



Building a Better World
for All of Us®

MEMORANDUM

TO: David Bennett, P.E., Public Works Director/City Engineer
City of Northfield

FROM: Thomas A. Sohrweide, P.E., PTOE
Justin Anibas, E.I.T.

DATE: January 24, 2018

RE: All-way Stop Request at Division Street at 6th Street
Northfield, MN
SEH No. NFIEL 143632

REQUEST

Check if all-way stop control is justified at the intersection of Division Street at 6th Street.

EXISTING CONDITIONS

Division Street is a two lane minor arterial with a posted speed limit of 30 mph. 6th Street is a two lane roadway with a posted speed limit of 30 mph. There is on-street parking on both sides of both Division Street and 6th Street. The intersection is located in the city center of Northfield. The intersection is minor street stop controlled with traffic on 6th Street being required to stop. All approaches to the intersection have a single lane for all movements.

13-hour (6 am – 7 pm) intersection turning movement counts were conducted in November 2017. The intersection was found to have a total of 352 pedestrians/bikes using the intersection during the 13-hour count; with the north leg and east leg each having more than 100 users. The intersection currently has a marked crosswalk on the north and south legs of the intersection with warning signs at the crossings. The north leg of the intersection had 20 or more crossings during 1 of the 13 hours counted; 20 or more crossings an hour is a general guide for establishing a marked crosswalk.

SAFETY REVIEW

Crash data from January 1, 2013 through December 31, 2015 was collected using the Minnesota Crash Mapping Analysis Tool (MnCMAT). There was one crash reported at this intersection between 2013 and 2015. The single crash was a head on crash that resulted in possible injury. The intersection has a critical crash index of 0.20, which indicates that it is operating within the normal range compared to other minor street stop controlled intersections throughout the state.

SIGHT DISTANCE REVIEW

Sight distances were analyzed for vehicles approaching the intersection on 6th Street. MnDOT guidelines require a stopped vehicle to be able to see 400 feet in either direction to safely turn into traffic when the speed limit is 30 mph. It was determined that sight distances are not adequate at this intersection under existing conditions. The attached Figures 1 and 2 show the sight distance triangles for vehicles stopped on 6th Street. When vehicles are stopped at the stop bars, buildings on the northeast and northwest corners, an outdoor garden store on the southwest corner, and a sign and bushes on the southeast corner impair sight distance for drivers. As the

vehicles pull up to the curb, only parked cars along Division Street impair sight distance for vehicles stopped on 6th Street.

ENGINEERING GUIDANCE

According to the Minnesota Manual on Uniform Traffic Control Devices (MnMUTCD), all-way stop control should only be implemented if justification is provided. The MnMUTCD provides the following guidance for when it may be appropriate to install all-way stop control:

- **Condition A:** Where traffic signals are justified, all-way stop control can be installed as an interim measure
- **Condition B:** Five or more reported correctable crashes in a 12-month period
- **Condition C:** All-way stop warrant volume thresholds in Section 2B.7 of the 2011 MnMUTCD are met for any eight hours of an average day.
- **Optional Guidance:**
 - **Condition B:** The need to control vehicle/pedestrian conflicts near locations that generate high pedestrian volumes.
 - **Condition 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.

All-way stop control is not currently justified at the intersection of Division Street at 6th Street for Conditions A, B, or C. None of the 13 hours of intersection volumes meet the all-way stop warrant volume thresholds for Condition C. Over the past three years there has only been one crash, which is below the threshold for Condition B.

The north leg of the intersection had 20 or more pedestrian crossings during 1 of the 13 hours counted, which is a general guideline for marking a crosswalk. However, in our opinion Optional Condition B is not satisfied because it appears the existing marked crosswalk adequately facilitates safe pedestrian and bike crossings at the intersection.

Although the intersection of Division Street at 6th Street appears to meet Optional Condition C as even after a stopped vehicle on 6th Street has pulled forward past the stop bar up to the edge of the lane the sight distance is limited, the crash analysis shows that the intersection does not have a crash problem. The sight distance obstruction by parked vehicles is relatively normal in or near downtown areas, which requires drivers to be cautious.

RECOMMENDATION

It is recommended that the intersection of Division Street at 6th Street remain a minor stop controlled intersection because all-way stop guidance is not met.

Attachments:

Intersection Safety Screening
Figures 1 and 2 – Sight Distance Triangles
All-way Stop Warrant Analysis
13-hour Intersection Turning Movement Count

Intersection Safety Screening

Intersection: Division Street at 6th Street



Crash Data, 2013-2015.

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	0
Possible Injury	1
Property Damage	0
Total Crashes	1

Intersection Characteristics	
Entering Volume	7,150
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	30 mph

Annual crash cost = \$27,667

Statewide Comparison

Urban Thru / Stop

Total Crash Rate	
Observed	0.13
Statewide Average	0.19
Critical Rate	0.65
Critical Index	0.20

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.36
Critical Rate	9.48
Critical Index	0.00



The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.


The observed total crash rate for this period is 0.13 per MEV; this is 80% below the critical rate. Based on similar statewide intersections, an additional 5 crashes over the three years would indicate this intersection operates outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.


