TRAFFIC OPERATIONS STUDY

US 2 & Grand Forks Airport / Co 5 / 16th St NE



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INTRODUCTION

Roundabouts are gaining popularity in ND for providing safe and efficient traffic flow at a variety of intersections. The Grand Forks District asked the Traffic Operations Section how a roundabout would compare with other intersection types at the US 2 & Grand Forks Airport intersection. The purpose of this study is to compare traffic operations and safety for a variety of intersection configurations.

Documents referenced in this study include:

- -AASHTO Green Book, 2018 Edition
- -FHWA's Manual on Uniform Traffic Control Devices (MUTCD), 2009 Edition
- -ND's Vision Zero Plan, 2018
- -NDDOT's Traffic Operations Manual, January 2023
- -TRB's Highway Capacity Manual (HCM), 7th Edition, 2022

Previous Studies:

- In 2014 NDDOT published a Local Road Safety Plan for Grand Forks County, which recommended a Reduced Conflict Intersection (a.k.a. J-Turn, Reduced Crossing U-Turn, Directional Median). The concept is explained later in this study. <a href="https://www.ndd.number.ndm.nd.number.number.nd.number.nd.number.nd.number.nd.number.nd.number.nd.number.nd.number.nd.number.nd.number.nd.number.nd.number.nd.number.number.nd.number.number.nd.number.nd.number.nd.number.nd.number.nd.number.nd.numbe
- In 2015 the MPO commissioned KLJ to perform a corridor study for US 2, which recommended to install a Staggered-T Intersection. The concept is explained later in this study. MPO US 2 Corridor Study
- In 2017 a Road Safety Review meeting was held and included attendees from NDDOT, MPO, Grand Forks County, City of Grand Forks, and the Grand Forks International Airport. Consensus could not be reached regarding a major change to the intersection, but minor improvements were recommended and completed in 2018 with PCN 22029.

EXISTING CONDITIONS

US 2: Functional Classification = Principal Arterial
Highway Performance Classification System = Interregional Corridor
Speed Limit = 55mph, changes to 70mph just west of the intersection
*The 2015 MPO Study reported that the 85th percentile speeds were measured to be 72mph for WB traffic and 69mph for EB traffic.

Co 5 / 16th St NE (south leg of intersection): Functional Classification = Major Collector Speed Limit = 55mph

Airport Rd (north leg of intersection): Functional Classification = Local Speed Limit = 40mph

The intersection is controlled with a traffic signal, and equipment ages are shown in **Table 1**.

Table 1 - Traffic Signal Equipment Ages										
Equipment	Year Installed (age)	Typical Life								
Controller	2019 (4yrs old)	10-15yrs								
Video Detection System	2019 (4yrs old)	10-15yrs								
Oldest Poles	1994 (29yrs old)	20-30yrs								

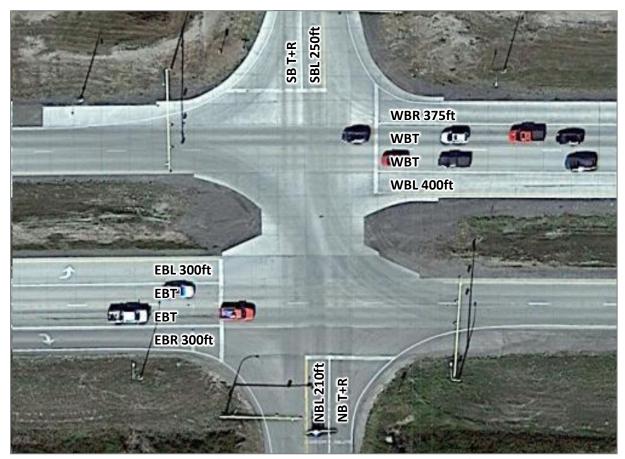


Figure 1 – Existing Lane Configurations and Full Width Lengths, Image from Google Maps

CRASH INFORMATION

The intersection frequently appears on the statewide Rural Spot High Crash Location List. The intersection is ranked #10 out of 25 on the most recent list (2018-2022).

Crash data was compiled for the most recent 5yrs (10/1/18 - 9/30/23) and detailed info is in **Appendix A. Table 2** shows a summary of the crash data.

	Table 2 - Crash Data for US 2 & Grand Forks Airport																												
				Manner of Collsion													Severity			Surface Cond.									
					Angle				Re	ar E	nd		Side	eswip	e Sam	e Dir.				er									n?
			NB+EB	NB+WB	SB+EB	SB+WB		NB	SB	EB	WB		NB	SB	EB W	В	_	l o	Veh	n/other								>	ction
ear	Start	End	\rightarrow	<u></u> ←	1	W	ubtotal	\Rightarrow	\leftrightarrow	\Rightarrow	\leftarrow	ubtotal	$\uparrow \uparrow$	$\downarrow \downarrow$	\Rightarrow	ubtotal	acking	Ped/Bike	Single \	P	la					>	*	/Sno	Construc
Ϋ́e	Date	Date			—> v	w—	Sul	l '	,			Su			´ `	Sul	Ba	Pe	ŝ	Head	Total	K A	В	С	0	۵	š	<u>8</u>	ပိ
1	10/1/18	9/30/19								1		1									1				1		1		
2	10/1/19	9/30/20							1	3	1	5	1			1					6			1	5	5		1	3
3	10/1/20	9/30/21				1	1			7	1	8								1	10	1	1	1	7	8	1	1	8
4	10/1/21	9/30/22								1		1			1	1			2		4				4	1	2	1	
5	10/1/22	9/30/23						1		1		2		1		1					3				3	2		1	
						1	1	1	1	13	2	17	1	1	1	3			2	1	24	1	1	2	20	16	4	4	11

Road Construction

In 2020 and 2021, PCN 21981 and 21982 were road construction projects that overlaid US 2 and temporarily reduced the number of EB/WB lanes through the area. 11 of 24 crashes (46%) occurred during road construction (3 in 2020, 8 in 2021). During construction there was 1 fatal crash, which involved an EB semi-truck that rear-ended a vehicle stopped behind other traffic at a red light. 10 of 11 road construction crashes were rear-ends (8 EB, 2 WB).

Non-Dry Conditions

8 of 24 crashes (33%) occurred during non-dry conditions (4 wet, 4 ice/snow).

TRAFFIC VOLUME INFORMATION

NDDOT's Traffic Data Section counted traffic on 9/19/2023. **Appendix B** contains detailed volume info and **Table 3** summarizes the volumes.

	Table 3 - Peak Hour Volumes, US 2 & Grand Forks Airport													
	SB R	SB T	SB L	WB R	WBT	WB L	NB R	NB T	NB L	EB R	EB T	EB L	Totals	PHF
2023 AM Peak	0	3	16	67	442	10	42	29	193	120	309	3	1,237	0.86
2023 PM Peak	8	49	103	72	339	50	25	17	141	269	439	6	1,519	0.94
2022 All Day	66	370	935	1,013	4,338	370	443	358	1,630	1,741	4,179	57	15,509	
2023 All-Day	0%	2%	6%	7%	28%	2%	3%	2%	11%	11%	27%	0%		
All-Day Trucks	6%	1%	1%	2%	20%	59%	60%	1%	5%	6%	23%	2%	17%	
2043 AM Peak	0	4	22	90	595	13	57	39	260	162	416	4	1,666	0.86
2043 PM Peak	11	66	139	97	457	67	34	23	190	362	591	8	2,046	0.94

Future traffic based on growth of 1.5% per year.

Highest Volume Movements

EB+WB through movements dominate at this intersection.

Next are NB to WB left turners and EB to SB right turners. These vehicles go to/from the air force base, located ~9 miles west of this intersection.

Next are SB to EB left turners and WB to NB right turners. These vehicles go to/from the airport. In 2021 the Grand Forks International Airport was ranked the 12th busiest airport in the nation. https://www.grandforksherald.com/news/local/grand-forks-airport-ranked-12th-busiest-in-the-country-in-2021

TRAFFIC SIGNAL ANALYSIS

Traffic Signal Warrants

The traffic signal warrant form is in **Appendix C** and warrants #1B and #2 are satisfied. Therefore, traffic signal configurations are included in the alternatives section below. Satisfying a traffic signal warrant does not mean that a traffic signal **MUST** be installed. MUTCD section 4B.04.01 states "...consideration should be given to providing alternatives to traffic control signals even if one or more of the signal warrants has been satisfied."

Left Turn Phasing

NDDOT's Traffic Operations Manual has a flowchart to help determine the appropriate left turn phasing for each approach. The flowcharts are in **Appendix C** and results are shown in **Table 4**.

Table 4 - Recommended										
Left Turn Heads*										
Directions	Existing	Revised								
Directions	Geometry	Geometry								
EB+WB		Flash								
NB+SB	Flash	Flash								
*If the inters	ection is signa	alized.								

ALTERNATIVES

The next page shows NDDOT's Traffic Operations Manual graph to help determine which alternatives may be appropriate. According to the graph, traffic volumes are not high enough to justify an interchange. Therefore, an interchange was not analyzed in this study.

Six alternatives were analyzed:

Existing Geometry (signalized) - no changes

Revised Geometry (signalized) - Figure 2

Staggered-T Intersection (unsignalized) - Figure 3

Reduced Conflict Intersection (unsignalized*) - Figure 4

*This configuration is also known as a J-Turn, RCUT (Reduced Crossing U-Turn), or Superstreet

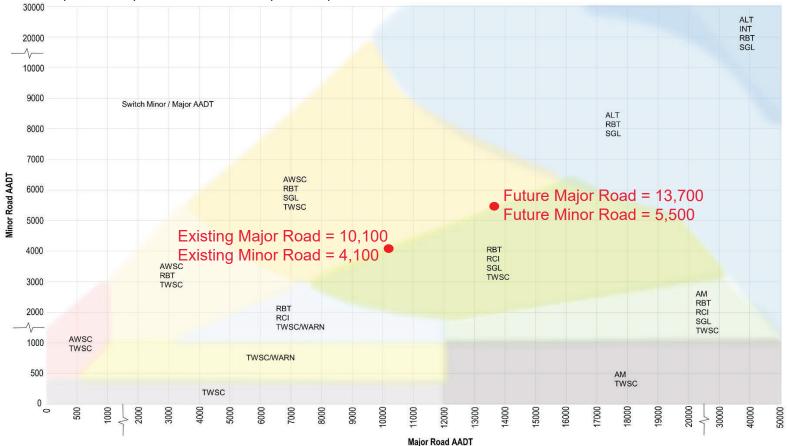
*This configuration could be signalized in the future if traffic increases.

Roundabout 2x1 - Figure 5

Roundabout 1x1 with Right Turn Lane Drops - Figure 6

INTERSECTION TYPE - HIGH LEVEL

Given the AADT's on the major and minor roads, use the chart below as a *starting point* to determine the appropriate type of analysis of a study intersection. The acronyms are explained in further detail below.



ALT: Alternative Intersections – As traffic volumes increase, conventional intersections may no longer be appropriate. A displaced left turn is an example of an alternative intersection.

For more information see FHWA: https://safety.fhwa.dot.gov/intersection/alter-design/

AM: Access Management - Removing a minor road connection can be considered in cases where the minor road has a very low volume and the major road has heavy traffic. Opportunities to reroute the minor road traffic to a different location should be explored. Other options for access management may be ¾ intersection or right-in/right-out. See Access Management section.

AWSC: All-way Stop Control - Stop control is in place on all intersection approaches. This type of intersection works best without the presence of turn lanes where a 2-lane road meets with another 2-lane road. Use SFN form 59012 to evaluate MUTCD warrants for all-way stop control.

INT: Interchange – A grade-separated intersection

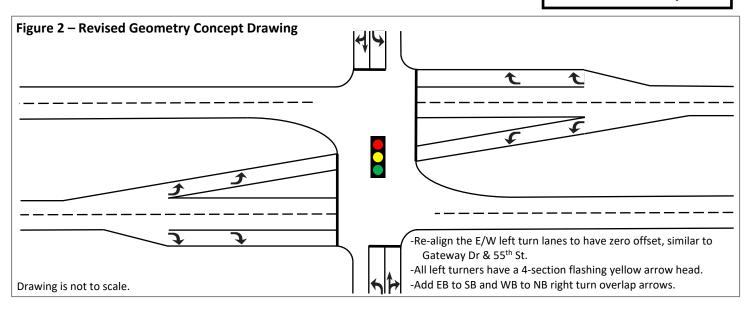
RBT: Roundabout – This type of intersection is becoming more common throughout the country due to their proven safety benefits. They may be considered at any intersection. A rule of thumb for a traffic study is to consider a roundabout when both the major road and minor road AADT is over 1000.

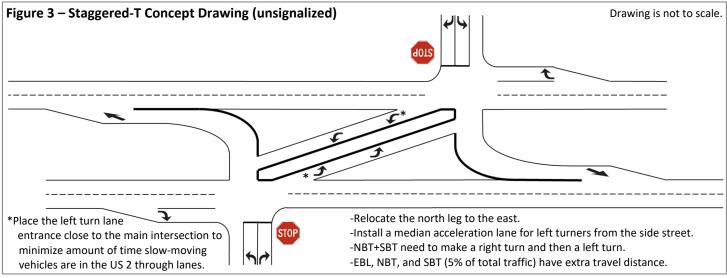
RCI: Reduced Conflict Intersection - this type of intersection reduces the number of conflict points by re-routing left turn movements from the minor road.

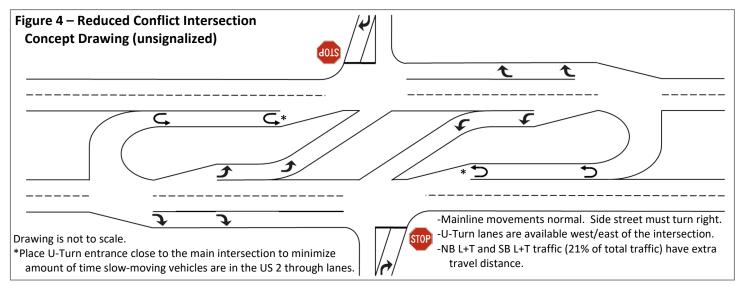
SGL: <u>Traffic Signal</u> - an analysis of MUTCD warrants should be done prior to a traffic signal capacity analysis.

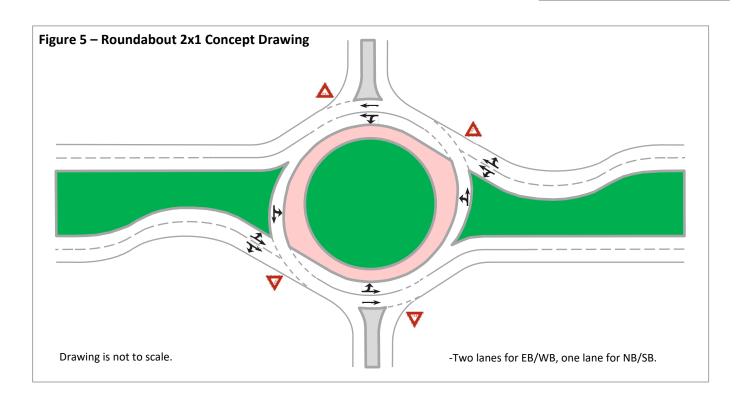
TWSC: Two-way Stop Control - The most common type of intersection where the major road is free-flow and the minor road traffic is controlled by a stop sign.

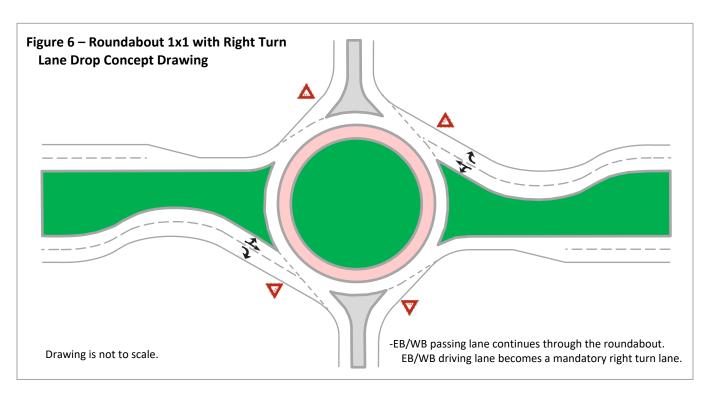
WARN: <u>Warning Enhancements for rural intersections</u> – adding additional emphasis to an existing TWSC intersection using signing and markings may be appropriate.











Conflict Points

Conflict points are locations where vehicle paths overlap each other. Crossing conflicts are generally more severe than merging/diverging conflicts. Conflict points are often used as a safety surrogate, especially for newer/innovative intersection configurations.

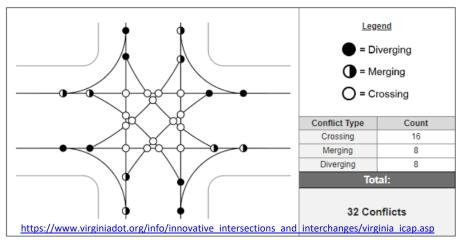
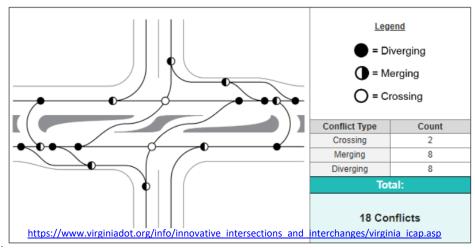
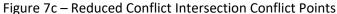


Figure 7a – Existing/Revised Geometry Conflict Points

Figure 7b – Staggered-T Conflict Points





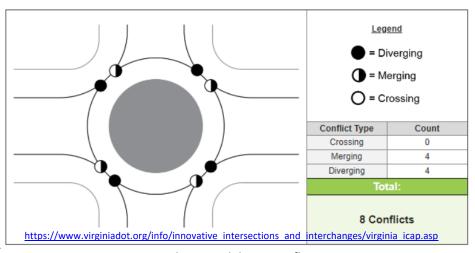


Figure 7d – Roundabout Conflict Points

CAPACITY ANALYSIS

The software program HCS2022 (version 8.1) was used to perform capacity analyses. The software print-out sheets are in **Appendix D** and **Table 5** lists the LOS (Level of Service) ranges. The Staggered-T and Reduced Conflict Intersection alternatives are considered "Distributed Intersections" (some vehicles are re-routed) and have the same LOS thresholds as signalized intersections. Roundabouts, however, have a lower threshold for LOS letters.

The signalized alternatives have BE PREPARED TO STOP WHEN FLASHING assemblies which hold mainline for an extra 7sec after gapping out. In the capacity analysis, this extra 7sec delay was added to the yellow time.

Table 6 on the next page shows the capacity results.

	Table 5 - Capa	acity LOS Ranges
	Roundabout	Signalized and
LOS	Delay	Distributed Intersection
	(sec/veh)	Delay (sec/veh)
Α	≤ 10	≤ 10
В	>10 - 15	>10 - 20
С	>15 - 25	>20 - 35
D	>25 - 35	>35 - 55
E	>35 - 50	>55 - 80
F	>50	>80

⁻LOS = Level of Service

Existing Geometry (signalized)

The overall intersection LOS is C or better with existing or future traffic volumes. However, due to protected-only left turn phasing, EB and WB left turners have long wait times (LOS E and F). It is recommended to discard this alternative in favor of Revised Geometry Signalized, which has similar delay for the overall intersection but 2x to 5x less delay for EB+WB left turners.

Revised Geometry (signalized)

The future overall intersection LOS is C for both the AM and PM peaks. The longest queue lengths are WB T (275ft) in the AM Peak and EB T (300ft) in the PM Peak.

Staggered-T (unsignalized)

The future overall intersection LOS is A in the AM Peak and C in the PM Peak. The main benefit of this alternative is that the highest volumes (EB T + WB T) do not have to stop. In the PM Peak the highest-volume side street movement (NB L) operates with LOS F (170 sec/veh delay, 275ft queue length). SB T and WB L volumes are both higher in the PM Peak than in the AM Peak, which results in limited gaps for NB L vehicles. Because the highest-volume side street movement has LOS F, it is recommended to discard this alternative.

Reduced Conflict Intersection (unsignalized)

The future overall intersection LOS is B in both the AM and PM peaks, with the overall intersection delay being roughly 3x less than Revised Geometry Signalized. The main benefit of this alternative is that the highest volumes (EB T + WB T) do not have to stop. 21% of traffic must re-route and experience extra travel time, but there are only short queue lengths for all movements. If traffic volumes increase more than expected, this alternative could be signalized in the future.

Roundabout 2x1

The future overall intersection LOS is A for the AM Peak and B for the PM Peak. All movements have short queue lengths.

⁻Values from 2022 HCM Exhibits 19-8, 22-8, and 23-13.

 ⁻The Staggered-T and Reduced Conflict Intersection configurations are "Distributed Intersections".

Roundabout 1x1 with Right Turn Lane Drops

The future overall intersection LOS is C for the AM Peak and B for the PM Peak. The worst movement is WB L+T (delay 26.1 sec/veh, 250ft queue length) in the AM Peak. Because the lane drops could potentially surprise drivers and result in abrupt lane-changes and because the 2x1 roundabout has better operations, it is recommended to discard this alternative in favor of the 2x1 roundabout.

