Grand Forks - East Grand Forks
Metropolitan Planning Organization

Grand Forks – East Grand Forks Bridge Closure Traffic Management Study

Final Report

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Executive Summary

The cities of Grand Forks, ND, and East Grand Forks, MN, which are separated by the Red River, have experienced a history of spring flooding from the Red River and the Red Lake River. Three of the six highest Red River crests have occurred in this area since 1996. Therefore, flood control projects were appropriated for Grand Forks and East Grand Forks in 1999 to provide permanent flood protection from both the Red River and the Red Lake River. The primary components of the project include constructing levees, diversions, and flood walls to provide protection for a 250-year flood event.

Three Red River bridges provide motor vehicle access between the two cities, which include the Kennedy Bridge (Gateway Dr./US Highway 2), Sorlie Bridge (Demers Ave.), and the Point Bridge (Minnesota Ave/1st St. SE). Spring flooding can close some of these bridges for an extended period of time, creating significant delay time for motorists. The closures cause excessive traffic congestion, resulting in increased response time for emergency vehicles and additional delay time for motorists. In addition, bridge closures may occur periodically due to planned maintenance or inspection activities. Currently, no formal protocols or procedures exist for managing traffic during bridge closure events in the Grand Forks/East Grand Forks metropolitan area. Because of the significant impacts of bridge closures to the traveling public, the Grand Forks/East Grand Forks Metropolitan Planning Organization (GF-EGF MPO) undertook this study to evaluate and improve traffic management and operations during bridge flood and maintenance events.

This study brought key stakeholders, such as the City of Grand Forks, City of East Grand Forks, North Dakota Department of Transportation (NDDOT), Minnesota Department of Transportation (Mn/DOT), and the US Army Corps of Engineers, together to discuss and develop protocols for coordinating the closing and reopening of bridges. This study analyzed eight bridge closure scenarios (three flood scenarios and five maintenance scenarios), which are as follows:

- Point Bridge Closed (Flood Scenario)
- Point and Sorlie Bridges Closed (Flood Scenario)
- Point, Sorlie, and Murray Bridges Closed (Flood Scenario)
- Point Bridge Closed (Maintenance Scenario)
- Sorlie Bridge Closed (Maintenance Scenario)
- Murray Bridge Closed (Maintenance Scenario)
- Kennedy Bridge Closed (Maintenance Scenario)
- Kennedy Bridge 50% Closed (Maintenance Scenario)

A series of action levels was created based on Red River elevation/stage for guiding agencies during bridge closure events. Each of the closure scenarios has two action levels. The first action level relates to notifying the appropriate agencies and the public about the impending traffic detour (due to the bridge closure). The second action deals with traffic management and control tasks required to implement the closure plan, including signing, road closures, and special traffic signal timing plans.

The traffic management strategies were designed based on feedback from the project's steering committee, transportation analysis tools, and engineering judgment. Detour routes were designed to provide logical choices for detoured motorists using roadways that had sufficient capacity to accommodate diverted traffic.

The GF-EGF MPO's travel demand model was used to estimate travel time impacts for the bridge closure scenarios. The travel time output from the model was converted into road user cost, which determined that bridge closures could cost motorists $15,333 to $101,092 per day due to the additional delay time.

To minimize the adverse impacts of a bridge closure event, this study also performed traffic signal analyses for each bridge closure scenario during three peak-hour periods (AM, midday, and PM). When accounting for the delay time for these three hours, the signal improvements could reduce user cost from $1,201 to $14,754. Detailed information for each bridge closure scenario is contained in its own section after this report. When a bridge closure is foreseen, agencies will refer to the appropriate section of this document and implement the recommended (or equivalent) tasks based on their available resources.

Background

The Red River Valley has had a long history of spring flooding that is primarily caused by the Red River of the North. The cities of Grand Forks, ND, and East Grand Forks, MN, which are separated by the Red River, have an even greater risk of flooding since they are located at the confluence of the Red Lake River and the Red River of the North. Three of the six highest Red River crests have occurred in this area since 1996. Due to the record snow fall amounts received throughout the Red River Valley in the winter of 1996/1997, the spring flood of 1997 was the most severe in modern history. The Red River crested at 54.3 feet (26 feet above flood stage) and caused widespread evacuations and destruction. The disaster forced 90% of Grand Forks' 52,500 residents and all of East Grand Forks' 9,000 residents to abandon their homes. Approximately 75% of the homes in Grand Forks and 99% of the homes in East Grand Forks were damaged. In addition, the flood extensively damaged all of the downtown businesses of the two cities (*1, 2*).

Due to the frequency and severity of the areas spring flooding, flood control projects were appropriated for Grand Forks and East Grand Forks in 1999 to provide permanent flood protection from both the Red River and the Red Lake River. The primary components of the project include constructing levees, diversions, and flood walls that will protect the communities to a level greater than the peak discharge of 1997 or a 250-year flood event (*1, 2*).

Three bridges provide motor vehicle access between the two cities, which include the Kennedy Bridge (Gateway Dr./US Highway 2), Sorlie Bridge (Demers Ave.), and the Point Bridge (Minnesota Ave/1st St. SE). Spring flooding can close some of these bridges for an extended period of time, causing significant delay time for motorists. In April 2006, both the Point and Sorlie Bridges were closed, leaving only the Kennedy Bridge open for normal traffic operations. In addition, the Louis Murray Bridge (crossing the Red Lake River) along 3rd Ave. E. in East Grand Fork was almost closed due to flooding. The closures caused excessive traffic congestion, resulting in increased response time for emergency vehicles and additional delay time for motorists. In addition, bridge closures may occur periodically due to planned maintenance or inspection activities. Currently, no formal protocols or procedures exist for addressing traffic during bridge closure events in the Grand Forks/East Grand Forks metropolitan area.

Objectives

Because of the significant impacts of bridge closures, the Grand Forks/East Grand Forks Metropolitan Planning Organization (GF-EGF MPO) undertook this study to evaluate and improve traffic management and operations during flood and maintenance events. This study brought key stakeholders together to discuss and develop protocols for coordinating the closing and reopening of bridges. In addition, traffic management strategies were developed for various bridge closure scenarios.

The main approach in addressing these objectives focuses on proactive planning. This is achieved by establishing coordination among the relevant stakeholders across several local, county, and state jurisdictions. This coordination is necessary to establish action levels for closing the bridges to vehicular traffic, setting up traffic detours, and implementing alternative traffic control plans. For example, protocols are necessary to ensure that both sides of the bridge are closed at the same time once decisions have been made by the appropriate agencies, such as the City of Grand Forks, City of East Grand Forks, North Dakota Department of Transportation (NDDOT), Minnesota Department of Transportation (Mn/DOT), and the US Army Corps of Engineers. In addition, the agencies should provide traveler information regarding detour routes and implement appropriate traffic control plans to accommodate diverted traffic.

Description of Study Area

This study focuses on the Red River and Red Lake River areas between Grand Forks and East Grand Forks, including the four bridges and their vicinities. The three bridges along the Red River are spaced approximately a half mile apart and serve a significant number of local motorists, as well as pass-through motorists using US Highway 2 and Minnesota State Highway 220 (Figure 1). Average daily traffic (ADT) using the Kennedy, Sorlie, and Point Bridges was 20,800, 13,450, and 6,200, respectively (2005 counts). In addition, the Murray Bridge crossing the Red Lake River in East Grand Forks provides access to the south part of the city and had an ADT of 7,700 (2005 count).

As with most urban areas, the railroad industry is an active component of the Grand Forks/East Grand Forks transportation system. A BNSF Railroad Bridge crosses the Red River between the Sorlie and Point Bridges. This bridge serves a main-line track having two sets of track. Several grade separations exist in Grand Forks to limit the train/vehicle interactions. Within this project's study area, the main tracks intersect several roads within both downtown areas with approximately eight trains per day.

A BNSF branch line crosses Gateway Dr. near 5th St. N./Mill Rd. (Grand Forks), providing one train per day to the ND State Mill. This crossing location was a concern to some of this study's committee members since Gateway Dr. is a major arterial roadway. A discussion with the BNSF Yard Master of Grand Forks stated they may be able to modify their train schedule to/from the mill if requested and approved by the State Mill. In addition, a spur line crosses 4th St. N. near 6th Ave. N. (East Grand Forks), which provides one train per day to Crystal Sugar.

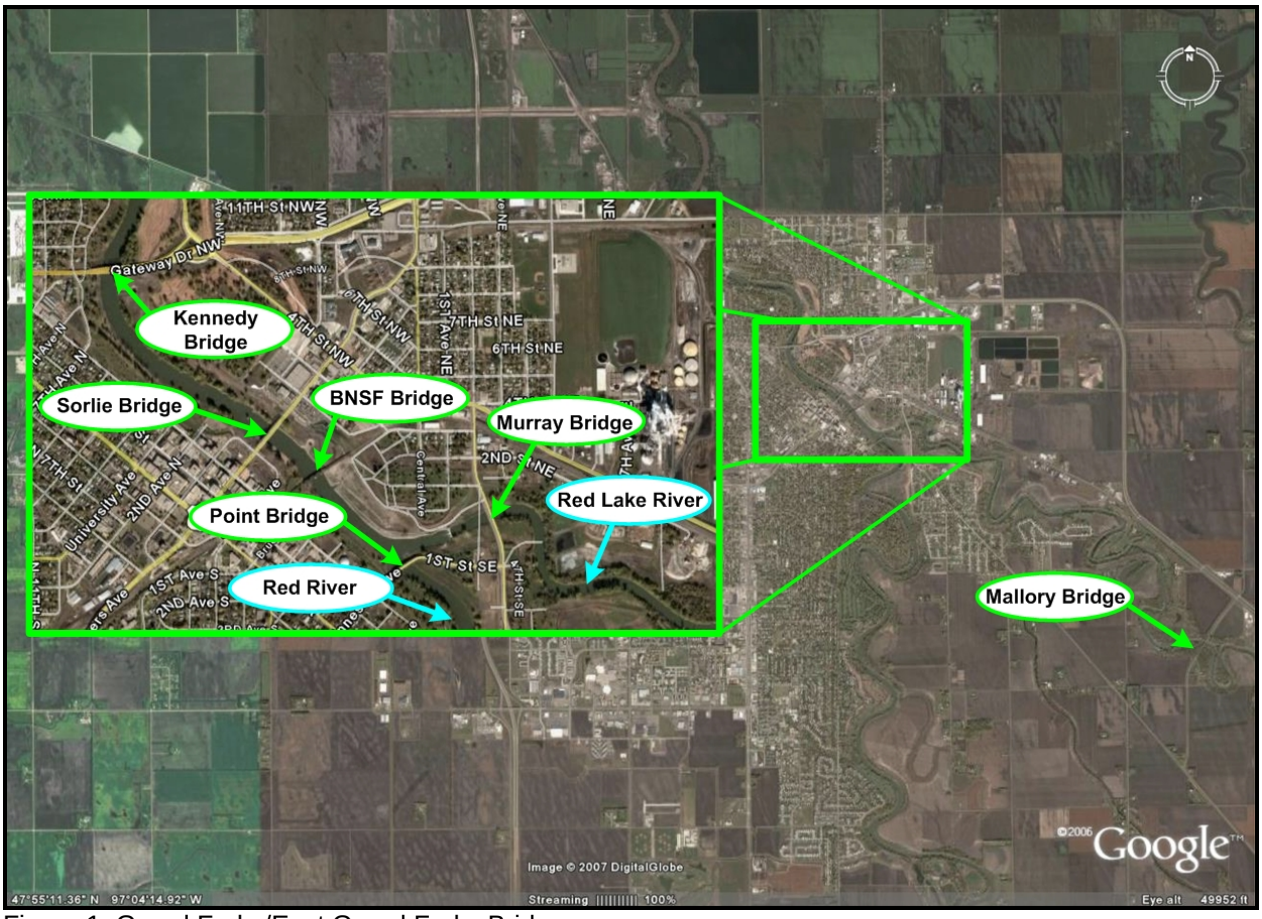


Figure 1. Grand Forks/East Grand Forks Bridges

Steering Committee

A technical steering committee consisting of the GF-EGF MPO's Technical Advisory Committee (TAC) and flood protection staff provided guidance for the project. The stakeholders involved in the steering committee included the following:

a. City of Grand Forks
b. City of East Grand Forks
c. North Dakota Department of Transportation
d. Minnesota Department of Transportation
e. US Army Corps of Engineers
f. Emergency Management Coordinators
g. Grand Forks/East Grand Forks MPO
h. Burlington Northern Santa Fe (BNSF) Railway

The study's kick-off meeting, which occurred on December 13, 2006, brought together the stakeholders to discuss the project and collect relevant information related to bridge closures, which include the following:

a. Agency authority
b. Agency policies/procedures
c. Interagency communication methods
d. Method of information dissemination to the public
e. Traffic management strategies/practices

Several follow-up TAC meetings, conversations, and site visits with various agency representatives were performed to accurately document the information listed above. In addition, the group provided feedback related to the various components of the projects, such as appropriate detour routes, detour signal timing plans, and implementation action levels.

Data Collection

This study required information related to the existing roadway geometry, traffic volume data (average daily traffic and turning movement counts), and traffic control devices, which primarily include traffic signal timing plans. A majority of road network information and ADT data were obtained from the GF-EGF MPO's regional travel demand model, which is currently maintained by the Advanced Traffic Analysis Center (ATAC). Traffic signal timing data were provided by the GF-EGF MPO, City of Grand Forks, and Mn/DOT. The turning movement data at the critical intersections located within the study area (Figure 2) were provided by the GF-EGF MPO. In addition, a SYNCHRO network containing the major routes and intersections for the metro area was provided by the GF-EGF MPO; however, extensive modifications/additions were performed by ATAC to make the model more accurate and useable for this study. Other relevant data used for the study included aerial photos, computer-aided design (CAD) drawings, and documentation related to the current flood control policies/procedures.

Figure 2. Study Area

Current Flood Impact Management Efforts

Due to the significant spring flooding within the Grand Forks/East Grand Forks metropolitan area over the past decade, local, state, and federal agencies have had to work together to minimize the flood water impact. Although most of the policies and procedures in dealing with flood events are not documented, various agencies have coordinated their efforts primarily through meetings and phone calls. The following sections provide an overview of current flood fighting efforts related to managing flood-related road closures and traffic operations.

Flood Forecasts and Warnings

The National Weather Service River Forecast Center collects, processes, and provides river elevation forecasts for major river basins. Red River forecasts and warnings are provided by the North Central River Forecast Center (NCRFC) located in Chanhassen, MN, and can be viewed at the following web page: http://www.crh.noaa.gov/ahps2/hydrograph.php?wfo=fgf&gage=egfm5&view=1,1,1,1,1,1

Documented Policies/Procedures

As the flood water approaches, the cities of Grand Forks and East Grand Forks monitor river projections from the National Weather Service to determine the magnitude and timing of expected river levels. Several documents guide agencies on when to close flood gates, roads, bridges, etc., as a function of river elevation. When an action elevation is forecasted, agencies close the appropriate facility and announce the closure to the media and public regarding the date and time of the closure. In addition, local agencies coordinate with neighboring agencies to close both sides of the bridge concurrently. If flood walls are needed, they require at least one day per site to install. Bridge and road closure decisions are highly visible among the public and policy makers who lobby to keep the roads/bridges open as long as possible and reopen them as soon as possible.

City of Grand Forks
The City of Grand Forks has developed a flood control plan to assist in dealing with Red River flooding. The plan primarily consists of several pages of tables that are organized in order of river elevation. The information includes category identifiers (various gates, closures, and miscellaneous items), area identifiers (physical location), responsible departments (storm water, street, engineering, etc.), description/location/action, and a comment section.

As flood waters approach, the City of Grand Forks activates an Emergency Operation Center (EOC), which provides a central location for control, response, and communication for flood emergencies. During flood events, emergency management members meet 2-3 times per week to discuss the flood forecasts and determine what actions are required for the immediate and foreseeable future.

City of East Grand Forks
The City of East Grand Forks does not have a flood control plan; however, it does have a flood activation map that contains a list of actions based on the river elevation. The information provided includes the affected structure (pump station, gates, and closures), the required action (close gates, activate pump stations, and assemble road closures), gate and bulkhead panel sizes, and phase number (1-4).

Similar to the City of Grand Forks, an emergency management team, which consists of city staff and council members, is organized when river elevations begin to rise. Initial meetings are held one to two times per week prior to flood stage. Once flood stage is reached, the Emergency Operation Center is activated and meetings are held daily to discuss critical and upcoming issues.

Minnesota Department of Transportation
District 2 of Mn/DOT, which includes East Grand Forks, has developed a bridge emergency plan to ensure the safety of the traveling public. The plan serves as a first response to a bridge emergency and consists of several sequential actions to perform with contact information for key personnel within Mn/DOT and other agencies. In addition, the plan is primarily intended for structural issues that may arise.

United States Army Corps of Engineers
An important responsibility of the U.S. Corps of Engineers is flood protection from our nation's rivers and lakes. Guidance documents and regulations have been prepared to assist city officials in the operation and maintenance of the flood control project, such as the Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) Manuals (*1, 2*).

As specified in the OMRR&R Manuals, the cities of Grand Forks and East Grand Forks notify the Corps of Engineers when the Red River nears flood stage (28.0 ft). The Corps then initiates their emergency operations staff who help coordinate the closure levels and provide technical assistance during the flood event. In addition, Corps staff attend both cities emergency management meetings. The OMRR&R Manuals (one for each city) provide action levels for closing critical structures and details on installing the flood walls and stop logs.

While these resources are valuable for protecting the infrastructure of both communities, they lack management strategies to address traffic impacts of bridge closures. In addition, these documents do not consider detour routes and signal timing plans for the traffic affected by the bridge closures. This study was performed to address these voids.

Bridge Closure Scenarios

This study includes nine bridge closure scenarios (three flood scenarios, five maintenance scenarios, and one base scenario) ranging from having all bridges open (base case) to having three bridges closed at the same time (note Table 1). The base case will serve as a base line for comparing the various flood and maintenance scenarios in terms of travel time. The primary focus of this study relates to the bridge

closures that occur due to spring flooding. The order for closing the GF-EGF bridges due to flooding is as follows:

1. Point Bridge
2. Sorlie Bridge
3. Murray Bridge
4. Kennedy Bridge

The adverse travel time effects due to bridge closures are observed metro wide. When bridge closures occur, motorists must select alternative routes to reach their destination across the Red River. As more bridges are closed, travel time impacts to motorists increase significantly. It should be pointed out that the Kennedy Bridge closure will not be evaluated since no options are available to cross the Red River and the metro area would be in an emergency situation.

In addition to flooding, bridges may be temporarily closed due to maintenance. The Point Bridge was closed for several months in 2006 due to maintenance activities. Similar to the flood scenarios, the maintenance scenarios were evaluated in terms of identifying and signing detour routes and designing updated signal timing plans. Since the Kennedy Bridge is the only four lane bridge in the metro area, it will have two scenarios: 50% closed and completely closed.

Table 1. Bridge Closure Evaluation Scenarios

<table>
<tr><th>Bridge
Closure Group</th><th>Bridge
Closure Scenario</th><th>Traffic Management</th></tr>
<tr><td>Base Case</td><td>All Open</td><td>Do Nothing</td></tr>
<tr><td rowspan="3">Flood
Scenarios</td><td>Point Bridge Closed</td><td rowspan="8">Detour routes
(with traffic control adjustment)

Signal timing updates (AM, midday, and PM peak periods)</td></tr>
<tr><td>Point and Sorlie Bridges Closed</td></tr>
<tr><td>Point, Sorlie, and Murray Bridges Closed</td></tr>
<tr><td rowspan="5">Maintenance
Scenarios</td><td>Point Bridge Closed</td></tr>
<tr><td>Sorlie Bridge Closed</td></tr>
<tr><td>Murray Bridge Closed</td></tr>
<tr><td>Kennedy Bridge Closed</td></tr>
<tr><td>Kennedy Bridge 50% Closed</td></tr>
</table>

Bridge/Road Closure Action Levels

Although flood control projects in the area provide a tremendous amount of flood protection and guidance for closing and maintaining key structures of both cities, closure guidance for two of the four downtown bridges is not documented. Due to the nature of the 2nd Ave. N.E. and Bygland Rd. closures in East Grand Forks, the area between these two closures, which include the Point and Murray Bridges, is abandoned. However, these two bridges are closed by flood water prior to installing the flood walls at 2nd Ave. and Bygland Rd. Road and bridge closures may occur at different river elevations between the two cities since bridge sill elevations are not the same on both sides of the structure. Therefore, the lower of the two river stages/elevations will be used for establishing the action levels. It should be noted that the action levels defined in this report serve only as a guide and field conditions will dictate the actual levels. A contact list for key personnel related to the action levels is provided in Appendix A.

As flood waters rise, the cities prepare for closing various structures. Action 1 river elevations/stages are intended for agencies to prepare for closing the bridge (Table 2). Cities should contact each other, Mn/DOT, and NDDOT to coordinate the possible closure. In addition, the media is notified of the potential closure. If the Red River reaches the Action 2 level and it has not yet crested, the cities will install traffic

closures, detour signing, clay dikes, and stop logs. The Action 2 levels for the Sorlie and Kennedy Bridges are based on the levels prescribed by the US Corps of Engineers and are typically three feet below the bridge sill (which typically provides approximately three days before reaching the sill elevation). The Point Bridge is closed due to water reaching the roadway on the East Grand Forks approach. The Murray Bridge would close shortly after the Point Bridge; however, dikes are constructed on both sides of 3rd Ave. E. to keep the road open for a longer period. The Murray Bridge is a vital link for citizens living in the Point Area (southern part of East Grand Forks) to travel to the rest of the city and into North Dakota. When the Point and Murray Bridges are closed, motorists of the Point Area must use the Mallory Bridge, which is a detour of over seven miles.

Table 2. Traffic Closure Action Elevations

Bridge/Road Closure	Action 1 River Elev. (ft) / River Stage (ft)	Action 2 River Elev. (ft) / River Stage (ft)
Point Bridge – Minnesota Ave./1St St. S.	818.0 / 39.0	819.0 / 40.0
Sorlie Bridge – Demers Ave.	821.5 / 42.5	822.5 / 43.5
Murray Bridge – using berms along 3rd Ave. E	823.0 / 44.0	824.0 / 45.0
Kennedy Bridge – Gateway Dr.	829.0 / 50.0	831.0 / 52.0

Notes:

- Action 1: The cities shall contact each other, Mn/DOT, and NDDOT for installing the traffic closures and detours and inform the media of the event.
- Action 2: The cities shall install traffic closures, detour signing, clay dikes, and stop logs. In addition, closure traffic signal plans should be implemented in the traffic controllers.
- Approximately 1 day can be expected between action 1 and action 2 (based on the historical rate of rise of the Red River).
- All action elevations are based on the USGS gage at Demers Ave.

As Red River elevations decline after the crest, action levels have been identified to reopen the bridge structures. It should be noted that the Action 2 levels for closing and reopening the bridges are the same. However, unlike the action levels for closing a bridge, Action 1 for reopening a bridge consists of a majority of the tasks (Table 3). Cities should contact each other, Mn/DOT, NDDOT, and the media to coordinate the bridge reopening. In addition, the cities will remove the stop logs, clean roadway/bridge, and perform inspections. After these tasks have been performed, Mn/DOT and NDDOT (Sorlie and Kennedy Bridges) must provide approval before the structure can be reopened. Approximately one day will be provided for these activities to take place for the Point and Sorlie Bridges. Since the Murray and Kennedy Bridge closures incorporate clay dikes, an additional day is provided to remove this material prior to reopening the structure. Action 2 consists of opening roadway/bridges, removing traffic detour signing, and changing the traffic signal timing plans back to the original plans.

Table 3. Traffic Reopening Action Elevations

Bridge/Road Closure	Action 1 River Elev. (ft) / River Stage (ft)	Action 2 River Elev. (ft) / River Stage (ft)
Point Bridge – Minnesota Ave./1St St. S.	820.0 / 41.0	819.0 / 40.0
Sorlie Bridge – Demers Ave.	823.5 / 44.5	822.5 / 43.5
Murray Bridge – using berms along 3rd Ave. E	826.0 / 47.0	824.0 / 45.0
Kennedy Bridge – Gateway Dr.	833.0 / 54.0	831.0 / 52.0

Notes:

- Action 1: The cities shall contact each other, Mn/DOT, and NDDOT for reopening the bridges and inform the media of the event. Approximately 1 day is provided to remove the stop logs, clean roadway/bridge, and perform inspections. Two days are provided for Murray and Kennedy Bridges due to the removal of clay dikes.
- Action 2: Once NDDOT and Mn/DOT have approved reopening the bridge structure, agencies shall reopen roadway/bridges, remove traffic detour signing, and change the traffic signal timing plans back to those used in pre-flood conditions.

Bridge Closure Traffic Impacts

Based on historical events, closing one or more of the GF-EGF bridges has a negative impact on the transportation system in terms of travel time and safety. It is difficult to measure these impacts but transportation analysis tools, such as travel demand models, can provide an estimate on travel time changes due to various bridge/road closure scenarios. Fortunately, this study can use the GF-EGF travel demand model for performing such analyses.

The daily travel time impacts (user costs) were calculated from the demand model for the base case (existing conditions) and for the various flood and maintenance bridge closure scenarios. The difference in network travel time, which is in terms of vehicle hours of travel (VHT), is caused by the traffic using alternative routes and the additional congestion (v/c ratios) created on the remaining road network. The hourly rate of $16.45 per hour, which is based on the median household income of Grand Forks in 2000, was used to convert the travel time into user cost (*3*). To estimate the travel time impacts (user cost) for the bridge closure scenarios, modifications to the GF-EGF travel demand model were performed. Since flooding occurs at the underpass of 4th St. N. and Gateway Dr. in East Grand Forks before any of the bridges are closed, this network link was removed from the model for the flood scenarios.

Based on the travel demand model output, the flood closure scenarios create significant user cost increases. Having one, two, and three bridges closed, creates additional user costs values of $27,059, $84,701, and $101,092 per day, respectively (Table 4). As expected, the maintenance scenarios generally produced a lower user cost increase since only one bridge is closed at a time. It also should be pointed out that the Point Bridge Closed (Maintenance) has lower network travel time than the Point Bridge Closed (Flood) since the underpass at 4th St. N. and Gateway Dr. is open during this scenario. However, the Kennedy Bridge closure produced a significant addition in user cost. The Kennedy Bridge closure created $76,795 in additional user cost, which is comparable to the $84,701 in additional user cost for the Point and Sorlie Bridge closure.

Table 4. Bridge Closure Daily Travel Time Impacts Based on Travel Demand Model

Bridge Closure Scenario	Travel Time (Vehicle Hours of Travel)		Additional User Cost
	Total VHT	Additional VHT	
Base Case	55,588	--	--
Point Bridge Closed (Flood)	57,224	1,636	$27,059
Point & Sorlie Bridges Closed (Flood)	60,709	5,121	$84,701
Point, Sorlie & Murray Bridges Closed (Flood)	61,700	6,112	$101,092
Murray Bridge Closed (Maintenance)	55,995	407	$6,732
Sorlie Bridge Closed (Maintenance)	56,515	927	$15,333
Point Bridge Closed (Maintenance)	56,589	1,001	$16,557
Kennedy Bridge 50% Capacity (Maintenance)	56,950	1,362	$22,405
Kennedy Bridge Closed (Maintenance)	60,231	4,643	$76,795

Note: The user cost was based on $16.45/hr, which equates to the 2000 GF median household income of $34,194 (3).

It should be pointed out that the travel time calculated by the GF-EGF travel demand model is probably on the conservative side since it doesn't directly account for intersection delay. Planning models can incorporate more detail into their model, such as traffic signal parameters, to account for this delay time. Signal timing adjustments that account for the estimated diverted traffic will help reduce the closure impact. These signal adjustments will be designed and discussed later in this document.

Traffic Detour Routes for Bridge Closures

When a bridge or road is closed due to flooding or maintenance activity, the public is notified through the media in advance (typically 24 hours prior to the closure). Local motorists typically know or find the best alternative route based on experience, while visitors to the area are in need of guidance to travel around the closure. This is achieved by providing detour signs along selected (detour) routes. The detour routes were chosen based on feedback from the steering committee and considered several factors, including route convenience, roadway functional class, and intersection control.

Once the detour routes were approved by the steering group, detailed traffic detour drawings were developed for each bridge closure scenario. Computer-aided drafting (CAD) drawings were made for each direction of travel and were based on the 2003 Edition of the Manual on Uniform Traffic Control Devices (MUTCD) and 2005 Minnesota MUTCD (*4, 5*). The detour sign layouts for all of the scenarios are illustrated in the appropriate bridge closure sections following this report. The drawings provide the appropriate signs and sequence; however, agencies must ensure proper sign spacing during the installation process by using the appropriate MUTCD version. In addition, alternative devices (MUTCD approved) may be used to provide the equivalent traveler information. General notes and a legend for the detour drawings are provided in Appendix B. The detour routes for the flood and maintenance scenarios are discussed in the following sections.

Point Bridge Detour (Flood Scenario)

The Point Bridge detour route is unique since the detour neither starts nor ends on road segments that are connected to the Point Bridge (Figure 3). Minnesota Ave. in Grand Forks provides eastbound access to the bridge and exists for only three blocks before ending at 4th Ave. S. Access to the Point Bridge from East Grand Forks is provided by 1st St. S., which terminates at 3rd Ave. (about 1,100 feet from the Point Bridge). The detour, which used the Sorlie Bridge, starts/ends at the intersection of Belmont Rd. and 4th Ave. S. on the Grand Forks side and the intersection of 1st St. S. and 3rd Ave. E. on the East Grand Forks side.

Point and Sorlie Bridge Detour (Flood Scenario)

The Kennedy Bridge is the only bridge providing access between Grand Forks and East Grand Forks when the Point and Sorlie Bridges are both closed (Figure 4). Motorists attempting to use the Point Bridge from Grand Forks are detoured at Belmont Rd and 4th Ave. S. and guided to/from Gateway Dr. via 5th St. N. Grand Forks motorists attempting to use the Sorlie Bridge will also be detoured to 5th St. N. at the intersection of 5th St. N. and Demers Ave. In addition, trucks will be detoured at the intersection of Washington St. and Demers Ave., which provides better road geometry to perform turning maneuvers.

Similar to the Point Bridge detour, the streets of 3rd Ave. S. and 4th St. N. will be used in East Grand Forks when both the Point and Sorlie Bridges are closed. In addition, traffic will be required to use Demers Ave./Central Ave., providing access to Gateway Dr.