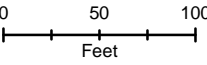


Legend

-  Vehicle Stopping at Stop Bar
-  Vehicle Stopping at Edge of Lane



N

0 50 100
Feet

Project: NFIEL 143632
 Print Date: 12/18/2017
 Map by: jdanibas
 Projection: Rice County Coords
 Source: MnDOT, SEH, MnGeo

Sight Distance Triangles
 6th Street Approaching from the West
 Northfield, Minnesota


Figure 1

This map is neither a legally recorded map nor a survey map and is not intended to be used as one. This map is a compilation of records, information, and data gathered from various sources listed on this map and is to be used for reference purposes only. SEH does not warrant that the Geographic Information System (GIS) Data used to prepare this map are error free, and SEH does not represent that the GIS Data can be used for navigational, tracking, or any other purpose requiring exacting measurement of distance or direction or precision in the depiction of geographic features. The user of this map acknowledges that SEH shall not be liable for any damages which arise out of the user's access or use of data provided.




Legend

- Vehicle Stopping at Stop Bar
- Vehicle Stopping at Edge of Lane



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0 50 100
Feet

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Sight Distance Triangles
 6th Street Approaching from the East
 Northfield, Minnesota

Figure
 2

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SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

**Existing 2017 - Division Street at 6th Street
 ALL WAY STOP
 WARRANT ANALYSIS**

LOCATION: Division Street at 6th Street
 COUNTY: Rice
 REF. POINT: 0
 DATE: 12/13/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach Total
30	Major App1: Division Street NB	1	2545
30	Major App3: Division Street SB	1	2544
30	Minor App2: 6th Street EB	1	303
30	Minor App4: 6th Street WB	1	378

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement
300 200

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	102	59	1	6	161	7	NO / NO
7:00 - 8:00	177	131	4	16	308	20	YES / NO
8:00 - 9:00	228	215	10	13	443	23	YES / NO
9:00 - 10:00	182	153	11	25	335	36	YES / NO
10:00 - 11:00	152	151	13	20	303	33	YES / NO
11:00 - 12:00	182	167	13	20	349	33	YES / NO
12:00 - 13:00	179	204	26	35	383	61	YES / NO
13:00 - 14:00	187	193	33	29	380	62	YES / NO
14:00 - 15:00	206	239	32	33	445	65	YES / NO
15:00 - 16:00	280	268	49	42	548	91	YES / NO
16:00 - 17:00	249	282	40	50	531	90	YES / NO
17:00 - 18:00	217	295	40	50	512	90	YES / NO
18:00 - 19:00	204	187	31	39	391	70	YES / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	2545	2544	303	378			