								Table	6 - Ca	pacity	Analys	is Resu	lts									
	Time	Alternative		I	ЕВ			W	В			N	В			S	В		Inter	WB to EB	EB to WB	
F	Period	Alternative	L	Т	R	Appr	L	T	R	Appr	L	T	R	Appr	L	T	R	Appr	Section	U-Turn	U-Turn	
_	AM	Ex Geom	Ε	В	В	В	F	В	В	В	С	E	3	С	В	P	Ą	В	В			
053	Peak	Signalized	62.0	16.7	15.0	16.8	107.4	17.6	14.2	19.1	22.1	17	7.8	21.2	18.5	0.		18.3	18.8			
Existing 2023	· can	0.8.10.1200	0	75	25		25	100	25		100	2			0	C						
istir	PM	Ex Geom	D	В	В	В	F	В	В	С	С	E		С	С	E		С	С			
Ä	Peak	Signalized	49.8	18.6	18.8	18.9	137.9	15.3	13.5	29.3	23.9	18		23.2	21.1	19		20.5	22.8			
			0	100	100		100	75	25		75	()		50	2	5					
		I	Ε	_		-	F	С				(,	_	_			-		ı		
		Ex Geom	72.9	C 26.0	B 12.1	C 23.6	135.4	28.2	B 19.7	C 29.5	C 27.6	24		C	C 22.1	25		C 24.1	C 26.9			
		Signalized	0	175	50	23.0	25	250	50	29.5	225	5	-	27.0	25	25		24.1	26.9			
			С	C C	B	С	C	C C	C C	С	C C)		С	C	-		С	С			
		Rev Geom	24.8	29.1	14.2	26.2	23.9	32.0	22.2	30.9	26.2	24		25.8	26.9	0.		28.0	28.2			
		Signalized	0	200	50	20.2	25.3	275	50	30.5	225		0	25.0	25	0.		20.0	20.2			
			С	Α	A	Α	В	Α	A	Α	С	D	В	С	В	D	В	С	Α			
		Staggered-T*	30.8	0.0	0.0	0.2	11.1	0.0	0.0	0.2	27.2	43.1	12.3	26.6	18.1	42.9	10.7	22.0	6.2			
	AM	Unsignalized	0	0	0		0	0	0		125		25		25		0				ŀ	
	Peak	DCI*	В	Α	Α	Α	В	Α	Α	Α	D	D	В	D	D	D	Α	D	В	Α	В	
		RCI* Unsignalized	11.0	0.0	0.0	0.1	11.2	0.0	0.0	0.2	49.8	49.8	16.0	44.4	40.0	40.0	0.0	40.0	10.2	9.9	16.1	
		Ulisignalizeu	0	0	0		0	0	0				100				0			0	75	
		Roundabout	Roundabout			Α	Α	Α		В	В		В		В		Α		Α	Α		
		2x1	5.7		6.2	6.0	9.7		10.8	10.3		13.8		13.8		7.7		7.7	9.5			
			25		25		50		75			100				0						
		Roundabout		A	Α	Α		D	Α	С		С		С		Α		Α	С			
043		1x1 with		7.9 50	4.4	7.0		6.1 50	5.2	23.8		18.4 125		18.4		9.8 25		9.8	16.5			
Future 2043		RT Lane Drops			25				25											1		
nţn		Ex Geom	Ε	С	В	С	Ε	С	В	С	С	(С	С	0		С	С			
Г		Signalized	64.2	29.4	18.9	26.2	73.7	21.1	12.9	26.1	30.7	34		31.3	29.0	39		32.8	27.5			
			25	250 D	200		100	150 C	25	_	150	2			125	7.						
		Rev Geom	C	39.8	C	D 25.2	C	29.6	B	C	C	31		C	D	34		D 36.9	C 32.5			
		Signalized	24.6 25	39.8	26.8 250	35.3	29.9 50	29.6	19.1 50	28.5	27.5 175	2		28.1	38.1	34 7		36.9	32.5			
			23 C	A	250 A	Α	30 B	A	30 A	Α	1/3 F	D	В	F	200 B	D	В	С	С			
		Staggered-T*	30.1	0.0	0.0	0.3	18.0	0.0	0.0	2.0	170.3	42.7		136.9	18.9	49.9	10.8	28.0	20.2			
	PM	Unsignalized	0	0.0	0.0	0.5	50	0.0	0.0	2.0	275	42.7	25	130.5	50	43.3	25	20.0	20.2			
	Peak		A	A	A	Α	В		A	Α	D	D	В	D	D	D	B	D	В	В	В	
		RCI*	9.5	0.0	0.0	0.1	19.0	0.0	0.0	2.0	44.9	44.9	15.5	40.9	46.7	46.7	13.4	45.0	10.3	15.6	11.7	
		Unsignalized	0	0	0		25	0	0				50				50			50	25	
		Danmel-l	В		В	В	Α		Α	Α		В		В		В		В	В			
		Roundabout 2x1	11.	1 :	12.8	12.0	7.4		8.0	7.7		13.8		13.8		10.3		10.3	10.8			
		ZXI	75		100		50		50			50				50						
		Roundabout		С	Α	В		В	Α	В		С		С		В		В	В			
		1x1 with		8.4	8.5	15.0		2.8	4.7	11.8		19.3		19.3		13.6		13.6	14.4			
		RT Lane Drops	1	.75	50		1	00	0			75				50						

[·]Values shown are LOS, Delay (sec), and Queue Length (ft).

⁻Queue lengths ≥ 200ft are highlighted blue.

^{*}For the Staggered-T scenario; the EB L, NB T, and SB T results account for extra distance travel time.

^{*}For the Staggered-T scenario, the distance between the north leg and the south leg was assumed to be 715ft (50ft cushion for turning, 180ft taper, 335ft decel, 100ft storage, 50ft cushion for turning). If the actual design is farther apart, then extra distance travel time will be longer than shown here (more delay than shown here).

^{*}For the RCI (Reduced Conflict Intersection) scenario; the NB L, NB T, SB L, and SB T results account for extra distance travel time.

For the RCI scenario, the distance between the main intersection and the U-Turn was assumed to be 715ft (50ft cushion for turning, 180ft taper, 335ft decel, 100ft storage, 50ft cushion for turning). If the actual design is farther apart, then extra distance travel time will be longer than shown here (more delay than shown here).

RECOMMENDATIONS

If it is decided to make changes to the intersection, then it is recommended to carry forward the below three alternatives to the environmental document. Concept drawings are on pages 10 and 11. **Table 7** compares some attributes of the three alternatives.

	Table	7 - Comparison of Rec	commended Alternatives			
		Revised Geometry (signalized)	Reduced Conflict Intersection (unsignalized)	Roundabout 2x1		
Νι	umber of Conflict Points	32 total (16 crossing)	18 total (2 crossing)	8 total (0 crossing)		
Amo	ount of traffic required to travel extra distance	None	21%	None		
2043	Overall LOS/Delay	C 28.2 sec/veh	B 10.2 sec/veh	A 9.5 sec/veh		
AM Peak	Worst Movement Delay/Queue	WB T 32.0 sec/veh 275ft queue	NB 49.8* sec/veh 100ft queue	NB 13.8 sec/veh 100ft queue		
2043	Overall LOS/Delay	C 32.5 sec/veh	B 10.3 sec/veh	B 10.8 sec/veh		
PM Peak	Worst Movement Delay/Queue	EB T 39.8 sec/veh 300ft queue	NB 44.9* sec/veh 50ft queue	EB T 12.8 sec/veh 100ft queue		
Is	EB+WB through traffic required to stop?	Yes, on red lights	No	Yes, if conflicting traffic is present		
	there extra features that nay cause snow drifts?	No	Yes, raised curbs	Yes, raised curbs and center mound		
	tersection still operates ally during a power outage?	No	Yes	Yes		
*Accou	nts for control delay and extra dis	tance travel time.				

23 USC § 407 Documents NDDOT Reserves All Objections

Appendix A – Crash Information

Intersection and/or Urban Crash Summary Sheets

Total Crashes: 24 (Sorted by Date)

City: Grand Forks

Location: US 2 & Grand Forks Airport Start - End Date: 10/1/2018 - 9/30/2023 (5 Years)

Notes: Non-injury animal crashes were

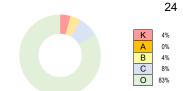
not included.

23 USC § 407 Documents NDDOT Reserves All Objections



Statistics for Total Crashes

Crash Severity	Letter Code	No. of Crashes
Fatal	K	1
Incapacitating Injury	Α	0
Non-incapacitating Injury	В	1
Possible Injury	С	2
Property Damage Only	0	20



EPDO Score = 159

Under Construction											
Yes =	11	46%									

Day of Weel	k	
Monday =	6	25%
Tuesday =	4	17%
Wednesday =	4	17%
Thursday =	2	8%
Friday =	3	13%
Saturday =	1	4%
Sunday =	4	17%
· •	24	

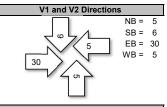
Manner of Co	llicion		Bı	reakdo	wn by	Sever	ity
Walliel Of CO	IIISIOII		Κ	Α	В	С	0
Angle	1	4%	0	0	0	0	1
Rear End	17	71%	1	0	1	1	14
Left Turn	0	0%	0	0	0	0	0
Sideswipe (same dir.)	3	13%	0	0	0	1	2
Sideswipe (opp dir.)	0	0%	0	0	0	0	0
Single Vehicle	2	8%	0	0	0	0	2
Ped/Bike	0	0%	0	0	0	0	0
Head On	1	4%	0	0	0	0	1
Backing	0	0%	0	0	0	0	0
Other	0	0%	0	0	0	0	0
	24	100%	1	0	1	2	20

Surface Co	nditions		Bi	reakdo	wn by	Sever	rity
Surface Co	Jiiuilions		K	Α	В	С	0
Dry	16	67%	1	0	1	2	12
Wet	4	17%	0	0	0	0	4
Ice / Snow	4	17%	0	0	0	0	4
Other	0	0%	0	0	0	0	0
	24	100%	1	0	1	2	20

Limbina (`anditiana		Bi	reakdo	wn by	Sever	ity
Lighting	Conditions	•	K	Α	В	С	0
Dawn/Dusk	1	4%	0	0	0	0	1
Daylight	21	88%	1	0	1	2	17
Dark	0	0%	0	0	0	0	0
Dark (lighted)	2	8%	0	0	0	0	2
Unknown	0	0	0	0	0	0	
	24	100%	1	0	1	2	20

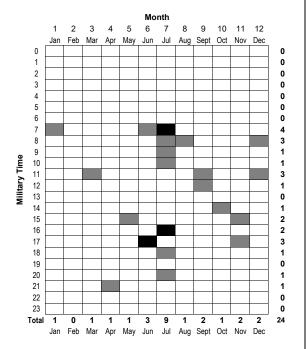
V1 and V2 Configuration* Passenger Car = 11 PU / Van / Utility = 27 Truck = 8 Bus / Motorhome = 0 Motorcycle + Moped = 0

Ped or Bike = 0
These are only the most popular choices.



D1 and D2 Alcohol / Drugs* Yes (alcohol or drugs present) = 1

D1 an	nd D2 A	ge/S	Sex
Age	M	F	Total
0-17	2	0	2
18-20	4	0	4
21-24	5	1	6
25-34	5	0	5
35-44	3	3	6
45-54	3	3	6
55-64	7	1	8
65-74	7	0	7
75+	2	0	2
-	38	8	46



												Manı	ner of Co	llsion														Sever	ity		Su	ırface	Cond.	
					Angle				Re	ar End	1			Left Tur	n			Sidesv	vipe	Same	Dir.				_									۲2
			NB+EB	NB+WB	SB+EB	SB+WB		NB	SB	EB V	٧B	NB to W	B SB to B	EB EB to	NB W	B to SB		NB SE	B EE	3 WB			a l	Veh.	the								>	tion?
Year	Start Date	End Date	$\longrightarrow_{\uparrow}$	↑	\rightarrow	↓	Subtotal	*	→→	>> <	Subtotal	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	1	_7^	-	> V_	Subtotal	$\uparrow\uparrow$		* =	Subtotal	Backing	Ped/Bike	Single V	Head-on/other	Total	K A	В	С	0	Dry	Wet	lce/Snov	Construc
1	10/1/18	9/30/19					,			1	1		1													1				1		1		
2	10/1/19	9/30/20							1	3	1 5							1			1					6			1	5	5		1	3
3	10/1/20	9/30/21				1	1			7	1 8														1	10	1	1	1	7	8	1	1	8
4	10/1/21	9/30/22								1	1								1		1			2		4				4	1	2	1	
5	10/1/22	9/30/23						1		1	2							1			1					3				3	2		1	
						1	1	1	1	13	2 1	7						1	1	1	3			2	1	24	1	1	. 2	2 20	16	4	4	11

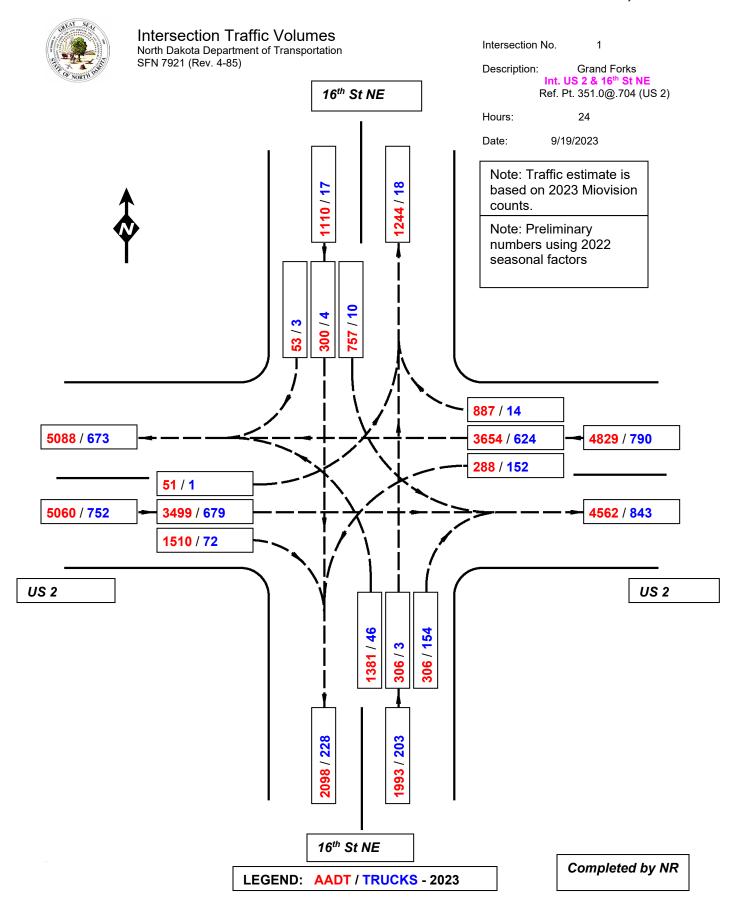
				Intersect	ion and/or Urban Crash Summary She				
Total Crashes:	24 (Sorted by Date)		JSC § 407 Documents			LEGEND	1. Contributing Factor * = alcohol or drugs involved	VI	SION
City:	Grand Forks	NDDOT	Reserves All Objections			► Fatal ► Incapacitating Injury	= alconor or drugs involved		ER 🚱
Location:	US 2 & Grand Forks Airport					Non-Incapacitating Injury	2. Most Harmful Event		ERV
Start - End Date:	10/1/2018 - 9/30/2023 (5 Years)					⊳Possible Injury	For single vehicle crashes, the most harmful event is shown in parentheses in the "Type of Collision"		
						♦Wet surface Snow, Ice, Slush, Frost	column		
						Crash related to work zone			
						①Unit number			
				0					
	Orașala Orașallea			AGE SEX CITY STATE Unit Configuration					
	Crash Severity Date, Day		Type of Collision	Movement (traffic control)					
	Surface Conditions, Weather			Contributing Factor ¹					
Crash No.	Lighting, Time			Most Harmful Event ²			Shortened Narrative		Diagram
1 1077407	PDO			1) 25M GRAND FORKS ND	② 56M ADAMS ND				
	04/28/19 Sunday			Pickup - Van - Utility	Pickup - Van - Utility				
	Wet Rain	•	Rear End	EB Stopped (Signal)	EB Stopped (Signal)				$\rightarrow \rightarrow$
	Dark(L) 9:15 PM			Weather	Weather				
	222								
2 1089847	PDO			① 30M GRAND FORKS ND	② 59M GRAND FORKS ND				
	01/14/20 Tuesday	_		Passenger Car	Pickup - Van - Utility				1
	Ice / Snow Blowing Snow	*	Rear End	SB Slowing/Stopping (Signal)	SB Going Straight (Signal)				i
	Dawn 7:10 AM			To Fast for Conditions					4
2 1000000	PDO			O 105 DELW 0 1	@ 0.444 O.D.A.V.D =======				
3 1096208	PDO 07/00/20 Wednesday			1 42F DEVILS LAKE ND	② 24M GRAND FORKS ND				
	07/08/20 Wednesday			Pickup - Van - Utility	Pickup - Van - Utility				
	Dry Clear		Rear End	EB Going Straight (Signal)	EB Stopped (Signal)				$\longrightarrow \longrightarrow$
	Daylight 10:40 AM			Ran Red Light					
4 4000000 5									
4 1096330 ⊳	Possible Injury			① 65M NORTHWOOD ND	② 44M BUXTON ND				
	07/13/20 Monday			Truck Tractor	Passenger Car				
	Dry Cloudy		Sideswipe (Same Dir.)	NB Turning Right (Signal)	NB Passing (Signal)				$\uparrow \uparrow$
	Daylight 9:46 AM				Improper Overtaking				
5 1096635	PDO			O CALL OR AND FORMS AND	A JEW ORANIE FORMONIE	A LETT OF AND FORWAND			
5 1096635				1) 21M GRAND FORKS ND	② 15M GRAND FORKS ND	③ 17M GRAND FORKS ND			
	07/13/20 Monday			Passenger Car	Passenger Car	Passenger Car			
	Dry Clear	_	Rear End	EB Going Straight (Signal)	EB Going Straight (Signal)	EB Stopped (Signal)			$\rightarrow \rightarrow$
	Daylight 6:34 PM			Following too Close					
6 1096399	PDO			© FONA CRADY ND	© CAM ESTEDO EL	2 AOM CRAND FORKS ND			
0 1090399	07/15/20 Wednesday			① 58M CRARY ND	② 64M ESTERO FL	3 49M GRAND FORKS ND			
	Dry Clear		Rear End	Truck Tractor	Pickup - Van - Utility	Pickup - Van - Utility			
	Daylight 7:53 AM	_	Rear End	EB Going Straight (Signal)	EB Stopped (Signal)	EB Stopped (Signal)			$\rightarrow \rightarrow$
	Daylight 7.33 AW			Careless/Reckless Driving					
7 1097802	PDO			19M WEST FARGO ND	② 64M LEEDS ND			\longrightarrow	
1037002	08/17/20 Monday			~	~				
	Dry Clear		Rear End	Pickup - Van - Utility WR Going Straight (Signal)	Pickup - Van - Utility				
	Daylight 8:42 AM	A	Real Ellu	WB Going Straight (Signal)	WB Stopped (Signal)				$\leftarrow \leftarrow$
	Daylight 0.42 AW			Following too Close	Following				
8 1099713	PDO			① 67M LAKOTA ND	② 76M THOMPSON ND			\longrightarrow	
	10/05/20 Monday			Passenger Car	Pickup - Van - Utility				
	Dry Clear		Rear End	EB Going Straight (Beacon)	EB Going Straight				
	Daylight 2:21 PM		Real Ellu	Care Required	LD Going Straight				$\rightarrow \rightarrow$
	Daylight 2.211 W			Care Required					
9 1102036	PDO			60M DEVILS LAKE ND	② 53F EMERADO ND				
	12/13/20 Sunday			Pickup - Van - Utility	Passenger Car				
	Snow Clear	*	Head on	SB Turning Right (Signal)	NB Going Straight (Signal)				\downarrow
	Daylight 8:16 AM	W.	riedu Uli	Weather	ND Going Straight (Signar)				↑
	Sayingine O. 10 / Wi			**Gaulei					'
10 1108361	PDO			1) 23F GRAND FORKS AFB ND	② 17M GRAND FORKS AFB ND				
	05/28/21 Friday			Passenger Car	Pickup - Van - Utility				
	Dry Clear		Rear End	EB Going Straight (Signal)	EB Stopped (Signal)				$\rightarrow \rightarrow$
	Daylight 3:18 PM		INGAI EIIU	Following too Close	En grobber (gildigi)				$\rightarrow \rightarrow$
	Sayingin O. 10 1 W			1 Showing too Close					
				İ	Page 18				

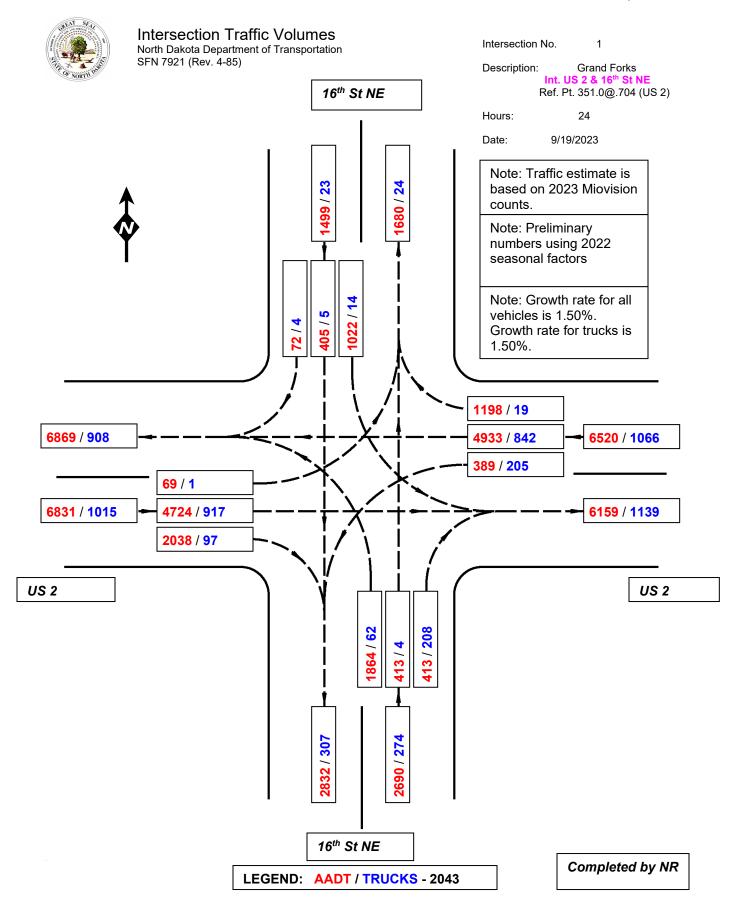
			intersec	ction and/or Urban Crash Summary S			
Total Crashes:	24 (Sorted by Date)	23 USC § 407 Documents			LEGEND Sector	1. Contributing Factor * = alcohol or drugs involved	VISION
City:	Grand Forks	NDDOT Reserves All Objections			► Fatal ► Incapacitating Injury	- alconol of drugs involved	ZERS
Location: Start - End Date:	US 2 & Grand Forks Airport 10/1/2018 - 9/30/2023 (5 Years)				► Non-Incapacitating Injury ➤ Possible Injury ◆ Wet surface S Snow, Ice, Slush, Frost ▲ Crash related to work zone ① Unit number	2. Most Harmful Event For single vehicle crashes, the most harmful event is shown in parentheses in the "Type of Collision" column	ZER
Crash No.	Crash Severity Date, Day Surface Conditions, Weather Lighting, Time	Type of Collision	AGE SEX CITY STATE Unit Configuration Movement (traffic control) Contributing Factor¹ Most Harmful Event²			Shortened Narrative	Diagram
11 1108945	Non-incapacitating injury		1 19M FORDVILLE ND	② 70M GRAND FORKS ND	③ 25F GRAND FORKS ND		
	06/15/21 Tuesday Dry Cloudy Daylight 5:21 PM	▲ Rear End	Truck Tractor EB Going Straight (Signal) Following too Close	Truck Tractor EB Stopped (Signal)	Passenger Car EB Stopped (Signal)		$\longrightarrow \longrightarrow$
12 1109077	PDO		1) 33M GRAND FORKS ND	② 35M WALES MI	③ 34M GRAND FORKS ND		
	06/22/21 Tuesday		Pickup - Van - Utility	Pickup - Van - Utility	Passenger Car		
	Dry Clear Daylight 7:20 AM	▲ Rear End	WB Going Straight (Signal) Careless/Reckless Driving	WB Stopped (Signal)	WB Stopped (Signal)		← ←
13 1109723	PDO		① 20M GRAND FORKS ND	② 26M GRAND FORKS ND	③ 86M NIAGARA ND		
	07/01/21 Thursday		Pickup - Van - Utility	Pickup - Van - Utility	Passenger Car		
	Dry Clear Daylight 4:25 PM	▲ Rear End	EB Going Straight Speed	EB Going Straight Speed	EB Going Straight Speed		$\rightarrow \rightarrow$
14 1109637	▶ Fatal		① 54M FELTON MN	② 61M DES MOINES IA	③ 57M WATERVILLE MN	V1 (semi truck) rear-ended V2, which was	
14 1103037	07/02/21 Friday		Unknown Heavy Truck	Passenger Car	Pickup - Van - Utility	stopped behind other traffic at a red light. There	
	Dry Clear Daylight 7:33 AM	▲ Rear End	EB Going Straight (Signal)	EB Stopped (Signal)	EB Stopped (Signal)	were a total of 8 vehicles involved. D2 died.	$\rightarrow \rightarrow$
15 1109614	PDO		(1) 66M REEDER ND	② 68M PLYMOUTH NH			
	07/06/21 Tuesday		Unknown Heavy Truck	Pickup - Van - Utility			
	Dry Cloudy Daylight 4:11 PM	▲ Rear End	EB Going Straight (Signal) Careless/Reckless Driving	EB Stopped (Signal)			$\rightarrow \rightarrow$
16 1109854 ▷	Possible Injury		① 39F GRAND FORKS ND	② 41M SPRING GROVE MN			
	07/08/21 Thursday		Pickup - Van - Utility	Pickup - Van - Utility			
	Dry Cloudy Daylight 8:27 PM	▲ Rear End	EB Going Straight (Signal) D.U.I. (Drugs)*	EB Stopped (Signal)			$\rightarrow \rightarrow$
17 1112577	PDO		1 21M GRAND FORKS ND	② 77M ROTHSAY MN			
	09/20/21 Monday		Passenger Car	Pickup - Van - Utility			1
	Wet Rain Daylight 11:20 AM	♠ ▲ Angle	SB Going Straight (Signal)	WB Going Straight (Signal) Ran Red Light			↓
18 1114942	PDO		1 48M GRAND FORKS ND	② 65M NORTHWOOD ND			
	11/12/21 Friday		Passenger Car	Pickup - Van - Utility			\rightarrow
	Wet Clear Daylight 3:04 PM) EB Changing Lanes (Signal) Fail Keep in Proper Lane	EB Going Straight (Signal)			\rightarrow
19 1116848	PDO		① 59F FARGO ND				
	12/26/21 Sunday		Pickup - Van - Utility				
	Ice / Snow Cloudy Daylight 11:05 AM	Single Veh. (Overturn / Rollover)	EB Turning Right (Signal) To Fast for Conditions				→X
20 1124426	PDO		Overturn / Rollover (1) 68M WEST FARGO ND	② 28M FARGO ND			
20 1124420	06/20/22 Monday		2-Axle	(2) 28M FARGO ND Pickup - Van - Utility			
	Wet Cloudy Daylight 5:10 PM	♦ Rear End	EB Going Straight Careless/Reckless Driving	EB Going Straight			$\rightarrow \rightarrow$