Point, Sorlie, and Murray Bridge Detour (Flood Scenario)

Similar to the previous scenario, the Kennedy Bridge is the only bridge providing access between the two cities. No changes are required for the Grand Forks detour routes; however, additional detour routes are required for traffic accessing the Point Area of East Grand Forks (Figure 5). The Mallory Bridge is the closest option for motorists when the Murray Bridge is closed, which can require up to an additional seven miles of travel. Northbound traffic using the Mallory Bridge will turn onto US 2 and either remains on US 2/ Gateway Dr. to travel north and into North Dakota or use 4th Ave. N. to travel to the downtown area of East Grand Forks.

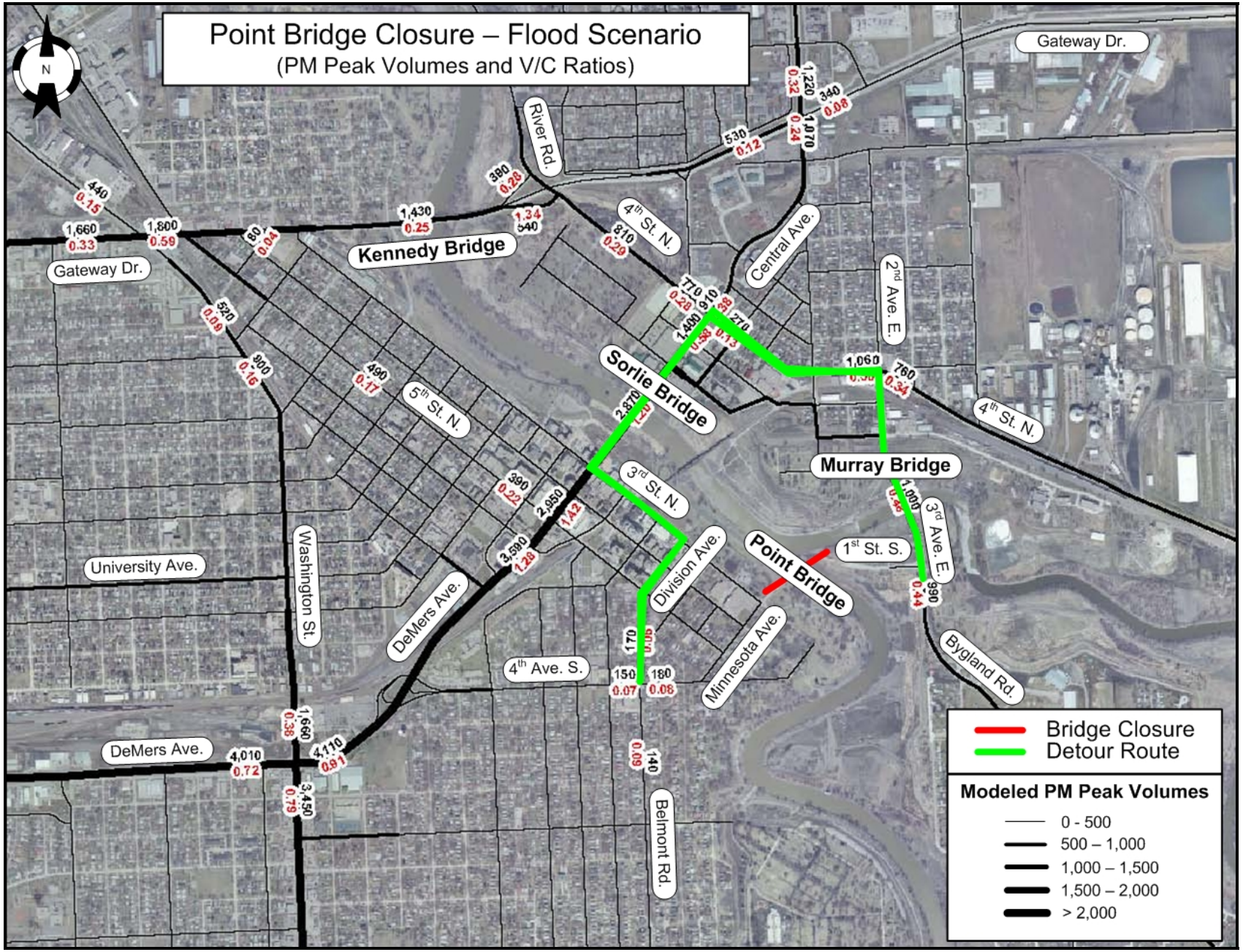


Figure 3. Point Bridge Closure Detour Route (Flood Scenario)

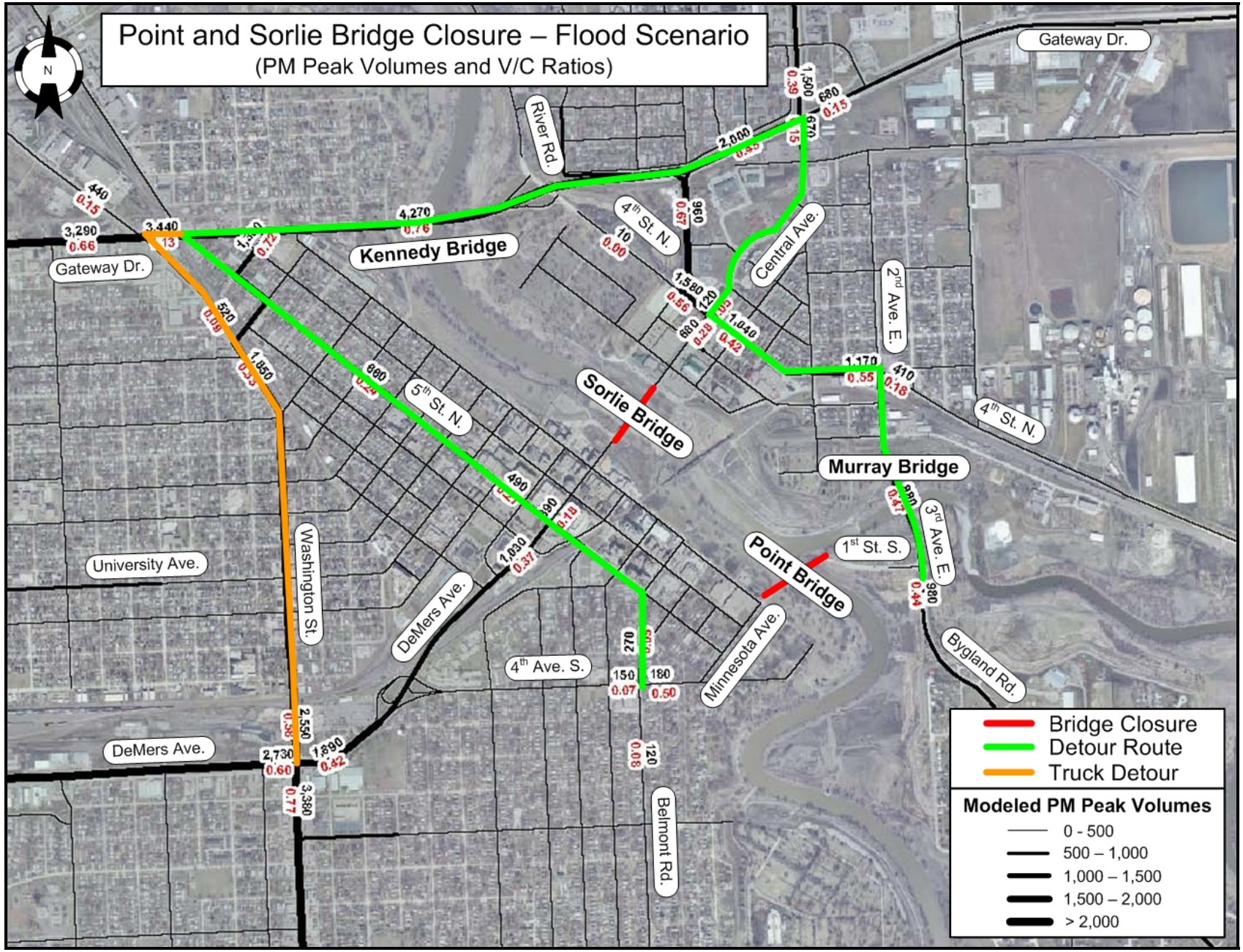


Figure 4. Point and Sorlie Bridge Closure Detour Route (Flood Scenario)

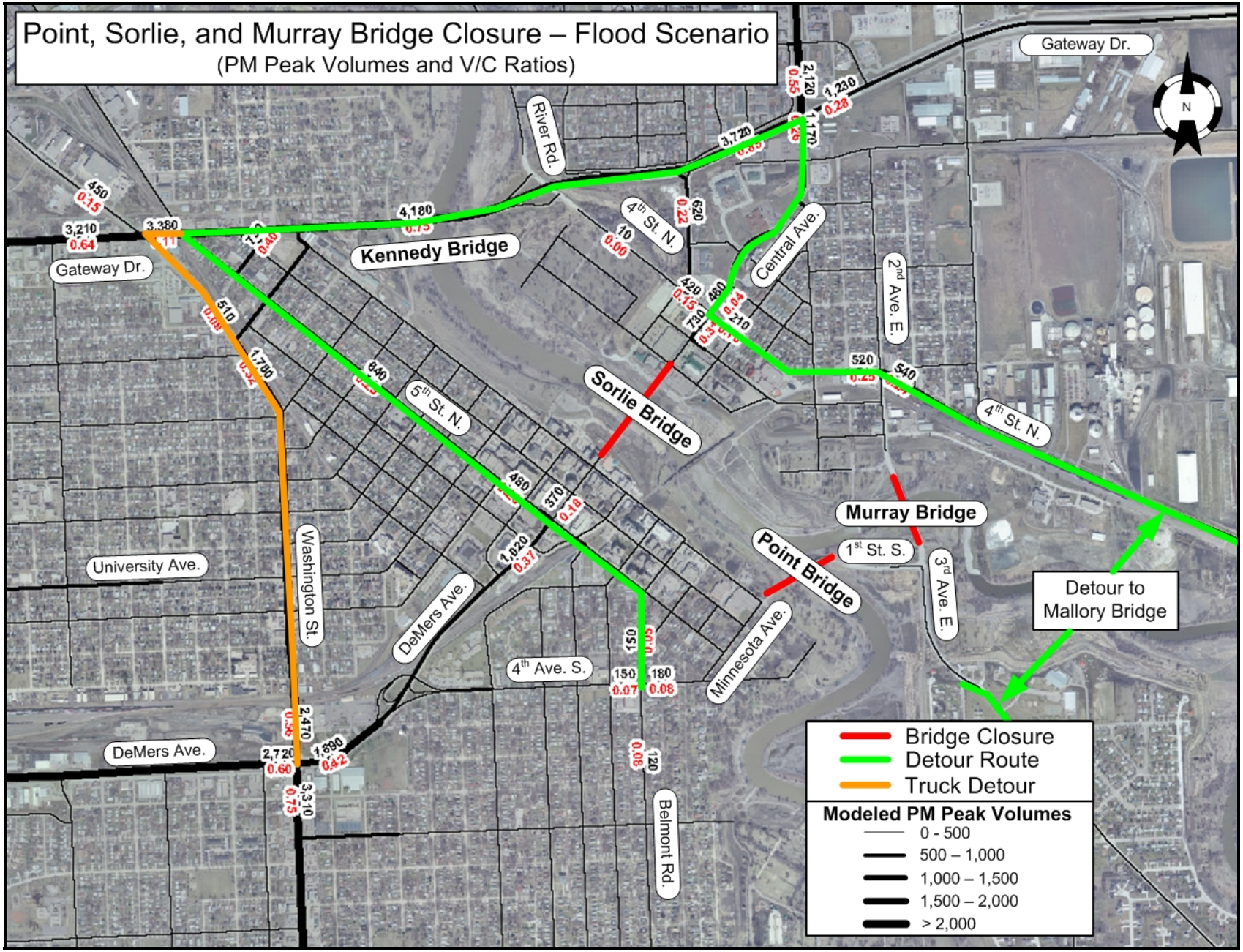


Figure 5. Point, Sorlie, and Murray Bridge Closure Detour Route (Flood Scenario)

Point Bridge Detour (Maintenance Scenario)

The maintenance scenario for the Point Bridge is the same as that of the flood scenario (Figure 6). The detour, which used the Sorlie Bridge, starts/ends at the intersection of Belmont Rd. and 4th Ave. S. on the Grand Forks side and the intersection of 1st St. S. and 3rd Ave. E. on the East Grand Forks side.

Sorlie Bridge Detour (Maintenance Scenario)

Grand Forks motorists are detoured at the intersection of 5th St. N. and Demers Ave. and guided to Gateway Dr. via 5th St. N. (Figure 7). Truck traffic will be detoured at the intersection of Washington St. and Demers Ave., since this route provides better road geometry for performing turning maneuvers. Once the traffic reaches Gateway Dr., motorists will use the Kennedy Bridge to access East Grand Forks.

East Grand Forks motorists are detoured at the intersection of 4th St. N. and Demers Ave. and guided along 4th St. N. to Gateway Dr. (Figure 7). Once the traffic reaches Gateway Dr., motorists will use the Kennedy Bridge to access Grand Forks.

Murray Bridge Detour (Maintenance Scenario)

The Murray Bridge detour requires the north/south trips to/from the Point area of East Grand Forks to use both the Point and Sorlie Bridges (Figure 8). Motorists are detoured at the intersections of 1st St. S. and 3rd Ave. E. (south side of the bridge) and the intersection of 4th St. N. and 2nd Ave. E. (a few blocks north of the bridge).

Kennedy Bridge Detour (Maintenance Scenario)

Grand Forks motorists are detoured at the intersection of 5th St. N. and Gateway Dr. and guided to Demers Ave. via 5th St. N. (Figure 9). Truck traffic will be detoured at the intersection of Washington St. and Gateway Dr., since this route provides better road geometry for performing turning maneuvers. Once the traffic reaches Demers Ave., motorists will use the Sorlie Bridge to access East Grand Forks.

East Grand Forks motorists are detoured at the intersection of Gateway Dr. and Central Ave. Once traveling on Central Ave. for a few blocks, the roadway changes to Demers Ave. and provides access to the Sorlie Bridge for reaching Grand Forks.

Mallory Bridge Detour (Maintenance Scenario)

The closest available detour route for motorists using the Mallory Bridge consists of traveling through East Grand Forks and using the Murray Bridge. Motorists traveling northbound that encounter the detour will travel northwest via Polk Co. 72 and Bygland Rd. prior to reaching the Murray Bridge (Figure 10). Southbound motorists will travel back to East Grand Forks via 4th St. N. to reach the Murray Bridge.

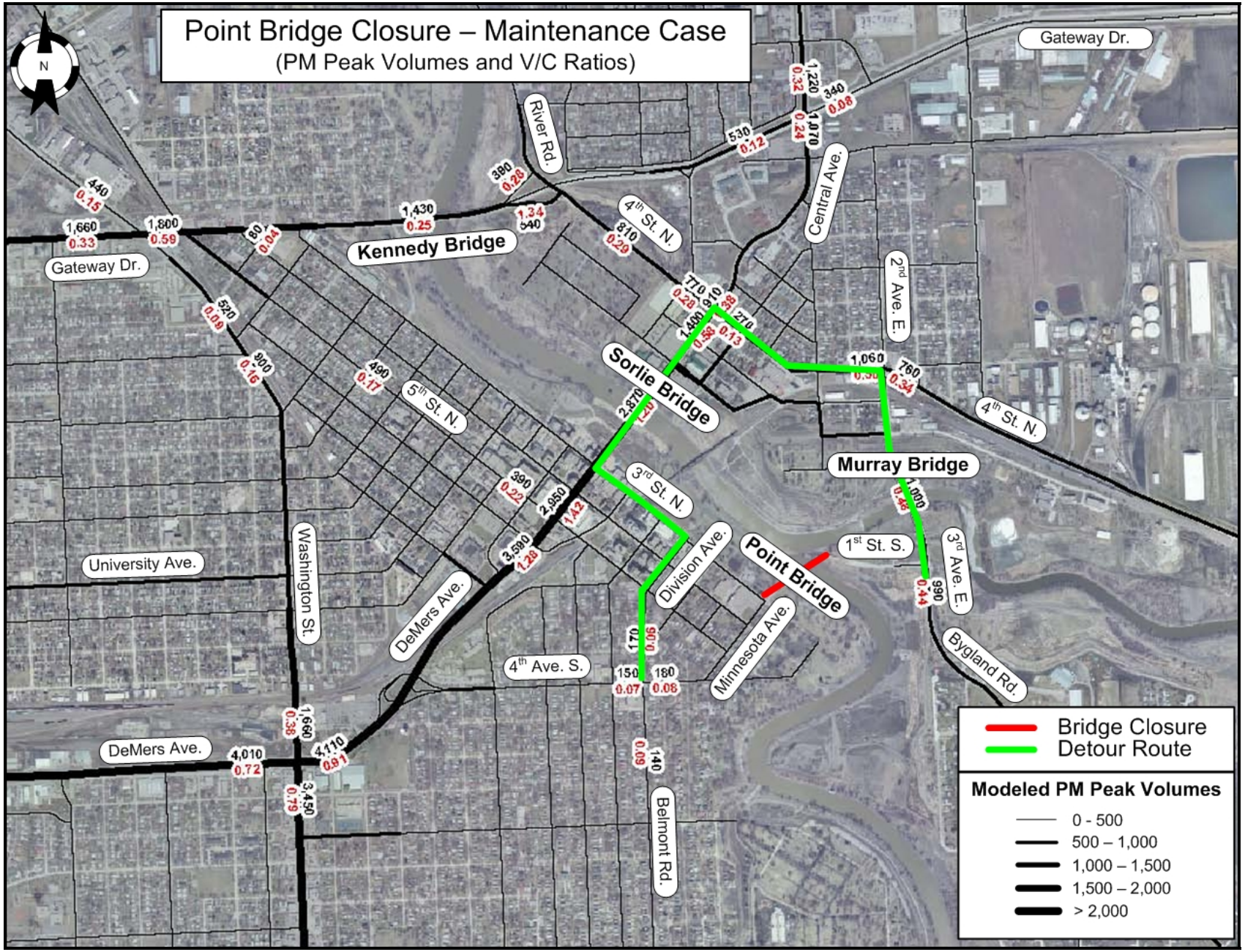


Figure 6. Point Bridge Closure Detour Route (Maintenance Scenario)

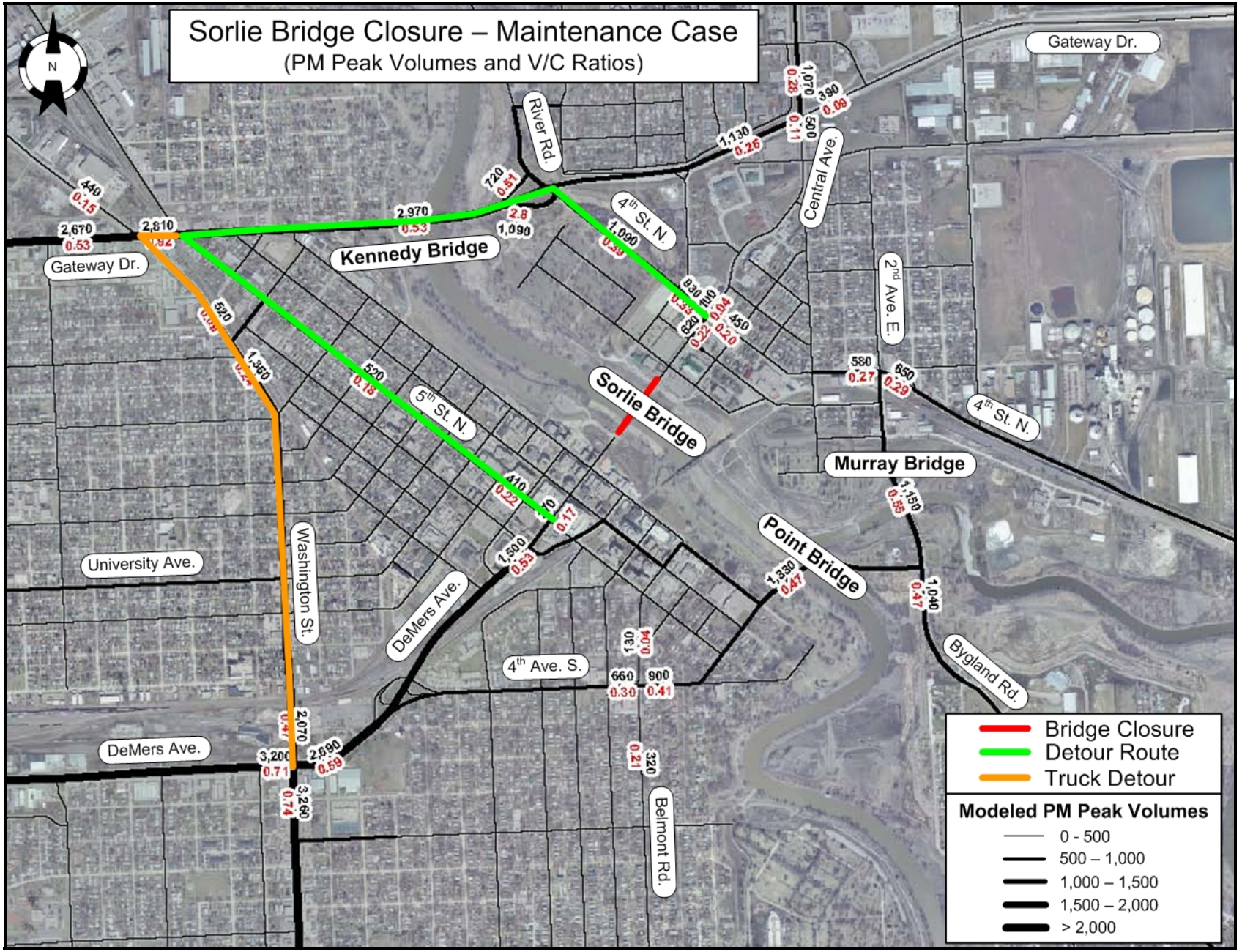


Figure 7. Sorlie Bridge Closure Detour Route (Maintenance Scenario)

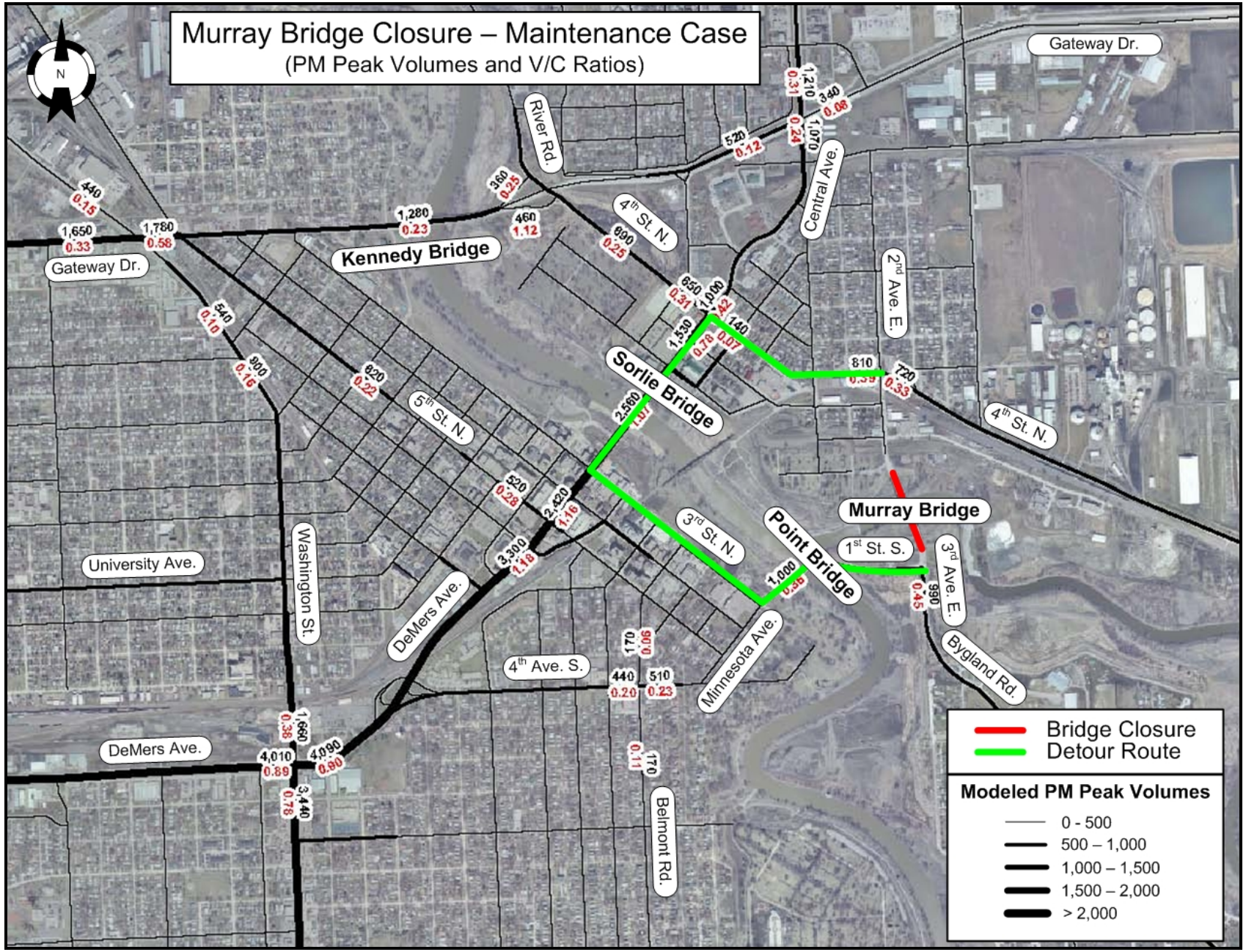


Figure 8. Murray Bridge Closure Detour Route (Maintenance Scenario)

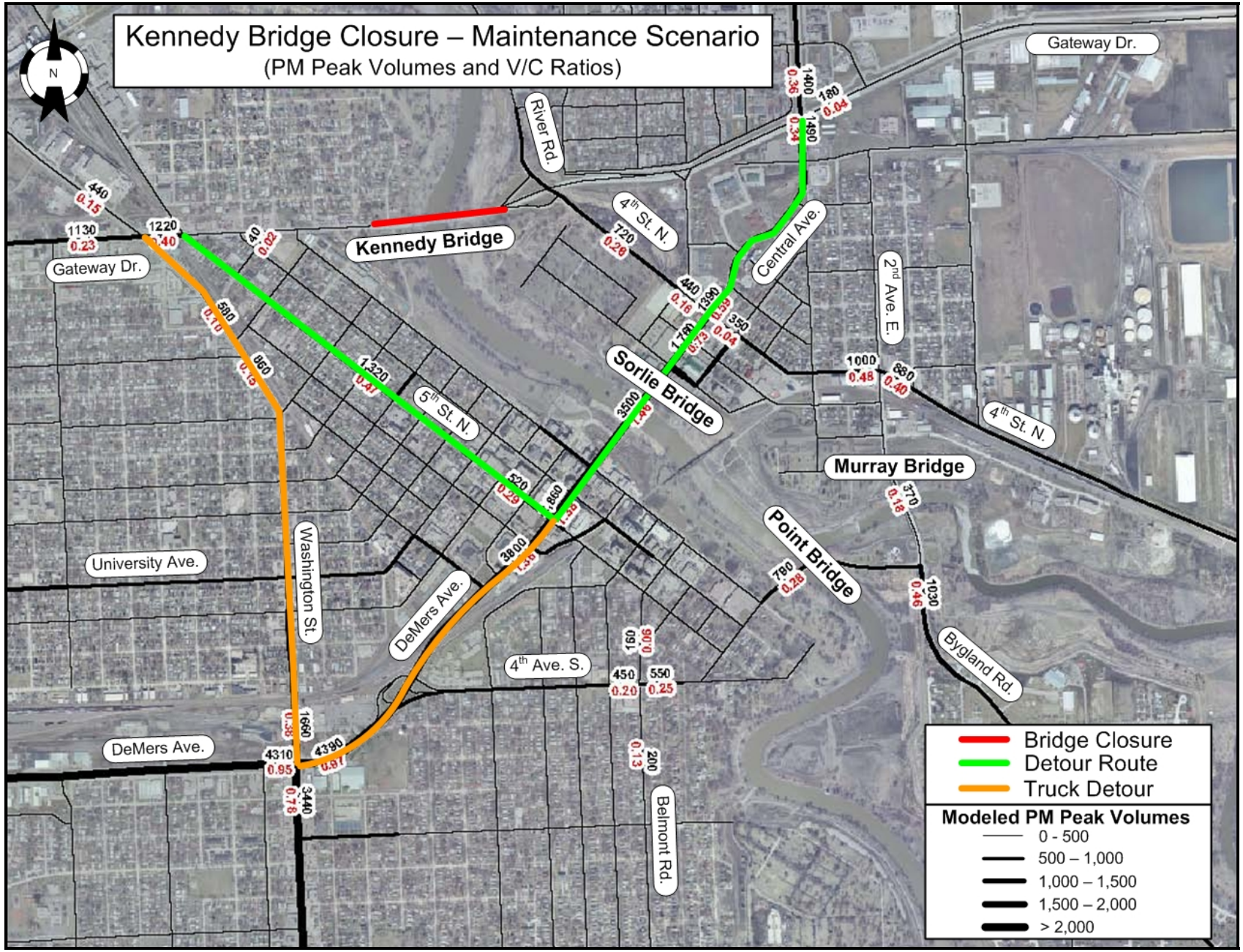


Figure 9. Kennedy Bridge Closure Detour Route (Maintenance Scenario)

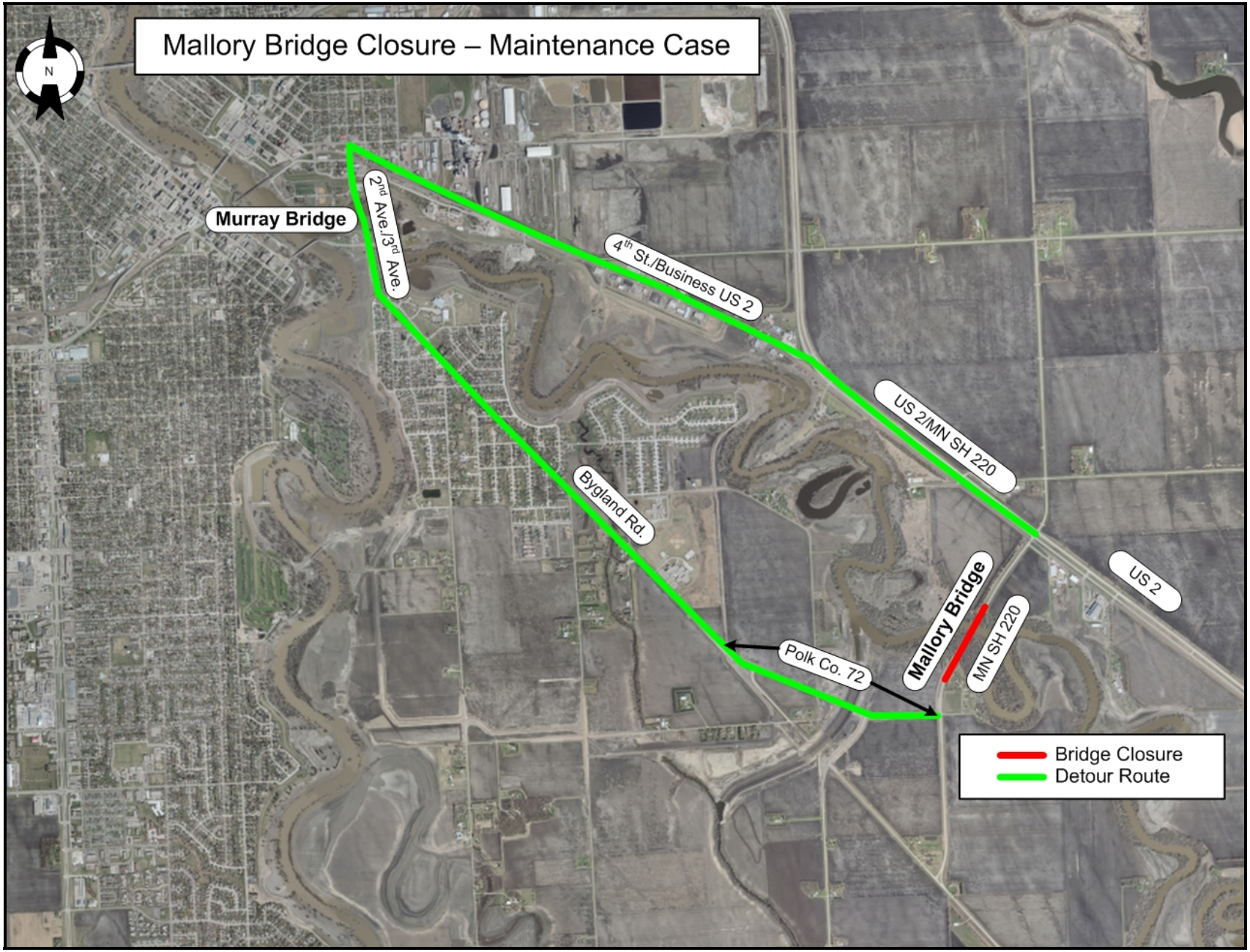


Figure 10. Mallory Bridge Closure Detour Route (Maintenance Scenario)

Traffic Signal Timing Plans

Traffic signal timing plans play an important role in the operational performance of a transportation network. Although roadway and intersection geometry may provide sufficient capacity, traffic may be significantly impeded at signalized intersections due to inadequate signal timing parameters and settings. This issue is even more critical during special events (flooding or maintenance activities) since traffic will be diverted to alternative routes. Therefore, alternate signal timing plans were developed for the bridge closure scenarios during the AM, midday, and PM peak periods. Although 27 signalized intersections are located within the study area, timing plans will be adjusted only when the existing timing plans cannot sufficiently accommodate the diverted traffic. This was done to reduce the number of timing plans that would have to be implemented by the traffic engineers. With eight scenarios and three peak periods, as many as 648 timing plans could be implemented.