Hours met for warrant: **Met (Hr) 0 Required (Hr) 8**

All-way Stop Warrant: **Not satisfied**

REMARKS: _____

Location: Division Street at 6th Street
 Count Date: 11/29/2017
 Counted By: JDA



TURNING MOVEMENT COUNT DATA

All Vehicles

Start Time	Division St				6th St				Division St				6th St				Int. Total	
	Southbound				Westbound				Northbound				Eastbound					
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds		
6:00	0	13	0	0	1	0	2	1	0	20	0	0	0	0	0	0	0	36
6:15	1	11	1	0	0	0	2	0	0	23	0	0	0	0	0	0	1	38
6:30	1	15	0	0	0	0	0	0	0	27	0	0	0	0	0	1	0	44
6:45	0	16	1	1	0	0	1	0	0	32	0	0	0	0	0	0	1	50
7:00	2	21	0	0	3	1	0	0	3	29	0	0	1	0	1	0	0	61
7:15	1	33	0	0	0	2	3	0	1	33	0	0	0	0	0	0	1	73
7:30	1	37	0	0	0	2	1	2	2	48	0	0	0	0	1	0	0	92
7:45	1	34	1	3	0	1	3	2	2	56	3	0	0	0	1	0	0	102
8:00	1	32	1	0	1	1	1	1	1	41	0	0	1	0	1	0	0	81
8:15	1	48	4	1	0	1	2	3	4	49	2	0	0	0	1	0	0	112
8:30	2	71	2	0	2	0	0	0	2	45	2	0	1	1	1	1	1	129
8:45	1	47	5	0	1	1	3	1	4	76	2	0	1	0	3	1	1	144
9:00	1	36	2	0	2	2	3	0	4	42	2	0	1	0	0	1	1	95
9:15	4	37	7	1	0	3	1	0	4	44	2	0	0	0	3	2	2	105
9:30	2	32	3	0	0	3	5	1	4	33	1	0	0	0	2	1	1	85
9:45	2	22	5	0	0	4	2	2	1	44	1	2	0	1	4	2	2	86
10:00	3	34	1	1	2	2	3	3	4	29	1	0	0	1	2	1	1	82
10:15	1	32	4	0	4	1	1	2	0	35	1	1	0	2	2	3	3	83
10:30	2	29	2	0	1	0	1	1	2	32	0	0	0	0	2	2	2	71
10:45	2	39	2	1	0	1	4	3	5	41	2	0	0	2	2	5	5	100
11:00	2	38	3	4	1	0	4	3	5	34	1	0	0	1	2	1	1	91
11:15	3	31	6	1	2	0	3	4	7	42	1	1	0	0	2	0	0	97
11:30	4	30	1	3	1	2	4	1	1	38	3	2	1	0	2	1	1	87
11:45	6	34	9	0	0	2	1	3	3	44	3	1	1	1	3	4	4	107
12:00	1	43	7	1	3	2	6	2	5	39	0	0	2	2	1	2	2	111
12:15	2	35	3	1	3	0	4	1	5	40	4	0	2	0	8	1	1	106
12:30	4	40	6	2	1	4	4	0	3	35	4	0	1	1	2	2	2	105
12:45	4	53	6	0	0	0	8	3	4	39	1	1	2	0	5	2	2	122
13:00	3	42	5	0	1	0	4	1	1	42	1	0	1	3	3	3	3	106
13:15	4	37	7	1	1	1	5	2	4	42	1	1	3	5	5	2	2	115
13:30	6	39	3	1	2	2	6	1	4	38	1	1	0	5	4	2	2	110
13:45	6	35	6	1	0	2	5	0	5	46	2	1	0	0	4	0	0	111
14:00	1	45	7	3	1	1	3	1	2	31	0	3	1	0	3	1	1	95
14:15	2	36	2	3	1	2	9	3	6	41	2	2	1	2	7	3	3	111
14:30	4	63	6	3	1	1	4	2	1	39	2	0	1	1	10	1	1	133
14:45	4	65	4	0	0	3	7	1	5	76	1	0	3	1	2	1	1	171
15:00	7	53	3	6	0	0	8	4	8	74	3	4	4	1	8	0	0	169
15:15	6	52	4	4	3	2	3	1	7	52	3	6	2	4	8	0	0	146
15:30	5	70	2	3	1	5	5	3	9	64	2	1	2	3	8	0	0	176
15:45	10	52	4	1	2	2	11	11	4	51	3	0	0	3	6	4	4	148
16:00	5	64	5	4	0	5	6	5	7	49	4	0	1	1	5	2	2	152
16:15	7	52	1	0	0	0	5	6	2	59	2	0	3	2	12	5	5	145
16:30	11	63	5	8	1	3	10	7	5	51	4	8	0	1	6	7	7	160
16:45	8	55	6	3	5	3	12	5	12	53	1	6	0	3	6	3	3	164
17:00	6	70	3	4	3	2	8	3	3	49	2	3	0	3	10	4	4	159
17:15	7	51	5	4	3	3	9	3	5	56	5	0	4	3	8	1	1	159
17:30	10	65	10	6	3	2	10	1	3	44	1	0	2	1	5	2	2	156
17:45	7	53	8	6	0	1	6	5	3	44	2	1	0	0	4	3	3	128
18:00	7	38	2	7	4	2	9	12	7	52	0	0	2	1	9	0	0	133
18:15	5	40	4	3	1	0	6	3	4	45	1	0	1	0	7	0	0	114
18:30	5	38	1	4	2	2	6	5	8	44	2	0	1	1	5	0	0	115
18:45	3	39	5	5	2	0	5	1	4	36	1	3	2	1	1	0	0	99
Total	194	2160	190	100	65	79	234	125	195	2268	82	48	48	57	198	79		5770
Cars+	190	2049	188	96	63	79	217	120	193	2152	78	43	46	56	198	70		5509
Trucks	4	111	2	4	2	0	17	5	2	116	4	5	2	1	0	9		261
% Trucks	2.1	5.1	1.1	4.0	3.1	0.0	7.3	4.0	1.0	5.1	4.9	10.4	4.2	1.8	0.0	11.4		
	4.6				5.0				4.8				1.0				4.5	



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MEMORANDUM

TO: David Bennett, P.E., Public Works Director/City Engineer
City of Northfield

FROM: Thomas A. Sohrweide, P.E., PTOE
Justin Anibas, E.I.T.

DATE: January 24, 2018

RE: All-way Stop Request at Division Street at 7th Street
Northfield, MN
SEH No. NFIEL 143632

REQUEST

Check if all-way stop control is justified at the intersection of Division Street at 7th Street.

EXISTING CONDITIONS

Division Street is a two lane minor arterial with a posted speed limit of 30 mph. 7th Street is a two lane minor collector west of Division Street and a two lane major collector east of Division Street with a posted speed limit of 30 mph. There is on-street parking on both sides of both Division Street and 7th Street. The intersection is located in the city center of Northfield. The intersection is minor street stop controlled with traffic on 7th Street being required to stop. All approaches to the intersection have a single lane for all movements.

13-hour (6 am – 7 pm) intersection turning movement counts were conducted in November 2017. The intersection was found to have a total of 175 pedestrians/bikes using the intersection during the 13-hour count; with the west leg and east leg each having more than 50 users. The intersection currently has a marked crosswalk on the north leg of the intersection with warning signs at the crossing. However, neither Division Street leg had 20 or more crossings per hour, which is a general guide for establishing a marked crosswalk.

SAFETY REVIEW

Crash data from January 1, 2013 through December 31, 2015 was collected using the Minnesota Crash Mapping Analysis Tool (MnCMAT). There were four crashes reported at this intersection between 2013 and 2015. There were three property damage only crashes and one non-incapacitating injury crash. Each of the four crashes was of a different crash type: one rear end, one sideswipe passing, one head on, and one other (appears to be right angle). The intersection has a critical crash index of 0.78, which indicates that it is operating within the normal range compared to other minor street stop controlled intersections throughout the state.

