Memorandum

To:	Jenna Fabish, PE, Dakota County
From:	Nick Semeja, PE Matt Flanagan
Date:	April 14, 2022
Subject:	County Road 46 and County Road 46/TH 52 Interchange Safety and Mobility Improvement Project – 2022 RAISE Program Grant Application Benefit-Cost Analysis Memorandum

Introduction

This memorandum summarizes the assumptions, methodology and results developed for the benefit-cost analysis of the No Build and Build Alternatives evaluated as part of the County Road 46 and County Road 46/TH 52 Interchange Safety and Mobility Improvement Project - 2022 RAISE Grant Program Application. The objective of a benefit-cost analysis (BCA) is to bring all the direct effects of a transportation investment into a common measure (dollars), and to account for the fact that benefits accrue over an extended period while costs are incurred primarily in the initial years. The primary elements that can be monetized are travel time, changes in vehicle operating costs, vehicle crashes, environmental impacts, capital costs and remaining capital value, and maintenance costs. The benefit-cost analysis can provide an indication of the economic desirability of an alternative, but decision-makers must weigh the results against other considerations, effects, and impacts of the project.

Project Overview

Dakota County is submitting this 2022 RAISE grant request for $25 million in funding. The requested funds will be used toward County Road 46 and County Road 46/TH 52 Interchange Safety and Mobility Improvement Project (herein referred to as the Project).

The Project will expand 5 miles of County Road 46 from TH 3 to TH 52 from two lanes to a four-lane divided section to address safety and mobility needs due to increasing traffic volumes and the disproportionately high amount of heavy commercial vehicle traffic. In addition, the Project will modify the interchange ramp access at TH 52 with roundabouts to eliminate right angle crashes. Beyond the TH 52 Interchange, the Project will include just under a mile of pavement restoration to the east Project limits. A multi-modal trail will be constructed along the north side of County Road 46 and will include a new trail underpass connecting the Vermillion Highlands Greenway.

Description of Alternatives

For the purpose of this analysis, a No Build and Build Alternative were under consideration.

No Build Alternative

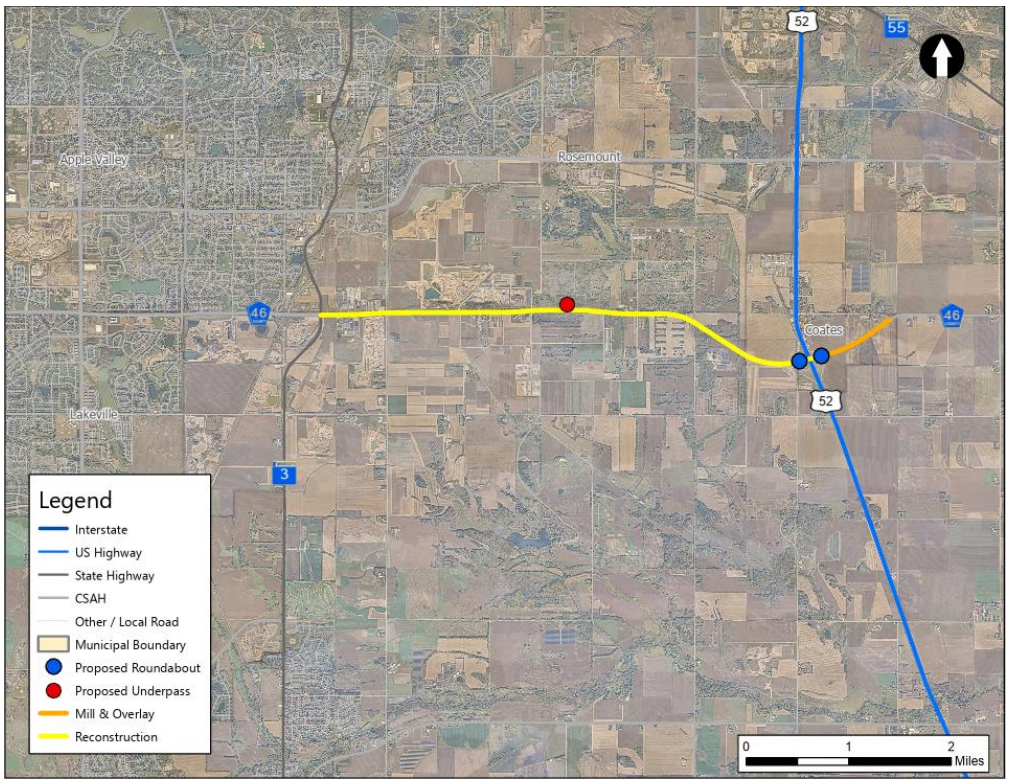
The No Build Alternative included leaving County Road 46 and the Trunk Highway 52 Interchange in its current configuration with the existing geometrics and operational conditions. Regional roadway improvements that are currently programmed were included as part of the regional transportation network for development of future traffic volumes. Intensified maintenance activities that were recently incurred to keep assets operational are expected to persist over the benefit-cost analysis. No Build AADT volumes were obtained from the CSAH 46 Improvements Traffic Forecast Memorandum (20221)[1]. 2040 Build Volumes were obtained from the 2040 Dakota Transit Plan[2].

Build Alternative

The proposed project includes the following main components:

- Expand 5 miles of CSAH 46 from TH 3 to TH 52 from two lanes to four-lane divided
- Modify the interchange ramp access at TH 52 with roundabouts
- Resurface one mile of CSAH 46 East of 52

Figure 1. Project Overview



[1] 2021 Traffic Forecast Memorandum: CSAH 46 From TH 3 to US Highway 52 Preliminary Through 30% Final Design is included in Attachment A.

[2]2040 Dakota County Transit Plan:
https://www.co.dakota.mn.us/Transportation/PlanningPrograms/Documents/2040TransportationPlan.pdf

The project schedule indicates that grant funds can be obligated by November 2024 in advance of the RAISE funding obligation date requirement of September 30, 2026. Construction would begin in April of 2025 with a completion date of August 31, 2027.

BCA Methodology

The following methodology and assumptions were used for the benefit-cost analysis:

1. **Main Components**: The main components analyzed included:
   - Travel time/delay
   - Vehicle operating costs
   - Crashes by severity
   - Environmental and air quality impacts
   - Initial capital costs: Capital costs were expected to be incurred in years 2024 through 2027
   - Remaining Capital Value: The remaining capital value (value of improvement beyond the analysis period) was considered a benefit and was added to other user benefits.
   - Operating and maintenance costs

2. **Analysis Years**: This analysis assumed that the Build Alternative would be constructed over a two-year period starting, starting in year 2025, with completion in year 2027. An additional two-year period is assumed for project planning and design between year 2023 and 2025. Year 2025 was assumed to be the first full year that most benefits will be accrued from the entirety of the project. The analysis primarily focused on annual benefits for the twenty-year period from 2028 to 2047[3]. The present value of all benefits and costs was calculated using 2020 as the year of current dollars.

3. **Economic Assumptions**: Value of time, vehicle operating costs, emissions costs, and cost of crashes were obtained from the Benefit Cost Analysis Guidance for Discretionary Grant Programs, dated March 2022 (Revised)[4]. The analysis was completed using an assumed discount rate of seven percent.

4. **Development of Vehicle Hours Traveled (VHT)**: HCM analysis was conducted to evaluate the change in operations at the proposed CSAH 46 & TH 52 interchange. Synchro/HCS models were developed for morning and afternoon peak hours to evaluate total user travel time under each operating condition. Year 2019 and year 2040 volumes were developed for both the No Build and Build Alternatives. Benefits for the years between 2019 and 2040 were interpolated based on model results using an annual growth rate. VMT and VHT for years beyond year 2040 were extrapolated using the same annual growth rate. Savings due to

[3] *This study assumed 365 days per year.*

[4] *U.S. DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs*
https://www.transportation.gov/sites/dot.gov/files/2022-03/Benefit%20Cost%20Analysis%20Guidance%202022%20%28Revised%29.pdf

reduction of VMT and VHT were calculated using costs per mile and per hour that account for vehicle occupancy and different vehicle types.

5. **Vehicle Occupancy and Vehicle Types**: The composite cost per mile used in the benefit-cost analysis accounted for the percentage split of autos and trucks in the travel area.
   - The truck percentage used in the analysis was 11.5 percent, based on a weighted average of year 2018 vehicle turning movement counts performed at the CSAH 46 and TH 52 Ramp Terminals.
   - Vehicle occupancy that was used in the analysis is consistent with values provided by *Benefit Cost Analysis Guidance for Discretionary Grant Programs*, dated March 2022 (Updated). The analysis assumed occupancy of 1.67 people per automobile and 1.00 people per truck.

6. **Safety Analysis:**

   The Build Alternative improves safety in the project area by providing the following elements quantified in this Benefit-Cost Analysis:

   - Conversion of 5.0-mile segment of CSAH 46 to four-lane divided cross-section
   - Construction of roundabouts at CSAH 46/TH 52 ramp terminal intersections

   Crash data from 2013-2021 was obtained from a MnDOT crash database[5] to determine average annual number of crashes by severity. Reductions in crashes along the CSAH 46 corridor were estimated using crash modification factors for the CSAH 46 mainline and ramp terminal improvements.

   The crash modification factor for the treatment *Convert Two-Lane Undivided to Four-Lane Divided*[6] was obtained from the CMF Clearinghouse database. The crash modification factor was applied to all crashes that occurred in two-lane sections of CSAH 46.

   The crash modification factor for the treatment *Install Two-Way Left-Turn Lane on Two Lane Road*[7] was obtained from the CMF Clearinghouse database. This CMF along with the CMF *Convert Two-Lane Undivided to Four-Lane Divided* was used to derive the CMF for *Convert Two-Lane with Two-Way Left-Turn Lane (TWTL) to Four-Lane Divided*. Refer to the attached documentation which displays this derivation. The crash modification factor was applied to all crashes that occurred in TWLTL sections of CSAH 46.

[5] *Minnesota Crash Mapping Analysis Tool (MnCMAT2):* https://www.dot.state.mn.us/stateaid/mncmat2.html
[6] *Convert Two-Lane Undivided to Four-Lane Divided:* http://www.cmfclearinghouse.org/detail.cfm?facid=7566
[7] *Install Two-Way Left-Turn Lane on Two Lane Road:* https://www.cmfclearinghouse.org/detail.cfm?facid=2337

The Crash Modification factor for the treatment *Convert Intersection to RAB*[8][9] was obtained from the CMF Clearinghouse database. These crash modification factors were applied to appropriate severity types at crashes on the CSAH 46 & TH 52 interchange ramp terminals.

Expected number of crashes in year 2040 were calculated by multiplying the base year crashes by the percent change in traffic volumes between the base year 2018 being near the center of the crash analysis period and the period for which there was the most available turning movement and daily volume data and forecast year 2040. Forecast year crash costs were calculated for the No Build scenario and Build Alternative crash costs were obtained by applying the appropriate crash modification factors to the No Build scenario crash costs.

The safety benefit was quantified for years 2018 and 2040 and interpolated/extrapolated based on an annual growth rate to determine total safety benefits for the period from year 2028-2047 crash cost assumptions are consistent with values and methodologies published in the *Benefit Cost Analysis Guidance for Discretionary Grant Programs*, dated March 2022 (Updated).

7. **Environmental and Air Quality Impacts:** Annual delay is expected to be reduced by capacity expansion along. The change in equivalent VHT between No Build and Build conditions was obtained by applying an equivalent VHT to VMT factor[10] to quantify the environmental impacts of idling vehicles at the CSAH 46 & TH 52 Interchange. Average emission rates per vehicle type were obtained from the Environmental Protection Agency's Motor Vehicle Emission Simulator (MOVES) version 3. Emission rates per vehicle type are provided in the attached BCA Workbook. Total change in emissions was valued in accordance with the *Benefit Cost Analysis Guidance for Discretionary Grant Programs*, dated March 2022 (Updated).

8. **Operating and Maintenance Costs**: Changes in annual roadway maintenance costs are expected due to intensified maintenance that will be required to keep the No Build Alternative serviceable compared to what will be required on new infrastructure under the Build. Anticipated costs for the No Build and Build Alternatives were provided by MnDOT and are presented in the BCA Workbook.

9. **Calculation of Remaining Capital Value**: Because many components of the initial capital costs have service lives well beyond the 20-year analysis period, the remaining capital value was calculated for the Build Alternative. This value was expressed in terms of 2020 dollars and was added to other project benefits in accordance with USDOT guidance. The assumed service life for the Build Alternative was 30 years, which was provided through coordination with MnDOT staff. In determining the remaining capital value of the Build Alternative, project components were assumed to have a linear depreciation from the time each phase was completed to the end of the benefit-cost analysis period. The remaining capital value quantities were discounted and attributed to other project benefits for the Build Alternative.

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[8] *Convert Intersection to RAB All (All Crashes/Type K):* http://www.cmfclearinghouse.org/detail.cfm?facid=9156
[9] *Convert Intersection to RAB (All Crashes/Type A,B,C)*: http://www.cmfclearinghouse.org/detail.cfm?facid=7566
[10] *Argonne National Laboratory, Idling Reduction Savings Calculator*
http://www.transportation.anl.gov/pdfs/idling_worksheet.pdf

10. **Factors Not Quantified**: Several factors were not quantified as part of the analysis that could potentially add to the benefits assumed in the BCA. These factors include the following:
    - Increased travel time reliability in the study area due to a reduction in crashes from safety improvements and enhanced pavement condition.
    - Safety benefits, changes in needed upkeep and maintenance, and vehicle operating costs on corridors associated with detour routes under the No Build Alternative due to a shift in VMT.
    - Improved resiliency to floods and associated detours due to profile enhancements along the corridor.
    - Trips lying outside the specified subarea may accrue benefits that were not accounted for.
    - Operating cost savings from improved vehicle efficiency due to increased average vehicle speeds in Build Alternative.

BCA RESULTS

The benefit-cost analysis provides an indication of the economic desirability of a scenario, but results must be weighed by decision-makers along with the assessment of other effects and impacts. Projects are considered cost-effective if the benefit-cost ratio is at least 1.0. The larger the ratio number, the greater the benefits per unit cost. Results of the benefit-cost analysis are shown in Table 1. See Attachment A for the complete benefit-cost analysis workbook.

