

*Bismarck-Mandan MPO Signalized  
Intersections Traffic Data Collection  
Pilot Project*

Final Report

March 2024

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Bismarck-Mandan Metropolitan Planning Organization

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## INTRODUCTION

Reliable intersection-traffic data are essential for transportation planning, operations, and safety. The City of Bismarck relies on targeted short counts, which is the predominant, albeit outdated, type of intersection traffic data collection. The city recently updated its signalized intersection equipment, hardware, and communications, making it possible to remotely monitor, maintain, troubleshoot, and collect continuous traffic data.

The Upper Great Plains Transportation Institute (UGPTI) has built a web-based traffic data analysis tool. This traffic analysis tool uses existing traffic signal control devices to collect data 24 hours per day, seven days per week, and 365 days per year. The primary purpose of this pilot project was to develop the agency-to-UGPTI connections and build a compatible traffic analysis tool database for the Bismarck-Mandan MPO to collect data from intersections operated/maintained by City of Bismarck.

## OBJECTIVES

For this project, the six intersections set up for data collection and analysis are listed in Table 1.

#	Main Street	Cross Street
1	43rd Ave NE	Ottawa St/Lockport St
2	Main Ave	3rd St
3	Main Ave	5th St
4	N Bismarck Expy	E Divide Ave/Revere Dr
5	Tyler Pkwy	Burnt Boat Dr
6	US Hwy 83	ND 1804/71st Ave NE

*Table 1. Pilot project intersections*

## METHODOLOGY

This study was divided into following major tasks:

- Traffic PC provision & traffic software installation
- Intersection detection zones and calibration checks
- Intersection traffic data collection setup
- API script and data transfer setup
- Traffic data import and website setup
- Training

These tasks are discussed in detail below.

### **Traffic PC Provision & Traffic Software Installation**

In this task, UGPTI worked with City of Bismarck's Information Technology (IT) division to set up remote connections and to facilitate import of traffic data into the existing web-based application. Instead of a new traffic PC, the city's IT department identified efficiencies and decided to provide UGPTI access to its new ATMS server. The required software was then installed on that existing server.

## Intersection Detection Zones And Calibration Checks

In this task, each camera was checked for its calibration in terms of cross-lane, down-lane, and vertical directions and distances. The distances were estimated from available aerial images and measurements. Figure 1 below shows a sample existing camera calibration and Figure 2 shows the updated calibration at the same camera.

## Intersection Traffic Data Collection Setup

In this task, intersections were set to collect turning movement count and speed data. Wherever necessary, zone labels were updated as per agreed-upon conventions. Also, zones were added wherever missing as seen in Figures 3 and 4. These missing zones were not previously required and do not impact day-to-day signal operations, especially for through movements and signal phases.

The intersections were set up to count traffic one approach at a time. At any given approach, based on factors such as geometrics and lane assignment, all lane groups with exclusive lanes were counted separately using corresponding detector stations and zones. Table 2 provides detailed information on lane assignments and counting capabilities set per approach. Note that in the table, each arrow corresponds to a lane group and may represent multiple lanes. Also, each dot represents a separate detector station that counts the corresponding movement(s). As can be seen, the detectors were grouped into turning movements per lane-group, per approach, per intersection.



Figure 1. Sample existing camera calibration



Figure 2. Sample updated camera calibration



Figure 3. Non-conventional zone labels and missing (right-turn) zone



Figure 4. Updated setup with corrected zone labels and added zone

Agency	#	Main Street	Cross Street	NB			EB			SB			WB		
				L	T	R	L	T	R	L	T	R	L	T	R
Bismarck	1	43rd Ave NE	Ottawa St/ Lockport St	•	•	•	•	•	•	•	•	•	•	•	•
	2	N Bismarck Expy	E Divide Ave/ Revere Dr	↶	↷	•	↶	↷	↷	↶	•	•	•	•	•
	3	Main Ave	5th St	↶	↷	•	↶	↷	↷	↶	•	•	•	•	•
	4	Main Ave	3rd St	↶	↷	•	↶	↷	↶	↷	•	•	•	•	•
	5	Tyler Pkwy	Burnt Boat Dr	↶	↷	•	↶	↷	↶	↷	•	•	•	•	•
	6	US Hwy 83	ND 1804/ 71st Ave NE	↶	↷	•	↶	↷	↶	↷	↶	↷	↶	↷	•

Table 2. Setup of intersection lane assignments and detectors per approach\*

## API Script And Data Transfer Setup

UGPTI created API-based and other scripts for the data download process. City of Bismarck IT then scheduled the scripts to run at regular intervals along with database connections to automate the data download and transfer processes.

\* Notes:

1. Each arrow corresponds to a lane group and may represent multiple lanes.
2. Each dot represents a separate zone that counts the corresponding movement(s).



## Traffic Data Import And Website Setup

UGPTI created reporting and exporting capabilities for each of the six intersections using the newly expanded database to include the City of Bismarck.

## Training

UGPTI provided training to all stakeholders at a meeting held October 5, 2023.

## DATA QUALITY AUDITS

Random data quality audits were performed, and traffic volumes were collected manually in 15-minute intervals at each of the approaches. The manually collected traffic counts were then compared with data collected by cameras. Hourly traffic volumes were then compared using the GEH statistic, which is computed as follows:

$$GEH = \sqrt{\frac{(A - M)^2}{(A + M)/2}}$$

Where:

A = Autoscope traffic count

M = manual traffic count

Also, peak hour factors (PHF) were compared for hourly traffic volumes. For intersection turning movement counts, PHF is computed as follows:

$$PHF = \frac{V}{4 \times V_{15}}$$

Where:

V = hourly volume

V<sub>15</sub> = volume during the peak 15 minutes of flow

The results of the data quality audit are shown below in Tables 3 through 8.

Table 3. Data quality audit results for 43rd Ave NE @ Ottawa St/Lockport St

43rd Ave NE @ Ottawa St/Lockport St																	
Interval	Source	Southbound				Westbound				Northbound				Eastbound			
		Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total
15-min interval	Manual		20	28	48		76	5	81		37	5	42		51	6	57
	Autoscope		20	28	48		76	5	81		37	5	42		51	6	57
15-min interval	Manual		27	24	51		108	3	111		28	5	33		69	22	91
	Autoscope		28	28	56		108	4	112		28	5	33		70	22	92
15-min interval	Manual		28	30	58		105	4	109		31	7	38		74	16	90
	Autoscope		29	28	57		105	6	111		31	7	38		74	16	90
15-min interval	Manual		30	20	50		117	10	127		25	8	33		81	15	96
	Autoscope		33	21	54		117	10	127		26	8	34		81	15	96
Hourly Totals	Manual		105	102	207		406	22	428		121	25	146		275	59	334
	Autoscope		110	105	215		406	25	431		122	25	147		276	59	335
	GEH		<b>0.5</b>	<b>0.3</b>	<b>0.6</b>		<b>0.0</b>	<b>0.6</b>	<b>0.1</b>		<b>0.1</b>	<b>0.0</b>	<b>0.1</b>		<b>0.1</b>	<b>0.0</b>	<b>0.1</b>