SIGHT DISTANCE REVIEW

Sight distances were analyzed for vehicles approaching the intersection on 7th Street. MnDOT guidelines require a stopped vehicle to be able to see 400 feet in either direction to safely turn into traffic when the speed limit is 30 mph. It was determined that sight distances are not adequate at this intersection under existing conditions. The attached Figures 1 and 2 show the sight distance triangles for vehicles stopped on 7th Street. When vehicles are stopped at the stop bars, a building on the northwest corner, bushes on the northeast corner, a parking lot on the

southeast corner, and a sign on the southwest corner impair sight distance for drivers. As the vehicles pull up to the curb, only parked cars along Division Street impair sight distance for vehicles stopped on 7th Street.

ENGINEERING GUIDANCE

According to the Minnesota Manual on Uniform Traffic Control Devices (MnMUTCD), all-way stop control should only be implemented if justification is provided. The MnMUTCD provides the following guidance for when it may be appropriate to install all-way stop control:

- **Condition A:** Where traffic signals are justified, all-way stop control can be installed as an interim measure
- **Condition B:** Five or more reported correctable crashes in a 12-month period
- **Condition C:** All-way stop warrant volume thresholds in Section 2B.7 of the 2011 MnMUTCD are met for any eight hours of an average day.
- **Optional Guidance:**
 - **Condition B:** The need to control vehicle/pedestrian conflicts near locations that generate high pedestrian volumes.
 - **Condition 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.

All-way stop control is not currently justified at the intersection of Division Street at 7th Street for Conditions A, B, or C. None of the 13 hours of intersection volumes meet the all-way stop warrant volume thresholds for Condition C. Over the past three years there were no more than two correctable crashes within a 12-month period, which is below the threshold for condition B.

In our opinion, Optional Condition B is not satisfied as evidenced by the fact that each intersection leg has less than 20 pedestrian crossings per hour, which is a general guideline for marking a crosswalk.

Although the intersection of Division Street at 7th Street appears to meet Optional Condition C as even after a stopped vehicle on 7th Street has pulled forward past the stop bar up to the edge of the lane the sight distance is limited, the crash analysis shows that the intersection does not have a crash problem. The sight distance obstruction by parked vehicles is relatively normal in or near downtown areas, which requires drivers to be cautious.

RECOMMENDATION

It is recommended that the intersection of Division Street at 7th Street remain a minor stop controlled intersection because all-way stop guidance is not met.

Attachments:

Intersection Safety Screening
Figures 1 and 2 – Sight Distance Triangles
All-way Stop Warrant Analysis
13-hour Intersection Turning Movement Count

Intersection Safety Screening

Intersection: Division Street at 7th Street



Crash Data, 2013-2015.

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	1
Possible Injury	0
Property Damage	3
Total Crashes	4

Intersection Characteristics	
Entering Volume	7,350
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	30 mph

Annual crash cost = \$64,267

Statewide Comparison

Urban Thru / Stop

Total Crash Rate	
Observed	0.50
Statewide Average	0.19
Critical Rate	0.64
Critical Index	0.78

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.36
Critical Rate	9.26
Critical Index	0.00

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.50 per MEV; this is 22% below the critical rate. Based on similar statewide intersections, an additional 2 crashes over the three years would indicate this intersection operates outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.



N

0 50 100
Feet

Project: NFIEL 143632
 Print Date: 12/18/2017
 Map by: jdanibas
 Projection: Rice County Coords
 Source: MnDOT, SEH, MnGeo

Sight Distance Triangles
 7th Street Approaching from the West
 Northfield, Minnesota

Figure 1

This map is neither a legally recorded map nor a survey map and is not intended to be used as one. This map is a compilation of records, information, and data gathered from various sources listed on this map and is to be used for reference purposes only. SEH does not warrant that the Geographic Information System (GIS) Data used to prepare this map are error free, and SEH does not represent that the GIS Data can be used for navigational, tracking, or any other purpose requiring exacting measurement of distance or direction or precision in the depiction of geographic features. The user of this map acknowledges that SEH shall not be liable for any damages which arise out of the user's access or use of data provided.




E 7th St


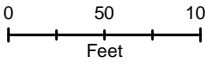
Division St

Legend

- Vehicle Stopping at Stop Bar
- Vehicle Stopping at Edge of Lane



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0 50 100
Feet

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Sight Distance Triangles
 7th Street Approaching from the East
 Northfield, Minnesota

Figure
 2

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SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

**Existing 2017 - Division Street at 7th Street
ALL WAY STOP
WARRANT ANALYSIS**

LOCATION: Division Street at 7th Street
COUNTY: Rice
REF. POINT: 0
DATE: 12/13/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach Total
30	Major App1: Division Street NB	1	2713
30	Major App3: Division Street SB	1	2403
30	Minor App2: 7th Street EB	1	378
30	Minor App4: 7th Street WB	1	467

