0.4	0.1	1.5	1.7	0.3	1.3	1.4
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	25.8	39.7	25.8	26.3	46.6	27.7	13.9	14.5	16.6	13.8	13.3	14.7
Level of Service (LOS)	C	D	C	C	D	C	B	B	B	B	B	B
Approach Delay, s/veh / LOS	35.2	D		42.2	D		15.4	B		14.0	B	
Intersection Delay, s/veh / LOS	25.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.28	B	2.29	B	2.10	B	2.09	B
Bicycle LOS Score / LOS	1.53	B	1.36	A	1.10	A	1.09	A

HCS7 Signalized Intersection Intermediate Values

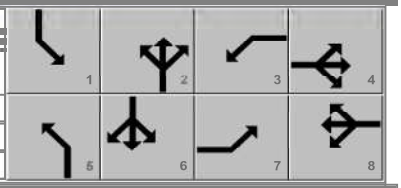
General Information				Intersection Information	
Agency	GHA			Duration, h	0.250
Analyst	JTO	Analysis Date	10/31/2019	Area Type	Other
Jurisdiction	Local	Time Period	2026 TOTAL PM	PHF	0.98
Urban Street	Madison St & Ridgeland…	Analysis Year	2026	Analysis Period	1> 5:00
Intersection	Madison St & Ridgeland…	File Name	Madison & Ridgeland 2026 TOTAL PM.xus		
Project Description	2026 TOTAL PM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	115	421	85	46	402	72	48	553	125	84	550	83

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	3.4	1.0		38.6	3.8	2.6		21.6				
Yellow	3.5	0.0		4.5	3.5	0.0		4.5				
Red	0.0	0.0		1.5	0.0	0.0		1.5				



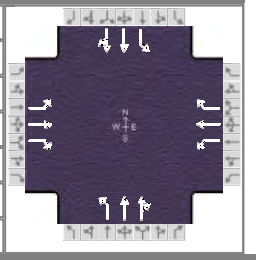
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	0.984	0.984	0.992	0.984	0.992	0.992	1.000	0.992	1.000	1.000	0.992	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.952	0.000		0.952	0.000		0.952	0.000		0.952	0.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.847		0.000	0.847		0.919	0.919		0.938	0.938
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	0.976			0.991			0.980			0.987		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			0.974			0.924			0.960			0.947
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	1781	1969	1557	1781	1984	1476	1810	3109	700	1810	3343	502
Proportion of Vehicles Arriving on Green (P)	0.07	0.27	0.27	0.04	0.24	0.24	0.04	0.57	0.43	0.05	0.59	0.44
Incremental Delay Factor (k)	0.11	0.34	0.15	0.11	0.36	0.15	0.11	0.50	0.50	0.11	0.50	0.50

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)	3.5	6.0	3.5	6.0	3.5	6.0	3.5	6.0
Green Ratio (g/C)	0.32	0.27	0.28	0.24	0.47	0.43	0.48	0.44
Permitted Saturation Flow Rate (s_p), veh/h/ln	976	0	958	0	797	0	764	0
Shared Saturation Flow Rate (s_{sh}), veh/h/ln								
Permitted Effective Green Time (g_p), s	22.7	0.0	21.6	0.0	38.6	0.0	38.6	0.0
Permitted Service Time (g_u), s	3.8	0.0	3.8	0.0	29.0	0.0	28.4	0.0
Permitted Queue Service Time (g_{ps}), s	2.6		0.9		0.6		1.3	
Time to First Blockage (g_f), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln		0		0				
Protected Right Effective Green Time (g_R), s		0.0		0.0				

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.557	0.000	1.557	0.000	1.389	0.000	1.389	0.000
Pedestrian F_s / F_{delay}	0.000	0.128	0.000	0.131	0.000	0.108	0.000	0.106
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	537.95	24.05	480.59	25.97	857.62	14.68	880.84	14.09
Bicycle F_w / F_v	-3.64	1.05	-3.64	0.88	-3.64	0.61	-3.64	0.60

