



September 14, 2022

Mr. Dale Mahoney
Ghilotti Construction Company Inc.
246 Ghilotti Avenue
Santa Rosa, CA 95407

Draft Warrant Study for the Ghilotti Construction Yard Project

Dear Mr. Mahoney;

W-Trans has completed an evaluation of the operational effects of converting to all-way stop controls at the intersection of Todd Road/Standish Avenue-Ghilotti Avenue in the County of Sonoma as an interim measure until the planned traffic signal can be constructed. The purpose of this letter is to set forth the data used, results of the analysis performed, and recommendations.

Setting

The intersection Todd Road/Standish Avenue-Ghilotti Avenue is a four-way intersection, with Ghilotti Avenue forming the south leg and Standish Avenue on the north side of the intersection. Ghilotti Avenue and Standish Avenue are currently stop-controlled, while traffic on Todd Road is free flowing.

Warrant Analysis

The California *Manual on Uniform Traffic Control Devices* (CA-MUTCD) provides warrant criteria for converting a two-way stop-controlled intersection to all-way stop controls (AWSC). Under the AWSC warrant criteria, at least one of the following four conditions should be satisfied to warrant AWSC installation.

1. A traffic signal has been warranted at the intersection, and the AWSC is an interim measure;
2. Five or more crashes in a 12-month period have occurred that are susceptible to correction by installing AWSC, such as right-turn, left-turn, and right-angle collisions;
3. The major street vehicle volume averages at least 300 vehicles per hour for each of eight hours on a typical day, the combined vehicle, pedestrian, and bicycle volume on the minor street averages at least 200 units per hour during the same eight hours, the minor street vehicular traffic faces an average delay of 30 seconds per vehicle during the peak hour, or 70 percent of the above values if the 85th percentile approach speed on the major street exceeds 40 miles per hour; and/or
4. The above two conditions are both satisfied to 80 percent, meaning four crashes in 12 months, 240 vehicles per hour on the major street, 160 units per hour on the minor street, and 24 seconds of delay.

Data collected and used for the *Final Traffic Impact Study for the Ghilotti Construction Yard*, W-Trans, March 7, 2018, was used for the analysis of volume warrants. It is noted that while this data is now more than four years old, due to the ongoing effects on traffic volumes associated with the COVID-19 pandemic it is anticipated that volumes are currently relatively similar to those used in this 2018 study.

Traffic Signal Warrant

AWSC may be used as an interim measure where a traffic signal is warranted. Many of the traffic signal warrants established by the CA-MUTCD do not apply to the study intersection, such as those relating to school crossings and grade crossings.

Sufficiently high vehicular volumes or pedestrian volumes also warrant traffic signal control. Based on existing peak hour volumes the peak hour signal warrant is met. Since a signal is warranted, the AWSC is warranted as an interim step to placing the traffic signal. A copy of the sign warrant spreadsheet is enclosed.

Collision History

For AWSC to be warranted to address an existing safety concern, five or more collisions of types made less likely by AWSC must have occurred within a 12-month period. Collision records for a five-year period from January 2012 through December 2016 were obtained from the California Highway Patrol as published in their Statewide Integrated Traffic Records System (SWITRS). Per this data, ten collisions occurred at the study intersection over five years. Seven of the ten collisions were broadsides or sideswipes which can be reduced by placing AWSC, but the number collisions within a 12-month period did not meet the minimum requirements to warrant an AWSC. Therefore, this warrant is not met.

Minimum Volumes

AWSC are warranted if there are sufficient volumes on both the major street approaches (Todd Road westbound and eastbound) and one minor street approach (Ghilotti Avenue northbound or Standish Avenue southbound). Over an eight-hour period on a typical day, an average of at least 300 vehicles on the major street approaches and 200 vehicles, bicycles, and pedestrians on the minor street must travel through the intersection. Also, the average delay of the minor street approaches must be at least 30 seconds. This warrant helps prevent drivers on the minor approach from waiting a long time to turn or performing dangerous maneuvers to find a gap in traffic. Four hours of traffic movements were collected for this intersection during peak hours. During these peak hours traffic met the requirements of this warrant. It is assumed that with off-peak hours added to these current counts the warrant would continue to be met.

80% Warrants 2 and 3

To meet this warrant there would need to be four collisions in one year rather than five and a volume of at least 160 vehicles on the minor street. There were fewer than four collisions in a single 12-month period, so while the volume might meet this warrant, based on the collision history this warrant is not met.

Optional Warrants

In addition to the above, the MUTCD also has four optional warrants. These alone are not enough to warrant installation of AWSC but may be used in conjunction with engineering judgment to alleviate minor shortfalls in fulfilling the above criteria, as well as addressing unusual cases. The four optional warrants are:

1. The need to control left-turn conflicts;
2. The need to control the interaction of pedestrians and vehicles near heavy pedestrian traffic generators;
3. Locations where a driver stopped at the minor street approach is unable to assess conflicting traffic due to poor sightlines; and/or
4. At the intersection of two neighborhood collectors where installing AWSC will improve operations.