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement
300 200

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	98	53	1	11	151	12	NO / NO
7:00 - 8:00	185	134	0	26	319	26	YES / NO
8:00 - 9:00	247	214	13	30	461	43	YES / NO
9:00 - 10:00	197	135	21	42	332	63	YES / NO
10:00 - 11:00	165	142	31	40	307	71	YES / NO
11:00 - 12:00	196	146	32	38	342	70	YES / NO
12:00 - 13:00	202	185	33	32	387	65	YES / NO
13:00 - 14:00	195	170	36	36	365	72	YES / NO
14:00 - 15:00	235	240	44	34	475	78	YES / NO
15:00 - 16:00	291	259	37	41	550	78	YES / NO
16:00 - 17:00	272	262	54	59	534	113	YES / NO
17:00 - 18:00	226	271	40	44	497	84	YES / NO
18:00 - 19:00	204	192	36	34	396	70	YES / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	2713	2403	378	467			

Hours met for warrant: **Met (Hr) 0 Required (Hr) 8**

All-way Stop Warrant: **Not satisfied**

REMARKS: _____

Location: Division Street at 7th Street
 Count Date: 11/29/2017
 Counted By: JDA



TURNING MOVEMENT COUNT DATA

All Vehicles

Start Time	Division St				7th St				Division St				7th St				Int. Total	
	Southbound				Westbound				Northbound				Eastbound					
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds		
6:00	2	10	0	0	0	0	1	0	0	21	0	0	0	0	0	0	0	34
6:15	0	8	0	0	0	0	1	0	0	22	0	0	0	0	0	0	1	31
6:30	4	12	1	1	1	0	1	1	0	20	0	0	1	0	0	1	40	
6:45	2	14	0	1	2	4	1	0	2	33	0	1	0	0	0	0	58	
7:00	1	23	0	0	1	2	1	1	1	33	1	0	0	0	0	0	63	
7:15	4	31	1	0	3	0	5	0	0	34	1	0	0	0	0	1	79	
7:30	3	33	0	1	2	2	3	1	3	50	4	0	0	0	0	1	100	
7:45	6	29	3	0	0	3	4	2	1	55	2	0	0	0	0	0	103	
8:00	4	31	2	0	2	2	2	1	3	42	6	0	0	1	1	7	96	
8:15	2	45	1	1	5	1	0	1	5	55	2	0	1	0	1	1	118	
8:30	1	71	2	0	5	2	4	0	2	48	0	0	2	3	0	2	140	
8:45	3	50	2	0	3	2	2	0	5	78	1	0	1	0	3	0	150	
9:00	3	32	0	2	5	1	4	3	2	49	5	1	2	6	1	1	110	
9:15	4	29	4	1	2	4	2	0	2	45	6	0	1	1	1	0	101	
9:30	8	30	1	2	3	5	4	0	2	36	5	0	1	3	1	4	99	
9:45	1	20	3	1	1	4	7	1	1	40	4	0	1	1	2	2	85	
10:00	2	31	3	0	3	6	1	2	1	38	2	1	1	2	6	2	96	
10:15	5	30	3	0	4	2	5	1	4	28	2	0	2	4	1	3	90	
10:30	3	25	1	1	2	0	2	1	1	33	6	0	0	1	3	0	77	
10:45	4	33	2	0	9	2	4	1	5	43	2	0	1	6	4	5	115	
11:00	4	35	3	0	4	0	5	0	2	42	3	0	0	6	3	0	107	
11:15	4	30	4	0	4	2	1	2	5	48	4	1	2	1	4	1	109	
11:30	5	24	4	2	1	3	2	1	4	41	6	0	0	7	0	1	97	
11:45	2	27	4	1	6	3	7	3	1	35	5	0	2	4	3	1	99	
12:00	4	44	0	0	3	1	4	1	3	41	4	1	1	5	5	4	115	
12:15	3	34	6	1	2	4	0	1	5	49	7	0	1	5	4	2	120	
12:30	2	34	1	0	3	3	4	1	2	38	7	0	3	3	1	0	101	
12:45	6	48	3	0	2	2	4	2	3	37	6	0	1	1	3	0	116	
13:00	4	40	2	1	6	3	4	0	2	44	4	0	0	8	4	1	121	
13:15	1	35	2	2	1	2	2	1	3	46	3	0	3	3	1	2	102	
13:30	6	34	3	2	1	2	3	0	3	39	2	0	1	4	3	1	101	
13:45	1	31	11	1	5	3	4	0	3	41	5	0	3	3	3	0	113	
14:00	9	44	6	0	2	1	1	0	6	39	2	1	3	3	2	1	118	
14:15	6	29	4	1	4	2	3	1	3	43	4	0	4	5	5	1	112	
14:30	1	63	8	2	9	2	1	0	7	37	6	0	6	2	4	0	146	
14:45	2	66	2	1	3	2	4	1	6	72	10	0	4	4	2	0	177	
15:00	4	52	3	2	3	1	2	2	2	76	7	1	7	1	4	0	162	
15:15	1	60	7	4	4	4	5	1	2	54	5	1	3	3	3	3	151	
15:30	8	54	6	2	5	2	4	2	5	72	4	0	2	5	4	1	171	
15:45	13	47	4	0	3	4	4	2	3	58	3	0	2	2	1	2	144	
16:00	6	57	8	0	8	5	5	2	4	53	5	0	6	7	5	2	169	
16:15	5	46	7	1	6	4	8	1	6	63	4	0	3	5	5	2	162	
16:30	4	64	7	0	3	2	2	1	4	61	4	3	3	6	5	5	165	
16:45	1	53	4	3	4	6	6	6	4	58	6	2	3	4	2	1	151	
17:00	9	68	7	0	5	1	3	1	5	54	3	0	4	2	3	1	164	
17:15	10	44	5	0	4	2	10	0	5	47	8	0	5	4	2	0	146	
17:30	1	64	4	1	9	1	2	0	2	44	2	0	3	1	2	1	135	
17:45	5	49	5	1	2	1	4	0	5	50	1	0	4	7	3	0	136	
18:00	2	46	3	1	2	3	2	1	6	49	3	0	5	5	6	0	132	
18:15	5	43	4	0	5	1	4	0	1	45	2	0	3	3	2	0	118	
18:30	4	38	3	2	2	3	4	2	3	54	1	0	2	6	1	0	121	
18:45	2	37	5	0	5	0	3	2	1	34	5	0	0	3	0	3	95	
Total	202	2027	174	42	179	117	171	53	156	2367	190	13	103	156	119	67	5961	
Cars+	186	1931	172	36	177	111	163	47	154	2260	183	11	103	153	117	60	5710	
Trucks	16	96	2	6	2	6	8	6	2	107	7	2	0	3	2	7	251	
% Trucks	7.9	4.7	1.1	14.3	1.1	5.1	4.7	11.3	1.3	4.5	3.7	15.4	0.0	1.9	1.7	10.4		
	4.7				3.4				4.3				1.3				4.2	