			Intersect	tion and/or Urban Crash Summary She	ets		
Total Crashes: City: Location: Start - End Date:	24 (Sorted by Date) Grand Forks US 2 & Grand Forks Airport 10/1/2018 - 9/30/2023 (5 Years)	23 USC § 407 Documents NDDOT Reserves All Objections			LEGEND ► Fatal ► Incapacitating Injury ► Non-Incapacitating Injury ▷ Possible Injury • Wet surface • Snow, Ice, Slush, Frost ▲ Crash related to work zone ① Unit number	1. Contributing Factor * = alcohol or drugs involved 2. Most Harmful Event For single verhicle crashes, the most harmful event is shown in parentheses in the "Type of Collision" column	VISION ZER®
Crash No.	Crash Severity Date, Day Surface Conditions, Weather Lighting, Time	Type of Collision	AGE SEX CITY STATE Unit Configuration Movement (traffic control) Contributing Factor¹ Most Harmful Event²			Shortened Narrative	Diagram
21 1125049	PDO 07/02/22 Saturday Dry Clear Daylight 8:25 AM	Single Veh. (Traffic Signal Support)	① 48M HUNTSVILLE TX Truck Tractor EB Going Straight (Signal) Traffic Signal Support				→X
22 1130168	PDO 11/16/22 Wednesday Ice / Snow Blowing Snow Dark(L) 5:22 PM	♣ Rear End	45F GRAND FORKS AFB ND Pickup - Van - Utility EB Slowing/Stopping (Signal) To Fast for Conditions	② 24M GRAND FORKS ND Passenger Car EB Stopped (Signal)			$\rightarrow \rightarrow$
23 1135875	PDO 03/05/23 Sunday Dry Clear Daylight 11:54 AM	Rear End	24M DEVILS LAKE ND Pickup - Van - Utility NB Turning Left (Signal) Following too Close	39F GRAND FORKS AFB ND Pickup - Van - Utility NB Turning Left (Signal)			↑
24 1143157	PDO 09/06/23 Wednesday Dry Clear Daylight 12:00 PM	Sideswipe (Same Dir.	20M GRAND FORKS ND Pickup - Van - Utility SB Changing Lanes (Signal) Improper Turn	48F EAST GRAND FORKS MN Pickup - Van - Utility SB Turning Left (Signal)			1 1
25							
26							
27							
28							
29							
30							

23 USC § 407 Documents NDDOT Reserves All Objections

Appendix B – Traffic Volume Information





Study Name US 2 & Grand Forks Airport Start Date 09/19/2023

23 USC § 407 Documents NDDOT Reserves All Objections

Start Time	SB R	SB T	SB L	SB U	WB R	WB T	WB L	WB U	NB R	NB T	NB L	NB U	EB R	EB T	EB L	EB U	Totals	PHF
0.00	2	0	9	0	0	8	0	0	1	2	4	0	3	6	0	0	35	
0.25	0	3	3	0	0	3	0	0	0	1	1	0	2	6	0	0	19	
0.50	0	1	1	0	0	5	0	0	0	0	2	0	1	4	0	0	14	
0.75	0	0	0	0	1	1	0	0	0	0	0	0	1	6	0	0	9	
1.00	0	0	0	0	0	2	0	0	0	0	0	0	0	5	0	0	7	
1.25	0	0	0	0	2	4	0	0	0	0	2	0	0	3	0	0	11	
1.50	0	1	0	0	0	2	0	0	0	0	0	0	0	4	0	0	7	
1.75	0	0	0	0	0	3	0	0	0	0	0	0	0	4	0	0	7	
2.00	0	0	0	0	0	1	1	0	0	0	1	0	2	3	0	0	8	
2.25	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	
2.50	0	0	0	0	4	3	0	0	0	1	5	0	1	0	0	0	14	
2.75	0	0	0	0	4	4	0	0	0	1	0	0	0	3	0	0	12	
3.00	0	1	1	0	5	4	0	0	0	0	0	0	0	5	0	0	16	
3.25	0	1	0	0	3	1	0	0	0	4	0	0	0	5	0	0	14	
3.50	0	1	3	0	13	4	0	0	0	4	0	0	1	5	1	0	32	
3.75	0	3	4	0	6	3	0	0	0	4	0	0	1	8	1	0	30	
4.00	1	1	1	0	5	6	0	0	0	1	0	0	3	5	1	0	24	
4.25	0	0	1	0	6	10	0	0	0	1	1	0	2	5	0	0	26	
4.50	0	1	2	0	2	7	0	0	1	0	10	0	6	15	1	0	45	
4.75	0	0	0	0	3	18	0	0	1	1	2	0	3	8	0	0	36	
5.00	0	4	3	0	1	16	1	0	2	0	4	0	8	15	0	0	54	
5.25	0	0	0	0	3	33	0	0	0	0	6	0	5	13	0	0	60	
5.50	0	2	2	0	7	29	0	0	4	3	11	0	6	17	0	0	81	
5.75	1	1	0	0	6	48	0	0	2	2	8	0	9	32	2	0	111	
6.00	0	1	1	0	8	53	0	0	2	3	19	0	7	25	2	0	121	
6.25	0	0	2	0	16	66	1	0	4	7	32	0	20	44	0	0	192	
6.50	0	0	1	0	21	104	1	0	4	9	56	0	14	53	1	0	264	
6.75	0	0	1	0	20	81	3	0	6	9	44	0	17	52	2	0	235	
7.00	0	1	0	0	8	132	2	0	15	5	51	0	28	64	0	0	306	
7.25	0	1	5	0	20	119	1	0	10	8	46	0	31	87	0	0	328	0.86
7.50	0	0	2	0	19	107	3	0	14	6	61	3	43	101	2	0	361	
7.75	0	1	9	0	20	84	4	0	3	10	35	0	18	57	1	0	242	
8.00	0	1	7	0	19	67	10	0	4	8	31	0	25	58	0	0	230	
8.25	1	0	5	0	13	92	6	0	6	5	42	0	26	63	0	0	259	
8.50	1	1	7	0	13	82	15	0	9	8	31	0	30	64	1	0	262	
8.75	0	2	8	0	14	60	3	0	17	5	21	0	18	51	0	0	199	
9.00	1	2	13	0	8	70	5	0	9	4	18	0	37	58	2	0	227	
9.25	1	1	5	0	14	60	7	0	14	3	15	0	20	52	2	1	195	
9.50	0	1	8	0	25	68	8	0	9	5	9	0	24	67	1	0	225	
9.75	1	1	6	0	19	55	7	0	4	6	25	0	28	45	1	0	198	

Hourly Volume	Hourly Rank	Major Rd EB+WB	Minor Rd NB L+T+R	Minor Rd SB L+T+R
77	22	77	11	19
32	24	32	2	1
37	23	37	8	0
92	21	92	12	14
131	20	131	18	7
306	16	306	42	13
812	12	812	195	6
1,237	2	1,237	264	19
950	7	950	187	33
845	11	845	121	40

Study Name US 2 & Grand Forks Airport Start Date 09/19/2023

23 USC § 407 Documents NDDOT Reserves All Objections

Start Time	SB R	SB T	SB L	SB U	WB R	WB T	WB L	WB U	NB R	NB T	NB L	NB U	EB R	EB T	EB L	EB U	Totals	PHF
10.00	2	0	7	0	17	59	5	0	8	4	15	0	15	56	0	0	188	
10.25	1	9	24	0	22	53	13	0	15	13	19	0	34	65	2	0	270	
10.50	1	4	10	0	27	68	4	0	10	7	14	0	20	60	0	0	225	
10.75	0	6	6	0	31	70	8	0	4	16	18	0	23	56	0	0	238	
11.00	2	14	29	0	20	66	11	0	14	10	15	0	14	54	1	0	250	
11.25	3	10	38	0	19	74	10	0	8	4	19	0	16	75	1	0	277	
11.50	1	4	21	0	16	64	8	0	4	7	19	0	23	54	1	0	222	
11.75	1	12	17	0	13	55	9	0	9	6	14	0	18	62	2	0	218	
12.00	1	2	15	0	19	60	12	0	12	3	14	0	16	68	0	0	222	
12.25	0	4	16	0	17	63	2	2	10	3	18	0	19	61	1	0	216	
12.50	2	6	16	0	25	62	6	0	9	7	21	0	19	61	2	0	236	
12.75	2	2	17	0	16	70	8	0	10	7	20	0	29	57	1	0	239	
13.00	1	5	10	0	19	61	5	0	7	3	20	0	22	70	0	0	223	
13.25	1	7	17	0	19	71	5	0	8	4	21	0	21	72	3	0	249	
13.50	1	6	10	0	16	64	14	0	13	4	20	0	26	87	0	0	261	
13.75	1	3	9	0	18	53	9	0	6	5	22	0	22	55	0	0	203	
14.00	2	2	10	0	17	72	5	0	13	6	21	0	31	59	1	0	239	
14.25	2	6	22	0	16	67	7	0	19	3	29	0	32	71	0	0	274	
14.50	2	5	22	0	27	72	7	0	5	6	19	2	32	85	1	0	285	
14.75	3	12	16	0	14	48	5	0	5	6	34	0	38	61	3	0	245	
15.00	2	5	10	0	12	73	14	0	7	3	14	0	43	69	2	0	254	
15.25	3	6	18	0	18	78	10	0	9	1	33	0	38	84	4	0	302	
15.50	0	11	18	0	17	70	9	0	9	9	31	0	45	93	0	0	312	
15.75	1	6	21	0	17	81	4	0	12	3	36	0	45	96	0	0	322	
16.00	2	4	21	0	19	85	7	0	7	6	32	0	55	124	0	0	362	
16.25	0	8	11	0	26	95	9	0	4	4	42	0	65	96	0	0	360	
16.50	4	11	19	0	23	84	7	0	2	7	35	0	66	120	2	0	380	0.94
16.75	3	11	42	0	17	73	18	1	6	3	17	0	75	132	4	0	402	0.04
17.00	1	19	31	0	6	87	16	0	13	3	47	0	63	91	0	0	377	
17.25	1	6	12	0	12	69	9	0	3	2	37	0	35	87	0	0	273	
17.50	0	5	17	0	7	61	4	0	10	4	24	0	38	79	0	0	249	
17.75	0	4	19	0	12	49	4	0	7	1	33	0	26	62	2	0	219	
18.00	0	9	18	0	13	57	3	0	3	1	22	0	28	56	0	0	210	
18.25	0	7	15	0	3	64	2	0	2	2	24	0	15	65	1	0	200	
18.50	2	6	13	0	7	48	3	0	2	1	31	0	28	47	0	0	188	
18.75	0	5	19	0	14	50	3	0	0	4	18	0	20	55	0	0	188	
19.00	0	7	7	0	8	36	1	0	1	10	20	0	14	39	0	0	143	
19.25	0	7	11	0	6	38	2	0	2	3	17	0	15	43	1	0	145	
19.50	0	3	10	0	7	48	1	0	0	2	23	0	19	51	0	0	164	
19.75	0	6	14	0	8	39	2	0	4	2	19	0	9	36	0	0	139	

Hourly Volume	Hourly Rank	Major Rd EB+WB	Minor Rd NB L+T+R	Minor Rd SB L+T+R
921	9	921	143	70
967	6	967	129	152
913	10	913	134	83
936	8	936	133	71
1,043	5	1,043	166	104
1,190	3	1,190	167	101
1,504	1	1,504	165	136
1,118	4	1,118	184	115
786	13	786	110	94
591	14	591	103	65

Study Name US 2 & Grand Forks Airport Start Date 09/19/2023

23 USC § 407 Documents NDDOT Reserves All Objections

Start Time	SB R	SB T	SB L	SB U	WB R	WB T	WB L	WB U	NB R	NB T	NB L	NB U	EB R	EB T	EB L	EB U	Totals
20.00	0	2	11	0	3	29	2	0	0	0	13	0	18	21	0	0	99
20.25	1	4	12	0	4	30	1	0	3	0	17	0	13	37	0	0	122
20.50	0	4	11	0	2	24	1	0	4	3	14	0	10	37	0	0	110
20.75	1	2	8	0	2	21	3	0	0	5	6	0	6	29	0	0	83
21.00	0	2	4	0	2	28	0	0	0	11	10	0	4	18	0	0	79
21.25	0	6	1	0	4	26	0	0	1	7	8	0	7	15	0	0	75
21.50	0	1	9	0	0	24	3	0	0	3	4	0	8	12	0	0	64
21.75	0	5	2	0	2	12	0	0	1	0	1	0	5	15	0	0	43
22.00	0	5	7	0	0	15	0	0	0	0	10	0	6	16	0	0	59
22.25	0	0	2	0	7	17	0	0	0	1	3	0	3	9	0	0	42
22.50	1	2	15	0	5	7	0	0	1	0	2	0	3	7	0	0	43
22.75	0	4	7	0	3	6	0	0	0	0	0	0	2	6	0	0	28
23.00	0	5	15	0	3	9	0	0	0	0	0	0	2	4	0	0	38
23.25	0	5	13	0	2	7	1	0	0	3	0	0	1	5	0	0	37
23.50	3	11	19	0	4	6	0	0	0	3	0	0	1	7	0	0	54
23.75	3	14	11	0	2	5	0	0	0	1	2	0	0	6	1	0	45
Totals	66	370	935	0	1,013	4,338	370	3	443	358	1,630	5	1,741	4,179	57	1	15,509
iviais	0%	2%	6%	0%	7%	28%	2%	0%	3%	2%	11%	0%	11%	27%	0%	0%	

Hourly Volume	Hourly Rank	Major Rd EB+WB	Minor Rd NB L+T+R	Minor Rd SB L+T+R
414	15	414	65	56
261	17	261	46	30
172	19	172	17	43
174	18	174	9	99

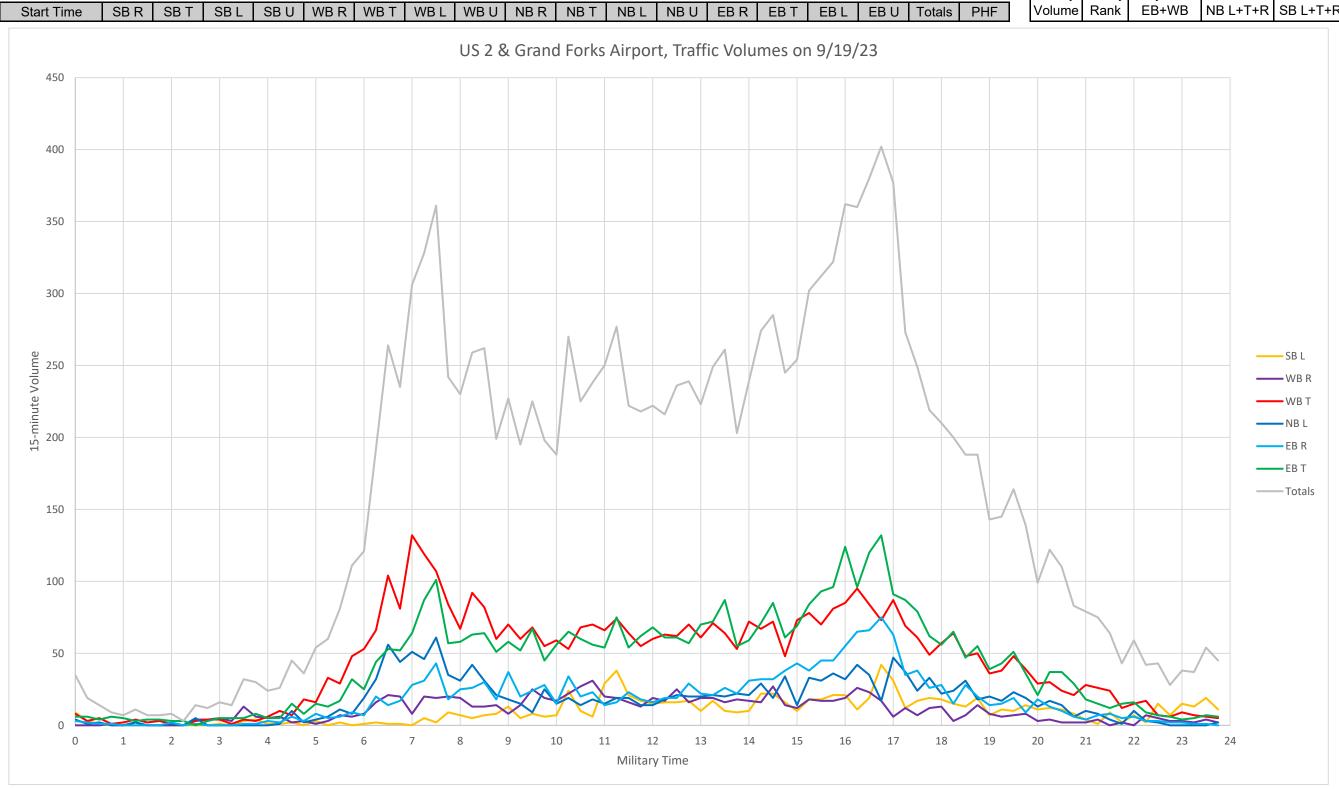
					Table	e 3 - Pea	k Hour \	/olumes	, US 2 &	Grand I	Forks Ai	rport						
	SB R	SB T	SB L	SB U	WB R	WB T	WB L	WB U	NB R	NB T	NB L	NB U	EB R	EB T	EB L	EB U	Totals	PHF
2023 AM Peak	0	3	16	0	67	442	10	0	42	29	193	3	120	309	3	0	1,237	0.86
2023 PM Peak	8	49	103	0	72	339	50	1	25	17	141	0	269	439	6	0	1,519	0.94
2023 All-Day	66	370	935	0	1,013	4,338	370	3	443	358	1,630	5	1,741	4,179	57	1	15,509	
2023 All-Day	0%	2%	6%	0%	7%	28%	2%	0%	3%	2%	11%	0%	11%	27%	0%	0%		
All-Day Trucks	6%	1%	1%	0%	2%	20%	59%	0%	60%	1%	5%	0%	6%	23%	2%	0%	17%	
2043 AM Peak	0	4	22	0	90	595	13	0	57	39	260	4	162	416	4	0	1,666	0.86
2043 PM Peak	11	66	139	0	97	457	67	1	34	23	190	0	362	591	8	0	2,046	0.94

Future traffic based on growth of 1.5% per year.

Study Name US 2 & Grand Forks Airport Start Date 09/19/2023

23 USC § 407 Documents
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Hourly Hourly Major Rd Minor Rd Minor Rd Volume Rank EB+WB NB L+T+R SB L+T+R



Appendix C – Traffic Signal Forms and Flowcharts

Traffic Signal Warrant Form	29
Left Turn Phasing Flowcharts	36

TRAFFIC CONTROL STUDY - WARRANTS FOR TRAFFIC SIGNALS

North Dakota Department of Transportation, Programming SFN 7924 (3-2023)

23 USC § 407 Documents NDDOT Reserves All Objections

Date	Prepared by CLH	City	Analysis Year
10/13/2023		Grand Forks	2023
Major Road		Speed Limit (mph)	Number of Lanes
US 2 (EB+WB)		55	2
Minor Road	est of NB or SB)	Speed Limit (mph)	Number of Lanes
Grand Forks Airport (highe		55	2
right-turn lane and right-tu 1. Posted or 85th-percentil 2. In built-up area of isolate	e excluded from the analysis because there is an extra traffic enters the Major Road with minimal conflictions are speed of major road traffic is > 40 mph: ed community < 10,000 population: red yes, then use 70% volume criteria:		

WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Requirements: Either Condition A (Minimum Vehicular Volume) or Condition B (Interruption of Continuous Traffic) is satisfied to 100% of the stated volumes for each of any 8 hours of an average day.

Or: Both Condition A and Condition B are satisfied to 80% of the stated volumes for each of any 8 hours of an average day.