Table 1 – Total Project Results

	Initial Capital Cost (2020 Dollars)	Project Benefits (2020 Dollars)	Benefit-Cost Ratio (7% Discount Rate)	Net Present Value (2020Dollars)
No Build vs. Build	$32.7 million	$46.9 million	1.44	$14.2 million

Attachment A

Benefit-Cost Analysis Worksheet

Attachment B

Existing Turning Movement Counts – CSAH 46 & TH 52 Interchange

MINNESOTA DEPARTMENT OF TRANSPORTATION

TRAFFIC DATA COLLECTION - Metro

(TRUCKS ONLY)

Location: TH-52 at CSAH-46 E-Ramp _2018
Ref. Pt: 113+00.318
Data Prepared By: ACS
TURNING MOVEMENT COUNT

File Name : TH-52 at CSAH-46 E-Ramp_2018
Site Code :
Start Date : 9/12/2018
Page No : 1

Groups Printed- Trucks

	Clayton Ave Southbound				CSAH-46 (160th St W) Westbound				TH-52 E Ramp Northbound				CSAH-46 (160th St W) Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:00	0	0	2	0	2	1	1	0	0	0	0	0	0	1	14	0	21
06:15	0	2	1	0	0	3	0	0	6	0	0	0	0	1	14	0	27
06:30	0	0	0	0	3	4	0	0	1	0	1	0	1	6	14	0	30
06:45	0	0	0	0	10	6	0	0	4	0	0	0	0	1	23	0	44
Total	0	2	3	0	15	14	1	0	11	0	1	0	1	9	65	0	122
07:00	1	0	0	0	7	3	0	0	5	0	2	0	1	0	15	0	34
07:15	1	0	0	0	3	5	0	0	6	0	0	0	2	2	21	0	40
07:30	0	0	0	0	1	5	0	0	3	0	0	0	1	2	29	0	41
07:45	0	0	1	0	1	6	0	0	2	0	0	0	0	2	16	0	28
Total	2	0	1	0	12	19	0	0	16	0	2	0	4	6	81	0	143
08:00	0	1	1	0	3	4	0	0	3	0	1	0	1	5	24	0	43
08:15	0	1	0	0	2	4	0	0	4	0	0	0	0	3	25	0	39
08:30	0	0	0	0	5	8	0	0	4	0	0	0	1	3	13	0	34
08:45	0	0	1	0	1	8	0	0	7	0	1	0	2	1	16	0	37
Total	0	2	2	0	11	24	0	0	18	0	2	0	4	12	78	0	153
09:00	0	1	0	0	0	3	0	0	7	0	0	0	1	2	13	0	27
09:15	0	0	1	0	1	6	0	0	4	0	0	0	0	5	17	0	34
09:30	0	1	1	0	1	0	0	0	4	0	0	0	1	6	18	0	32
09:45	0	0	0	0	2	6	0	0	6	0	0	0	3	3	19	0	39
Total	0	2	2	0	4	15	0	0	21	0	0	0	5	16	67	0	132
10:00	0	0	0	0	1	2	0	0	3	0	1	0	0	10	15	0	32
10:15	0	0	0	0	0	6	0	0	2	0	0	0	0	4	14	0	26
10:30	0	0	0	0	2	3	0	0	3	0	0	0	2	5	22	0	37
10:45	0	0	2	0	2	5	0	0	2	0	0	0	1	3	15	0	30
Total	0	0	2	0	5	16	0	0	10	0	1	0	3	22	66	0	125
11:00	0	0	0	0	1	3	0	0	8	0	1	0	2	3	18	0	36
11:15	0	1	0	0	1	2	0	0	4	0	0	0	0	3	17	0	28
11:30	0	0	0	0	1	4	0	0	5	0	0	0	1	2	16	0	29
11:45	0	0	0	0	0	2	0	0	2	0	0	0	1	5	14	0	24
Total	0	1	0	0	3	11	0	0	19	0	1	0	4	13	65	0	117
12:00	0	0	1	0	4	1	0	0	4	0	0	0	0	4	18	0	32
12:15	0	0	0	0	1	6	0	0	3	0	0	0	1	2	17	0	30
12:30	0	0	0	0	1	3	0	0	2	0	1	0	0	5	13	0	25
12:45	0	1	1	0	1	6	0	0	4	0	1	0	0	3	7	0	24
Total	0	1	2	0	7	16	0	0	13	0	2	0	1	14	55	0	111
13:00	0	0	0	0	0	3	0	0	4	0	0	0	1	5	21	0	34
13:15	0	0	0	0	2	4	0	0	4	0	0	0	1	3	27	0	41
13:30	0	0	0	0	1	2	0	0	5	0	0	0	0	4	13	0	25
13:45	0	0	0	0	4	2	0	0	6	0	0	0	0	3	18	0	33
Total	0	0	0	0	7	11	0	0	19	0	0	0	2	15	79	0	133

MINNESOTA DEPARTMENT OF TRANSPORTATION

TRAFFIC DATA COLLECTION - Metro

.

Location: TH-52 at CSAH-46 E-Ramp _2018
Ref. Pt: 113+00.318
Data Prepared By: ACS
TURNING MOVEMENT COUNT

File Name : TH-52 at CSAH-46 E-Ramp_2018
Site Code :
Start Date : 9/12/2018
Page No : 2

Groups Printed- Trucks

	Clayton Ave Southbound				CSAH-46 (160th St W) Westbound				TH-52 E Ramp Northbound				CSAH-46 (160th St W) Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
14:00	0	0	1	0	1	1	0	0	10	0	1	0	0	3	12	0	29
14:15	0	1	0	0	1	1	0	0	2	1	0	0	0	6	10	0	22
14:30	0	0	0	0	1	2	0	0	4	0	0	0	0	5	11	0	23
14:45	0	0	0	0	2	4	0	0	5	0	0	0	0	4	12	0	27
Total	0	1	1	0	5	8	0	0	21	1	1	0	0	18	45	0	101
15:00	0	0	0	0	1	5	0	0	3	0	1	0	0	5	15	0	30
15:15	0	0	0	0	1	1	0	0	3	0	0	0	1	8	20	0	34
15:30	0	0	0	0	1	4	0	0	5	0	0	0	0	7	14	0	31
15:45	1	1	0	0	1	5	0	0	2	0	0	0	0	9	8	0	27
Total	1	1	0	0	4	15	0	0	13	0	1	0	1	29	57	0	122
16:00	0	0	0	0	1	4	0	0	2	0	1	0	0	2	10	0	20
16:15	0	0	0	0	1	3	0	0	1	0	0	0	1	4	9	0	19
16:30	0	0	0	0	0	5	0	0	1	0	0	0	1	7	9	0	23
16:45	0	0	0	0	0	7	0	0	1	0	1	0	0	5	7	0	21
Total	0	0	0	0	2	19	0	0	5	0	2	0	2	18	35	0	83
17:00	0	0	0	0	0	4	0	0	1	0	0	0	0	5	8	0	18
17:15	0	0	0	0	0	2	0	0	1	0	0	0	0	4	5	0	12
17:30	0	0	0	0	0	1	0	0	1	0	0	0	0	4	2	0	8
17:45	0	0	0	0	0	1	0	0	0	1	0	0	0	4	5	0	11
Total	0	0	0	0	0	8	0	0	3	1	0	0	0	17	20	0	49
Grand Total	3	10	13	0	75	176	1	0	169	2	13	0	27	189	713	0	1391
Apprch %	11.5	38.5	50	0	29.8	69.8	0.4	0	91.8	1.1	7.1	0	2.9	20.3	76.7	0	
Total %	0.2	0.7	0.9	0	5.4	12.7	0.1	0	12.1	0.1	0.9	0	1.9	13.6	51.3	0	

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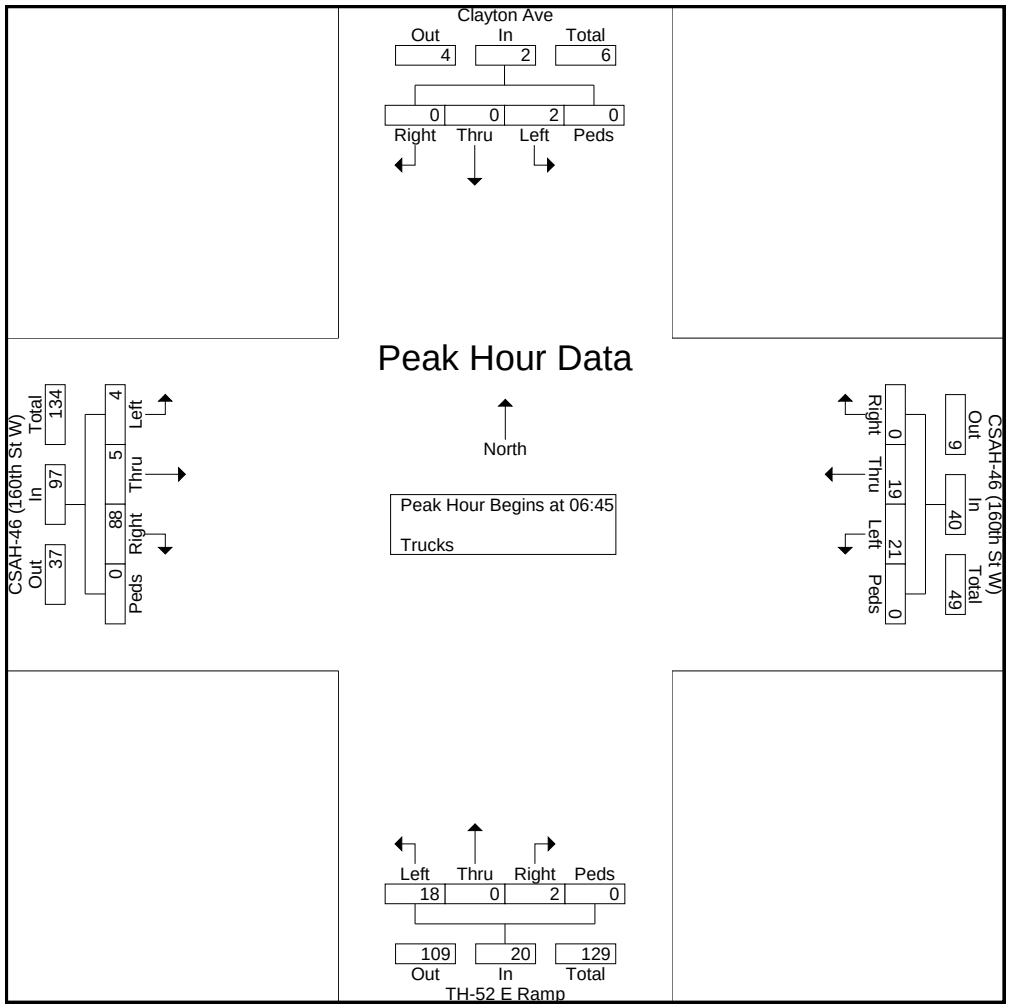
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 to 11:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 06:45																					
06:45	0	0	0	0	0	10	6	0	0	16	4	0	0	0	4	0	1	23	0	24	44
07:00	1	0	0	0	1	7	3	0	0	10	5	0	2	0	7	1	0	15	0	16	34
07:15	1	0	0	0	1	3	5	0	0	8	6	0	0	0	6	2	2	21	0	25	40
07:30	0	0	0	0	0	1	5	0	0	6	3	0	0	0	3	1	2	29	0	32	41
Total Volume	2	0	0	0	2	21	19	0	0	40	18	0	2	0	20	4	5	88	0	97	159
% App. Total	100	0	0	0		52.5	47.5	0	0		90	0	10	0		4.1	5.2	90.7	0		
PHF	.500	.000	.000	.000	.500	.525	.792	.000	.000	.625	.750	.000	.250	.000	.714	.500	.625	.759	.000	.758	.903



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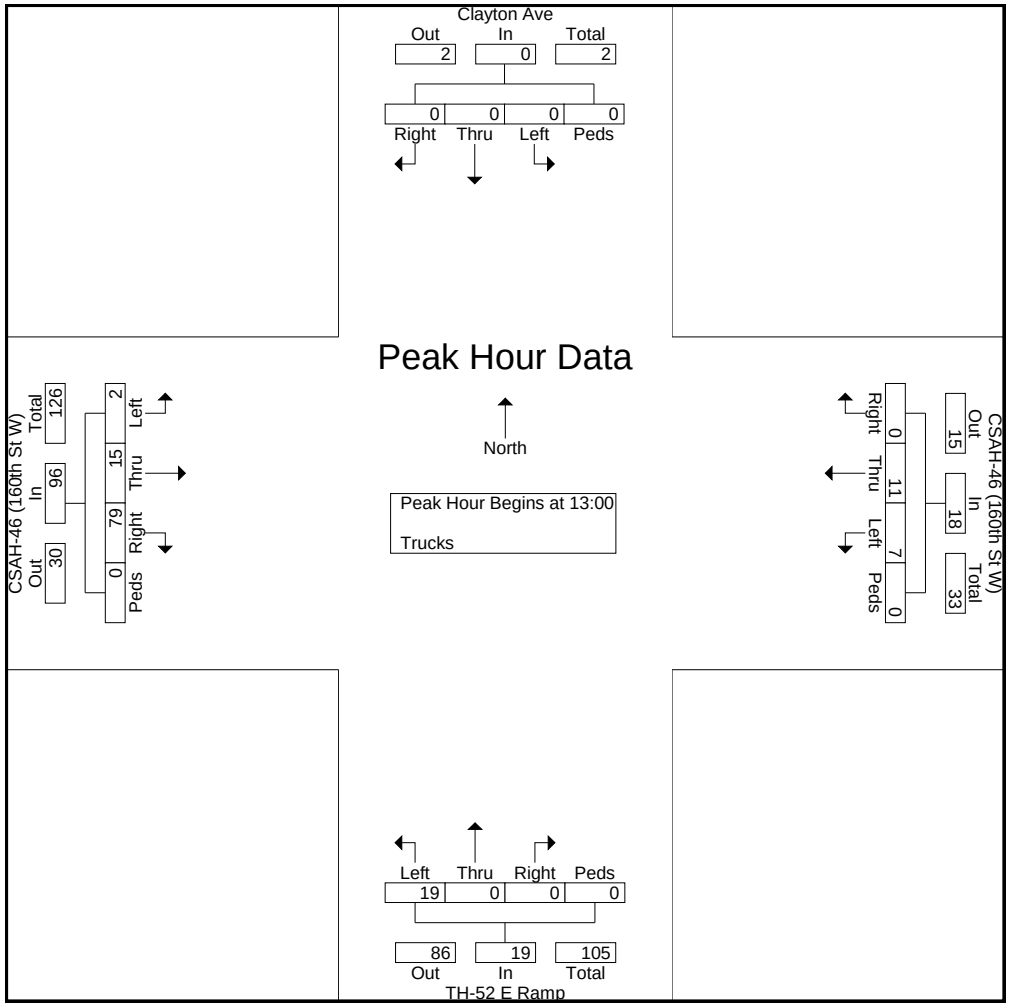
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 to 17:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 13:00																					
13:00	0	0	0	0	0	0	3	0	0	3	4	0	0	0	4	1	5	21	0	27	34
13:15	0	0	0	0	0	2	4	0	0	6	4	0	0	0	4	1	3	27	0	31	41
13:30	0	0	0	0	0	1	2	0	0	3	5	0	0	0	5	0	4	13	0	17	25
13:45	0	0	0	0	0	4	2	0	0	6	6	0	0	0	6	0	3	18	0	21	33
Total Volume	0	0	0	0	0	7	11	0	0	18	19	0	0	0	19	2	15	79	0	96	133
% App. Total	0	0	0	0		38.9	61.1	0	0		100	0	0	0		2.1	15.6	82.3	0		
PHF	.000	.000	.000	.000	.000	.438	.688	.000	.000	.750	.792	.000	.000	.000	.792	.500	.750	.731	.000	.774	.811



Associated Consulting Services (ACS)