Left-turn Conflicts

The potential for left-turn conflicts specifically applies to the side-street traffic; in other words, are there conflicts between left-turning traffic on one approach and through or right-turning traffic on the other. Given the high volume of left turns from Standish Avenue, it appears that this warrant may be met.

Vehicle/Pedestrian Conflicts

Based on small pedestrian volumes recorded in 2016, this optional warrant is not met.

Sight Distance

Sight distances along Todd Road from Ghilotti Avenue and Standish Avenue were evaluated based on sight distance criteria contained in *A Policy on Geometric Design on Highways and Streets* published by American Association of State Highway and Transportation Officials (AASHTO). For the posted 35-mph speed limit on Todd Road near the study intersection, the recommended corner sight distance is 390 feet for a left turn and 335 feet for a right turn. Based on a review of the field conditions, sight distance extends 500 feet to both the east and west which is enough to satisfy speeds greater than 35 mph. Therefore, there is not a sufficient visibility issue to warrant AWSC.

Residential Collector Streets

As this intersection is not at the intersection of two neighborhood collectors this warrant is not met.

Summary of Warrant Findings

All-way stop controls are warranted at the intersection of Todd Road/Standish Avenue-Ghilotti Avenue based on the peak hour traffic warranting a traffic signal as well as volumes and the potential for left-turn conflicts. Conversion to AWSC is warranted as an interim measure and due to the high volumes experienced on Standish Avenue.

Effect of AWSC

Traffic Operation

Since the conversion from a two-way stop-controlled intersection to an AWSC intersection is warranted the effect on traffic operation of using AWSC was analyzed. Concerns had been expressed that this change would result in a substantial increase in delay and, as a result, queuing on the westbound approach. To address this concern operational calculations were completed for conditions will AWSC, with these results compared to operation with both the existing two-way stop controls and a traffic signal. As shown in Table 1, the intersection would be expected to operate at LOS C with all-way stop controls and prior to occupation of the Ghilotti construction yard, and LOS C or D with the added truck trips associated with the construction yard. While delays would be higher with AWSC than a traffic signal plus a separate left-turn lane on the Standish Avenue approach as is planned as part of the signalization project, the intersection would still be expected to operate acceptably and with substantially less delay on the southbound Standish Avenue approach. Conversion to AWSC through installation of appropriate signing and markings, including stop signs, stop legends, stop bars, and advance warning signs of the changed condition, therefore appears to be a reasonable interim measure as it would improve operation overall and particularly for the stop-controlled Standish Avenue approach. It

Copies of the calculations for the Existing and Existing plus Project scenarios are enclosed.

Table 1 – Existing and Existing plus Project Peak Hour Intersection Levels of Service

Study Intersection <i>Approach</i>	Existing Conditions				Existing plus Project			
	AM Peak		PM Peak		AM Peak		PM Peak	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1. Todd Rd/Standish Ave-Ghilotti Ave	10.3	B	38.4	E	20.6	C	74.8	F
<i>NB (Ghilotti Ave) Approach</i>	<i>13.6</i>	<i>B</i>	<i>12.7</i>	<i>B</i>	<i>12.2</i>	<i>B</i>	<i>12.5</i>	<i>B</i>
<i>SB (Standish Ave) Approach</i>	<i>52.1</i>	<i>F</i>	**	F	<i>114.7</i>	<i>F</i>	**	F
<i>With signal and SB left-turn lane</i>	16.9	B	18.2	B	20.0	B	21.1	C
<i>With AWSC</i>	19.3	C	23.6	C	21.2	C	23.8	C

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics*; ** = delay greater than 120 seconds; **Bold** text = deficient operation; = conditions with recommended improvements

Queuing

Consideration was also given to the queue length that would be expected to form on westbound Todd Road approaching the stop controls, if implemented. As indicated in the calculation output, the 95th percentile queue during the critical p.m. peak period is projected to be about 214 feet without the Ghilotti construction yard and 243 feet with it. Given that the SMART railroad tracks are more than 500 feet east of Ghilotti Road, no conflict would be anticipated between the queue and operation of the SMART trains.

Conclusions and Recommendations

- All-way stop controls are currently warranted at Todd Road/Standish Avenue-Ghilotti Avenue given that a traffic signal is warranted as well as based on side street volumes and to address potential conflicts for left-turning drivers.
- Installation of all-way stop controls would improve operation during the p.m. peak hour, resulting in acceptable LOS D operation versus LOS E with the existing two-way stop controls.
- The westbound queue is projected to be substantially less than the distance to the SMART tracks, indicating that there would not be a conflict between operation of the trains and the queue.
- It is recommended that stop signs, limit lines, stop legends and advance “changed condition ahead” warning signs with flags be installed on Todd Road on both approaches to Standish Avenue-Ghilotti Avenue. The advance warning signs should be removed after the AWSC has been in place for two to three months.

Mr. Dale Mahoney

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We hope this information is useful in the planning of future improvements. Thank you for giving us the opportunity to provide these services.