HCS7 Signalized Intersection Results Graphical Summary

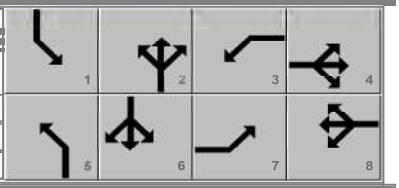
General Information				Intersection Information	
Agency	GHA			Duration, h	0.250
Analyst	JTO	Analysis Date	10/31/2019	Area Type	Other
Jurisdiction	Local	Time Period	2026 TOTAL PM	PHF	0.98
Urban Street	Madison St & Ridgeland…	Analysis Year	2026	Analysis Period	1> 5:00
Intersection	Madison St & Ridgeland…	File Name	Madison & Ridgeland 2026 TOTAL PM.xus		
Project Description	2026 TOTAL PM				



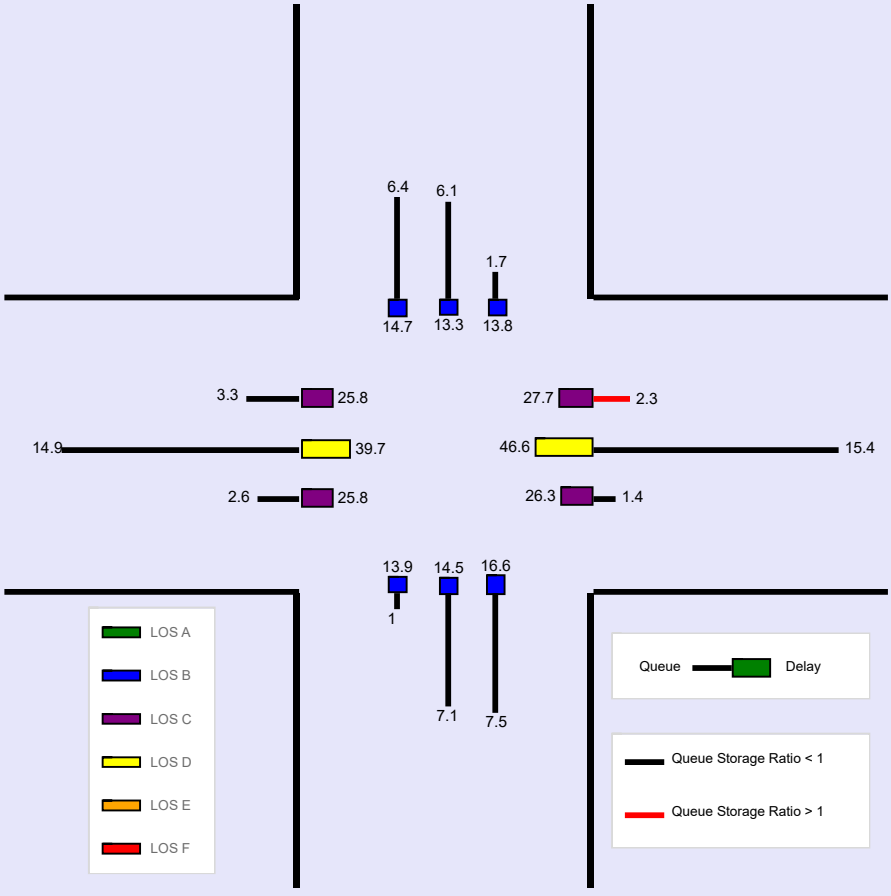
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	115	421	85	46	402	72	48	553	125	84	550	83

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	3.4	1.0	38.6	3.8	2.6	21.6						
Yellow	3.5	0.0	4.5	3.5	0.0	4.5						
Red	0.0	0.0	1.5	0.0	0.0	1.5						



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)	84.8	377.9	65.8	34.6	388	58.2	24.3	177.7	187	42.3	154.6	160.7
Back of Queue (*Q*), veh/ln (95 th percentile)	3.3	14.9	2.6	1.4	15.4	2.3	1.0	7.1	7.5	1.7	6.1	6.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.85	0.00	0.82	0.53	0.00	1.16	0.30	0.00	0.00	0.53	0.00	0.00
Control Delay (*d*), s/veh	25.8	39.7	25.8	26.3	46.6	27.7	13.9	14.5	16.6	13.8	13.3	14.7
Level of Service (LOS)	C	D	C	C	D	C	B	B	B	B	B	B
Approach Delay, s/veh / LOS	35.2		D	42.2		D	15.4		B	14.0		B
Intersection Delay, s/veh / LOS	25.1						C					



--- Messages ---

WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

--- Comments ---