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MEMORANDUM

TO: David Bennett, P.E., Public Works Director/City Engineer
City of Northfield

FROM: Thomas A. Sohrweide, P.E., PTOE
Justin Anibas, E.I.T.

DATE: January 24, 2018

RE: All-way Stop Request at Washington Street at 4th Street
Northfield, MN
SEH No. NFIEL 143632

REQUEST

Check if the existing all-way stop control is justified at the intersection of Washington Street at 4th Street.

EXISTING CONDITIONS

Washington Street is a two lane major collector with a posted speed limit of 30 mph. 4th Street is a two lane minor collector west of Washington Street and a two lane local roadway east of Washington Street with a posted speed limit of 30 mph. There is on-street parking on both sides of both Washington Street and 4th Street. The intersection is located just east of the city center of Northfield. The intersection is all-way stop controlled. All approaches to the intersection have a single lane for all movements. The intersection does not currently have bump outs, however, the proposed design will have bump outs on each corner of the intersection.

13-hour (6 am – 7 pm) intersection turning movement counts were conducted in November 2017. The intersection was found to have a total of 353 pedestrians/bikes using the intersection during the 13-hour count; with each leg having more than 50 users. The intersection currently has marked crosswalks on all intersection approaches; however, none of the marked crosswalks have warning signs because it is an all-way stop controlled intersection. The north leg of the intersection had 20 or more crossings during 2 of the 13 hours counted; 20 or more crossings an hour is a general guide for establishing a marked crosswalk.

SAFETY REVIEW

Crash data from January 1, 2013 through December 31, 2015 was collected using the Minnesota Crash Mapping Analysis Tool (MnCMAT). There was one crash reported at this intersection between 2013 and 2015. The single crash was a head on crash with an object off of the roadway with possible injury. The intersection has a critical crash index of 0.19, which indicates that it is operating within the normal range compared to other all-way stop controlled intersections throughout the state.

SIGHT DISTANCE REVIEW

Sight distances were analyzed for vehicles approaching the intersection on 4th Street. MnDOT guidelines require a stopped vehicle to be able to see 400 feet in either direction to safely turn into traffic when the speed limit is 30 mph. It was determined that sight distances are not adequate at this intersection under existing conditions. The attached Figures 1 and 2 show the sight distance triangles for vehicles stopped on 4th Street. When vehicles are stopped at the stop bars, buildings on the northwest and southwest corners, a sign, trees, and a hill on the

northeast corner, and parked cars along Washington Avenue impair sight distance for drivers. As the vehicles pull up to the curb, only parked cars along Washington Street impair sight distance for vehicles stopped on 4th Street. However, the proposed bump outs on each corner of the intersection will improve vehicle sight distance and will ensure that, at a minimum, vehicles traveling along Washington Street will have adequate stopping sight distance.

ENGINEERING GUIDANCE

According to the Minnesota Manual on Uniform Traffic Control Devices (MnMUTCD), existing all-way stop control should only be removed if justification is provided. The MnMUTCD provides the following guidance for when it may be appropriate to install all-way stop control:

- **Condition A:** Where traffic signals are justified, all-way stop control can be installed as an interim measure
- **Condition B:** Five or more reported correctable crashes in a 12-month period (Not applicable when an all-way stop is already in place)
- **Condition C:** All-way stop warrant volume thresholds in Section 2B.7 of the 2011 MnMUTCD are met for any eight hours of an average day.
- **Optional Guidance:**
 - **Condition B:** The need to control vehicle/pedestrian conflicts near locations that generate high pedestrian volumes.
 - **Condition 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.

