

# Highway Safety Improvement Program (HSIP) (For State Fiscal Years 2022 and 2023)



*August, 2016*

**Applicant: Hennepin County**

**Project Name: CSAH 35 (Portland Avenue), and CSAH 52 (Nicollet Avenue) Safety Improvements**

**Project Location: CSAH 35 Corridor within the City of Bloomington and CSAH 52 within the City of Richfield**

**HSIP application (Form 1)**

**Federal HSIP Funding Application (Form 1)**

**INSTRUCTIONS:** Complete and return completed application to Lars Impola, MnDOT, Metro District, 1500 West County Road B2, Roseville, Minnesota 55113. (651) 234-7820. **Applications must be received by 4:30 PM or postmarked on August 31, 2018...\*Be sure to complete and attach the Project Information form. (Form 2)**


**I. GENERAL INFORMATION**

1. APPLICANT: Hennepin County			
2. JURISDICTIONAL AGENCY (IF DIFFERENT): Hennepin County Public Works			
3. MAILING ADDRESS: 1600 Prairie Drive			
CITY: Medina	STATE: MN	ZIP CODE: 55340	4. COUNTY: Hennepin
5. CONTACT PERSON: Chad Ellos	TITLE: Transportation Planning Division Manager		PHONE NO. ( 612 ) 596 - 0395
CONTACT E-MAIL ADDRESS: <a href="mailto:Chad.Ellos@hennepin.us">Chad.Ellos@hennepin.us</a>			

**II. PROJECT INFORMATION**

6. PROJECT NAME: CSAH 35 (Portland Avenue), and CSAH 52 (Nicollet Avenue) Safety Improvements
7. BRIEF PROJECT DESCRIPTION - Include location, road name, type of improvement, etc... (A complete description can be submitted separately):  The following safety improvements are proposed at appropriate intersections based on engineering judgement along Nicollet Avenue and Portland Avenue.  Signal improvements including signal head replacement, retiming, additional signal heads, confirmation lights, and exclusive left-turn phasing. Pedestrian improvements including curb extensions (if feasible), upgrading the pedestrian ramps to current ADA requirements, installation of Accessible Pedestrian Signals (APS), and countdown timers.
8. HSIP PROJECT CATEGORY – Circle which project grouping in which you wish your project to be scored. Proactive <b>Reactive</b>

**III. PROJECT FUNDING**

9. Are you applying or have you applied for funds from another source(s) to implement this project? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If yes, please identify the source(s):	
10. FEDERAL AMOUNT: \$ 846,000	13. MATCH % OF PROJECT TOTAL: 10%
11. MATCH AMOUNT: \$ 94,000	14. SOURCE OF MATCH FUNDS: Hennepin County
12. PROJECT TOTAL: \$ 940,000	15. REQUESTED PROGRAM YEAR(S) : SEE NOTE BELOW <input checked="" type="checkbox"/> 2022 <input type="checkbox"/> 2023 <input type="checkbox"/> Either year
16. SIGNATURE: 	17. TITLE: Transportation Planning Division Manager

**\*NOTE: If funding should become available in 2019, 2020, or 2021, would this project be able to be advanced to meet this schedule? \_\_\_\_\_ No**

**Project information sheet (Form 2)**

## PROJECT INFORMATION (Form 2)

(To be used to assign State Project Number after project is selected)

Please fill in the following information as it pertains to your proposed project. Items that do not apply to your project, please label N/A. **Do not send this form to the State Aid Office. For project solicitation package only.**

COUNTY, CITY, or LEAD AGENCY: **Hennepin County**

FUNCTIONAL CLASS OF ROAD:

**CSAH 35 is an A-Minor Arterial (Expander)**

**CSAH 52 is a B-Minor Arterial**

ROAD SYSTEM: **County State Aid Highway (CSAH)**

NAME OF ROAD

**CSAH 35 (Portland Avenue)**

**CSAH 52 (Nicollet Avenue)**

ZIP CODE WHERE MAJORITY OF WORK IS BEING PERFORMED

**CSAH 35 (Portland Avenue): 55420**

**CSAH 52 (Nicollet Avenue): 55423**

APPROXIMATE BEGIN CONSTRUCTION DATE (MO/YR): **April 2022**

APPROXIMATE END CONSTRUCTION DATE (MO/YR): **November 2022**

LOCATION:

**CSAH 35: Within the City of Bloomington**

**CSAH 52: Within the City of Richfield**

TYPE OF WORK (Examples: GRADE, AGG BASE, BIT BASE, BIT SURF, SIDEWALK, CURB AND GUTTER, STORM SEWER, SIGNALS, LIGHTING, GUARDRAIL, BIKE PATH, PED RAMPS, BRIDGE, PARK AND RIDE, ETC)

**SIGNAL IMPROVEMENTS, ADA IMPROVEMENTS, CURB EXTENSIONS, STORM SEWER, CURB AND GUTTER**



**Project Description**

**Project Name:** CSAH 35 (Portland Avenue) and CSAH 52 (Nicollet Avenue) Safety Improvements  
**CSAH 35 Project Termini:** Within Bloomington City Limits  
**CSAH 52 Project Termini:** Within Richfield City Limits

**Purpose & Justification**

Hennepin County is submitting this application seeking funds from the Highway Safety Improvement Program (HSIP) for proposed safety improvements at various intersections along the Nicollet Avenue and Portland Avenue corridors. The proposed project is needed to improve safety and traffic operations at these intersections by addressing the high number of crashes (particularly those resulting in injuries) and providing more flexible left-turn phasing. Hennepin County, through a partnership with the Cities of Richfield and Bloomington, have analyzed the types of crashes occurring along these corridors and have developed a general project scope. Letters of support provided by the cities are included in Attachment D.

CSAH 35 - Portland Avenue is a 4-lane undivided roadway with AADTs that range from 3,500 to 8,500 vehicles per day within the project area. Hennepin County has a planned repaving project along this section of Portland Avenue in 2018 that will convert the existing roadway configuration to a 3-lane section in a effort to provide traffic calming, improve access to residential driveways, and introduce an on-road bikeway. However, signal modifications will not be included within the scope of the 2018 repaving project. Portland Avenue provides users with access to I-494 and serves as a critical north/south connection between Old Shakopee Road (CSAH 1) and American Boulevard.

CSAH 52 - Nicollet Avenue is a 3-lane roadway with AADTs that range from 9,100 to 12,100 vehicles per day within the project area. This roadway was converted from a 4-lane undivided section to a 3-lane section in 2014 as part of a county repaving project in an effort to provide traffic calming and better facilitate vehicle turning movements. Signal modifications (specifically the introduction of dedicated left-turn phasing) were not within the scope of the 2014 repaving project. Nicollet Avenue provides users with access to I-494, along with the Richfield Hub and West Shopping Center.

The recent crash history indicates that the crash rate exceeds the critical rate at many of the intersections included within the project limits (as illustrated in the Corridor Characteristics section below). In review of the crash data provided by MnDOT (for the years 2013-2015) there is a high percentage of left-turn crashes occurring at these intersections (nearly 27% of the total crashes). The proposed improvements will reduce these crashes through the introduction of Flashing Yellow Arrows (FYA) to allow for flexible left-turn signal operations. The proposed improvements outlined in the project scope are estimated to have a construction cost of \$940,000; Hennepin County is requesting \$846,000 of federal assistance, and is accepting responsibility for the 10% local match (\$94,000). With a total benefit of \$4,600,000, this project has a Benefit/Cost ratio 4.89, which makes this project is a great candidate for the HSIP funding.

**Corridor Characteristics**

<b>Current AADT for Project Area (Avg) :</b>	<b>CSAH 35 (Portland Avenue)</b>
	3,500 - 10,700 ( <b>7,100</b> )
	<b>CSAH 52 (Nicollet Avenue)</b>
	9,100 - 12,100 ( <b>10,800</b> )
<b>Crash History Provided by H.C., TIS (2013 - 2015):</b> (Collision Diagrams: Attachment F)	<b>Intersection Related</b>
	CSAH 35 ( 35 P, 23 C, 8 B, 0 A) CSAH 52 ( 14 P, 10 C, 2 B, 0 A) Total ( 49 P, 33 C, 10 B, 0 A)
<b>3-Year Crash Rate (2013-2015) - crashes/million vehicles</b> <b>Crash Rate / (Critical Crash Rate)</b> (Crash Rate Calculations: Attachment C)	<b>CSAH 35/ American Blvd - 1.08 (0.77)</b>
	<b>CSAH 35/ 86th St - 0.91 (0.97)</b>
	<b>CSAH 35/ 90th St - 1.03 (1.00)</b>
	<b>CSAH 35/ 98th St - 0.33 (0.72)</b>
	<b>CSAH 52/ 70th St - 1.06 (0.97)</b>
	<b>CSAH 52/ 76th St - 0.77 (0.97)</b>

## Project Scope

Hennepin County will coordinate this project with each affected city to determine the appropriate project elements for each signalized intersection based on agreements developed for traffic signal ownership, maintenance, and timing responsibilities.

The following is a list of proposed improvements to be implemented at various locations as determined by engineering judgment in an effort to reduce crashes:

- Flashing Yellow Arrows (FYA) for left-turning movements on selected approaches
- Improved signal timing
- Confirmation lights for red light running enforcement
- Restricted left-turn phasing whenever the pedestrian phase is initiated
- ADA improvements including pedestrian ramps and Accessible Pedestrian Signals (APS)
- Pedestrian safety enhancements (wherever feasible) including countdown timers, Leading Pedestrian Interval (LPI), and curb extensions

## Crash Reduction Analysis

The estimate of crash reductions used for the proposed improvements is based on various FHWA Crash Modification Factors (CMF's). Based on the 2018 HSIP criteria, multiple safety improvements may be used to determine the crash reductions for the Benefit/Cost (B/C) Analysis. Whenever multiple CMF's were applied to one or more crashes, the multiple safety improvement crash reduction formula (provided in the HSIP solicitation packet) was employed. The HSIP B/C worksheets (Attachment H) includes the individual crashes and reduction factors. Descriptions for each of the CMF's may be found in Attachment G. The estimation of project costs is provided in Attachment B. The following five crash modification factors were considered based on the most common crash types and the greatest crash reductions for the proposed improvements. **No more than two CMF's are applied at each project location.**

- Convert signal phasing from permissive only to Flashing Yellow Arrow (FYA)
  - o (CMF ID 7684; 40.2% reduction in left-turn crashes)
- Convert signal phasing from protected/permissive to Flashing Yellow Arrow (FYA)
  - o (CMF ID 4177; 19.4% reduction in left-turn crashes)
- Install pedestrian countdown timers
  - o (CMF ID 5272; 70% reduction in pedestrian crashes)
- Install pedestrian countdown timers
  - o (CMF ID 8790; 8.8% reduction in all crashes)
- Install confirmation lights
  - o (CMF ID 8824; 28.7% reduction in right-angle crashes)

Overall, this project will provide a significant safety benefit to all transportation users on Nicollet Avenue and Portland Avenue by reducing crashes. Curb extensions (if determined feasible during the project design phase), countdown timers and Leading Pedestrian Interval (LPI) will provide safety enhancements for bicyclists and pedestrians with destinations to Valley View Park, Augsburg Park, and the Richfield Hub and West Shopping Center. ADA improvements will provide accessible infrastructure, free of obstructions, for persons with limited mobility. Signal upgrades, including dedicated left-turn phasing and additional signal heads, will improve visibility and reduce left-turn crashes. FYA upgrades will allow left turns to operate in both Permissive/Protected and Protected scenarios. This is especially important during peak hours when potential conflicts are common due to high traffic and pedestrian crossing volumes. Should this project be successful in securing funding, Hennepin County will work in collaboration with the Cities of Richfield and Bloomington and their residents to deliver this important safety project.