Sincerely,

William Andrews, EIT
Assistant Engineer

Dalene J. Whitlock, PE, PTOE
Senior Principal

DJW/wa/SOX574.L2

Enclosures: Traffic Signal Warrant Spreadsheet; AWSC Warrant Spreadsheet; LOS Calculations

Draft

Warrant 3: Peak-Hour Volumes and Delay

Sonoma County
Todd Rd & Standish-Ghilotti Ave

304 Todd Road CUP

	Major Street	Minor Street
Street Name	Todd Rd	Standish-Ghilotti Ave
Direction	E-W	N-S
Number of Lanes	1	1
Approach Speed	35	30

Population less than 10,000? No
Date of Count: Tuesday, October 04, 2016
Scenario: PM Existing

Warrant 3 Met?: Met when either Condition A or B is met **Yes**

Condition A: Met when conditions A1, A2, and A3 are met Met
 Condition A1 Met

The total delay experienced by traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one lane approach, or five vehicle-hours for a two-lane approach

Minor Approach Delay: 15.92 vehicle-hours

Condition A2 Met

The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic of 150 vph for two moving lanes

Minor Approach Volume: 319 vph

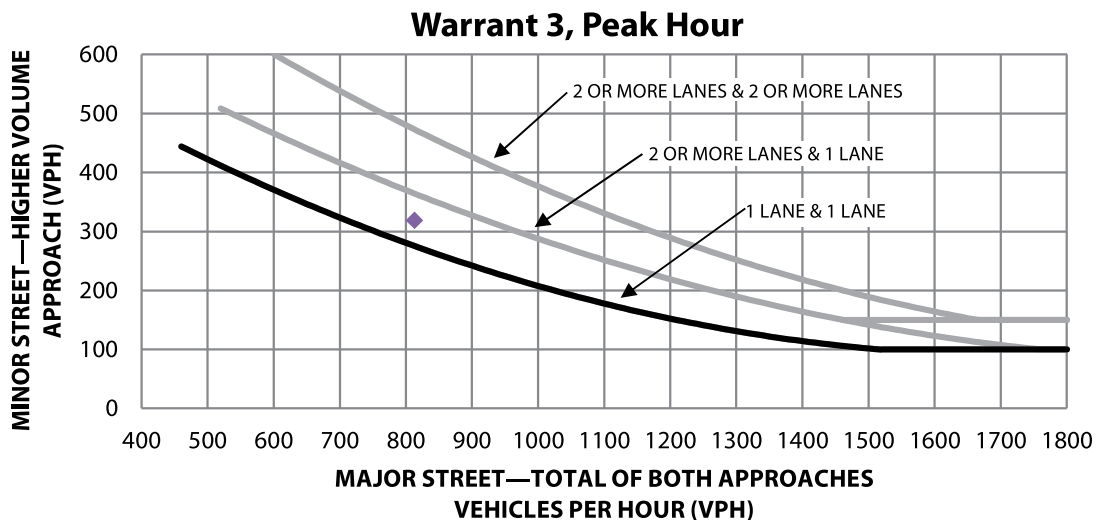
Condition A3 Met

The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more approaches or 650 vph for intersections with three approaches

Total Entering Volume: 1158 vph

Condition B Met

The plotted point falls above the curve



California Manual on Uniform Traffic Control Devices (CaMUTCD)
All-Way Stop Control (AWSC) Warrant Worksheet



Intersection #:	1	Calc:	WA
Major Street:	Todd Street	Date:	9/13/2022
Minor Street:	Standish Avenue/Gholitti Lane	Check:	DJW
Existing Control:	Two-Way Stop	Date:	9/14/2022
Volume Count Date:	10/4/2016		
Speed Count Date:	10/21/2016	At least one warrant satisfied?	Yes
Field Visit Date:	10/21/2016	Optional Warrants Satisfied?	1

WARRANT A - Interim Measure **Satisfied? Yes**

CaMUTCD Language

Condition A: Where traffic control signals are justified, the multi-way stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the traffic control signal.

Are traffic control signals justified at this location? **Yes**

WARRANT B - Crash History **Satisfied? No**

CaMUTCD Language

Condition B: Five or more reported crashes in a 12-month period that are susceptible to correction by a multi-way stop installation. Such crashes include right-turn and left-turn collisions as well as right-angle collisions.

	Crashes	Minimum
Total in a 12-month period	4	-
Total in a 12-month period susceptible to correction by AWSC	3	5

WARRANT C - Eight Hour Volume **C.1+C.2 or C.3 Satisfied? Yes**

CaMUTCD Language

Condition C.1: The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least 300 vehicles per hour for any 8 hours of an average day; and

Condition C.2: The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour.

Hour	C.1 Volume	C.2 Volume
7:00 - 8:00	425	193
8:00 - 9:00	492	207
16:00 - 17:00	448	320
17:00 - 18:00	434	213

	Average Volume	Minimum	Satisfied?
C.1	450	300	Yes
C.2	233	200	Yes

	Peak Hour Delay	Minimum	Satisfied?
C.2	120	30	Yes

Peak Hour
15:15 - 16:15



Intersection #: 1
Major Street: Todd Street
Minor Street: Standish Avenue/Gholitti Lane

CaMUTCD Language

Condition C.3: If the 85th-percentile approach speed of the major-street traffic exceeds 40 mph, the minimum vehicular volume warrants are 70 percent of the values provided in Items 1 and 2.