The existing all-way stop control is not currently justified at the intersection of Washington Street at 4th Street for Conditions A, B, or C. None of the 13 hours of intersection volumes meet the all-way stop warrant volume thresholds for Condition C.

The north leg of the intersection had 20 or more pedestrian crossings during 2 of the 13 hours counted, which is a general guideline for marking a crosswalk. However, in our opinion Optional Condition B for all-way stop control is not satisfied because the intersection is not located near a location that would typically generate high pedestrian volumes. In addition, minor street stop control intersections in the area have been able to provide adequate safety for pedestrian and bike crossings using marked crosswalks and warning signs. For example, the intersection of Division Street at 6th Street in downtown Northfield.

Although the intersection of Washington Street at 4th Street appears to meet Optional Condition C even after a stopped vehicle on 4th Street has pulled forward past the stop bar up to the edge of the lane the sight distance is limited. However, the proposed bump outs will improve sight distances to ensure that vehicles traveling along Washington Street will have adequate stopping sight distance.

RECOMMENDATION

Because the intersection does not meet all-way stop guidance, it is recommended that the intersection of Washington Street at 4th Street be converted to a minor stop controlled intersection with vehicles on 4th Street being required to stop. In addition, the intersection of Washington Street at 5th Street (350 feet south) is being converted to all-way stop control and is only 350 feet south.

Because the north leg of the intersection had 20 or more crossings during 2 of the 13 hours counted, marked crosswalks on the north and south legs of the intersection with warning signs should be considered to provide adequate safety for pedestrians and bikes using the intersection. Marked crosswalks with warning signs is consistent with other minor street stop controlled intersections in the area. For example, the intersection of Division Street at 6th Street in downtown Northfield.

All-way Stop Request at Washington Street at 4th Street
January 24, 2018
Page 3

Attachments:

Intersection Safety Screening
Figures 1 and 2 – Sight Distance Triangles
All-way Stop Warrant Analysis
13-hour Intersection Turning Movement Count

Intersection Safety Screening

Intersection: #Enter description of the intersection



Crash Data, 2013-2015.

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	0
Possible Injury	1
Property Damage	0
Total Crashes	1

Intersection Characteristics	
Entering Volume	4,150
Traffic Control	All stop
Environment	Suburban
Speed Limit	30 mph

Annual crash cost = \$27,667

Statewide Comparison

All Way Stop

Total Crash Rate	
Observed	0.22
Statewide Average	0.34
Critical Rate	1.16
Critical Index	0.19

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.72
Critical Rate	16.81
Critical Index	0.00

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.


The observed total crash rate for this period is 0.22 per MEV; this is 81% below the critical rate. Based on similar statewide intersections, an additional 5 crashes over the three years would indicate this intersection operates outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.




Legend

- Vehicle Stopping at Stop Bar
- Vehicle Stopping at Edge of Lane



N



0 50 100
Feet

Project: NFIEL 143632
 Print Date: 12/18/2017
 Map by: jdanibas
 Projection: Rice County Coords
 Source: MnDOT, SEH, MnGeo

Sight Distance Triangles
 4th Street Approaching from the West
 Northfield, Minnesota


Figure
1

This map is neither a legally recorded map nor a survey map and is not intended to be used as one. This map is a compilation of records, information, and data gathered from various sources listed on this map and is to be used for reference purposes only. SEH does not warrant that the Geographic Information System (GIS) Data used to prepare this map are error free, and SEH does not represent that the GIS Data can be used for navigational, tracking, or any other purpose requiring exacting measurement of distance or direction or precision in the depiction of geographic features. The user of this map acknowledges that SEH shall not be liable for any damages which arise out of the user's access or use of data provided.




Legend

- Vehicle Stopping at Stop Bar
- Vehicle Stopping at Edge of Lane



N



0 50 100
Feet

Project: NFIEL 143632
 Print Date: 12/18/2017
 Map by: jdanibas
 Projection: Rice County Coords
 Source: MnDOT, SEH, MnGeo

Sight Distance Triangles
 4th Street Approaching from the East
 Northfield, Minnesota

Figure
 2

This map is neither a legally recorded map nor a survey map and is not intended to be used as one. This map is a compilation of records, information, and data gathered from various sources listed on this map and is to be used for reference purposes only. SEH does not warrant that the Geographic Information System (GIS) Data used to prepare this map are error free, and SEH does not represent that the GIS Data can be used for navigational, tracking, or any other purpose requiring exacting measurement of distance or direction or precision in the depiction of geographic features. The user of this map acknowledges that SEH shall not be liable for any damages which arise out of the user's access or use of data provided.