Table 4. Data quality audit results for N Bismarck Expy @ E Divide Ave/Revere Dr

N Bismarck Expy @ E Divide Ave/Revere Dr																	
Interval	Source	Southbound				Westbound				Northbound				Eastbound			
		Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total
15-min interval	Manual	27	169	3	199	5	5	3	13		180	16	196	14	1	36	51
	Autoscope	27	169	3	199	5	5	3	13		173	16	189	18	1	38	57
15-min interval	Manual	36	166	2	204	1	3	7	11		168	19	187	12	5	50	67
	Autoscope	33	153	1	187	1	3	10	14		165	18	183	11	5	51	67
15-min interval	Manual	35	212	2	249	5	3	8	16		217	14	231	13	2	30	45
	Autoscope	39	194	2	235	8	6	8	22		210	13	223	12	2	28	42
15-min interval	Manual	31	190	1	222	2	2	4	8		193	23	216	21	3	37	61
	Autoscope	35	183	1	219	2	2	6	10		189	21	210	21	3	36	60
Hourly Totals	Manual	129	737	8	874	13	13	22	48		758	72	830	60	11	153	224
	Autoscope	134	699	7	840	16	16	27	59		737	68	805	62	11	153	226
	GEH	<b>0.4</b>	<b>1.4</b>	<b>0.4</b>	<b>1.2</b>	<b>0.8</b>	<b>0.8</b>	<b>1.0</b>	<b>1.5</b>		<b>0.8</b>	<b>0.5</b>	<b>0.9</b>	<b>0.3</b>	<b>0.0</b>	<b>0.0</b>	<b>0.1</b>

Table 5. Data quality audit results for Main Ave @ 5th St

Main Ave @ 5th St																	
Interval	Source	Southbound				Westbound				Northbound				Eastbound			
		Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total
15-min interval	Manual	5	12		17		107	7	114	17	14	5	36		113	5	118
	Autoscope	6	12		18		112	7	119	17	15	5	37		111	5	116
15-min interval	Manual	7	18		25		93	7	100	17	19	1	37		111	5	116
	Autoscope	9	14		23		96	7	103	17	19	2	38		123	5	128
15-min interval	Manual	6	21		27		107	6	113	10	19	7	36		120	3	123
	Autoscope	8	23		31		116	8	124	14	19	7	40		125	3	128
15-min interval	Manual	7	25		32		139	5	144	16	17	8	41		118	2	120
	Autoscope	12	24		36		133	2	135	18	25	4	47		129	2	131
Hourly Totals	Manual	25	76		101		446	25	471	60	69	21	150		462	15	477
	Autoscope	35	73		108		457	24	481	66	78	18	162		488	15	503
	GEH	1.8	0.3		0.7		0.5	0.2	0.5	0.8	1.0	0.7	1.0		1.2	0.0	1.2

Table 6. Data quality audit results for Main Ave @ 3rd St

Main Ave @ 3rd St																	
Interval	Source	Southbound				Westbound				Northbound				Eastbound			
		Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total
15-min interval	Manual		112	12	124	7	94	32	133		112	12	124	14	92	6	112
	Autoscope		96	19	115	7	91	29	127		96	17	113	18	92	9	119
15-min interval	Manual		59	2	61	7	88	36	131		79	10	89	11	54	1	66
	Autoscope		59	3	62	7	86	32	125		80	10	90	11	54	1	66
15-min interval	Manual		52	9	61	3	75	26	104		85	14	99	9	41	1	51
	Autoscope		50	9	59	3	73	25	101		84	13	97	9	41	1	51
15-min interval	Manual		55	10	65	6	70	20	96		78	8	86	7	40	3	50
	Autoscope		53	9	62	6	69	20	95		78	7	85	7	40	3	50
Hourly Totals	Manual		278	33	311	23	327	114	464		354	44	398	41	227	11	279
	Autoscope		258	40	298	23	319	106	448		338	47	385	45	227	14	286
	GEH		1.2	1.2	0.7	0.0	0.4	0.8	0.7		0.9	0.4	0.7	0.6	0.0	0.8	0.4

Table 7. Data quality audit results for Tyler Pkwy @ Burnt Boat Dr

Tyler Pkwy @ Burnt Boat Dr																	
Interval	Source	Southbound				Westbound				Northbound				Eastbound			
		Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total
15-min interval	Manual		132	9	141		12	48	60		154	55	209	22	12	26	60
	Autoscope		124	9	133		12	43	55		149	48	197	22	14	28	64
15-min interval	Manual		134	5	139		13	39	52		153	72	225	30	20	30	80
	Autoscope		131	5	136		11	29	40		143	68	211	28	20	31	79
15-min interval	Manual		175	5	180		19	57	76		174	63	237	30	16	31	77
	Autoscope		170	5	175		19	49	68		158	53	211	25	16	31	72
15-min interval	Manual		166	8	174		15	68	83		189	46	235	31	8	33	72
	Autoscope		162	8	170		13	60	73		175	41	216	28	8	34	70
Hourly Totals	Manual		607	27	634		59	212	271		670	236	906	113	56	120	289
	Autoscope		587	27	614		55	181	236		625	210	835	103	58	124	285
	GEH		<b>0.8</b>	<b>0.0</b>	<b>0.8</b>		<b>0.5</b>	<b>2.2</b>	<b>2.2</b>		<b>1.8</b>	<b>1.7</b>	<b>2.4</b>	<b>1.0</b>	<b>0.3</b>	<b>0.4</b>	<b>0.2</b>

Table 8. Data quality audit results for US Hwy 83 @ ND 1804/71st Ave NE

US Hwy 83 @ ND 1804/71st Ave NE																	
Interval	Source	Southbound				Westbound				Northbound				Eastbound			
		Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total
15-min interval	Manual	11	97	20	128	22	20	22	64	24	68	13	105	12	10	9	31
	Autoscope	11	96	27	134	22	16	17	55	25	69	13	107	10	10	8	28
15-min interval	Manual	7	72	13	92	18	15	16	49	22	68	5	95	11	9	7	27
	Autoscope	8	72	13	93	18	12	14	44	23	72	4	99	10	9	7	26
15-min interval	Manual	12	65	10	87	15	17	20	52	17	73	12	102	13	6	12	31
	Autoscope	11	65	10	86	14	15	17	46	22	76	12	110	13	6	12	31
15-min interval	Manual	18	66	18	102	17	23	17	57	25	58	16	99	9	15	11	35
	Autoscope	15	66	20	101	12	20	14	46	32	58	19	109	9	12	10	31
Hourly Totals	Manual	48	300	61	409	72	75	75	222	88	267	46	401	45	40	39	124
	Autoscope	45	299	70	414	66	63	62	191	102	275	48	425	42	37	37	116
	Difference	<b>0.4</b>	<b>0.1</b>	<b>1.1</b>	<b>0.2</b>	<b>0.7</b>	<b>1.4</b>	<b>1.6</b>	<b>2.2</b>	<b>1.4</b>	<b>0.5</b>	<b>0.3</b>	<b>1.2</b>	<b>0.5</b>	<b>0.5</b>	<b>0.3</b>	<b>0.7</b>

## TRAFFIC ANALYSIS TOOL CAPABILITIES

The NDSU Traffic Analysis Tool, which the aforementioned agencies can now access, has the following reporting capabilities:

- Graphs
  - Volume Profile
  - Speed Profile
  - Monthly Seasonal Factors
  - Day-of-the-Week Seasonal Factors
- Turning Movement Counts
  - Peak Hour Volume/Factor
  - Annual Average Daily Traffic (AADT)
  - Monthly Average Daily Traffic (MADT)
  - Average Daily Traffic (ADT)

These reports are briefly discussed below.

### Volume Profile

The Volume Profile report provides an analysis of 15-minute traffic counts to create a line chart of 15-minute volumes for the selected intersection. This report can be created for one or multiple days. In the case of multiple days, the reported traffic volumes are averaged over the selected number of days. The PDF report includes three charts – one for the entire intersection and the other two for the intersecting corridors. Sample charts showing the entire intersection are shown in Figures 5 and 6.