	Value	Minimum	Satisfied?
C.1. Major Street Entering Vehicles (Both Approaches)	450	210	Yes
C.2. Minor Street Entering Vehicles, Pedestrians, and Bicycles (Both Approaches)	233	140	Yes
C.2. Minor Street Peak Hour Vehicle Delay (Seconds)	120	21	Yes
C.3. Major Street 85th-percentile Speed	35.4	41	No

WARRANT D - Combination of Above

Satisfied? No

CaMUTCD Language

Condition D: Where no single criterion is satisfied, but where Criteria B, C.1, and C.2 are all satisfied to 80 percent of the minimum values. Criterion C.3 is excluded from this condition.

	Value	Minimum	Satisfied?
B. Crashes in 12-month period susceptible to correction by AWSC	3	4	No
C.1. Major Street Entering Vehicles (Both Approaches)	450	240	Yes
C.2. Minor Street Entering Vehicles, Pedestrians, and Bicycles (Both Approaches)	233	160	Yes
C.2. Minor Street Peak Hour Vehicular Delay (Seconds)	120	24	Yes

OPTIONAL WARRANTS

1 Optional Warrant Satisfied

- | | | | |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----|
| A | The need to control left-turn conflicts | Satisfied? | Yes |
| B | The need to control vehicle/pedestrian conflicts near locations that generate high pedestrian volumes | Satisfied? | No |
| C | Locations where a road user, after stopping, cannot see conflicting traffic and is not able to negotiate the intersection unless conflicting cross traffic is also required to stop | Satisfied? | No |
| D | An intersection of two residential neighborhood collector (through) streets of similar design and operating characteristics where multi-way stop control would improve traffic operational characteristics of the intersection | Satisfied? | No |

Intersection Level Of Service Report

Intersection 1: Todd Rd/Ghilotti Ave-Standish Ave

Control Type:	Two-way stop	Delay (sec / veh):	54.5
Analysis Method:	HCM 2010	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.720

Intersection Setup

Name	Ghilotti Ave			Standish Ave			Todd Rd			Todd Rd		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration	+			+			T			T		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	1	0	0	1	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	120.00	100.00	100.00	150.00	100.00	100.00
Speed [mph]	10.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Ghilotti Ave			Standish Ave			Todd Rd			Todd Rd		
Base Volume Input [veh/h]	2	2	10	150	1	43	91	283	2	12	232	259
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	2	2	10	150	1	43	91	283	2	12	232	259
Peak Hour Factor	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	3	40	0	12	25	76	1	3	63	70
Total Analysis Volume [veh/h]	2	2	11	162	1	46	98	305	2	13	250	279
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	No	Yes		
Storage Area [veh]	0	1	0	0
Two-Stage Gap Acceptance	No	No		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.01	0.01	0.01	0.72	0.00	0.07	0.09	0.00	0.00	0.01	0.00	0.00
d_M, Delay for Movement [s/veh]	22.63	23.15	10.20	54.46	53.26	43.92	8.83	0.00	0.00	7.90	0.00	0.00
Movement LOS	C	C	B	F	F	E	A	A	A	A	A	A
95th-Percentile Queue Length [veh]	0.11	0.11	0.11	5.77	5.77	5.77	0.31	0.00	0.00	0.03	0.00	0.00
95th-Percentile Queue Length [ft]	2.68	2.68	2.68	144.16	144.16	144.16	7.80	0.00	0.00	0.79	0.00	0.00
d_A, Approach Delay [s/veh]	13.58			52.14			2.14			0.19		
Approach LOS	B			F			A			A		
d_I, Intersection Delay [s/veh]	10.31											
Intersection LOS	F											

Intersection Level Of Service Report
Intersection 1: Todd Rd/Ghilotti Ave-Standish Ave

Control Type:	Two-way stop	Delay (sec / veh):	138.5
Analysis Method:	HCM 2010	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	1.050

Intersection Setup

Name	Ghilotti Ave			Standish Ave			Todd Rd			Todd Rd		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration	+			+			↔			↔		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	1	0	0	1	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	120.00	100.00	100.00	150.00	100.00	100.00
Speed [mph]	10.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Ghilotti Ave			Standish Ave			Todd Rd			Todd Rd		
Base Volume Input [veh/h]	2	4	20	252	2	65	45	316	7	10	264	171
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	2	4	20	252	2	65	45	316	7	10	264	171
Peak Hour Factor	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	5	68	1	17	12	85	2	3	71	46
Total Analysis Volume [veh/h]	2	4	21	271	2	70	48	339	8	11	284	184
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	No	Yes		
Storage Area [veh]	0	1	0	0
Two-Stage Gap Acceptance	No	No		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.01	0.02	0.03	1.05	0.01	0.10	0.04	0.00	0.00	0.01	0.00	0.00
d_M, Delay for Movement [s/veh]	20.98	19.62	10.56	138.50	137.17	129.92	8.44	0.00	0.00	8.00	0.00	0.00
Movement LOS	C	C	B	F	F	F	A	A	A	A	A	A
95th-Percentile Queue Length [veh]	0.17	0.17	0.17	14.47	14.47	14.47	0.14	0.00	0.00	0.03	0.00	0.00
95th-Percentile Queue Length [ft]	4.31	4.31	4.31	361.75	361.75	361.75	3.44	0.00	0.00	0.69	0.00	0.00
d_A, Approach Delay [s/veh]	12.68			136.74			1.03			0.18		
Approach LOS	B			F			A			A		
d_I, Intersection Delay [s/veh]	38.37											
Intersection LOS	F											