Location: Washington Street at 4th Street
 Count Date: 11/29/2017
 Counted By: JDA



TURNING MOVEMENT COUNT DATA

All Vehicles

Start Time	Washington St				4th St				Washington St				4th St				Int. Total
	Southbound				Westbound				Northbound				Eastbound				
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	
6:00	0	2	0	0	1	3	0	0	0	6	1	0	1	2	1	0	17
6:15	0	1	0	0	1	2	1	0	1	5	0	0	0	2	0	0	13
6:30	0	3	2	2	1	5	3	1	0	8	0	0	0	1	1	0	24
6:45	1	4	0	0	2	7	2	0	1	8	1	1	3	4	2	1	35
7:00	0	1	1	1	2	7	0	0	1	15	0	0	0	3	0	0	30
7:15	0	15	0	0	4	7	2	0	2	16	0	0	1	3	3	2	53
7:30	2	7	1	0	2	8	5	0	3	25	3	1	3	2	2	0	63
7:45	0	14	3	1	2	10	2	1	6	25	1	2	0	4	2	0	69
8:00	0	12	1	0	2	5	1	1	3	20	1	1	1	3	5	1	54
8:15	1	5	1	1	2	8	2	3	2	24	5	2	4	4	5	3	63
8:30	0	13	1	0	2	5	1	0	2	11	3	0	1	1	1	0	41
8:45	2	14	0	1	4	7	4	2	3	28	4	0	2	6	2	0	76
9:00	2	16	0	4	0	7	1	1	7	22	4	3	2	3	3	1	67
9:15	0	10	2	0	3	6	1	0	2	16	4	2	2	2	6	0	54
9:30	3	10	1	0	3	6	1	0	4	21	0	2	2	2	6	1	59
9:45	1	7	7	3	4	6	5	11	5	21	3	3	6	5	1	2	71
10:00	1	9	2	5	2	2	1	0	1	14	1	2	3	2	6	1	44
10:15	1	11	3	1	5	0	3	1	3	16	0	1	5	0	3	0	50
10:30	0	7	3	1	4	3	1	1	3	16	2	0	4	3	2	0	48
10:45	0	7	3	3	1	4	1	0	3	7	4	1	2	2	4	1	38
11:00	0	11	4	2	4	1	1	0	6	12	2	3	2	4	6	3	53
11:15	1	12	6	1	1	7	2	0	3	11	4	0	1	4	5	1	57
11:30	1	8	2	0	2	4	1	11	2	12	2	1	3	1	2	1	40
11:45	2	19	4	1	3	7	2	1	5	22	0	2	6	2	5	2	77
12:00	0	26	6	0	6	3	1	0	4	15	5	1	8	3	9	2	86
12:15	0	16	8	2	3	3	2	0	5	10	2	1	5	6	1	2	61
12:30	1	9	1	2	1	7	2	2	3	14	2	3	4	6	7	1	57
12:45	2	11	3	2	2	5	1	5	4	16	1	3	4	4	9	3	62
13:00	3	14	3	1	4	5	0	1	4	16	5	2	2	2	3	0	61
13:15	1	14	4	1	3	13	2	2	3	13	4	2	5	3	9	2	74
13:30	0	15	3	2	4	4	1	1	3	21	1	0	6	2	5	2	65
13:45	0	21	6	2	2	5	4	0	3	15	2	0	3	2	2	0	65
14:00	1	13	2	2	2	5	2	1	6	10	1	4	1	3	8	1	54
14:15	2	19	2	2	3	5	2	1	2	16	4	2	4	6	3	0	68
14:30	1	17	4	1	6	7	2	0	3	13	4	3	3	3	6	0	69
14:45	0	16	2	3	4	4	2	1	5	14	2	2	3	3	4	0	59
15:00	1	19	5	2	4	5	0	0	5	19	3	2	2	2	5	3	70
15:15	2	23	6	0	5	6	0	0	5	23	5	1	4	6	9	0	94
15:30	1	20	3	1	5	9	1	1	2	22	4	2	6	11	5	1	89
15:45	2	14	11	1	4	7	1	1	8	15	9	2	5	4	2	1	82
16:00	2	29	3	6	3	5	4	1	8	19	7	0	1	5	8	0	94
16:15	3	27	6	6	6	4	2	4	5	28	7	3	3	9	6	3	106
16:30	4	20	6	4	7	6	1	2	6	17	2	3	3	9	8	1	89
16:45	5	38	2	8	6	6	1	8	8	17	9	3	4	8	9	4	113
17:00	2	44	6	8	5	8	2	4	3	22	3	2	5	9	6	2	115
17:15	6	35	2	4	3	6	8	5	4	12	5	2	0	13	10	1	104
17:30	2	24	5	8	3	10	3	3	6	13	7	1	5	14	5	6	97
17:45	2	14	7	15	3	8	1	2	5	11	8	0	0	9	9	6	77
18:00	2	23	7	6	3	12	2	7	2	20	5	0	1	6	5	2	88
18:15	4	15	4	8	3	7	2	0	5	8	2	0	7	5	5	0	67
18:30	1	16	3	2	1	4	3	0	2	15	3	1	5	7	8	1	68
18:45	1	8	0	3	6	8	4	0	5	6	6	1	1	5	5	1	55
Total	69	778	167	129	164	304	99	86	192	821	163	73	154	230	244	65	3385
Cars+	66	746	161	123	162	299	96	78	192	807	160	65	135	225	243	59	3292
Trucks	3	32	6	6	2	5	3	8	0	14	3	8	19	5	1	6	93
% Trucks	4.3	4.1	3.6	4.7	1.2	1.6	3.0	9.3	0.0	1.7	1.8	11.0	12.3	2.2	0.4	9.2	
	4.0				1.8				1.4				4.0				2.7