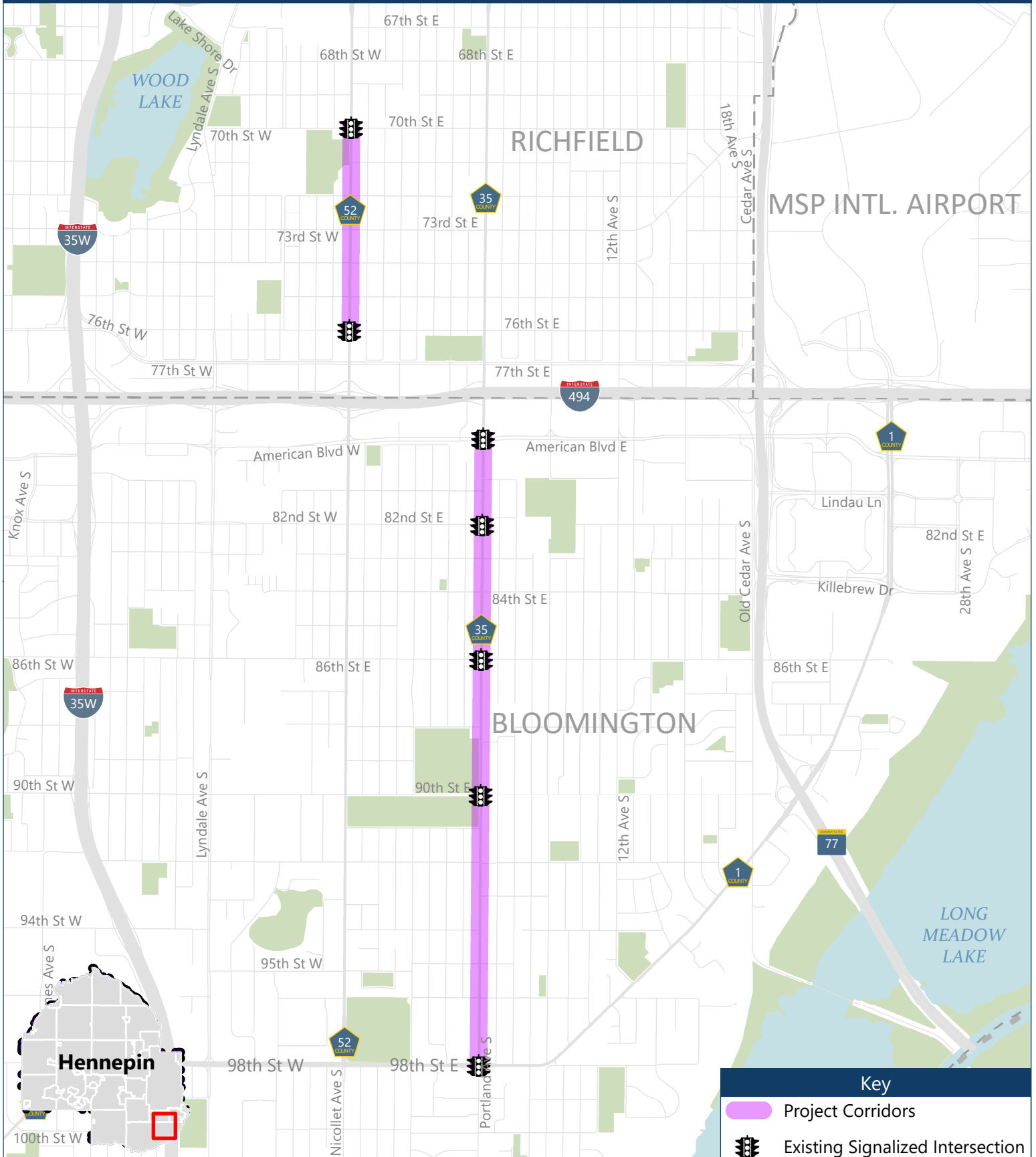
**Attachment A – Project Location Map**



# HSIP FYA Project Corridors

CSAH 35 & CSAH 52

HENNEPIN COUNTY  
MINNESOTA



**Disclaimer:** This map (i) is furnished "AS IS" with no representation as to completeness or accuracy; (ii) is furnished with no warranty of any kind; and (iii) is not suitable for legal, engineering or surveying purposes. Hennepin County shall not be liable for any damage, injury or loss resulting from this map.



**Attachment B – Estimate of Project Costs**

# Quantities and Cost Estimate Summary

## Traffic Signal Items

<b>Pay Item Description</b>	<b>Units</b>	<b>Qty</b>	<b>Est. Cost</b>
Revise Signal System A (CSAH 52/70th)	System	1	\$60,000
Revise Signal System B (CSAH 52/76th)	System	1	\$40,000
Revise Signal System C (CSAH 35/American)	System	1	\$70,000
Revise Signal System D (CSAH 35/86th)	System	1	\$100,000
Revise Signal System E (CSAH 35/90th)	System	1	\$70,000
Revise Signal System F (CSAH 35/98th)	System	1	\$70,000
<b>Pay Items Total</b>			<b>\$410,000</b>

<b>County Furnished Materials</b>			
Revise Signal System A (CSAH 52/70th)			\$25,000
Revise Signal System B (CSAH 52/76th)			\$0
Revise Signal System C (CSAH 35/American)			\$25,000
Revise Signal System D (CSAH 35/86th)			\$0
Revise Signal System E (CSAH 35/90th)			\$0
Revise Signal System F (CSAH 35/98th)			\$25,000
<b>County Furnished Total</b>			<b>\$75,000</b>

<b>ADA Upgrades</b>			
CSAH 52 & 70th		1	\$50,000
CSAH 52 & 76th		1	\$50,000
CSAH 35 & American		1	\$50,000
CSAH 35 & 86th		1	\$50,000
CSAH 35 & 90th		1	\$50,000
CSAH 35 & 98th		1	\$50,000
<b>ADA Total</b>			<b>\$300,000</b>

<b>Pay Item Total</b>			<b>\$785,000</b>
<b>Contingency 20%</b>			<b>\$155,000</b>
<b>Project Total</b>			<b>\$940,000</b>

**Attachment C – Existing Crash Rate Calculations**

# 3 YEAR INTERSECTION CRASH RATE

LOCATION CSAH 35 (Portland Ave) & American Blvd

INTERSECTION TYPE SG-D

INTERSECTION CRASH RATE (3 YR) = ACC/MV

CRASHES / MILLION VEHICLES = NO ACC x 1,000,000 / AADT x 365

Preliminary Data

* 2013	2014	2015	3 YR AVG. RATE
--------	------	------	----------------

ACC =	14
AADT =	28200
RATE =	1.36
DOT	365

ACC =	11
AADT =	27600
RATE =	1.09
DOT	365

ACC =	8
AADT =	27600
RATE =	0.79
DOT	365

RATE =	1.08
--------	------

3 YR SUBURBAN AVG (13-15)	(SG-D)	=	0.50
CRITICAL RATE	(K =2)	=	0.77
CRITICAL RATE INDEX		=	1.40

# 3 YEAR INTERSECTION CRASH RATE

**LOCATION** CSAH 35 (Portland Ave) & 86th St

**INTERSECTION TYPE** SG-A

INTERSECTION CRASH RATE (3 YR) = ACC/MV

CRASHES / MILLION VEHICLES = NO ACC x 1,000,000 / AADT x 365

Preliminary Data

* 2013	2014	2015	3 YR AVG. RATE
--------	------	------	----------------

ACC =	5
AADT =	13012
RATE =	1.05
DOT	365

ACC =	6
AADT =	12950
RATE =	1.27
DOT	365

ACC =	2
AADT =	12950
RATE =	0.42
DOT	365

RATE =	0.91
--------	------

3 YR SUBURBAN AVG (13-15)	(SG-A)	=	0.54
CRITICAL RATE	(K =2)	=	0.97
CRITICAL RATE INDEX		=	0.94

# 3 YEAR INTERSECTION CRASH RATE

LOCATION CSAH 35 (Portland Ave) & 90th St

INTERSECTION TYPE SG-A

INTERSECTION CRASH RATE (3 YR) = ACC/MV

CRASHES / MILLION VEHICLES = NO ACC x 1,000,000 / AADT x 365

Preliminary Data

* 2013	2014	2015	3 YR AVG. RATE
--------	------	------	----------------

ACC =   
 AADT =   
 RATE =   
 DOT 365

ACC =   
 AADT =   
 RATE =   
 365

ACC =   
 AADT =   
 RATE =   
 365

RATE =

3 YR SUBURBAN AVG (13-15) (SG-A) =   
 CRITICAL RATE (K =2) =   
 CRITICAL RATE INDEX =

# 3 YEAR INTERSECTION CRASH RATE

LOCATION CSAH 35 (Portland Ave) & CSAH 1 (98th St)

INTERSECTION TYPE SG-B

INTERSECTION CRASH RATE (3 YR) = ACC/MV

CRASHES / MILLION VEHICLES = NO ACC x 1,000,000 / AADT x 365

Preliminary Data

* 2013	2014	2015	3 YR AVG. RATE
--------	------	------	----------------

ACC =   
 AADT =   
 RATE =   
 DOT 365

ACC =   
 AADT =   
 RATE =   
 365

ACC =   
 AADT =   
 RATE =   
 365

RATE =

3 YR SUBURBAN AVG (13-15) (SG-B) =   
 CRITICAL RATE (K =2) =   
 CRITICAL RATE INDEX =



# 3 YEAR INTERSECTION CRASH RATE

LOCATION CSAH 52 (Nicollet Ave) & 70th St

INTERSECTION TYPE SG-A

INTERSECTION CRASH RATE (3 YR) = ACC/MV

CRASHES / MILLION VEHICLES = NO ACC x 1,000,000 / AADT x 365

Preliminary Data

* 2013	2014	2015	3 YR AVG. RATE
--------	------	------	----------------

ACC =   
 AADT =   
 RATE =   
 DOT 365

ACC =   
 AADT =   
 RATE =   
 365

ACC =   
 AADT =   
 RATE =   
 365

RATE =

3 YR SUBURBAN AVG (13-15) (SG-A) =   
 CRITICAL RATE (K =2) =   
 CRITICAL RATE INDEX =

# 3 YEAR INTERSECTION CRASH RATE

**LOCATION** CSAH 52 (Nicollet Ave) & 76th St

**INTERSECTION TYPE** SG-A

INTERSECTION CRASH RATE (3 YR) = ACC/MV

CRASHES / MILLION VEHICLES = NO ACC x 1,000,000 / AADT x 365

Preliminary Data

* 2013	2014	2015	3 YR AVG. RATE
--------	------	------	----------------

ACC =	3
AADT =	13625
RATE =	0.60
DOT	365

ACC =	5
AADT =	12725
RATE =	1.08
DOT	365

ACC =	3
AADT =	12725
RATE =	0.65
DOT	365

RATE =	0.77
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3 YR SUBURBAN AVG (13-15)	(SG-A)	=	0.54
CRITICAL RATE	(K =2)	=	0.97
CRITICAL RATE INDEX		=	0.79

**Attachment D – Letters of Support**



August 24, 2018

Carla Stueve, P.E., P.T.O.E  
Hennepin County Engineer  
Transportation Project Delivery  
1600 Prairie Drive  
Medina, MN 55340

Re: Support for Highway Safety Improvement program Application  
Flashing Yellow Arrow (FYA) Retrofit Project

Dear Ms. Stueve:

The City of Bloomington hereby expresses its support for the Hennepin County Highway Safety Improvement Program (HSIP) funding application for the proposed roadway safety project on CSAH 35 (Portland Avenue) within the City of Bloomington.