Various types of data and software tools were used to assess the traffic impacts of the bridge closure scenarios and design appropriate traffic management strategies. The GF-EGF MPO provided turning movement data for the signalized intersections during the AM, midday, and PM peak periods, which were primarily counted between 2005 and 2006 (Figure 11). Some of the turning movement data dates back to 2001; however, it should be similar to newer data since most of the older counts occurred within the downtown area which has been fully developed for a number of years.

The signalized intersection analyses were performed using the Synchro 6.0 traffic analysis program (*6*). A base network was provided by the GF-EGF MPO, which had information regarding most of the signalized intersections within the metro area. However, most of the information simply related to basic link and node (intersection) data. Therefore, significant time was required to update/correct various network attributes within the study area, which primarily included adding new links and nodes which were not in the original network, updating intersection geometry (e.g., turning lanes, link distances, etc.), and updating/adding signal phasing and timing data.

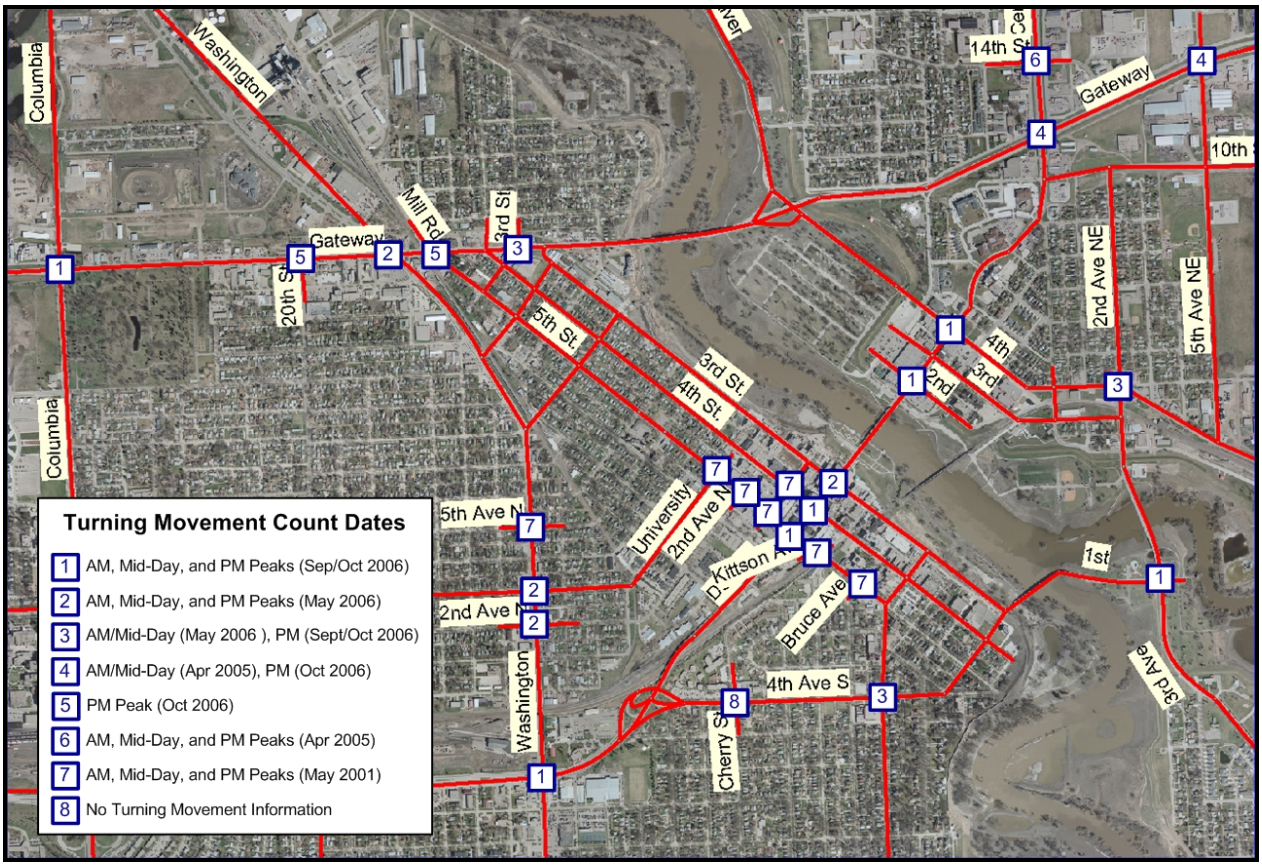


Figure 11. Turning Movement Data for Signalized Intersections

The traffic signal systems of Grand Forks and East Grand Forks are operated and maintained independently. The City of Grand Forks has a traffic engineer on staff, while the signals within East Grand Forks are under the control of Mn/DOT District 2, which is located in Bemdji, MN. Currently, signal coordination between the two cities does not exist and Demers Ave. is the only corridor that provides favorable conditions for coordination. In addition, the two cities have different types of traffic signal systems. East Grand Forks uses signal controllers which follow the protocol of the National Electrical Manufactures Association (NEMA), while Grand Forks uses signal controllers that follow the protocols of Type 170 controllers (which is the only city in North Dakota using this type of controller).

The existing traffic signal timing information was entered into the Synchro program to assess the current timings and provide enhancements at intersections that serve detoured traffic. All of the traffic signals in East Grand Forks operate as actuated uncoordinated, while most of the signals in Grand Forks (at least within the study area) have multiple time-of-day signal plans that use actuated-coordinated operation.

To estimate the impacts of diverted traffic to the study area as a result of a bridge closure, the 2005 GF-EGF regional travel demand model was used. Within the calibrated travel model, links were removed at the bridge locations to simulate a bridge closure. Once this was performed for each scenario, the travel demand model was rerun to produce new network paths and link flows. Next, a process called “select link” was performed for each direction on the remaining bridges in terms of ADT. This process provides all of the origins and destination trips (shown graphically) using that link. Therefore, each bridge would have two select link scenarios (e.g., eastbound and westbound). Then, the select link flows from each closure scenario were subtracted from the base case (existing conditions without a bridge closure). The difference in link flows represents the change in traffic due to the closure event. Next, a percentage of the additional traffic was added to the appropriate intersection and turning movement within Synchro. Once the intersections were updated for each scenario and peak period, the signal timing plans were evaluated and updated.

The travel demand model and signal analysis model are not compatible in any regards. The demand model uses link capacities and ADT, while the signal analysis model uses intersection capacities based on hourly turning movement volumes. Therefore, utilizing the traffic patterns of the detoured traffic from the planning model had to be manually incorporated into the signal analysis model. The additional traffic using the alternative routes were entered as a percentage of the ADT. The AM and PM peak traffic used 10% of the ADT, while the midday peak used 5% of the ADT. Increases of traffic flow were considered for links having differences of at least 500 vehicles since this quantity would only increase the volume served during each signal cycle by less than 2 vehicles (500 veh X 10% X 3600 sec/hr / 100 sec cycle length, which is a realistic cycle length). An example calculation of a turning movement adjustment used in the signal analysis process is illustrated in Figure 12. In addition, the travel demand model reroutes traffic only to reduce vehicle travel time. Therefore, some network links were assessed friction factors to produce more realistic alternative routes. It also should be pointed out that intersection approaches which were not adjusted higher due to detoured traffic used the original turning movement data.

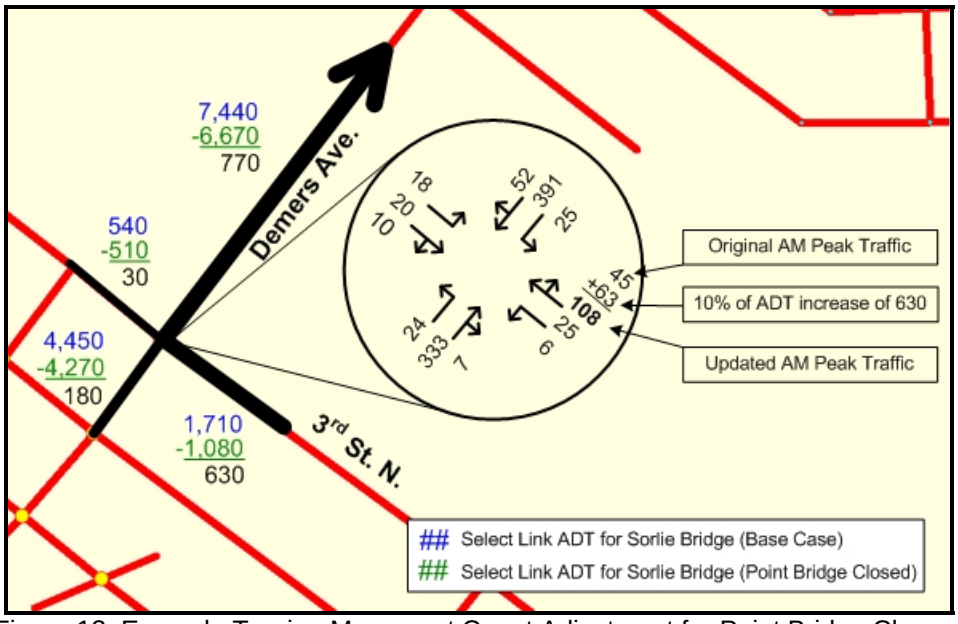


Figure 12. Example Turning Movement Count Adjustment for Point Bridge Closure

In terms of operation, signalized intersections can be classified as pretimed, actuated uncoordinated, and actuated coordinated. Pretimed operation does not use any form of vehicle detection so it simply cycles through the signal phases based on preset time intervals. Actuated-uncoordinated operation (also known as fully-actuated control) uses vehicle detection to serve phases and the green time is variable based on traffic demand and controller thresholds. Actuated-coordinated operation uses vehicle detection for some of the vehicle phases while guaranteeing a portion of the available green time to the main street (coordinated) phases. In addition, coordination incorporates a common cycle length with neighboring signalized intersections and offset values, which define a point within the cycle length where the coordination phase starts or ends. All of the signalized intersections within the study area have vehicle detection and may be setup to operate as uncoordinated or coordinated. Coordination is incorporated to reduce delay time by both accommodating the traffic at each independent signalized intersection as well as sending/receiving traffic between neighboring intersections (using the offset values).

Once the additional turning movement data were entered into Synchro for the three bridge closure scenarios, the existing traffic signal timing plans were assessed and adjusted for the AM, midday, and PM peak periods.

Due to variations in intersection spacing, signal timing phases, and turning movement data, several of the signalized intersections (approximately 9 of the 27) operated as actuated-uncoordinated signals. In addition, most of these uncoordinated signals were not changed from their original timing plan or minor adjustments were made, such as adjusting phase splits. Actuated-coordinated operation was designed for the downtown traffic signals and portions of Washington St. and Gateway Dr., which account for approximately 18 of the 27 signalized intersections. Illustrations showing the cycle lengths, detour routes and traffic flow patterns during the PM peak hour for the flood bridge closure scenarios are shown in Figures 13-15. The complete traffic signal timing data (illustrations and timing tables) for all of the closure scenarios and peak periods are provided in the appropriate bridge closure section.

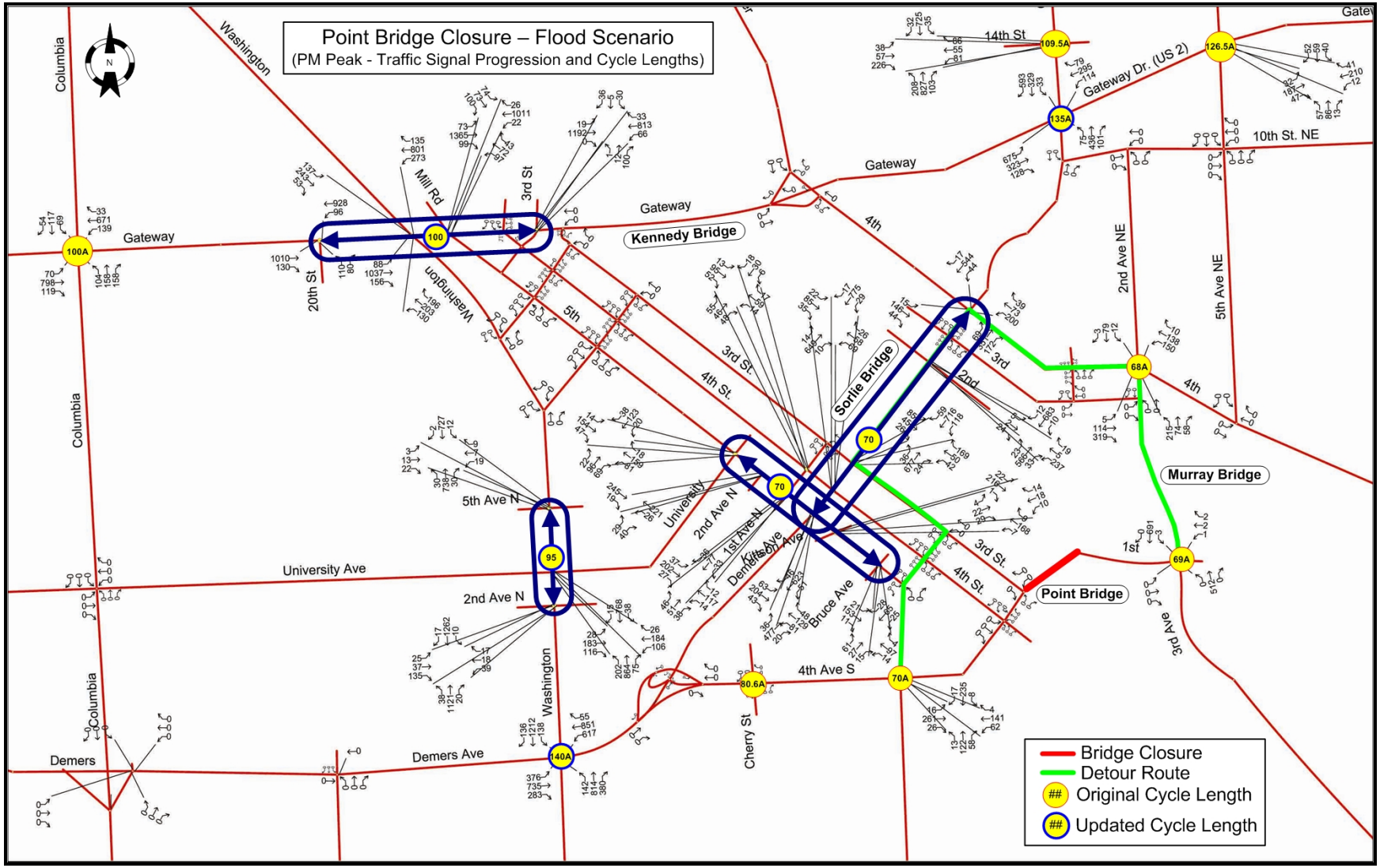


Figure 13. Point Bridge Closure Traffic Signal Information for PM Peak (Flood Scenario)

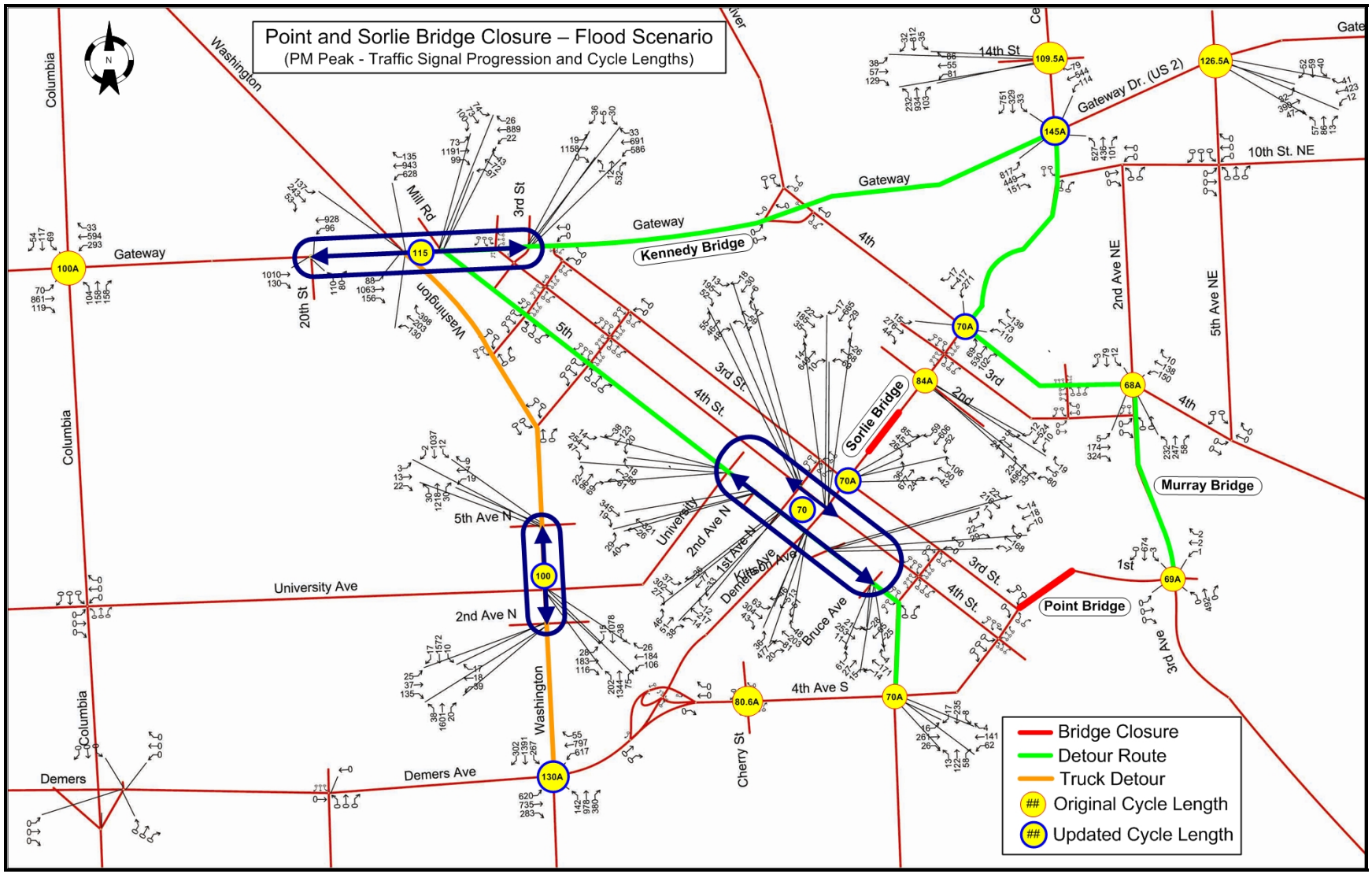


Figure 14. Point and Sorlie Bridge Closure Traffic Signal Information for PM Peak (Flood Scenario)

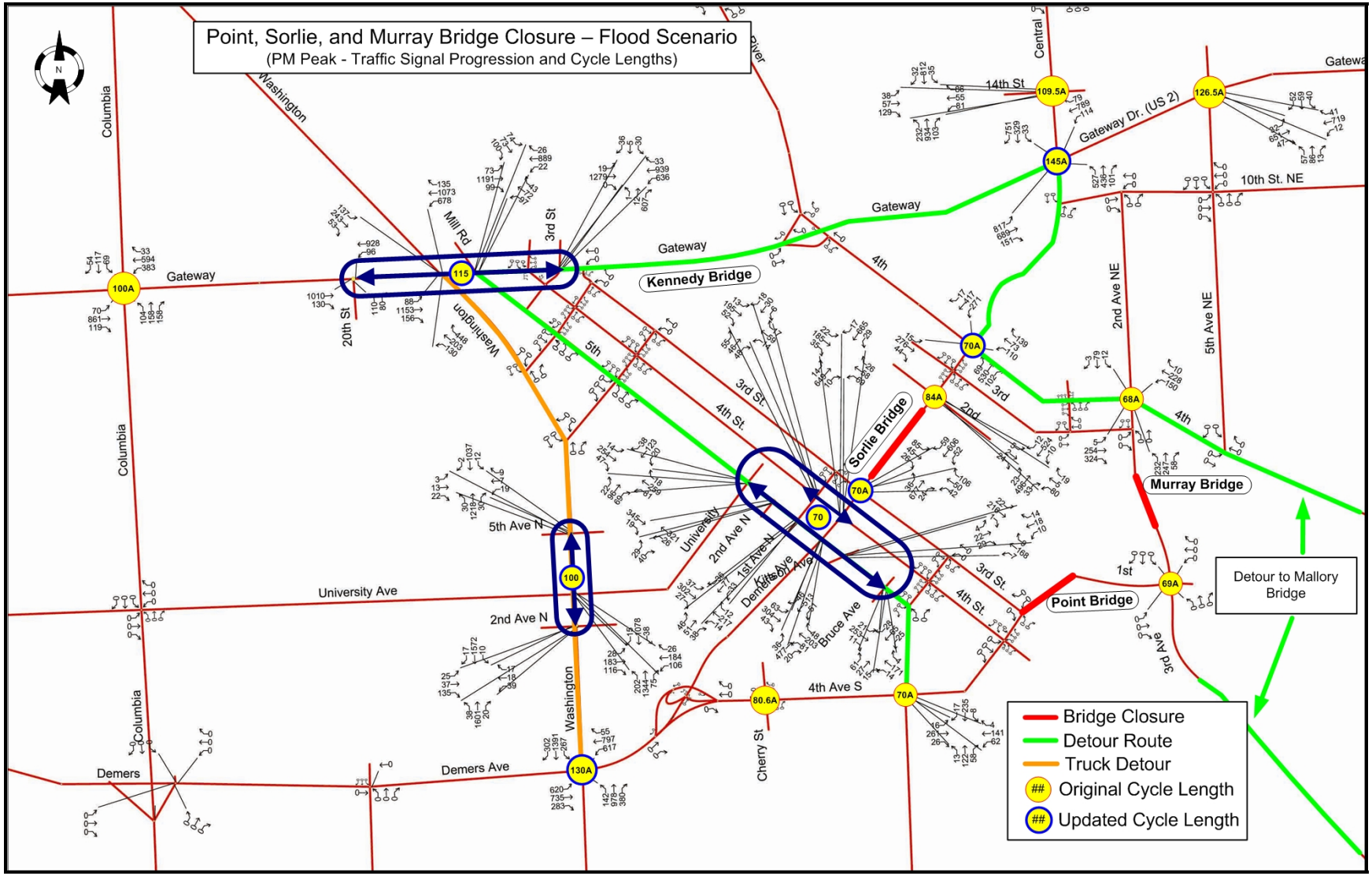


Figure 15. Point, Sorlie, and Murray Bridge Closure Traffic Signal Information for PM Peak (Flood Scenario)

Delay time comparisons between the existing timing plans and the updated timing plans provide some insight into the potential user cost savings for making traffic signal timing improvements. Although the GF-EGF travel demand model was a tremendous tool for this study, it lacks the level of detail to account for intersection delay time. However, the Synchro program provides numerous delay time values. Synchro's network delay time output primarily focuses on control delay (which accounts for delay time due to traffic control devices, such as traffic signal). Delay time changes between the existing and updated signal control plans provide an estimate in user cost benefits.

Using the adjusted turning movement data discussed earlier, delay time comparisons were made between the existing signal timing and updated signal timing Synchro networks for each bridge closure scenario. The change in vehicle-hours of travel (VHT) reflects the summation of the AM, midday, and PM peak hour conditions. Since the travel time comparisons only considered the three peak-hour periods, daily delay time reductions due to updated signal plans could be substantially greater. User cost reductions when having one, two, and three bridges closed were $1,340, $14,754, and $10, 668, respectively (Table 5). The reason for the decline in benefits when three bridges are closed relates to capacity issues for the PM peak period. For this period, the roadway or geometric constraints to the system are to such a level that signal timing adjustments do not produce significant delay improvements.

Updating the signal timing plans for the maintenance scenarios also provided user cost reductions (Table 5). When comparing the existing timing plans to the updated plans within Synchro, user cost reductions ranged from $1,201 to $2,928 for the three peak-hour periods. The difference between the two Point Bridge scenarios is attributed to having different traffic assignments between the two scenarios due to flood scenario's 4th St. N underpass closure.

Table 5. Bridge Closure Peak-Hour Delay Time Impacts Using Updated Signal Timing Plans

Bridge Closure Scenario	Network Vehicle Hours of Travel Reduction	Network User Cost Reduction
Point Bridge Closed (Flood)	81	$1,340
Point & Sorlie Bridges Closed (Flood)	892	$14,754
Point, Sorlie & Murray Bridges Closed (Flood)	645	$10,668
Point Bridge Closed (Maintenance)	98	$1,612
Sorlie Bridge Closed (Maintenance)	106	$1,744
Murray Bridge Closed (Maintenance)	77	$1,267
Kennedy Bridge Closed (Maintenance)	178	$2,928
Kennedy Bridge 50% Capacity (Maintenance)	73	$1,201

Note: User Cost of $16.45/hour (GF median household income of $34,194, U.S. Bureau of the Census, Census 2000)
Delay time reductions include the AM, Midday, and PM peak hour periods.

In addition to the network travel time reductions from updating the signal timing plans, significant benefits could be realized at critical intersections. The intersection of Washington St. and Demers Ave. and the intersection of Gateway Dr. and Central Ave. serve the most vehicles within the study area and certain approaches and/or turning movements experience moderate to severe peak-hour congestion during the peak-hour periods. The following paragraphs discuss the delay time comparisons during the PM-peak hour period from the Synchro analysis.

The intersection of Washington St. and Demers Ave. is controlled by an eight-phase signal, which means all four through and left turning movements have specific time allocated to them. During the PM-peak period, the highest vehicle movements include the northbound and southbound through movements, as well as the eastbound and westbound left-turn movements. The westbound left-turn movement is classified as the critical movement since it has the highest volume to capacity (v/c) ratio. By updating the timing plan for this intersection, delay time reductions for the overall intersection, westbound approach, and westbound left-turn movement were reduced by 28, 50, and 64 percent, respectively (Table 6). This was primarily achieved by increasing the cycle length and providing more green time to the westbound left-turn movement.

Table 6. Washington St. and Demers Ave. Control Delay Time Comparisons

PM Peak Hour	Cycle Length (sec.)	Intersection Delay (sec./veh.)	WB Approach Delay (sec./veh.)	WBL Movement Delay (sec./veh.)
Existing Timings	115	140.0	267.3	335.0
Updated Timings	140	101.3	133.7	121.2
% Change		**-28**	**-50**	**-64**

Note: Results are from the Point Bridge Closed (Flood) scenario.

The intersection of Gateway Dr. and Central Ave. is also controlled by an eight-phase signal. During the PM-peak period, the highest vehicle movements include the northbound and southbound through movements, as well as the eastbound left-turn movement. The eastbound left-turn movement is the critical movement with the highest volume to capacity (v/c) ratio and will increase as bridge closures occur. By updating the timing plan for this intersection, delay time reductions for the overall intersection, eastbound approach, and eastbound left-turn movement were reduced by 13, 24, and 24 percent, respectively (Table 6). This was primarily achieved by reducing the cycle length and providing more green time to the eastbound left-turn movement.

Table 7. Gateway Dr. and Central Ave. Control Delay Time Comparisons

PM Peak Hour	Cycle Length (sec.)	Intersection Delay (sec./veh.)	EB Approach Delay (sec./veh.)	EBL Movement Delay (sec./veh.)
Existing Timings	163	213.5	205.4	474.8
Updated Timings	145	186.1	156.5	359.0
% Change		**-13**	**-24**	**-24**

Note: Results are from the Point, Sorlie & Murray Bridges Closed (Flood) bridge closure scenario.