Table 4C-1. Warrant 1, Eight-Hour Vehicular Volume
Condition A - Minimum Vehicular Volume

Number of lar traffic on ea	nes for moving ch approach			ır on majo approacl				higher-volun	
Major Street	Minor Street	100%ª	80%b	70%°	56% ^d	100%a	80%b	70% ^c	56% ^d
1	1	500	400	350	280	150	120	105	84
2 or more	1	600	480	420	336	150	120	105	84
2 or more	2 or more	600	480	420	336	200	160	140	112
1	2 or more	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic

Number of lar traffic on ea	nes for moving ch approach		s per hou al of both					higher-volun one direction	
Major Street	Minor Street	100%ª	80%b	70% ^c	56% ^d	100% ^a	80%b	70% ^c	56% ^d
1	1	750	600	525	420	75	60	53	42
2 or more	1	900	720	630	504	75	60	53	42
2 or more	2 or more	900	720	630	504	100	80	70	56
1	2 or more	750	600	525	420	100	80	70	56

^a Basic minimum hourly volume

^d May be used for combination of Conditions A and B after adequate trial of other remedial measures when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

		8 High	nest Hou	ır Volum	es			
	1	2	3	4	5	6	7	8
Both Approaches Major Road	1,504	1,237	1,190	1,118	1,043	967	950	936
Highest Approach Minor Road	165	264	167	184	166	152	187	133

Page 29

Warrant 1 Met?	X Yes	No	Does not apply	

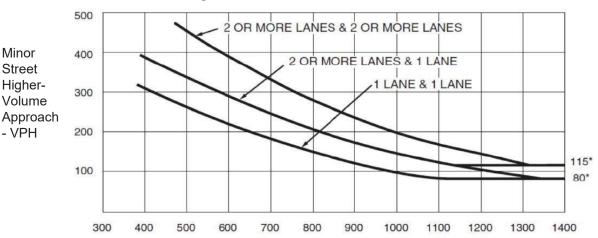
^b Used for combination of Conditions A and B after adequate trial of other remedial measures

^c May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10.000

WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Requirements: Plot four highest hour volumes on the applicable figure below. If four points lie above the applicable curve then the warrant is satisfied.

Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume

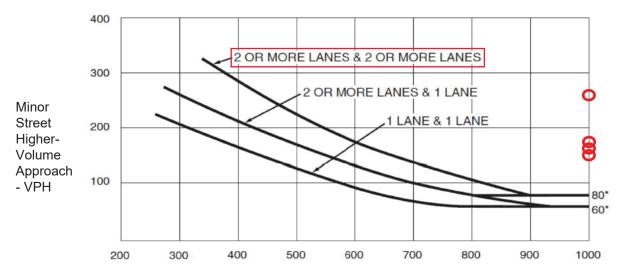


MAJOR STREET - TOTAL OF BOTH APPROACHES VEHICLES PER HOUR (VPH)

*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(Community Less than 10,000 Population or Above 40 MPH on Major Street)



MAJOR STREET -- TOTAL OF BOTH APPROACHES VEHICLES PER HOUR (VPH)

*Note: 80 vph applies as the lower threshold volume for a minorstreet approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

23 USC § 407 Documents NDDOT Reserves All Objections

WARRANT 3, PEAK HOUR

Requirements: This signal warrant shall only be applied in unusual cases. Such cases include, but are not limited to, office complexes, manufacturing plants, industrial complexes, or high occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.

Unusual Condition

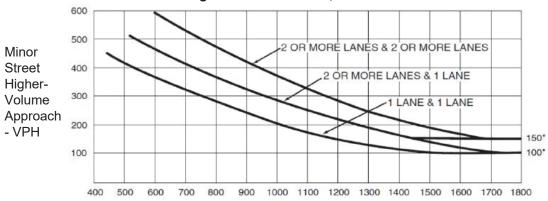
Either Condition A or Condition B is satisfied.

Condition A: The condition is satisfied if all three of the criteria are satisfied.

Criteria	Critorio Mot if	Peak-Hour Value	Satisf	fied?
Chiena	Criteria Met if	Peak-Hour value	Yes	No
Delay on Minor Approach (veh-hr)	4 veh-hr for 1 lane approach or 5 veh-hr for two-lane approach			
Volume on Minor Approach (veh/hr)	100 veh/hr for one moving lane of traffic, or 150 veh/hr for two lanes			
Total Entering Volume (veh/hr)	650 veh/hr for 3 approaches or 800 veh/hr for 4 or more			

Condition B: Plot peak hour volumes on the applicable figure below. These conditions exist for the same 1 hour (and four consecutive, 15-minute periods) of an average day. If the point is above the appropriate line, then the warrant is satisfied.

Figure 4C-3. Warrant 3, Peak Hour

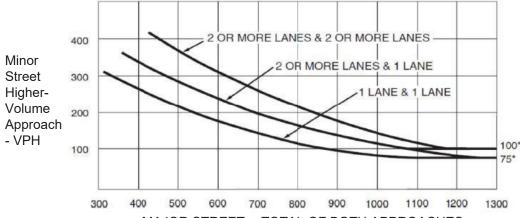


MAJOR STREET -- TOTAL OF BOTH APPROACHES VEHICLES PER HOUR (VPH)

*Note: 150 vph applies as the lower threshold volume for a minorstreet approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(Community Less than 10,000 Population or Above 40 MPH on Major Street)



MAJOR STREET -- TOTAL OF BOTH APPROACHES VEHICLES PER HOUR (VPH)

*Note: 100 vph applies as the lower threshold volume for a minorstreet approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Warrant 3 Met? Yes No Does not apply

23 USC § 407 Documents NDDOT Reserves All Objections

WARRANT 4, PEDESTRIAN VOLUME

Requirements: This warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street. It shall not be applied at locations where the distance to the nearest traffic signal or stop sign controlling the street that pedestrians desire to cross is less than 300 feet.

Either criterion A or criterion B is satisfied.

A: For each of any 4 hours of an average day, the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) all fall above the curve in Figure 4C-5.

Figure 4C-5. Warrant 4, **Pedestrian Four-Hour Volume**

Total of all pedestrians crossing major streetpedestrians per hour(pph)

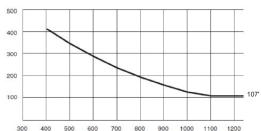
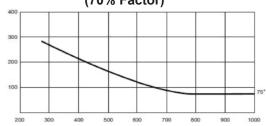


Figure 4C-6. Warrant 4, **Pedestrian Four-Hour Volume** (70% Factor)



MAJOR STREET -- TOTAL OF BOTH APPROACHES VEHICLES PER HOUR (VPH)

*Note: 107 pph applies as the lower threshold volume.

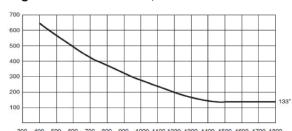
MAJOR STREET -- TOTAL OF BOTH APPROACHES VEHICLES PER HOUR (VPH)

*Note: 75 pph applies as the lower threshold volume.

B: For 1 hour (any four consecutive 15-minute periods) of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) all fall above the curve in Figure 4C-7.

Figure 4C-7. Warrant 4, Pedestrian Peak Hour

Total of all pedestrians crossing major streetpedestrians per hour(pph)

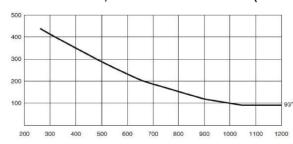


MAJOR STREET -- TOTAL OF BOTH APPROACHES VEHICLES PER HOUR (VPH)

*Note: 133 pph applies as the lower threshold volume.

Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)

Total of all pedestrians crossing major streetpedestrians per hour(pph)



MAJOR STREET -- TOTAL OF BOTH APPROACHES VEHICLES PER HOUR (VPH)

*Note: 93 pph applies as the lower threshold volume.

If the speed on major street exceeds 40 mph, or if population is less than 10,000, Figure 4C-6 or 4C-8 may be used.

23 USC § 407 Documents NDDOT Reserves All Objections

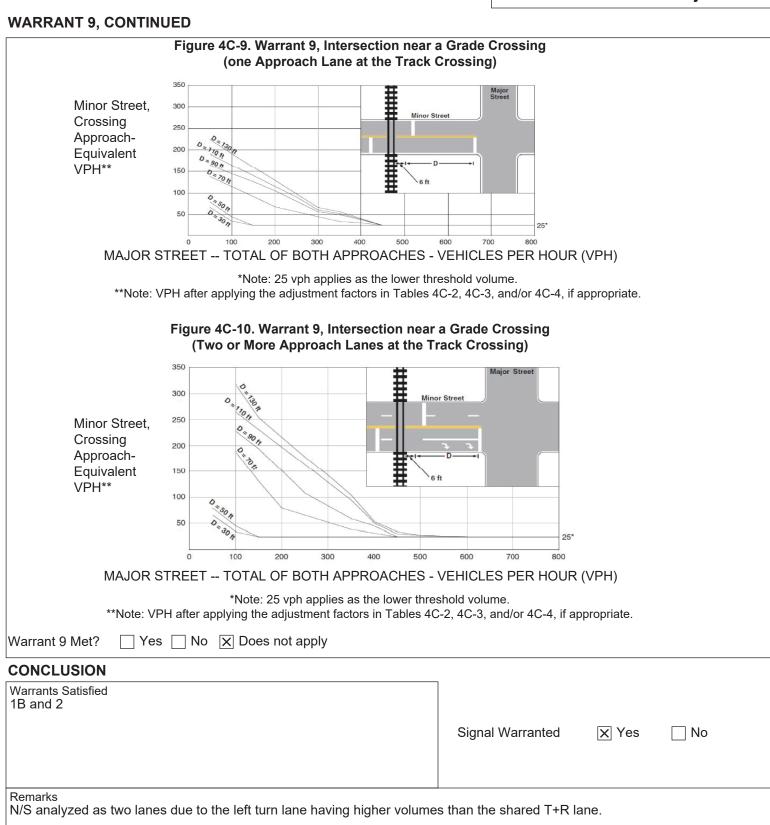
WARRANT 5, SCHOOL CROSSING

	all three of the criteria are satisfied.						
	Criteria					Satis Yes	sfied? No
During the time Gaps < Number	period when schoolchildren are using the crossing of minutes	:					
There are a mir	imum of 20 schoolchildren during the highest cros	sing hour					
nearest traffic s progressive mo	fic signal along the major road is located more tha gnal is within 300 ft but the proposed traffic signal vement of traffic.						
5 Met? Ye	s ☐ No ☒ Does not apply						
ments: This warra	INATED SIGNAL SYSTEM Int is satisfied if either criteria is satisfied. This	s warrant	t shou	uld not	be appl	ied wł	nen th
spacing wo	ould be less than 1000 ft. Criteria					Satis Yes	fied? No
	reet or a street that has traffic predominantly in on rapart that they do not provide the necessary deg						
	reet, adjacent traffic control signals do not provide ne proposed and adjacent traffic control signals wil				of		
progressive ope			oly pi	ovido d			
progressive ope 6 Met? Ye	ation. S No X Does not apply		oly pro				
progressive ope 6 Met? Ye ANT 7, CRASH	ation. S No X Does not apply						
progressive ope 6 Met? Ye ANT 7, CRASH	EXPERIENCE		Hou		I .	tisfied	
progressive ope 6 Met? Ye ANT 7, CRASH	EXPERIENCE Int is satisfied if all three of the criteria are sat				Sa Ye		
progressive ope 6 Met? Ye ANT 7, CRASH	EXPERIENCE Int is satisfied if all three of the criteria are sat Criteria Warrant 4.1at 80% of volume requirements:				I .		
progressive ope 6 Met? Ye ANT 7, CRASH ments: The warra One of the warrants to the	EXPERIENCE Int is satisfied if all three of the criteria are satisfied. Criteria Warrant 4.1at 80% of volume requirements: 80 ped/hr for 4 hrs or 152 ped/hr for 1 hr				I .		
one of the warrants to the right is met:	EXPERIENCE Int is satisfied if all three of the criteria are satisfied. Criteria Warrant 4.1at 80% of volume requirements: 80 ped/hr for 4 hrs or 152 ped/hr for 1 hr Warrant 1, Condition A (80% satisfied)		Hou	ır	I .		

23 USC § 407 Documents NDDOT Reserves All Objections

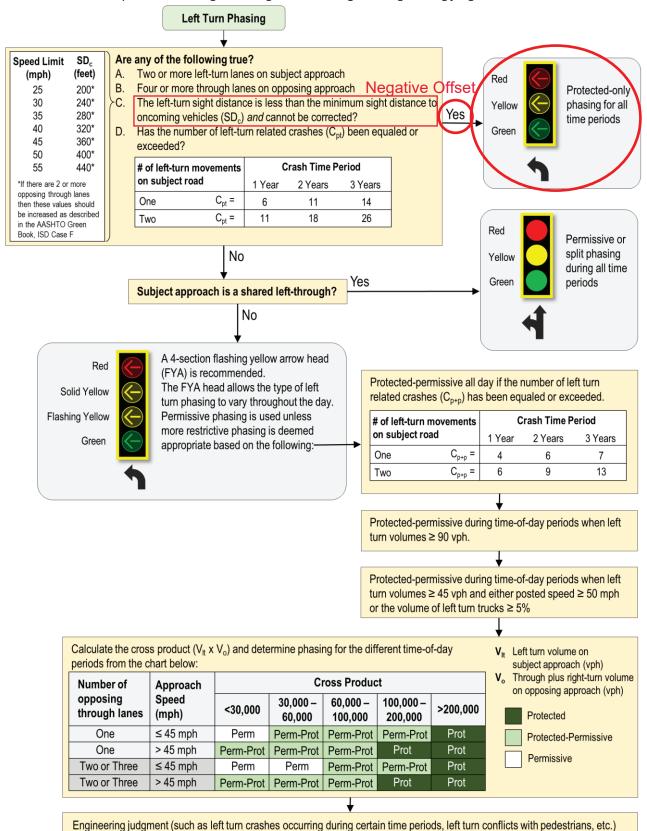
WARRANT 8, ROADWAY NETWORK

		Characteristics of a Major F	Route		Satis	
	street or highway s	system that serves as a principa		through	Yes	No
traffic flow. Rural or sul	burban highway ou	itside of, entering, or traversing	a city.			
Appears as	a major route on a	an official plan.				
		ol signal shall be considered o or more major routes mee	9	•		
Gommon	ntorsection or two	Criteria		ronowing on		sfied No
1. Both of	veh/hr during	ing volume of at least 1,000 typical weekday peak hour.	Entering Volume:		1	
criteria to right are m	the b. Five-year p	projected volumes that satisfy of Warrants 1,2, or 3.	Warrant(s) satisfied:		┤ <u> </u>	
		least 1,000 veh/hr for each of ousiness day (Sat. or Sun.)	Hour	Volume	- 🗆	
Varrant 8 Met?	es No 🗵 Do	pes not apply				
	es No X Do	pes not apply A GRADE CROSSING				
NARRANT 9, INTERSE Requirements: This warrar signal warra	ection NEAR Int is intended for ants are met, but by a STOP or YIE	A GRADE CROSSING use at a location where nor the proximity to the intersec	ction of grade crossin	g on an inte	rsectio	n app
WARRANT 9, INTERSE Requirements: This warrar signal warra controlled b	ection NEAR Int is intended for ants are met, but by a STOP or YIE	A GRADE CROSSING use at a location where nor the proximity to the intersec	ction of grade crossin	g on an inte ling a traffic	rsectionsignal.	n app
NARRANT 9, INTERSE Requirements: This warrar signal warra controlled b Both condition A and cond A. A grade controlled condenses the condens	ection NEAR Int is intended for ants are met, but by a STOP or YIE Ilition B are satisfications.	A GRADE CROSSING use at a location where nor the proximity to the intersect LD sign is the principal reased.	ction of grade crossing on to consider instal	g on an inte ling a traffic	rsectionsignal.	n app
NARRANT 9, INTERSE Requirements: This warrar signal warra controlled b Both condition A and cond A. A grade condition the track in approach. B. During the point represe corresponding direction only 4C-10 for the	et highest traffic voluenting the vehicles per hour, approaching the existing combinate e	A GRADE CROSSING use at a location where nor the proximity to the intersect LD sign is the principal reased. Criteria n approach controlled by a STO	or yield line of the crossing the cotal of both approaches that crosses the track oplicable curve in Figure	g on an inte ling a traffic the center n the plotted e) and the (one e) 4C-9 or	rsectionsignal.	n app



LEFT TURN PHASING

This flowchart was adapted from the Signal Timing Manual along with engineering judgment.

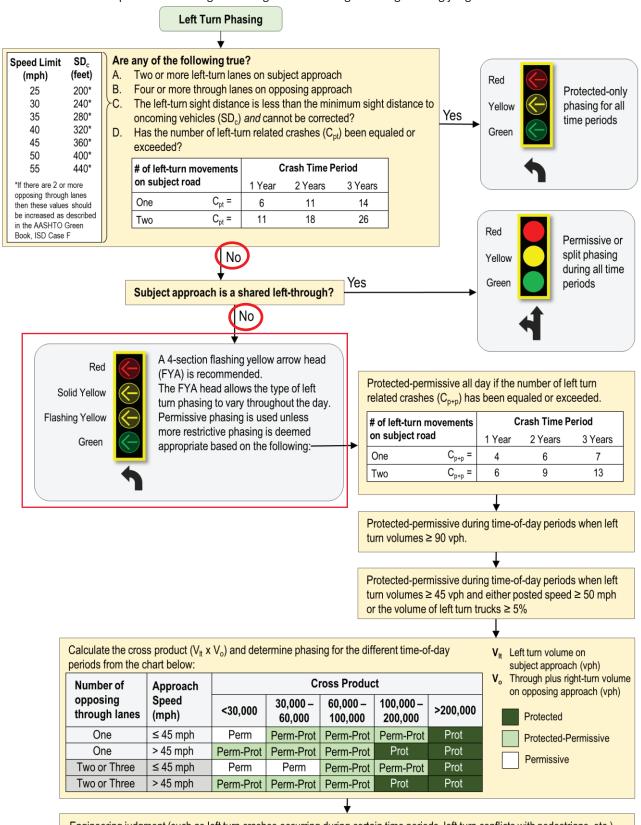


References:

1. TRB, "NCHRP Report 812: Signal Timing Manual, 2nd Edition", 2015

LEFT TURN PHASING

This flowchart was adapted from the Signal Timing Manual along with engineering judgment.



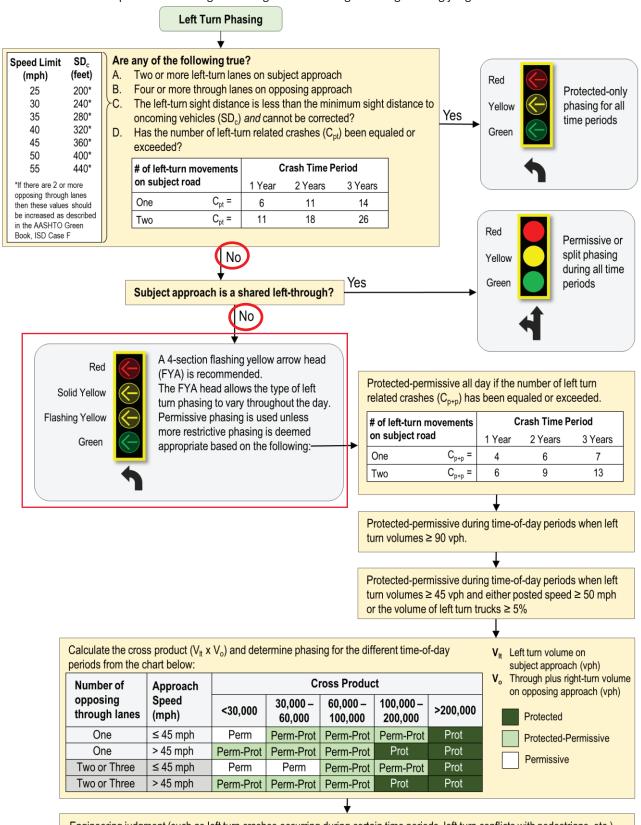
Engineering judgment (such as left turn crashes occurring during certain time periods, left turn conflicts with pedestrians, etc.)

References:

1. TRB, "NCHRP Report 812: Signal Timing Manual, 2nd Edition", 2015

LEFT TURN PHASING

This flowchart was adapted from the Signal Timing Manual along with engineering judgment.



Engineering judgment (such as left turn crashes occurring during certain time periods, left turn conflicts with pedestrians, etc.)