The safety project will include (but is not limited to): upgrading to Flashing Yellow Arrow signal indications, installation of confirmation lights, signal upgrades, and ADA accommodations.

Thank you for making us aware of this application effort and the opportunity to provide support. The city looks forward to working with you on this project.

Sincerely,

A handwritten signature in blue ink that reads "Shelly Hanson". The signature is fluid and cursive, with the first name "Shelly" and last name "Hanson" clearly legible.

Shelly Hanson, P.E.  
City Engineer



August 23, 2018

**MAYOR**

PAT ELLIOTT

**CITY COUNCIL**

EDWINA GARCIA

MICHAEL HOWARD

MARIA REGAN GONZALEZ

SIMON TRAUTMANN

**CITY MANAGER**

STEVEN DEVICH

Carla Stueve, P.E., P.T.O.E  
Hennepin County Engineer  
Transportation Project Delivery  
1600 Prairie Drive  
Medina, MN 55340

Re: Support for Highway Safety Improvement program Application  
Flashing Yellow Arrow (FYA) Retrofit Project

Dear Ms. Stueve:

The City of Richfield hereby expresses its support for the Hennepin County Highway Safety Improvement Program (HSIP) funding application for the proposed roadway safety project on CSAH 52 (Nicollet Avenue) within the City of Richfield.

The safety project will include (but is not limited to): upgrading to Flashing Yellow Arrow signal indications, installation of confirmation lights, signal upgrades, and ADA accommodations.

Thank you for making us aware of this application effort and the opportunity to provide support. The city looks forward to working with you on this project.

Sincerely,

Kristin Asher, P.E.  
Public Works Director  
City of Richfield

## **Attachment E – Crash Data (2013-2015)**

Hennepin County Public Works  
**CSAH 35 (Portland Ave) at American Blvd**  
 2013 - 2015

RD NO	MILE PT	LEFT DIST	RIGHT DIST	ROAD TYPE	INTER TYPE	CRSH YR	CRSH MONT H	CRSH DAY	CRSH HOUR	CRSH D O WK	CRSH NO	MUN	CITY CODE	MAX SEV	CRSH DIAG	CRSH TYPE	NO VEH	CRSH LIGHIN G	CRSH PRI WEATH ER	RD SUR	CRSH WKZO TYPE
35	2.30	0	0	0	15	2013	2	8	13	6	130570067	1	385	N	1	1	2	99	99	99	98
35	2.30	0	0	0	15	2013	10	30	8	4	133370142	1	385	N	2	1	2	1	2	2	98
35	2.31	0	0	0	15	2013	3	3	20	1	130950067	1	385	C	3	1	2	4	1	1	98
35	2.31	0	0	0	15	2013	1	8	6	3	130430061	1	385	N	1	1	2	2	1	1	98
35	2.31	0	0	0	15	2013	4	19	10	6	131090150	1	385	N	1	1	2	1	7	5	98
35	2.31	0	0	0	15	2013	12	16	9	2	140210084	1	385	N	1	1	2	1	4	5	98
35	2.31	0	0	0	15	2013	6	26	10	4	131770111	1	385	C	5	1	2	1	2	1	98
35	2.31	0	0	0	15	2013	9	17	21	3	132910047	1	385	N	1	1	2	4	1	1	98
35	2.31	0	0	0	15	2013	12	13	17	6	133470202	1	385	B	90	6	1	4	1	4	98
35	2.31	0	0	0	15	2013	10	6	18	1	132790206	1	385	N	2	1	2	1	3	2	98
35	2.31	0	0	0	15	2013	4	8	17	2	131330040	1	385	N	3	1	2	1	1	1	98
35	2.31	0	0	0	15	2013	11	27	16	4	133650132	1	385	N	5	1	2	1	1	1	98
35	2.31	0	0	0	15	2013	5	3	14	6	131560068	1	385	B	1	1	3	1	3	2	98
35	2.31	0	0	0	15	2013	1	19	21	7	130200007	1	385	N	3	1	3	4	1	1	98
35	2.30	0	0	0	15	2014	3	26	18	4	141180034	1	385	C	1	1	2	1	1	1	98
35	2.31	0	0	0	15	2014	5	29	14	5	141820112	1	385	N	1	1	2	1	1	1	98
35	2.31	0	0	0	15	2014	2	9	13	1	140700066	1	385	N	3	1	2			99	98
35	2.31	0	0	0	15	2014	9	1	5	2	142440036	1	385	C	5	1	2	4	3	2	98
35	2.31	0	0	0	15	2014	3	14	19	6	140730126	1	385	C	1	1	2	3	1	1	98
35	2.31	0	0	0	15	2014	10	21	14	3	142970048	1	385	C	3	1	2	1	1	1	98
35	2.31	0	0	0	15	2014	6	23	10	2	141740091	1	385	N	1	1	2	1	1	1	98
35	2.31	0	0	0	15	2014	5	16	6	6	141640116	1	385	N	5	1	2	1	1	1	98
35	2.31	0	0	0	15	2014	10	11	14	7	143170109	1	385	N	2	1	2	1	1	1	98

Hennepin County Public Works  
**CSAH 35 (Portland Ave) at American Blvd**  
 2013 - 2015

RD NO	MILE PT	LEFT DIST	RIGHT DIST	ROAD TYPE	INTER TYPE	CRSH YR	CRSH MONT H	CRSH DAY	CRSH HOUR	CRSH D O WK	CRSH NO	MUN	CITY CODE	MAX SEV	CRSH DIAG	CRSH TYPE	NO VEH	CRSH LIGHIN G	CRSH PRI WEATH ER	RD SUR	CRSH WKZO TYPE
35	2.31	0	0	0	15	2014	1	6	17	2	140060184	1	385	C	3	1	2	4	1	5	98
35	2.31	0	0	0	15	2014	5	23	12	6	141760057	1	385	C	5	1	2	1	1	1	98
35	2.31	0	0	0	15	2015	8	14	18	6	152580100	1	385	N	5	1	2	1		1	98
35	2.31	0	0	0	15	2015	11	14	9	7	153180099	1	385	N	1	1	2	1	1	1	98
35	2.31	0	0	0	15	2015	3	24	15	3	151170063	1	385	N	5	1	2	1	1	1	98
35	2.31	0	0	0	15	2015	3	26	13	5	150850101	1	385	B	1	1	2	1	1	1	98
35	2.31	0	0	0	15	2015	5	7	16	5	151590092	1	385	B	1	1	2	1	2	1	98
35	2.31	0	0	0	15	2015	9	1	17	3	152440119	1	385	C	1	1	2	1	1	1	98
35	2.32	0	0	0	15	2015	5	3	17	1	151540047	1	385	N	2	1	2	1	2	1	98
35	2.32	0	0	0	15	2015	11	10	10	3	153450040	1	385	C	1	1	2	1	1	1	
Total				33																	



Hennepin County Public Works  
 CSAH 35 (Portland Ave) at 86th Street  
 2013 - 2015

RD NO	MILE PT	LEFT DIST	RIGHT DIST	ROAD TYPE	INTER TYPE	CRSH YR	CRSH MONT H	CRSH DAY	CRSH HOUR	CRSH D O WK	CRSH NO	MUN	CITY CODE	MAX SEV	CRSH DIAG	CRSH TYPE	NO VEH	CRSH LIGHIN G	CRSH PRI WEATH ER	RD SUR	CRSH WKZO TYPE
35	1.50	0	0	0	12	2013	11	25	15	2	133290119	1	385	N	3	1	2	1	2	1	98
35	1.50	0	0	0	12	2013	1	9	17	4	130430060	1	385	N	3	1	2	3	1	1	98
35	1.50	0	0	0	12	2013	2	2	8	7	130330120	1	385	N	5	1	2	1	1	3	98
35	1.50	0	0	0	12	2013	4	13	14	7	131030105	1	385	C	3	1	2	1	2	1	98
35	1.50	0	0	0	12	2013	5	20	16	2	131750059	1	385	N	2	1	2	1	2	1	98
35	1.50	0	0	0	12	2014	11	17	13	2	143360029	1	385	N	7	22	1	1	99	99	98
35	1.50	0	0	0	12	2014	11	29	11	7	143650092	1	385	C	5	1	2	1	1	1	98
35	1.50	0	0	0	12	2014	2	15	13	7	140770095	1	385	N	5	1	3	1	4	3	98
35	1.50	0	0	0	12	2014	1	3	16	6	140030188	1	385	B	3	1	2	1	2	5	98
35	1.50	0	0	0	12	2014	2	26	8	4	140570098	1	385	C	5	1	2	1	1	5	98
35	1.50	0	0	0	12	2014	3	14	17	6	141060053	1	385	C	5	1	2	1	1	1	98
35	1.50	0	0	0	12	2015	10	8	8	5	153140093	1	385	N	3	1	2	1	3	2	98
35	1.50	0	0	0	12	2015	2	5	14	5	150360154	1	385	C	5	1	2	1	1	1	98
Total				13																	

Hennepin County Public Works  
**CSAH 35 (Portland Ave) at 90th Street**  
 2013 - 2015

RD NO	MILE PT	LEFT DIST	RIGHT DIST	ROAD TYPE	INTER TYPE	CRSH YR	CRSH MONT H	CRSH DAY	CRSH HOUR	CRSH D O WK	CRSH NO	MUN	CITY CODE	MAX SEV	CRSH DIAG	CRSH TYPE	NO VEH	CRSH LIGHIN G	CRSH PRI WEATH ER	RD SUR	CRSH WKZO TYPE
35	1.00	0	0	0	12	2013	2	1	18	6	130320161	1	385	C	3	1	2	4	4	3	98
35	1.00	0	0	0	12	2014	2	23	11	1	140540234	1	385	N	5	1	3	1	1	5	98
35	1.00	0	0	0	12	2014	8	9	13	7	142210054	1	385	C	5	1	3	1	2	1	98
35	1.00	0	0	0	12	2014	2	13	7	5	140760032	1	385	N	3	1	2	1	2	2	98
35	1.00	0	0	0	12	2014	11	15	16	7	143510110	1	385	N	3	1	2	1	2	4	98
35	1.00	0	0	0	12	2014	6	1	18	1	141520100	1	385	B	5	1	2	1	2	1	98
35	1.00	0	0	0	12	2014	9	17	18	4	142610016	1	385	N	3	1	2	1	1	1	98
35	1.00	0	0	0	12	2014	2	24	7	2	140850054	1	385	N	1	1	2	1	1	5	98
35	1.00	0	0	0	12	2014	4	7	17	2	141290029	1	385	N	1	1	2	1	1	1	98
35	1.00	0	0	0	12	2014	9	23	15	3	142660188	1	385	C	5	1	2	1	1	1	98
35	1.00	0	0	0	12	2014	4	28	17	2	141180127	1	385	B	5	1	2	1	3	2	98
35	1.00	0	0	0	12	2015	1	21	13	4	150550058	1	385	N	3	1	2			2	98
35	1.00	0	0	0	12	2015	4	16	11	5	151380122	1	385	C	3	1	2	1	1	1	98
Total				13																	

Hennepin County Public Works  
**CSAH 35 (Portland Ave) at CSAH 1 (98th Street)**  
 2013 - 2015