Lane Group Calculations

Lane Group	C	L	C	L	C	L	C
C, Cycle Length [s]	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00
I1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	1	8	8	4	34	1	31
g / C, Green / Cycle	0.02	0.13	0.13	0.07	0.57	0.02	0.52
(v / s)_i Volume / Saturation Flow Rate	0.01	0.09	0.03	0.06	0.17	0.01	0.31
s, saturation flow rate [veh/h]	1640	1774	1588	1774	1861	1774	1704
c, Capacity [veh/h]	34	224	200	132	1059	33	875
d1, Uniform Delay [s]	29.18	25.34	23.73	27.34	6.70	29.26	10.35
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.11	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	8.70	4.41	0.59	7.93	0.69	7.54	3.09
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

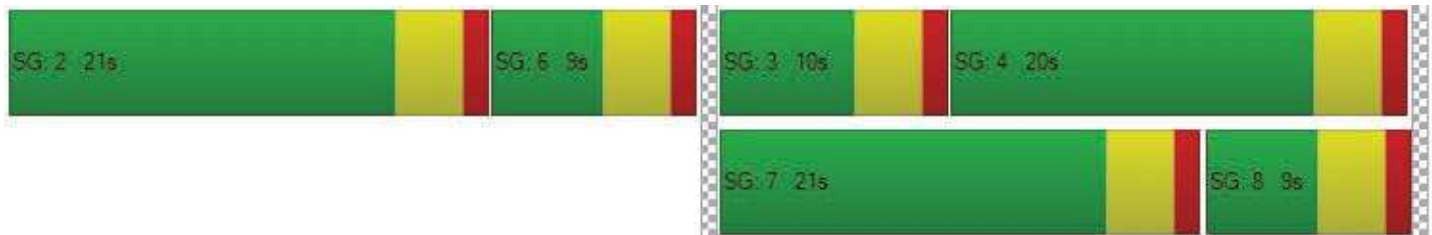
X, volume / capacity	0.44	0.72	0.23	0.74	0.29	0.40	0.60
d, Delay for Lane Group [s/veh]	37.88	29.75	24.32	35.27	7.39	36.79	13.45
Lane Group LOS	D	C	C	D	A	D	B
Critical Lane Group	Yes	Yes	No	Yes	No	No	Yes
50th-Percentile Queue Length [veh]	0.30	2.37	0.60	1.57	1.69	0.24	4.57
50th-Percentile Queue Length [ft]	7.50	59.15	15.03	39.35	42.25	6.08	114.31
95th-Percentile Queue Length [veh]	0.54	4.26	1.08	2.83	3.04	0.44	8.08
95th-Percentile Queue Length [ft]	13.51	106.46	27.06	70.83	76.05	10.94	201.98

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	37.88	37.88	37.88	29.75	24.32	24.32	35.27	7.39	7.39	36.79	13.45	13.45
Movement LOS	D	D	D	C	C	C	D	A	A	D	B	B
d_A, Approach Delay [s/veh]	37.88			28.53			14.14			14.01		
Approach LOS	D			C			B			B		
d_I, Intersection Delay [s/veh]	16.95											
Intersection LOS	B											
Intersection V/C	0.582											

Sequence

Ring 1	2	6	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	-	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Lane Group Calculations

Lane Group	C	L	C	L	C	L	C
C, Cycle Length [s]	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00
I1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	2	12	12	3	30	1	28
g / C, Green / Cycle	0.03	0.19	0.19	0.05	0.50	0.02	0.46
(v / s)_i Volume / Saturation Flow Rate	0.02	0.15	0.05	0.03	0.19	0.01	0.27
s, saturation flow rate [veh/h]	1633	1774	1590	1774	1855	1774	1742
c, Capacity [veh/h]	53	343	307	85	914	29	803
d1, Uniform Delay [s]	28.69	23.17	20.56	28.09	9.54	29.36	11.98
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.11	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	7.24	4.12	0.39	5.78	1.20	8.14	3.08
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.51	0.79	0.23	0.57	0.38	0.38	0.58
d, Delay for Lane Group [s/veh]	35.93	27.29	20.95	33.87	10.74	37.50	15.06
Lane Group LOS	D	C	C	C	B	D	B
Critical Lane Group	Yes	Yes	No	Yes	No	No	Yes
50th-Percentile Queue Length [veh]	0.50	3.79	0.83	0.77	2.58	0.21	4.43
50th-Percentile Queue Length [ft]	12.43	94.69	20.84	19.21	64.39	5.32	110.80
95th-Percentile Queue Length [veh]	0.89	6.82	1.50	1.38	4.64	0.38	7.88
95th-Percentile Queue Length [ft]	22.37	170.45	37.52	34.58	115.90	9.57	197.12