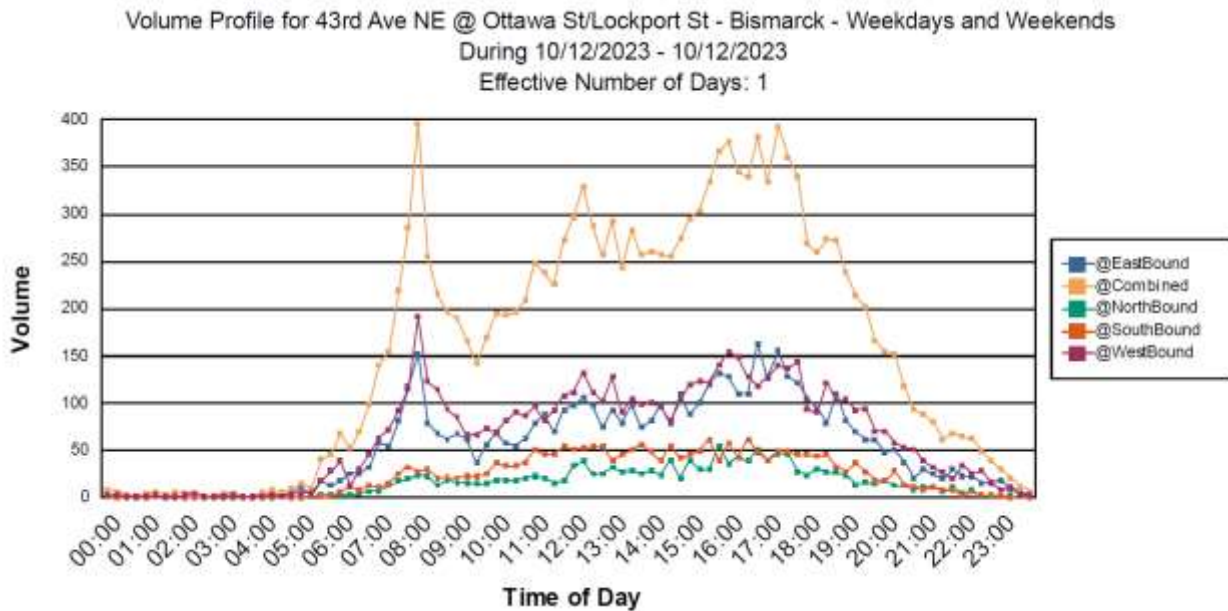


Figure 5. Sample Volume Profile report for 43rd Ave NE @ Ottawa St/Lockport St, Bismarck

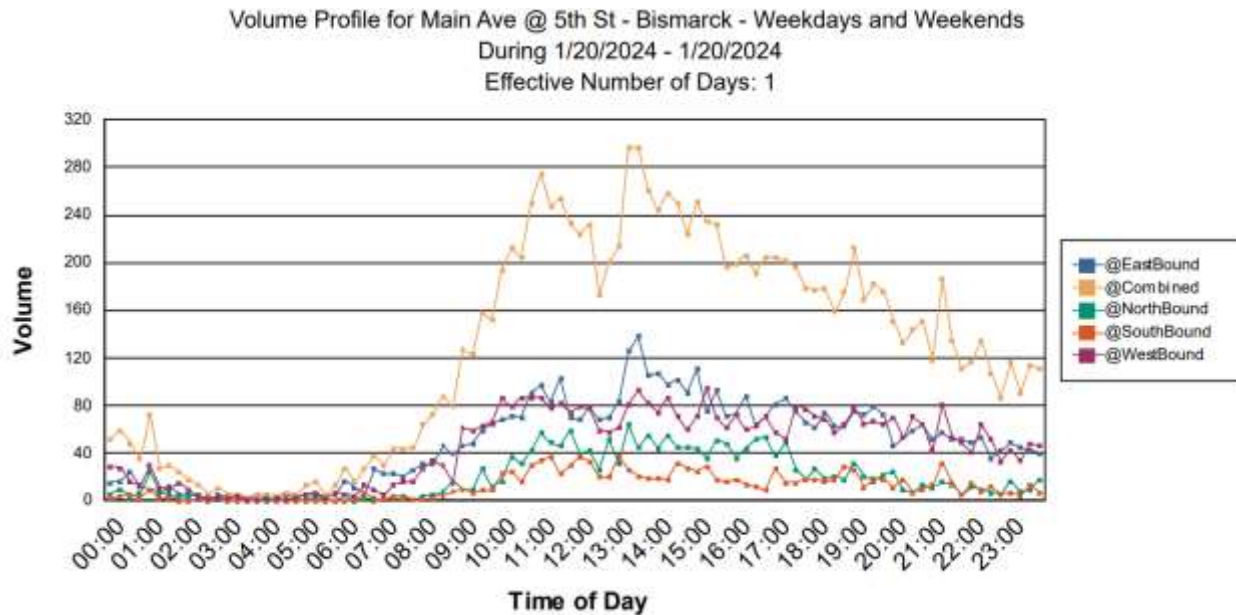


Figure 6. Sample Volume Profile report for Main Ave @ 5th St, Bismarck

This report can be used to determine the beginning and end of peak/off-peak periods and to visualize their level of dispersion over time. This information is helpful in deciding implementation schedules of time-of-day plans, including flash modes.

In addition to the PDF report with charts, an Excel export of the underlying data can also be performed.

### Speed Profile Report

Similar to Volume Profile, Speed Profile plots 15-minute average speed data over a 24-hour period. When multiple days are selected for analysis, the speeds for individual 15-minute periods are averaged over the days. Note that only through-lane speeds are considered for analysis in this report. The PDF report includes three charts – one for the entire intersection and the other two for the individual intersecting corridors. A sample chart showing the series for the entire intersection is shown in Figure 7.

This report can be used to identify problem spots/times where drivers commonly speed, such as around bar closing, where coordinated efforts between engineering and law enforcement may be required. Time periods with zero detected vehicles are not plotted in this chart.

Speed Profile for US Hwy 83 @ ND 1804/71st Ave NE - Bismarck - Weekdays and Weekends  
 During 7/22/2022 - 7/22/2022  
 Effective Number of Days: 1

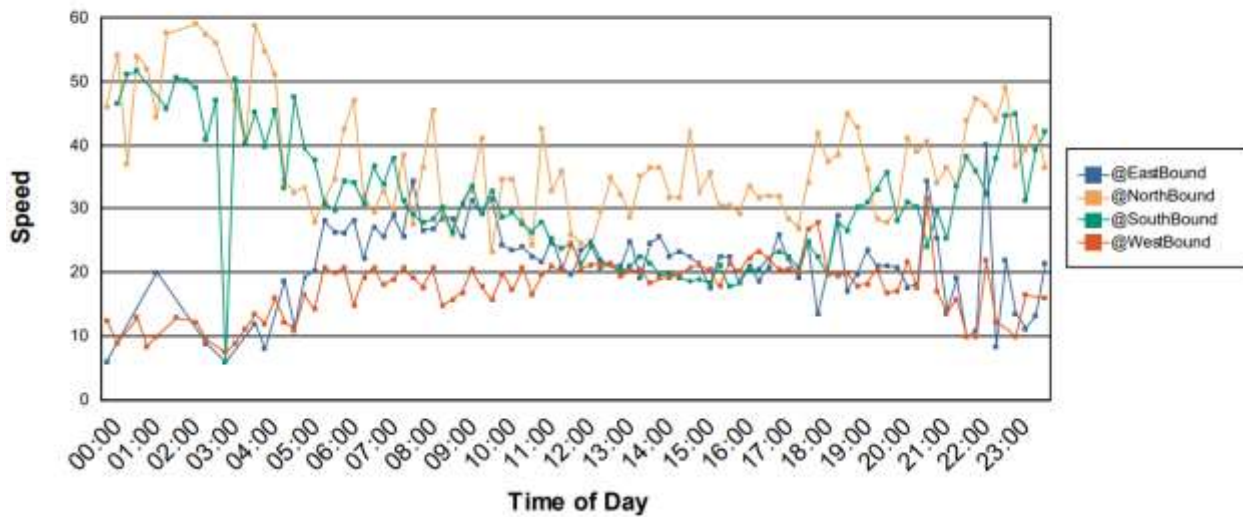


Figure 7. Sample Speed Profile report for US Hwy 83 @ ND 1804/71st Ave NE, Bismarck

### Monthly Seasonal Factors

The Monthly Seasonal Factors report provides an analysis of daily traffic count data to create a bar chart of monthly average daily traffic volumes and corresponding factors (in comparison with AADT) for the selected intersection. The report can be created for a selected year or for the immediate past 12 months if desired. This report consists of two charts – one for the entire intersection and another based on bi-directional totals at all legs of the intersection. A sample chart for the entire intersection is shown in Figure 8.