RD NO	MILE PT	LEFT DIST	RIGHT DIST	ROAD TYPE	INTER TYPE	CRSH YR	CRSH MONT H	CRSH DAY	CRSH HOUR	CRSH D O WK	CRSH NO	MUN	CITY CODE	MAX SEV	CRSH DIAG	CRSH TYPE	NO VEH	CRSH LIGHIN G	CRSH PRI WEATH ER	RD SUR	CRSH WKZO TYPE
35	0.00	0	0	0	13	2013	6	25	12	3	131760126	1	385	C	90	6	1	1	2	1	98
35	0.00	0	0	0	13	2014	9	25	19	5	143010082	1	385	N	3	1	3	1	1	1	98
35	0.00	0	0.01	0	13	2014	1	7	17	3	140420113	1	385	C	5	1	2	3	2	1	98
35	0.00	0	0.01	0	13	2015	10	1	13	5	152740124	1	385	C	1	1	2	1	1	1	98
35	0.00	0	0	0	13	2015	8	8	15	7	152200115	1	385	N	1	1	3	1	1	1	98
35	0.00	0	0	0	13	2015	1	13	13	3	150130245	1	385	C	1	1	3	1	1	1	98
35	0.01	0	0	0	13	2015	4	4	7	7	150940023	1	385	B	7	30	1	1	1	1	98
Total				7																	

Hennepin County Public Works  
 CSAH 52 (Nicollet Ave) at 70th Street  
 2013 - 2015

RD NO	MILE PT	LEFT DIST	RIGHT DIST	ROAD TYPE	INTER TYPE	CRSH YR	CRSH MONT H	CRSH DAY	CRSH HOUR	CRSH D O WK	CRSH NO	MUN	CITY CODE	MAX SEV	CRSH DIAG	CRSH TYPE	NO VEH	CRSH LIGHIN G	CRSH PRI WEATH ER	RD SUR	CRSH WKZO TYPE
52	3.45	0	0	0	12	2013	5	17	14	6	131380040	36	3210	C	3	1	2	1	2	2	98
52	3.46	0	0	0	12	2013	2	19	15	3	130530029	36	3210	N	1	1	2	1	1	1	98
52	3.46	0	0	0	12	2013	2	26	17	3	130570183	36	3210	N	3	1	2	1	1	2	98
52	3.46	0	0	0	12	2013	1	18	15	6	130190007	36	3210	N	1	1	2	1	1	1	98
52	3.46	0	0	0	12	2013	11	26	16	3	133300160	36	3210	N	1	1	2	1	1	1	98
52	3.46	0	0	0	12	2013	10	3	13	5	132800111	36	3210	N	1	1	2	1	1	1	98
52	3.46	0	0	0	12	2013	9	10	16	3	132590025	36	3210	N	1	1	2	1	1	1	98
52	3.49	0	0	0	12	2013	9	4	14	4	132470144	36	3210	N	1	1	2	1	1	1	98
52	3.45	0	0	0	12	2014	12	7	17	1	143410121	36	3210	C	1	1	3	4	4	2	98
52	3.46	0	0	0	12	2014	8	28	12	5	142400074	36	3210	N	1	1	2	1	2	1	1
52	3.46	0	0	0	12	2014	2	15	17	7	140460219	36	3210	C	3	1	2	4	1	3	98
52	3.46	0	0	0	12	2014	6	26	16	5	142090115	36	3210	N	1	1	2				98
52	3.46	0	0	0	12	2014	10	27	15	2	143000186	36	3210	B	5	1	3	1	1	1	98
52	3.46	0	0	0	12	2014	10	24	10	6	142990078	36	3210	N	3	1	2	1	1	1	98
52	3.46	0	0	0	12	2015	11	17	14	3	153240062	36	3210	C	3	1	3	1	3	2	98
Total				15																	

Hennepin County Public Works  
 CSAH 52 (Nicollet Ave) at 76th Street  
 2013 - 2015

RD NO	MILE PT	LEFT DIST	RIGHT DIST	ROAD TYPE	INTER TYPE	CRSH YR	CRSH MONT H	CRSH DAY	CRSH HOUR	CRSH D O WK	CRSH NO	MUN	CITY CODE	MAX SEV	CRSH DIAG	CRSH TYPE	NO VEH	CRSH LIGHIN G	CRSH PRI WEATH ER	RD SUR	CRSH WKZO TYPE
52	2.70	0	0	0	12	2013	3	27	9	4	130860119	36	3210	N	7	24	1	1	1	1	98
52	2.70	0	0	0	12	2013	2	19	16	3	130530070	36	3210	N	3	1	2	1	1	1	98
52	2.71	0	0	0	12	2013	1	23	14	4	130230202	36	3210	C	3	1	2	1	1	1	98
52	2.71	0	0	0	12	2014	7	8	13	3	141890168	36	3210	C	90	7	1	1	1	1	98
52	2.71	0	0	0	12	2014	1	16	9	5	140160110	36	3210	C	5	1	2	1	2	4	98
52	2.71	0	0	0	12	2014	2	22	12	7	140530257	36	3210	C	5	1	2	1	1	5	98
52	2.71	0	0	0	12	2014	10	6	14	2	142790152	36	3210	N	1	1	2	1	1	1	98
52	2.71	0	0	0	12	2014	2	20	14	5	140510121	36	3210	N	5	1	2	1	4	3	98
52	2.71	0	0	0	12	2015	9	30	18	4	152750136	36	3210	C	90	6	1	1	1	1	98
52	2.71	0	0	0	12	2015	10	15	12	5	152880100	36	3210	B	5	1	2	1	1	1	98
52	2.71	0	0	0	12	2015	1	19	14	2	150190079	36	3210	C	5	1	2	1	1	1	98
Total				11																	

## **Attachment F – Collision Diagrams**

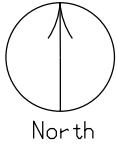
# Collision Diagram

Hennepin County Transportation Department

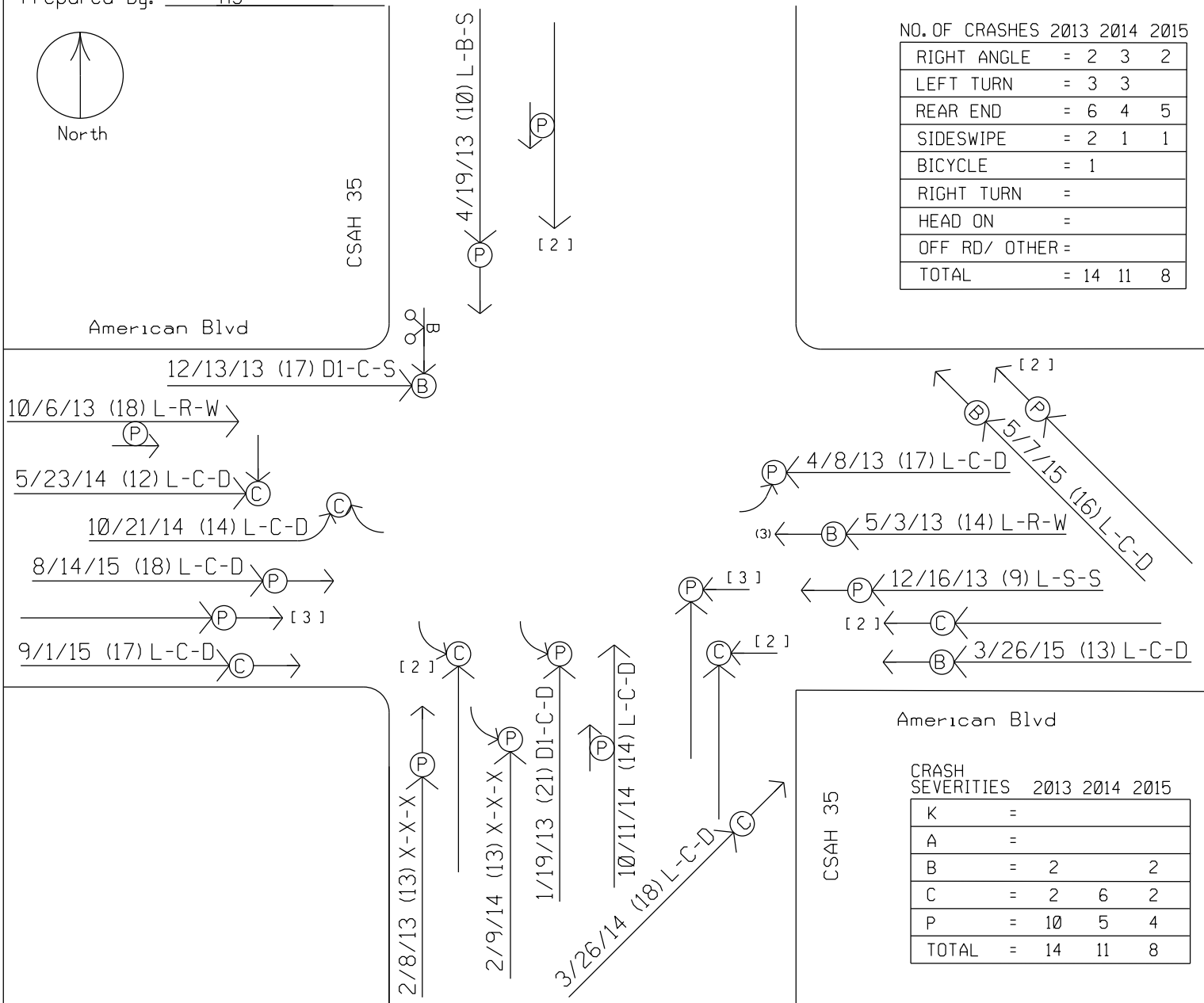
Location: CSAH 35 (Portland Ave) at American Blvd

Time Period: 01/01/2013 to 12/31/2015 Date: 8/13/2018

Prepared By: AS



NO. OF CRASHES 2013 2014 2015				
RIGHT ANGLE	=	2	3	2
LEFT TURN	=	3	3	
REAR END	=	6	4	5
SIDESWIPE	=	2	1	1
BICYCLE	=	1		
RIGHT TURN	=			
HEAD ON	=			
OFF RD/ OTHER	=			
TOTAL	=	14	11	8



CRASH SEVERITIES 2013 2014 2015				
K	=			
A	=			
B	=	2	2	
C	=	2	6	2
P	=	10	5	4
TOTAL	=	14	11	8

**KEY**

- Motor Vehicle Out of Control
- Motor Vehicle Backing Up
- Motor Vehicle Rollover
- Motor Vehicle Sideswipe
- Fixed Object
- Fatal Crash
- A Injury Crash
- B Injury Crash
- C Injury Crash
- Property Damage Crash
- Pedestrian
- Bicycle
- Motorcycle
- Parked Vehicle
- Rear End Property Damage
- Right Angle B Injury

**NOTES**

<p><b>Light:</b></p> <p>L= Daylight ( 1 )                  Dn= Dawn ( 2 )                  Du= Dusk ( 3 )                  D1= Dark, Lighted ( 4 )                  Do= Dark, Lights Off ( 5 )                  D= Dark, Unlighted ( 6 )                  X= Unknown ( 90 or 99 )</p>	<p><b>Weather:</b></p> <p>C= Clear or Cloudy ( 1 or 2 )                  R= Rain ( 3 )                  S= Snow or Sleet ( 4 or 5 )                  F= Fog, Smog, Smoke ( 6 )                  B= Blowing Sand/Dust ( 7 )                  W= Severe Crosswinds ( 8 )                  X= Other or Unknown ( 90 or 99 )</p>	<p><b>Surface:</b></p> <p>D= Dry ( 1 )                  W= Wet ( 2 )                  S= Snow,Ice,Slush ( 3, 4, or 5 )                  M= Muddy ( 7 )                  Db= Debris ( 8 )                  O= Oily ( 9 )                  X= Other or Unknown (90/99)</p>
<p>( X ) = Number of Vehicles In Crash ( X )</p> <p style="text-align: center;"> </p>		