References:

1. TRB, "NCHRP Report 812: Signal Timing Manual, 2nd Edition", 2015

Appendix D – Capacity Analysis Sheets

Existing 2023	
AM Existing Geometry	
PM Existing Geometry	41
<u>Future 2043</u>	
AM Existing Geometry	42
AM Revised Geometry (signalized)	43
AM Staggered-T	44
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AM Roundabout 2x1	50
AM Roundabout 1x1 with Right Turn Lane Drops	51
PM Existing Geometry	
PM Revised Geometry (signalized)	
PM Staggered-T	54
PM Reduced Conflict Intersection	56
PM Roundabout 2x1	60
PM Roundabout 1x1 with Right Turn Lane Drops	61

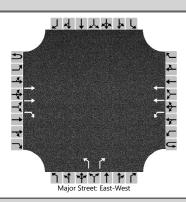
HCS Signalized Intersection Results Summary 1 4 14 4 1 12 14 Intersection Information **General Information** NDDOT Duration, h 0.250 Agency CLH Analyst Analysis Date Oct 13, 2023 Area Type Other PHF 0.86 Jurisdiction Time Period AM Peak 1> 7:00 Urban Street US 2 Analysis Year 2023 **Analysis Period** File Name 2023 AM Peak Ex Geom Signalized.xus Intersection Grand Forks Airport & U... **Project Description** 2023 AM Ex Geom Signalized 下对 个 中下 **Demand Information** EB **WB** NB SB Approach Movement R L R L R L R 442 67 42 3 Demand (v), veh/h 3 309 120 10 193 29 16 0 **Signal Information** والح Cycle, s 54.0 Reference Phase 2 542 Offset, s 0 Reference Point Begin 0.0 Green 0.3 0.5 15.0 11.3 0.0 Uncoordinated Yes Simult. Gap E/W On Yellow 3.0 0.0 0.0 0.0 12.0 3.9 Force Mode Fixed Simult. Gap N/S On Red 3.0 0.0 2.0 3.0 0.0 0.0 **Timer Results EBL EBT WBL WBT** NBL **NBT** SBL SBT **Assigned Phase** 2 6 8 5 1 4 Case Number 2.0 3.0 2.0 3.0 6.0 6.0 Phase Duration, s 29.0 6.8 29.5 18.2 18.2 6.3 6.0 14.0 6.0 14.0 6.9 Change Period, (Y+Rc), s 6.9 Max Allow Headway (MAH), s 4.2 4.2 4.2 4.2 4.3 4.3 Queue Clearance Time (g s), s 2.1 7.9 2.7 10.6 10.3 4.2 Green Extension Time (g_e), s 0.0 4.8 0.0 4.7 1.1 1.1 Phase Call Probability 0.05 1.00 0.16 1.00 0.99 0.99 0.00 0.00 0.00 0.00 0.00 0.00 Max Out Probability NB SB **Movement Group Results** EΒ **WB** Approach Movement L Т R L Т R L Т R L Т R **Assigned Movement** 5 2 12 1 6 16 3 8 18 7 4 14 3 359 70 12 514 43 224 59 19 0 Adjusted Flow Rate (v), veh/h Adjusted Saturation Flow Rate (s), veh/h/ln 1641 1367 1414 900 1406 1460 1379 1611 1354 0 0.1 2.0 0.7 1.2 0.6 0.0 Queue Service Time (g_s), s 5.9 8.6 8.3 1.6 1.2 Cycle Queue Clearance Time (q c), s 0.1 5.9 2.0 0.7 8.6 8.3 1.6 2.2 0.0 0.28 0.29 0.29 0.21 Green Ratio (g/C) 0.00 0.28 0.01 0.21 0.21 Capacity (c), veh/h 8 760 393 13 810 421 354 336 310 Volume-to-Capacity Ratio (X) 0.447 0.473 0.178 0.868 0.634 0.102 0.634 0.176 0.060 0.000 Back of Queue (Q), ft/ln (95 th percentile) Back of Queue (Q), veh/ln (95 th percentile) 0.2 2.6 0.9 8.0 3.9 0.6 4.1 0.9 0.3 0.0 Queue Storage Ratio (RQ) (95 th percentile) 0.02 0.00 0.08 0.08 0.00 0.04 0.54 0.00 0.03 0.00 Uniform Delay (d 1), s/veh 26.8 16.2 14.8 26.5 16.7 14.1 20.2 17.5 18.4 Incremental Delay (d 2), s/veh 35.2 0.5 0.2 80.8 8.0 0.1 1.9 0.2 0.1 0.0 Initial Queue Delay (d 3), s/veh 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Control Delay (d), s/veh 62.0 16.7 15.0 107.4 17.6 14.2 22.1 17.8 18.5 Level of Service (LOS) Ε В В F В В С В В 16.8 В 19.1 В 21.2 С 18.3 Approach Delay, s/veh / LOS В Intersection Delay, s/veh / LOS 18.8 В **Multimodal Results** ΕB WB NB Pedestrian LOS Score / LOS 1.93 В 1.90 В 2.47 2.51 С В Bicycle LOS Score / LOS 0.84 Α 0.96 Α 0.96 Α 0.52 Α

HCS Signalized Intersection Results Summary 1 4 14 4 1 12 14 Intersection Information **General Information** NDDOT Duration, h 0.250 Agency CLH Analyst Analysis Date Oct 13, 2023 Area Type Other PHF 0.94 Jurisdiction Time Period PM Peak 1> 7:00 Urban Street US 2 Analysis Year 2023 **Analysis Period** File Name 2023 PM Peak Ex Geom Signalized.xus Intersection Grand Forks Airport & U... **Project Description** 2023 PM Ex Geom Signalized 下对 个 中下 **Demand Information** EB **WB** NB SB Approach Movement R L R L R L R 339 Demand (v), veh/h 6 439 269 50 72 141 17 25 103 49 8 **Signal Information** والح Cycle, s 56.6 Reference Phase 2 542 Offset, s 0 Reference Point Begin 2.4 0.0 Green 0.5 15.8 11.0 0.0 Uncoordinated Yes Simult. Gap E/W On Yellow 3.0 0.0 0.0 12.0 3.9 0.0 Force Mode Fixed Simult. Gap N/S On Red 3.0 0.0 2.0 3.0 0.0 0.0 **Timer Results EBL EBT WBL WBT** NBL **NBT** SBL SBT **Assigned Phase** 2 6 8 5 1 4 Case Number 2.0 3.0 2.0 3.0 6.0 6.0 Phase Duration, s 6.5 29.8 8.9 32.2 17.9 17.9 6.0 14.0 6.0 14.0 6.9 6.9 Change Period, (Y+Rc), s Max Allow Headway (MAH), s 4.2 4.2 4.2 4.2 4.3 4.3 Queue Clearance Time (g s), s 2.2 10.4 4.9 7.7 9.9 6.6 Green Extension Time (g_e), s 0.0 5.4 0.1 5.4 1.2 1.3 Phase Call Probability 0.10 1.00 0.57 1.00 1.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 Max Out Probability NB SB **Movement Group Results** EΒ **WB** Approach Movement L Т R L Т R L Т R L Т R **Assigned Movement** 5 2 12 1 6 16 3 8 18 7 4 14 6 467 222 53 361 45 150 23 110 61 Adjusted Flow Rate (v), veh/h Adjusted Saturation Flow Rate (s), veh/h/ln 1641 1367 900 1406 1460 1310 1668 1399 1694 1414 0.2 7.6 2.9 5.7 1.2 3.9 1.7 Queue Service Time (g_s), s 8.4 6.1 0.6 1.2 Cycle Queue Clearance Time (q c), s 0.2 8.4 7.6 2.9 5.7 7.9 0.6 4.6 1.7 0.28 0.28 0.20 0.20 0.20 Green Ratio (g/C) 0.01 0.05 0.32 0.32 0.20 Capacity (c), veh/h 14 762 394 46 904 469 279 326 320 331 Volume-to-Capacity Ratio (X) 0.459 0.613 0.564 1.158 0.399 0.095 0.537 0.072 0.342 0.183 Back of Queue (Q), ft/ln (95 th percentile) Back of Queue (Q), veh/ln (95 th percentile) 0.3 3.9 3.7 3.5 2.5 0.6 3.0 0.4 2.0 1.0 Queue Storage Ratio (RQ) (95 th percentile) 0.02 0.00 0.33 0.35 0.00 0.04 0.39 0.00 0.20 0.00 17.5 20.5 Uniform Delay (d 1), s/veh 28.0 17.8 26.9 15.0 13.5 22.3 18.6 19.0 Incremental Delay (d 2), s/veh 21.8 8.0 1.3 111.0 0.3 0.1 1.6 0.1 0.6 0.3 Initial Queue Delay (d 3), s/veh 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Control Delay (d), s/veh 49.8 18.6 18.8 137.9 15.3 13.5 23.9 18.7 21.1 19.3 Level of Service (LOS) D В В F В В С В С В 18.9 В 29.3 С 23.2 С 20.5 С Approach Delay, s/veh / LOS Intersection Delay, s/veh / LOS 22.8 С **Multimodal Results** ΕB WB NB Pedestrian LOS Score / LOS 1.93 В 1.90 В 2.47 2.51 С В Bicycle LOS Score / LOS 1.06 Α 0.87 Α 0.77 Α 0.77 Α

HCS Signalized Intersection Results Summary 1 4 14 4 1 12 14 Intersection Information **General Information** NDDOT Duration, h 0.250 Agency CLH Analyst Analysis Date Oct 13, 2023 Area Type Other PHF 0.86 Jurisdiction Time Period AM Peak **Urban Street** US 2 Analysis Year 2023 **Analysis Period** 1> 7:00 File Name 2043 AM Peak Ex Geom Signalized (NS Prot-Per... Intersection Grand Forks Airport & U... **Project Description** 2043 AM Ex Geom Signalized (NS prot-perm) 7 4 1 4 7 **Demand Information** EB **WB** NB SB Approach Movement R L R L R L R 90 4 Demand (v), veh/h 4 416 162 13 595 260 39 57 22 0 **Signal Information** ٨, Cycle, s 87.5 Reference Phase 2 医小乙 Offset, s 0 Reference Point Begin Green 0.5 1.0 27.1 2.3 8.3 9.4 Uncoordinated Yes Simult. Gap E/W On Yellow 3.0 0.0 12.0 3.0 3.0 3.9 Force Mode Fixed Simult. Gap N/S On Red 3.0 0.0 2.0 3.0 3.0 3.0 **Timer Results EBL EBT WBL WBT** NBL **NBT** SBL SBT **Assigned Phase** 2 6 8 5 1 3 7 4 Case Number 2.0 3.0 2.0 3.0 1.1 4.0 1.1 4.0 Phase Duration, s 41.1 7.5 42.1 22.6 30.6 8.3 16.3 6.5 6.0 14.0 6.0 14.0 6.0 6.9 6.9 Change Period, (Y+Rc), s 6.0 Max Allow Headway (MAH), s 4.2 4.2 4.2 4.2 3.2 4.3 3.2 4.3 Queue Clearance Time (g s), s 2.2 15.0 3.5 21.4 16.3 5.7 3.0 2.2 Green Extension Time (g_e), s 0.0 7.0 0.0 6.6 0.2 0.3 0.0 0.3 Phase Call Probability 0.11 1.00 0.31 1.00 1.00 1.00 0.46 0.94 0.00 0.03 0.00 0.07 0.71 0.00 0.00 0.00 Max Out Probability **Movement Group Results** EΒ **WB** NB SB Approach Movement L Т R L Т R L Т R L Т R **Assigned Movement** 5 2 12 1 6 16 3 8 18 7 4 14 5 484 119 15 692 70 302 88 26 0 Adjusted Flow Rate (v), veh/h Adjusted Saturation Flow Rate (s), veh/h/ln 1641 1367 1414 900 1406 1460 1602 1596 1654 0 0.2 13.0 19.4 2.9 1.0 0.0 Queue Service Time (g_s), s 4.0 1.5 14.3 3.7 Cycle Queue Clearance Time (q c), s 0.2 13.0 4.0 1.5 19.4 2.9 14.3 3.7 1.0 0.0 0.50 0.02 0.32 Green Ratio (g/C) 0.01 0.31 0.35 0.30 0.27 0.30 Capacity (c), veh/h 10 846 705 16 902 507 490 432 386 Volume-to-Capacity Ratio (X) 0.461 0.572 0.168 0.953 0.767 0.138 0.617 0.204 0.066 0.000 Back of Queue (Q), ft/ln (95 th percentile) Back of Queue (Q), veh/ln (95 th percentile) 0.3 6.9 1.9 1.3 9.9 1.6 8.7 2.4 0.6 0.0 Queue Storage Ratio (RQ) (95 th percentile) 0.03 0.00 0.17 0.13 0.00 0.11 0.45 0.00 0.06 0.00 Uniform Delay (d 1), s/veh 43.4 25.4 12.0 43.0 26.8 19.6 26.7 24.7 22.0 Incremental Delay (d 2), s/veh 29.5 0.6 0.1 92.5 1.4 0.1 1.0 0.2 0.0 0.0 Initial Queue Delay (d 3), s/veh 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Control Delay (d), s/veh 72.9 26.0 12.1 135.4 28.2 19.7 27.6 24.9 22.1 Level of Service (LOS) Ε С В F С В С С С 23.6 С 29.5 С 27.0 С 24.1 С Approach Delay, s/veh / LOS Intersection Delay, s/veh / LOS 26.9 С **Multimodal Results** ΕB WB NB Pedestrian LOS Score / LOS 1.95 В 1.92 В 2.48 2.54 С В Bicycle LOS Score / LOS 0.99 Α 1.13 Α 1.13 Α 0.54 Α

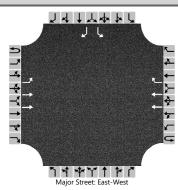
HCS Signalized Intersection Results Summary 1 4 14 4 1 12 14 Intersection Information **General Information** NDDOT Duration, h 0.250 Agency CLH Analyst Analysis Date Oct 13, 2023 Area Type Other PHF 0.86 Jurisdiction Time Period AM Peak 1> 7:00 **Urban Street** US 2 Analysis Year 2023 **Analysis Period** File Name 2043 AM Peak Rev Geom Signalized.xus Intersection Grand Forks Airport & U... **Project Description** 2043 AM Rev Geom Signalized **Demand Information** EB **WB** NB SB Approach Movement R L R L R R 90 4 Demand (v), veh/h 4 416 162 13 595 260 39 57 22 0 **Signal Information** Д., Cycle, s 96.0 Reference Phase 2 \mathbb{S} \mathbb{A} \mathbb{Z} Offset, s 0 Reference Point Begin Green 0.6 1.1 28.9 2.5 8.8 15.2 Uncoordinated Yes Simult. Gap E/W On Yellow 3.0 0.0 3.0 3.0 12.0 3.9 Force Mode Fixed Simult. Gap N/S On Red 3.0 0.0 2.0 3.0 3.0 3.0 **Timer Results EBL EBT WBL WBT** NBL **NBT** SBL SBT **Assigned Phase** 2 6 8 5 1 3 7 4 Case Number 1.1 3.0 1.1 3.0 1.1 4.0 1.1 4.0 Phase Duration, s 6.6 42.9 7.7 44.0 23.3 36.9 8.5 22.1 6.0 14.0 6.0 14.0 6.0 6.9 6.9 Change Period, (Y+Rc), s 6.0 Max Allow Headway (MAH), s 3.2 4.2 3.2 4.2 3.2 4.3 3.2 4.3 Queue Clearance Time (g s), s 2.2 16.4 3.1 23.5 16.8 32.0 3.0 2.2 Green Extension Time (g_e), s 0.0 7.0 0.0 6.5 0.5 0.0 0.0 0.3 Phase Call Probability 0.12 1.00 0.33 1.00 1.00 1.00 0.49 0.96 0.00 0.04 0.00 0.00 1.00 0.00 0.00 Max Out Probability 0.10 **Movement Group Results** EΒ WB NB SB Approach Movement L Т R L Т R L Т R L Т R **Assigned Movement** 5 2 12 1 6 16 3 8 18 7 4 14 5 484 119 15 692 70 302 88 26 0 Adjusted Flow Rate (v), veh/h 1414 Adjusted Saturation Flow Rate (s), veh/h/ln 1641 1367 900 1602 1596 1654 0 1406 1460 0.2 14.4 1.1 21.5 3.2 1.0 0.0 Queue Service Time (g_s), s 4.6 14.8 3.9 Cycle Queue Clearance Time (q c), s 0.2 14.4 4.6 1.1 21.5 3.2 14.8 3.9 1.0 0.0 0.30 0.32 0.32 0.48 0.31 0.34 0.34 0.31 0.34 Green Ratio (g/C) 114 Capacity (c), veh/h 824 681 129 879 494 541 499 80 Volume-to-Capacity Ratio (X) 0.041 0.587 0.174 0.117 0.787 0.141 0.559 0.177 0.319 0.000 Back of Queue (Q), ft/ln (95 th percentile) Back of Queue (Q), veh/ln (95 th percentile) 0.1 7.8 2.3 0.4 11.1 1.8 8.8 2.4 0.7 0.0 Queue Storage Ratio (RQ) (95 th percentile) 0.01 0.00 0.20 0.04 0.00 0.12 0.46 0.00 0.07 0.00 Uniform Delay (d 1), s/veh 24.8 28.4 14.1 23.8 30.1 22.1 25.9 24.0 26.0 Incremental Delay (d 2), s/veh 0.1 0.7 0.1 0.1 1.9 0.1 0.3 0.2 8.0 0.0 Initial Queue Delay (d 3), s/veh 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Control Delay (d), s/veh 24.8 29.1 14.2 23.9 32.0 22.2 26.2 24.2 26.9 Level of Service (LOS) С С В С С С С С С 26.2 С 30.9 С 25.8 С 28.0 С Approach Delay, s/veh / LOS Intersection Delay, s/veh / LOS 28.2 С **Multimodal Results** ΕB WB NB Pedestrian LOS Score / LOS 1.95 В 1.92 В 2.48 2.54 С В Bicycle LOS Score / LOS 0.99 Α 1.13 Α 1.13 Α 0.54 Α

HCS Two-Way Stop-Control Report											
General Information		Site Information									
Analyst	CLH	Intersection	US 2 & Grand Forks Airport								
Agency/Co.	NDDOT	Jurisdiction									
Date Performed	10/26/2023	East/West Street	US 2								
Analysis Year	2043	North/South Street	Grand Forks Airport								
Time Analyzed	AM Peak	Peak Hour Factor	0.86								
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25								
Project Description	2043 AM Offset Tee, West Intersection										



Vehicle Volumes and Adj	ustme	tments															
Approach		Eastk	ound			Westl	oound			North	bound			South	bound		
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R	
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12	
Number of Lanes	0	0	2	1	0	1	2	0		1	0	1		0	0	0	
Configuration			Т	R		L	Т			L		R					
Volume (veh/h)			420	162	0	18	0			260		96					
Percent Heavy Vehicles (%)					0	59				5		60					
Proportion Time Blocked																	
Percent Grade (%))						
Right Turn Channelized		N	lo							Ν	lo						
Median Type Storage				Undi	vided												
Critical and Follow-up He	eadwa	ys															
Base Critical Headway (sec)						4.1				7.5		6.9					
Critical Headway (sec)						5.28				6.90		8.10					
Base Follow-Up Headway (sec)						2.2				3.5		3.3					
Follow-Up Headway (sec)						2.79				3.55		3.90					
Delay, Queue Length, and	d Leve	l of S	ervice														
Flow Rate, v (veh/h)						21				302		112					
Capacity, c (veh/h)						615				455		606					
v/c Ratio						0.03				0.66		0.18					
95% Queue Length, Q ₉₅ (veh)						0.1				4.8		0.7					
Control Delay (s/veh)						11.1				27.2		12.3					
Level of Service (LOS)					В			D B									
Approach Delay (s/veh)		11.1								23	3.2						
Approach LOS							3			(C						

HCS Two-Way Stop-Control Report										
General Information		Site Information								
Analyst	CLH	Intersection	US 2 & Grand Forks Airport							
Agency/Co.	NDDOT	Jurisdiction								
Date Performed	10/26/2023	East/West Street	US 2							
Analysis Year	2043	North/South Street	Grand Forks Airport							
Time Analyzed	AM Peak	Peak Hour Factor	0.86							
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25							
Project Description	2043 AM Offset Tee, East Intersection									

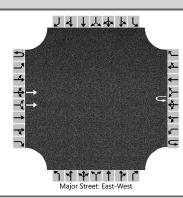


Vehicle Volumes and Adj	justme	nts															
Approach		Eastk	bound			West	bound			North	bound			South	bound		
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R	
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12	
Number of Lanes	0	1	2	0	0	0	2	1		0	0	0		1	0	1	
Configuration		L	Т				Т	R						L		R	
Volume (veh/h)	0	43	0				609	90						22		4	
Percent Heavy Vehicles (%)	0	2												1		6	
Proportion Time Blocked																	
Percent Grade (%)														(0		
Right Turn Channelized						N	Vo							N	10		
Median Type Storage				Undi	ivided												
Critical and Follow-up H	eadwa	ys															
Base Critical Headway (sec)	T	4.1												7.5		6.9	
Critical Headway (sec)		4.14												6.82		7.0	
Base Follow-Up Headway (sec)		2.2												3.5		3.3	
Follow-Up Headway (sec)		2.22												3.51		3.3	
Delay, Queue Length, an	d Leve	l of S	ervice	,													
Flow Rate, v (veh/h)	T	50												26		5	
Capacity, c (veh/h)		810												301		63	
v/c Ratio		0.06												0.09		0.0	
95% Queue Length, Q ₉₅ (veh)		0.2												0.3		0.0	
Control Delay (s/veh)		9.7												18.1		10.	
Level of Service (LOS)		А											С		В		
Approach Delay (s/veh)	T	9	9.7										16.9				
Approach LOS			Α										С				