This report can be used to identify locations where variations in seasonal ADT are high enough to warrant a seasonal signal timing plan. This report can also show how a combination of various seasonal factors, such as school sessions or harvest seasons, affect ADT.

2022 Monthly Seasonal Factors for US Hwy 83 @ ND 1804/71st Ave NE - Bismarck  
 Effective Number of Days: 365

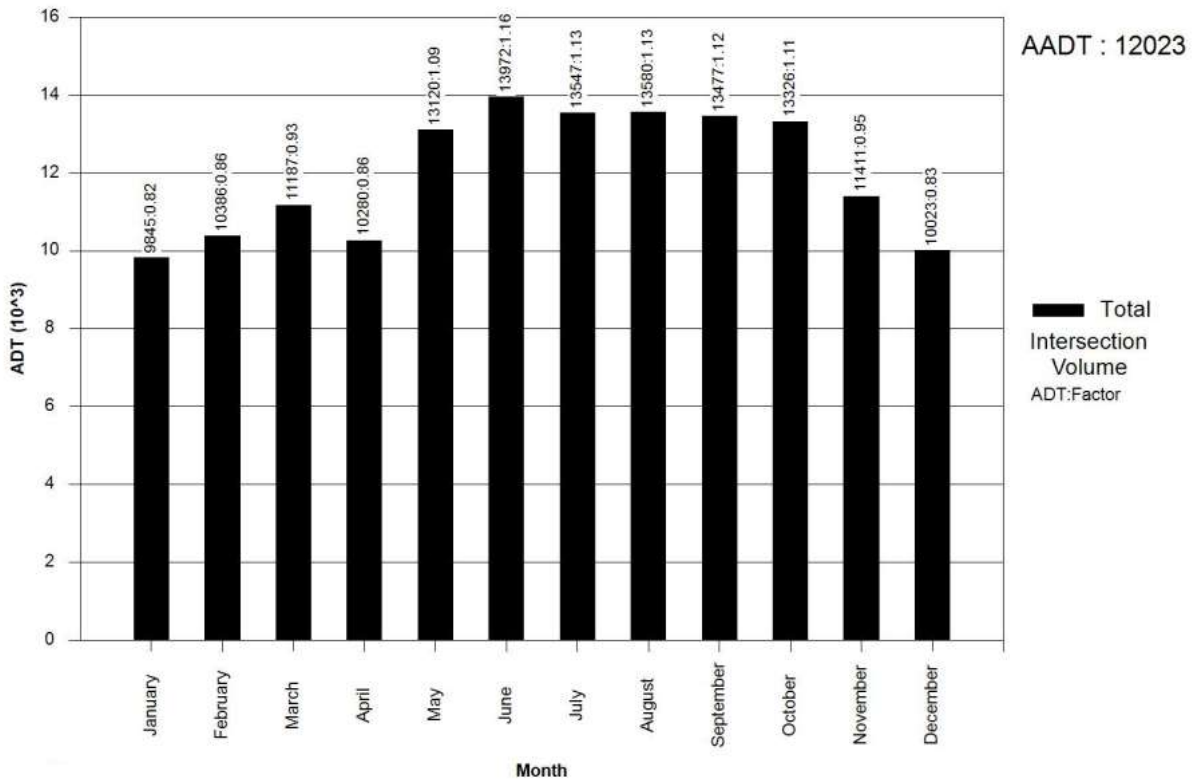


Figure 8. Sample 2022 Monthly Seasonal Factors report for US Hwy 83 @ ND 1804/71st Ave NE, Bismarck

### Day-of-the-Week Seasonal Factors

The Day-of-the-Week Seasonal Factors report provides an analysis of daily traffic counts to create a bar chart showing ADT for each day of the week for a given month. It also shows bi-directional ADT volumes by each approach at the intersection. The report can be created for any month/year for which data are available.

This report can be used to identify fluctuations in ADT across the week that may be a result of changing demand, special events, or other factors. Further, this report would help to determine locations that may require a special time-of-day plan for the weekends. A sample chart is shown in Figure 9.



January 2024 Day of the Week Seasonal Factors for Main Ave @ 5th St - Bismarck  
 Effective Number of Days: 21

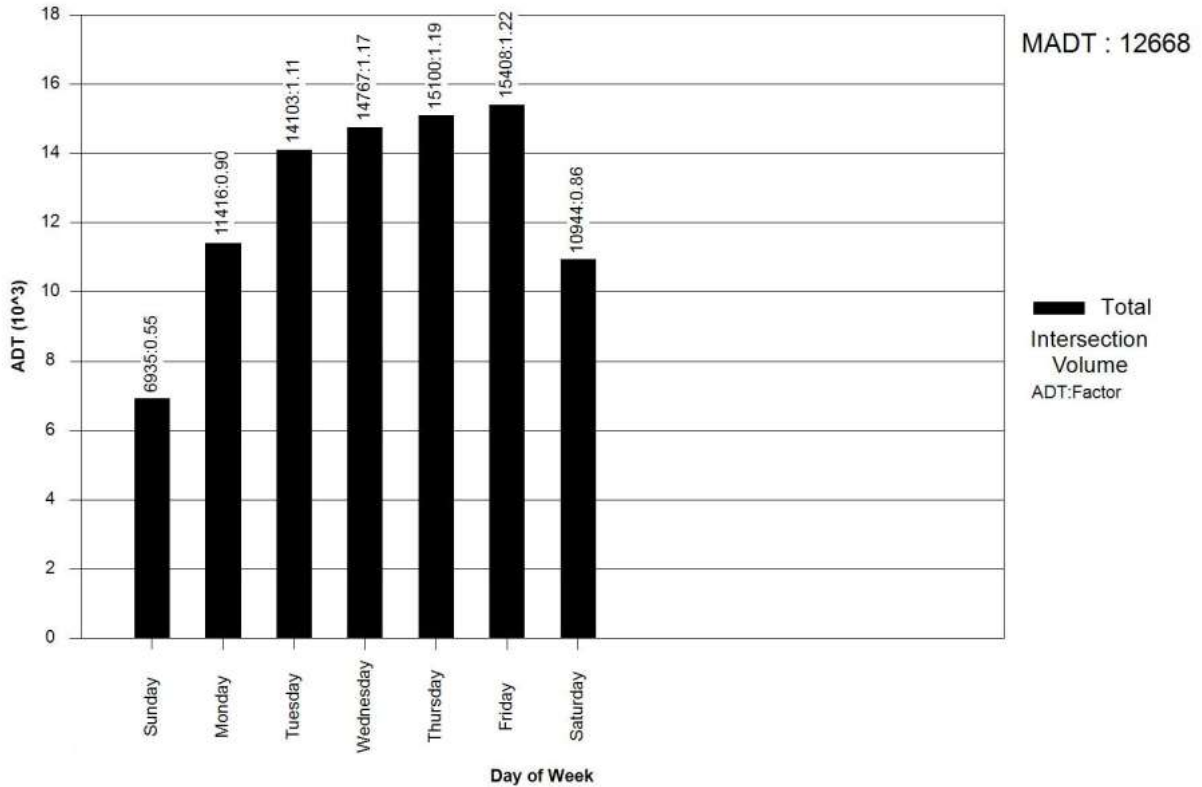


Figure 9. Sample January 2024 Day-of-the-week Seasonal Factor report for Main Ave @ 5th St, Bismarck