Intersection Traffic Control Modifications

In addition to updating signal timing during bridge closure events, changing intersection control devices at some of the intersections could also provide operational and safety benefits. Based on the discussions with members of the steering committee and traffic volume output from the travel demand model, it is recommended that the traffic control devices at several intersections should be modified during various bridge closure scenarios. The proposed intersection control modifications are listed and illustrated in the following sections:

5th St. N. and Division Ave. (Grand Forks)

Replace the YIELD sign from the northwest approach (5th St. N.) with a STOP sign, as shown in Figure 16. Remove the STOP sign from the northeast approach (Division Ave.). These modifications are recommended when the Point Bridge is closed while the Sorlie Bridge is open.

4th St. N. and Division Ave. (Grand Forks)

Add STOP signs to the northwest and southeast approaches (4th St. N.) and remove the STOP signs from the northeast and southwest approaches (Division Ave.), as shown in Figure 16. These modifications are recommended when the Point Bridge is closed while the Sorlie Bridge is open.

3rd St. N. and Division Ave. (Grand Forks)

Add a STOP sign to the southeast approach (3rd St. N.), add a YIELD sign to the northwest approach (3rd St. N.), and remove the STOP sign for the southwest approach (Division Ave.), as shown in Figure 16. These modifications are recommended when the Point Bridge is closed while the Sorlie Bridge is open.

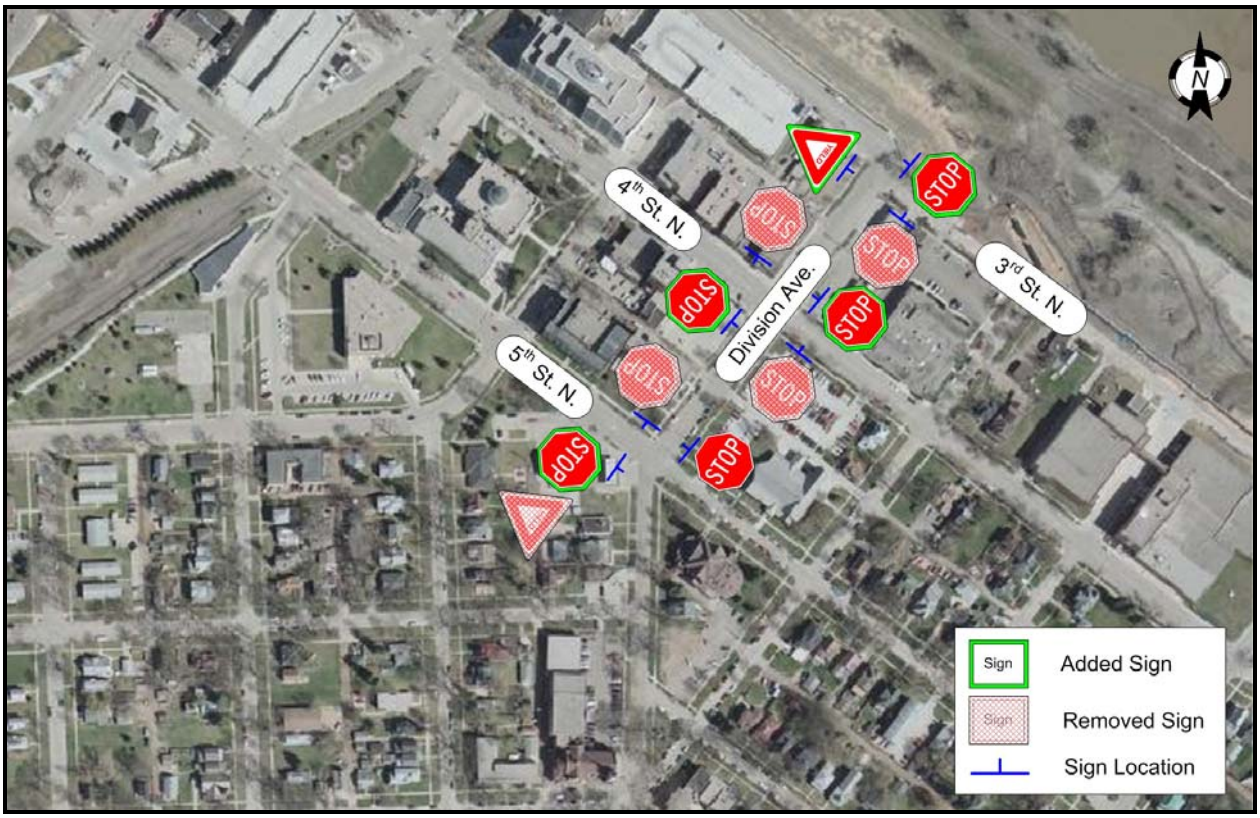


Figure 16. Grand Forks Downtown Traffic Control Modifications (Point Closed and Sorlie Open).

4th St. N.W. and 5th Ave. N.W. (East Grand Forks)

Add a STOP sign to the northwest approach (4th St. N.W.), add a YIELD sign to the southeast approach (4th St. N.W.), and remove the STOP sign for the northeast approach (5th Ave. N.W.), as shown in Figure 17. These modifications are recommended for all flood scenarios since the 4th St. N.W. underpass at Gateway Dr. is flooded.

3rd St. N.E. and Central Ave. N.E. (East Grand Forks)

Add STOP signs to the north and south approaches (Central Ave. N.E.), and remove STOP signs for the east and west approaches (3rd St. N.E.), as shown in Figure 17. These modifications are recommended for both the Point Bridge flood and maintenance scenarios.

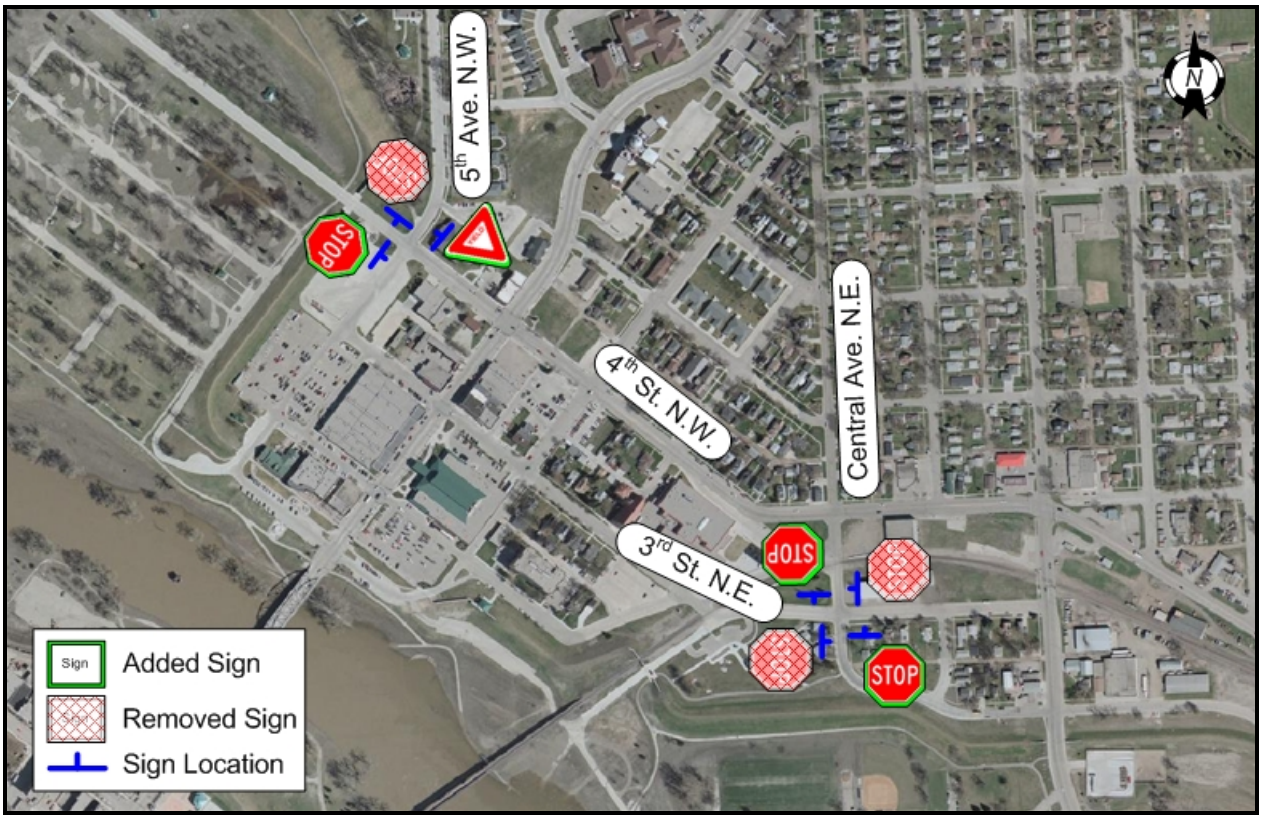


Figure 17. East Grand Forks Downtown Traffic Control Modifications.

When both the Point and Murray Bridges are closed, the southern residents of East Grand Forks must use the Mallory Bridge to travel north and west. Therefore, an additional 9,000 vehicles per day could use the Mallory Bridge, which is approximately 8.5 times the existing ADT of 1,170 (Figure 18). Several intersections, including the intersection of US 2 and MN SH 220 and the intersection of MN SH 220 and Polk Co. 72, will incur significant increases in travel time. It is recommended that the traffic control at these two intersections be modified during this bridge closure occurrence to assist in traffic flow and safety.

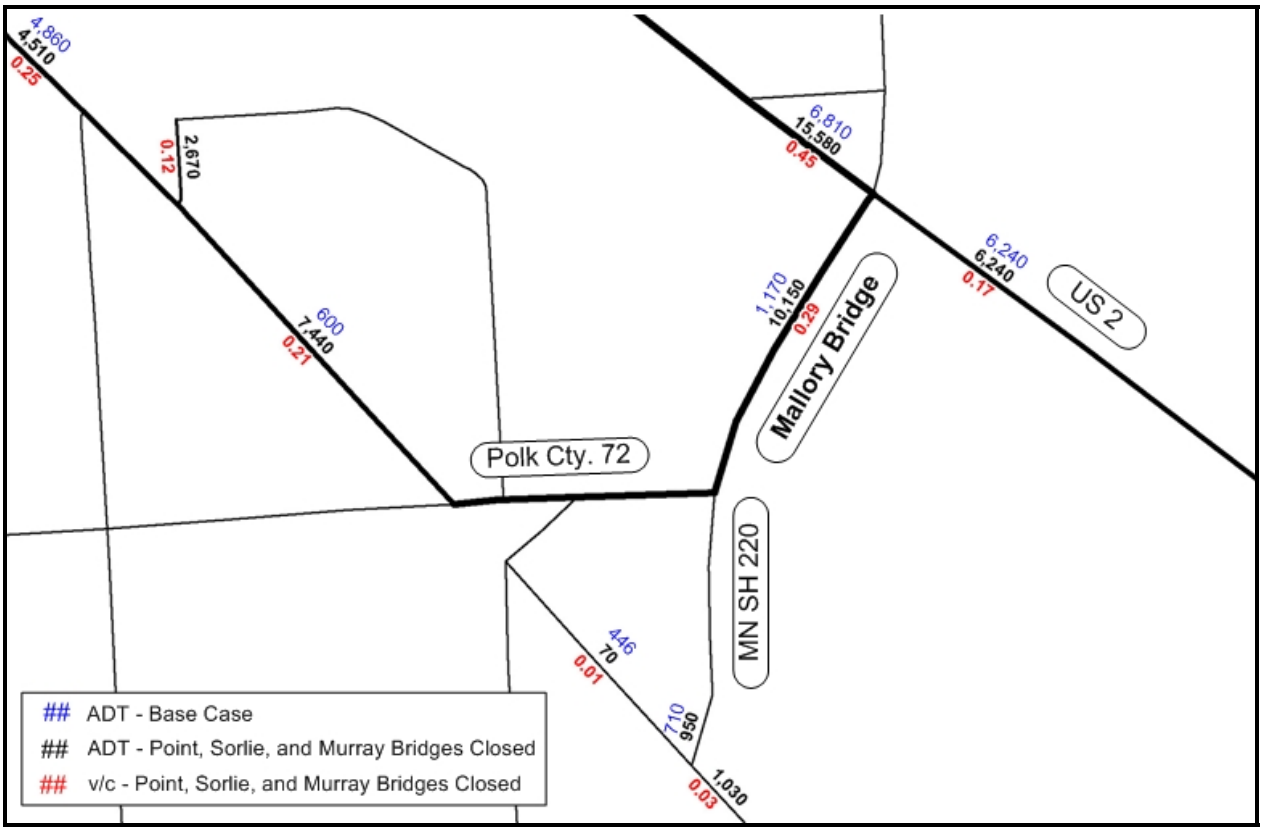


Figure 18. East Grand Forks Traffic Volume Data (Point and Murray Bridges Closed).

US 2 and MN SH 220 (East Grand Forks)

Add TRAFFIC CONTROL CHANGE AHEAD, Stop ahead, and STOP signs to the northwest and southeast approaches (US 2), as shown in Figure 19. Therefore, this intersection will be temporarily an all-way stop and should incorporate the ALL WAY or 4-WAY supplemental plaque sign. In addition, Type A Low-Intensity Flashing warning lights should be mounted on the STOP signs on US 2. This intersection should be monitored under the four-way stop condition to determine whether the traffic control should be changed back to two-way stop control or temporary signals should be installed (if available). These modifications are recommended for the flood scenario having the Point, Sorlie, and Murray Bridges closed.

MN SH 220 and Polk Co. 72

Add a STOP sign and Stop Ahead sign to the south approach (MN SH 220), add a YIELD sign to the north approach (MN SH 220), and remove the STOP sign for the west approach (Polk Co. 72), as shown in Figure 19. These modifications are recommended for the flood scenario having the Point, Sorlie, and Murray Bridges closed.

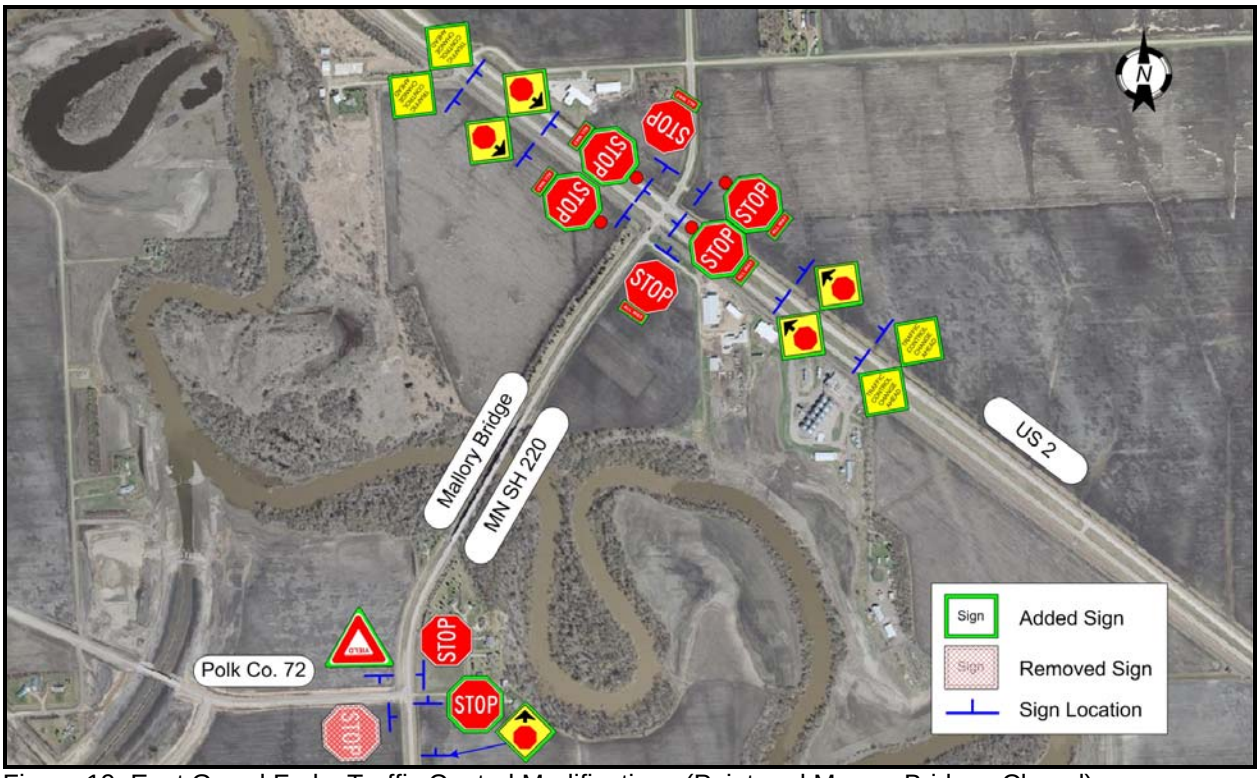


Figure 19. East Grand Forks Traffic Control Modifications (Point and Murray Bridges Closed).

Recommendations

Due to the history of spring flooding by the Red River and Red Lake River, establishing protocols and implementing traffic management strategies during flood and maintenance events can improve travel time and safety. This study developed action levels, traffic detour routes and signing, and traffic signal timing plans for eight bridge closure scenarios. Although some of the action levels may be modified due to changes in flood preparation (e.g., construction of clay dikes along 3rd Ave. E.), it is critical that all of the agencies are informed of this decision. In addition, field adjustments may be required for the signal timing plans.

Based on this study, significant travel time increases are caused by having various bridges closed. To combat the adverse impacts from the detoured traffic, implementing traffic control strategies along the alternative routes will help alleviate the congestion. Even delay time reductions of a few thousand dollars per day can be significant for a closure with a duration of a few weeks.

References

1. US Army Corps of Engineers, St. Paul District, Grand Forks Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual, Volume 1, January 2007.

2. US Army Corps of Engineers, St. Paul District, East Grand Forks Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual, Volume 1, January 2007.

3. US Census Bureau; Census 2000, Summary File 3 (SF 3); generated by Shawn Birst; using American Factfinder; <http://factfinder.census.gov/>; (13 February 2007).

4. Federal Highway Administration, *Manual of Uniform Traffic Control Devices 2003 Edition*, Revision 1, November 2004.

5. Minnesota Department of Transportation, *Minnesota Manual of Uniform Traffic Control Devices 2005 Edition,* Revision 1, January 2007.

6. Trafficware, SYNCHRO 6.0 (Build 614), Albany, CA, 1997 - 2004.

APPENDIX A:
Action Level Contact List

Bridge Closure Contact List

Contact information, including agency, position name, and telephone number is provided below. If changes are required in the future, the appropriate agency should provide the remaining agencies with the updated information, which should include the revision date.

Agency	Telephone Number
City of Grand Forks	
City Engineer	(701) 746-2630
Traffic Engineer	(701) 787-3720
Public Works - Streets	(701) 746-2570
Public Works 24-hour Emergency Line	(701) 746-2595
North Dakota Department of Transportation	
Grand Forks District Engineer	(701) 787-6500
ND State Radio (use after normal business hours)	(800) 472-2121
City of East Grand Forks	
City Engineer	(218) 773-1185
Public Works - Streets	(701) 773-1313
Police Department (use after normal business hours)	(218) 773-1104
Minnesota Department of Transportation	
Mn/DOT District 2 Engineer	(218) 755-6549
Mn/DOT District 2 Traffic Engineer	(218) 755-6574
Mn/DOT District 2 Maintenance Engineer	(218) 277-7962
Mn/DOT District 2 Bridge Engineer	(218) 277-7963
MN State Patrol, Thief River Falls	(218) 681-0943
BNSF Railway	
Grand Forks Terminal Manager	(701) 795-1255

Revision Date: June 25, 2007

APPENDIX B:
Detour Signing and Signal Timing Notes and Legends

DETOUR SIGNING NOTES

1. THE ADVANCED TRAFFIC ANALYSIS CENTER (ATAC) DEVELOPED THE TRAFFIC DETOUR LAYOUTS FOR THE BRIDGE CLOSURE SCENARIOS BASED ON BOTH THE 2003 EDITION (REVISION 1) OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) AND 2005 MINNESOTA MUTCD (REVISION 1).

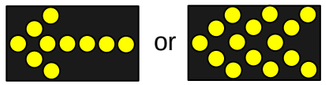
2. FIELD CONDITIONS MAY REQUIRE ADJUSTMENTS TO THESE LAYOUTS WHEN NECESSARY.

3. ALL DISTANCES ON DRAWINGS ARE APPROXIMATE.

4. SIGNS, BARRICADES, AND CHANNELIZING DEVICES MUST BE INSTALLED AS DETAILED IN APPROPRIATE EDITION/REVISION OF BOTH THE MUTCD AND MN MUTCD.

5. THE KENNEDY BRIDGE 50% CAPACITY MAINTENANCE SCENARIO DOES NOT ACCOUNT FOR TRAVERSING THE GATEWAY DR. MEDIAN IN EAST GRAND FORKS. DEPENDING ON THE TYPE OF MAINTENANCE REQUIRED, THE MEDIAN MAY BE REMOVED OR RAMPS MAY BE CONSTRUCTED TO TRAVERSE OVER THE MEDIAN.

DETOUR SIGNING LEGEND



Arrow panel

Arrowboard support or trailer (shown facing down)

Channelizing device

Direction of travel

Portable variable message sign (VMS)

Sign (shown facing to the left)

Type A flashing warning light

Type III barricade

SIGNAL TIMING LEGEND

Bridge Closure

Detour Route

Truck Detour

Original Cycle Length

Updated Cycle Length

Boundary for Coordinated Signals

Signal Coordination Designed to Favor Direction with Closed Arrow

Signal Coordination Designed for Both Directions

This document was originally issued and sealed by Shawn C. Birst, Registration Number PE-5438, on 7/31/2007 and the original document is stored at the Advanced Traffic Analysis Center

I HEREBY CERTIFY THAT THE INFORMATION IN THE FOLLOWING SECTIONS OF THIS STUDY WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA.

ATAC ADVANCED TRAFFIC ANALYSIS CENTER

Grand Forks/East Grand Forks Bridge Closure Traffic Management Study

Notes and Drawing Legends

Detour Signing & Signal Timing

Point Bridge Closure (Flood Scenario)

Bridge Closure

- Once Action 1 is reached (Red River Stage of 39.0 ft) and the Red River has not yet crested, the cities shall contact each other, Mn/DOT, NDDOT, and BNSF for installing the traffic closure and detour route and inform the media of the event.
- Once Action 2 is reached (Red River Stage of 40.0 ft) and the Red River has not yet crested, the cities shall install traffic closures, detour signing, and alternate traffic signal plans for the Point Bridge Closure (Flood Scenario).

    - City of Grand Forks
        - Close the Point Bridge (coordinate with East Grand Forks) at Minnesota Ave. with Type III barricades.
        - Install the appropriate detour and traffic control signs in Grand Forks.
        - Implement the alternate timing plans for the signalized intersections in Grand Forks

    - City of East Grand Forks
        - Close the Point Bridge (coordinate with Grand Forks) at 1st St. S. with Type III barricades.
        - Install the appropriate detour and traffic control signs in East Grand Forks.

    - Mn/DOT
        - Implement the alternate timing plans for the signalized intersections in East Grand Forks.

Bridge Reopening

- Once Action 1 is reached as the river recedes (Red River Stage of 41.0 ft), the cities shall contact each other, Mn/DOT, NDDOT, and BNSF for reopening the Point Bridge and inform the media of the event. Approximately 1 day is provided to clean the roadway/bridge and perform inspections.
- Once Action 2 is reached as the river recedes (Red River Stage of 40.0 ft) and the bridge has passed inspection, the structure will be reopened to traffic, the traffic detour signing will be removed, and traffic signal timing plans will be returned back to the original plans.

    - City of Grand Forks
        - Clean and inspect the Grand Forks side of the Point Bridge.
        - Remove the Type III barricades and open the Point Bridge (coordinate with East Grand Forks).
        - Remove the detour and traffic control signs in Grand Forks.
        - Revert back to the original timing plans for the signalized intersections in Grand Forks.

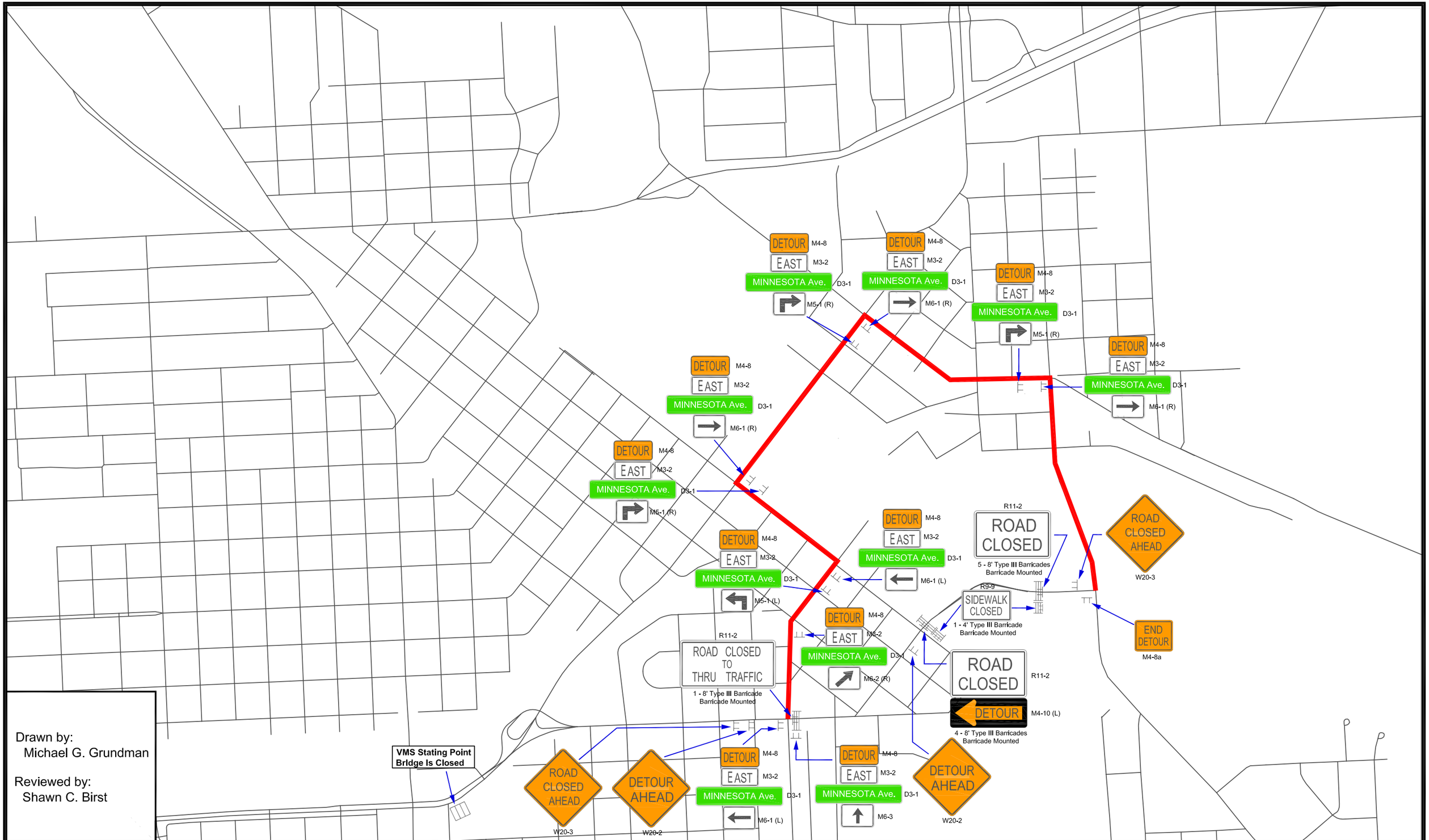
    - City of East Grand Forks
        - Clean and inspect the East Grand Forks side of the Point Bridge.
        - Remove the Type III barricades and open the Point Bridge (coordinate with Grand Forks).
        - Remove the detour and traffic control signs in East Grand Forks.

    - Mn/DOT
        - Revert back to the original timing plans for the signalized intersections in East Grand Forks.

Note: Emergency declarations by cities/counties/states allow additional resources to be used for installing closure and detour route signs, as well as implementing traffic control modifications and signal timing plans.