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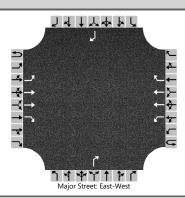
Intersection One (Ro) Color Col				HCS	Alte	rnativ	e Inte	rsecti	ions I	Resul	ts Su	mmar	У								
Agency																					
Agency		formation									Alt	ernati	ve Inte	ersect	ion Inf	ormat	tion				
Analyst			NDDOT								_							TWSC			
Duration						An	alvsis l	Date	10/27	7/2023					e. ft						
Intersection)	5 2			_			_	,	_										
Main Intersection File			US 2 & Grand F	orks A	virport	_									,		West				
West Crossover File 2043 AM RCI, West U-Turn.xtw									0.00		7 4.1	orial B				Lact	11001				
East Crossover File																					
Project Description 2043 AM RCI, Main Intersection																					
Demand																					
Intersection One Demand (v), veh/h	roject Bet	oonpaon	20 107 (11 1101, 11		10100	THO I															
Intersection One Demand (v), veh/h	Domand			EDII	EDI	EDT	EDD	WDII	WDI	WDT	WDD	NDII	NDI	NDT	NIDD	CDII	CDI	CDT	SBF		
Intersection Two Demand (v), veh/h 0 4 438 166 0 13 855 129 356		- O D	- d (, ,) , , , , b / b	EBU	EBL		EBK		WBL	WBI	WBR	NBU	NBL	INDI	NBK	280	SBL	SBI	SBR		
Company Comp			, ,	0	4		400		40	055	400				250				200		
(1) West Crossover (2) Main Intersection (3) East Crossover (4) Major Street East West (5) Major Street East West (6) Major Street East West (7) Major Street East West (8) East West (8) East West (9) Major Street East West (9			, ,		4	438	100	U	13		129				350				26		
Queue-to-Storage Ratio EBU EBL EBT EBR WBU WBL WBL NBL NBT NBR SBU SBL SB Intersection One (Ra) 0.00 0.01 0.	miersection	n Three Dema	and (v), ven/n	299						699											
Queue-to-Storage Ratio EBU EBL EBT EBR WBU WBT WBR NBU NBL NBT NBR SBU SBL SB Intersection One (Ro.) 0.00 0.01 0.																					
Color Colo		(1) West C	rossover	(2) Main Intersection										(3) East	Cross	over				
Alternative Intesection Results O-D O-D Movements Flow Rate (veh/h) Control Delay (s/veh) EDTT (s/veh) ETT (s/veh) V/c>1? Ro>1 EBL EBL(2) 3 11.0 11.0 No No EBT EBR(2) 359 0.0 0.0 EBR EBR(2) 140 0.0 0.0 WBL WBL(2) 12 11.2 11.2 No No WBT WBT(2) 514 0.0 0.0 WBR WBR(2) 78 0.0 0.0 NBL NBR(2) + EBU(3) + WBT(2) 224 32.1 17.7 49.8 No No NBT NBR(2) + EBU(3) + WBR(2) 34 32.1 17.7 49.8 No No NBR NBR(2) + BU(3) + WBR(2) 49 16.0 16.0 No No SBL SBR(2) + WBU(1) + EBT(2) 19 22.3 17.7 40.0 No No SBT SBR(2) + WBU(1) + EBR(2) 3 22.3 17.7 40.0 No No	11447177		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			1744717 1744717				, t t t	<u> </u>		114471	a a				11111111111			
O-D O-D Movements Flow Rate (veh/h) Control Delay (s/veh) EDTT (s/veh) V/c>1? Ro>1 EBL EBL(2) 3 11.0 11.0 No No EBT EBT(2) 359 0.0 0.0 EBR EBR(2) 140 0.0 0.0 WBL WBL(2) 12 11.2 11.2 No No WBR WBT(2) 514 0.0 0.0 WBR WBR(2) 78 0.0 0.0 NBL NBR(2) + EBU(3) + WBT(2) 224 32.1 17.7 49.8 No No NBR NBR(2) + EBU(3) + WBR(2) 34 32.1 17.7 49.8 No No NBR NBR(2) 49 16.0 16.0 No No SBL SBR(2) + WBU(1) + EBT(2) 3	Intersection	Storage Rati n One (Ro)		EBU		EBT	Majo	wBU	WBL	WBT	WBR	NBU	NBL	NBT	Major Stre			SBT	SBF		
O-D O-D Movements Flow Rate (veh/h) Control Delay (s/veh) EDTT (s/veh) V/c>1? Ro>1 EBL EBL(2) 3 11.0 11.0 No No EBT EBT(2) 359 0.0 0.0 EBR EBR(2) 140 0.0 0.0 WBL WBL(2) 12 11.2 11.2 No No WBR WBT(2) 514 0.0 0.0 WBR WBR(2) 78 0.0 0.0 NBL NBR(2) + EBU(3) + WBT(2) 224 32.1 17.7 49.8 No No NBT NBR(2) + EBU(3) + WBR(2) 34 32.1 17.7 49.8 No No NBR NBR(2) 49 16.0 16.0 No No SBL SBR(2) + WBU(1) + EBT(2) 3	Intersectior Intersectior	Storage Rati n One (Ra) n Two (Ra)				EBT	Majo	wBU	WBL	WBT	WBR	NBU	NBL	NBT	Major Stre			SBT	SBR		
O-D O-D Movements Flow Rate (veh/h) Control Delay (s/veh) EDTT (s/veh) V/c>1? Ro>1 EBL EBL(2) 3 11.0 11.0 No No EBT EBT(2) 359 0.0 0.0 EBR EBR(2) 140 0.0 0.0 WBL WBL(2) 12 11.2 11.2 No No WBR WBT(2) 514 0.0 0.0 WBR WBR(2) 78 0.0 0.0 NBL NBR(2) + EBU(3) + WBT(2) 224 32.1 17.7 49.8 No No NBT NBR(2) + EBU(3) + WBR(2) 34 32.1 17.7 49.8 No No NBR NBR(2) 49 16.0 16.0 No No SBL SBR(2) + WBU(1) + EBT(2) 3	Intersectior Intersectior	Storage Rati n One (Ra) n Two (Ra)				EBT	Majo	wBU	WBL	WBT	WBR	NBU	NBL	NBT	Major Stre			SBT	SBF		
EBT EBT(2) 359 0.0 0.0 EBR EBR(2) 140 0.0 0.0 WBL WBL(2) 12 11.2 11.2 No No WBT WBT(2) 514 0.0 0.0 WBR WBR(2) 78 0.0 0.0 NBL NBR(2) + EBU(3) + WBT(2) 224 32.1 17.7 49.8 No No NBT NBR(2) + EBU(3) + WBR(2) 34 32.1 17.7 49.8 No No NBR NBR(2) 49 16.0 16.0 No No SBL SBR(2) + WBU(1) + EBT(2) 19 22.3 17.7 40.0 No No SBT SBR(2) + WBU(1) + EBR(2) 3 22.3 17.7 40.0 No No	Intersectior Intersectior Intersectior	Storage Rati n One (Ra) n Two (Ra) n Three (Ra)	0			EBT	Majo	wBU	WBL	WBT	WBR	NBU	NBL	NBT	Major Stre			SBT	SBR		
EBT EBT(2) 359 0.0 0.0 EBR EBR(2) 140 0.0 0.0 WBL WBL(2) 12 11.2 11.2 No No WBT WBT(2) 514 0.0 0.0 WBR WBR(2) 78 0.0 0.0 NBL NBR(2) + EBU(3) + WBT(2) 224 32.1 17.7 49.8 No No NBT NBR(2) + EBU(3) + WBR(2) 34 32.1 17.7 49.8 No No NBR NBR(2) 49 16.0 16.0 No No SBL SBR(2) + WBU(1) + EBT(2) 19 22.3 17.7 40.0 No No SBT SBR(2) + WBU(1) + EBR(2) 3 22.3 17.7 40.0 No No	Intersection Intersection Intersection Alternative	Storage Ratin One (Ra)n Two (Ra)n Three (Ra)	o Results		0.00		EBR	WBU	WBL 0.01						NBR	SBU	SBL	SBT			
EBR EBR(2) 140 0.0 0.0 WBL WBL(2) 12 11.2 11.2 No No WBT WBT(2) 514 0.0 0.0 WBR WBR(2) 78 0.0 0.0 NBL NBR(2) + EBU(3) + WBT(2) 224 32.1 17.7 49.8 No No NBT NBR(2) + EBU(3) + WBR(2) 34 32.1 17.7 49.8 No No NBR NBR(2) 49 16.0 16.0 No No SBL SBR(2) + WBU(1) + EBT(2) 19 22.3 17.7 40.0 No No SBT SBR(2) + WBU(1) + EBR(2) 3 22.3 17.7 40.0 No No	Intersection Intersection Intersection Alternative O-D	Storage Ratin One (Ra)n Two (Ra)n Three (Ra)	Results Movements		0.00	Rate (EBR	WBU	WBL 0.01	ay (s/v		EDTT (s	s/veh)	ETT	NBR	SBU	SBL		SBR		
WBL WBL(2) 12 11.2 11.2 No No WBT WBT(2) 514 0.0 0.0 No	Intersection Intersection Intersection Intersection Alternative O-D EBL	Storage Ratin One (Ra)n Two (Ra)n Three (Ra)	Results Movements EBL(2)		0.00	Rate (EBR	WBU	0.01 rol Del 11.	ay (s/v		EDTT (\$	s/veh)	ETT 1	NBR (s/veh	SBU) V/c2	SBL	R _Q >1?	LOS		
WBT WBT(2) 514 0.0 0.0 WBR WBR(2) 78 0.0 0.0 NBL NBR(2) + EBU(3) + WBT(2) 224 32.1 17.7 49.8 No No NBT NBR(2) + EBU(3) + WBR(2) 34 32.1 17.7 49.8 No No NBR NBR(2) 49 16.0 16.0 No No SBL SBR(2) + WBU(1) + EBT(2) 19 22.3 17.7 40.0 No No SBT SBR(2) + WBU(1) + EBR(2) 3 22.3 17.7 40.0 No No	Intersection Intersection Intersection Alternative O-D EBL EBT	Storage Ratin One (Ra)n Two (Ra)n Three (Ra)	Results Movements EBL(2) EBT(2)		0.00	Rate (3 359	EBR	WBU	0.01 rol Del 11. 0.0	ay (s/v 0		EDTT (:	s/veh)	ETT 1	NBR (s/veh	SBU) V/c	SBL >1?	Ra>1? No	LOS B		
WBR WBR(2) 78 0.0 0.0 NBL NBR(2) + EBU(3) + WBT(2) 224 32.1 17.7 49.8 No No NBT NBR(2) + EBU(3) + WBR(2) 34 32.1 17.7 49.8 No No NBR NBR(2) 49 16.0 16.0 No No SBL SBR(2) + WBU(1) + EBT(2) 19 22.3 17.7 40.0 No No SBT SBR(2) + WBU(1) + EBR(2) 3 22.3 17.7 40.0 No No	Intersection Intersection Intersection Alternative O-D EBL EBT EBR	Storage Ratin One (Ra)n Two (Ra)n Three (Ra)	Results Movements EBL(2) EBT(2) EBR(2)		0.00	Rate (13 3 359 140	EBR	WBU	0.01 rol Del 11. 0.0	ay (s/v 0)		EDTT (:	s/veh)	ETT 1	NBR (s/veh 11.0 0.0	SBU) V/cx N	SBL	Ra>1? No	LOS B A		
NBL NBR(2) + EBU(3) + WBT(2) 224 32.1 17.7 49.8 No No NBT NBR(2) + EBU(3) + WBR(2) 34 32.1 17.7 49.8 No No NBR NBR(2) 49 16.0 16.0 No No SBL SBR(2) + WBU(1) + EBT(2) 19 22.3 17.7 40.0 No No SBT SBR(2) + WBU(1) + EBR(2) 3 22.3 17.7 40.0 No No	Intersection Intersection Intersection Intersection Alternative O-D EBL EBT EBR WBL	Storage Ration One (Ra) n Two (Ra) n Three (Ra) e Intesection	Results Movements EBL(2) EBT(2) EBR(2) WBL(2)		0.00	Rate (3 359 140	EBR	WBU	0.01 rol Del 11. 0.0 11.	ay (s/v 0)		EDTT (%	s/veh)	ETT 1 () () () 1	(s/veh 11.0 0.0 0.1 11.2) V/c> N	>1? 0 -	Ra>1? No No	LOS B A		
NBT NBR(2) + EBU(3) + WBR(2) 34 32.1 17.7 49.8 No No NBR NBR(2) 49 16.0 16.0 No No SBL SBR(2) + WBU(1) + EBT(2) 19 22.3 17.7 40.0 No No SBT SBR(2) + WBU(1) + EBR(2) 3 22.3 17.7 40.0 No No	Intersection Intersection Intersection Intersection Alternative O-D EBL EBT EBR WBL WBL	Storage Rati n One (Ra) n Two (Ra) n Three (Ra) e Intesection O-D	Results Movements EBL(2) EBT(2) EBR(2) WBL(2) WBL(2)		0.00	Rate (*3 359 140 12 514	EBR	WBU	WBL 0.01 rol Del 11. 0.0 11.	ay (s/v 0 0))		EDTT (s	s/veh)	ETT 1 (((((((((((((((((((s/veh 1.0 0.0 1.2 0.0) V/c2 N N	>1?	R _Q >1? No No	LOS B A A B		
NBR NBR(2) 49 16.0 16.0 No No SBL SBR(2) + WBU(1) + EBT(2) 19 22.3 17.7 40.0 No No SBT SBR(2) + WBU(1) + EBR(2) 3 22.3 17.7 40.0 No No	Intersection Intersection Intersection Intersection Alternative O-D EBL EBT EBR WBL WBL WBT WBR	Storage Ratin One (Ra) In Two (Ra) In Three (Ra) In Three (Ra) In Three O-D	Results Movements EBL(2) EBT(2) EBR(2) WBL(2) WBL(2) WBT(2) WBR(2)	0.16	0.00	Rate (*3 359 140 12 514 78	EBR	WBU	0.01 rol Del 11. 0.0 11. 0.0 0.0	ay (s/v 0 0))		EDTT (:	s/veh)	ETT 1 () () () () () () () () () ((s/veh 1.0 0.0 1.2 0.0 0.0) V/c2 N N	>1? 	R _Q >1? No No	LOS B A A B		
SBL SBR(2) + WBU(1) + EBT(2) 19 22.3 17.7 40.0 No No SBT SBR(2) + WBU(1) + EBR(2) 3 22.3 17.7 40.0 No No	Intersection Intersection Intersection Intersection Intersection Alternative O-D EBL EBT EBR WBL WBL WBT WBR NBL	Storage Ration One (Ra) In Two (Ra) In Three (Ra) e Intesection O-D NBR(2) +	Results Movements EBL(2) EBT(2) EBR(2) WBL(2) WBL(2) WBT(2) WBR(2) EBU(3) + WBT(2)	0.16	0.00	Rate (*3 359 140 12 514 78 224	EBR	WBU	0.01 rol Del 11. 0.0 11. 0.0 32.	ay (s/v 0)) 2)		EDTT (\$ 17.	s/veh)	ETT 1 (((((((((((((((((((s/veh 1.0 0.0 1.2 0.0 0.0 49.8) V/c> N N N	>1? 00	Rq>1? No No 	LOS B A A B A		
SBT SBR(2) + WBU(1) + EBR(2) 3 22.3 17.7 40.0 No No	Intersection Inter	Storage Ration One (Ra) In Two (Ra) In Three (Ra) e Intesection O-D NBR(2) +	Results Movements EBL(2) EBT(2) EBR(2) WBL(2) WBL(2) WBR(2) EBU(3) + WBT(2) EBU(3) + WBR(2)	0.16	0.00	Rate (** 3 359 140 12 514 78 224 34	EBR	WBU	0.01 rol Del 11. 0.0 11. 0.0 32.	ay (s/v 0 0 0 2 0 0 1		EDTT (\$ 17.	s/veh) 7 7	ETT 1 ((((4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	(s/veh 1.0 0.0 0.0 1.2 0.0 0.0 9.8	SBU) V/c> N N N N N N	>1? 00 00 00 00 00 00	Ra>1? No No No	LOS B A A B A A		
	Intersection Intersection Intersection Intersection Intersection Alternative O-D EBL EBT EBR WBL WBT WBR NBL NBT NBR	Storage Ration One (Ra) In Two (Ra) In Three	Results Movements EBL(2) EBT(2) EBR(2) WBL(2) WBL(2) WBR(2) EBU(3) + WBT(2 EBU(3) + WBR(2 NBR(2)	0.16	0.00	Rate (13 359 140 12 514 78 224 34 49	EBR	WBU	0.01 rol Del 11. 0.0 11. 0.0 32. 32. 16.	ay (s/v 0 0 0 0 1 1 0		EDTT (s	7 7	ETT 1 (((((((((((((((((((s/veh 1.0 0.0 0.0 1.2 0.0 0.0 19.8 19.8 6.0) V/c2 N N	>1?	Ro>1? No No No No No	LOS B A A B A D		
	Intersection Intersection Intersection Intersection Alternative O-D EBL EBT EBR WBL WBT WBR NBL NBT NBR NBL NBT NBR SBL	Storage Ration One (Ra) In Two (Ra) In Three (Ra) e Intesection O-D NBR(2) + NBR(2) + SBR(2) +	Results Movements EBL(2) EBT(2) EBR(2) WBL(2) WBL(2) WBR(2) EBU(3) + WBT(2 EBU(3) + WBR(2 NBR(2) NBR(2) WBU(1) + EBT(2	0.16	0.00	Rate (1 3 359 140 12 514 78 224 34 49 19	EBR	WBU	0.01 rol Del 11. 0.0 11. 0.0 32. 32. 16. 22.	ay (s/v 0 0 0 0 1 1 0 3		EDTT (\$ 17. 17.	7 7	ETT 1 (((((((((((((((((((s/veh 1.0 0.0 0.0 0.0 9.8 9.8 6.0 0.0	SBU V/cx N N N N N N N	>1? 00 00 00 00 00 00	R _Q >1? No No No No No	LOS B A A B A D D		
	Intersection Inter	Storage Ration One (Ra) In Two (Ra) In Three (Ra) e Intesection O-D NBR(2) + NBR(2) + SBR(2) +	Results Movements EBL(2) EBT(2) EBR(2) WBL(2) WBT(2) WBR(2) EBU(3) + WBT(2 EBU(3) + WBR(2) EBU(3) + WBR(2 WBR(2) WBU(1) + EBT(2 WBU(1) + EBR(2)	0.16	0.00	Rate (** 3 359 140 12 514 78 224 34 49 19 3	EBR	WBU	0.01 rol Del 11. 0.0 11. 0.0 32. 32. 16. 22.	ay (s/v 0 0 0 0 1 1 0 3		EDTT (\$ 17. 17.	7 7	ETT 1 (((((((((((((((((((s/veh 1.0 0.0 0.0 0.0 9.8 9.8 6.0 0.0) V/c2 N N N N N N N N N	>1? 00 -	Ra>1? No No No No No No	LOS B A A B A D D B		
Overall Results EB WB NB SB	Intersection Inter	Storage Ration One (Ra) In Two (Ra) In Three (Ra) e Intesection O-D NBR(2) + NBR(2) + SBR(2) +	Results Movements EBL(2) EBT(2) EBR(2) WBL(2) WBT(2) WBR(2) EBU(3) + WBT(2 EBU(3) + WBR(2) EBU(3) + WBR(2 WBR(2) WBU(1) + EBT(2 WBU(1) + EBR(2)	0.16	0.00	Rate (** 3 359 140 12 514 78 224 34 49 19 3	EBR	WBU	0.01 rol Del 11. 0.0 11. 0.0 32. 32. 16. 22.	ay (s/v 0 0 0 0 1 1 0 3		EDTT (\$ 17. 17.	7 7	ETT 1 (((((((((((((((((((s/veh 1.0 0.0 0.0 0.0 9.8 9.8 6.0 0.0) V/c2 N N N N N N N N N	>1? 00 -	RQ>1? NO NO NO NO NO NO NO	LOS B A A B A D D B D		
Approach ETT, s/veh LOS	Intersection Inter	Storage Ration One (Ra) In Two (Ra) In Three	Results Movements EBL(2) EBT(2) EBR(2) WBL(2) WBT(2) WBR(2) EBU(3) + WBT(2 EBU(3) + WBR(2) EBU(3) + WBR(2 WBR(2) WBU(1) + EBT(2 WBU(1) + EBR(2)	0.16	Flow I	Rate (** 3 359 140 12 514 78 224 34 49 19 3 0	EBR	WBU	0.01 rol Del 11. 0.0 11. 0.0 32. 32. 16. 22.	ay (s/v 0 0 0 0 1 1 0 3 3		EDTT (\$ 17. 17.	7 7 7	ETT 1 (((((((((((((((((((s/veh 1.0 0.0 0.0 0.0 9.8 9.8 6.0 0.0) V/c2 N N N N N N N N N	>1? 0 0 0 0 0 0 0 0	Ra>1? No No No No No No No No	LOS B A A B A D D B D		
Intersection ETT, s/veh LOS 10.2 B	Intersection Inter	Storage Ration One (Ra) in Two (Ra) in Three (Ra) in Three (Ra) in Three (Da) in Three	Results Movements EBL(2) EBT(2) EBR(2) WBL(2) WBT(2) WBR(2) EBU(3) + WBT(2 EBU(3) + WBR(2) EBU(3) + WBR(2 WBU(1) + EBT(2 WBU(1) + EBR(2 SBR(2)	2) 2) 2)	Flow I	Rate (** 3 359 140 12 514 78 224 34 49 19 3 0	EBR	WBU 0.01 Contr	0.01 rol Del 11. 0.0 11. 0.0 32. 32. 16. 22.	ay (s/v 0 0 0 0 1 1 0 3 3	reh) E	EDTT (\$\frac{1}{2} \\ \frac{1}{2} \\	7 7 7	ETT 1 () () () () () () () () () ((s/veh 11.0 0.0 0.0 0.0 19.8 19.8 19.8 10.0) V/c2 N N N N N N N N N	SBL	Ra>1? No	LOS B A A B A D D B D		

	HCS Two-Way Stop	op-Control Report							
General Information		Site Information							
Analyst	CLH	Intersection	US 2 & Grand Forks Airport						
Agency/Co.	NDDOT	Jurisdiction							
Date Performed	10/27/2023	East/West Street	US 2						
Analysis Year	2043	North/South Street	Grand Forks Airport						
Time Analyzed	AM Peak	Peak Hour Factor	0.86						
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25						
Project Description	2043 AM RCI, West U-Turn								



Approach	Т	Fac+h	ound			Westk	nound			North	bound		Southbound				
Movement	U	L	T	R	U	L	Т	R	U	L	Т	R	U	L	Т	R	
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12	
Number of Lanes	0	0	2	0	1	0	0	0		0	0	0		0	0	0	
Configuration			Т		U											<u> </u>	
Volume (veh/h)			582		26												
Percent Heavy Vehicles (%)					4												
Proportion Time Blocked																	
Percent Grade (%)																	
Right Turn Channelized																	
Median Type Storage				Undi	vided												
Critical and Follow-up Ho	eadwa	ys															
Base Critical Headway (sec)					4.3												
Critical Headway (sec)					4.42												
Base Follow-Up Headway (sec)					2.6												
Follow-Up Headway (sec)					2.61												
Delay, Queue Length, an	d Leve	l of S	ervice														
Flow Rate, v (veh/h)					30												
Capacity, c (veh/h)					760												
v/c Ratio					0.04												
95% Queue Length, Q ₉₅ (veh)					0.1												
Control Delay (s/veh)					9.9												
Level of Service (LOS)					A												
Approach Delay (s/veh)						9.9											
Approach LOS	1						4										

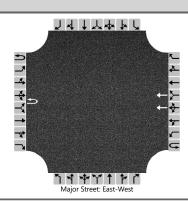
	HCS Two-Way Stop	-Control Report	
General Information		Site Information	
Analyst	CLH	Intersection	US 2 & Grand Forks Airport
Agency/Co.	NDDOT	Jurisdiction	
Date Performed	10/27/2023	East/West Street	US 2
Analysis Year	2043	North/South Street	Grand Forks Airport
Time Analyzed	AM Peak	Peak Hour Factor	0.86
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	2043 AM RCI, Main Intersection		



ıstme	stments														
		ound		Ι	Westh	oound			North	bound			South	bound	
U		1	R	U			R	U			R	U			R
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)				0	
	N	lo			N	lo			N	lo			N	lo	
			Undi	vided											
adwa	ys														
	4.1				4.1						6.9				6.9
	4.14				5.28						7.00				6.92
	2.2				2.2						3.3				3.3
	2.22				2.79						3.35				3.31
l Leve	l of Se	ervice													
	5				15						414				30
	606				597						736				521
	0.01				0.03						0.56				0.06
	0.0				0.1						3.5				0.2
	11.0				11.2						16.0				12.3
	В				В						С	В			
	0.1 0.1								16	5.0		12.3			
	A A							СВВ						В	
	0 0 0 0	U L 1U 1 0 1 0 4 0 2 Adways 4.1 4.14 2.2 2.22 Level of Section	Eastbound U	Castbound Cast	Eastbund U L T R U 1U 1 2 3 4U 0 1 2 1 0 L T R 0 4 438 166 0 0 2 0 0 No Undivided adways 4.1	Eastbound Westle	Eastbound Westbound	Eastbound Westbound Westbound U	Eastbound Westbound	Eastbound Westbound North	Variable Variable	Eastbound Westbound Northbound	Eastbound Westbound Northbound U	Eastbound Westbound Northbound South	Eastburnt

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	HCS Two-Way Stop	p-Control Report						
General Information		Site Information						
Analyst	CLH	Intersection	US 2 & Grand Forks Airport					
Agency/Co.	NDDOT	Jurisdiction						
Date Performed	10/27/2023	East/West Street	US 2					
Analysis Year	2043	North/South Street	Grand Forks Airport					
Time Analyzed	AM Peak	Peak Hour Factor	0.86					
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25					
Project Description	2043 AM RCI, East U-Turn							



Vehicle Volumes and Ad	justme	nts																
Approach		Eastk	oound			Westl	bound			North	bound			South	bound			
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R		
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12		
Number of Lanes	1	0	0	0	0	0	2	0		0	0	0		0	0	0		
Configuration	U						Т											
Volume (veh/h)	299						699											
Percent Heavy Vehicles (%)	5																	
Proportion Time Blocked																		
Percent Grade (%)																		
Right Turn Channelized																		
Median Type Storage				Undi	vided													
Critical and Follow-up H	leadwa	ys																
Base Critical Headway (sec)	4.3																	
Critical Headway (sec)	4.44																	
Base Follow-Up Headway (sec)	2.6																	
Follow-Up Headway (sec)	2.62																	
Delay, Queue Length, an	d Leve	l of S	ervice															
Flow Rate, v (veh/h)	348																	
Capacity, c (veh/h)	668																	
v/c Ratio	0.52																	
95% Queue Length, Q ₉₅ (veh)	3.0																	
Control Delay (s/veh)	16.1																	
Level of Service (LOS)	С																	
Approach Delay (s/veh)		1	6.1															
Approach LOS		16.1 C																