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	35.93	35.93	35.93	27.29	20.95	20.95	33.87	10.74	10.74	37.50	15.06	15.06
Movement LOS	D	D	D	C	C	C	C	B	B	D	B	B
d_A, Approach Delay [s/veh]	35.93			25.96			13.55			15.57		
Approach LOS	D			C			B			B		
d_I, Intersection Delay [s/veh]	18.24											
Intersection LOS	B											
Intersection V/C	0.634											

Sequence

Ring 1	2	6	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	-	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 1: Todd Rd/Ghilotti Ave-Standish Ave

Control Type:	All-way stop	Delay (sec / veh):	19.3
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.803

Intersection Setup

Name	Ghilotti Ave			Standish Ave			Todd Rd			Todd Rd		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration	+			+			T			T		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	120.00	100.00	100.00	150.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	10.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Ghilotti Ave			Standish Ave			Todd Rd			Todd Rd		
Base Volume Input [veh/h]	2	2	10	150	1	43	91	283	2	12	232	259
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	2	2	10	150	1	43	91	283	2	12	232	259
Peak Hour Factor	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	3	40	0	12	25	76	1	3	63	70
Total Analysis Volume [veh/h]	2	2	11	162	1	46	98	305	2	13	250	279
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Lanes

Capacity per Entry Lane [veh/h]	555	571	557	605	568	659
Degree of Utilization, x	0.03	0.37	0.18	0.51	0.02	0.80

Movement, Approach, & Intersection Results

95th-Percentile Queue Length [veh]	0.08	1.67	0.63	2.87	0.07	8.15
95th-Percentile Queue Length [ft]	2.08	41.75	15.84	71.79	1.76	203.66
Approach Delay [s/veh]	9.67	12.90	13.64		26.20	
Approach LOS	A	B	B		D	
Intersection Delay [s/veh]	19.27					
Intersection LOS	C					

Intersection Level Of Service Report
Intersection 1: Todd Rd/Ghilotti Ave-Standish Ave

Control Type:	All-way stop	Delay (sec / veh):	23.6
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.816

Intersection Setup

Name	Ghilotti Ave			Standish Ave			Todd Rd			Todd Rd		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration	+			+			T			T		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	120.00	100.00	100.00	150.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	10.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Ghilotti Ave			Standish Ave			Todd Rd			Todd Rd		
Base Volume Input [veh/h]	2	4	20	252	2	65	45	316	7	10	264	171
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	2	4	20	252	2	65	45	316	7	10	264	171
Peak Hour Factor	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	5	68	1	17	12	85	2	3	71	46
Total Analysis Volume [veh/h]	2	4	21	271	2	70	48	339	8	11	284	184
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Lanes

Capacity per Entry Lane [veh/h]	502	552	500	539	509	574
Degree of Utilization, x	0.05	0.62	0.10	0.64	0.02	0.82

Movement, Approach, & Intersection Results

95th-Percentile Queue Length [veh]	0.17	4.24	0.32	4.55	0.07	8.21
95th-Percentile Queue Length [ft]	4.25	105.95	7.93	113.83	1.65	205.34
Approach Delay [s/veh]	10.57	19.63	19.43		30.54	
Approach LOS	B	C	C		D	
Intersection Delay [s/veh]	23.57					
Intersection LOS	C					

Intersection Level Of Service Report

Intersection 1: Todd Rd/Ghilotti Ave-Standish Ave

Control Type:	Two-way stop	Delay (sec / veh):	118.1
Analysis Method:	HCM 2010	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.950

Intersection Setup

Name	Ghilotti Ave			Standish Ave			Todd Rd			Todd Rd		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration	+			+			T			T		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	1	0	0	1	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	120.00	100.00	100.00	150.00	100.00	100.00
Speed [mph]	10.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Ghilotti Ave			Standish Ave			Todd Rd			Todd Rd		
Base Volume Input [veh/h]	2	2	10	150	1	43	91	283	2	12	232	259
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	2	0	43	0	0	0	0	0	2	43	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	4	2	53	150	1	43	91	283	4	55	232	259
Peak Hour Factor	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	14	40	0	12	25	76	1	15	63	70
Total Analysis Volume [veh/h]	4	2	57	162	1	46	98	305	4	59	250	279
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	No	Yes		
Storage Area [veh]	0	1	0	0
Two-Stage Gap Acceptance	No	No		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.02	0.01	0.08	0.95	0.00	0.07	0.09	0.00	0.00	0.05	0.00	0.00
d_M, Delay for Movement [s/veh]	26.45	26.86	10.72	118.15	114.49	102.50	8.83	0.00	0.00	8.02	0.00	0.00
Movement LOS	D	D	B	F	F	F	A	A	A	A	A	A
95th-Percentile Queue Length [veh]	0.38	0.38	0.38	9.02	9.02	9.02	0.31	0.00	0.00	0.15	0.00	0.00
95th-Percentile Queue Length [ft]	9.44	9.44	9.44	225.43	225.43	225.43	7.80	0.00	0.00	3.71	0.00	0.00
d_A, Approach Delay [s/veh]	12.23			114.69			2.13			0.80		
Approach LOS	B			F			A			A		
d_I, Intersection Delay [s/veh]	20.58											
Intersection LOS	F											