The remaining pages of this section contain detailed information regarding the following topics:

- Detour Sign Layouts
- Traffic Signal Timing Plans
- Traffic Control Device Modifications



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Reviewed by:
Shawn C. Birst

ATAC ADVANCED TRAFFIC ANALYSIS CENTER

Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Point Bridge Flood Closure

Eastbound Traffic

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M6-1 (L)

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M5-1 (L)

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M6-2 (R)

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M6-3

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M6-1 (L)

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M5-1 (L)

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M6-1 (L)

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M5-1 (L)

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M6-1 (R)

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M5-1 (R)

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M6-2 (L)

END DETOUR
M4-8a

R11-2
ROAD CLOSED
5 - 8' Type III Barricades
Barricade Mounted

ROAD CLOSED AHEAD
W20-3

R9-9
SIDEWALK CLOSED
1 - 4' Type III Barricade
Barricade Mounted

R11-4
ROAD CLOSED TO THRU TRAFFIC
1 - 8' Type III Barricade
Barricade Mounted

R11-2
ROAD CLOSED

DETOUR M4-10 (L)
4 - 8' Type III Barricades
Barricade Mounted

DETOUR AHEAD
W20-2

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M6-3

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ATAC ADVANCED TRAFFIC ANALYSIS CENTER

Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Point Bridge Flood Closure

Westbound Traffic

Point Bridge Closure – Flood Scenario

(AM Peak - Traffic Signal Progression and Cycle Lengths)

N

Columbia
Washington
River
Central
14th St
Gateway Dr. (US 2)
Gateway
10th St. NE
Mill Rd
3rd St
Gateway
Kennedy Bridge
4th
20th St
Washington
5th
3rd St.
4th St.
Sorlie Bridge
2nd Ave NE
5th Ave NE
3rd
2nd
4th
Columbia
5th Ave N
University
2nd Ave N
1st Ave N
Kitt Ave
Demers Ave
Murray Bridge
1st
3rd St.
4th St.
Point Bridge
3rd Ave
University Ave
2nd Ave N
Bruce Ave
Columbia
Washington
4th Ave S
Cherry St
Demers
Demers Ave

142.5A
90
109.5A
130A
126.5A
70
80A
95
69A
80.6A
70A
120A

Bridge Closure
Detour Route
Original Cycle Length
Updated Cycle Length

Signal Timing Plans - Point Bridge Closed - AM Peak - Flood Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	120.0	95.0	95.0	95.0	142.5	90.0	90.0	90.0	90.0	80.6
Offset		14	8	44		0	0	5	54	
Φ1										
Max. Split	15.0		29.0		35.5		14.0	20.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	49.0	60.0	27.0	55.0	61.1	54.0	34.0	35.0	50.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	18.0		10.0				17.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	38.0	35.0	29.0	40.0	45.7		25.0	35.0	40.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	15.0	20.0			35.7	20.0	18.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	49.0	40.0	56.0	55.0	61.1	34.0	30.0	55.0	50.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	18.0						17.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	38.0	35.0	39.0	40.0	45.7	36.0	25.0	35.0	40.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan

Signal Timing Plans - Point Bridge Closed - AM Peak - Flood Scenario - Grand Forks

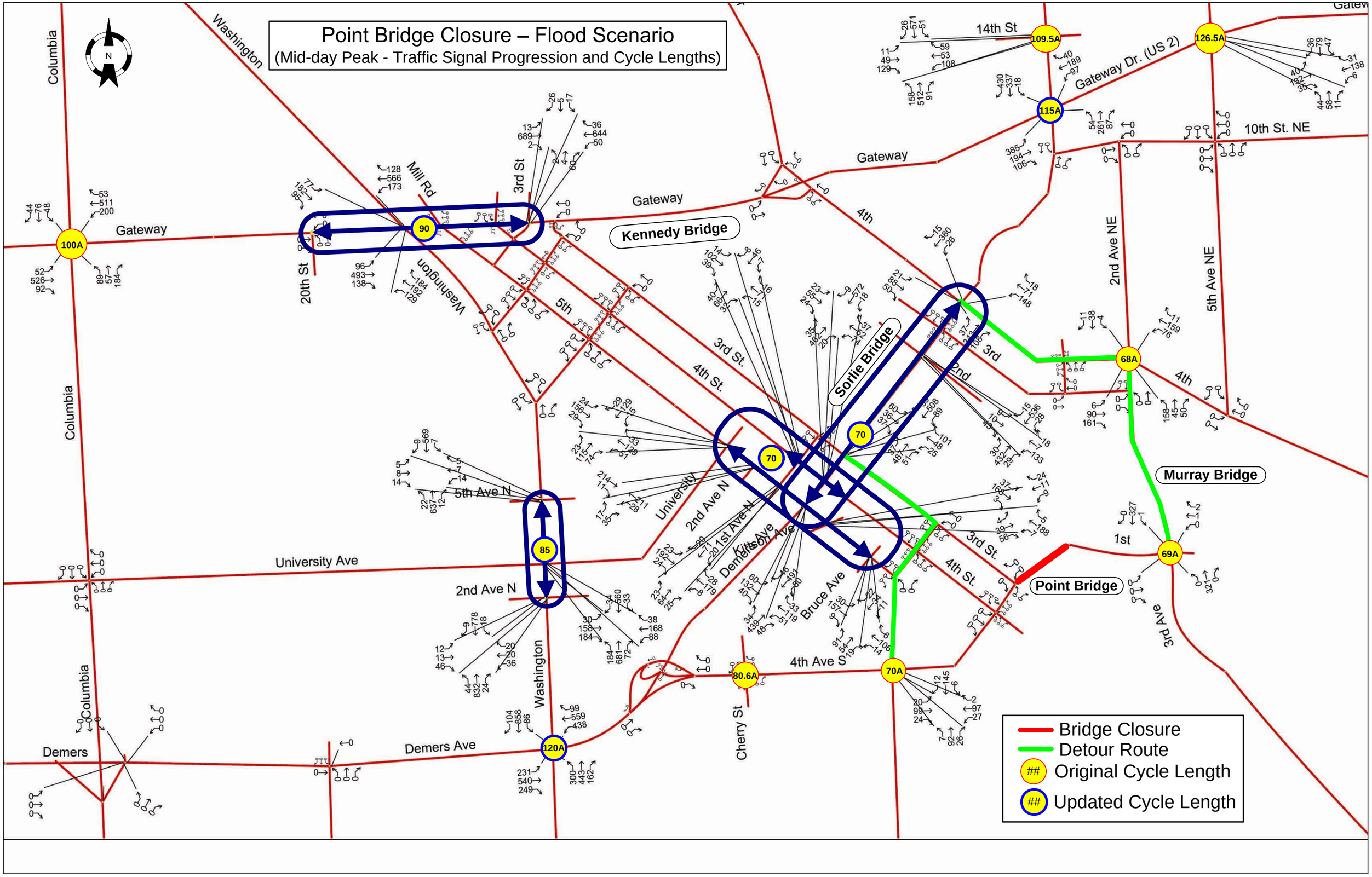
Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset		17	40	68	38	57	52	8	50	2
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	40.0	30.0	40.0	40.0	40.0	35.0	40.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	30.0	40.0	30.0	30.0	30.0	35.0	30.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Changed to Uncoordinated	Offset Ref. to 4&8 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 2 Yellow

Signal Timing Plans - Point Bridge Closed - AM Peak - Flood Scenario - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	130.0	126.5	109.5	70.0	70.0	80.0	69.0
Offset				0	0		
Φ1							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	37.0	52.5	50.0	30.0	30.0	25.0	54.0
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	15.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	63.0	42.5	35.0	40.0	40.0	55.0	15.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	37.0	52.5	50.0	30.0	30.0	25.0	54.0
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	44.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	34.0	42.5	35.0	40.0	40.0	55.0	15.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
		Original Timing Plan	Original Timing Plan	Offset Ref. to 4&8 Green	Offset Ref. to 4&8 Green		Changed Phase Splits

Point Bridge Closure – Flood Scenario

(Mid-day Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Point Bridge Closed - MID Peak - Flood Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	120.0	85.0	85.0	85.0	100.0	90.0	90.0	90.0	90.0	80.6
Offset		66	61	84		8	0	15	84	
Φ1										
Max. Split	26.0		19.0		17.0		17.0	20.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	40.0	52.0	27.0	45.0	45.0	54.0	34.0	38.0	55.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	24.0		10.0				15.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	30.0	33.0	29.0	40.0	38.0		24.0	32.0	35.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	15.0	15.0			26.0	18.0	23.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	51.0	37.0	46.0	45.0	36.0	36.0	28.0	58.0	55.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	21.0						18.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	33.0	33.0	39.0	40.0	38.0	36.0	21.0	32.0	35.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan Changed to Uncoordinated	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan

Signal Timing Plans - Point Bridge Closed - MID Peak - Flood Scenario - Grand Forks

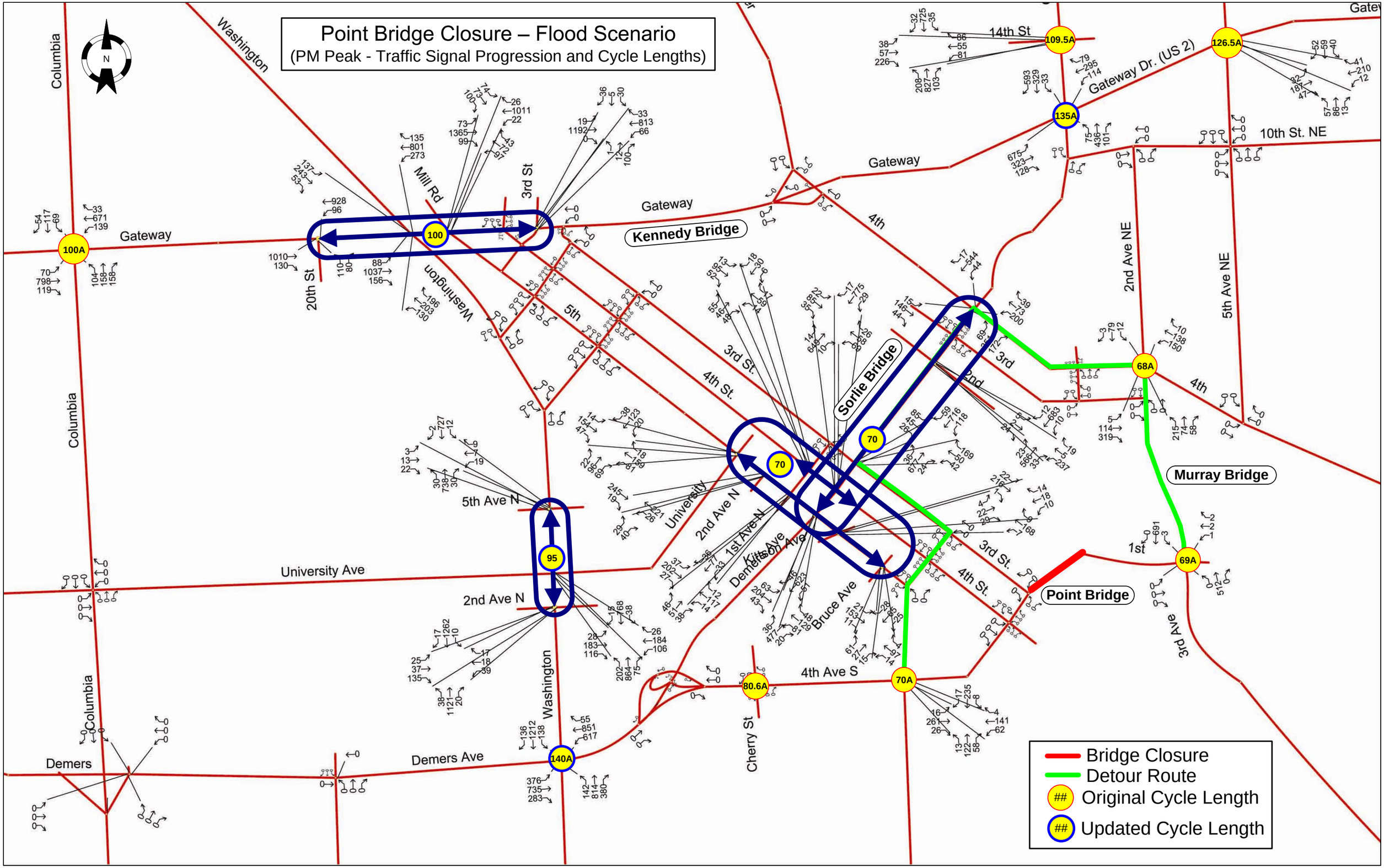
Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset		28	45	0	29	31	19	7	48	0
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	40.0	30.0	40.0	40.0	40.0	30.0	40.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	30.0	40.0	30.0	30.0	30.0	40.0	30.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Changed to Uncoordinated	Offset Ref. to 4&8 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 2 Yellow

Signal Timing Plans - Point Bridge Closed - MID Peak - Flood Scenario - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	115.0	126.5	109.5	70.0	70.0	68.0	69.0
Offset				0	0		
Φ1							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	35.0	52.5	50.0	30.0	30.0	34.0	54.0
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	16.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	49.0	42.5	35.0	40.0	40.0	34.0	15.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	35.0	52.5	50.0	30.0	30.0	34.0	54.0
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	31.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	34.0	42.5	35.0	40.0	40.0	34.0	15.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
		Original Timing Plan	Original Timing Plan	Offset Ref. to 4&8 Green	Offset Ref. to 4&8 Green	Original Timing Plan	Changed Phase Splits

Point Bridge Closure – Flood Scenario

(PM Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Point Bridge Closed - PM Peak - Flood Scenario - Grand Forks

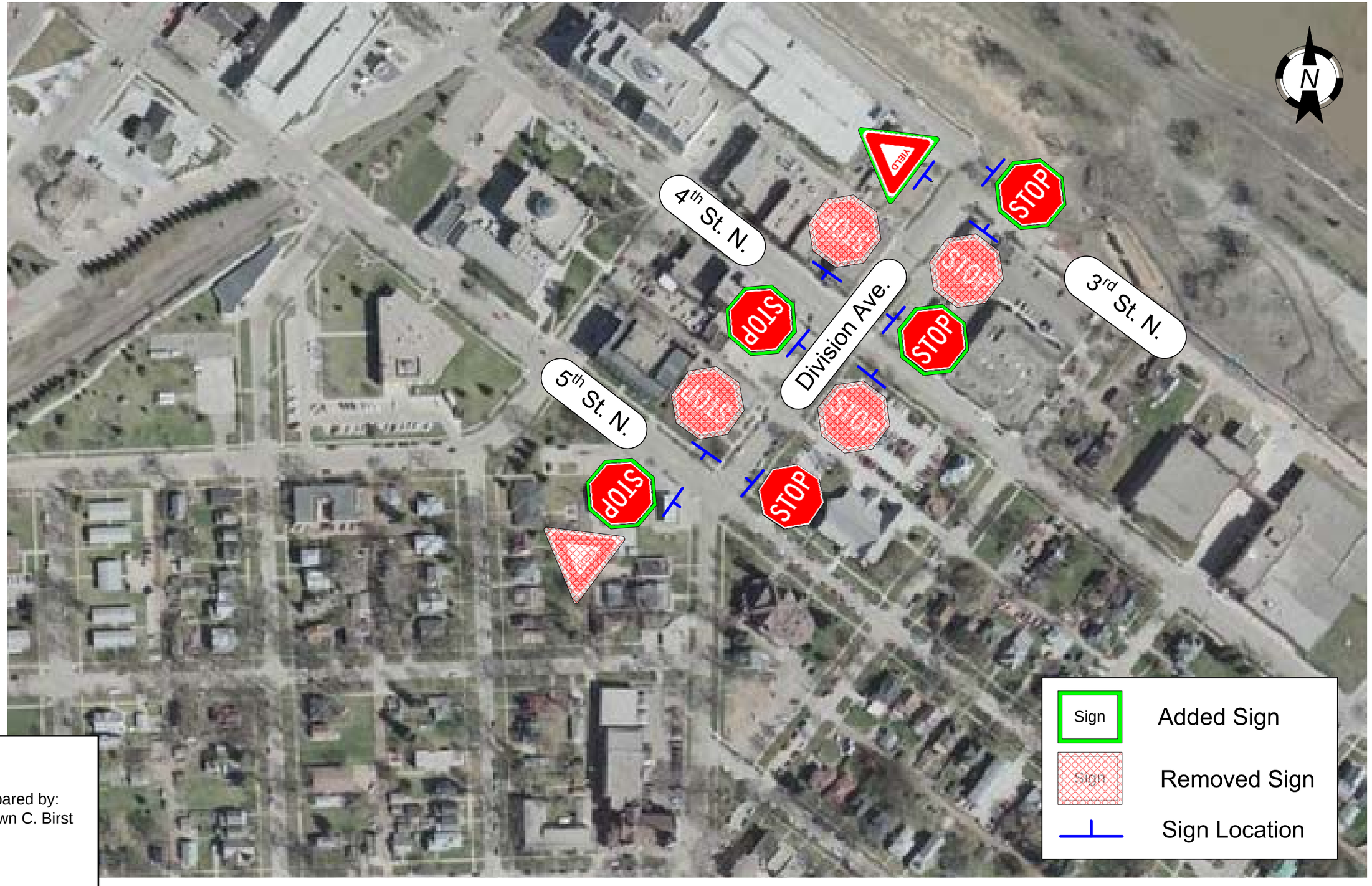
Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	140.0	95.0	95.0	95.0	100.0	100.0	100.0	100.0	100.0	80.6
Offset		77	68	6		77	9	20	43	
Φ1										
Max. Split	20.0		20.0		23.0		18.0	15.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	48.0	60.0	31.0	60.0	33.0	65.0	42.0	50.0	60.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	33.0		15.0				18.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	39.0	35.0	29.0	35.0	44.0		22.0	35.0	40.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	20.0	15.0			23.0	15.0	26.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	48.0	45.0	51.0	60.0	33.0	50.0	34.0	65.0	60.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	25.0						18.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	47.0	35.0	44.0	35.0	44.0	35.0	22.0	35.0	40.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan Changed to Uncoordinated	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan

Signal Timing Plans - Point Bridge Closed - PM Peak - Flood Scenario - Grand Forks

Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset		30	40	59	10	28	25	0	38	60
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	40.0	30.0	40.0	40.0	40.0	30.0	40.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	30.0	40.0	30.0	30.0	30.0	40.0	30.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Changed to Uncoordinated	Offset Ref. to 4&8 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 2 Yellow

Signal Timing Plans - Point Bridge Closed - PM Peak - Flood Scenario - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	135.0	126.5	109.5	70.0	70.0	68.0	69.0
Offset				60	60		
Φ1							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	35.0	52.5	50.0	30.0	30.0	34.0	54.0
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	15.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	70.0	42.5	35.0	40.0	40.0	34.0	15.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	35.0	52.5	50.0	30.0	30.0	34.0	54.0
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	51.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	34.0	42.5	35.0	40.0	40.0	34.0	15.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
		Original Timing Plan	Original Timing Plan	Offset Ref. to 4&8 Green	Offset Ref. to 4&8 Green	Original Timing Plan	Changed Phase Splits



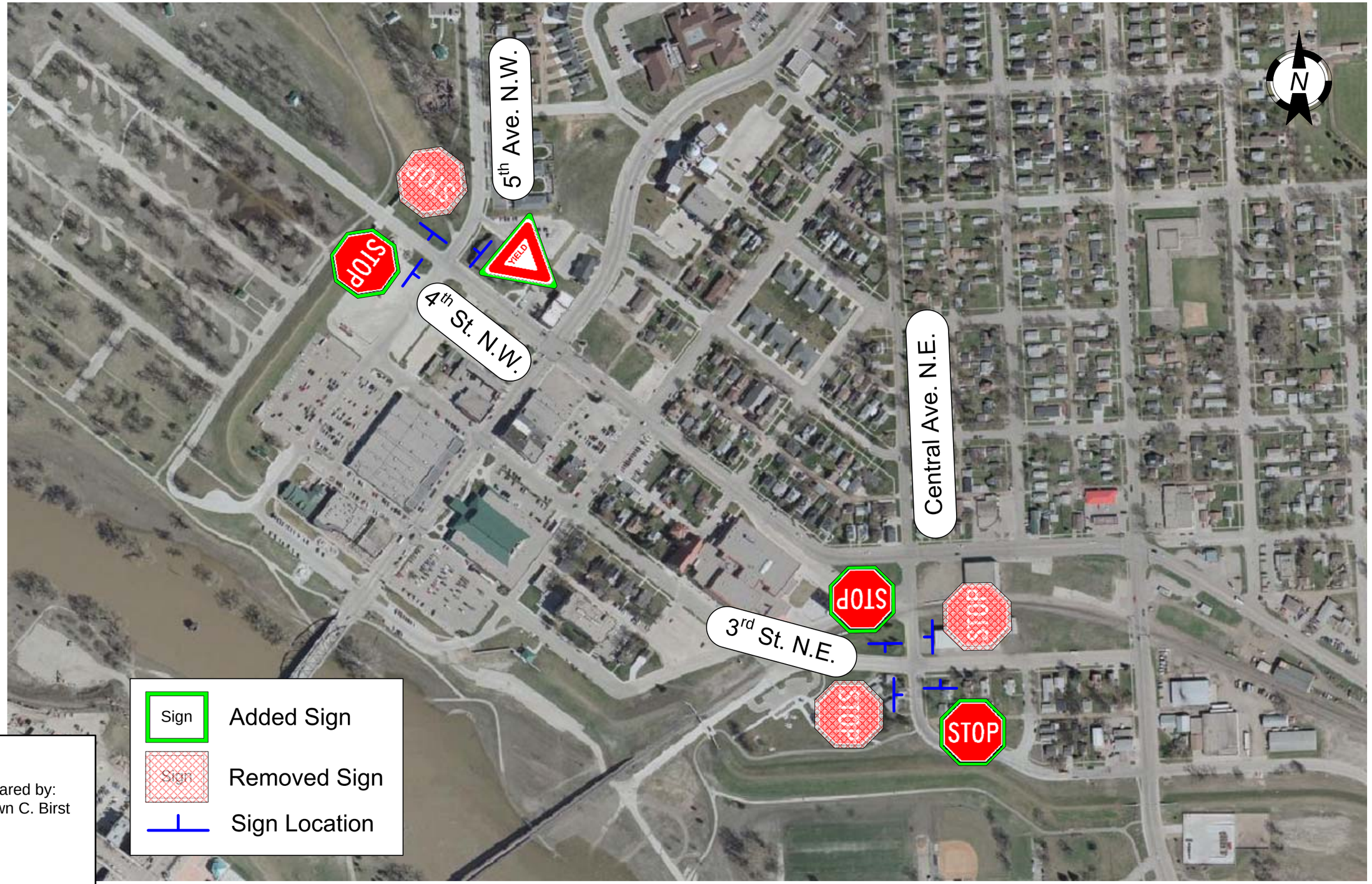
Prepared by:
Shawn C. Birst

ATAC ADVANCED TRAFFIC ANALYSIS CENTER

Grand Forks/East Grand Forks Bridge Closure Study

Traffic Control Modifications: Point Bridge Closed and Sorlie Bridge Open

Purpose: Benefit detoured traffic



Prepared by:
Shawn C. Birst

Grand Forks/East Grand Forks Bridge Closure Study

Traffic Control Modifications: Point Bridge Closed (Flood Scenario)

Purpose: Benefit detoured traffic

Point and Sorlie Bridge Closure (Flood Scenario)

Bridge Closure (Sorlie Bridge)

- Once Action 1 is reached (Red River Stage of 42.5 ft) and the Red River has not yet crested, the cities shall contact each other, Mn/DOT, NDDOT, and BNSF for installing the traffic closure and detour route and inform the media of the event.
- Once Action 2 is reached (Red River Stage of 43.5 ft) and the Red River has not yet crested, the cities shall install traffic closures, detour signing, and alternate traffic signal plans for the Point and Sorlie Bridge Closure (Flood Scenario).
    - City of Grand Forks
        - Request/receive approval from NDDOT to close the Sorlie Bridge.
        - Close the Sorlie Bridge (coordinated with East Grand Forks) at Demers Ave. with Type III barricades.
        - Install the appropriate detour and traffic control signs in Grand Forks.
        - Implement the alternate timing plans for the signalized intersections in Grand Forks.
    - City of East Grand Forks
        - Request/receive approval from Mn/DOT to close the Sorlie Bridge.
        - Close the Sorlie Bridge (coordinate Grand Forks) at Demers Ave. with Type III barricades.
        - Install the appropriate detour and traffic control signs in East Grand Forks.
    - Mn/DOT
        - Implement the alternate timing plans for the signalized intersections in East Grand Forks.

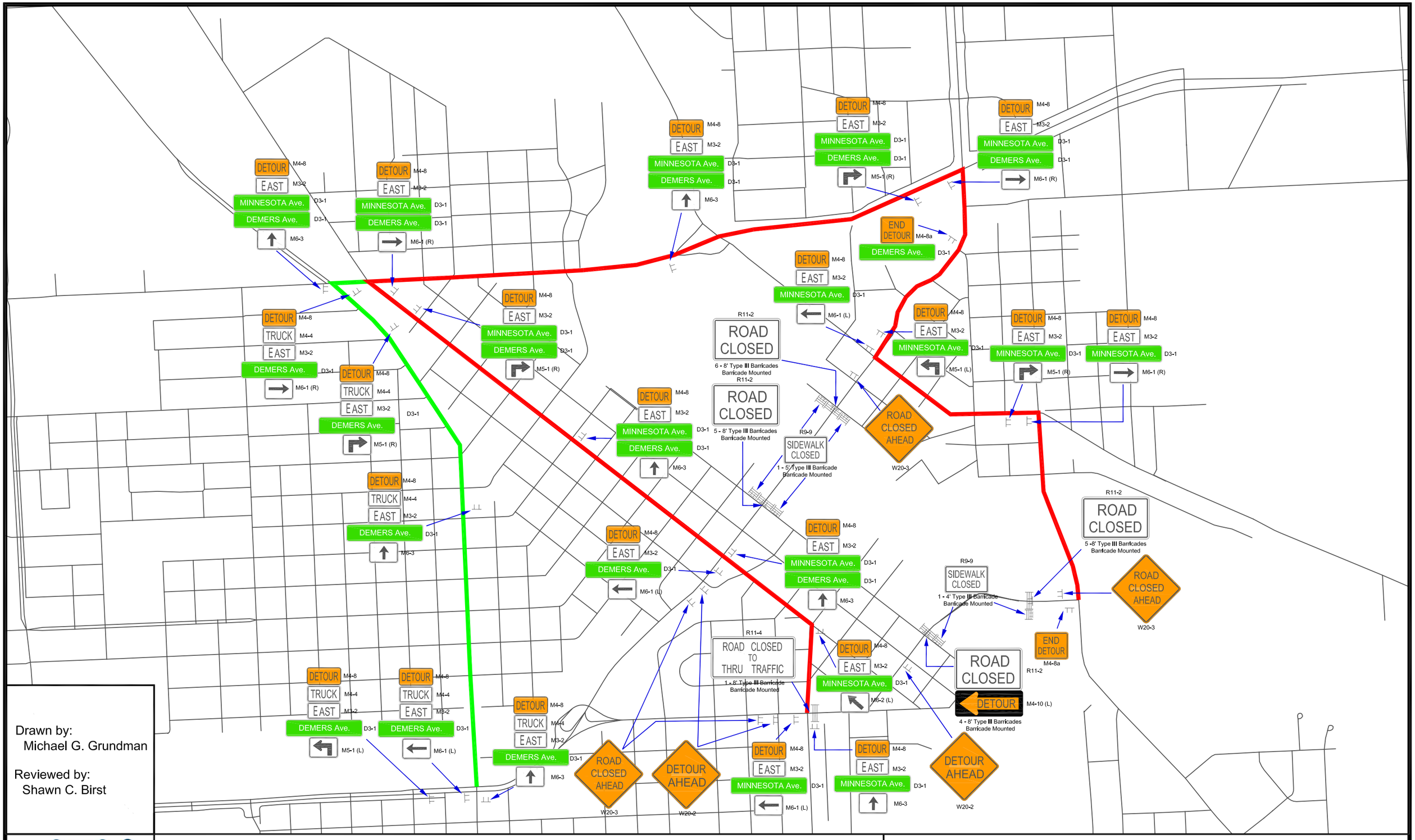
Bridge Reopening (Sorlie Bridge)

- Once Action 1 is reached as the river recedes (Red River Stage of 44.5 ft), the cities shall contact each other, Mn/DOT, NDDOT, and BNSF for reopening the Sorlie Bridge and inform the media of the event. Approximately 1 day will be provided to clean the roadway/bridge and perform inspections.
- Once Action 2 is reached as the river recedes (Red River Stage of 43.5 ft) and the bridge has passed inspection, the structure will be reopened to traffic, the traffic detour signing will be removed, and traffic signal timing plans will go back to those identified in the Point Bridge Closure (Flood Scenario).
    - City of Grand Forks
        - Clean and inspect the Grand Forks side of the Sorlie Bridge.
        - Request/receive approval from NDDOT to reopen the Sorlie Bridge.
        - Remove the Type III barricades and open the bridge (coordinate with East Grand Forks).
        - Remove detour and traffic control signs in Grand Forks related to the Sorlie Bridge closure.
        - Change the Grand Forks signal timing plans back to those used when only the Point Bridge is closed.
    - NDDOT
        - Inspect the Sorlie Bridge.
    - City of East Grand Forks
        - Clean and inspect the East Grand Forks side of the Sorlie Bridge.
        - Remove the Type III barricades and open the Sorlie Bridge (coordinate with Grand Forks).
        - Remove detour and traffic control signs in East Grand Forks related to the Sorlie Bridge closure.
    - Mn/DOT
        - Inspect the Sorlie Bridge.
        - Change the East Grand Forks signal timing plans back to those used when only the Point Bridge is closed.

Note: Emergency declarations by cities/counties/states allow additional resources to be used for installing closure and detour route signs, as well as implementing traffic control modifications and signal timing plans.