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				HC	S Rou	ndab	outs	Rep	oort							
General Information						5	ite In	forn	natior	1						
Analyst	CLH					*			Inters	ection			US 2	& Grar	nd Forks /	Airport
Agency or Co.	NDDO	TC				+			E/W S	Street Na	me		US 2			
Date Performed	10/27	7/2023						\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	N/S S	treet Nar	ne		Grand	d Forks	Airport	
Analysis Year	2043				▼ ↓ ∣	W + I	1		Analy	sis Time	Period, h	rs	0.25			
Time Analyzed	AM P	eak			₹ \				Peak I	Hour Fac	tor		0.86			
Project Description	2043	AM RAI	3 2x1			<u> </u>	*		Jurisd	liction						
Volume Adjustments	and	Site C	Charact	eristic	s											
Approach			EB			WB				N	В				SB	
Movement						R	U	L	Т	R	U	L	Т	R		
Number of Lanes (N)	0	0 0 2 0 0 0 2 0 0				0	1	0	0	0	1	0				
Lane Assignment	L	_T	Т	TR LT TR LTR					R				LTR			
Volume (V), veh/h	0	4	416	162					260	39	57	0	22	4	0	
Percent Heavy Vehicles, %	0	2	23	6	0	59	20	2	0	5	1	60	0	1	1	6
Flow Rate (VPCE), pc/h	0	5	5 595 200 0 24 830					107	0	317	46	106	0	26	5	0
Right-Turn Bypass		N	one			None	2			No	ne			-	None	
Conflicting Lanes			1			1				2					2	
Pedestrians Crossing, p/h			0			0				C)				0	
Proportion of CAVs								(0							
Critical and Follow-U	b Hea	adwa	v Adiu	stmen	t											
Approach	P 113.		<i>,</i>	EB		_	WE				NB		$\overline{}$		SB	
			l oft		D. mass	Loft			Pumass	l oft		D. man	20 1	oft		Dumass
Lane			Left	Right	Bypass	+	Righ	_	Bypass	Left	Right	Вура	SS L	eft	Right	Bypass
Critical Headway, s			4.5436	4.5436		4.5430	_	_			4.3276		_		4.3276	
Follow-Up Headway, s	_	•	2.5352	2.5352		2.5357	2 2.53	02			2.5352				2.5352	
Flow Computations,	Capac	city a	nd v/c	Ratios												
Approach				EB		_	WE	_			NB		_		SB	
Lane			Left	Right	Bypass	Left	Rigl	it E	Bypass	Left	Right	Вура	ss L	eft	Right	Bypass
Entry Flow (v _e), pc/h			376	424		452	509				469		\perp		31	
Entry Volume, veh/h			318	359		381	430				414				31	
Circulating Flow (v _c), pc/h				55			368				626				1171	
Exiting Flow (vex), pc/h				727			114	7			158				229	
Capacity (c _{pce}), pc/h			1351	1351		1016	101	6			834				525	
Capacity (c), veh/h			1144	1144		858	858				736				520	
v/c Ratio (x)			0.28	0.31		0.44	0.5)			0.56				0.06	
Delay and Level of Se	ervice															
Approach				EB			WE				NB				SB	
Lane			Left	Right	Bypass	Left	Rigl	it E	Bypass	Left	Right	Вура	ss L	eft	Right	Bypass
Lane Control Delay (d), s/veh			5.7	6.2		9.7	10.	3			13.8				7.7	
Lane LOS			Α	А		А	В				В				Α	
				1.4		2.3	2.9				3.5				0.2	
95% Queue, veh																
95% Queue, veh Approach Delay, s/veh				6.0			10.)								
				A			B ge 50)			В		+		A	

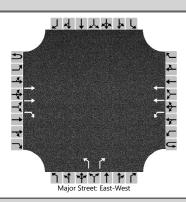
				HC	S Rou	ındar	oout	ts Re	port									
General Information						:	Site	Infor	matior	1								
Analyst	CLH			П		*			Inters	ection			US 2	& Gran	nd Forks /	Airport		
Agency or Co.	NDDO	TC				←			E/W S	Street Na	me		US 2					
Date Performed	10/27	7/2023		\neg				1	N/S S	treet Nar	ne		Grand	d Forks	Airport			
Analysis Year	2043				∡ ↓	W + S	E	1		sis Time I	Period, hı	rs .	0.25					
Time Analyzed	AM P	eak							Peak	Hour Fact	tor		0.86					
Project Description	2043	AM RAI	3 1x1 with	RT La		→	*		Jurisd	liction								
Volume Adjustments	and	Site C	Charact	eristic	S													
Approach			EB			WB	3			N	В				SB			
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U L T			R		
Number of Lanes (N)	0	0	1	1	0	0	1	1	0	0	1	0	0	0	1	0		
Lane Assignment	ı	т_т	F	₹	LT			R			LTI	۲				LTR		
Volume (V), veh/h	0 4 416 162 0 13 595				90	0	260	39	57	0	22	4	0					
Percent Heavy Vehicles, %	0	2	23	6	0	59	20	2	0	5	1	60	0	1	1	6		
Flow Rate (VPCE), pc/h	0	5	595	200	0	24	830	107	0	317	46	106	0	26	5	0		
Right-Turn Bypass		N	one			Non	ie	<u> </u>		No	ne			1	None			
Conflicting Lanes			1			1				1					1			
Pedestrians Crossing, p/h			0			0				C)				0			
Proportion of CAVs									0									
Critical and Follow-U	lp Hea	adwa	y Adju	stmen	t													
Approach	<u> </u>			EB		Т		WB			NB		т		SB			
Lane			Left	Right	Bypass	Left	: F	Right	Bypass	Left	Right	Bypas	s L	eft	Right	Bypass		
Critical Headway, s			4.5436	4.5436	 			.5436	71		4.9763				4.9763	71		
Follow-Up Headway, s			2.5352	2.5352		2.5352 2.5352 2.6087					2.6087							
Flow Computations,	Capac	citv a	nd v/c	Ratios									_					
Approach				EB		Т		WB			NB		$\overline{}$		SB			
Lane			Left	Right	Bypass	Left	_	Right	Bypass	Left	Right	Bypas	, ,	eft	Right	Bypass		
Entry Flow (v _e), pc/h			600	200	Бураза	854	_	107	Буразз	Leit	469	- Dypus		.cit	31	Бураз		
Entry Volume, veh/h			508	169		721		90			414				31			
Circulating Flow (v _c), pc/h			300	55		721		368			626		+		1171			
Exiting Flow (vex), pc/h				727				1147			158		+		229			
Capacity (c _{pce}), pc/h			1351	1351		1016		1016			729	Τ	+	Т	418			
Capacity (c), veh/h			1144	1144		858	_	858			643				414			
v/c Ratio (x)			0.44	0.15		0.84	_	0.11			0.64				0.07			
Delay and Level of Se	ervice					,,,,												
Approach EB					T		WB			NB		T		SB				
Lane			Left	Right	Bypass	Left	_	Right	Bypass	Left	Right	Bypas	s L	eft	Right	Bypas		
Lane Control Delay (d), s/veh			7.9	4.4	7,5233	26.1	_	5.2	7 1 2 3 3		18.4	-,,,,,,,			9.8	7 200		
						D		A			С				A			
Lane LOS A A						10.0		0.4			4.7		+		0.2			
95% Queue, veh				7.0				23.8			18.4				9.8			
				7.0 A			2	23.8 C			18.4 C		+		9.8 A			

HCS Signalized Intersection Results Summary 1 4 14 4 4 4 1 Intersection Information **General Information** NDDOT Duration, h 0.250 Agency CLH Analyst Analysis Date Oct 13, 2023 Area Type Other PHF 0.94 Jurisdiction Time Period PM Peak **Urban Street** US 2 Analysis Year 2023 **Analysis Period** 1> 7:00 File Name 2043 PM Peak Ex Geom Signalized.xus Intersection Grand Forks Airport & U... **Project Description** 2043 PM Ex Geom Signalized 下对 个 中下 **Demand Information** EB **WB** NB SB Approach Movement R L R L R L R Demand (v), veh/h 8 591 362 67 457 97 190 23 34 139 66 11 **Signal Information** Д., Cycle, s 91.2 Reference Phase 2 $\mathbb{S} \Lambda Z$ Offset, s 0 Reference Point Begin 3.4 Green 1.0 0.8 28.4 8.8 10.0 Uncoordinated Yes Simult. Gap E/W On Yellow 3.0 3.0 3.0 0.0 12.0 3.9 Force Mode Fixed Simult. Gap N/S On Red 3.0 3.0 2.0 3.0 0.0 3.0 **Timer Results EBL EBT WBL WBT** NBL **NBT** SBL SBT **Assigned Phase** 2 6 8 5 1 3 7 4 Case Number 2.0 3.0 2.0 3.0 1.1 4.0 1.1 4.0 Phase Duration, s 7.0 42.4 13.8 49.2 18.2 20.3 14.8 16.9 6.0 14.0 6.0 14.0 6.9 6.0 6.9 Change Period, (Y+Rc), s 6.0 Max Allow Headway (MAH), s 4.2 4.2 4.2 4.2 3.2 4.2 3.2 4.2 Queue Clearance Time (g s), s 2.5 20.8 9.2 13.7 12.0 3.9 8.8 6.1 Green Extension Time (g_e), s 0.0 7.6 0.1 8.1 0.2 0.4 0.2 0.4 Phase Call Probability 0.19 1.00 0.84 1.00 0.99 1.00 0.98 1.00 0.00 0.11 0.00 0.05 0.00 0.00 0.00 Max Out Probability 0.01 **Movement Group Results** EΒ WB NB SB Approach Movement L Т R L Т R L Т R L Т R **Assigned Movement** 5 2 12 1 6 16 3 8 18 7 4 14 9 629 321 71 486 71 202 39 148 82 Adjusted Flow Rate (v), veh/h Adjusted Saturation Flow Rate (s), veh/h/ln 1641 1367 900 1406 1460 1602 1626 1654 1693 1414 0.5 18.8 14.9 7.2 11.7 2.4 4.1 Queue Service Time (g_s), s 10.0 1.9 6.8 Cycle Queue Clearance Time (q c), s 0.5 18.8 14.9 7.2 11.7 2.4 10.0 1.9 6.8 4.1 Green Ratio (g/C) 0.01 0.31 0.44 0.09 0.39 0.48 0.24 0.15 0.24 0.11 Capacity (c), veh/h 18 851 629 77 1085 704 336 238 372 185 Volume-to-Capacity Ratio (X) 0.486 0.739 0.511 0.927 0.448 0.101 0.602 0.165 0.398 0.442 Back of Queue (Q), ft/ln (95 th percentile) Back of Queue (Q), veh/ln (95 th percentile) 0.5 9.5 7.7 3.9 6.2 1.2 6.4 1.3 4.5 3.0 Queue Storage Ratio (RQ) (95 th percentile) 0.04 0.00 0.68 0.39 0.00 0.08 0.34 0.00 0.45 0.00 Uniform Delay (d 1), s/veh 44.9 28.1 18.2 41.5 20.8 12.9 30.0 34.1 28.8 38.0 Incremental Delay (d 2), s/veh 19.3 1.3 0.6 32.3 0.3 0.1 0.6 0.3 0.3 1.7 Initial Queue Delay (d 3), s/veh 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Control Delay (d), s/veh 64.2 29.4 18.9 73.7 21.1 12.9 30.7 34.4 29.0 39.7 Level of Service (LOS) Ε С В Ε С В С С С D 26.2 С 26.1 С 31.3 С 32.8 С Approach Delay, s/veh / LOS Intersection Delay, s/veh / LOS 27.5 С **Multimodal Results** ΕB WB NB Pedestrian LOS Score / LOS 1.95 В В 2.49 2.54 С 1.91 В Bicycle LOS Score / LOS 1.28 Α 1.01 Α 0.89 Α 0.87 Α

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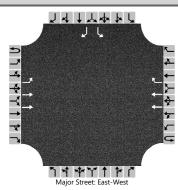
HCS Signalized Intersection Results Summary 1 4 14 4 4 4 1 Intersection Information **General Information** NDDOT Duration, h 0.250 Agency CLH Analyst Analysis Date Oct 13, 2023 Area Type Other PHF 0.94 Jurisdiction Time Period PM Peak **Urban Street** US 2 Analysis Year 2023 **Analysis Period** 1> 7:00 File Name 2043 PM Peak Rev Geom Signalized.xus Intersection Grand Forks Airport & U... **Project Description** 2043 PM Rev Geom Signalized 下对 个 中下 **Demand Information** EB **WB** NB SB Approach Movement R L R L R L R Demand (v), veh/h 8 591 362 67 457 97 190 23 34 139 66 11 **Signal Information** Д., Cycle, s 113.2 Reference Phase 2 $\mathbb{S} \Lambda Z$ Offset, s 0 Reference Point Begin 27.0 Green 1.2 0.3 32.9 9.9 3.0 Uncoordinated Yes Simult. Gap E/W On Yellow 3.0 3.0 3.0 0.0 12.0 3.9 Force Mode Fixed Simult. Gap N/S On Red 3.0 3.0 2.0 3.0 0.0 3.0 **Timer Results EBL EBT WBL WBT** NBL **NBT** SBL SBT **Assigned Phase** 2 6 8 5 1 3 7 4 Case Number 1.1 3.0 1.1 3.0 1.1 4.0 1.1 4.0 Phase Duration, s 7.2 46.9 13.4 53.2 18.9 36.9 15.9 33.9 6.0 14.0 6.0 14.0 6.0 6.9 6.0 6.9 Change Period, (Y+Rc), s Max Allow Headway (MAH), s 3.2 4.2 3.2 4.2 3.2 4.2 3.2 4.2 Queue Clearance Time (g s), s 2.4 26.0 8.3 17.5 12.6 32.0 9.7 6.4 Green Extension Time (g_e), s 0.0 7.0 0.1 7.8 0.4 0.0 0.3 0.4 Phase Call Probability 0.23 1.00 0.89 1.00 1.00 1.00 0.99 1.00 0.00 0.19 0.00 0.07 0.00 1.00 0.00 0.00 Max Out Probability **Movement Group Results** EΒ WB NB SB Approach Movement L Т R L Т R L Т R L Т R **Assigned Movement** 5 2 12 1 6 16 3 8 18 7 4 14 9 629 321 71 486 71 202 39 148 82 Adjusted Flow Rate (v), veh/h Adjusted Saturation Flow Rate (s), veh/h/ln 1641 900 1406 1460 1602 1626 1654 1693 1367 1414 0.4 24.0 19.8 15.5 2.1 7.7 4.4 Queue Service Time (g_s), s 6.3 3.3 10.6 Cycle Queue Clearance Time (q c), s 0.4 24.0 19.8 6.3 15.5 3.3 10.6 2.1 7.7 4.4 0.29 0.24 Green Ratio (g/C) 0.36 0.41 0.36 0.35 0.43 0.35 0.27 0.35 Capacity (c), veh/h 240 795 573 126 974 633 471 431 177 404 Volume-to-Capacity Ratio (X) 0.035 0.790 0.561 0.567 0.499 0.113 0.429 0.091 0.838 0.203 Back of Queue (Q), ft/ln (95 th percentile) Back of Queue (Q), veh/ln (95 th percentile) 0.3 12.3 10.3 2.3 8.5 1.9 6.8 1.4 7.6 3.1 Queue Storage Ratio (RQ) (95 th percentile) 0.02 0.00 0.91 0.23 0.00 0.13 0.36 0.00 0.76 0.00 Uniform Delay (d 1), s/veh 24.6 36.9 25.9 28.5 29.2 19.1 27.2 31.3 34.0 34.5 Incremental Delay (d 2), s/veh 0.0 2.8 0.9 1.5 0.4 0.1 0.2 0.1 4.0 0.2 Initial Queue Delay (d 3), s/veh 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Control Delay (d), s/veh 24.6 39.8 26.8 29.9 29.6 19.1 27.5 31.4 38.1 34.7 Level of Service (LOS) С D С С С В С С D С 35.3 D 28.5 С 28.1 С 36.9 Approach Delay, s/veh / LOS D Intersection Delay, s/veh / LOS 32.5 С **Multimodal Results** ΕB WB NB Pedestrian LOS Score / LOS 1.96 В 1.93 В 2.49 2.54 В С Bicycle LOS Score / LOS 1.28 Α 1.01 Α 0.89 Α 0.87 Α

HCS Two-Way Stop-Control Report										
General Information		Site Information								
Analyst	CLH	Intersection	US 2 & Grand Forks Airport							
Agency/Co.	NDDOT	Jurisdiction								
Date Performed	10/26/2023	East/West Street	US 2							
Analysis Year	2043	North/South Street	Grand Forks Airport							
Time Analyzed	PM Peak	Peak Hour Factor	0.94							
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25							
Project Description 2043 PM Offset Tee, West Intersection										



Vehicle Volumes and Adj	ustme	nts															
Approach		Eastb	ound			Westl	oound			North	bound			South	bound		
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R	
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12	
Number of Lanes	0	0	2	1	0	1	2	0		1	0	1		0	0	0	
Configuration			Т	R		L	Т			L		R					
Volume (veh/h)			599	362	0	133	0			190		57					
Percent Heavy Vehicles (%)					0	59				5		60					
Proportion Time Blocked																	
Percent Grade (%))						
Right Turn Channelized		Ν	10							Ν	lo						
Median Type Storage				Undi	vided												
Critical and Follow-up He	eadwa	ys															
Base Critical Headway (sec)						4.1				7.5		6.9					
Critical Headway (sec)						5.28				6.90		8.10					
Base Follow-Up Headway (sec)						2.2				3.5		3.3					
Follow-Up Headway (sec)						2.79				3.55		3.90					
Delay, Queue Length, and	Leve	l of Se	ervice														
Flow Rate, v (veh/h)						141				202		61					
Capacity, c (veh/h)						417				175		533					
v/c Ratio						0.34				1.16		0.11					
95% Queue Length, Q ₉₅ (veh)						1.5				10.6		0.4					
Control Delay (s/veh)						18.0				170.3		12.6					
Level of Service (LOS)	C						F		В								
Approach Delay (s/veh)		18.0							13	3.9							
Approach LOS						(C				F						

HCS Two-Way Stop-Control Report										
General Information		Site Information								
Analyst	CLH	Intersection	US 2 & Grand Forks Airport							
Agency/Co.	NDDOT	Jurisdiction								
Date Performed	10/26/2023	East/West Street	US 2							
Analysis Year	2043	North/South Street	Grand Forks Airport							
Time Analyzed	PM Peak	Peak Hour Factor	0.94							
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25							
Project Description 2043 PM Offset Tee, East Intersection										

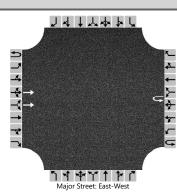


Vehicle Volumes and Ad	1								П				Т					
Approach		Eastb	ound			Westl	oound			North	bound			South	bound			
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R		
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12		
Number of Lanes	0	1	2	0	0	0	2	1		0	0	0		1	0	1		
Configuration		L	Т				Т	R						L		R		
Volume (veh/h)	0						524	97						139		77		
Percent Heavy Vehicles (%)	0	0 2												1		6		
Proportion Time Blocked																		
Percent Grade (%)														()			
Right Turn Channelized						Ν	lo							N	lo			
Median Type Storage				Undi	vided													
Critical and Follow-up H	eadwa	ys																
Base Critical Headway (sec)		4.1												7.5		6.9		
Critical Headway (sec)		4.14												6.82		7.02		
Base Follow-Up Headway (sec)		2.2												3.5		3.3		
Follow-Up Headway (sec)		2.22												3.51		3.36		
Delay, Queue Length, ar	d Leve	l of Se	ervice															
Flow Rate, v (veh/h)		33												148		82		
Capacity, c (veh/h)		924												405		707		
v/c Ratio		0.04												0.36		0.12		
95% Queue Length, Q ₉₅ (veh)		0.1									Ì	Ì		1.6		0.4		
Control Delay (s/veh)		9.0												18.9		10.8		
Level of Service (LOS)		А									Ì			С		В		
Approach Delay (s/veh)		9	.0											16	5.0			
Approach LOS			Α											С				