Saint Paul, MN 55127

-- TRAFFIC DATA --

Location: TH-52 at CSAH-46 E-Ramp _2018
Ref. Pt: 113+00.318
Data Prepared By: ACS
TURNING MOVEMENT COUNT

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Site Code :
Start Date : 9/12/2018
Page No : 1

Groups Printed- Cars - Trucks

	Clayton Ave Southbound				CSAH-46 (160th St W) Westbound				TH-52 E Ramp Northbound				CSAH-46 (160th St W) Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:00	0	0	4	0	28	34	1	0	29	0	1	0	1	23	46	0	167
06:15	0	3	5	0	26	58	1	0	40	2	2	0	3	30	68	0	238
06:30	0	1	6	0	38	61	0	0	39	1	4	0	2	34	79	0	265
06:45	0	0	2	0	38	78	0	0	30	1	0	0	2	38	87	0	276
Total	0	4	17	0	130	231	2	0	138	4	7	0	8	125	280	0	946
07:00	1	1	1	0	28	52	0	0	33	3	3	0	4	40	107	0	273
07:15	1	1	0	0	37	66	0	0	35	2	0	0	4	40	122	0	308
07:30	0	1	0	0	26	53	1	0	44	1	2	0	3	40	126	0	297
07:45	0	1	2	0	32	66	0	0	33	0	1	0	2	27	93	0	257
Total	2	4	3	0	123	237	1	0	145	6	6	0	13	147	448	0	1135
08:00	0	2	5	0	13	31	2	0	25	1	1	0	4	41	64	0	189
08:15	1	2	3	0	21	29	0	0	28	1	0	0	4	31	73	0	193
08:30	0	0	2	0	16	31	1	0	32	0	1	1	5	24	57	0	170
08:45	1	0	3	0	6	21	0	0	31	0	1	0	4	27	51	0	145
Total	2	4	13	0	56	112	3	0	116	2	3	1	17	123	245	0	697
09:00	0	2	6	0	9	26	0	0	28	1	1	0	1	14	37	0	125
09:15	0	0	5	0	7	23	1	0	28	1	2	0	1	24	40	0	132
09:30	0	1	4	0	6	15	0	0	21	1	0	0	2	32	43	0	125
09:45	0	0	1	0	10	27	0	0	25	0	2	0	6	26	42	0	139
Total	0	3	16	0	32	91	1	0	102	3	5	0	10	96	162	0	521
10:00	0	0	0	0	4	24	0	0	25	2	2	0	1	35	27	0	120
10:15	0	0	0	0	8	28	1	0	25	2	1	0	5	31	27	0	128
10:30	0	0	0	0	8	24	0	0	22	2	0	0	5	21	39	0	121
10:45	0	0	4	0	5	20	1	0	18	0	0	0	5	16	21	0	90
Total	0	0	4	0	25	96	2	0	90	6	3	0	16	103	114	0	459
11:00	0	1	0	0	4	16	0	0	25	1	2	0	5	24	33	0	111
11:15	1	1	2	0	9	17	1	0	28	1	2	0	9	24	34	0	129
11:30	0	0	4	0	4	26	2	0	27	4	0	0	7	20	32	0	126
11:45	0	0	3	0	4	25	0	0	33	3	0	0	9	23	28	0	128
Total	1	2	9	0	21	84	3	0	113	9	4	0	30	91	127	0	494
12:00	0	1	8	0	5	17	0	0	18	2	0	0	11	21	34	0	117
12:15	1	1	8	0	1	19	1	0	26	0	0	0	7	23	30	0	117
12:30	2	1	8	1	5	25	4	0	22	1	2	0	5	27	28	0	131
12:45	0	1	6	0	4	25	2	0	21	0	3	0	2	14	21	0	99
Total	3	4	30	1	15	86	7	0	87	3	5	0	25	85	113	0	464
13:00	0	0	3	1	2	24	0	0	28	2	0	0	7	24	37	0	128
13:15	0	0	3	0	5	25	0	0	16	0	1	0	5	22	38	0	115
13:30	0	0	2	0	4	35	0	0	28	4	0	0	6	36	29	0	144
13:45	0	2	3	0	9	27	2	0	26	3	0	0	5	24	35	0	136
Total	0	2	11	1	20	111	2	0	98	9	1	0	23	106	139	0	523
14:00	0	0	3	0	6	20	0	0	30	1	2	0	4	27	27	0	120
14:15	1	3	5	0	5	23	1	0	42	2	2	0	9	41	35	0	169
14:30	0	2	9	0	8	25	1	0	23	1	0	0	7	36	35	0	147

Associated Consulting Services (ACS)

Saint Paul, MN 55127

-- TRAFFIC DATA --

Location: TH-52 at CSAH-46 E-Ramp _2018
Ref. Pt: 113+00.318
Data Prepared By: ACS
TURNING MOVEMENT COUNT

File Name : TH-52 at CSAH-46 E-Ramp_2018
Site Code :
Start Date : 9/12/2018
Page No : 2

Groups Printed- Cars - Trucks

	Clayton Ave Southbound				CSAH-46 (160th St W) Westbound				TH-52 E Ramp Northbound				CSAH-46 (160th St W) Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
14:45	0	0	2	0	6	26	0	0	27	0	0	0	7	39	32	0	139
Total	1	5	19	0	25	94	2	0	122	4	4	0	27	143	129	0	575
15:00	0	0	1	1	7	32	1	0	28	0	4	0	4	47	33	0	158
15:15	0	0	4	0	4	30	3	0	32	1	2	0	12	62	53	0	203
15:30	0	1	5	0	4	38	1	0	40	1	1	0	12	76	41	0	220
15:45	1	3	4	0	5	45	4	0	45	1	3	0	12	86	45	0	254
Total	1	4	14	1	20	145	9	0	145	3	10	0	40	271	172	0	835
16:00	0	0	5	0	11	37	1	0	44	1	1	0	10	70	37	0	217
16:15	0	0	6	0	3	50	2	0	46	5	1	0	14	69	42	0	238
16:30	1	1	5	0	8	50	0	0	55	3	1	0	14	75	39	0	252
16:45	0	0	8	0	4	65	0	0	50	5	2	0	11	66	33	0	244
Total	1	1	24	0	26	202	3	0	195	14	5	0	49	280	151	0	951
17:00	1	2	5	0	6	41	1	0	39	3	3	0	10	83	40	0	234
17:15	0	0	6	0	10	41	3	0	44	1	3	0	14	80	33	0	235
17:30	1	1	4	0	8	39	2	0	39	4	1	0	10	86	40	0	235
17:45	0	0	6	0	6	30	0	0	36	6	0	0	8	79	32	0	203
Total	2	3	21	0	30	151	6	0	158	14	7	0	42	328	145	0	907
Grand Total	13	36	181	3	523	1640	41	0	1509	77	60	1	300	1898	2225	0	8507
Apprch %	5.6	15.5	77.7	1.3	23.7	74.4	1.9	0	91.6	4.7	3.6	0.1	6.8	42.9	50.3	0	
Total %	0.2	0.4	2.1	0	6.1	19.3	0.5	0	17.7	0.9	0.7	0	3.5	22.3	26.2	0	
Cars	10	26	168	3	448	1464	40	0	1340	75	47	1	273	1709	1512	0	7116
% Cars	76.9	72.2	92.8	100	85.7	89.3	97.6	0	88.8	97.4	78.3	100	91	90	68	0	83.6
Trucks	3	10	13	0	75	176	1	0	169	2	13	0	27	189	713	0	1391
% Trucks	23.1	27.8	7.2	0	14.3	10.7	2.4	0	11.2	2.6	21.7	0	9	10	32	0	16.4

Associated Consulting Services (ACS)

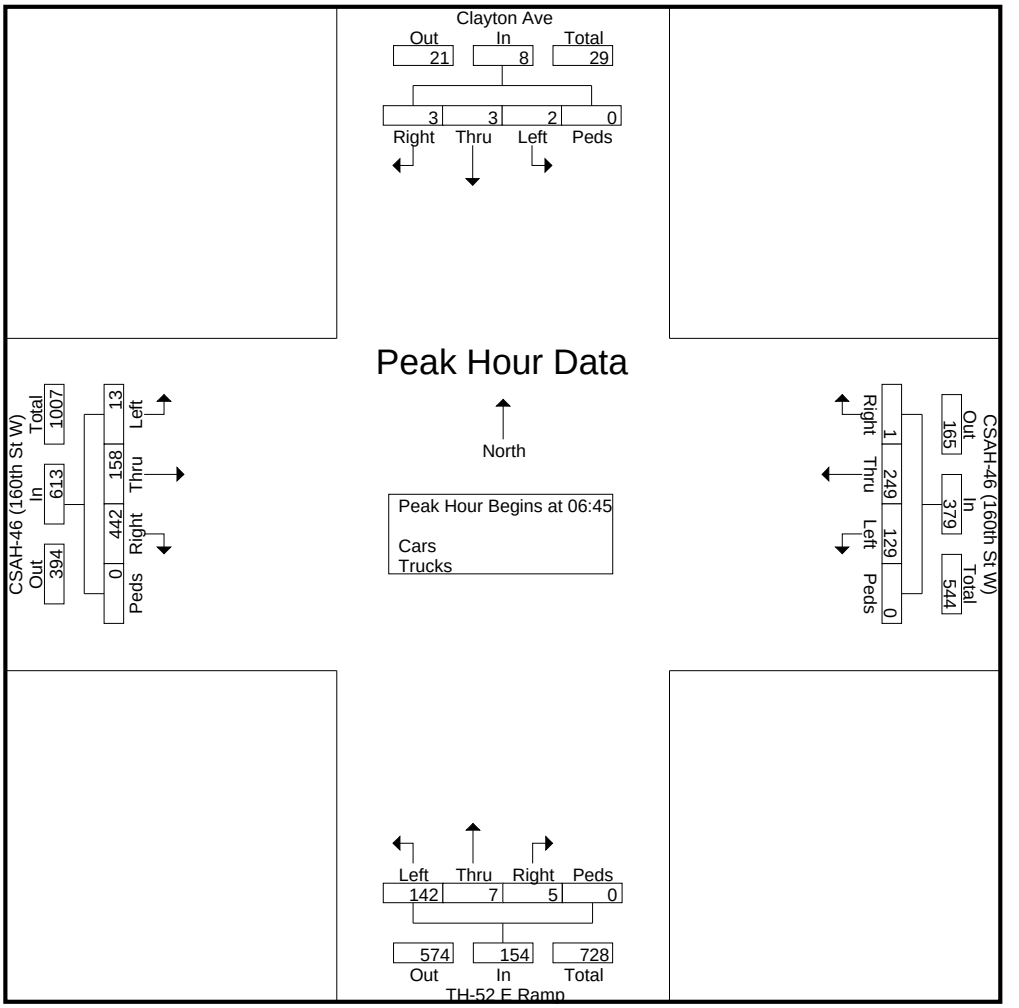
Saint Paul, MN 55127

-- TRAFFIC DATA --

Location: TH-52 at CSAH-46 E-Ramp _2018
Ref. Pt: 113+00.318
Data Prepared By: ACS
TURNING MOVEMENT COUNT

File Name : TH-52 at CSAH-46 E-Ramp_2018
Site Code :
Start Date : 9/12/2018
Page No : 3

	Clayton Ave Southbound					CSAH-46 (160th St W) Westbound					TH-52 E Ramp Northbound					CSAH-46 (160th St W) Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 to 11:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 06:45																					
06:45	0	0	**2**	0	2	**38**	**78**	0	0	**116**	30	1	0	0	31	2	38	87	0	127	276
07:00	**1**	**1**	1	0	**3**	28	52	0	0	80	33	**3**	**3**	0	39	**4**	**40**	107	0	151	273
07:15	1	1	0	0	2	37	66	0	0	103	35	2	0	0	37	4	40	122	0	166	**308**
07:30	0	1	0	0	1	26	53	**1**	0	80	**44**	1	2	0	**47**	3	40	**126**	0	**169**	297
Total Volume	2	3	3	0	8	129	249	1	0	379	142	7	5	0	154	13	158	442	0	613	1154
% App. Total	25	37.5	37.5	0		34	65.7	0.3	0		92.2	4.5	3.2	0		2.1	25.8	72.1	0		
PHF	.500	.750	.375	.000	.667	.849	.798	.250	.000	.817	.807	.583	.417	.000	.819	.813	.988	.877	.000	.907	.937



Associated Consulting Services (ACS)

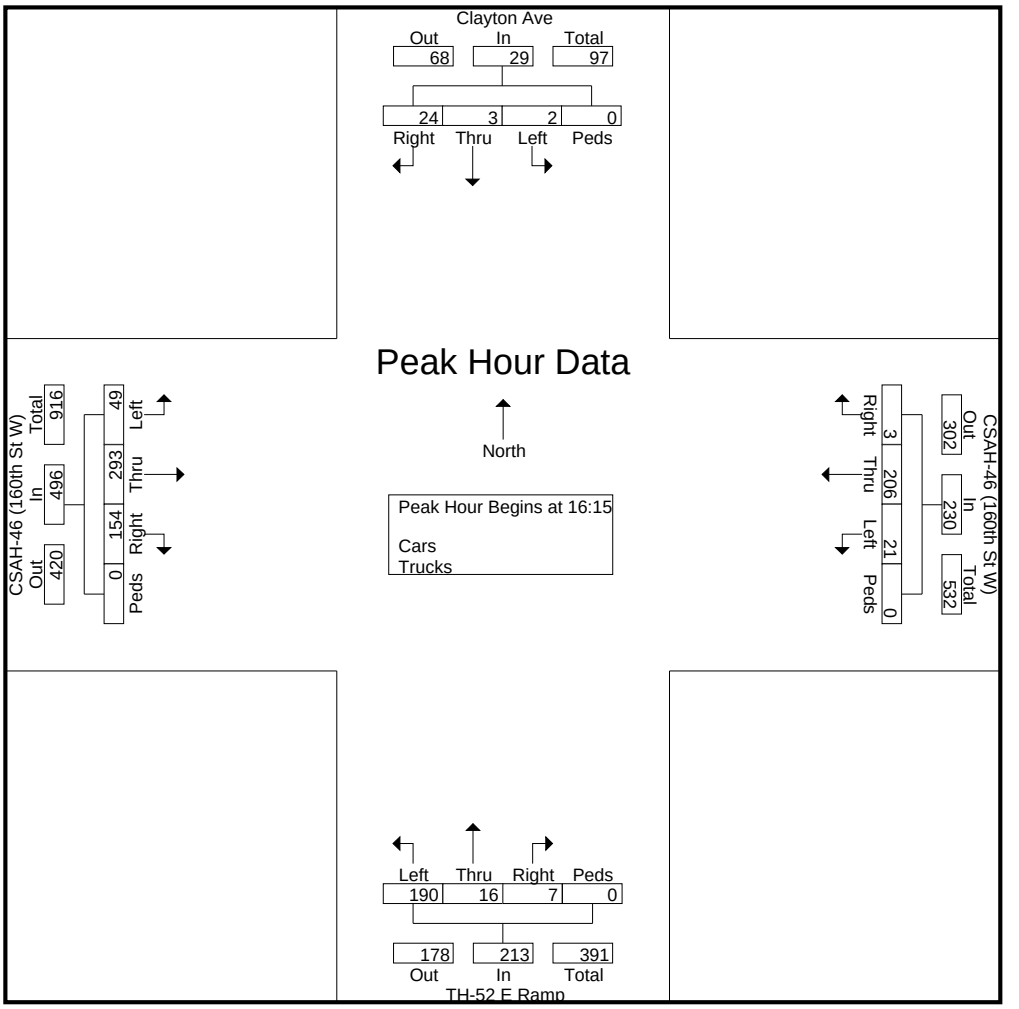
Saint Paul, MN 55127

-- TRAFFIC DATA --

Location: TH-52 at CSAH-46 E-Ramp _2018
Ref. Pt: 113+00.318
Data Prepared By: ACS
TURNING MOVEMENT COUNT