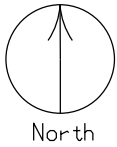
# Collision Diagram

Hennepin County Transportation Department

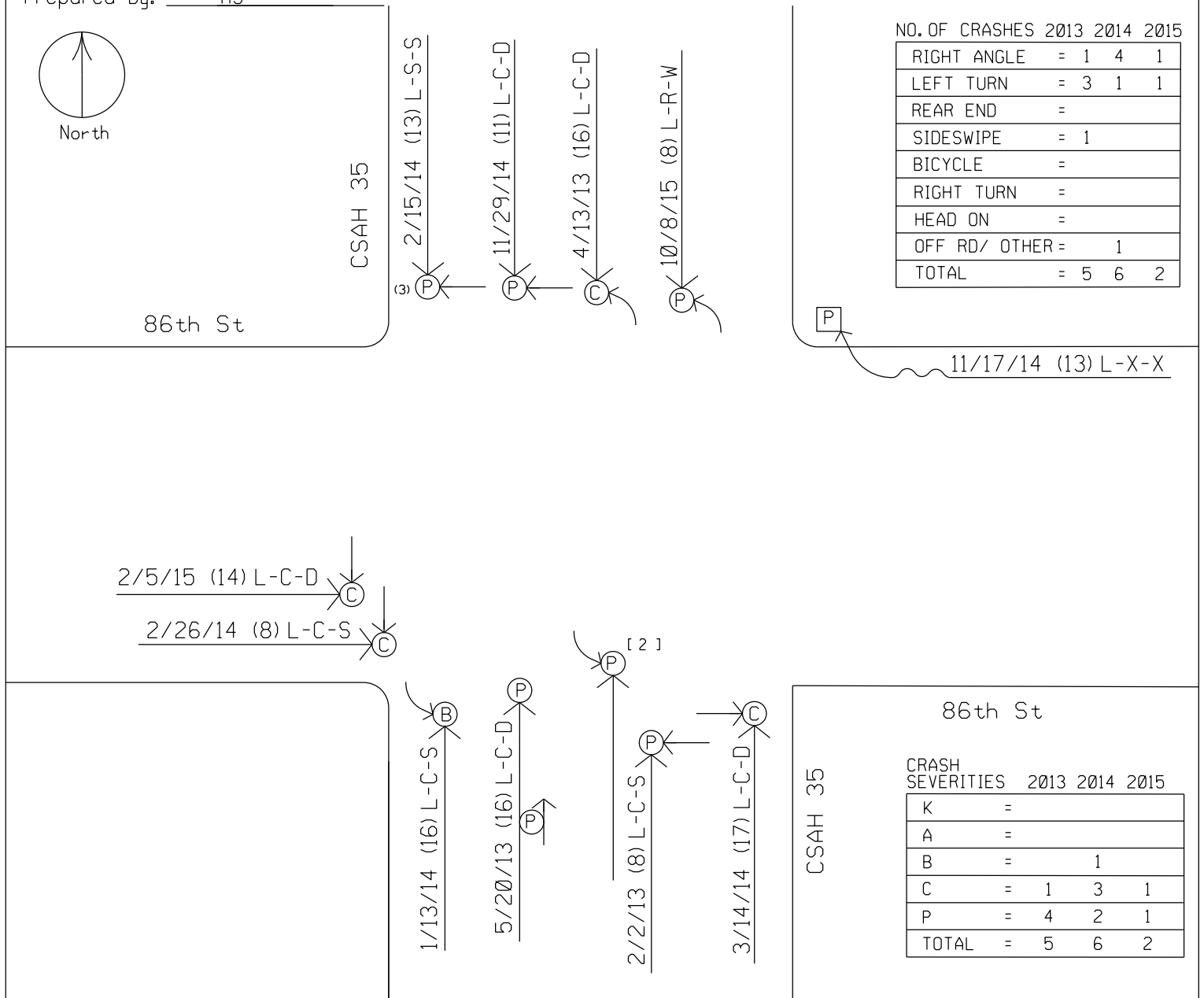
Location: CSAH 35 (Portland Ave) at 86th St

Time Period: 01/01/2013 to 12/31/2015 Date: 8/13/2018

Prepared By: AS



NO. OF CRASHES 2013 2014 2015				
RIGHT ANGLE	=	1	4	1
LEFT TURN	=	3	1	1
REAR END	=			
SIDESWIPE	=	1		
BICYCLE	=			
RIGHT TURN	=			
HEAD ON	=			
OFF RD/ OTHER	=	1		
TOTAL	=	5	6	2



CRASH SEVERITIES 2013 2014 2015				
K	=			
A	=			
B	=	1		
C	=	1	3	1
P	=	4	2	1
TOTAL	=	5	6	2

**KEY**

- Motor Vehicle Out of Control
- Motor Vehicle Backing Up
- Motor Vehicle Rollover
- Motor Vehicle Sideswipe
- Fixed Object
- Fatal Crash
- A Injury Crash
- B Injury Crash
- C Injury Crash
- Property Damage Crash
- Pedestrian
- Bicycle
- Motorcycle
- Parked Vehicle
- Rear End Property Damage
- Right Angle B Injury

**NOTES**

Light:	Weather:	Surface:
L= Daylight ( 1 )	C= Clear or Cloudy ( 1 or 2 )	D= Dry ( 1 )
Dn= Dawn ( 2 )	R= Rain ( 3 )	W= Wet ( 2 )
Du= Dusk ( 3 )	S= Snow or Sleet ( 4 or 5 )	S= Snow,Ice,Slush ( 3, 4, or 5 )
DI= Dark, Lighted ( 4 )	F= Fog, Smog, Smoke ( 6 )	M= Muddy ( 7 )
Do= Dark, Lights Off ( 5 )	B= Blowing Sand/Dust ( 7 )	Db= Debris ( 8 )
D= Dark, Unlighted ( 6 )	W= Severe Crosswinds ( 8 )	O= Oily ( 9 )
X= Unknown ( 90 or 99 )	X= Other or Unknown ( 90 or 99 )	X= Other or Unknown (90/99)

( X ) = Number of Vehicles In Crash ( X ) [Date]-[Time (hrst)][Light-Weather-Surface]



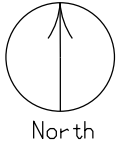
# Collision Diagram

Hennepin County Transportation Department

Location: CSAH 35 (Portland Ave) at 90th St

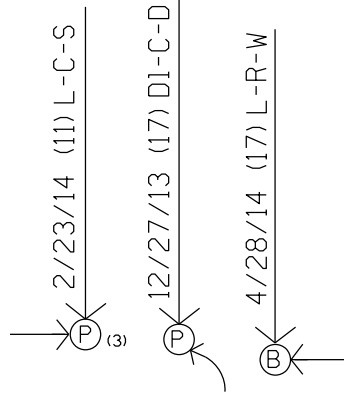
Time Period: 01/01/2013 to 12/31/2015 Date: 8/13/2018

Prepared By: AS



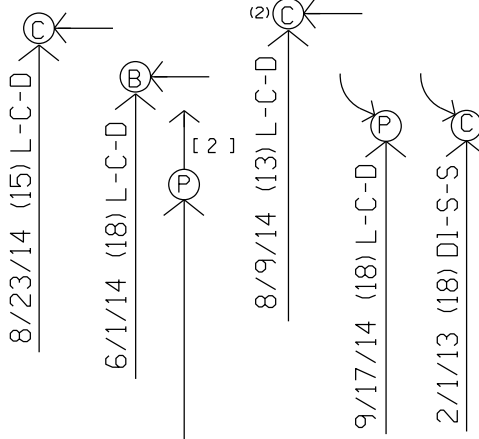
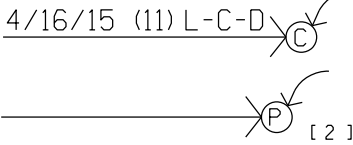
90th St

CSAH 35



NO. OF CRASHES 2013 2014 2015

RIGHT ANGLE	=	5
LEFT TURN	=	1 3 2
REAR END	=	2
SIDESWIPE	=	
BICYCLE	=	
RIGHT TURN	=	
HEAD ON	=	
OFF RD/ OTHER	=	
TOTAL	=	1 10 2



90th St

CSAH 35

CRASH SEVERITIES 2013 2014 2015

K	=		
A	=		
B	=	2	
C	=	1 2 1	
P	=	6 1	
TOTAL	=	1 10 2	

**KEY**

- Motor Vehicle Out of Control
- Motor Vehicle Backing Up
- Motor Vehicle Rollover
- Motor Vehicle Sideswipe
- Fixed Object
- Fatal Crash
- A Injury Crash
- B Injury Crash
- C Injury Crash
- Property Damage Crash
- Pedestrian
- Bicycle
- Motorcycle
- Parked Vehicle
- Rear End Property Damage
- Right Angle B Injury

**NOTES**

**Light:**

- L= Daylight ( 1 )
- Dn= Dawn ( 2 )
- Du= Dusk ( 3 )
- DI= Dark, Lighted ( 4 )
- Do= Dark, Lights Off ( 5 )
- D= Dark, Unlighted ( 6 )
- X= Unknown ( 90 or 99 )

**Weather:**

- C= Clear or Cloudy ( 1 or 2 )
- R= Rain ( 3 )
- S= Snow or Sleet ( 4 or 5 )
- F= Fog, Smog, Smoke ( 6 )
- B= Blowing Sand/Dust ( 7 )
- W= Severe Crosswinds ( 8 )
- X= Other or Unknown ( 90 or 99 )

**Surface:**

- D= Dry ( 1 )
- W= Wet ( 2 )
- S= Snow,Ice,Slush ( 3, 4, or 5 )
- M= Muddy ( 7 )
- Db= Debris ( 8 )
- O= Oily ( 9 )
- X= Other or Unknown ( 90/99 )

( X ) = Number of Vehicles In Crash ( X ) [Date]- [Time (hrst)][Light-Weather-Surface]

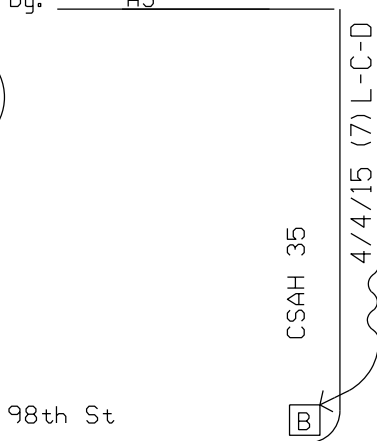
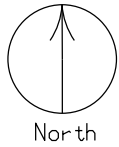
# Collision Diagram

Hennepin County Transportation Department

Location: CSAH 35 (Portland Ave) at CSAH 1 (98th St)

Time Period: 01/01/2013 to 12/31/2015 Date: 8/13/2018

Prepared By: AS



NO. OF CRASHES 2013 2014 2015

RIGHT ANGLE	=	1
LEFT TURN	=	1
REAR END	=	3
SIDESWIPE	=	
BICYCLE	=	
RIGHT TURN	=	
HEAD ON	=	
OFF RD/ OTHER	=	1 1
TOTAL	=	1 2 4

1/7/14 (17) Du-C-R

8/8/15 (15) L-C-D

9/25/14 (19) L-C-D (3)

1/13/15 (13) L-C-D

10/1/15 (13) L-C-D

6/25/13 (12) L-C-D

98th St

CRASH SEVERITIES 2013 2014 2015

CSAH 35

K	=		
A	=		
B	=		1
C	=	1 1	2
P	=	1 1	
TOTAL	=	1 2	4

**KEY**

- Motor Vehicle Out of Control
- Motor Vehicle Backing Up
- Motor Vehicle Rollover
- Motor Vehicle Sideswipe
- Fixed Object
- Fatal Crash
- A Injury Crash
- B Injury Crash
- C Injury Crash
- Property Damage Crash
- Pedestrian
- Bicycle
- Motorcycle
- Parked Vehicle
- Rear End Property Damage
- Right Angle B Injury