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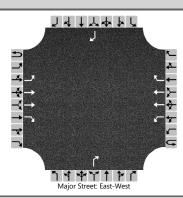
			HCS	Alte	rnativ	e Inte	rsect	ions I	Result	ts Su	mmar	У						
General Ir	nformation									Al	ternati	ve Inte	ersect	ion In	forma	tion		
Agency		NDDOT								Int	ersecti	on Typ	е		RCU	T with	TWSC	
Analyst		CLH			An	alysis	Date	10/27	7/2023	Se	gment	One D	Distanc	e, ft	715			
Jurisdiction	n				Du	ration,	h	0.25		Se	gment	Two D	istanc	e, ft	715			
Intersectio	on .	US 2 & Grand F	orks A	Airport	PH	IF		0.94		Ar	terial D	irectio	n		East-	-West		
Main Inters	section File	2043 PM RCI, N	√ain Ir	ntersec	tion.xt	tw												
West Cros	ssover File	2043 PM RCI, V	Vest L	J-Turn.	xtw													
East Cross	sover File	2043 PM RCI, E																
Project De	escription	2043 PM RCI, N	∕lain Ir	ntersec	tion													
Demand			EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBF
Intersectio	n One Demar	nd (<i>v</i>), veh/h			962		205											
Intersectio	n Two Demar	nd (v), veh/h	0	8	730	428	0	67	646	120				246				215
Intersectio	n Three Dema	and (<i>v</i>), veh/h	213						621									
	(1) West C	Crossover				(2) Ma	ain Inte	ersecti	on		Т		(3) East	Cross	over		
	1417						↓从,						•	1 ↑ ↑ ,				
4 4 4 1	<u>.</u>	4 4 			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				<u>.</u> ←;	Major Street: East-West				1 1 4 4 7 1				
7	Major Street:	East-West			A C		↑ → Tor Street: Ea	ast-West		•		→ → →		Major Stre	eet: East-V	Vest	, <u>, , , , , , , , , , , , , , , , , , </u>	
¬.	Major Street:		EBU	EBL	EBT	Majo	or Street: E		WBT	WBR	NBU	NBL	NBT				SBT	SBF
Queue-to-			EBU	EBL	EBT	Majo	or Street: E		WBT	WBR	NBU	NBL	NBT				SBT	SBF
Queue-to- Intersectio	-Storage Rati		EBU	EBL 0.00	EBT	Majo	wBU		WBT	WBR	NBU	NBL	NBT				SBT	SBF
Queue-to- Intersectio	-Storage Rati on One (Ro)		EBU 0.06		EBT	Majo	wBU	WBL	WBT	WBR	NBU	NBL	NBT				SBT	SBF
Queue-to- Intersectio	-Storage Rati on One (Ro) on Two (Ro)				EBT	Majo	wBU	WBL	WBT	WBR	NBU	NBL	NBT				SBT	SBF
Queue-to- Intersectio Intersectio	-Storage Rati on One (Ro) on Two (Ro)	io			EBT	Majo	wBU	WBL	WBT	WBR	NBU	NBL	NBT				SBT	SBF
Queue-to- Intersectio Intersectio	-Storage Ration One (Ra) on Two (Ra) on Three (Ra) we Intesection	io		0.00		EBR	WBU 0.10	WBL 0.06			NBU				SBU	SBL	SBT	
Queue-to- Intersectio Intersectio	-Storage Ration One (Ra) on Two (Ra) on Three (Ra) we Intesection	io n Results		0.00		EBR	WBU 0.10	WBL 0.06	ay (s/v				ETT	NBR	SBU	SBL		
Queue-to- Intersectio Intersectio Alternativ O-D	-Storage Ration One (Ra) on Two (Ra) on Three (Ra) we Intesection	n Results Movements		0.00	Rate (EBR	WBU 0.10	WBL 0.06	ay (s/w		EDTT (s	s/veh)	ETT	NBR	SBU) v/c	SBL	Rq>1?	LOS
Queue-to- Intersectio Intersectio Alternativ O-D EBL	-Storage Ration One (Ra) on Two (Ra) on Three (Ra) we Intesection	n Results O Movements EBL(2)		0.00	Rate (EBR	WBU 0.10	0.06 ol Del 9.5	ay (s/v 5		EDTT (s	s/veh)	ETT	NBR (s/veh	SBU) v/c	SBL	R _Q >1?	LOS
Queue-to- Intersectio Intersectio Intersectio Alternativ O-D EBL EBT	-Storage Ration One (Ra) on Two (Ra) on Three (Ra) we Intesection	n Results Movements EBL(2) EBT(2)		0.00	Rate (9 629	EBR	WBU 0.10	0.06 rol Del 9.6	ay (s/v 5)		EDTT (s	s/veh)	ETT !	(s/veh 9.5 0.0	SBU) V/c N	>1? lo	Ra>1? No	LOS A A
Queue-to- Intersectio Intersectio Alternativ O-D EBL EBT EBR	-Storage Ration One (Ra) on Two (Ra) on Three (Ra) we Intesection	n Results O Movements EBL(2) EBT(2) EBR(2)		0.00	Rate (1962)	EBR	WBU 0.10	0.06 rol Del 9.5	ay (s/v 5)		EDTT (\$	s/veh)	ETT ((s/veh 9.5 0.0) V/c	>1? 	Ra>1? No 	LOS A A
Queue-to- Intersectio Intersectio Alternativ O-D EBL EBT EBR WBL	-Storage Ration One (Ra) on Two (Ra) on Three (Ra) re Intesection	n Results Movements EBL(2) EBT(2) EBR(2) WBL(2)		0.00	Rate (* 9 629 385 71	EBR	WBU 0.10	0.06 rol Del 9.6 0.0 19.	ay (s/v 5))		EDTT (\$	s/veh)	ETT ((s/veh 9.5 0.0 0.0) V/c	>1? lo	Ro>1? No No	LOS A A A B
Queue-to- Intersectio Intersectio Intersectio Alternativ O-D EBL EBT EBR WBL WBT	-Storage Ration One (Ra) on Two (Ra) on Three (Ra) or Three (Da) or Three O-D	n Results Movements EBL(2) EBT(2) EBR(2) WBL(2) WBL(2)	0.06	0.00	Rate (* 9 629 385 71 486	EBR	WBU 0.10	0.06 rol Del 9.9 0.0 19.	ay (s/v 5 0 0		EDTT (s	s/veh)	ETT ()	(s/veh 9.5 0.0 0.0 9.0) V/c	>1? lo lo	Ro>1? No No	LOS A A A B A
Queue-to- Intersectio Intersectio Intersectio Alternativ O-D EBL EBT EBR WBL WBT WBR	-Storage Ration One (Ra) on Two (Ra) on Three (Ra) on Three (Da) or Three O-D	n Results O Movements EBL(2) EBT(2) EBR(2) WBL(2) WBL(2) WBT(2) WBR(2)	0.06	0.00	Rate (19 629 385 71 486 103	EBR	WBU 0.10	0.06 rol Del 9.6 0.0 19. 0.0	ay (s/v 5)) 0)		EDTT (\$	s/veh)	ETT 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(s/veh 9.5 0.0 0.0 9.0 0.0) v/c	>1? lo	Rq>1? No No	LOS A A B A
Queue-to- ntersectio ntersectio Alternativ O-D EBL EBT EBR WBL WBT WBR NBL	-Storage Ration One (Ra) on Two (Ra) on Three (Ra) on Three (Da) or Three O-D	n Results O Movements EBL(2) EBT(2) EBR(2) WBL(2) WBL(2) WBT(2) WBR(2) EBU(3) + WBT(2)	0.06	0.00	Rate (*9 629 385 71 486 103 202	EBR	WBU 0.10	0.06 rol Del 9.5 0.0 19. 0.0 27.	ay (s/v 5 0 0 0 0 2 2		EDTT (\$ 17.	5/veh) 7 7	ETT 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(s/veh 9.5 0.0 0.0 9.0 0.0 0.0) V/c	>1? lo	Ra>1? No No No	LOS A A A B B A A A D
Queue-to- Intersectio Intersectio Alternativ O-D EBL EBT EBR WBL WBT WBR NBL NBT	NBR(2) +	n Results Movements EBL(2) EBT(2) EBR(2) WBL(2) WBL(2) WBT(2) WBR(2) EBU(3) + WBT(2) EBU(3) + WBR(2)	0.06	0.00	Rate (** 9 629 385 71 486 103 202 24	EBR	WBU 0.10	0.06 rol Del 9.9 0.0 19.0 0.0 27.27.	ay (s/v 5 0 0 0 2 2		EDTT (\$	s/veh) 7	ETT : : : : : : : : : : : : : : : : : :	(s/veh 9.5 0.0 0.0 9.0 0.0 4.9) V/c	>1? lo lo lo lo	RQ>1? No No No No	LOS A A A B B A A D D
Queue-to- Intersectio Intersectio Intersectio Alternativ O-D EBL EBT EBR WBL WBT WBR NBL NBT NBR	NBR(2) + NBR(2) + SBR(2) +	io Results Movements EBL(2) EBR(2) WBL(2) WBL(2) WBR(2) WBR(2) EBU(3) + WBR(2) EBU(3) + WBR(2) NBR(2)	2) 2)	0.00	Rate (1962) 385 71 486 103 202 24 36	EBR	WBU 0.10	0.06 rol Del 9.8 0.0 19. 0.0 27. 27.	ay (s/v 5 0 0 0 2 2 5 0		EDTT (\$ 17.	7 7	ETT () () () () () () () () () () () () ()	(s/veh 9.5 0.0 0.0 9.0 0.0 4.9 4.9) V/c	>1? lo lo lo lo lo lo lo lo	Ro>1? No No No No No No	LOS A A A B B A A D D B B
Queue-to- Intersectio Intersectio Intersectio Alternativ O-D EBL EBT EBR WBL WBT WBR NBL NBT NBR SBL	NBR(2) + NBR(2) + SBR(2) +	io Results Movements EBL(2) EBT(2) EBR(2) WBL(2) WBL(2) WBR(2) EBU(3) + WBT(2) EBU(3) + WBR(2) EBU(3) + WBR(2) WBR(2) WBR(2) WBR(2) WBR(2)	2) 2)	0.00	Rate (*9 629 385 71 486 103 202 24 36 148	EBR	WBU 0.10	0.06 rol Del 9.5 0.0 19. 0.0 27. 27. 15.	ay (s/v 5 0 0 0 2 2 5 0 0		EDTT (\$ 17. 17.	7 7	ETT 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(s/veh 9.5 0.0 0.0 9.0 0.0 4.9 4.9 5.5) V/c	>1? lo lo lo lo lo lo lo lo lo	Ra>1? No No No No No No	LOS A A A B A A D D D B B
Queue-to- Intersectio Intersectio Intersectio Alternativ O-D EBL EBT EBR WBL WBT WBR NBL NBT NBR SBL SBT	NBR(2) + NBR(2) + SBR(2) +	io Results Movements EBL(2) EBT(2) EBR(2) WBL(2) WBL(2) WBR(2) EBU(3) + WBT(2 EBU(3) + WBR(2 NBR(2) WBR(2) WBR(2) WBU(1) + EBT(2 WBU(1) + EBR(2)	2) 2)	0.00	Rate (*9 629 385 71 486 103 202 24 36 148 70	EBR	WBU 0.10	0.06 0.00 0.00 0.00 0.00 0.00 27. 27. 15. 29.	ay (s/v 5 0 0 0 2 2 5 0 0		EDTT (\$ 17. 17. 17.	7 7	ETT 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(s/veh 9.5 0.0 0.0 0.0 0.0 4.9 4.9 5.5 6.7) V/c	>1? lo	RQ>1? NO NO NO NO NO NO	LOS A A A B B A A A D D D B B D D D
Queue-to- Intersectio Intersectio Intersectio Alternativ O-D EBL EBT EBR WBL WBT WBR NBL NBT NBR SBL SBT SBR	NBR(2) + SBR(2) + SBR(2) +	io Results Movements EBL(2) EBT(2) EBR(2) WBL(2) WBL(2) WBR(2) EBU(3) + WBT(2 EBU(3) + WBR(2 NBR(2) WBR(2) WBR(2) WBU(1) + EBT(2 WBU(1) + EBR(2)	2) 2)	Flow	Rate (*9 629 385 71 486 103 202 24 36 148 70 12	EBR	WBU 0.10	0.06 rol Del 9.8 0.0 19. 0.0 27. 27. 15. 29. 29.	ay (s/v 5 0 0 0 2 2 5 0 0 4		EDTT (\$ 17. 17. 17.	7 7 7	ETT 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(s/veh 9.5 0.0 0.0 0.0 0.0 4.9 4.9 5.5 6.7) V/c	>1? lo lo lo lo lo lo lo	Ra>1? No No No No No No No	LOS A A A B A A D D B D
Queue-to- Intersectio Intersectio Intersectio Alternativ O-D EBL EBT EBR WBL WBT WBR NBL NBT NBR SBL SBT SBR	NBR(2) + SBR(2) + SBR(2) +	io Results Movements EBL(2) EBT(2) EBR(2) WBL(2) WBL(2) WBT(2) WBR(2) EBU(3) + WBT(2 EBU(3) + WBR(2 WBR(2) WBU(1) + EBT(2 SBR(2)	2) 2) 2)	Flow	Rate (** 9 629 385 71 486 103 202 24 36 148 70 12	EBR	WBU 0.10	0.06 rol Del 9.8 0.0 19. 0.0 27. 27. 15. 29. 29.	ay (s/v 5 0 0 0 2 2 5 0 0 4		EDTT (\$ 17. 17. 17.	7 7 7	ETT 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(s/veh 9.5 0.0 0.0 0.0 0.0 4.9 4.9 5.5 6.7) V/c	>1? lo lo lo lo lo lo lo	Ro>1? No	LOS A A A B A A D D B D

HCS Two-Way Stop-Control Report										
General Information		Site Information								
Analyst	CLH	Intersection	US 2 & Grand Forks Airport							
Agency/Co.	NDDOT	Jurisdiction								
Date Performed	10/27/2023	East/West Street	US 2							
Analysis Year	2043	North/South Street	Grand Forks Airport							
Time Analyzed	PM Peak	Peak Hour Factor	0.94							
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25							
Project Description 2043 PM RCI, West U-Turn										



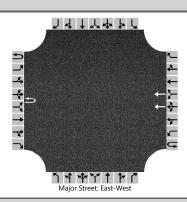
Approach		Eastl	oound			Westl	oound			North	bound			South	bound			
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R		
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12		
Number of Lanes	0	0	2	0	1	0	0	0		0	0	0		0	0	0		
Configuration			Т		U													
Volume (veh/h)			962		205													
Percent Heavy Vehicles (%)					4													
Proportion Time Blocked																		
Percent Grade (%)																		
Right Turn Channelized																		
Median Type Storage				Undi	vided													
Critical and Follow-up H	leadwa	ys																
Base Critical Headway (sec)					4.3													
Critical Headway (sec)					4.42													
Base Follow-Up Headway (sec)					2.6													
Follow-Up Headway (sec)					2.61													
Delay, Queue Length, an	d Leve	l of S	ervice															
Flow Rate, v (veh/h)	Т				218													
Capacity, c (veh/h)					556													
v/c Ratio					0.39													
95% Queue Length, Q ₉₅ (veh)					1.9													
Control Delay (s/veh)					15.6													
Level of Service (LOS)					С													
Approach Delay (s/veh)						15	5.6				-							
Approach LOS						(

HCS Two-Way Stop-Control Report										
General Information		Site Information								
Analyst	CLH	Intersection	US 2 & Grand Forks Airport							
Agency/Co.	NDDOT	Jurisdiction								
Date Performed	10/27/2023	East/West Street	US 2							
Analysis Year	2043	North/South Street	Grand Forks Airport							
Time Analyzed	PM Peak	Peak Hour Factor	0.94							
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25							
Project Description	roject Description 2043 PM RCI, Main Intersection									



Vehicle Volumes and Adj	ustme	nts															
Approach		Eastb	ound			Westl	oound			North	bound			South	bound		
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R	
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12	
Number of Lanes	0	1	2	1	0	1	2	1		0	0	1		0	0	1	
Configuration		L	Т	R		L	Т	R				R				R	
Volume (veh/h)	0				0	67	646	120				246				215	
Percent Heavy Vehicles (%)	0 2			0	59						5				1		
Proportion Time Blocked																	
Percent Grade (%)										(0				0		
Right Turn Channelized		Ν	lo			N	lo			Ν	lo		No				
Median Type Storage				Undi	vided												
Critical and Follow-up He	eadwa	ys															
Base Critical Headway (sec)		4.1				4.1						6.9				6.9	
Critical Headway (sec)		4.14				5.28						7.00				6.92	
Base Follow-Up Headway (sec)		2.2				2.2						3.3				3.3	
Follow-Up Headway (sec)		2.22				2.79						3.35				3.31	
Delay, Queue Length, and	Leve	l of Se	ervice														
Flow Rate, v (veh/h)		9				71						262				229	
Capacity, c (veh/h)		808				329						602				655	
v/c Ratio		0.01				0.22						0.43				0.35	
95% Queue Length, Q ₉₅ (veh)		0.0				0.8						2.2				1.6	
Control Delay (s/veh)		9.5				19.0						15.5				13.4	
Level of Service (LOS)	A C				С						С				В		
Approach Delay (s/veh)		0.1				1	.5			15	5.5			13	13.4		
Approach LOS		A				,	4			(С				В		

HCS Two-Way Stop-Control Report										
General Information		Site Information								
Analyst	CLH	Intersection	US 2 & Grand Forks Airport							
Agency/Co.	NDDOT	Jurisdiction								
Date Performed	10/27/2023	East/West Street	US 2							
Analysis Year	2043	North/South Street	Grand Forks Airport							
Time Analyzed	PM Peak	Peak Hour Factor	0.94							
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25							
Project Description 2043 PM RCI, East U-Turn										



Vehicle Volumes and Adj	ustme	nts															
Approach		Eastk	oound			Westl	bound			North	bound		Southbound				
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R	
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12	
Number of Lanes	1	0	0	0	0	0	2	0		0	0	0		0	0	0	
Configuration	U						Т										
Volume (veh/h)	213						621										
Percent Heavy Vehicles (%)	5																
Proportion Time Blocked																	
Percent Grade (%)																	
Right Turn Channelized																	
Median Type Storage				Undi	vided												
Critical and Follow-up He	eadwa	ys															
Base Critical Headway (sec)	4.3																
Critical Headway (sec)	4.44																
Base Follow-Up Headway (sec)	2.6																
Follow-Up Headway (sec)	2.62																
Delay, Queue Length, and	d Leve	l of S	ervice														
Flow Rate, v (veh/h)	227																
Capacity, c (veh/h)	766																
v/c Ratio	0.30																
95% Queue Length, Q ₉₅ (veh)	1.2																
Control Delay (s/veh)	11.7																
Level of Service (LOS)	В																
Approach Delay (s/veh)		1	1.7														
Approach LOS			В														

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				HC	S Rou	ındak	out	ts Re	port									
General Information						!	Site I	Infor	mation	า								
Analyst	CLH					*			Inters	ection			US 2	& Gran	nd Forks A	Airport		
Agency or Co.	NDDC	OT				/ ↓			E/W S	Street Na	me	ĺ	US 2					
Date Performed	10/27	//2023						7	N/S S	treet Nar	ne		Grand	d Forks	Airport			
Analysis Year	2043				▲ ↓ ∣	W +	E	1 🗡		sis Time	Period, h	rs	0.25					
Time Analyzed	PM Pe	eak			₹ \				Peak	Hour Fac	tor		0.94					
Project Description	2043	PM RAE	3 2x1			<u> </u>	*		Juriso	liction								
Volume Adjustments	and S	Site C	Charact	eristic	s													
Approach			EB			WB				N	В				SB			
Movement	U	L	Т	R	U	L	T	R	U	L	Т	R	U	L	Т	R		
Number of Lanes (N)	0	0	2	0	0	0	2	0	0	0	1	0	0	0	1	0		
Lane Assignment	L	.T	Т	R	LT		Т	ΓR			LTI	R				LTR		
Volume (V), veh/h	0	8	591	362	0	67	457	97	0	190	23	34	0	139	66	11		
Percent Heavy Vehicles, %	0	2	23	6	0	59	20	2	0	5	1	60	0	1	1	6		
Flow Rate (VPCE), pc/h	0	9	773	408	0	113	583	105	0	212	25	58	0	149	71	12		
Right-Turn Bypass		N	lone			Non	e			No	ne			1	None			
Conflicting Lanes			1			1				2			2					
Pedestrians Crossing, p/h	0					0				C)			0				
Proportion of CAVs									0									
Critical and Follow-U	р Неа	adwa	v Adiu	stmen	t													
Approach	•			EB		Т	,	WB			NB		$\overline{}$		SB			
Lane			Left	Right	Bypass	Left		Right	Bypass	Left	Right Bypa		sc I					
Critical Headway, s			4.5436	4.5436	Буразз	4.543	_	.5436	Буразз	Leit	4.3276		55 L	-	4.3276	Bypass		
Follow-Up Headway, s			2.5352	2.5352		2.535	_	.5352			2.5352		+		2.5352			
	C	-:4				2.555	2 2.	.5552			2.3332				2.3332			
Flow Computations,	Сарас	city a	na v/c			_).4./D					_					
Approach			EB				WB Dight I				NB				SB	_		
Lane	16		Left	Right	Bypass	+	3		Bypass	Left	Right	Вура	ss L	.eft	Right	Bypass		
	Entry Flow (v _e), pc/h		559	631		376		425			295			_	232			
Entry Volume, veh/h			480	542		310		350			263		229					
Circulating Flow (v _c), pc/h				333				246			931		908					
Exiting Flow (vex), pc/h				980			807				139							
Capacity (c _{pce}), pc/h			1049	1049		1135	1135 1135					_			656			
Capacity (c), veh/h	Capacity (c), veh/h		901	901		935		935			574				648			
v/c Ratio (x)			0.53	0.60		0.33	(0.37			0.46		\perp		0.35			
Delay and Level of Se	ervice	1																
Approach				EB			,	WB			NB				SB			
Lane			Left	Right	Bypass	Left	R	Right	Bypass	Left	Right	Вура	ss L	.eft	Right	Bypass		
Lane Control Delay (d), s/veh			11.1	12.8		7.4		8.0			13.8				10.3			
Lane LOS			В	В		А		Α			В				В			
95% Queue, veh			3.2	4.1		1.5		1.8			2.4				1.6			
Approach Delay, s/veh 12.0								7.7			13.8				10.3			
Approach Delay, s/veh	Approach LOS B					A							В					
· · ·				В		_	ige 60	Α			В				В			

				HC:	S Rou	ndab	outs F	Repc	ort									
General Information						S	ite Inf	orma	atior	ı								
Analyst	CLH					*			Inters	ection			US 2	US 2 & Grand Forks Airport				
Agency or Co.	NDDO	OT				_ ←			E/W S	Street Na	me		US 2					
Date Performed	10/27	/2023				M			N/S S	treet Nar	ne		Grand	d Forks	Airport			
Analysis Year	2043				▼ ↓	W T E	1		Analy	sis Time I	Period, hı	rs	0.25					
Time Analyzed	PM Pe	eak			2				Peak I	Hour Fact	tor		0.94					
Project Description	2043	PM RAE	3 1x1 with	RT La		→	+		Jurisd	liction								
Volume Adjustments	and	Site C	haract	eristic	s													
Approach			EB			WB				N	В				SB			
Movement	U	L	Т	R	U	L	Т	٦ .	U	L	Т	R	U	L	Т	R		
Number of Lanes (N)	0	0	1	1	0	0	1	1	0	0	1	0	0	0	1	0		
Lane Assignment	L	т.	F	2	LT		R				LTI	R				LTR		
Volume (V), veh/h	0	8	591	362	0	67	457 9	7	0	190	23	34	0	139	66	11		
Percent Heavy Vehicles, %	0	2	23	6	0	59	20	2	0	5	1	60	0	1	1	6		
Flow Rate (VPCE), pc/h	0	9	773	408	0	113	583 1	05	0	212	25	58	0	149	71	12		
Right-Turn Bypass	None					None	1			No	ne			<u> </u>	None	<u> </u>		
Conflicting Lanes			1			1				1			1					
Pedestrians Crossing, p/h			0			0			C)		0						
Proportion of CAVs								0										
Critical and Follow-U	ln Hea	adwa	v Adiu	stmen	t .													
	p net	au viu	y 7 laja.			т	\A/D				NB		_		CD			
Approach Lane				EB		1 6	WB			1 6	SB ss Left Right Bypass							
Lane				Right	Bypass	+	Right		pass	Left	Right	Вура	SS L	-	Right	Bypass		
Critical Headway, s			4.5436	4.5436		4.5436		_			4.9763				4.9763			
Follow-Up Headway, s			2.5352	2.5352		2.5352	2.535	2			2.6087				2.6087			
Flow Computations,	Capac	ity a	nd v/c	Ratios														
Approach			EB				WB				NB				SB			
Lane			Left	Right	Bypass	Left	Right	Right Bypa:		Left	Left Right		ss L	eft	Right	Bypass		
Entry Flow (v _e), pc/h	ntry Flow (v _e), pc/h		782	408			696 105				295				232			
Entry Volume, veh/h			672	350	573		86				263				229			
Circulating Flow (vc), pc/h				333			246				931		908					
Exiting Flow (vex), pc/h				980			807	807			139		592					
Capacity (c _{pce}), pc/h			1049	1049		1135	1135 1135				534				547			
Capacity (c), veh/h	Capacity (c), veh/h		901	901		935	935				476				540			
v/c Ratio (x)			0.75	0.39		0.61	0.09				0.55				0.42			
Delay and Level of Se	ervice																	
Approach				EB			WB				NB		T		SB			
Lane			Left	Right	Bypass	Left	Right	Вур	pass	Left	Right	Вура	ss L	eft	Right	Bypass		
Lane Control Delay (d), s/veh			18.4	8.5		12.8	4.7				19.3				13.6			
Lane LOS			С	А		В	А				С				В			
			7.1	1.9		4.3	0.3				3.3				2.1			
95% Queue, veh							11.8				19.3				13.6			
95% Queue, veh Approach Delay, s/veh				15.0														
				C			B ge 61				С				В			