File Name : TH-52 at CSAH-46 E-Ramp_2018
Site Code :
Start Date : 9/12/2018
Page No : 4

	Clayton Ave Southbound					CSAH-46 (160th St W) Westbound					TH-52 E Ramp Northbound					CSAH-46 (160th St W) Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 to 17:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:15																					
16:15	0	0	6	0	6	3	50	**2**	0	55	46	**5**	1	0	52	**14**	69	**42**	0	125	238
16:30	**1**	1	5	0	7	**8**	50	0	0	58	**55**	3	1	0	**59**	14	75	39	0	128	**252**
16:45	0	0	**8**	0	**8**	4	**65**	0	0	**69**	50	5	2	0	57	11	66	33	0	110	244
17:00	1	**2**	5	0	8	6	41	1	0	48	39	3	**3**	0	45	10	**83**	40	0	**133**	234
Total Volume	2	3	24	0	29	21	206	3	0	230	190	16	7	0	213	49	293	154	0	496	968
% App. Total	6.9	10.3	82.8	0		9.1	89.6	1.3	0		89.2	7.5	3.3	0		9.9	59.1	31	0		
PHF	.500	.375	.750	.000	.906	.656	.792	.375	.000	.833	.864	.800	.583	.000	.903	.875	.883	.917	.000	.932	.960



MINNESOTA DEPARTMENT OF TRANSPORTATION

TRAFFIC DATA COLLECTION - Metro

(TRUCKS ONLY)

Location: TH-52 at CSAH-46 W-Ramp_2018
Ref. Pt: 113+00.572
Data Prepared By: ACS
TURNING MOVEMENT COUNT

File Name : th-52 at csah-46 w-ramp_2018
Site Code :
Start Date : 9/12/2018
Page No : 1

Groups Printed- Trucks

	Clayton Ave Southbound				CSAH-46 (160th St W) Westbound				TH-52 SB Exit loop Northbound				CSAH-46 (160th St W) Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:00	3	0	7	0	0	4	0	0	1	0	0	0	0	12	1	0	28
06:15	0	0	7	0	1	9	0	0	1	0	1	0	0	14	1	0	34
06:30	1	1	4	0	0	5	0	0	1	0	1	0	1	19	1	0	34
06:45	0	0	6	0	0	9	0	0	4	0	0	0	0	22	6	0	47
Total	4	1	24	0	1	27	0	0	7	0	2	0	1	67	9	0	143
07:00	0	0	7	0	0	8	0	0	3	0	2	0	0	17	3	0	40
07:15	1	0	9	0	0	10	0	0	3	0	0	0	0	26	2	0	51
07:30	0	0	6	0	0	10	0	0	2	0	2	0	0	30	4	0	54
07:45	2	0	7	0	1	8	0	0	5	0	1	0	0	13	5	0	42
Total	3	0	29	0	1	36	0	0	13	0	5	0	0	86	14	0	187
08:00	2	0	5	0	1	8	0	0	2	0	4	0	1	22	3	0	48
08:15	0	0	3	0	0	10	0	0	3	0	2	0	0	28	4	0	50
08:30	0	0	7	0	0	12	0	0	2	0	0	0	0	14	4	0	39
08:45	1	0	14	0	0	13	1	0	9	0	0	0	0	17	1	0	56
Total	3	0	29	0	1	43	1	0	16	0	6	0	1	81	12	0	193
09:00	1	0	7	0	0	10	0	0	9	0	1	0	0	14	4	0	46
09:15	0	0	7	0	0	10	1	0	6	0	2	0	0	21	4	0	51
09:30	4	0	7	0	0	7	0	0	7	0	2	0	1	18	3	0	49
09:45	2	0	7	0	0	9	1	0	3	0	2	0	0	23	6	0	53
Total	7	0	28	0	0	36	2	0	25	0	7	0	1	76	17	0	199
10:00	2	0	3	0	0	5	0	0	8	0	0	0	0	23	2	0	43
10:15	3	0	11	0	1	6	2	0	5	0	1	0	1	19	3	0	52
10:30	1	0	7	0	0	7	0	0	6	0	2	0	1	19	6	0	49
10:45	2	0	8	0	0	7	2	0	6	0	0	0	0	17	7	0	49
Total	8	0	29	0	1	25	4	0	25	0	3	0	2	78	18	0	193
11:00	4	0	5	0	0	10	0	0	3	0	2	0	1	19	1	0	45
11:15	2	0	5	0	0	6	0	0	4	0	0	0	0	18	6	0	41
11:30	1	0	6	0	0	8	1	0	8	0	3	0	0	17	0	0	44
11:45	1	0	10	0	0	5	0	0	6	0	3	0	0	14	2	0	41
Total	8	0	26	0	0	29	1	0	21	0	8	0	1	68	9	0	171
12:00	1	0	6	0	1	3	2	0	2	0	3	0	0	19	4	0	41
12:15	4	0	5	0	0	9	0	0	1	0	0	0	0	13	2	0	34
12:30	0	0	6	0	0	6	0	0	10	0	4	0	0	14	5	0	45
12:45	0	0	6	0	0	8	2	0	11	0	1	0	1	12	2	0	43
Total	5	0	23	0	1	26	4	0	24	0	8	0	1	58	13	0	163
13:00	2	0	5	0	0	7	0	0	10	0	4	0	0	24	2	0	54
13:15	2	1	5	0	0	7	0	0	2	0	2	0	0	21	3	0	43
13:30	2	0	9	0	0	8	0	0	6	0	1	0	0	16	3	0	45
13:45	0	1	3	0	0	7	0	0	2	0	1	0	0	17	1	0	32
Total	6	2	22	0	0	29	0	0	20	0	8	0	0	78	9	0	174

MINNESOTA DEPARTMENT OF TRANSPORTATION

TRAFFIC DATA COLLECTION - Metro

(TRUCKS ONLY)

Location: TH-52 at CSAH-46 W-Ramp_2018
Ref. Pt: 113+00.572
Data Prepared By: ACS
TURNING MOVEMENT COUNT

File Name : th-52 at csah-46 w-ramp_2018
Site Code :
Start Date : 9/12/2018
Page No : 2

Groups Printed- Trucks

	Clayton Ave Southbound				CSAH-46 (160th St W) Westbound				TH-52 SB Exit loop Northbound				CSAH-46 (160th St W) Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
14:00	1	0	5	0	0	12	0	0	2	0	3	0	0	13	3	0	39
14:15	1	0	5	0	0	3	0	0	9	0	1	0	1	12	2	0	34
14:30	3	0	6	0	0	7	0	0	2	0	1	0	0	14	2	0	35
14:45	1	0	5	0	0	7	0	0	9	0	0	0	1	13	2	0	38
Total	6	0	21	0	0	29	0	0	22	0	5	0	2	52	9	0	146
15:00	0	0	7	0	0	9	0	0	5	0	4	0	1	16	3	0	45
15:15	3	1	1	0	0	4	0	0	9	0	3	0	1	26	3	0	51
15:30	2	0	8	0	0	6	2	0	2	0	0	0	0	18	5	0	43
15:45	1	1	2	0	1	5	0	0	1	0	2	0	0	12	5	0	30
Total	6	2	18	0	1	24	2	0	17	0	9	0	2	72	16	0	169
16:00	1	1	6	0	0	6	0	0	4	0	1	0	1	13	7	0	40
16:15	1	0	5	0	0	3	0	0	3	0	2	0	2	9	1	0	26
16:30	0	0	5	0	0	6	0	0	1	0	2	0	1	14	4	0	33
16:45	2	0	7	0	0	9	0	0	1	0	4	0	0	9	2	0	34
Total	4	1	23	0	0	24	0	0	9	0	9	0	4	45	14	0	133
17:00	0	1	4	0	1	3	0	0	2	0	1	0	0	10	5	0	27
17:15	0	0	3	0	0	3	0	0	2	0	1	0	0	11	5	0	25
17:30	0	0	5	0	0	3	0	0	0	0	1	0	1	3	3	0	16
17:45	0	0	3	0	0	0	0	0	2	0	1	0	0	7	0	0	13
Total	0	1	15	0	1	9	0	0	6	0	4	0	1	31	13	0	81
Grand Total	60	7	287	0	7	337	14	0	205	0	74	0	16	792	153	0	1952
Apprch %	16.9	2	81.1	0	2	94.1	3.9	0	73.5	0	26.5	0	1.7	82.4	15.9	0	
Total %	3.1	0.4	14.7	0	0.4	17.3	0.7	0	10.5	0	3.8	0	0.8	40.6	7.8	0	

MINNESOTA DEPARTMENT OF TRANSPORTATION

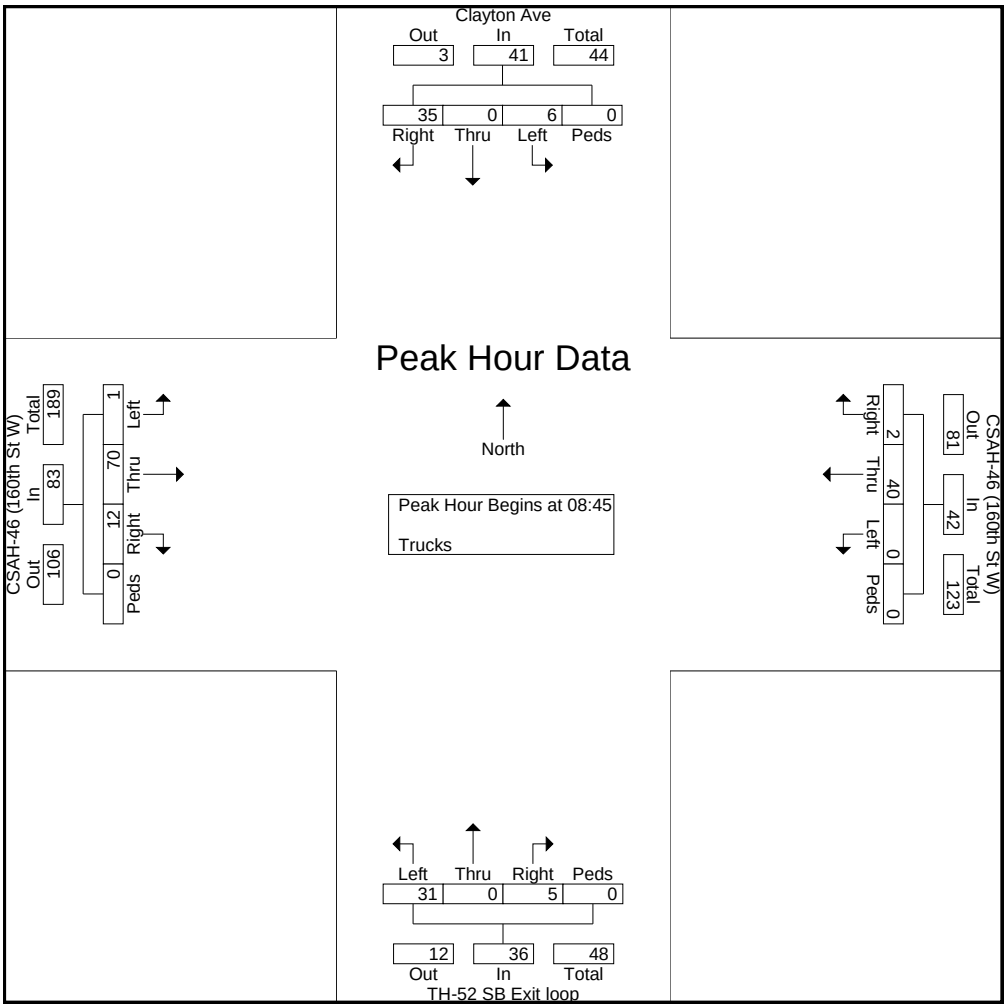
TRAFFIC DATA COLLECTION - Metro

(TRUCKS ONLY)

Location: TH-52 at CSAH-46 W-Ramp_2018
Ref. Pt: 113+00.572
Data Prepared By: ACS
TURNING MOVEMENT COUNT

File Name : th-52 at csah-46 w-ramp_2018
Site Code :
Start Date : 9/12/2018
Page No : 3

	Clayton Ave Southbound					CSAH-46 (160th St W) Westbound					TH-52 SB Exit loop Northbound					CSAH-46 (160th St W) Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 to 11:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:45																					
08:45	1	0	14	0	15	0	13	1	0	14	9	0	0	0	9	0	17	1	0	18	56
09:00	1	0	7	0	8	0	10	0	0	10	9	0	1	0	10	0	14	4	0	18	46
09:15	0	0	7	0	7	0	10	1	0	11	6	0	2	0	8	0	21	4	0	25	51
09:30	4	0	7	0	11	0	7	0	0	7	7	0	2	0	9	1	18	3	0	22	49
Total Volume	6	0	35	0	41	0	40	2	0	42	31	0	5	0	36	1	70	12	0	83	202
% App. Total	14.6	0	85.4	0		0	95.2	4.8	0		86.1	0	13.9	0		1.2	84.3	14.5	0		
PHF	.375	.000	.625	.000	.683	.000	.769	.500	.000	.750	.861	.000	.625	.000	.900	.250	.833	.750	.000	.830	.902