**NOTES**

<p><b>Light:</b></p> <p>L= Daylight ( 1 )                  Dn= Dawn ( 2 )                  Du= Dusk ( 3 )                  D1= Dark, Lighted ( 4 )                  D= Dark, Unlighted ( 6 )                  X= Unknown ( 90 or 99 )</p>	<p><b>Weather:</b></p> <p>C= Clear or Cloudy ( 1 or 2 )                  R= Rain ( 3 )                  S= Snow or Sleet ( 4 or 5 )                  F= Fog, Smog, Smoke ( 6 )                  B= Blowing Sand/Dust ( 7 )                  W= Severe Crosswinds ( 8 )                  X= Other or Unknown ( 90 or 99 )</p>	<p><b>Surface:</b></p> <p>D= Dry ( 1 )                  W= Wet ( 2 )                  S= Snow,Ice,Slush ( 3, 4, or 5 )                  M= Muddy ( 7 )                  Db= Debris ( 8 )                  O= Oily ( 9 )                  X= Other or Unknown (90/99)</p>
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( X ) = Number of Vehicles In Crash ( X ) [Injury Type] [Date]-[Time (hrst)][Light-Weather-Surface]

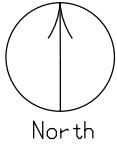
# Collision Diagram

Hennepin County Transportation Department

Location: CSAH 52 (Nicollet Ave) at 70th St

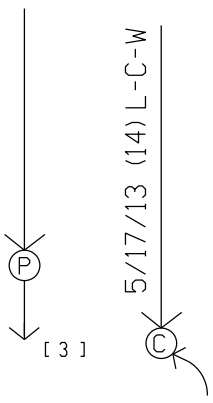
Time Period: 01/01/2013 to 12/31/2015 Date: 8/13/2018

Prepared By: AS



70th St

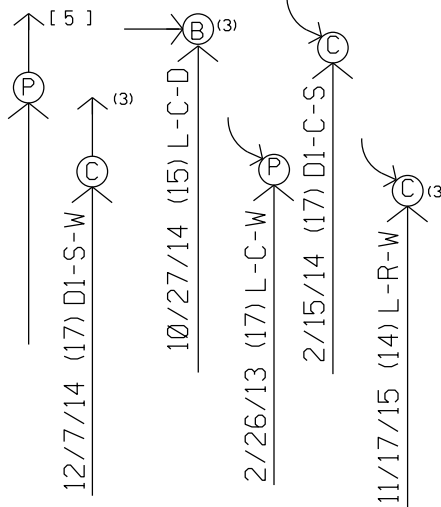
CSAH 52



NO. OF CRASHES 2013 2014 2015

RIGHT ANGLE	=	1		
LEFT TURN	=	2	2	1
REAR END	=	6	3	
SIDESWIPE	=			
BICYCLE	=			
RIGHT TURN	=			
HEAD ON	=			
OFF RD/ OTHER	=			
TOTAL	=	8	6	1

10/24/14 (10) L-C-D



70th St

CSAH 52

CRASH SEVERITIES 2013 2014 2015

K	=			
A	=			
B	=		1	
C	=	1	2	1
P	=	7	3	
TOTAL	=	8	6	1

**KEY**

- Motor Vehicle Out of Control
- Motor Vehicle Backing Up
- Motor Vehicle Rollover
- Motor Vehicle Sideswipe
- Fixed Object
- Fatal Crash
- A Injury Crash
- B Injury Crash
- C Injury Crash
- Property Damage Crash
- Pedestrian
- Bicycle
- Motorcycle
- Parked Vehicle
- Rear End Property Damage
- Right Angle B Injury

**NOTES**

<p><b>Light:</b></p> <p>L= Daylight ( 1 )                  Dn= Dawn ( 2 )                  Du= Dusk ( 3 )                  D1= Dark, Lighted ( 4 )                  D= Dark, Unlighted ( 6 )                  X= Unknown ( 90 or 99 )</p>	<p><b>Weather:</b></p> <p>C= Clear or Cloudy ( 1 or 2 )                  R= Rain ( 3 )                  S= Snow or Sleet ( 4 or 5 )                  F= Fog, Smog, Smoke ( 6 )                  B= Blowing Sand/Dust ( 7 )                  W= Severe Crosswinds ( 8 )                  X= Other or Unknown ( 90 or 99 )</p>	<p><b>Surface:</b></p> <p>D= Dry ( 1 )                  W= Wet ( 2 )                  S= Snow,Ice,Slush ( 3, 4, or 5 )                  M= Muddy ( 7 )                  Db= Debris ( 8 )                  O= Oily ( 9 )                  X= Other or Unknown (90/99)</p>
---	--	--

( X ) = Number of Vehicles In Crash ( X ) [Date]- [Time (hrst)][Light-Weather-Surface]

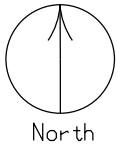
# Collision Diagram

Hennepin County Transportation Department

Location: CSAH 52 (Nicollet Ave) at 76th St

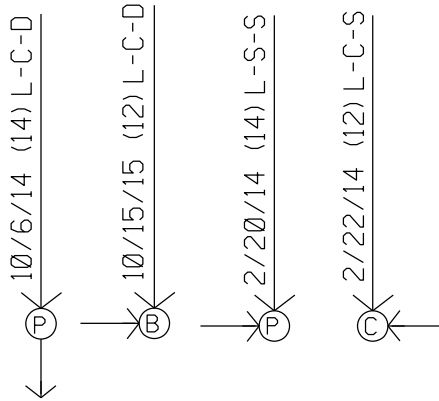
Time Period: 01/01/2013 to 12/31/2015 Date: 8/13/2018

Prepared By: AS



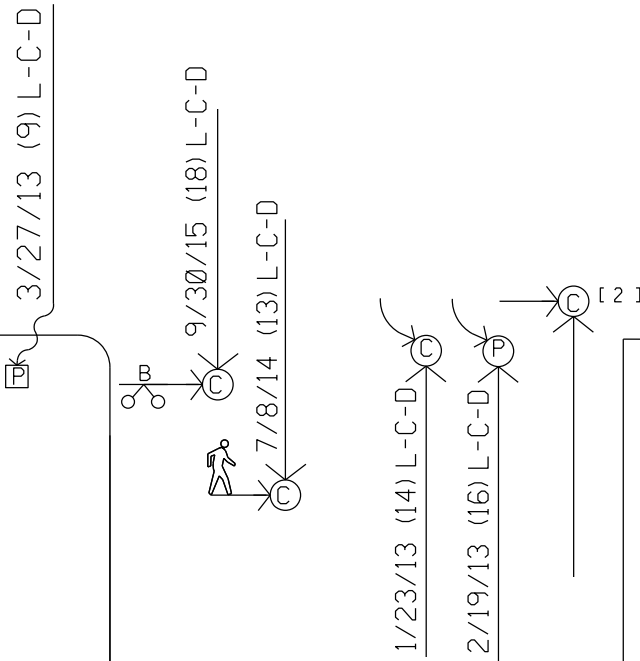
76th St

CSAH 52



NO. OF CRASHES 2013 2014 2015

RIGHT ANGLE	=	3	2
LEFT TURN	=	2	
REAR END	=	1	
SIDESWIPE	=		
BICYCLE	=		
RIGHT TURN	=		
HEAD ON	=		
OFF RD/ OTHER	=	1	1
TOTAL	=	3	5



76th St

CSAH 52

CRASH SEVERITIES 2013 2014 2015

K	=		
A	=		
B	=		1
C	=	1	3
P	=	2	2
TOTAL	=	3	5

**KEY**

- Motor Vehicle Out of Control
- Motor Vehicle Backing Up
- Motor Vehicle Rollover
- Motor Vehicle Sideswipe
- Fixed Object
- Fatal Crash
- A Injury Crash
- B Injury Crash
- C Injury Crash
- Property Damage Crash
- Pedestrian
- Bicycle
- Motorcycle
- Parked Vehicle
- Rear End Property Damage
- Right Angle B Injury

**NOTES**

**Light:**

- L= Daylight ( 1 )
- Dn= Dawn ( 2 )
- Du= Dusk ( 3 )
- DI= Dark, Lighted ( 4 )
- Do= Dark, Lights Off ( 5 )
- D= Dark, Unlighted ( 6 )
- X= Unknown ( 90 or 99 )

**Weather:**

- C= Clear or Cloudy ( 1 or 2 )
- R= Rain ( 3 )
- S= Snow or Sleet ( 4 or 5 )
- F= Fog, Smog, Smoke ( 6 )
- B= Blowing Sand/Dust ( 7 )
- W= Severe Crosswinds ( 8 )
- X= Other or Unknown ( 90 or 99 )

**Surface:**

- D= Dry ( 1 )
- W= Wet ( 2 )
- S= Snow,Ice,Slush ( 3, 4, or 5 )
- M= Muddy ( 7 )
- Db= Debris ( 8 )
- O= Oily ( 9 )
- X= Other or Unknown (90/99)

( X ) = Number of Vehicles In Crash ( X ) = Other Vehicle Injury Type [Date]-[Time (hrst)][Light-Weather-Surface]

**Attachment G – Documentation of CRFs**



## CMF / CRF Details

**CMF ID: 4177**

### Changing left turn phasing from protected-permissive to flashing yellow arrow (FYA)

**Description:** CMFs are calculated the intersection level and not the treated approach(es) level.

**Prior Condition:** All treated approaches had protected-permissive left turn

**Category:** Intersection traffic control

**Study:** [Evaluation of Safety Strategies at Signalized Intersections, Srinivasan, et al., 2011](#)

**Image:** [View the countermeasure image.](#)

**Star Quality Rating:**  [\[View score details\]](#)

#### Crash Modification Factor (CMF)

**Value:** 0.806

**Adjusted Standard Error:**

**Unadjusted Standard Error:** 0.146

#### Crash Reduction Factor (CRF)

**Value:** 19.4 *(This value indicates a **decrease** in crashes)*

**Adjusted Standard Error:**

**Unadjusted Standard Error:** 14.6

#### Applicability

**Crash Type:** Left turn

**Crash Severity:** All

**Roadway Types:** Not Specified

**Number of Lanes:**

<b>Road Division Type:</b>	
<b>Speed Limit:</b>	
<b>Area Type:</b>	Urban
<b>Traffic Volume:</b>	
<b>Time of Day:</b>	Not specified

***If countermeasure is intersection-based***

<b>Intersection Type:</b>	Roadway/roadway (not interchange related)
<b>Intersection Geometry:</b>	4-leg
<b>Traffic Control:</b>	Signalized
<b>Major Road Traffic Volume:</b>	Minimum of 8260 to Maximum of 43000 Annual Average Daily Traffic (AADT)
<b>Minor Road Traffic Volume:</b>	Minimum of 600 to Maximum of 13745 Annual Average Daily Traffic (AADT)

**Development Details**

<b>Date Range of Data Used:</b>	
<b>Municipality:</b>	
<b>State:</b>	NC, OR, WA
<b>Country:</b>	USA
<b>Type of Methodology Used:</b>	Before/after using empirical Bayes or full Bayes
<b>Sample Size (crashes):</b>	134 crashes before, 47 crashes after

**Other Details**

<b>Included in Highway Safety Manual?</b>	No
<b>Date Added to Clearinghouse:</b>	Dec-06-2012
<b>Comments:</b>	