The remaining pages of this section contain detailed information regarding the following topics:

- Detour Sign Layouts
- Traffic Signal Timing Plans
- Traffic Control Device Modifications



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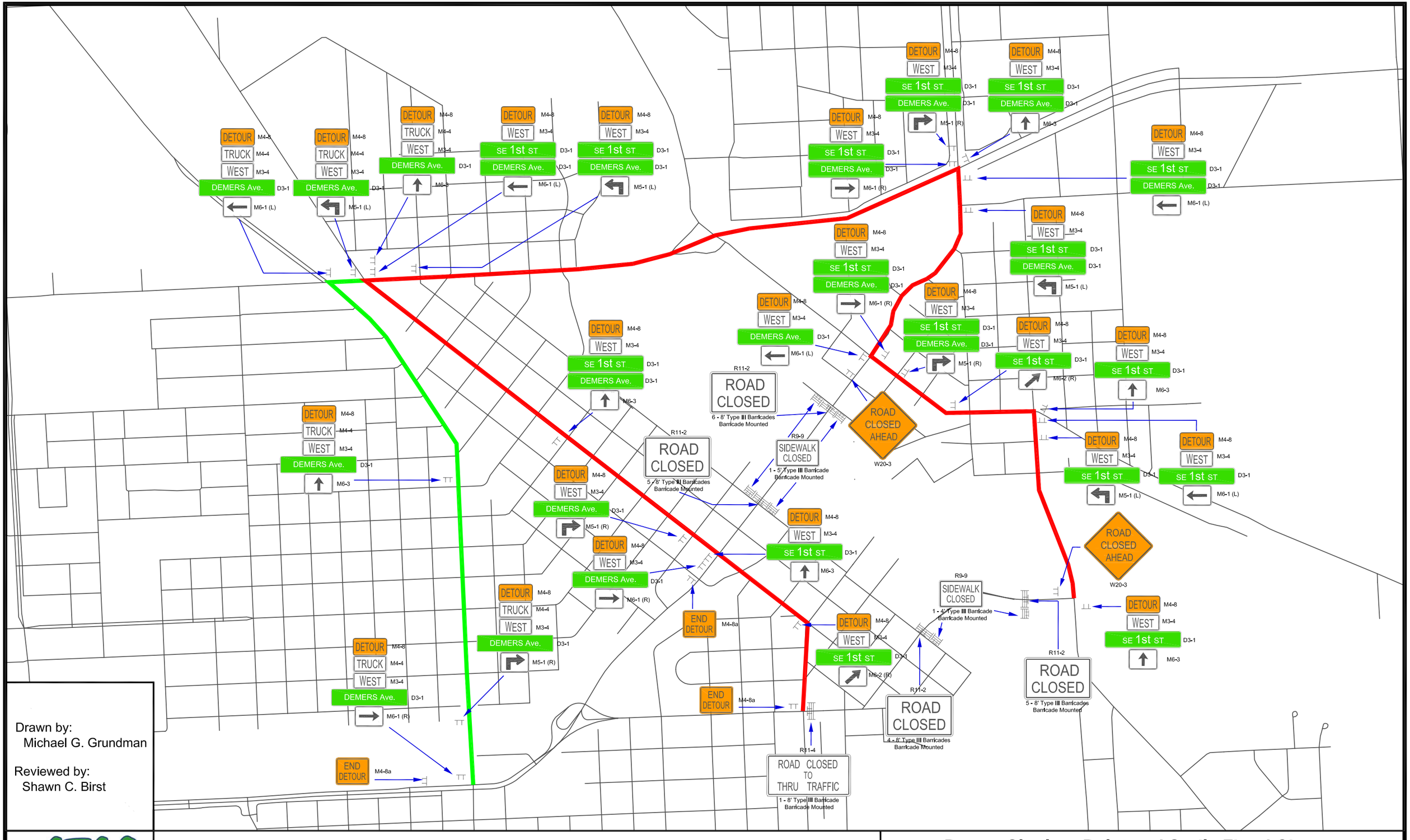
ATAC ADVANCED TRAFFIC ANALYSIS CENTER

Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Point and Sorlie Flood Closure

Eastbound Traffic



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ATAC ADVANCED TRAFFIC ANALYSIS CENTER

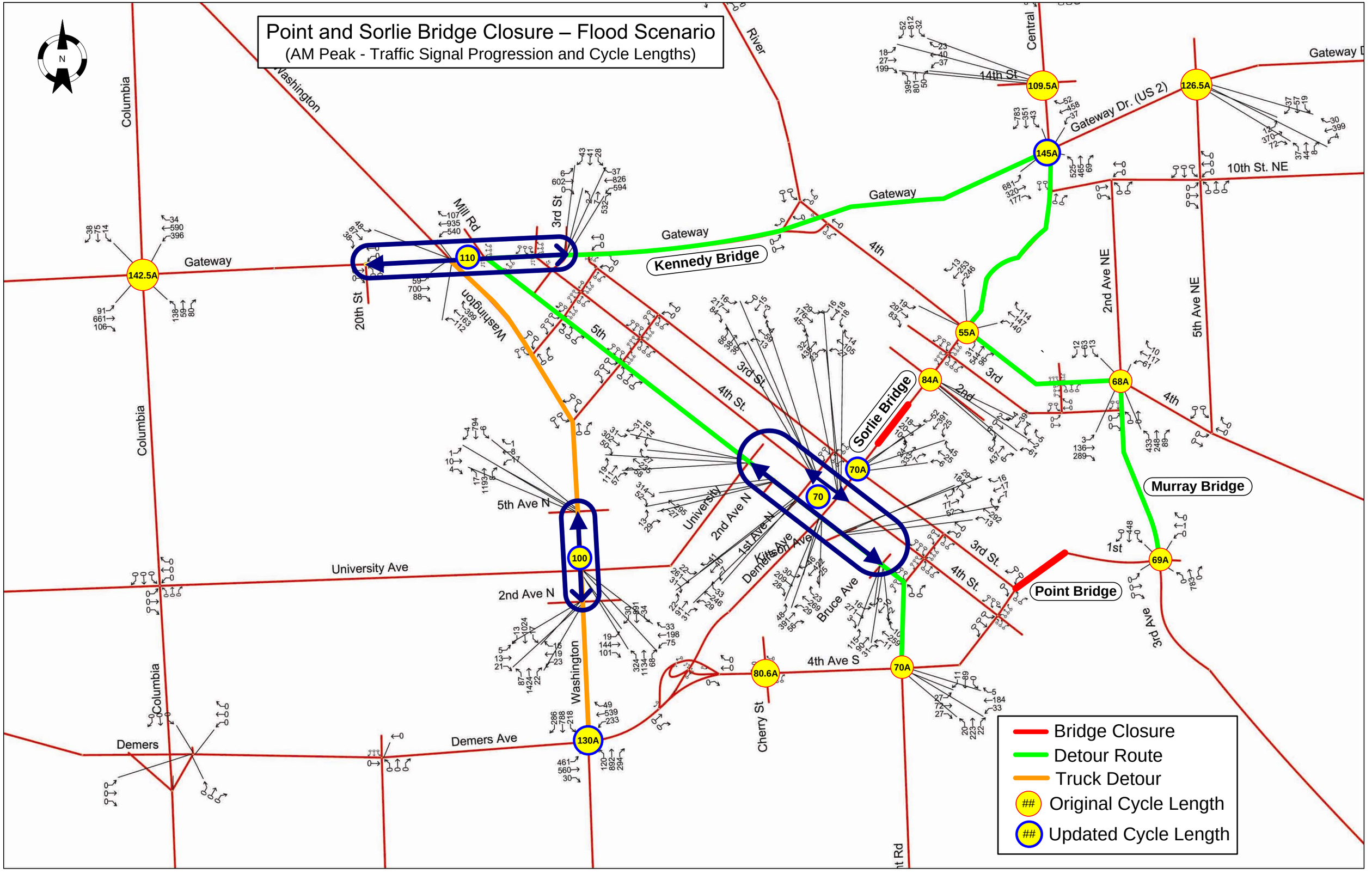
Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Point and Sorlie Flood Closure

Westbound Traffic

Point and Sorlie Bridge Closure – Flood Scenario

(AM Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Point-Sorlie Bridges Closed - AM Peak - Flood Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	130.0	100.0	100.0	100.0	142.5	110.0	110.0	110.0	110.0	80.6
Offset		52	40	72		0	0	29	63	
Φ1										
Max. Split	15.0		30.0		35.5		15.0	15.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	56.0	60.0	28.0	60.0	61.1	65.0	52.0	55.0	65.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	20.0		13.0				18.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	39.0	40.0	29.0	40.0	45.7		25.0	40.0	45.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	21.0	15.0			35.7	25.0	40.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	50.0	45.0	58.0	60.0	61.1	40.0	27.0	70.0	65.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	26.0						18.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	33.0	40.0	42.0	40.0	45.7	45.0	25.0	40.0	45.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan

Signal Timing Plans - Point-Sorlie Bridges Closed - AM Peak - Flood Scenario - Grand Forks

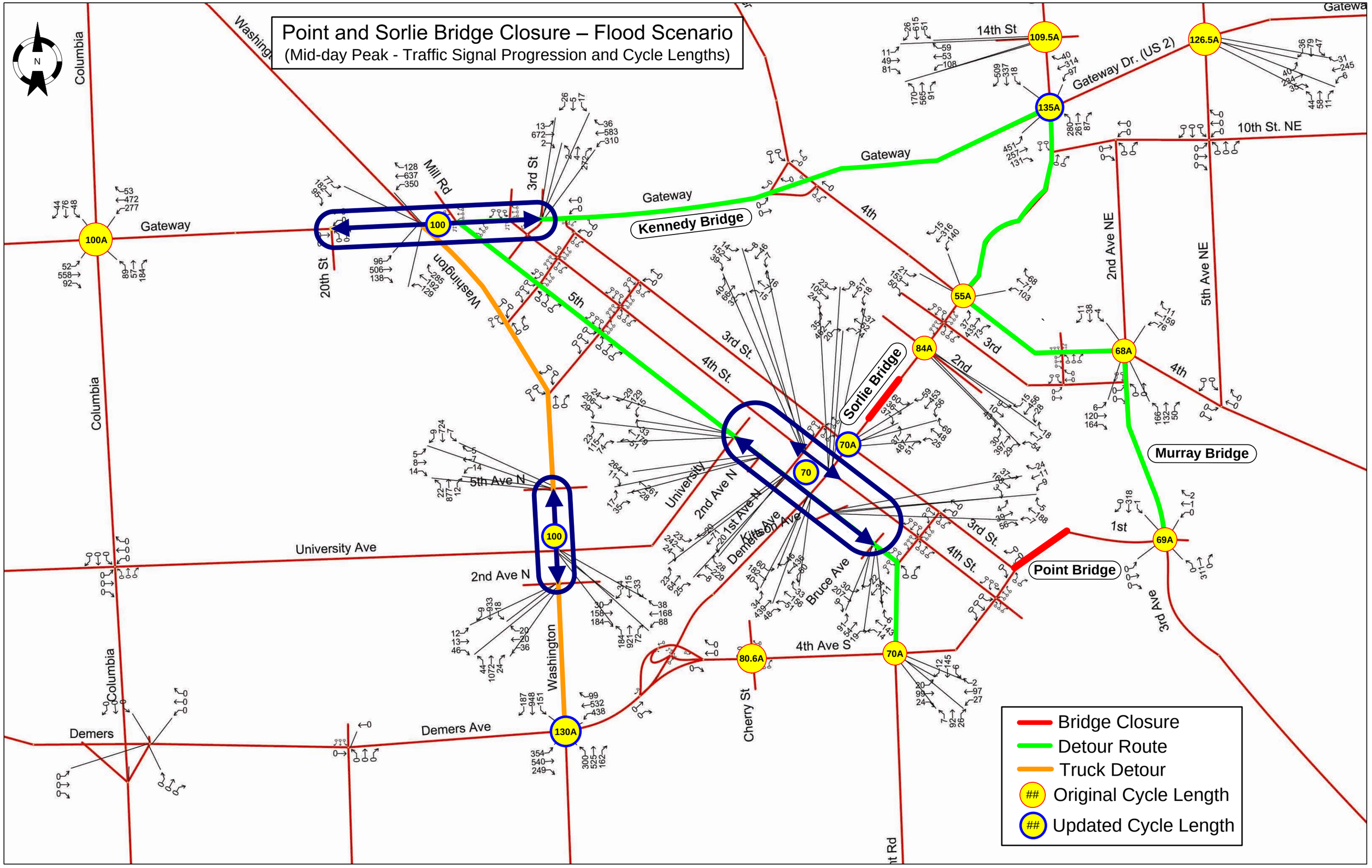
Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset		31	43	20	27	46	52	20	45	
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	35.0	30.0	40.0	40.0	35.0	30.0	35.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	35.0	40.0	30.0	30.0	35.0	40.0	35.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Changed to Uncoordinated	Offset Ref. to 4&8 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 4 Yellow (Changed from 2)	Changed to Uncoordinated

Signal Timing Plans - Point-Sorlie Bridges Closed - AM Peak - Flood Scenario - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	145.0	126.5	109.5	84.0	55.0	68.0	69.0
Offset							
Φ1							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	47.0	52.5	50.0	34.5	25.0	34.0	54.0
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	15.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	68.0	42.5	35.0	49.5	30.0	34.0	15.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	18.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	44.0	52.5	50.0	34.5	25.0	34.0	54.0
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	49.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	34.0	42.5	35.0	49.5	30.0	34.0	15.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
		Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Changed Phase Splits

Point and Sorlie Bridge Closure – Flood Scenario

(Mid-day Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Point-Sorlie Bridges Closed - MID Peak - Flood Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	130.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	80.6
Offset		17	0	31		78	37	48	15	
Φ1										
Max. Split	27.0		22.0		20.0		17.0	20.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	46.0	65.0	34.0	60.0	40.0	60.0	45.0	40.0	60.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	28.0		15.0				16.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	29.0	35.0	29.0	40.0	40.0		22.0	40.0	40.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	27.0	15.0			20.0	20.0	35.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	46.0	50.0	56.0	60.0	40.0	40.0	27.0	60.0	60.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	28.0						16.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	29.0	35.0	44.0	40.0	40.0	40.0	22.0	40.0	40.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan Changed to Uncoordinated	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan

Signal Timing Plans - Point-Sorlie Bridges Closed - MID Peak - Flood Scenario - Grand Forks

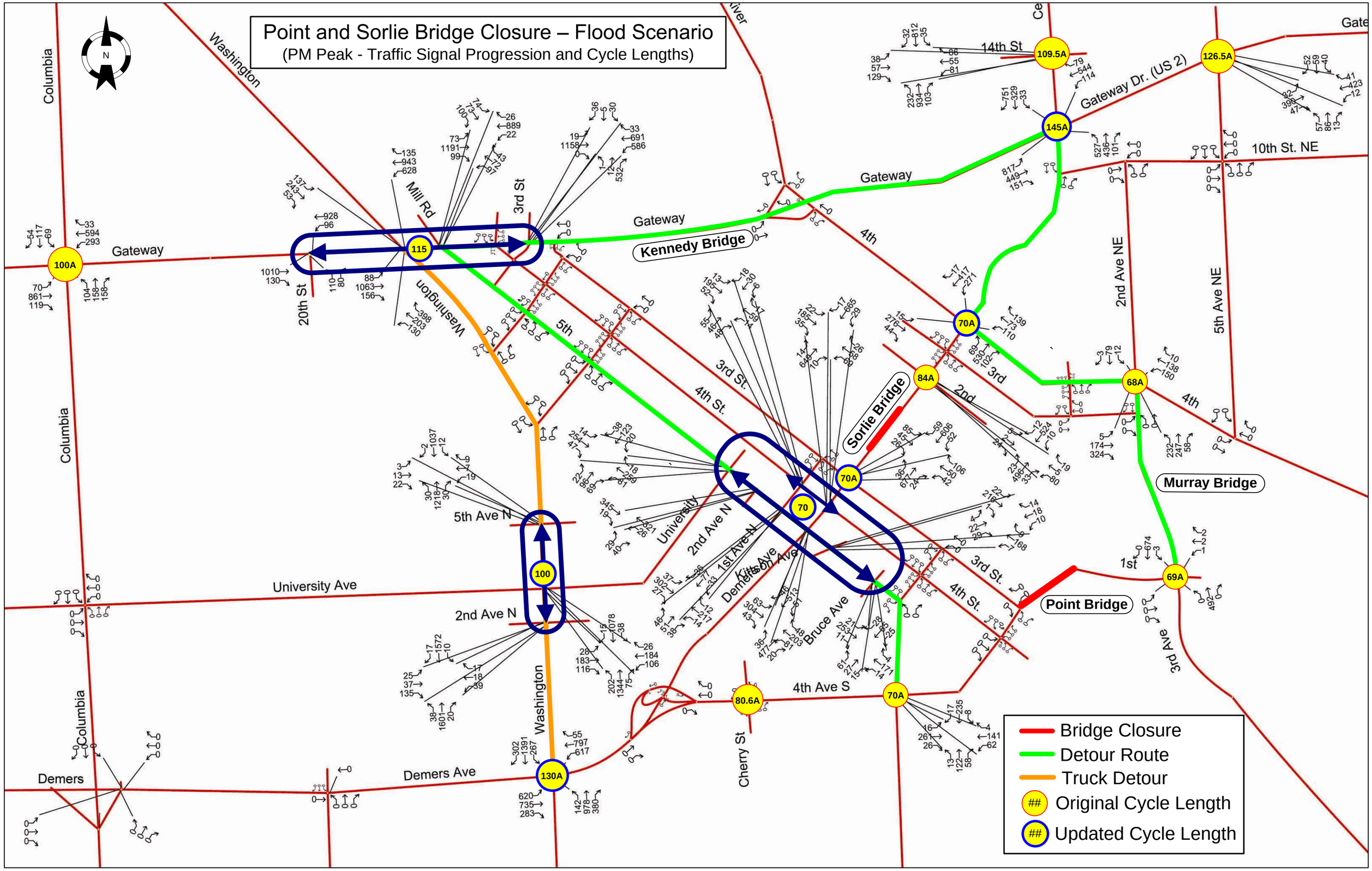
Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset		23	36	14	16	25	24	16	37	
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	35.0	30.0	40.0	40.0	35.0	30.0	35.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	35.0	40.0	30.0	30.0	35.0	40.0	35.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Changed to Uncoordinated	Offset Ref. to 4&8 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 4 Yellow (Changed from 2)	Changed to Uncoordinated

Signal Timing Plans - Point-Sorlie Bridges Closed - MID Peak - Flood Scenario - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	135.0	126.5	109.5	84.0	55.0	68.0	69.0
Offset							
Φ1							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	49.0	52.5	50.0	34.5	25.0	34.0	54.0
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	15.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	56.0	42.5	35.0	49.5	30.0	34.0	15.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	25.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	39.0	52.5	50.0	34.5	25.0	34.0	54.0
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	37.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	34.0	42.5	35.0	49.5	30.0	34.0	15.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
		Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Changed Phase Splits

Point and Sorlie Bridge Closure – Flood Scenario

(PM Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Point-Sorlie Bridges Closed - PM Peak - Flood Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	130.0	100.0	100.0	100.0	100.0	115.0	115.0	115.0	115.0	80.6
Offset		9	88	21		110	107	108	95	
Φ1										
Max. Split	15.0		20.0		23.0		20.0	15.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	47.0	60.0	36.0	60.0	33.0	80.0	60.0	55.0	70.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	26.0		15.0				15.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	42.0	40.0	29.0	40.0	44.0		20.0	45.0	45.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	18.0	15.0			23.0	20.0	45.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	44.0	45.0	56.0	60.0	33.0	60.0	35.0	70.0	70.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	27.0						15.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	41.0	40.0	44.0	40.0	44.0	35.0	20.0	45.0	45.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Changed to Uncoordinated	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan

Signal Timing Plans - Point-Sorlie Bridges Closed - PM Peak - Flood Scenario - Grand Forks

Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset		1	10	48	51	68	2	44	2	
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	35.0	30.0	40.0	40.0	35.0	30.0	35.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	35.0	40.0	30.0	30.0	35.0	40.0	35.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Changed to Uncoordinated	Offset Ref. to 4&8 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 4 Yellow (Changed from 2)	Changed to Uncoordinated

Signal Timing Plans - Point-Sorlie Bridges Closed - PM Peak - Flood Scenario - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	145.0	126.5	109.5	84.0	70.0	68.0	69.0
Offset							
Φ1							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	50.0	52.5	50.0	34.5	30.0	34.0	54.0
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	20.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	60.0	42.5	35.0	49.5	40.0	34.0	15.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	30.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	35.0	52.5	50.0	34.5	30.0	34.0	54.0
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	46.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	34.0	42.5	35.0	49.5	40.0	34.0	15.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
		Original Timing Plan	Original Timing Plan	Original Timing Plan		Original Timing Plan	Changed Phase Splits

Prepared by:
Shawn C. Birst

Grand Forks/East Grand Forks Bridge Closure Study

Traffic Control Modifications: Used for All Flood Scenarios

Purpose: Benefit detoured traffic

Point, Sorlie, and Murray Bridges Closed (Flood Scenario)

Bridge Closure (Murray Bridge)

- Once Action 1 is reached (Red River Stage of 44.0 ft) and the Red River has not yet crested, East Grand Forks shall contact Mn/DOT, Grand Forks, and BNSF for installing the traffic closure and detour route and inform the media of the event.
- Once Action 2 is reached (Red River Stage of 45.0 ft) and the Red River has not yet crested, the cities shall install traffic closures, detour signing, and alternate traffic signal plans for the Point, Sorlie, and Murray Bridges Closed (Flood Scenario).

    - City of Grand Forks
        - Implement the alternate timing plans for the signalized intersections in Grand Forks.

    - City of East Grand Forks
        - Close the Murray Bridge at 2nd Ave. E./3rd Ave. E. with Type III barricades.
        - Install the appropriate detour and traffic control signs in East Grand Forks.

    - Mn/DOT
        - Install the detour and traffic control signs along Polk Co 72, MN SH 220, and US 2.
        - Implement the alternate timing plans for the signalized intersections in East Grand Forks.

Bridge Reopening (Murray Bridge)

- Once Action 1 is reached as the river recedes (Red River Stage of 47.0 ft), East Grand Forks shall contact Mn/DOT, Grand Forks, and BNSF for reopening the Murray Bridge and inform the media of the event. Approximately 2 days will be allowed to remove the clay berms and clean the roadway/bridge and perform inspections.
- Once Action 2 is reached as the river recedes (Red River Stage of 45.0 ft) and the bridge has passed inspection, the structure will be reopened to traffic, the traffic detour signing will be removed, and traffic signal timing plans will be returned back to those identified in the Point and Sorlie Bridge Closure (Flood Scenario).

    - City of Grand Forks
        - Change the Grand Forks signal timing plans back to those used when both the Point and Sorlie Bridges are closed.

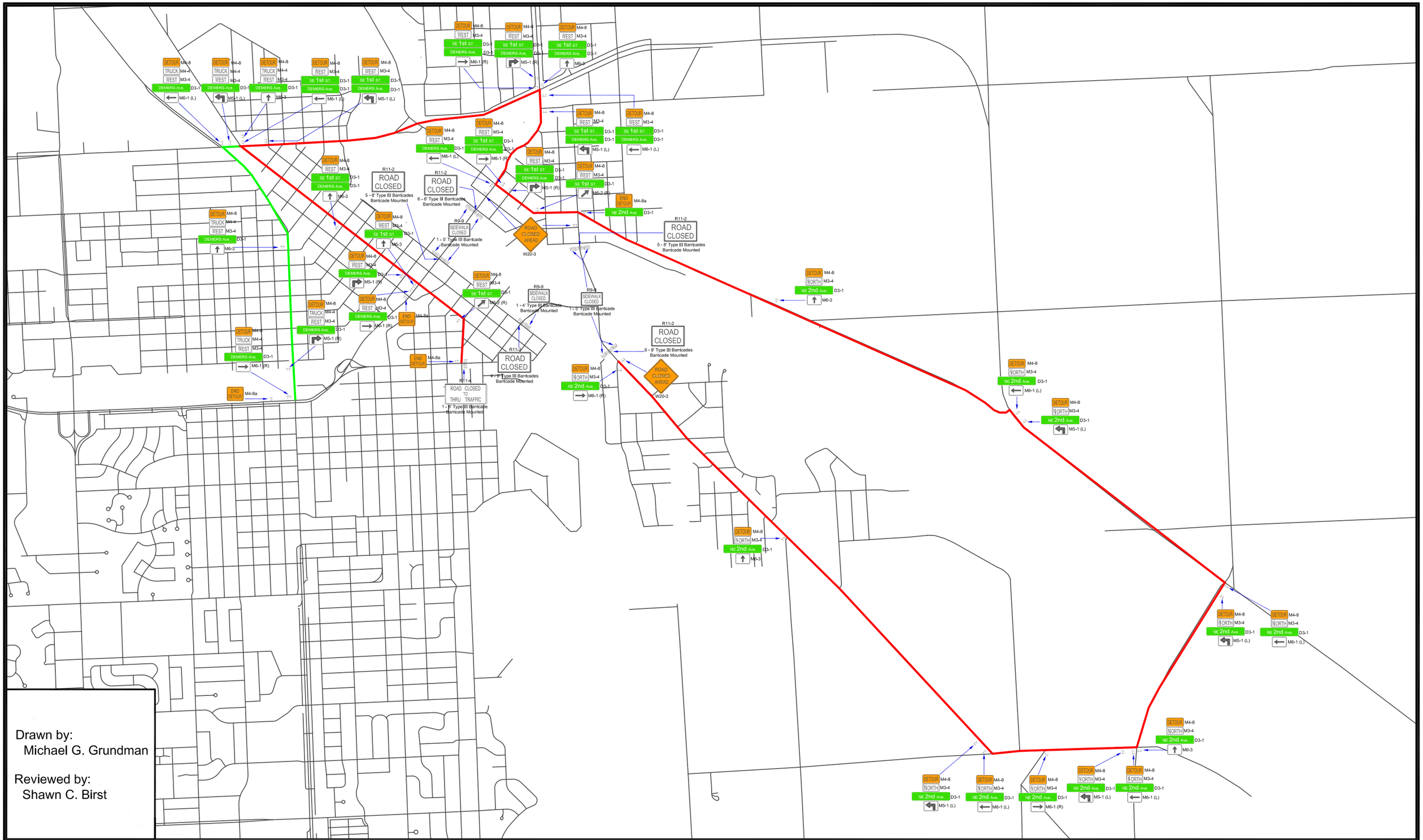
    - City of East Grand Forks
        - Clean and inspect the Murray Bridge.
        - Remove the Type III barricades and open the Murray Bridge.
        - Remove the detour and traffic control signs in East Grand Forks related to the Murray Bridge closure.

    - Mn/DOT
        - Remove the detour and traffic control signs along Polk Co 72, MN SH 220, and US 2 related to the Murray Bridge closure.
        - Change the East Grand Forks signal timing plans back to those used when both the Point and Sorlie Bridges are closed.

Note: Emergency declarations by cities/counties/states allow additional resources to be used for installing closure and detour route signs, as well as implementing traffic control modifications and signal timing plans.

The remaining pages of this section contain detailed information regarding the following topics:

- Detour Sign Layouts
- Traffic Signal Timing Plans
- Traffic Control Device Modifications



Drawn by:
Michael G. Grundman

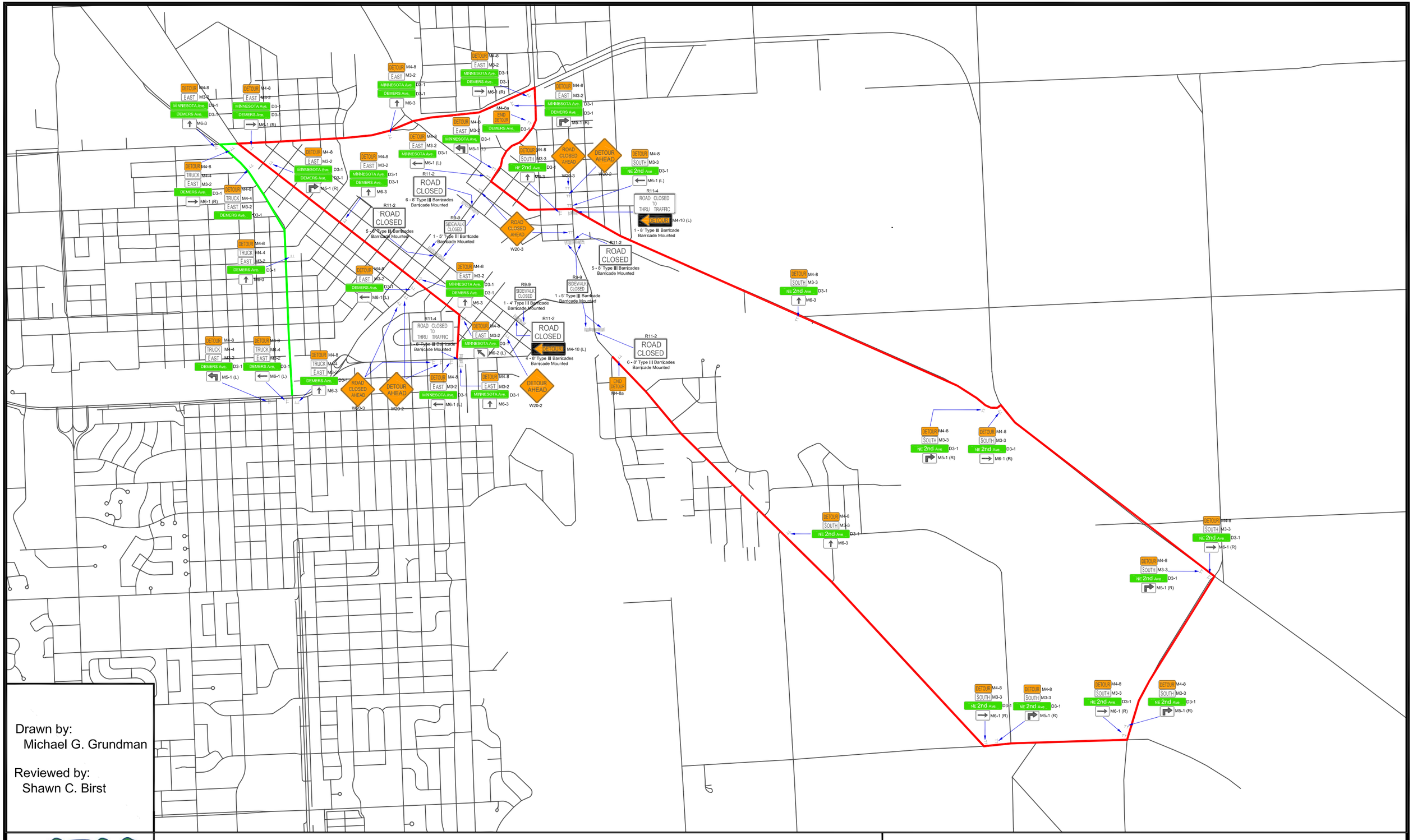
Reviewed by:
Shawn C. Birst

ADVANCED TRAFFIC ANALYSIS CENTER

Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Point, Sorlie & Murray Flood Closure

Northbound Traffic



Drawn by:
Michael G. Grundman

Reviewed by:
Shawn C. Birst

ATAC ADVANCED TRAFFIC ANALYSIS CENTER

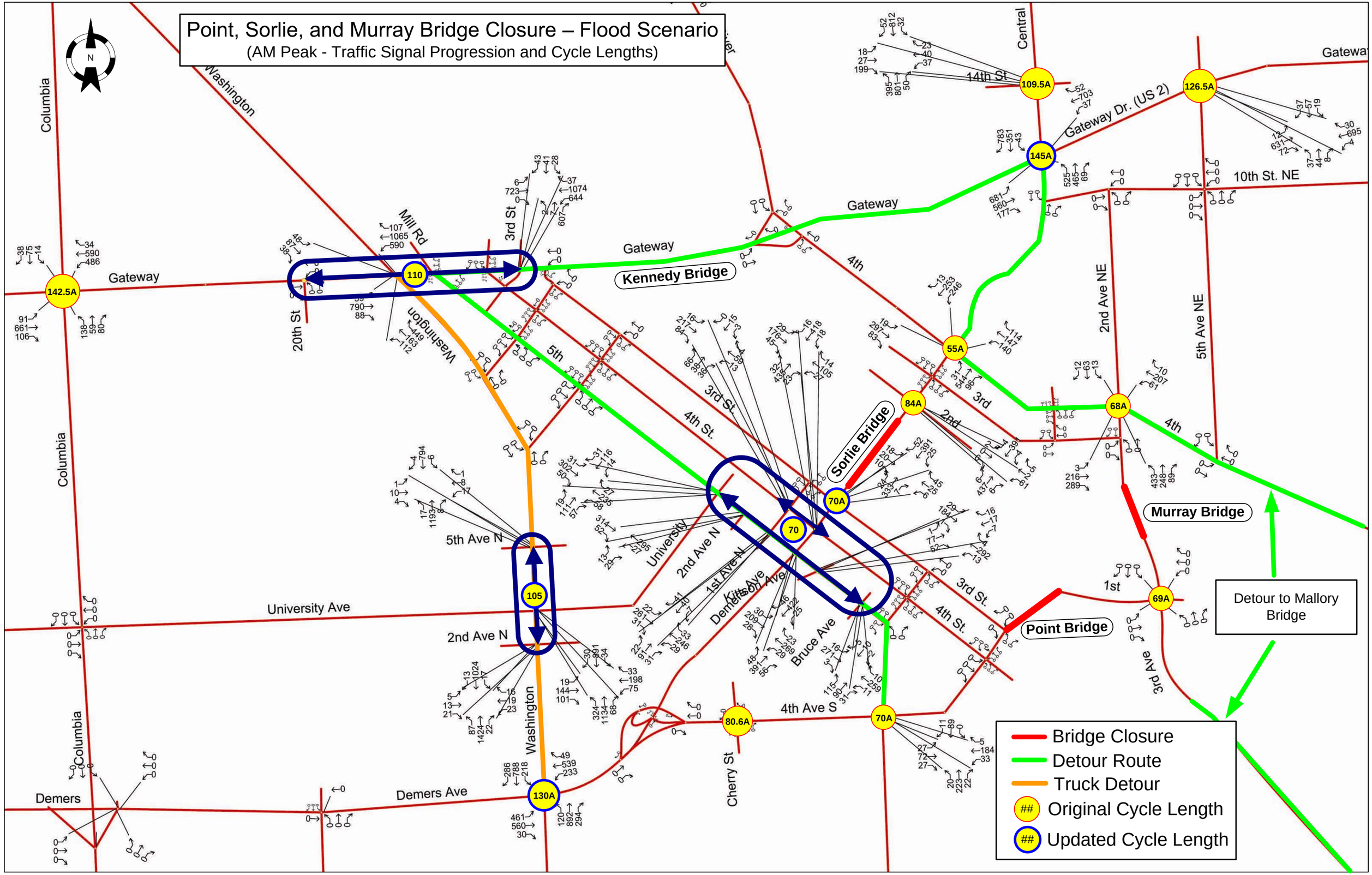
Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Point, Sorlie & Murray Flood Closure