MINNESOTA DEPARTMENT OF TRANSPORTATION

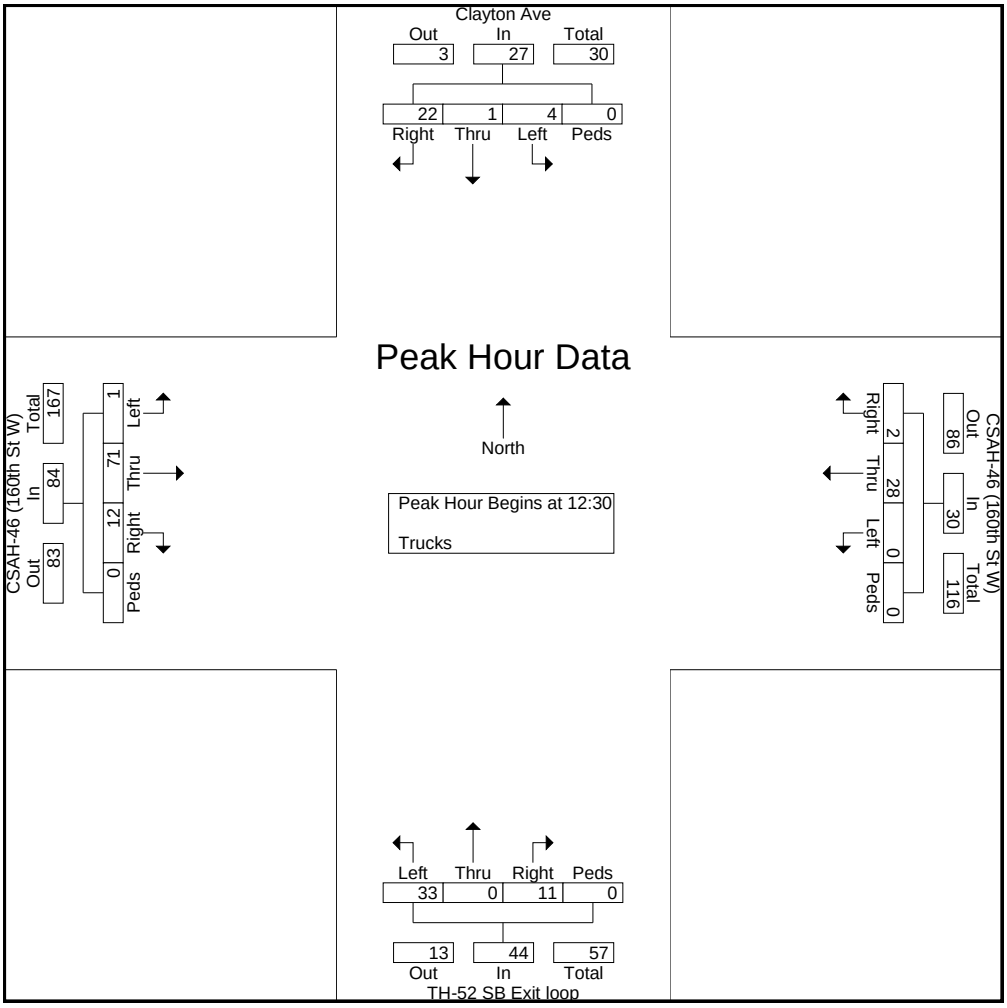
TRAFFIC DATA COLLECTION - Metro

(TRUCKS ONLY)

Location: TH-52 at CSAH-46 W-Ramp_2018
Ref. Pt: 113+00.572
Data Prepared By: ACS
TURNING MOVEMENT COUNT

File Name : th-52 at csah-46 w-ramp_2018
Site Code :
Start Date : 9/12/2018
Page No : 4

	Clayton Ave Southbound					CSAH-46 (160th St W) Westbound					TH-52 SB Exit loop Northbound					CSAH-46 (160th St W) Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 to 17:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 12:30																					
12:30	0	0	6	0	6	0	6	0	0	6	10	0	4	0	14	0	14	5	0	19	45
12:45	0	0	6	0	6	0	8	2	0	10	11	0	1	0	12	1	12	2	0	15	43
13:00	2	0	5	0	7	0	7	0	0	7	10	0	4	0	14	0	24	2	0	26	54
13:15	2	1	5	0	8	0	7	0	0	7	2	0	2	0	4	0	21	3	0	24	43
Total Volume	4	1	22	0	27	0	28	2	0	30	33	0	11	0	44	1	71	12	0	84	185
% App. Total	14.8	3.7	81.5	0		0	93.3	6.7	0		75	0	25	0		1.2	84.5	14.3	0		
PHF	.500	.250	.917	.000	.844	.000	.875	.250	.000	.750	.750	.000	.688	.000	.786	.250	.740	.600	.000	.808	.856



MINNESOTA DEPARTMENT OF TRANSPORTATION

TRAFFIC DATA COLLECTION - Metro

.

Location: TH-52 at CSAH-46 W-Ramp_2018
Ref. Pt: 113+00.572
Data Prepared By: ACS
TURNING MOVEMENT COUNT

File Name : th-52 at csah-46 w-ramp_2018
Site Code :
Start Date : 9/12/2018
Page No : 1

Groups Printed- Cars - Trucks

	Clayton Ave Southbound				CSAH-46 (160th St W) Westbound				TH-52 SB Exit loop Northbound				CSAH-46 (160th St W) Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:00	3	0	11	0	2	68	0	0	13	0	7	0	1	68	17	0	190
06:15	1	0	24	0	5	97	1	0	6	0	9	0	0	90	34	0	267
06:30	3	1	16	0	3	101	0	0	7	0	6	0	2	114	33	0	286
06:45	1	0	12	0	3	98	5	0	14	0	12	0	0	123	50	0	318
Total	8	1	63	0	13	364	6	0	40	0	34	0	3	395	134	0	1061
07:00	1	0	18	0	3	86	3	0	8	0	8	0	1	139	38	0	305
07:15	2	0	16	0	1	100	0	0	9	0	4	0	1	165	26	0	324
07:30	0	0	14	0	4	96	0	0	5	0	7	0	1	162	53	0	342
07:45	3	0	19	0	2	93	0	0	10	0	6	0	0	103	29	0	265
Total	6	0	67	0	10	375	3	0	32	0	25	0	3	569	146	0	1236
08:00	2	0	8	0	3	54	0	0	10	0	11	0	1	99	33	0	221
08:15	0	0	8	0	3	60	0	0	9	0	4	0	0	110	24	0	218
08:30	1	0	11	0	3	62	1	0	8	0	3	1	0	68	37	0	195
08:45	2	0	19	0	1	51	2	0	17	0	4	0	0	81	26	0	203
Total	5	0	46	0	10	227	3	0	44	0	22	1	1	358	120	0	837
09:00	3	0	13	0	5	52	2	0	22	0	2	0	1	45	18	0	163
09:15	1	1	10	0	3	56	1	0	15	0	10	0	0	62	31	0	190
09:30	6	0	12	0	3	35	0	0	14	0	6	0	2	59	33	0	170
09:45	2	0	13	0	4	51	1	0	6	0	4	0	0	70	26	0	177
Total	12	1	48	0	15	194	4	0	57	0	22	0	3	236	108	0	700
10:00	3	0	5	0	0	45	0	0	17	0	2	0	1	55	21	0	149
10:15	4	0	17	0	2	51	2	0	12	0	11	0	2	53	16	0	170
10:30	2	0	12	0	1	47	1	0	13	0	5	0	1	50	20	0	152
10:45	2	0	15	0	2	34	2	0	9	0	7	0	0	33	28	0	132
Total	11	0	49	0	5	177	5	0	51	0	25	0	4	191	85	0	603
11:00	4	0	7	0	1	40	0	0	12	1	12	0	1	56	15	0	149
11:15	4	0	11	0	1	47	1	0	13	0	7	0	0	49	33	0	166
11:30	1	0	12	0	4	52	1	0	18	0	12	0	1	48	13	0	162
11:45	2	0	18	0	4	55	0	0	14	0	10	0	1	45	17	0	166
Total	11	0	48	0	10	194	2	0	57	1	41	0	3	198	78	0	643
12:00	8	0	9	0	4	33	5	0	7	0	13	0	0	49	26	0	154
12:15	5	0	9	0	6	46	2	0	11	0	8	0	2	42	27	0	158
12:30	2	0	10	1	7	48	0	0	21	0	9	0	1	47	25	0	171
12:45	3	1	12	0	1	48	2	0	20	0	3	0	2	39	20	0	151
Total	18	1	40	1	18	175	9	0	59	0	33	0	5	177	98	0	634
13:00	4	0	9	1	1	52	0	0	16	0	11	0	1	51	27	0	173
13:15	2	2	11	0	3	43	2	0	11	0	8	0	2	54	34	0	172
13:30	6	1	13	0	1	66	0	0	18	0	12	0	2	57	25	0	201
13:45	4	1	9	0	3	53	0	0	15	0	9	0	0	46	32	0	172
Total	16	4	42	1	8	214	2	0	60	0	40	0	5	208	118	0	718

MINNESOTA DEPARTMENT OF TRANSPORTATION

TRAFFIC DATA COLLECTION - Metro

.

Location: TH-52 at CSAH-46 W-Ramp_2018
Ref. Pt: 113+00.572
Data Prepared By: ACS
TURNING MOVEMENT COUNT

File Name : th-52 at csah-46 w-ramp_2018
Site Code :
Start Date : 9/12/2018
Page No : 2

Groups Printed- Cars - Trucks

	Clayton Ave Southbound				CSAH-46 (160th St W) Westbound				TH-52 SB Exit loop Northbound				CSAH-46 (160th St W) Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
14:00	4	0	10	0	3	49	2	0	14	0	10	0	0	54	23	0	169
14:15	2	0	16	0	4	65	1	0	18	0	14	0	2	59	24	0	205
14:30	10	2	14	0	3	50	2	0	16	0	8	0	0	62	32	0	199
14:45	4	1	12	0	5	56	0	0	25	0	13	0	1	64	26	0	207
Total	20	3	52	0	15	220	5	0	73	0	45	0	3	239	105	0	780
15:00	3	3	10	1	2	54	2	0	25	0	15	0	1	70	27	0	213
15:15	7	4	13	0	5	62	1	0	26	0	18	0	3	106	38	0	283
15:30	9	0	27	0	4	82	4	0	20	0	19	0	0	101	45	0	311
15:45	12	6	32	0	3	84	1	0	30	1	31	0	2	99	42	0	343
Total	31	13	82	1	14	282	8	0	101	1	83	0	6	376	152	0	1150
16:00	5	2	36	0	5	86	0	0	22	0	26	0	1	86	45	0	314
16:15	3	0	34	0	5	93	1	0	40	0	19	0	6	97	45	0	343
16:30	9	2	49	0	5	106	1	0	31	0	22	0	2	97	51	0	375
16:45	4	5	50	0	4	113	1	0	22	0	33	0	0	84	42	0	358
Total	21	9	169	0	19	398	3	0	115	0	100	0	9	364	183	0	1390
17:00	6	6	54	0	7	77	1	0	29	1	21	0	1	99	57	0	359
17:15	2	2	36	0	8	84	1	0	37	0	28	0	0	95	35	0	328
17:30	2	4	35	0	4	76	1	0	31	0	29	0	3	110	50	0	345
17:45	0	3	21	0	6	68	0	0	27	0	28	0	1	83	34	0	271
Total	10	15	146	0	25	305	3	0	124	1	106	0	5	387	176	0	1303
Grand Total	169	47	852	3	162	3125	53	0	813	3	576	1	50	3698	1503	0	11055
Apprch %	15.8	4.4	79.6	0.3	4.9	93.6	1.6	0	58.4	0.2	41.3	0.1	1	70.4	28.6	0	
Total %	1.5	0.4	7.7	0	1.5	28.3	0.5	0	7.4	0	5.2	0	0.5	33.5	13.6	0	
Cars	109	40	565	3	155	2788	39	0	608	3	502	1	34	2906	1350	0	9103
% Cars	64.5	85.1	66.3	100	95.7	89.2	73.6	0	74.8	100	87.2	100	68	78.6	89.8	0	82.3
Trucks	60	7	287	0	7	337	14	0	205	0	74	0	16	792	153	0	1952
% Trucks	35.5	14.9	33.7	0	4.3	10.8	26.4	0	25.2	0	12.8	0	32	21.4	10.2	0	17.7

MINNESOTA DEPARTMENT OF TRANSPORTATION

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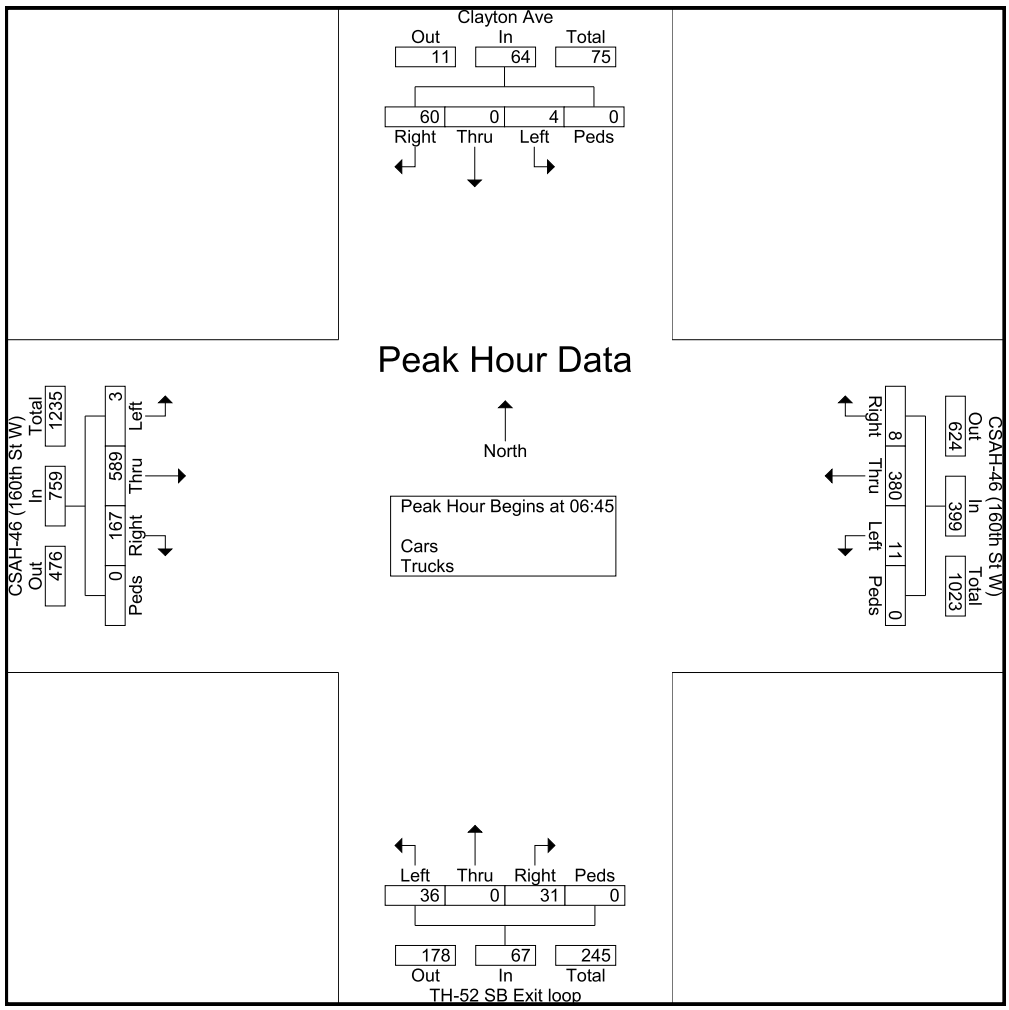
Site Code :
Start Date : 9/12/2018
Page No : 3

	Clayton Ave Southbound					CSAH-46 (160th St W) Westbound					TH-52 SB Exit loop Northbound					CSAH-46 (160th St W) Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 to 11:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 06:45																					
06:45	1	0	12	0	13	3	98	5	0	106	14	0	12	0	26	0	123	50	0	173	318
07:00	1	0	18	0	19	3	86	3	0	92	8	0	8	0	16	1	139	38	0	178	305
07:15	2	0	16	0	18	1	100	0	0	101	9	0	4	0	13	1	165	26	0	192	324
07:30	0	0	14	0	14	4	96	0	0	100	5	0	7	0	12	1	162	53	0	216	342
Total Volume	4	0	60	0	64	11	380	8	0	399	36	0	31	0	67	3	589	167	0	759	1289
% App. Total	6.2	0	93.8	0		2.8	95.2	2	0		53.7	0	46.3	0		0.4	77.6	22	0		
PHF	.500	.000	.833	.000	.842	.688	.950	.400	.000	.941	.643	.000	.646	.000	.644	.750	.892	.788	.000	.878	.942



MINNESOTA DEPARTMENT OF TRANSPORTATION

TRAFFIC DATA COLLECTION - Metro

.