### Peak Hour Volume/Factors

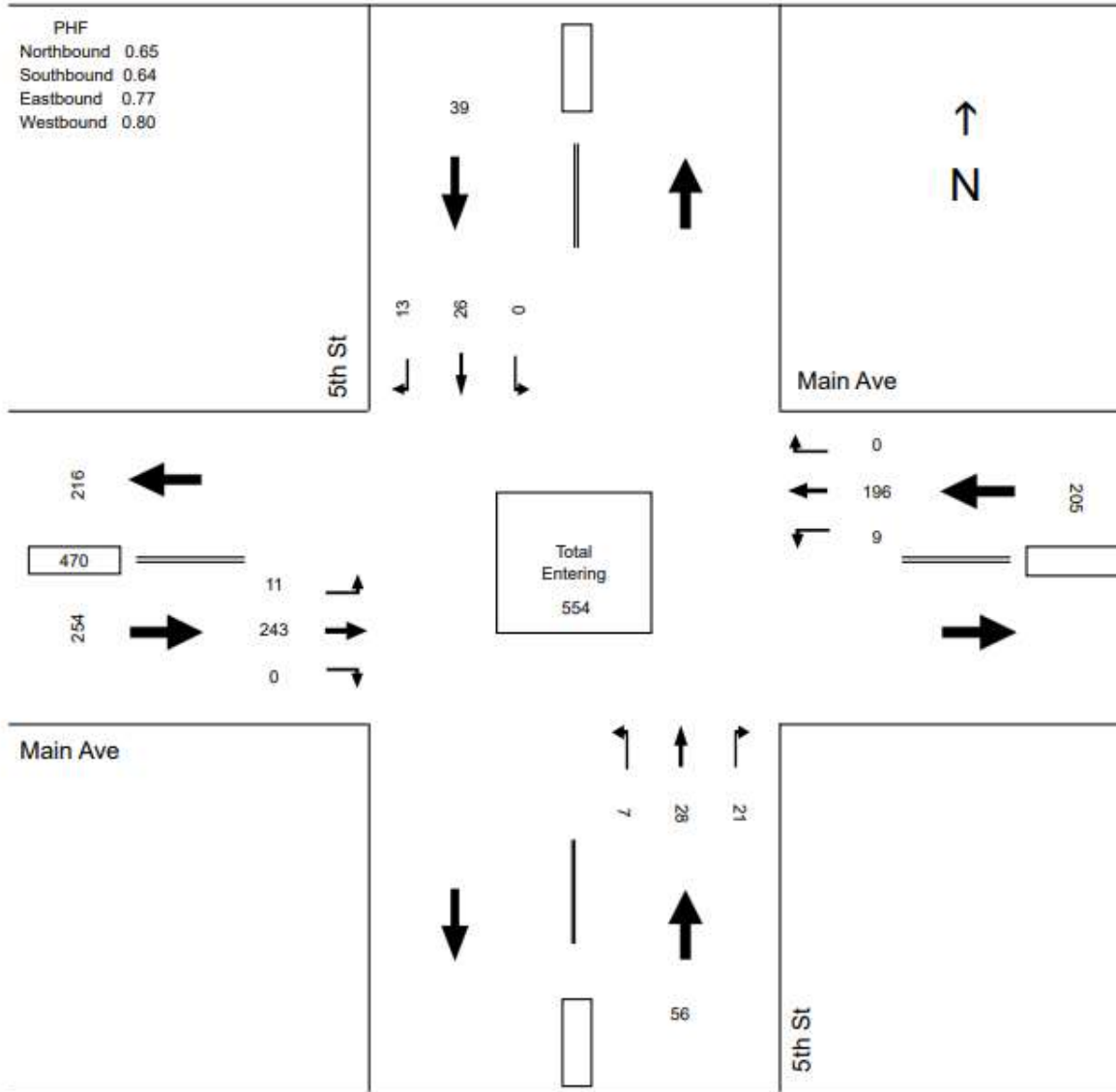
The Peak Hour Volume/Factors report provides an analysis of 15-minute traffic count data to create an intersection turning movement count diagram for selected peak period(s). This report can be created for a custom date range. By default, AM, midday, and PM peak periods can be analyzed. The peak-hourly traffic volumes reported are averaged over the selected date range. Note that the peak hour for each day included in the analysis period may be unique in that it may have occurred at a different time. This uniqueness of traffic demand is taken into consideration during the analysis, and only the peak hour traffic for each day is considered for averaging the hourly volumes. Also, peak hour factors are calculated for each of the approaches at the selected intersection. A sample report is shown in Figure 10. An Excel export of the underlying data can also be performed.

This turning movement counts generated in this report can be directly used as an input for phasing design, signal retiming, and progression design. Reports can be generated based on information presented in the Monthly Seasonal Factors report, therefore adding the ability to create seasonal time-of-day plans (e.g., September – April weekday plan, May – August weekday plan).

In addition to the built-in capability to create AM, midday, and PM peak period reports, a custom time period may also be selected for analysis. This functionality would enable agencies to create custom time-of-day plans for repetitive special events such as sporting events, etc.

# NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

Peak Hour Volume/Factor for Main Ave @ 5th St - Bismarck - Weekdays  
 During 2024-01-01 - 2024-01-21  
 Effective Number of Days: 15  
 AM (6 - 10 AM)