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## CMF / CRF Details

**CMF ID: 5272**

### Install pedestrian countdown timer

**Description:** Install pedestrian countdown timer

**Prior Condition:** Unknown

**Category:** Intersection traffic control

**Study:** [Evaluating pedestrian safety improvements, Van Houten et al., 2012](#)

<b>Star Quality Rating:</b>	
★★★★☆	<a href="#">[View score details]</a>

Crash Modification Factor (CMF)	
<b>Value:</b>	0.3
<b>Adjusted Standard Error:</b>	
<b>Unadjusted Standard Error:</b>	

Crash Reduction Factor (CRF)	
<b>Value:</b>	70 <i>(This value indicates a <b>decrease</b> in crashes)</i>
<b>Adjusted Standard Error:</b>	
<b>Unadjusted Standard Error:</b>	

Applicability	
<b>Crash Type:</b>	Vehicle/pedestrian
<b>Crash Severity:</b>	All
<b>Roadway Types:</b>	Not specified
<b>Number of Lanes:</b>	
<b>Road Division Type:</b>	
<b>Speed Limit:</b>	



<b>Area Type:</b>	Not specified
<b>Traffic Volume:</b>	
<b>Time of Day:</b>	
<b><i>If countermeasure is intersection-based</i></b>	
<b>Intersection Type:</b>	Roadway/roadway (not interchange related)
<b>Intersection Geometry:</b>	Not specified
<b>Traffic Control:</b>	Signalized
<b>Major Road Traffic Volume:</b>	
<b>Minor Road Traffic Volume:</b>	

Development Details	
<b>Date Range of Data Used:</b>	
<b>Municipality:</b>	Detroit
<b>State:</b>	MI
<b>Country:</b>	
<b>Type of Methodology Used:</b>	Time series
<b>Sample Size (sites):</b>	449 sites

Other Details	
<b>Included in Highway Safety Manual?</b>	No
<b>Date Added to Clearinghouse:</b>	Dec-02-2013
<b>Comments:</b>	The study did not adjust the reduction in crashes at the treatment location based on the change in the comparison sites.

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## CMF / CRF Details

**CMF ID: 7684**

### Change from permissive only to flashing yellow arrow protected/permissive left turn

**Description:** Change from permissive only to FYA - protected/permissive left turn

**Prior Condition:** Permissive phasing

**Category:** Intersection traffic control

**Study:** [Safety Effectiveness of Flashing Yellow Arrow: Evaluation of 222 Signalized Intersections in North Carolina, Simpson and Troy, 2015](#)

<b>Star Quality Rating:</b>	<a href="#">[View score details]</a>
-----------------------------	--------------------------------------

Crash Modification Factor (CMF)	
<b>Value:</b>	0.598
<b>Adjusted Standard Error:</b>	
<b>Unadjusted Standard Error:</b>	0.105

Crash Reduction Factor (CRF)	
<b>Value:</b>	40.2 <i>(This value indicates a <b>decrease</b> in crashes)</i>
<b>Adjusted Standard Error:</b>	
<b>Unadjusted Standard Error:</b>	10.5

Applicability	
<b>Crash Type:</b>	Left turn
<b>Crash Severity:</b>	All
<b>Roadway Types:</b>	Not specified
<b>Number of Lanes:</b>	
<b>Road Division Type:</b>	

<b>Speed Limit:</b>	35-55
<b>Area Type:</b>	Not specified
<b>Traffic Volume:</b>	
<b>Time of Day:</b>	
<b><i>If countermeasure is intersection-based</i></b>	
<b>Intersection Type:</b>	Roadway/roadway (not interchange related)
<b>Intersection Geometry:</b>	3-leg,4-leg
<b>Traffic Control:</b>	Signalized
<b>Major Road Traffic Volume:</b>	Minimum of 7000 to Maximum of 49000 Annual Average Daily Traffic (AADT)
<b>Minor Road Traffic Volume:</b>	Minimum of 600 to Maximum of 17000 Annual Average Daily Traffic (AADT)

<b>Development Details</b>	
<b>Date Range of Data Used:</b>	2003 to 2013
<b>Municipality:</b>	
<b>State:</b>	NC
<b>Country:</b>	
<b>Type of Methodology Used:</b>	Other before/after
<b>Sample Size (crashes):</b>	31 crashes before, 23 crashes after
<b>Sample Size (sites):</b>	30 sites before, 30 sites after

<b>Other Details</b>	
<b>Included in Highway Safety Manual?</b>	No
<b>Date Added to Clearinghouse:</b>	Nov-01-2015
<b>Comments:</b>	Target crashes are defined as "left-turn same roadway crashes with the left-turner on an approach treated with FYA and occurring during the time of day when FYA is in operation".

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## CMF / CRF Details

**CMF ID: 8790**

### Install pedestrian countdown timer

**Description:** Install pedestrian countdown timer

**Prior Condition:** No PCS installed

**Category:** Intersection traffic control

**Study:** [Developing Crash Modification Factors to Quantify Impacts of Pedestrian Countdown Signals to Drivers, Kitali et al., 2017](#)

**Star Quality Rating:**  [\[View score details\]](#)

#### Crash Modification Factor (CMF)

**Value:** 0.912

**Adjusted Standard Error:**

**Unadjusted Standard Error:** 0.029

#### Crash Reduction Factor (CRF)

**Value:** 8.8 *(This value indicates a **decrease** in crashes)*

**Adjusted Standard Error:**

**Unadjusted Standard Error:** 2.9

#### Applicability

**Crash Type:** All

**Crash Severity:** All

**Roadway Types:** Not specified

**Number of Lanes:** 2 to 6

**Road Division Type:**

**Speed Limit:** 30 to 55

**Area Type:**

<b>Traffic Volume:</b>	
<b>Time of Day:</b>	All
<b><i>If countermeasure is intersection-based</i></b>	
<b>Intersection Type:</b>	Roadway/roadway (not interchange related)
<b>Intersection Geometry:</b>	4-leg
<b>Traffic Control:</b>	Signalized
<b>Major Road Traffic Volume:</b>	Minimum of 6033 to Maximum of 57458 Annual Average Daily Traffic (AADT)
<b>Minor Road Traffic Volume:</b>	Minimum of 567 to Maximum of 36000 Annual Average Daily Traffic (AADT)

Development Details	
<b>Date Range of Data Used:</b>	2003 to 2014
<b>Municipality:</b>	Jacksonville and Gainesville
<b>State:</b>	FL
<b>Country:</b>	USA
<b>Type of Methodology Used:</b>	Before/after using empirical Bayes or full Bayes
<b>Sample Size (crashes):</b>	2022 crashes before, 1574 crashes after
<b>Sample Size (sites):</b>	110 sites before, 110 sites after

Other Details	
<b>Included in Highway Safety Manual?</b>	No
<b>Date Added to Clearinghouse:</b>	
<b>Comments:</b>	

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## CMF / CRF Details

**CMF ID: 8824**

### Install Red-light indicator lights

**Description:** Red-light indicator lights are mounted on the signal head or on the mast arm. The indicator activates simultaneously with the red interval, allowing an enforcement officer downstream to identify if a vehicle has violated the red interval.

**Prior Condition:** 4-legged signalized intersection without RLIL

**Category:** Advanced technology and ITS

**Study:** [Safety Evaluation of Red-Light Indicator Lights in Florida, Himes et al., 2017](#)

**Star Quality Rating:**  [\[View score details\]](#)

#### Crash Modification Factor (CMF)

**Value:** 0.713

**Adjusted Standard Error:**

**Unadjusted Standard Error:** 0.048

#### Crash Reduction Factor (CRF)

**Value:** 28.7 *(This value indicates a **decrease** in crashes)*

**Adjusted Standard Error:**

**Unadjusted Standard Error:**

#### Applicability

**Crash Type:** Other

**Crash Severity:** All

**Roadway Types:** Not specified

**Number of Lanes:**

**Road Division Type:**

**Speed Limit:**

**Area Type:** Not specified

<b>Traffic Volume:</b>	
<b>Time of Day:</b>	All
<b><i>If countermeasure is intersection-based</i></b>	
<b>Intersection Type:</b>	Roadway/roadway (not interchange related)
<b>Intersection Geometry:</b>	4-leg
<b>Traffic Control:</b>	Signalized
<b>Major Road Traffic Volume:</b>	Minimum of 5900 to Maximum of 80500 Annual Average Daily Traffic (AADT)
<b>Minor Road Traffic Volume:</b>	Minimum of 845 to Maximum of 62666 Annual Average Daily Traffic (AADT)

<b>Development Details</b>	
<b>Date Range of Data Used:</b>	2003 to 2012
<b>Municipality:</b>	
<b>State:</b>	FL
<b>Country:</b>	USA
<b>Type of Methodology Used:</b>	Before/after using empirical Bayes or full Bayes
<b>Sample Size (crashes):</b>	299 crashes before, 336 crashes after
<b>Sample Size (sites):</b>	108 sites before, 108 sites after
<b>Sample Size (site-years):</b>	365 site-years before, 599 site-years after

<b>Other Details</b>	
<b>Included in Highway Safety Manual?</b>	No
<b>Date Added to Clearinghouse:</b>	
<b>Comments:</b>	This CMF is for "disobey signal" crashes.

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**Attachment H – Benefit/Cost Ratios**



B/C worksheet		Control Section	T.H. / Roadway	Location			Beginning Ref. Pt.	Ending Ref. Pt.	State, County, City or Township	Study Period Begins	Study Period Ends		
			Portland Avenue	At American Boulevard			2.28	2.34	Hennepin County	1/1/2013	12/31/2015		
Description of Proposed Work		Convert phasing from prot/perm to FYA prot/perm (CMF ID 4177; 19% reduction in LT crashes on Portland Ave) Install confirmation lights (CMF ID 8824; 29% reduction in right angle crashes on Portland Ave)											
Accident Diagram Codes		1	2	3	5	4, 7	8, 9		6, 90, 98, 99				
										Pedestrian	Other	Total	
Study Period: Number of Crashes	Fatal	F											
	Personal Injury (PI)	A											
		B		3								1	4
		C		4		3	3						10
Property Damage	PD		9	4	3	3						19	
% Change in Crashes <small>*Use FHWA cmfclearingho use for Crash Reduction Factors</small>	Fatal	F											
	PI	A											
		B											
		C				-19%	-29%						
Property Damage	PD				-13%	-19%							
Change in Crashes <small>= No. of crashes X % change in crashes</small>	Fatal	F											
	PI	A											
		B		0.00								0.00	
		C		0.00		-0.58	-0.86						-1.44
Property Damage	PD		0.00	0.00	-0.39	-0.57						-0.96	
Year (Safety Improvement Construction)			2022										
Project Cost (exclude Right of Way)			\$ 180,000	Type of Crash	Study Period: Change in Crashes	Annual Change in Crashes	Cost per Crash	Annual Benefit	<div style="border: 1px solid black; padding: 5px; display: inline-block;">B/C= 3.79</div> <i>Using present worth values,</i> <b>B= \$ 682,663</b> <b>C= \$ 180,000</b> <i>See "Calculations" sheet for amortization.</i>				
Right of Way Costs (optional)				F			\$ 1,180,000						
Traffic Growth Factor			2%	A			\$ 590,000						
Capital Recovery				B			\$ 170,000						
1. Discount Rate			4.5%	C	-1.44	-0.48	\$ 87,000	\$ 41,885					
2. Project Service Life (n) See Appx F			20	PD	-0.96	-0.32	\$ 7,800	\$ 2,501					
							Total	\$ 44,386					