Location: TH-52 at CSAH-46 W-Ramp_2018
Ref. Pt: 113+00.572
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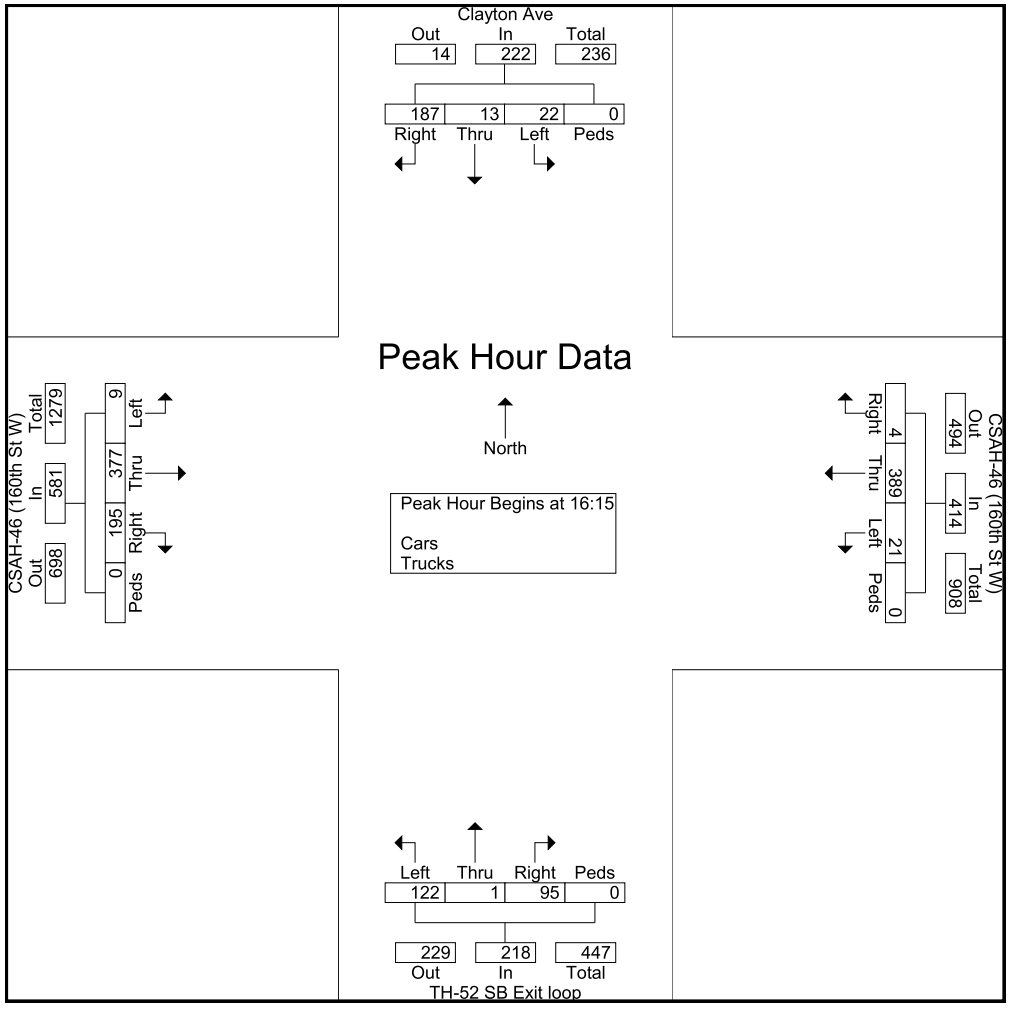
TURNING MOVEMENT COUNT

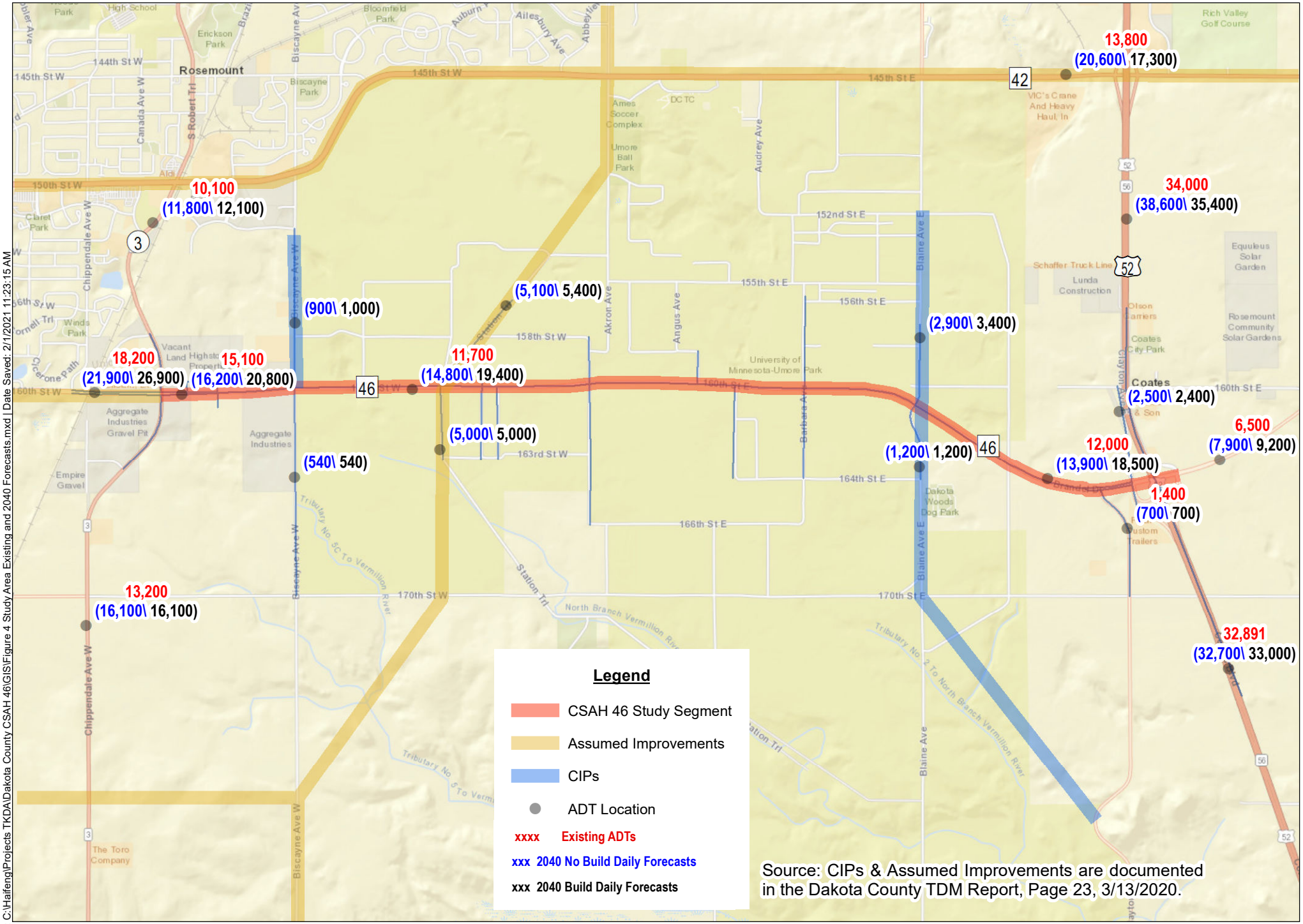
File Name : th-52 at csah-46 w-ramp_2018
Site Code :
Start Date : 9/12/2018
Page No : 4

	Clayton Ave Southbound					CSAH-46 (160th St W) Westbound					TH-52 SB Exit loop Northbound					CSAH-46 (160th St W) Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 to 17:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:15																					
16:15	3	0	34	0	37	5	93	1	0	99	40	0	19	0	59	6	97	45	0	148	343
16:30	9	2	49	0	60	5	106	1	0	112	31	0	22	0	53	2	97	51	0	150	375
16:45	4	5	50	0	59	4	113	1	0	118	22	0	33	0	55	0	84	42	0	126	358
17:00	6	6	54	0	66	7	77	1	0	85	29	1	21	0	51	1	99	57	0	157	359
Total Volume	22	13	187	0	222	21	389	4	0	414	122	1	95	0	218	9	377	195	0	581	1435
% App. Total	9.9	5.9	84.2	0		5.1	94	1	0		56	0.5	43.6	0		1.5	64.9	33.6	0		
PHF	.611	.542	.866	.000	.841	.750	.861		.000	.877	.763	.250	.720	.000	.924	.375	.952	.855	.000	.925	.957



Attachment C

CSAH 46 Improvements Traffic Forecast Memorandum (2021)



Map Document: C:\Haifeng\Projects TKDA\Dakota County CSAH 46\GIS\Figure 4 Study Area Existing and 2040 Forecasts.mxd | Date Saved: 2/1/2021 11:23:15 AM

Author: HXiao

Date: 4/27/2021

Study Area Existing and 2040 NoBuild/Build Daily Traffic Forecasts

CSAH 46 From TH 3 to US Highway 52 Preliminary Through 30% Final Design
Dakota County, Minnesota

Figure 4

Attachment D

Traffic Operations Outputs

Intersection	
Int Delay, s/veh	2.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	729	198	14	470	10	43	10	41	10	10	71
Future Vol, veh/h	10	729	198	14	470	10	43	10	41	10	10	71
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	275	-	275	500	-	250	0	-	0	300	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	16	9	2	10	2	33	2	13	25	2	47
Mvmt Flow	11	792	215	15	511	11	47	11	45	11	11	77

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	522	0	0	1007	0	0	1405	1366	792	1491	1570	511
Stage 1	-	-	-	-	-	-	814	814	-	541	541	-
Stage 2	-	-	-	-	-	-	591	552	-	950	1029	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.43	6.52	6.33	7.35	6.52	6.67
Critical Hdwy Stg 1	-	-	-	-	-	-	6.43	5.52	-	6.35	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.43	5.52	-	6.35	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.797	4.018	3.417	3.725	4.018	3.723
Pot Cap-1 Maneuver	1044	-	-	688	-	-	100	147	372	90	111	483
Stage 1	-	-	-	-	-	-	330	391	-	486	521	-
Stage 2	-	-	-	-	-	-	443	515	-	284	311	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1044	-	-	688	-	-	79	142	372	75	107	483
Mov Cap-2 Maneuver	-	-	-	-	-	-	189	261	-	168	214	-
Stage 1	-	-	-	-	-	-	326	387	-	481	510	-
Stage 2	-	-	-	-	-	-	356	504	-	240	308	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.3	22.9	17.2
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	189	261	372	1044	-	-	688	-	-	168	418
HCM Lane V/C Ratio	0.247	0.042	0.12	0.01	-	-	0.022	-	-	0.065	0.211
HCM Control Delay (s)	30.2	19.4	16	8.5	-	-	10.4	-	-	27.9	15.9
HCM Lane LOS	D	C	C	A	-	-	B	-	-	D	C
HCM 95th %tile Q(veh)	0.9	0.1	0.4	0	-	-	0.1	-	-	0.2	0.8

Intersection	
Int Delay, s/veh	9.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	16	208	556	169	315	10	169	10	15	10	10	10
Future Vol, veh/h	16	208	556	169	315	10	169	10	15	10	10	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	375	-	325	350	-	350	0	-	0	215	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	31	3	20	16	8	2	13	2	40	25	2	2
Mvmt Flow	17	226	604	184	342	11	184	11	16	11	11	11

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	353	0	0	830	0	0	987	981	226	1286	1574	342
Stage 1	-	-	-	-	-	-	260	260	-	710	710	-
Stage 2	-	-	-	-	-	-	727	721	-	576	864	-
Critical Hdwy	4.41	-	-	4.26	-	-	7.23	6.52	6.6	7.35	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.23	5.52	-	6.35	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.23	5.52	-	6.35	5.52	-
Follow-up Hdwy	2.479	-	-	2.344	-	-	3.617	4.018	3.66	3.725	4.018	3.318
Pot Cap-1 Maneuver	1062	-	-	745	-	-	216	249	727	127	110	701
Stage 1	-	-	-	-	-	-	721	693	-	390	437	-
Stage 2	-	-	-	-	-	-	399	432	-	464	371	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1062	-	-	745	-	-	~ 160	185	727	96	82	701
Mov Cap-2 Maneuver	-	-	-	-	-	-	229	259	-	181	139	-
Stage 1	-	-	-	-	-	-	709	682	-	384	329	-
Stage 2	-	-	-	-	-	-	286	325	-	439	365	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	3.9	57.3	23.5
HCM LOS			F	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	229	259	727	1062	-	-	745	-	-	181	232
HCM Lane V/C Ratio	0.802	0.042	0.022	0.016	-	-	0.247	-	-	0.06	0.094
HCM Control Delay (s)	63.7	19.5	10.1	8.4	-	-	11.4	-	-	26.2	22.1
HCM Lane LOS	F	C	B	A	-	-	B	-	-	D	C
HCM 95th %tile Q(veh)	5.9	0.1	0.1	0.1	-	-	1	-	-	0.2	0.3

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	17.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	472	11	27	489	10	145	10	124	29	18	222
Future Vol, veh/h	11	472	11	27	489	10	145	10	124	29	18	222
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	275	-	275	500	-	250	0	-	0	300	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	33	11	6	5	5	2	6	2	9	14	8	11
Mvmt Flow	12	513	12	29	532	11	158	11	135	32	20	241

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	543	0	0	525	0	0	1263	1138	513	1206	1139	532
Stage 1	-	-	-	-	-	-	537	537	-	590	590	-
Stage 2	-	-	-	-	-	-	726	601	-	616	549	-
Critical Hdwy	4.43	-	-	4.15	-	-	7.16	6.52	6.29	7.24	6.58	6.31
Critical Hdwy Stg 1	-	-	-	-	-	-	6.16	5.52	-	6.24	5.58	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.16	5.52	-	6.24	5.58	-
Follow-up Hdwy	2.497	-	-	2.245	-	-	3.554	4.018	3.381	3.626	4.072	3.399
Pot Cap-1 Maneuver	887	-	-	1027	-	-	~ 144	201	548	152	196	530
Stage 1	-	-	-	-	-	-	521	523	-	474	486	-
Stage 2	-	-	-	-	-	-	410	489	-	458	507	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	887	-	-	1027	-	-	~ 72	193	548	108	188	530
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 154	310	-	215	301	-
Stage 1	-	-	-	-	-	-	514	516	-	467	472	-
Stage 2	-	-	-	-	-	-	208	475	-	334	500	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.4	78.2	20.2
HCM LOS			F	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	154	310	548	887	-	-	1027	-	-	215	501
HCM Lane V/C Ratio	1.023	0.035	0.246	0.013	-	-	0.029	-	-	0.147	0.521
HCM Control Delay (s)	137.5	17	13.7	9.1	-	-	8.6	-	-	24.6	19.7
HCM Lane LOS	F	C	B	A	-	-	A	-	-	C	C
HCM 95th %tile Q(veh)	7.9	0.1	1	0	-	-	0.1	-	-	0.5	3