Intersection Level Of Service Report

Intersection 1: Todd Rd/Ghilotti Ave-Standish Ave

Control Type:	Two-way stop	Delay (sec / veh):	290.0
Analysis Method:	HCM 2010	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	1.396

Intersection Setup

Name	Ghilotti Ave			Standish Ave			Todd Rd			Todd Rd		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration	+			+			↔			↔		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	1	0	0	1	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	120.00	100.00	100.00	150.00	100.00	100.00
Speed [mph]	10.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Ghilotti Ave			Standish Ave			Todd Rd			Todd Rd		
Base Volume Input [veh/h]	2	4	20	252	2	65	45	316	7	10	264	171
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	2	0	43	0	0	0	0	0	2	43	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	4	4	63	252	2	65	45	316	9	53	264	171
Peak Hour Factor	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	17	68	1	17	12	85	2	14	71	46
Total Analysis Volume [veh/h]	4	4	68	271	2	70	48	339	10	57	284	184
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	No	Yes		
Storage Area [veh]	0	1	0	0
Two-Stage Gap Acceptance	No	No		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.02	0.02	0.10	1.40	0.01	0.10	0.04	0.00	0.00	0.05	0.00	0.00
d_M, Delay for Movement [s/veh]	24.57	22.77	11.17	290.02	286.36	276.84	8.44	0.00	0.00	8.12	0.00	0.00
Movement LOS	C	C	B	F	F	F	A	A	A	A	A	A
95th-Percentile Queue Length [veh]	0.47	0.47	0.47	20.60	20.60	20.60	0.14	0.00	0.00	0.15	0.00	0.00
95th-Percentile Queue Length [ft]	11.77	11.77	11.77	514.92	514.92	514.92	3.44	0.00	0.00	3.70	0.00	0.00
d_A, Approach Delay [s/veh]	12.49			287.31			1.02			0.88		
Approach LOS	B			F			A			A		
d_I, Intersection Delay [s/veh]	74.84											
Intersection LOS	F											

Lane Group Calculations

Lane Group	C	L	C	L	C	L	C
C, Cycle Length [s]	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	3	7	7	4	30	3	29
g / C, Green / Cycle	0.06	0.12	0.12	0.07	0.50	0.05	0.48
(v / s)_i Volume / Saturation Flow Rate	0.04	0.09	0.03	0.06	0.17	0.03	0.31
s, saturation flow rate [veh/h]	1602	1774	1588	1774	1858	1774	1704
c, Capacity [veh/h]	91	223	199	132	925	97	815
d1, Uniform Delay [s]	27.93	25.37	23.76	27.35	9.12	27.87	11.90
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.11	0.50
l, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	9.12	4.50	0.60	8.02	0.97	6.04	3.99
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

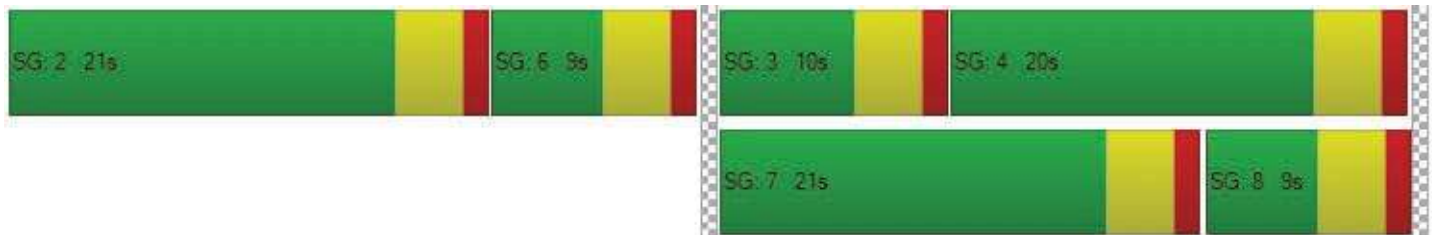
X, volume / capacity	0.69	0.73	0.24	0.74	0.33	0.61	0.65
d, Delay for Lane Group [s/veh]	37.05	29.87	24.36	35.36	10.09	33.91	15.89
Lane Group LOS	D	C	C	D	B	C	B
Critical Lane Group	Yes	Yes	No	Yes	No	No	Yes
50th-Percentile Queue Length [veh]	1.13	2.37	0.60	1.58	2.19	0.94	5.17
50th-Percentile Queue Length [ft]	28.37	59.29	15.05	39.42	54.76	23.45	129.34
95th-Percentile Queue Length [veh]	2.04	4.27	1.08	2.84	3.94	1.69	8.90
95th-Percentile Queue Length [ft]	51.06	106.72	27.09	70.95	98.57	42.21	222.59

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	37.05	37.05	37.05	29.87	24.36	24.36	35.36	10.09	10.09	33.91	15.89	15.89
Movement LOS	D	D	D	C	C	C	D	B	B	C	B	B
d_A, Approach Delay [s/veh]	37.05			28.63			16.18			17.70		
Approach LOS	D			C			B			B		
d_I, Intersection Delay [s/veh]	19.97											
Intersection LOS	B											
Intersection V/C	0.620											