Southbound Traffic

Point, Sorlie, and Murray Bridge Closure – Flood Scenario

(AM Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Point-Sorlie-Murray Closed - AM Peak - Flood - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	130.0	105.0	105.0	105.0	142.5	110.0	110.0	110.0	110.0	80.6
Offset		37	24	57		36	103	24	25	
Φ1										
Max. Split	16.0		33.0		35.5		17.0	25.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	55.0	65.0	30.0	65.0	61.1	65.0	54.0	45.0	65.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	18.0		13.0				17.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	41.0	40.0	29.0	40.0	45.7		22.0	40.0	45.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	21.0	15.0			35.7	20.0	40.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	50.0	50.0	63.0	65.0	61.1	45.0	31.0	70.0	65.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	25.0						17.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	34.0	40.0	42.0	40.0	45.7	45.0	22.0	40.0	45.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan

Signal Timing Plans - Point-Sorlie-Murray Closed - AM Peak - Flood - Grand Forks

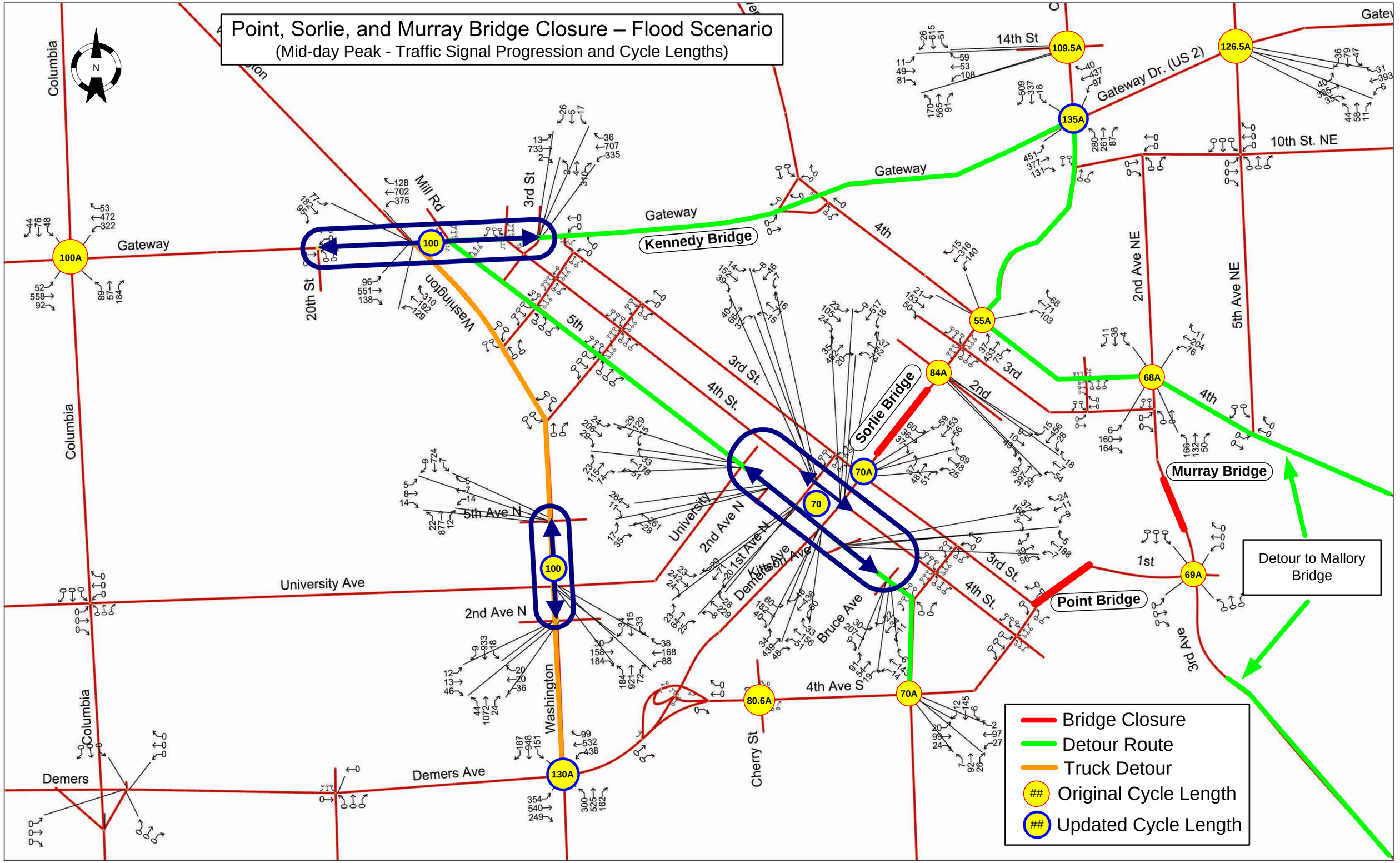
Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	60.0	70.0	70.0	70.0
Offset		31	43	20	27	46	40	20	45	
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	35.0	30.0	40.0	35.0	35.0	30.0	35.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	35.0	40.0	30.0	25.0	35.0	40.0	35.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Changed to Uncoordinated	Offset Ref. to 4&8 Yellow (Changed from 2&6)	Offset Ref. to 2&6 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 4 Yellow (Changed from 2)	Changed to Uncoordinated

Signal Timing Plans - Point-Sorlie-Murray Closed - AM Peak - Flood - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	145.0	126.5	109.5	84.0	55.0	68.0	69.0
Offset							
Φ1							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	43.0	52.5	50.0	34.5	25.0	43.0	34.5
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	15.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	72.0	42.5	35.0	49.5	30.0	25.0	34.5
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	23.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	35.0	52.5	50.0	34.5	25.0	43.0	34.5
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	49.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	38.0	42.5	35.0	49.5	30.0	25.0	34.5
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
		Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan

Point, Sorlie, and Murray Bridge Closure – Flood Scenario

(Mid-day Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Point-Sorlie-Murray Closed - MID Peak - Flood - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	130.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	80.6
Offset		17	0	31		78	37	48	15	
Φ1										
Max. Split	27.0		22.0		20.0		17.0	20.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	46.0	65.0	34.0	60.0	40.0	60.0	45.0	40.0	60.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	28.0		15.0				16.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	29.0	35.0	29.0	40.0	40.0		22.0	40.0	40.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	27.0	15.0			20.0	20.0	35.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	46.0	50.0	56.0	60.0	40.0	40.0	27.0	60.0	60.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	28.0						16.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	29.0	35.0	44.0	40.0	40.0	40.0	22.0	40.0	40.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan Changed to Uncoordinated	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan

Signal Timing Plans - Point-Sorlie-Murray Closed - MID Peak - Flood - Grand Forks

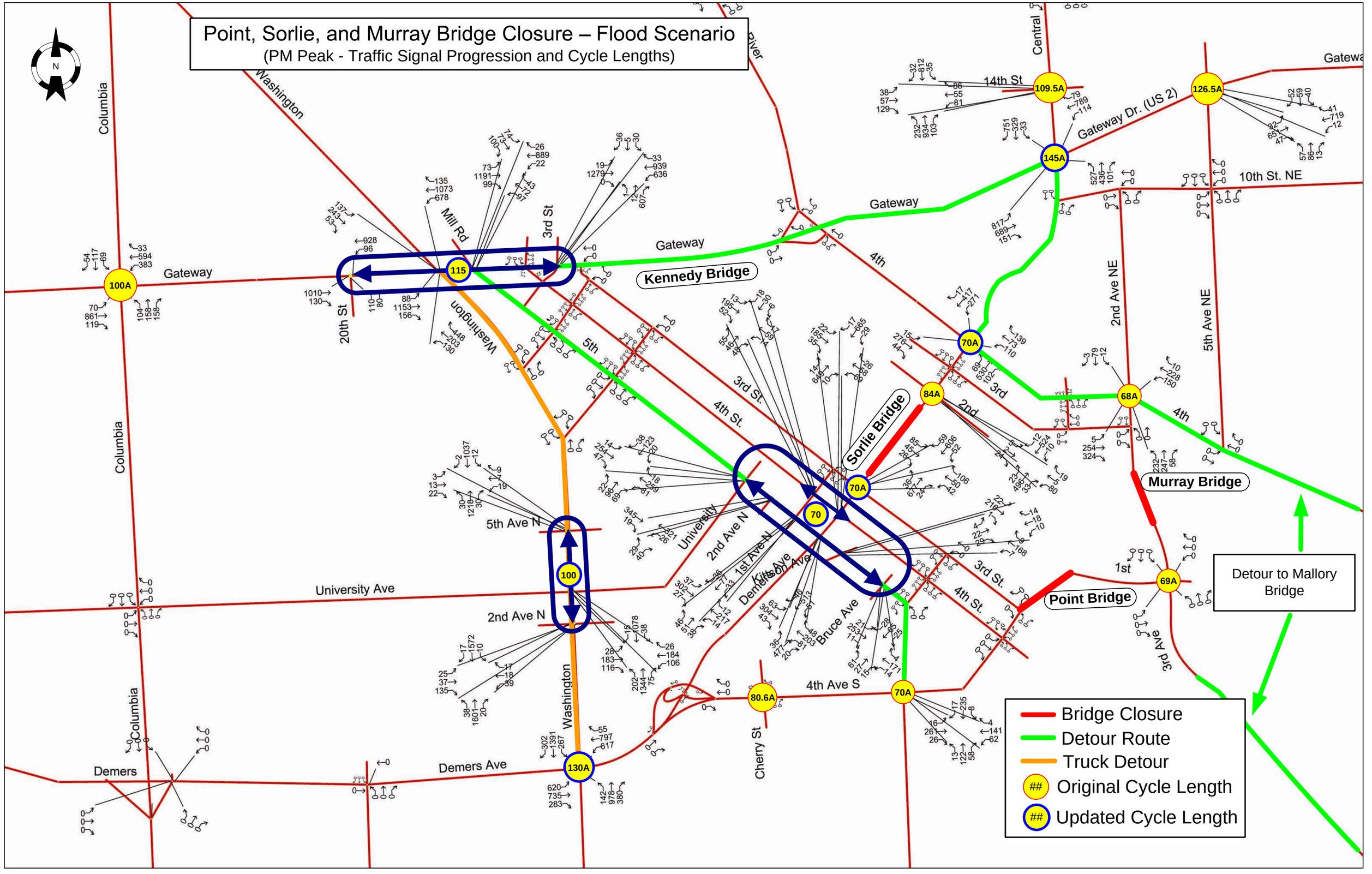
Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset		23	36	14	16	25	24	16	37	
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	35.0	30.0	40.0	40.0	35.0	30.0	35.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	35.0	40.0	30.0	30.0	35.0	40.0	35.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Changed to Uncoordinated	Offset Ref. to 4&8 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 4 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 4 Yellow	Changed to Uncoordinated

Signal Timing Plans - Point-Sorlie-Murray Closed - MID Peak - Flood - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	135.0	126.5	109.5	84.0	55.0	68.0	69.0
Offset							
Φ1							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	49.0	52.5	50.0	34.5	25.0	34.0	34.5
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	15.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	56.0	42.5	35.0	49.5	30.0	34.0	34.5
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	25.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	39.0	52.5	50.0	34.5	25.0	34.0	34.5
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	37.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	34.0	42.5	35.0	49.5	30.0	34.0	34.5
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
		Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Changed Phase Splits

Point, Sorlie, and Murray Bridge Closure – Flood Scenario

(PM Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Point-Sorlie-Murray Closed - PM Peak - Flood - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	130.0	100.0	100.0	100.0	100.0	115.0	115.0	115.0	115.0	80.6
Offset		9	88	21		15	110	112	93	
Φ1										
Max. Split	15.0		20.0		15.0		20.0	15.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	47.0	60.0	36.0	60.0	53.0	80.0	60.0	55.0	70.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	26.0		15.0				15.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	42.0	40.0	29.0	40.0	32.0		20.0	45.0	45.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	18.0	15.0			33.0	20.0	45.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	44.0	45.0	56.0	60.0	35.0	60.0	35.0	70.0	70.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	27.0						15.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	41.0	40.0	44.0	40.0	32.0	35.0	20.0	45.0	45.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Changed to Uncoordinated	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan

Signal Timing Plans - Point-Sorlie-Murray Closed - PM Peak - Flood - Grand Forks

Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset		1	10	48	51	68	2	44	2	
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	35.0	30.0	40.0	40.0	35.0	30.0	35.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	35.0	40.0	30.0	30.0	35.0	40.0	35.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Changed to Uncoordinated	Offset Ref. to 4&8 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 4 Yellow (Changed from 2)	Changed to Uncoordinated

Signal Timing Plans - Point-Sorlie-Murray Closed - PM Peak - Flood - East Grand Forks

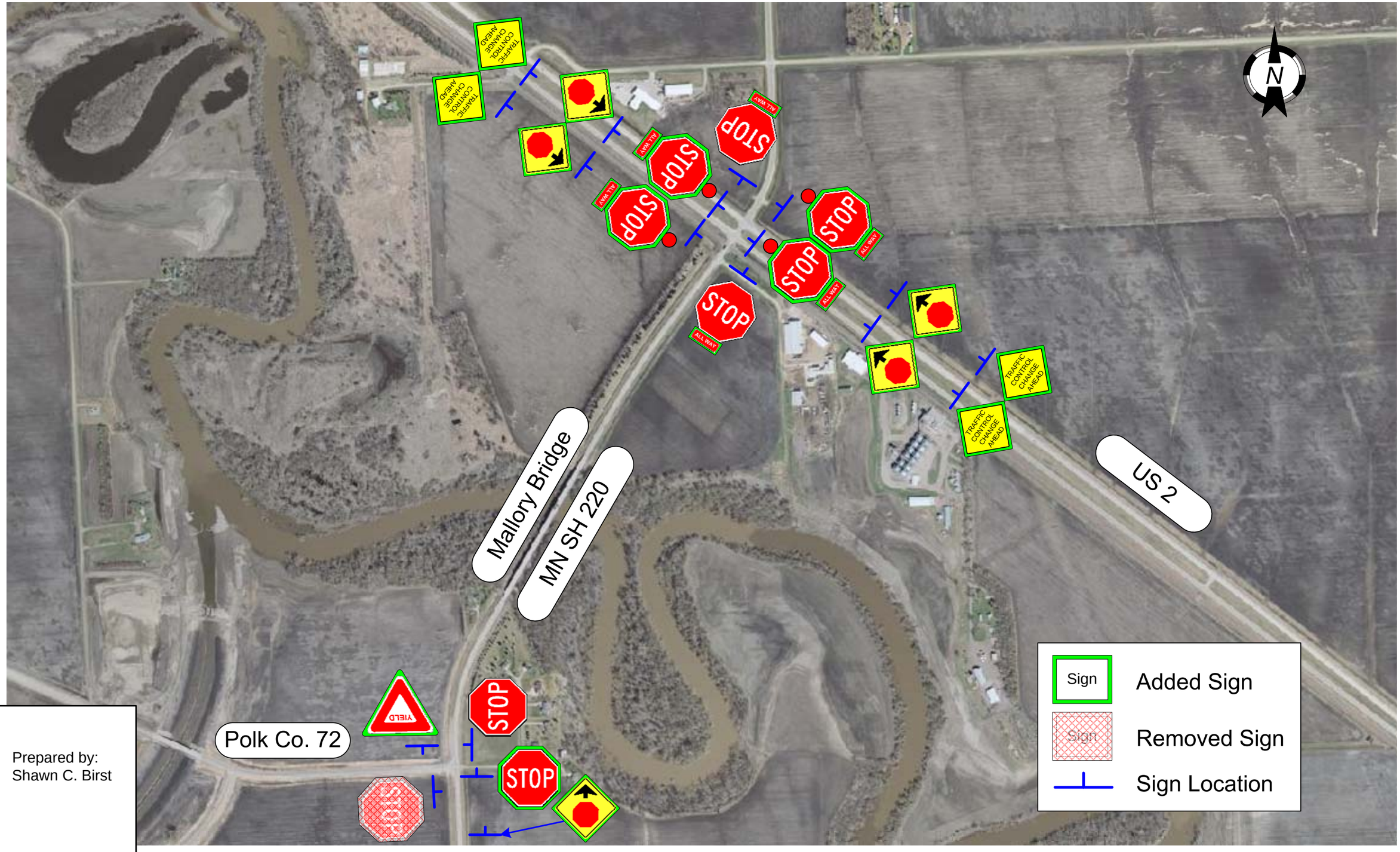
Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	145.0	126.5	109.5	84.0	70.0	68.0	69.0
Offset							
Φ1							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	50.0	52.5	50.0	34.5	30.0	34.0	34.5
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	20.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	60.0	42.5	35.0	49.5	40.0	34.0	34.5
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	30.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	35.0	52.5	50.0	34.5	30.0	34.0	34.5
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	46.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	34.0	42.5	35.0	49.5	40.0	34.0	34.5
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
		Original Timing Plan	Original Timing Plan	Original Timing Plan		Original Timing Plan	Original Timing Plan

Prepared by:
Shawn C. Birst

Grand Forks/East Grand Forks Bridge Closure Study

Traffic Control Modifications: Used for All Flood Scenarios

Purpose: Benefit detoured traffic



Prepared by:
Shawn C. Birst

Grand Forks/East Grand Forks Bridge Closure Study

Traffic Control Modifications: Point, Sorlie, and Murray Bridges Closed

Purpose: Benefit detoured traffic

Point Bridge Closed (Maintenance Scenario)

Bridge Closure

- City of Grand Forks
  - Contact NDDOT, East Grand Forks, Mn/DOT, BNSF, and the media about the closure event.
  - Close the Point Bridge (coordinate with East Grand Forks) at Minnesota Ave. with Type III barricades.
  - Install the appropriate detour and traffic control signs in Grand Forks.
  - Implement the alternate timing plans for the signalized intersections in Grand Forks.

- City of East Grand Forks
  - Contact Mn/DOT, Grand Forks, NDDOT, BNSF, and the media about the closure event.
  - Close the Point Bridge (coordinate with Grand Forks) at 1st St. S. with Type III barricades.
  - Install the appropriate detour and traffic control signs in East Grand Forks.

- Mn/DOT
  - Implement the alternate timing plans for the signalized intersections in East Grand Forks.

Bridge Reopening

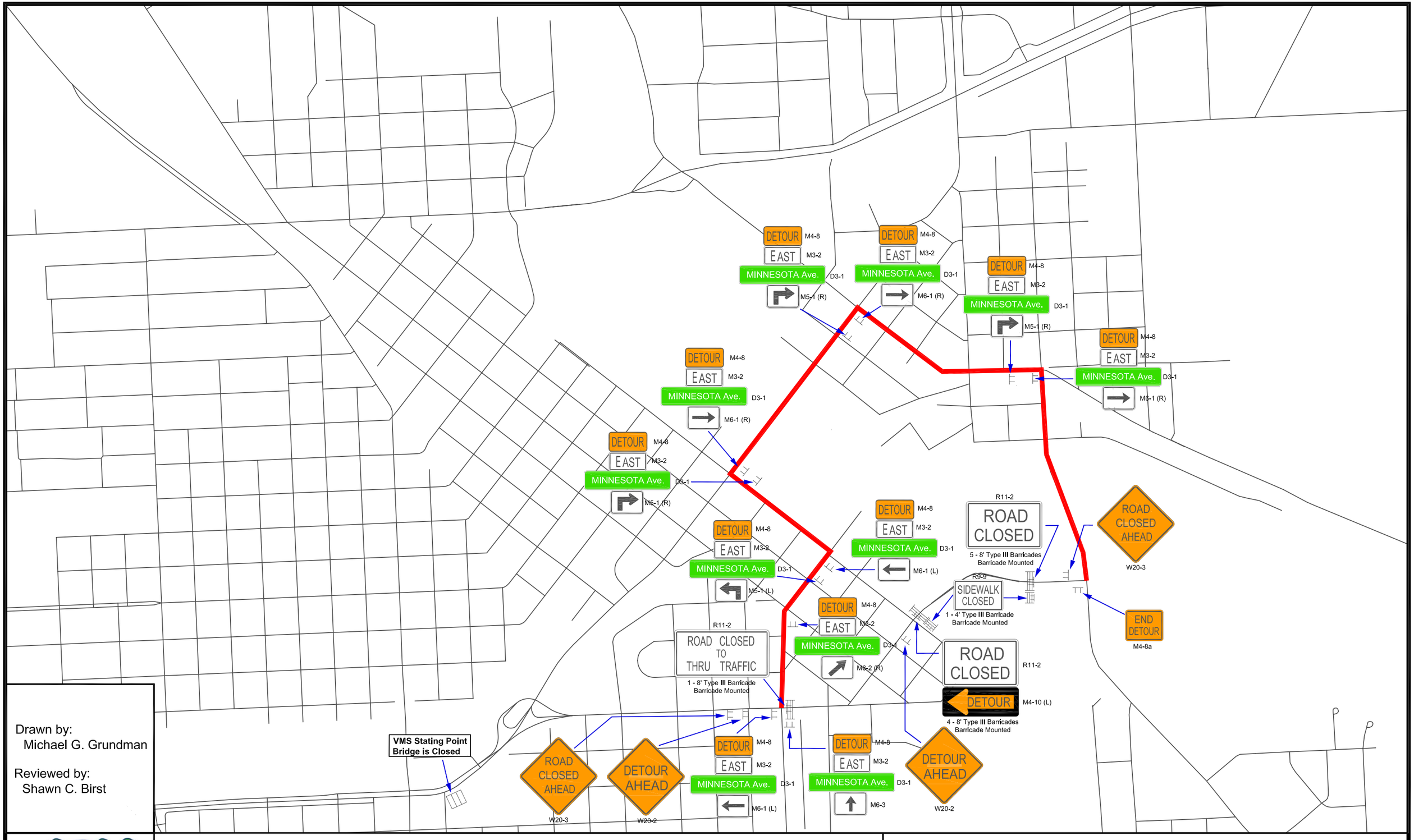
- City of Grand Forks
  - Clean and inspect the Grand Forks side of the Point Bridge.
  - Remove the Type III barricades and open the Point Bridge (coordinate with East Grand Forks)
  - Remove the detour and traffic control signs in Grand Forks.
  - Change the Grand Forks signal timing plans back to the original plans.

- City of East Grand Forks
  - Clean and inspect the East Grand Forks side of the Point Bridge.
  - Remove the Type III barricades and open the Point Bridge (coordinate with Grand Forks).
  - Remove the detour and traffic control signs in Grand Forks.

- Mn/DOT
  - Change the East Grand Forks timing plans back to the original plans.

The remaining pages of this section contain detailed information regarding the following topics:

- Detour Sign Layouts
- Traffic Signal Timing Plans
- Traffic Control Device Modifications



Drawn by:
Michael G. Grundman

Reviewed by:
Shawn C. Birst

ATAC ADVANCED TRAFFIC ANALYSIS CENTER

Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Point Bridge Maintenance Closure

Eastbound Traffic

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M6-1 (L)

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M5-1 (L)

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M6-2 (R)

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M6-3

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M6-1 (L)

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M6-1 (L)

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M5-1 (L)

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M5-1 (L)

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M6-1 (R)

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M5-1 (R)

R11-2
ROAD CLOSED
5 - 8' Type III Barricades
Barricade Mounted

ROAD CLOSED AHEAD
W20-3

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M6-3

R9-9
SIDEWALK CLOSED
1 - 4' Type III Barricade
Barricade Mounted

DETOUR M4-8
WEST M3-4
SE 1st ST D3-1
M6-2 (L)

R11-4
ROAD CLOSED TO THRU TRAFFIC
1 - 8' Type III Barricade
Barricade Mounted

R11-2
ROAD CLOSED

DETOUR M4-10 (L)
4 - 8' Type III Barricades
Barricade Mounted

END DETOUR
M4-8a

DETOUR AHEAD
W20-2

Drawn by:
Michael G. Grundman

Reviewed by:
Shawn C. Birst

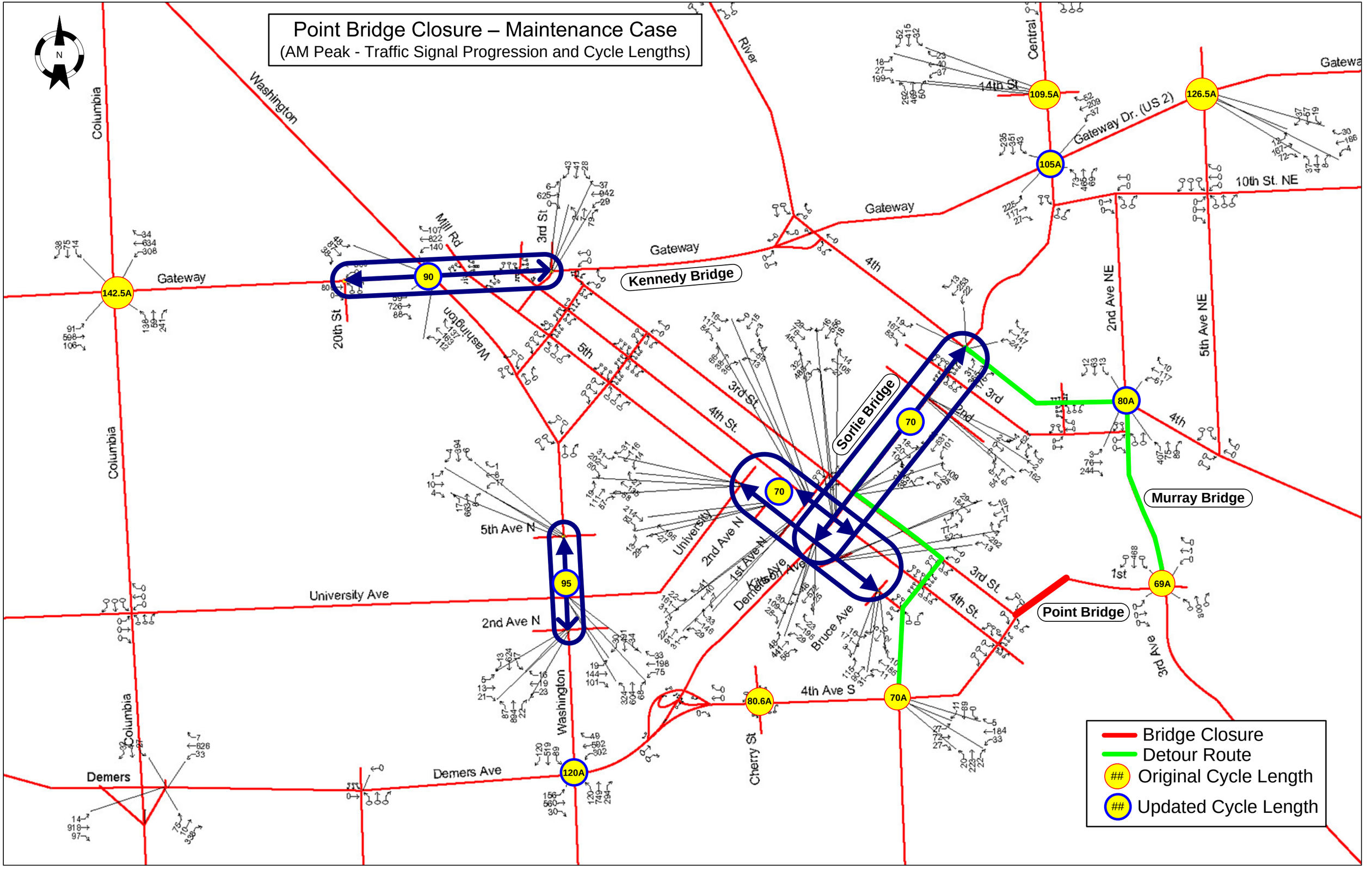
ATAC ADVANCED TRAFFIC ANALYSIS CENTER

Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Point Bridge Maintenance Closure

Westbound Traffic

Point Bridge Closure – Maintenance Case
(AM Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Point Bridge Closed - AM Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	120.0	95.0	95.0	95.0	142.5	90.0	90.0	90.0	90.0	80.6
Offset		14	8	44		0	0	5	54	
Φ1										
Max. Split	15.0		29.0		35.5		14.0	20.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	47.0	60.0	27.0	55.0	61.1	54.0	34.0	35.0	50.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	23.0		10.0				17.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	35.0	35.0	29.0	40.0	45.7		25.0	35.0	40.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	15.0	20.0			35.7	20.0	18.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	47.0	40.0	56.0	55.0	61.1	34.0	30.0	55.0	50.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	18.0						17.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	40.0	35.0	39.0	40.0	45.7	36.0	25.0	35.0	40.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow - Same Plan as Flood	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Original Timing Plan	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Original Timing Plan

Signal Timing Plans - Point Bridge Closed - AM Peak - Maintenance Scenario - Grand Forks