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	9.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	60	376	189	27	263	10	234	20	15	10	10	29
Future Vol, veh/h	60	376	189	27	263	10	234	20	15	10	10	29
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	375	-	325	350	-	350	0	-	0	215	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	4	7	21	5	9	2	2	2	14	2	2	2
Mvmt Flow	65	409	205	29	286	11	254	22	16	11	11	32

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	297	0	0	614	0	0	910	894	409	1005	1088	286
Stage 1	-	-	-	-	-	-	539	539	-	344	344	-
Stage 2	-	-	-	-	-	-	371	355	-	661	744	-
Critical Hdwy	4.14	-	-	4.15	-	-	7.12	6.52	6.34	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.236	-	-	2.245	-	-	3.518	4.018	3.426	3.518	4.018	3.318
Pot Cap-1 Maneuver	1253	-	-	951	-	-	255	280	617	220	216	753
Stage 1	-	-	-	-	-	-	527	522	-	671	637	-
Stage 2	-	-	-	-	-	-	649	630	-	452	421	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1253	-	-	951	-	-	~ 223	258	617	192	199	753
Mov Cap-2 Maneuver	-	-	-	-	-	-	336	354	-	291	292	-
Stage 1	-	-	-	-	-	-	500	495	-	636	618	-
Stage 2	-	-	-	-	-	-	592	611	-	399	399	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.8	0.8	38.8	13.4
HCM LOS			E	B

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	336	354	617	1253	-	-	951	-	-	291	536
HCM Lane V/C Ratio	0.757	0.061	0.026	0.052	-	-	0.031	-	-	0.037	0.079
HCM Control Delay (s)	42.5	15.8	11	8	-	-	8.9	-	-	17.9	12.3
HCM Lane LOS	E	C	B	A	-	-	A	-	-	C	B
HCM 95th %tile Q(veh)	5.9	0.2	0.1	0.2	-	-	0.1	-	-	0.1	0.3

Notes
~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	584	167	11	377	8	36	0	31	4	0	60
Future Vol, veh/h	3	584	167	11	377	8	36	0	31	4	0	60
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	275	-	275	500	-	250	0	-	0	300	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	16	9	2	10	2	33	2	13	25	2	47
Mvmt Flow	3	635	182	12	410	9	39	0	34	4	0	65

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	419	0	0	817	0	0	1112	1084	635	1183	1257	410
Stage 1	-	-	-	-	-	-	641	641	-	434	434	-
Stage 2	-	-	-	-	-	-	471	443	-	749	823	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.43	6.52	6.33	7.35	6.52	6.67
Critical Hdwy Stg 1	-	-	-	-	-	-	6.43	5.52	-	6.35	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.43	5.52	-	6.35	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.797	4.018	3.417	3.725	4.018	3.723
Pot Cap-1 Maneuver	1140	-	-	811	-	-	162	217	459	150	171	555
Stage 1	-	-	-	-	-	-	415	469	-	558	581	-
Stage 2	-	-	-	-	-	-	519	576	-	371	388	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1140	-	-	811	-	-	141	213	459	137	168	555
Mov Cap-2 Maneuver	-	-	-	-	-	-	261	329	-	246	278	-
Stage 1	-	-	-	-	-	-	414	468	-	556	572	-
Stage 2	-	-	-	-	-	-	451	567	-	343	387	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	17.6	12.8
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	261	-	459	1140	-	-	811	-	-	246	555
HCM Lane V/C Ratio	0.15	-	0.073	0.003	-	-	0.015	-	-	0.018	0.118
HCM Control Delay (s)	21.2	0	13.5	8.2	-	-	9.5	-	-	19.9	12.3
HCM Lane LOS	C	A	B	A	-	-	A	-	-	C	B
HCM 95th %tile Q(veh)	0.5	-	0.2	0	-	-	0	-	-	0.1	0.4

Intersection	
Int Delay, s/veh	4.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	13	159	447	129	251	1	142	7	5	2	3	3
Future Vol, veh/h	13	159	447	129	251	1	142	7	5	2	3	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	375	-	325	350	-	350	0	-	0	215	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	31	3	20	16	8	2	13	2	40	25	2	2
Mvmt Flow	14	173	486	140	273	1	154	8	5	2	3	3

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	274	0	0	659	0	0	758	755	173	1004	1240	273
Stage 1	-	-	-	-	-	-	201	201	-	553	553	-
Stage 2	-	-	-	-	-	-	557	554	-	451	687	-
Critical Hdwy	4.41	-	-	4.26	-	-	7.23	6.52	6.6	7.35	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.23	5.52	-	6.35	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.23	5.52	-	6.35	5.52	-
Follow-up Hdwy	2.479	-	-	2.344	-	-	3.617	4.018	3.66	3.725	4.018	3.318
Pot Cap-1 Maneuver	1139	-	-	866	-	-	310	338	781	200	175	766
Stage 1	-	-	-	-	-	-	776	735	-	479	514	-
Stage 2	-	-	-	-	-	-	496	514	-	546	447	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1139	-	-	866	-	-	265	280	781	170	145	766
Mov Cap-2 Maneuver	-	-	-	-	-	-	337	351	-	272	225	-
Stage 1	-	-	-	-	-	-	767	726	-	473	431	-
Stage 2	-	-	-	-	-	-	411	431	-	530	442	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	3.4	23.5	16.2
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	337	351	781	1139	-	-	866	-	-	272	348
HCM Lane V/C Ratio	0.458	0.022	0.007	0.012	-	-	0.162	-	-	0.008	0.019
HCM Control Delay (s)	24.4	15.5	9.6	8.2	-	-	10	-	-	18.3	15.5
HCM Lane LOS	C	C	A	A	-	-	A	-	-	C	C
HCM 95th %tile Q(veh)	2.3	0.1	0	0	-	-	0.6	-	-	0	0.1

Intersection	
Int Delay, s/veh	7.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	378	9	21	392	4	122	1	95	22	13	187
Future Vol, veh/h	9	378	9	21	392	4	122	1	95	22	13	187
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	275	-	275	500	-	250	0	-	0	300	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	33	11	6	5	5	2	6	2	9	14	8	11
Mvmt Flow	10	411	10	23	426	4	133	1	103	24	14	203

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	430	0	0	421	0	0	1014	907	411	960	913	426
Stage 1	-	-	-	-	-	-	431	431	-	472	472	-
Stage 2	-	-	-	-	-	-	583	476	-	488	441	-
Critical Hdwy	4.43	-	-	4.15	-	-	7.16	6.52	6.29	7.24	6.58	6.31
Critical Hdwy Stg 1	-	-	-	-	-	-	6.16	5.52	-	6.24	5.58	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.16	5.52	-	6.24	5.58	-
Follow-up Hdwy	2.497	-	-	2.245	-	-	3.554	4.018	3.381	3.626	4.072	3.399
Pot Cap-1 Maneuver	982	-	-	1122	-	-	213	276	626	225	267	610
Stage 1	-	-	-	-	-	-	595	583	-	550	549	-
Stage 2	-	-	-	-	-	-	491	557	-	539	567	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	982	-	-	1122	-	-	135	268	626	183	259	610
Mov Cap-2 Maneuver	-	-	-	-	-	-	235	376	-	298	364	-
Stage 1	-	-	-	-	-	-	589	577	-	545	538	-
Stage 2	-	-	-	-	-	-	312	546	-	445	561	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.4	26.8	15.1
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	235	376	626	982	-	-	1122	-	-	298	584
HCM Lane V/C Ratio	0.564	0.003	0.165	0.01	-	-	0.02	-	-	0.08	0.372
HCM Control Delay (s)	38.5	14.6	11.9	8.7	-	-	8.3	-	-	18.1	14.8
HCM Lane LOS	E	B	B	A	-	-	A	-	-	C	B
HCM 95th %tile Q(veh)	3.1	0	0.6	0	-	-	0.1	-	-	0.3	1.7

Intersection	
Int Delay, s/veh	5.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	49	292	154	21	203	3	190	16	7	2	3	24
Future Vol, veh/h	49	292	154	21	203	3	190	16	7	2	3	24
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	375	-	325	350	-	350	0	-	0	215	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	4	7	21	5	9	2	2	2	14	2	2	2
Mvmt Flow	53	317	167	23	221	3	207	17	8	2	3	26

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	224	0	0	484	0	0	706	693	317	786	857	221
Stage 1	-	-	-	-	-	-	423	423	-	267	267	-
Stage 2	-	-	-	-	-	-	283	270	-	519	590	-
Critical Hdwy	4.14	-	-	4.15	-	-	7.12	6.52	6.34	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.236	-	-	2.245	-	-	3.518	4.018	3.426	3.518	4.018	3.318
Pot Cap-1 Maneuver	1333	-	-	1063	-	-	351	367	697	310	295	819
Stage 1	-	-	-	-	-	-	609	588	-	738	688	-
Stage 2	-	-	-	-	-	-	724	686	-	540	495	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1333	-	-	1063	-	-	322	345	697	283	277	819
Mov Cap-2 Maneuver	-	-	-	-	-	-	423	426	-	379	364	-
Stage 1	-	-	-	-	-	-	585	564	-	708	673	-
Stage 2	-	-	-	-	-	-	682	671	-	497	475	-

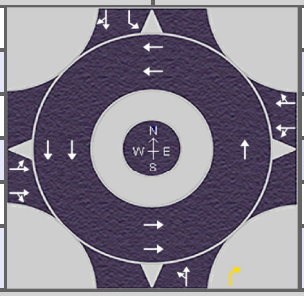
Approach	EB	WB	NB	SB
HCM Control Delay, s	0.8	0.8	20.5	10.5
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	423	426	697	1333	-	-	1063	-	-	379	719
HCM Lane V/C Ratio	0.488	0.041	0.011	0.04	-	-	0.021	-	-	0.006	0.041
HCM Control Delay (s)	21.4	13.8	10.2	7.8	-	-	8.5	-	-	14.6	10.2
HCM Lane LOS	C	B	B	A	-	-	A	-	-	B	B
HCM 95th %tile Q(veh)	2.6	0.1	0	0.1	-	-	0.1	-	-	0	0.1

HCS7 Roundabouts Report

General Information

Analyst	SRF Consulting
Agency or Co.	SRF Consulting
Date Performed	4/1/2022
Analysis Year	2018
Time Analyzed	AM Peak
Project Description	2018 Build Geometry



Site Information

Intersection	CSAH 46 and US 52 NB Ramp
E/W Street Name	CSAH 46
N/S Street Name	US 52 NB Ramps
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.92
Jurisdiction	Dakota County

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	2	0	0	0	2	0	0	0	1	0	0	1	1	0
Lane Assignment	LT		TR		LT		TR				LT		L		TR	
Volume (V), veh/h	0	14	170	478	0	138	269	1	0	152	7	5	0	2	3	3
Percent Heavy Vehicles, %	3	2	16	9	3	2	10	2	3	33	2	13	3	47	2	25
Flow Rate (v_{PCE}), pc/h	0	16	214	566	0	153	322	1	0	220	8	6	0	3	3	4
Right-Turn Bypass	None				None				Yielding				None			
Conflicting Lanes	2				1				2				2			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)	4.6453	4.3276		4.5436	4.5436			4.3276	4.3276	4.6453	4.3276	
Follow-Up Headway (s)	2.6667	2.5352		2.5352	2.5352			2.5352	2.5352	2.6667	2.5352	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	230	566		224	252			228	6	3	7	
Entry Volume, veh/h	208	512		209	235			173	5	2	6	
Circulating Flow (v_c), pc/h	159			244			233			695		
Exiting Flow (v_{ex}), pc/h	217			546			25			722		
Capacity (c_{pce}), pc/h	1166	1240		1137	1137			1165	1181	712	787	
Capacity (c), veh/h	1054	1121		1060	1060			885	1045	583	644	
v/c Ratio (x)	0.20	0.46		0.20	0.22			0.20	0.01	0.00	0.01	

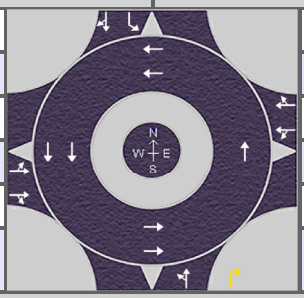
Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	5.2	8.2		5.2	5.5			6.0	3.5	6.2	5.7	
Lane LOS	A	A		A	A			A	A	A	A	
95% Queue, veh	0.7	2.4		0.7	0.8			0.7	0.0	0.0	0.0	
Approach Delay, s/veh	7.3			5.3			6.0			5.8		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	6.5						A					

HCS7 Roundabouts Report

General Information

Analyst	SRF Consulting
Agency or Co.	SRF Consulting
Date Performed	4/1/2022
Analysis Year	2018
Time Analyzed	PM Peak
Project Description	2018 Build Geometry



Site Information

Intersection	CSAH 46 and US 52 NB Ramp
E/W Street Name	CSAH 46
N/S Street Name	US 52 NB Ramps
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.92
Jurisdiction	Dakota County

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	2	0	0	0	2	0	0	0	1	0	0	1	1	0
Lane Assignment	LT		TR		LT		TR				LT		L		TR	
Volume (V), veh/h	0	52	312	165	0	22	217	3	0	203	17	7	0	2	3	26
Percent Heavy Vehicles, %	3	4	7	21	3	5	9	2	3	2	2	14	3	2	2	2
Flow Rate (v_{PCE}), pc/h	0	59	363	217	0	25	257	3	0	225	19	9	0	2	3	29
Right-Turn Bypass	None				None				Yielding				None			
Conflicting Lanes	2				1				2				2			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)	4.6453	4.3276		4.5436	4.5436			4.3276	4.3276	4.6453	4.3276	
Follow-Up Headway (s)	2.6667	2.5352		2.5352	2.5352			2.5352	2.5352	2.6667	2.5352	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	300	339		134	151			244	9	2	32	
Entry Volume, veh/h	270	305		123	139			239	8	2	31	
Circulating Flow (v_c), pc/h	30			303			424			507		
Exiting Flow (v_{ex}), pc/h	365			511			81			245		
Capacity (c_{pce}), pc/h	1313	1384		1078	1078			990	1041	847	923	
Capacity (c), veh/h	1182	1246		993	993			971	913	830	905	
v/c Ratio (x)	0.23	0.24		0.12	0.14			0.25	0.01	0.00	0.03	