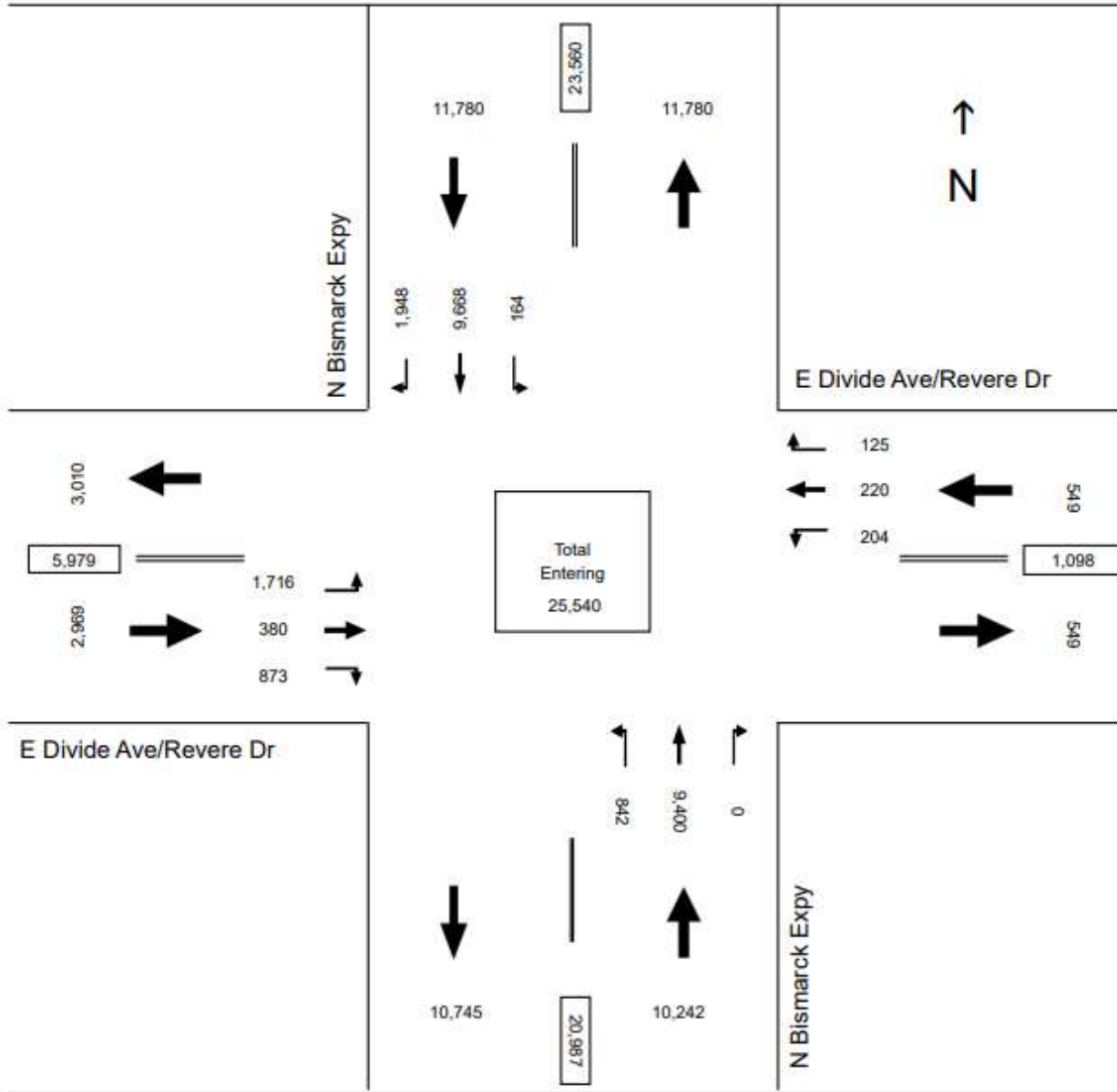


The information generated by this calculator is for estimation uses only. The Upper Great Plains Transportation Institute and North Dakota State University make no representation or warranty, expressed or implied, regarding the accuracy or reliability of the results.

Figure 10. Peak Hour Volume/Factor report for Main Ave @ 5th St, Bismarck

# NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

AADT TMC Diagram for N Bismarck Expy @ E Divide Ave/Revere Dr - Bismarck - Weekdays  
 During 01/01/2023 - 12/31/2023  
 Effective Number of Days: 222



The information generated by this calculator is for estimation uses only. The Upper Great Plains Transportation Institute and North Dakota State University make no representation or warranty, expressed or implied, regarding the accuracy or reliability of the results.

Figure 11. Annual Average Daily Traffic report for N Bismarck Expy @ E Divide Ave/Revere Dr, Bismarck

## **AADT**

The AADT report provides an analysis of ADT traffic counts to calculate the annual ADT volumes for the selected intersection. Similar to the Peak Hour Factor/Volume report, the information is provided in a turning movement count diagram format. In addition to the intersection AADT, the report also provides AADT values per approach/direction. This report can be created for a selected year or the immediate past 12 months. The traffic volumes reported are averaged over the entire year (based on days with available data). A sample report is shown in Figure 11. An Excel export of the underlying data can also be performed.

The AADT values calculated in this report can be used for traffic safety, traffic operations, and transportation planning purposes. The regional travel demand model can be calibrated using these AADT reports in addition to ATR counts/short counts.

## **MADT**

Similar to AADT, the MADT report provides an analysis of the ADT database to calculate the MADT volumes for the selected intersection and month. In addition to the MADT value for the intersection, the report also provides MADT values per approach/direction as well. This PDF report can be created for any selected month/year. The reported traffic volumes are averaged over the number of days based on available data within the selected month. An Excel export of the underlying data can also be performed. A sample report is shown in Figure 12.

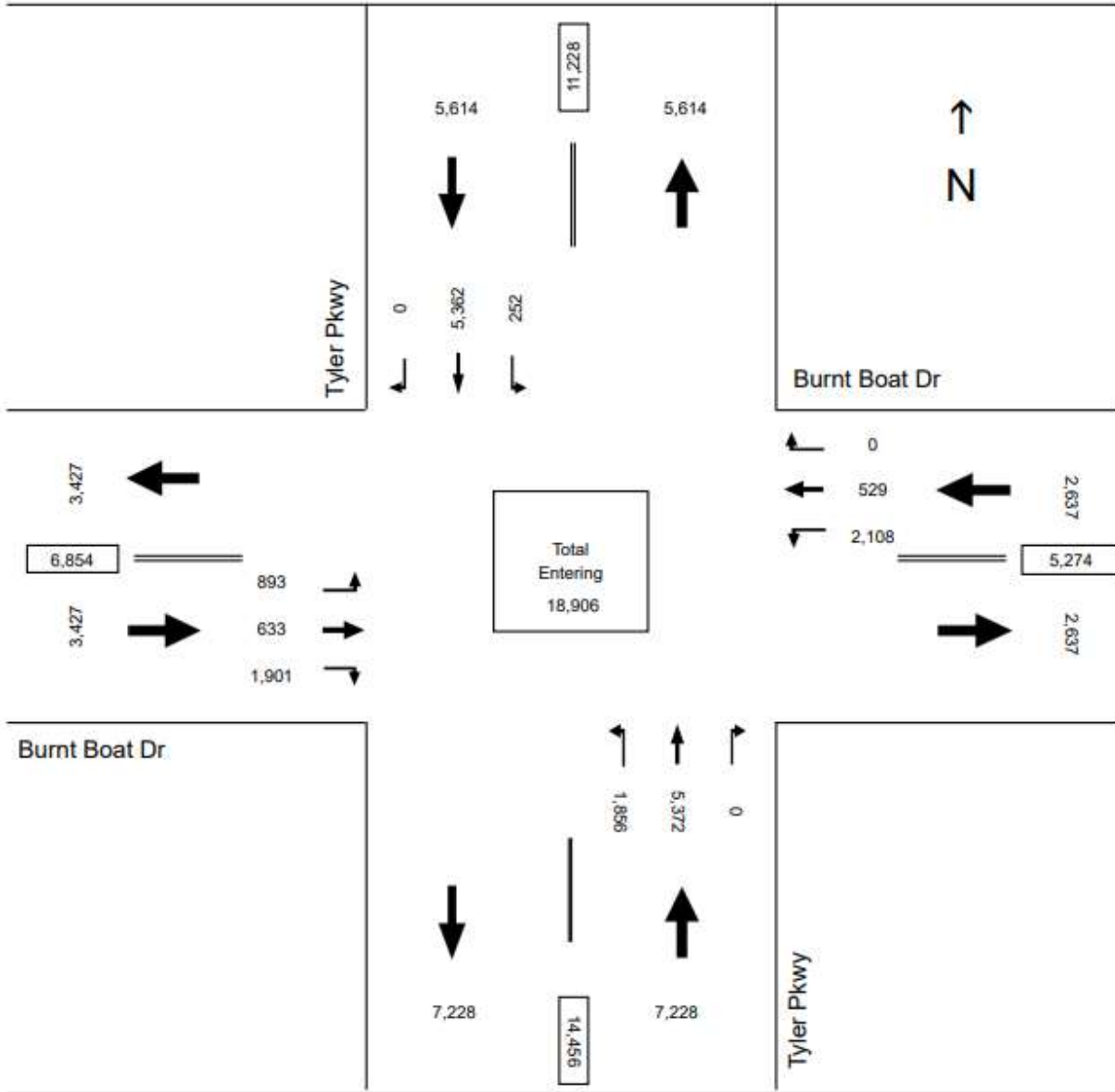
This report can be used to determine monthly average traffic volumes by each movement and approach at the selected intersection.

## **ADT**

Similar to AADT and MADT, the ADT report provides an analysis of the ADT database to calculate average daily traffic for custom durations. The traffic volume information is also presented in a similar manner. This report can be created for any number of days. The ADT report can be used to determine how certain special events may affect traffic demand and patterns. A sample report is shown in Figure 13.

# NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

January MADT TMC Diagram for Tyler Pkwy @ Burnt Boat Dr - Bismarck - Weekdays and Weekends  
 During 1/01/2024 - 1/31/2024  
 Effective Number of Days: 21

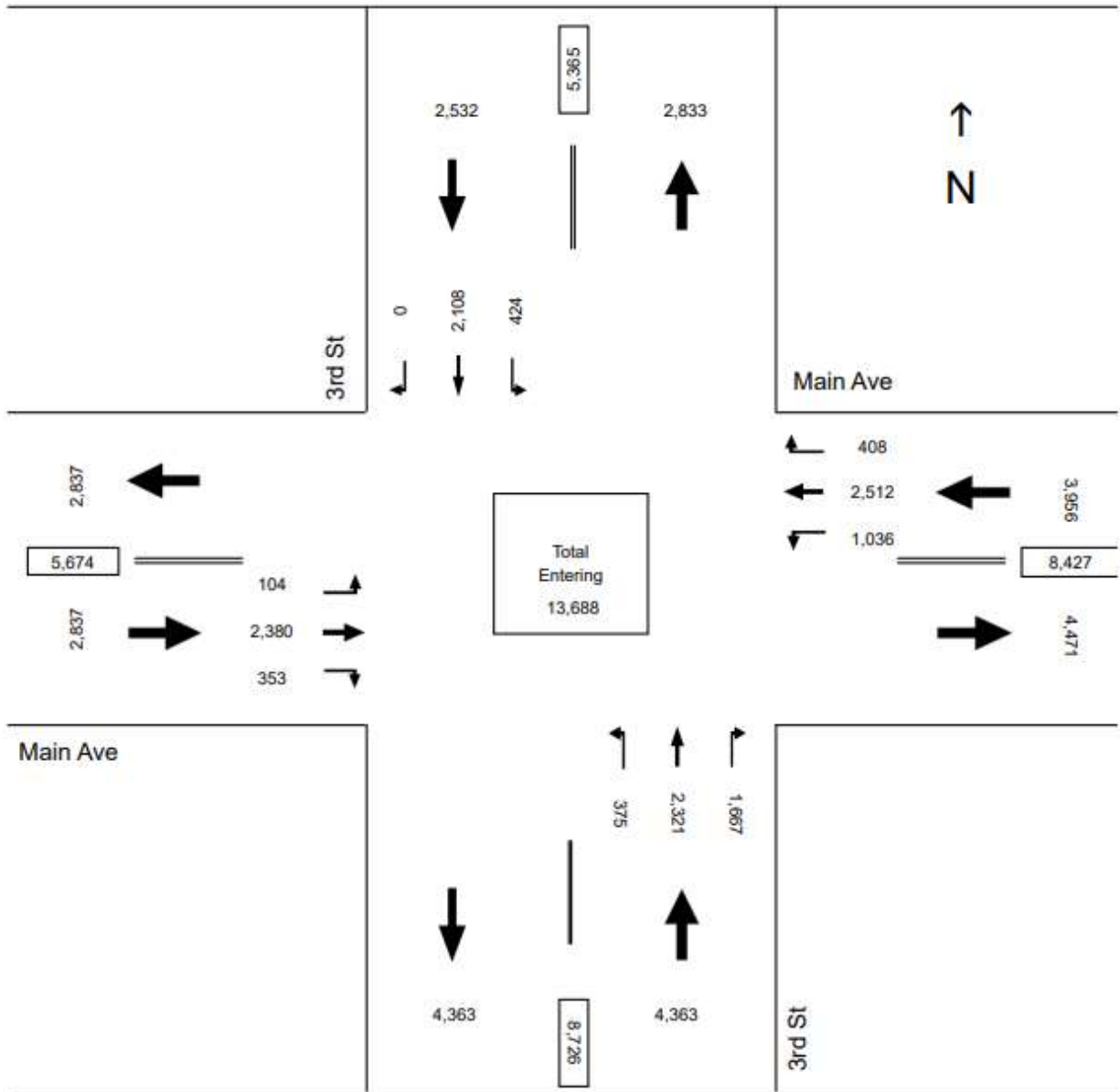


The information generated by this calculator is for estimation uses only. The Upper Great Plains Transportation Institute and North Dakota State University make no representation or warranty, expressed or implied, regarding the accuracy or reliability of the results.

Figure 12. January 2024 MADT report for Tyler Pkwy @ Burnt Boat Dr, Bismarck

# NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

ADT TMC Diagram for Main Ave @ 3rd St - Bismarck - Weekends  
 During 7/30/2020 - 1/21/2024  
 Effective Number of Days: 364



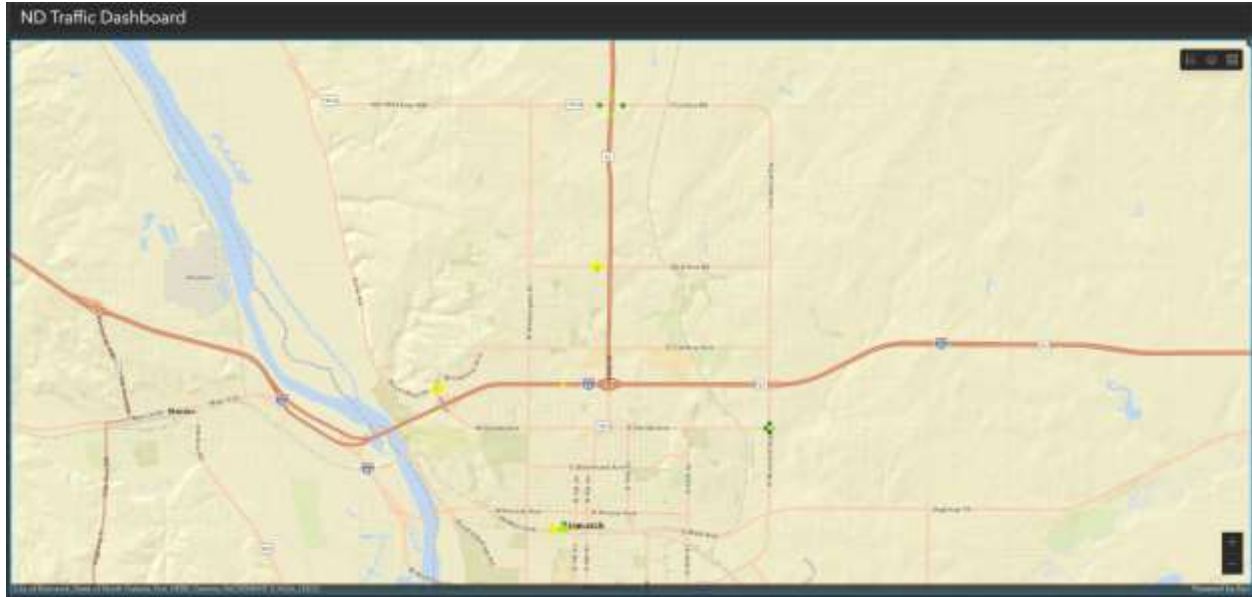
The information generated by this calculator is for estimation uses only. The Upper Great Plains Transportation Institute and North Dakota State University make no representation or warranty, expressed or implied, regarding the accuracy or reliability of the results.