<b>B/C worksheet</b>		Control Section	T.H. / Roadway	Location			Beginning Ref. Pt.	Ending Ref. Pt.	State, County, City or Township	Study Period Begins	Study Period Ends
			Portland Avenue	At 86th Street			1.47	1.56	Hennepin County	1/1/2013	12/31/2015
<b>Description of Proposed Work</b>		Convert phasing from perm only to FYA prot/perm (CMF ID 7684; 40% reduction for LT crashes on Portland Ave and 86th St) Install confirmation lights (CMF ID 8824; 29% reduction for right angle crashes on Portland Ave)									
<b>Accident Diagram Codes</b>		1	2	3	5	4, 7	8, 9		6, 90, 98, 99		
<b>Study Period: Number of Crashes</b>	Fatal	F									
	Personal Injury (PI)	A									
		B				1					1
		C				1	4				5
Property Damage	PD			1	3	2	1			7	
<b>% Change in Crashes</b> <small>*Use FHWA cmfclearingho use for Crash Reduction Factors</small>	Fatal	F									
	PI	A									
		B				-40%					
		C				-40%	-22%				
Property Damage	PD				-40%	-29%					
<b>Change in Crashes</b> <small>= No. of crashes X % change in crashes</small>	Fatal	F									
	PI	A									
		B				-0.40					-0.40
		C				-0.40	-0.86				-1.26
Property Damage	PD			0.00	-1.21	-0.57	0.00			-1.78	
<b>Year (Safety Improvement Construction)</b>		2022									
<b>Project Cost (exclude Right of Way)</b>		\$	185,000	Type of Crash	Study Period: Change in Crashes	Annual Change in Crashes	Cost per Crash	Annual Benefit	<div style="border: 1px solid black; padding: 5px; display: inline-block; background-color: #fce4ec;">B/C= 5.56</div> <i>Using present worth values,</i> <b>B= \$ 1,028,410</b> <b>C= \$ 185,000</b> <i>See "Calculations" sheet for amortization.</i>		
<b>Right of Way Costs (optional)</b>				F			\$ 1,180,000				
<b>Traffic Growth Factor</b>			2%	A			\$ 590,000				
<b>Capital Recovery</b>				B	-0.40	-0.13	\$ 170,000	\$ 22,801			
<b>1. Discount Rate</b>			4.5%	C	-1.26	-0.42	\$ 87,000	\$ 36,660			
<b>2. Project Service Life (n) See Appx F</b>			20	PD	-1.78	-0.59	\$ 7,800	\$ 4,632			
				<b>Total</b>				\$ 64,094			

<b>B/C worksheet</b>	<b>Control Section</b>	<b>T.H. / Roadway</b>	<b>Location</b>	<b>Beginning Ref. Pt.</b>	<b>Ending Ref. Pt.</b>	<b>State, County, City or Township</b>	<b>Study Period Begins</b>	<b>Study Period Ends</b>
		Portland Avenue	At 90th Street	0.97	1.03	Hennepin County	1/1/2013	12/31/2015
<b>Description of Proposed Work</b>		Convert phasing from perm only to FYA prot/perm (CMF ID 7684; 40% reduction for LT crashes on Portland Ave) Install confirmation lights (CMF ID 8824; 29% reduction for right angle crashes on Portland Ave)						

<b>Accident Diagram Codes</b>	1	2	3	5	4, 7	8, 9	<b>Pedestrian</b>	<b>Other</b>	<b>Total</b>

<b>Study Period: Number of Crashes</b>	Fatal	F							
	Personal Injury (PI)	A							
		B				2			2
		C			2	2			4
	Property Damage	PD		2		4	1		7

<b>% Change in Crashes</b> <small>*Use FHWA cmfclearingho use for Crash Reduction Factors</small>	Fatal	F						
	PI	A						
		B				-29%		
		C			-20%	-29%		
	Property Damage	PD			-27%			

<b>Change in Crashes</b> <small>= No. of crashes X % change in crashes</small>	Fatal	F						
	PI	A						
		B				-0.57		-0.57
		C			-0.40	-0.57		-0.98
	Property Damage	PD		0.00		-1.07		-1.07

Year (Safety Improvement Construction) 2022

Project Cost (exclude Right of Way)	Right of Way Costs (optional)	Traffic Growth Factor	Capital Recovery	1. Discount Rate	2. Project Service Life (n) See Appx F	Type of Crash	Study Period: Change in Crashes	Annual Change in Crashes	Cost per Crash	Annual Benefit
\$ 140,000		2%		4.5%	20	F			\$ 1,180,000	
						A			\$ 590,000	
						B	-0.57	-0.19	\$ 170,000	\$ 32,556
						C	-0.98	-0.33	\$ 87,000	\$ 28,330
						PD	-1.07	-0.36	\$ 7,800	\$ 2,790
<b>Total</b>									\$ 63,676	

**B/C= 7.00**

Using present worth values,  
**B= \$ 979,348**  
**C= \$ 140,000**

See "Calculations" sheet for amortization.

B/C worksheet		Control Section	T.H. / Roadway	Location	Beginning Ref. Pt.	Ending Ref. Pt.	State, County, City or Township	Study Period Begins	Study Period Ends	
			Portland Avenue	At CSAH 1 (98th Street)		0.00	0.03	Hennepin County	1/1/2013	12/31/2015
Description of Proposed Work		Convert phasing from prot/perm to FYA prot/perm (CMF ID 4177; 19% reduction for LT crashes on Portland Ave) Install pedestrian countdown timer (CMF ID 5272; 70% reduction for pedestrian crashes)								
Accident Diagram Codes		1	2	3	5	4, 7	8, 9	Pedestrian	Other	Total
Study Period: Number of Crashes	Fatal	F								
	Personal Injury (PI)	A								
		B					1			1
		C	2			1			1	4
Property Damage	PD	1		1					2	
% Change in Crashes <small>*Use FHWA cmfclearingho use for Crash Reduction Factors</small>	Fatal	F								
	PI	A								
		B								
		C							-70%	
Property Damage	PD									
Change in Crashes <small>= No. of crashes X % change in crashes</small>	Fatal	F								
	PI	A								
		B				0.00				
		C	0.00			0.00			-0.70	-0.70
Property Damage	PD	0.00		0.00						
Year (Safety Improvement Construction)		2022								
Project Cost (exclude Right of Way)		\$ 170,000	Type of Crash	Study Period: Change in Crashes	Annual Change in Crashes	Cost per Crash	Annual Benefit	<div style="border: 1px solid black; padding: 5px; display: inline-block;">B/C= 1.84</div> <i>Using present worth values,</i> <b>B= \$ 312,503</b> <b>C= \$ 170,000</b> <i>See "Calculations" sheet for amortization.</i>		
Right of Way Costs (optional)			F			\$ 1,180,000				
Traffic Growth Factor		2%	A			\$ 590,000				
Capital Recovery			B			\$ 170,000				
1. Discount Rate		4.5%	C	-0.70	-0.23	\$ 87,000	\$ 20,319			
2. Project Service Life (n) See Appx F		20	PD			\$ 7,800				
			Total			\$ 20,319				

<b>B/C worksheet</b>		Control Section	T.H. / Roadway	Location			Beginning Ref. Pt.	Ending Ref. Pt.	State, County, City or Township	Study Period Begins	Study Period Ends	
			Nicollet Avenue	At 70th Street			3.43	3.49	Hennepin County	1/1/2013	12/31/2015	
<b>Description of Proposed Work</b>		Convert phasing from perm only to FYA prot/perm (CMF ID 7684; 40% reduction in LT crashes on Nicollet Ave) Install confirmation lights (CMF ID 8824; 29% reduction in right angle crashes on Portland Ave)										
<b>Accident Diagram Codes</b>		1	2	3	5	4, 7	8, 9		6, 90, 98, 99			
										Pedestrian	Other	Total
<b>Study Period: Number of Crashes</b>	Fatal	F										
	Personal Injury (PI)	A										
		B				1						1
		C	1			3						4
Property Damage	PD	8			2						10	
<b>% Change in Crashes</b> <small>*Use FHWA cmfclearingho use for Crash Reduction Factors</small>	Fatal	F										
	PI	A										
		B				-29%						
		C				-40%						
Property Damage	PD				-20%							
<b>Change in Crashes</b> <small>= No. of crashes X % change in crashes</small>	Fatal	F										
	PI	A										
		B				-0.29						-0.29
		C	0.00			-1.21						-1.21
Property Damage	PD	0.00			-0.40						-0.40	
<b>Year (Safety Improvement Construction)</b>		2022										
<b>Project Cost (exclude Right of Way)</b>		\$	160,000	Type of Crash	Study Period: Change in Crashes	Annual Change in Crashes	Cost per Crash	Annual Benefit	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <b>B/C= 4.82</b> </div> <p>Using present worth values,  <b>B= \$ 771,931</b>  <b>C= \$ 160,000</b>  See "Calculations" sheet for amortization.</p>			
<b>Right of Way Costs (optional)</b>				F			\$ 1,180,000					
<b>Traffic Growth Factor</b>			1%	A			\$ 590,000					
<b>Capital Recovery</b>				B	-0.29	-0.10	\$ 170,000	\$ 16,278				
<b>1. Discount Rate</b>			4.5%	C	-1.21	-0.40	\$ 87,000	\$ 35,006				
<b>2. Project Service Life (n) See Appx F</b>			20	PD	-0.40	-0.13	\$ 7,800	\$ 1,046				
							<b>Total</b>	\$ 52,330				

B/C worksheet		Control Section	T.H. / Roadway	Location			Beginning Ref. Pt.	Ending Ref. Pt.	State, County, City or Township	Study Period Begins	Study Period Ends	
			Nicollet Avenue	At 76th Street			2.66	2.74	Hennepin County	1/1/2013	12/31/2015	
Description of Proposed Work		Convert phasing from perm only to FYA prot/perm (CMF ID 7684; 40% reduction in LT crashes on Portland Ave) Install confirmation lights (CMF ID 8824; 29% reduction in right angle crashes on Portland Ave)										
Accident Diagram Codes		1	2	3	5	4, 7	8, 9		6, 90, 98, 99			
										Pedestrian	Other	Total
Study Period: Number of Crashes	Fatal	F										
	Personal Injury (PI)	A										
		B				1						1
		C			1	3					2	6
Property Damage	PD	1		1	1	1					4	
% Change in Crashes <small>*Use FHWA cmfclearingho use for Crash Reduction Factors</small>	Fatal	F										
	PI	A										
		B				-29%						
		C			-40%	-29%						
Property Damage	PD			-40%								
Change in Crashes <small>= No. of crashes X % change in crashes</small>	Fatal	F										
	PI	A										
		B				-0.29						-0.29
		C			-0.40	-0.86				0.00		-1.26
Property Damage	PD	0.00		-0.40	0.00	0.00					-0.40	
Year (Safety Improvement Construction)		2022										
Project Cost (exclude Right of Way)		\$	105,000	Type of Crash	Study Period: Change in Crashes	Annual Change in Crashes	Cost per Crash	Annual Benefit	<div style="border: 1px solid black; padding: 5px; display: inline-block;">B/C= 7.58</div> <i>Using present worth values,</i> <b>B= \$ 796,337</b> <b>C= \$ 105,000</b> <i>See "Calculations" sheet for amortization.</i>			
Right of Way Costs (optional)				F			\$ 1,180,000					
Traffic Growth Factor			1%	A			\$ 590,000					
Capital Recovery				B	-0.29	-0.10	\$ 170,000	\$ 16,278				
1. Discount Rate			4.5%	C	-1.26	-0.42	\$ 87,000	\$ 36,660				
2. Project Service Life (n) See Appx F			20	PD	-0.40	-0.13	\$ 7,800	\$ 1,046				
							Total	\$ 53,985				