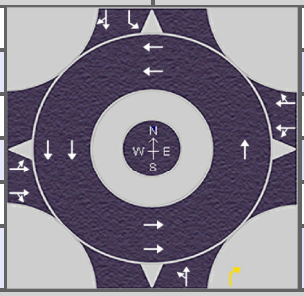
Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	5.1	5.0		4.8	4.9			6.1	4.0	4.4	4.3	
Lane LOS	A	A		A	A			A	A	A	A	
95% Queue, veh	0.9	1.0		0.4	0.5			1.0	0.0	0.0	0.1	
Approach Delay, s/veh	5.1			4.8			6.1			4.3		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	5.2						A					

HCS7 Roundabouts Report

General Information

Analyst	SRF Consulting
Agency or Co.	SRF Consulting
Date Performed	4/1/2022
Analysis Year	2040
Time Analyzed	AM Peak
Project Description	2040 Build Geometry



Site Information

Intersection	CSAH 46 and US 52 NB Ramp
E/W Street Name	CSAH 46
N/S Street Name	US 52 NB Ramps
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.92
Jurisdiction	Dakota County

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	2	0	0	0	2	0	0	0	1	0	0	1	1	0
Lane Assignment	LT		TR		LT		TR				LT		L		TR	
Volume (V), veh/h	0	22	283	756	0	231	434	10	0	233	11	15	0	10	10	10
Percent Heavy Vehicles, %	3	31	3	20	3	16	8	2	3	13	2	40	3	25	2	2
Flow Rate (v_{PCE}), pc/h	0	31	317	986	0	291	509	11	0	286	12	23	0	14	11	11
Right-Turn Bypass	None				None				Yielding				None			
Conflicting Lanes	2				1				2				2			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)	4.6453	4.3276		4.5436	4.5436			4.3276	4.3276	4.6453	4.3276	
Follow-Up Headway (s)	2.6667	2.5352		2.5352	2.5352			2.5352	2.5352	2.6667	2.5352	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	348	986		381	430			298	23	14	22	
Entry Volume, veh/h	301	852		344	388			265	16	13	20	
Circulating Flow (v_c), pc/h	316			329			362			1086		
Exiting Flow (v_{ex}), pc/h	331			806			54			1288		
Capacity (c_{pce}), pc/h	1009	1086		1053	1053			1044	1072	497	564	
Capacity (c), veh/h	873	938		951	951			928	766	452	514	
v/c Ratio (x)	0.34	0.91		0.36	0.41			0.29	0.02	0.03	0.04	

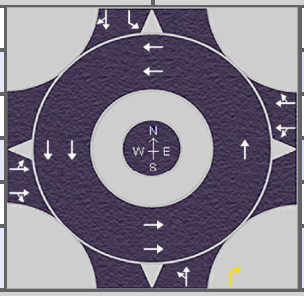
Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	8.0	32.4		7.7	8.4			6.9	4.9	8.3	7.5	
Lane LOS	A	D		A	A			A	A	A	A	
95% Queue, veh	1.5	13.3		1.7	2.0			1.2	0.1	0.1	0.1	
Approach Delay, s/veh	26.0			8.1			6.7			7.8		
Approach LOS	D			A			A			A		
Intersection Delay, s/veh | LOS	17.3						C					

HCS7 Roundabouts Report

General Information

Analyst	SRF Consulting
Agency or Co.	SRF Consulting
Date Performed	4/1/2022
Analysis Year	2040
Time Analyzed	PM Peak
Project Description	2040 Build Geometry



Site Information

Intersection	CSAH 46 and US 52 NB Ramp
E/W Street Name	CSAH 46
N/S Street Name	US 52 NB Ramps
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.92
Jurisdiction	Dakota County

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	2	0	0	0	2	0	0	0	1	0	0	1	1	0
Lane Assignment	LT		TR		LT		TR				LT		L		TR	
Volume (V), veh/h	0	82	514	258	0	38	358	10	0	319	25	15	0	10	10	40
Percent Heavy Vehicles, %	3	4	7	21	3	5	9	2	3	2	2	14	3	2	2	2
Flow Rate (v_{PCE}), pc/h	0	93	598	339	0	43	424	11	0	354	28	19	0	11	11	44
Right-Turn Bypass	None				None				Yielding				None			
Conflicting Lanes	2				1				2				2			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)	4.6453	4.3276		4.5436	4.5436			4.3276	4.3276	4.6453	4.3276	
Follow-Up Headway (s)	2.6667	2.5352		2.5352	2.5352			2.5352	2.5352	2.6667	2.5352	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	484	546		225	253			382	19	11	55	
Entry Volume, veh/h	436	492		207	234			375	17	11	54	
Circulating Flow (v_c), pc/h	65			475			702			821		
Exiting Flow (v_{ex}), pc/h	609			822			132			393		
Capacity (c_{pce}), pc/h	1272	1344		922	922			782	846	634	707	
Capacity (c), veh/h	1146	1211		850	850			767	742	622	693	
v/c Ratio (x)	0.38	0.41		0.24	0.27			0.49	0.02	0.02	0.08	

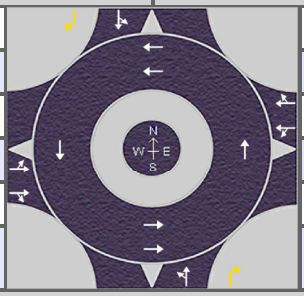
Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	7.0	7.0		6.8	7.2			11.5	5.1	6.0	6.0	
Lane LOS	A	A		A	A			B	A	A	A	
95% Queue, veh	1.8	2.0		1.0	1.1			2.7	0.1	0.1	0.3	
Approach Delay, s/veh	7.0			7.0			11.3			6.0		
Approach LOS	A			A			B			A		
Intersection Delay, s/veh | LOS	7.9						A					

HCS7 Roundabouts Report

General Information

Analyst	SRF Consulting
Agency or Co.	SRF Consulting
Date Performed	4/1/2022
Analysis Year	2018
Time Analyzed	AM Peak
Project Description	2018 Build Geometry



Site Information

Intersection	CSAH 46 and US 52 SB Ramp
E/W Street Name	CSAH 46
N/S Street Name	US 52 SB Ramps
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.92
Jurisdiction	Dakota County

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	2	0	0	0	2	0	0	0	1	0	0	0	1	0
Lane Assignment	LT		TR		LT		TR				LT				LT	
Volume (V), veh/h	0	3	625	179	0	12	403	9	0	39	0	33	0	4	0	64
Percent Heavy Vehicles, %	3	2	16	9	3	2	10	2	3	33	2	13	3	25	2	47
Flow Rate (v_{PCE}), pc/h	0	3	788	212	0	13	482	10	0	56	0	41	0	5	0	102
Right-Turn Bypass	None				None				Yielding				Yielding			
Conflicting Lanes	1				1				2				2			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)	4.5436	4.5436		4.5436	4.5436			4.3276	4.3276		4.3276	4.3276
Follow-Up Headway (s)	2.5352	2.5352		2.5352	2.5352			2.5352	2.5352		2.5352	2.5352

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	471	532		237	268			56	41		5	102
Entry Volume, veh/h	412	465		217	244			42	36		4	69
Circulating Flow (v_c), pc/h	18			59			796			551		
Exiting Flow (v_{ex}), pc/h	793			538			13			225		
Capacity (c_{pce}), pc/h	1397	1397		1346	1346			722	724		889	899
Capacity (c), veh/h	1221	1221		1228	1228			543	640		711	611
v/c Ratio (x)	0.34	0.38		0.18	0.20			0.08	0.06		0.01	0.11

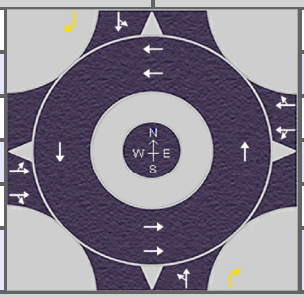
Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	6.1	6.7		4.4	4.7			7.6	6.2		5.1	7.2
Lane LOS	A	A		A	A			A	A		A	A
95% Queue, veh	1.5	1.8		0.6	0.7			0.3	0.2		0.0	0.4
Approach Delay, s/veh	6.4			4.6			7.0			7.1		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	5.9						A					

HCS7 Roundabouts Report

General Information

Analyst	SRF Consulting
Agency or Co.	SRF Consulting
Date Performed	4/1/2022
Analysis Year	2018
Time Analyzed	PM Peak
Project Description	2018 Build Geometry



Site Information

Intersection	CSAH 46 and US 52 SB Ramp
E/W Street Name	CSAH 46
N/S Street Name	US 52 SB Ramps
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.92
Jurisdiction	Dakota County

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	2	0	0	0	2	0	0	0	1	0	0	0	1	0
Lane Assignment	LT		TR		LT		TR				LT				LT	
Volume (V), veh/h	0	10	404	10	0	22	419	4	0	131	1	102	0	24	14	200
Percent Heavy Vehicles, %	3	33	11	6	3	5	5	26	3	6	2	9	3	14	8	11
Flow Rate (v_{PCE}), pc/h	0	14	487	12	0	25	478	5	0	151	1	121	0	30	16	241
Right-Turn Bypass	None				None				Yielding				Yielding			
Conflicting Lanes	1				1				2				2			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)	4.5436	4.5436		4.5436	4.5436			4.3276	4.3276		4.3276	4.3276
Follow-Up Headway (s)	2.5352	2.5352		2.5352	2.5352			2.5352	2.5352		2.5352	2.5352

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	241	272		239	269			152	121		46	241
Entry Volume, veh/h	216	244		227	256			143	111		41	217
Circulating Flow (v_c), pc/h	71			166			531			654		
Exiting Flow (v_{ex}), pc/h	517			629			20			53		
Capacity (c_{pce}), pc/h	1331	1331		1221	1221			904	915		814	832
Capacity (c), veh/h	1195	1195		1161	1161			853	839		728	750
v/c Ratio (x)	0.18	0.20		0.20	0.22			0.17	0.13		0.06	0.29

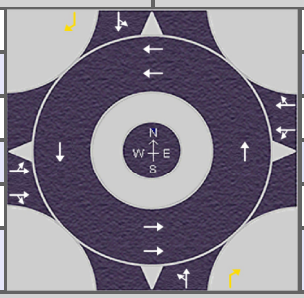
Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	4.6	4.8		4.8	5.1			5.9	5.6		5.5	8.2
Lane LOS	A	A		A	A			A	A		A	A
95% Queue, veh	0.7	0.8		0.7	0.8			0.6	0.5		0.2	1.2
Approach Delay, s/veh	4.7			5.0			5.8			7.8		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	5.5						A					

HCS7 Roundabouts Report

General Information

Analyst	SRF Consulting
Agency or Co.	SRF Consulting
Date Performed	4/1/2022
Analysis Year	2040
Time Analyzed	AM Peak
Project Description	2040 Build Geometry



Site Information

Intersection	CSAH 46 and US 52 SB Ramp
E/W Street Name	CSAH 46
N/S Street Name	US 52 SB Ramps
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.92
Jurisdiction	Dakota County

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	2	0	0	0	2	0	0	0	1	0	0	0	1	0
Lane Assignment	LT		TR		LT		TR				LT				LT	
Volume (V), veh/h	0	10	996	271	0	20	643	14	0	58	10	55	0	10	10	97
Percent Heavy Vehicles, %	3	2	16	9	2	2	10	2	3	33	2	13	3	25	2	47
Flow Rate (v_{PCE}), pc/h	0	11	1256	321	0	22	769	16	0	84	11	68	0	14	11	155
Right-Turn Bypass	None				None				Yielding				Yielding			
Conflicting Lanes	1				1				2				2			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)	4.5436	4.5436		4.5436	4.5436			4.3276	4.3276		4.3276	4.3276
Follow-Up Headway (s)	2.5352	2.5352		2.5352	2.5352			2.5352	2.5352		2.5352	2.5352

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	746	842		379	428			95	68		25	155
Entry Volume, veh/h	652	736		346	390			74	60		22	105
Circulating Flow (v_c), pc/h	47			106			1281			875		
Exiting Flow (v_{ex}), pc/h	1270			853			38			354		
Capacity (c_{pce}), pc/h	1361	1361		1289	1289			478	482		675	688
Capacity (c), veh/h	1189	1189		1177	1177			372	427		594	468
v/c Ratio (x)	0.55	0.62		0.29	0.33			0.20	0.14		0.04	0.23

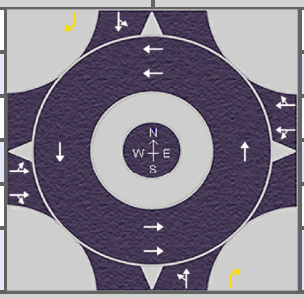
Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	9.4	10.9		5.8	6.2			13.1	10.5		6.5	11.0
Lane LOS	A	B		A	A			B	B		A	B
95% Queue, veh	3.5	4.5		1.2	1.5			0.7	0.5		0.1	0.9
Approach Delay, s/veh	10.2			6.0			11.9			10.3		
Approach LOS	B			A			B			B		
Intersection Delay, s/veh | LOS	9.0						A					

HCS7 Roundabouts Report

General Information

Analyst	SRF Consulting
Agency or Co.	SRF Consulting
Date Performed	4/1/2022
Analysis Year	2040
Time Analyzed	PM Peak
Project Description	2040 Build Geometry



Site Information

Intersection	CSAH 46 and US 52 SB Ramp
E/W Street Name	CSAH 46
N/S Street Name	US 52 SB Ramps
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.92
Jurisdiction	Dakota County

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	2	0	0	0	2	0	0	0	1	0	0	0	1	0
Lane Assignment	LT		TR		LT		TR				LT				LT	
Volume (V), veh/h	0	15	645	15	0	38	669	10	0	198	10	170	0	39	18	303
Percent Heavy Vehicles, %	3	33	11	6	3	5	5	2	3	6	2	9	3	14	8	11
Flow Rate (v_{PCE}), pc/h	0	22	778	17	0	43	764	11	0	228	11	201	0	48	21	366
Right-Turn Bypass	None				None				Yielding				Yielding			
Conflicting Lanes	1				1				2				2			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)	4.5436	4.5436		4.5436	4.5436			4.3276	4.3276		4.3276	4.3276
Follow-Up Headway (s)	2.5352	2.5352		2.5352	2.5352			2.5352	2.5352		2.5352	2.5352

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	384	433		384	434			239	201		69	366
Entry Volume, veh/h	345	389		366	413			226	184		62	330
Circulating Flow (v_c), pc/h	112			261			848			1035		
Exiting Flow (v_{ex}), pc/h	826			992			44			81		
Capacity (c_{pce}), pc/h	1282	1282		1120	1120			691	704		589	611
Capacity (c), veh/h	1151	1151		1067	1067			653	646		526	551
v/c Ratio (x)	0.30	0.34		0.34	0.39			0.35	0.29		0.12	0.60

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	6.0	6.4		6.8	7.4			10.1	9.2		8.3	18.8
Lane LOS	A	A		A	A			B	A		A	C
95% Queue, veh	1.3	1.5		1.5	1.9			1.5	1.2		0.4	3.9
Approach Delay, s/veh	6.2			7.2			9.7			17.2		
Approach LOS	A			A			A			C		
Intersection Delay, s/veh | LOS	9.0						A					