Figure 13. Sample ADT report for Main Ave @ 3rd St - Bismarck

## NORTH DAKOTA TRAFFIC DASHBOARD

ATAC has created a GIS-based web dashboard for traffic data collected from state-owned automatic traffic recorders (ATRs) as well as the signalized intersections in the NDSU Traffic Analysis Tool database. The signalized intersections include those in the Grand Forks, Fargo, and Bismarck metro regions. The dashboard can be found at:

<https://www.ugpti.org/r/trafficdb/>



*Figure 14. North Dakota Traffic Dashboard displaying Bismarck area intersections*

Figure 14 shows each leg of intersection data collection locations set up under this project that have more than a year's worth of data in the database. For this COG/MPO signalized intersection data, three type of traffic growth/decay metrics can be displayed based on the "stations" displaying within the map window in Figure 14:

1. Weekly ADT  
Week-by-week trend line plot of weekly ADT.
2. Growth Rate  
Bar chart comparing weekly ADT to that of the same week in the previous year.
3. Daily ADT  
Day-to-day trend line plot of daily ADT

Figures 15, 16, and 17 show weekly ADT, weekly growth rate, and daily ADT plots, respectively, for the locations shown in Figure 14.

Note that the creation of this traffic dashboard was not undertaken as part of this project. Information about the dashboard is shared here as an example of useful application of the valuable data being collected.

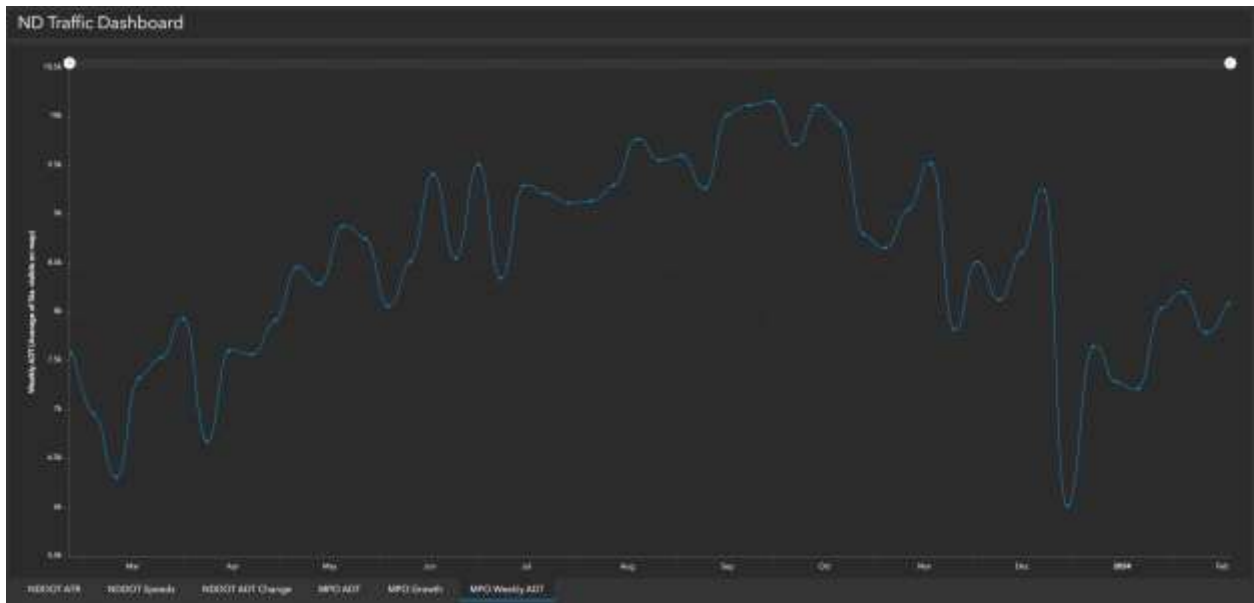


Figure 15. Weekly ADT plot for Bismarck's intersections

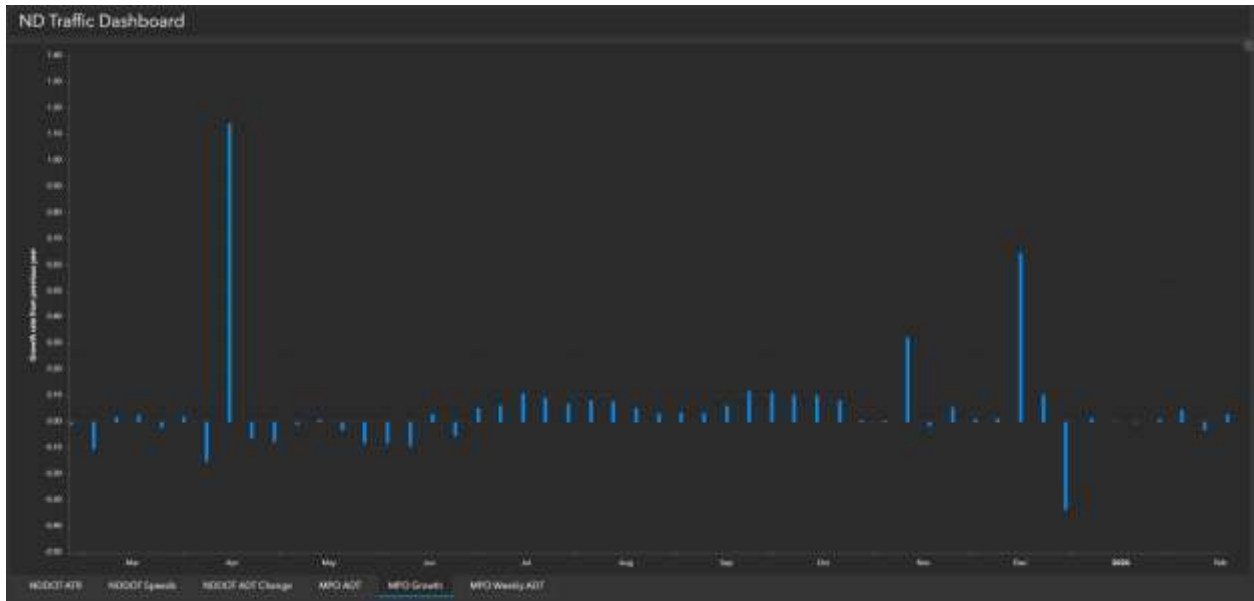


Figure 16. Weekly growth rate plot for Bismarck's intersections





Figure 17. Daily ADT plot for Bismarck intersections

## EMAIL NOTIFICATIONS

These emails are sent to stakeholders, engineers, and developers to notify them of potential outages, which may have been caused by power disruptions, communication loss, or other circumstances. These would facilitate prompt troubleshooting of any issues, thereby minimizing data loss. Currently, weekly emails are sent to stakeholders to reassure them that the data are not more than a week old. UGPTI staff, including engineers and developers, receive these emails daily so any issues may be tackled as soon as possible.

UGPTI engineers and developers also receive notifications regarding the availability of data from intersections newly set for traffic data collection. This facilitates a timely setup of intersections within the traffic analysis database.

## Corridor Reports

The graphical user interface (GUI) of the traffic analysis website and the supporting programming enables collective reporting of a group of intersections along a corridor. So far, this feature is available for AADT, MADT, and ADT reports. The homepage of the traffic analysis website now presents the user with an option to either select a single intersection or a corridor using separate drop-down menu items. In the case of corridor reports, the website creates a compressed folder containing individual PDF reports. Note that major intersections along intersecting corridors are included in groups of both intersecting streets.

## RECOMMENDATIONS

Based on the data quality audit findings of this pilot project for the BisMan MPO and City of Bismarck, several next steps have been identified and the corresponding recommendations are discussed below.

## **BisMan MPO**

Consider:

- Continue to support member agencies in its traffic data collection efforts.
- Assist City of Mandan so a similar pilot project for its intersection data collection may also be undertaken.
- Set up more intersections for traffic data collection in City of Bismarck.

## **City of Bismarck**

Consider:

- Set up more locations for traffic data collection, mainly to include intersections along Bismarck Expy and Main Ave corridors.
- Continue collaborating with UGPTI to keep automated processes and current connections in place to facilitate troubleshooting.
- Continue collaborating with UGPTI until ongoing IT-related changes are finalized, and issues already identified have been rectified.