Sequence

Ring 1	2	6	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	-	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Lane Group Calculations

Lane Group	C	L	C	L	C	L	C
C, Cycle Length [s]	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00
I1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	4	11	11	3	26	3	26
g / C, Green / Cycle	0.06	0.19	0.19	0.05	0.43	0.05	0.44
(v / s)_i Volume / Saturation Flow Rate	0.05	0.15	0.05	0.03	0.19	0.03	0.27
s, saturation flow rate [veh/h]	1605	1774	1590	1774	1853	1774	1742
c, Capacity [veh/h]	98	340	304	83	795	93	757
d1, Uniform Delay [s]	27.82	23.21	20.59	28.08	12.08	27.90	13.15
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.11	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	12.10	4.31	0.40	6.17	1.76	6.39	3.77
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.77	0.80	0.24	0.58	0.44	0.61	0.62
d, Delay for Lane Group [s/veh]	39.92	27.52	20.99	34.25	13.84	34.29	16.93
Lane Group LOS	D	C	C	C	B	C	B
Critical Lane Group	Yes	Yes	No	Yes	No	No	Yes
50th-Percentile Queue Length [veh]	1.42	3.80	0.83	0.77	3.14	0.91	4.83
50th-Percentile Queue Length [ft]	35.56	95.08	20.85	19.36	78.44	22.84	120.68
95th-Percentile Queue Length [veh]	2.56	6.85	1.50	1.39	5.65	1.64	8.43
95th-Percentile Queue Length [ft]	64.01	171.15	37.54	34.84	141.20	41.12	210.77

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	39.92	39.92	39.92	27.52	20.99	20.99	34.25	13.84	13.84	34.29	16.93	16.93
Movement LOS	D	D	D	C	C	C	C	B	B	C	B	B
d_A, Approach Delay [s/veh]	39.92			26.15			16.31			18.81		
Approach LOS	D			C			B			B		
d_I, Intersection Delay [s/veh]	21.14											
Intersection LOS	C											
Intersection V/C	0.676											

Sequence

Ring 1	2	6	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	-	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 1: Todd Rd/Ghilotti Ave-Standish Ave

Control Type:	All-way stop	Delay (sec / veh):	21.2
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.842

Intersection Setup

Name	Ghilotti Ave			Standish Ave			Todd Rd			Todd Rd		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration	+			+			T			T		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	120.00	100.00	100.00	150.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	10.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Ghilotti Ave			Standish Ave			Todd Rd			Todd Rd		
Base Volume Input [veh/h]	2	2	10	150	1	43	91	283	2	12	232	259
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	2	0	43	0	0	0	0	0	2	43	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	4	2	53	150	1	43	91	283	4	55	232	259
Peak Hour Factor	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280	0.9280
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	14	40	0	12	25	76	1	15	63	70
Total Analysis Volume [veh/h]	4	2	57	162	1	46	98	305	4	59	250	279
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Lanes

Capacity per Entry Lane [veh/h]	550	547	529	572	544	628
Degree of Utilization, x	0.11	0.38	0.19	0.54	0.11	0.84

Movement, Approach, & Intersection Results

95th-Percentile Queue Length [veh]	0.39	1.78	0.67	3.21	0.36	9.19
95th-Percentile Queue Length [ft]	9.64	44.46	16.87	80.33	9.06	229.78
Approach Delay [s/veh]	10.39	13.58	14.92		29.37	
Approach LOS	B	B	B		D	
Intersection Delay [s/veh]	21.18					
Intersection LOS	C					

Intersection Level Of Service Report
Intersection 1: Todd Rd/Ghilotti Ave-Standish Ave

Control Type:	All-way stop	Delay (sec / veh):	23.8
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.819

Intersection Setup

Name	Ghilotti Ave			Standish Ave			Todd Rd			Todd Rd		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration	+			+			T			T		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	120.00	100.00	100.00	150.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	10.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Ghilotti Ave			Standish Ave			Todd Rd			Todd Rd		
Base Volume Input [veh/h]	2	4	20	252	2	65	45	316	7	10	264	171
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	2	0	0	0	0	0	0	0	2	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	4	4	20	252	2	65	45	316	9	10	264	171
Peak Hour Factor	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310	0.9310
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	5	68	1	17	12	85	2	3	71	46
Total Analysis Volume [veh/h]	4	4	21	271	2	70	48	339	10	11	284	184
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Lanes

Capacity per Entry Lane [veh/h]	498	551	498	538	508	572
Degree of Utilization, x	0.06	0.62	0.10	0.65	0.02	0.82

Movement, Approach, & Intersection Results

95th-Percentile Queue Length [veh]	0.18	4.26	0.32	4.63	0.07	8.27
95th-Percentile Queue Length [ft]	4.62	106.55	7.95	115.70	1.66	206.75
Approach Delay [s/veh]	10.67	19.75	19.66		30.84	
Approach LOS	B	C	C		D	
Intersection Delay [s/veh]	23.77					
Intersection LOS	C					