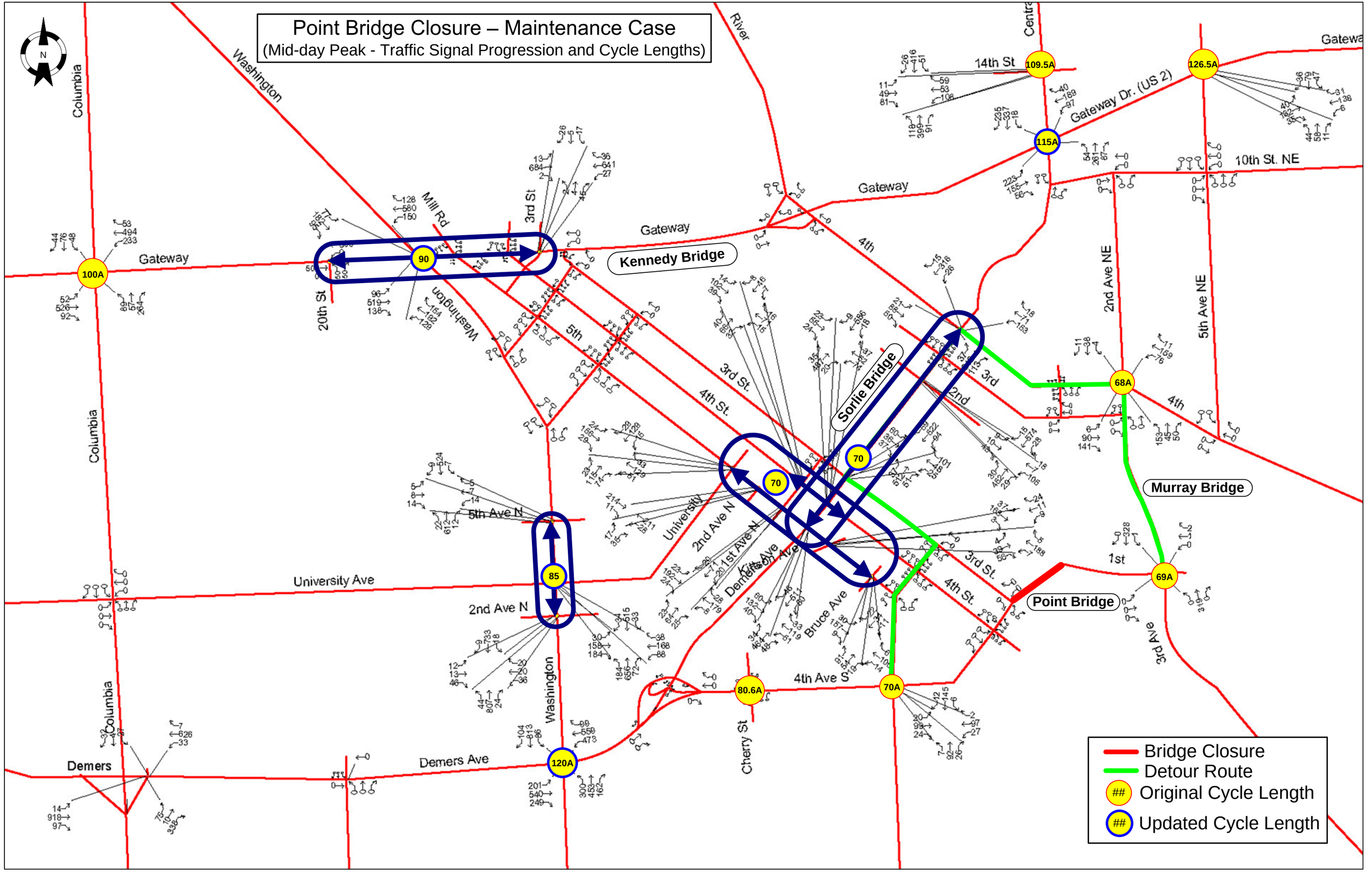
Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset		17	40	68	38	57	52	8	15	2
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	40.0	30.0	40.0	40.0	40.0	35.0	40.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	30.0	40.0	30.0	30.0	30.0	35.0	30.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Changed to Uncoordinated	Offset Ref. to 4&8 Yellow (Changed from 2&6) - Same Plan as Flood	Offset Ref. to 2 Yellow - Same Plan as Flood	Offset Ref. to 2 Yellow - Same Plan as Flood	Offset Ref. to 4 Yellow (Changed from 2) - Same Plan as Flood	Offset Ref. to 2 Yellow - Same Plan as Flood	Offset Ref. to 2 Yellow - Same Plan as Flood	Offset Ref. to 2 Yellow - Same Plan as Flood	Offset Ref. to 4 Yellow (Changed from 2) - Same Plan as Flood	Offset Ref. to 2 Yellow - Same Plan as Flood

Signal Timing Plans - Point Bridge Closed - AM Peak - Maintenance Scenario - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	105.0	126.5	109.5	70.0	70.0	80.0	69.0
Offset				0	0		
Φ1							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	35.0	52.5	50.0	30.0	35.0	25.0	54.0
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	15.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	40.0	42.5	35.0	40.0	35.0	55.0	15.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	35.0	52.5	50.0	30.0	35.0	25.0	54.0
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	20.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	35.0	42.5	35.0	40.0	35.0	55.0	15.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
		Original Timing Plan	Original Timing Plan	Offset Ref. to 4&8 Green - Same Plan as Flood	Offset Ref. to 4&8 Green	Same Plan as Flood	Changed Phase Splits - Same Plan as Flood

Point Bridge Closure – Maintenance Case

(Mid-day Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Point Bridge Closed - MID Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	120.0	85.0	85.0	85.0	100.0	90.0	90.0	90.0	90.0	80.6
Offset		66	61	84		8	0	15	84	
Φ1										
Max. Split	26.0		19.0		17.0		17.0	20.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	39.0	52.0	27.0	45.0	45.0	54.0	34.0	38.0	55.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	25.0		10.0				15.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	30.0	33.0	29.0	40.0	38.0		24.0	32.0	35.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	15.0	15.0			26.0	18.0	23.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	50.0	37.0	46.0	45.0	36.0	36.0	28.0	58.0	55.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	23.0						18.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	32.0	33.0	39.0	40.0	38.0	36.0	21.0	32.0	35.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow - Same Plan as Flood	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Original Timing Plan Changed to Uncoordinated	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Original Timing Plan

Signal Timing Plans - Point Bridge Closed - MID Peak - Maintenance Scenario - Grand Forks

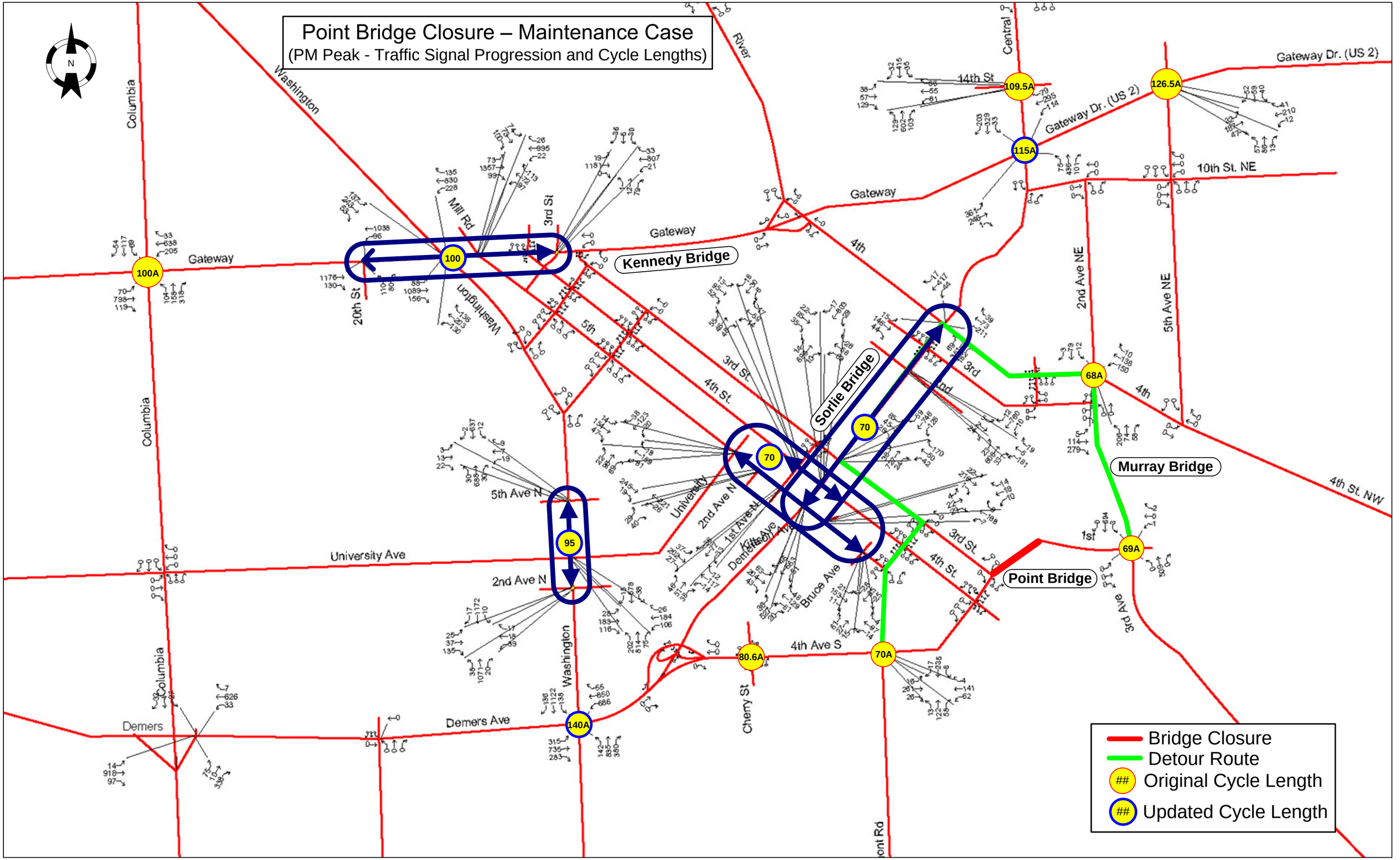
Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset		28	45	0	29	31	19	7	48	0
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	40.0	30.0	40.0	40.0	40.0	30.0	40.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	30.0	40.0	30.0	30.0	30.0	40.0	30.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Changed to Uncoordinated	Offset Ref. to 4&8 Yellow (Changed from 2&6) - Same Plan as Flood	Offset Ref. to 2 Yellow - Same Plan as Flood	Offset Ref. to 2 Yellow - Same Plan as Flood	Offset Ref. to 4 Yellow (Changed from 2) - Same Plan as Flood	Offset Ref. to 2 Yellow - Same Plan as Flood	Offset Ref. to 2 Yellow - Same Plan as Flood	Offset Ref. to 2 Yellow - Same Plan as Flood	Offset Ref. to 4 Yellow (Changed from 2) - Same Plan as Flood	Offset Ref. to 2 Yellow - Same Plan as Flood

Signal Timing Plans - Point Bridge Closed - MID Peak - Maintenance Scenario - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	115.0	126.5	109.5	70.0	70.0	68.0	69.0
Offset				0	0		
Φ1							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	35.0	52.5	50.0	30.0	30.0	34.0	54.0
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	16.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	49.0	42.5	35.0	40.0	40.0	34.0	15.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	35.0	52.5	50.0	30.0	30.0	34.0	54.0
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	31.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	34.0	42.5	35.0	40.0	40.0	34.0	15.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
		Original Timing Plan	Original Timing Plan	Offset Ref. to 4&8 Green - Same Plan as Flood	Offset Ref. to 4&8 Green -Same Plan as Flood	Same Plan as Flood	Changed Phase Splits - Same Plan as Flood

Point Bridge Closure – Maintenance Case

(PM Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Point Bridge Closed - PM Peak - Maintenance Scenario - Grand Forks

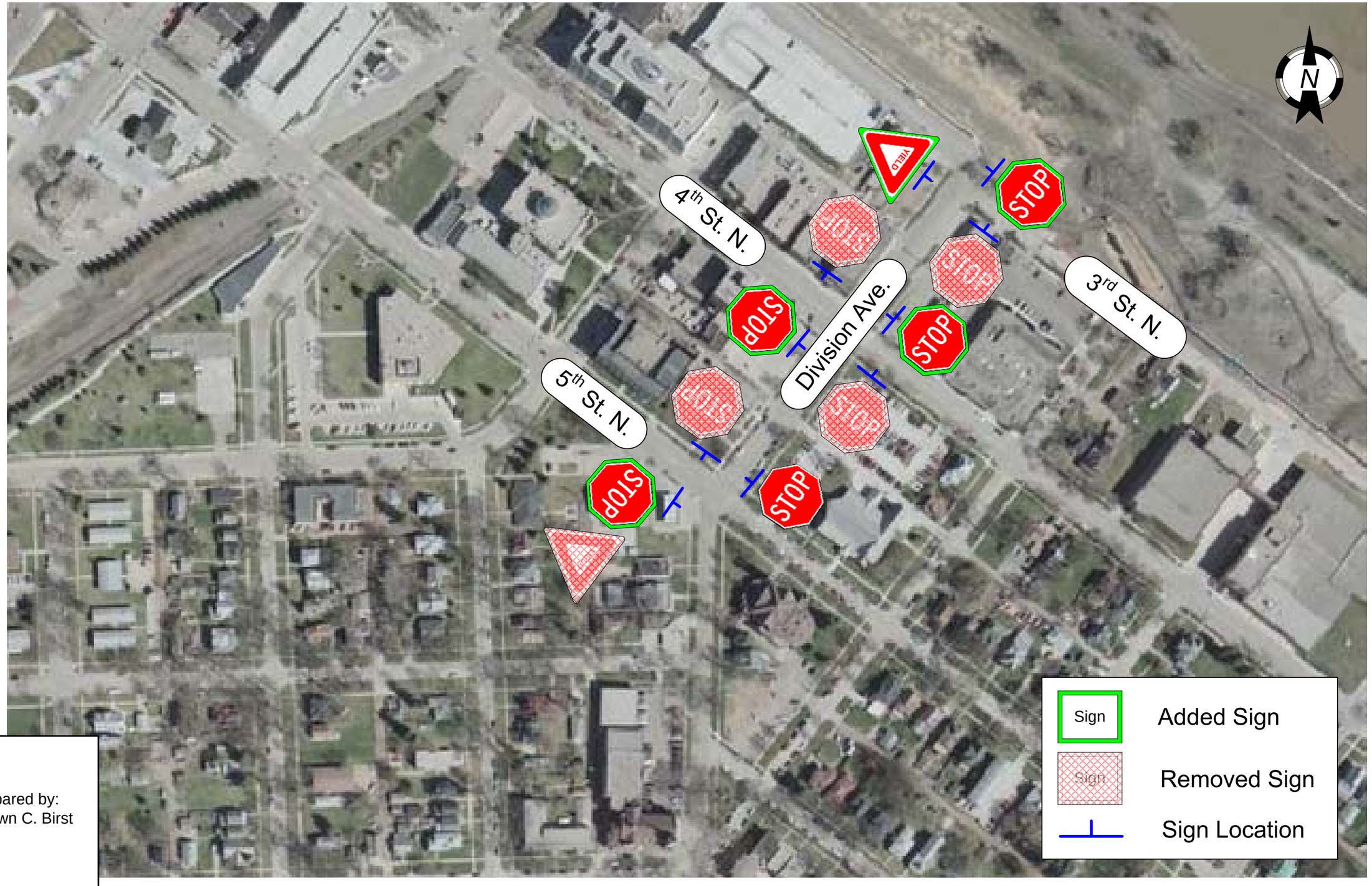
Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	140.0	95.0	95.0	95.0	100.0	100.0	100.0	100.0	100.0	80.6
Offset		77	68	6		77	9	20	43	
Φ1										
Max. Split	20.0		20.0		23.0		18.0	15.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	48.0	60.0	31.0	60.0	33.0	65.0	42.0	50.0	60.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	33.0		15.0				18.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	39.0	35.0	29.0	35.0	44.0		22.0	35.0	40.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	20.0	15.0			23.0	15.0	26.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	48.0	45.0	51.0	60.0	33.0	50.0	34.0	65.0	60.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	25.0						18.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	47.0	35.0	44.0	35.0	44.0	35.0	22.0	35.0	40.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
	Same Plan as Flood	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Original Timing Plan	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Offset Ref. to 2&6 Yellow - Same Plan as Flood	Original Timing Plan

Signal Timing Plans - Point Bridge Closed - PM Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset		30	40	59	10	28	25	0	38	60
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	40.0	30.0	40.0	40.0	40.0	30.0	40.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	30.0	40.0	30.0	30.0	30.0	40.0	30.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Changed to Uncoordinated	Offset Ref. to 4&8 Yellow (Changed from 2&6) - Same Plan as Flood	Offset Ref. to 2 Yellow - Same Plan as Flood	Offset Ref. to 2 Yellow - Same Plan as Flood	Offset Ref. to 4 Yellow (Changed from 2) - Same Plan as Flood	Offset Ref. to 2 Yellow - Same Plan as Flood	Offset Ref. to 2 Yellow - Same Plan as Flood	Offset Ref. to 2 Yellow - Same Plan as Flood	Offset Ref. to 4 Yellow (Changed from 2) - Same Plan as Flood	Offset Ref. to 2 Yellow - Same Plan as Flood

Signal Timing Plans - Point Bridge Closed - PM Peak - Maintenance Scenario - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	115.0	126.5	109.5	70.0	70.0	68.0	69.0
Offset				60	60		
Φ1							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	40.0	52.5	50.0	30.0	30.0	34.0	54.0
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	15.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	45.0	42.5	35.0	40.0	40.0	34.0	15.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	40.0	52.5	50.0	30.0	30.0	34.0	54.0
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	25.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	35.0	42.5	35.0	40.0	40.0	34.0	15.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
		Original Timing Plan	Original Timing Plan	Offset Ref. to 4&8 Green - Same Plan as Flood	Offset Ref. to 4&8 Green -Same Plan as Flood	Same Plan as Flood	Changed Phase Splits - Same Plan as Flood



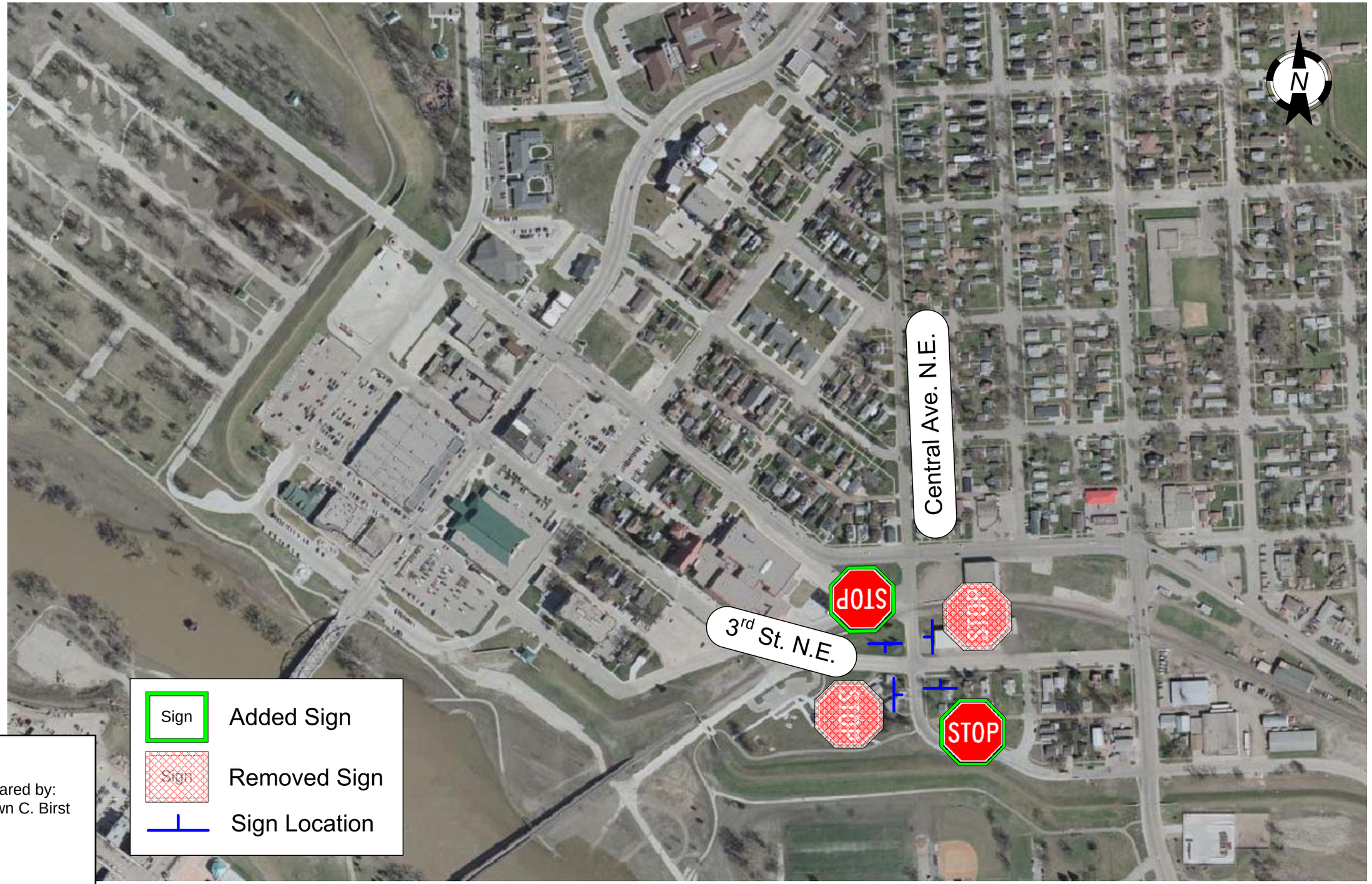
Prepared by:
Shawn C. Birst

ATAC ADVANCED TRAFFIC ANALYSIS CENTER

Grand Forks/East Grand Forks Bridge Closure Study

Traffic Control Modifications: Point Bridge Closed and Sorlie Bridge Open

Purpose: Benefit detoured traffic



Prepared by:
Shawn C. Birst

Grand Forks/East Grand Forks Bridge Closure Study

Traffic Control Modifications: Point Bridge Closed (Maintenance Scenario)

Purpose: Benefit detoured traffic

Sorlie Bridge Closed (Maintenance Scenario)

Bridge Closure

- City of Grand Forks
  - Implement the alternate timing plans for the signalized intersections in Grand Forks.

- NDDOT
  - Contact Grand Forks, East Grand Forks, Mn/DOT, BNSF, and the media about the closure event.
  - Close the Sorlie Bridge (coordinate with Grand Forks, East Grand Forks, and Mn/DOT) at Demers Ave. with Type III barricades.
  - Install the appropriate detour signs in Grand Forks.

- Mn/DOT
  - Contact East Grand Forks, Grand Forks, NDDOT, BNSF, and the media about the closure event.
  - Close the Sorlie Bridge (coordinate with Grand Forks, East Grand Forks, and NDDOT) at Demers Ave. with Type III barricades.
  - Install the appropriate detour signs in East Grand Forks.
  - Implement the alternate timing plans for the signalized intersections in East Grand Forks.

Bridge Reopening

- City of Grand Forks
  - Change the Grand Forks signal timing plans back to the original plans.

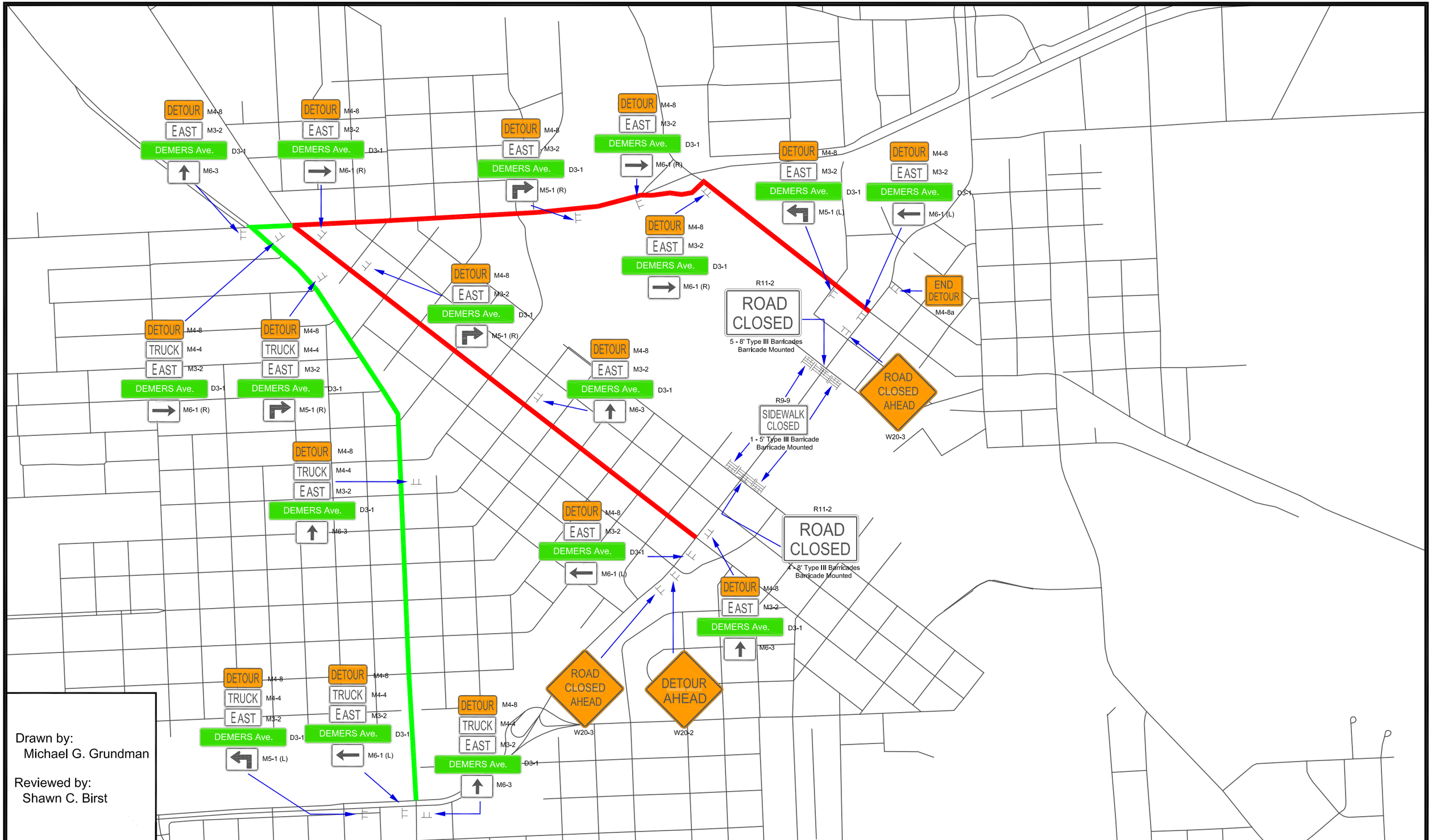
- NDDOT
  - Clean and inspect the Grand Forks side of the Sorlie Bridge.
  - Remove the Type III barricades and open the Sorlie Bridge (coordinate with Grand Forks, East Grand Forks, and Mn/DOT).
  - Remove the detour signs in Grand Forks.

- Mn/DOT
  - Clean and inspect the East Grand Forks side of the Sorlie Bridge.
  - Remove the Type III barricades and open the Sorlie Bridge (coordinate with Grand Forks, East Grand Forks, and NDDOT).
  - Remove the detour signs in East Grand Forks.
  - Change the East Grand Forks signal timing plans back to the original plans.

The remaining pages of this section contain detailed information regarding the following topics:

- Detour Sign Layouts

- Traffic Signal Timing Plans



Drawn by:
Michael G. Grundman

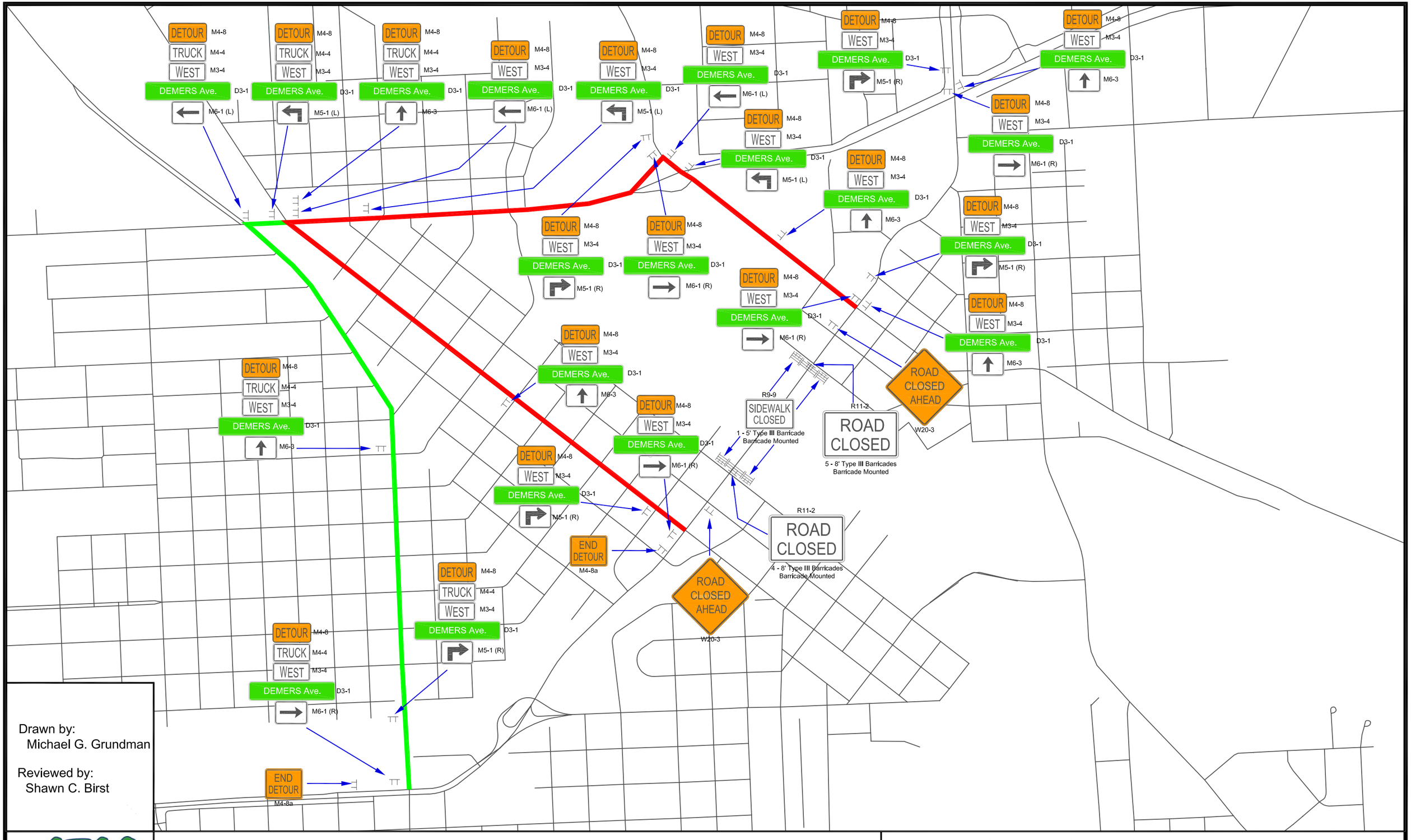
Reviewed by:
Shawn C. Birst

ATAC ADVANCED TRAFFIC ANALYSIS CENTER

Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Sorlie Bridge Maintenance Closure

Eastbound Traffic



Drawn by:
Michael G. Grundman

Reviewed by:
Shawn C. Birst

ATAC ADVANCED TRAFFIC ANALYSIS CENTER

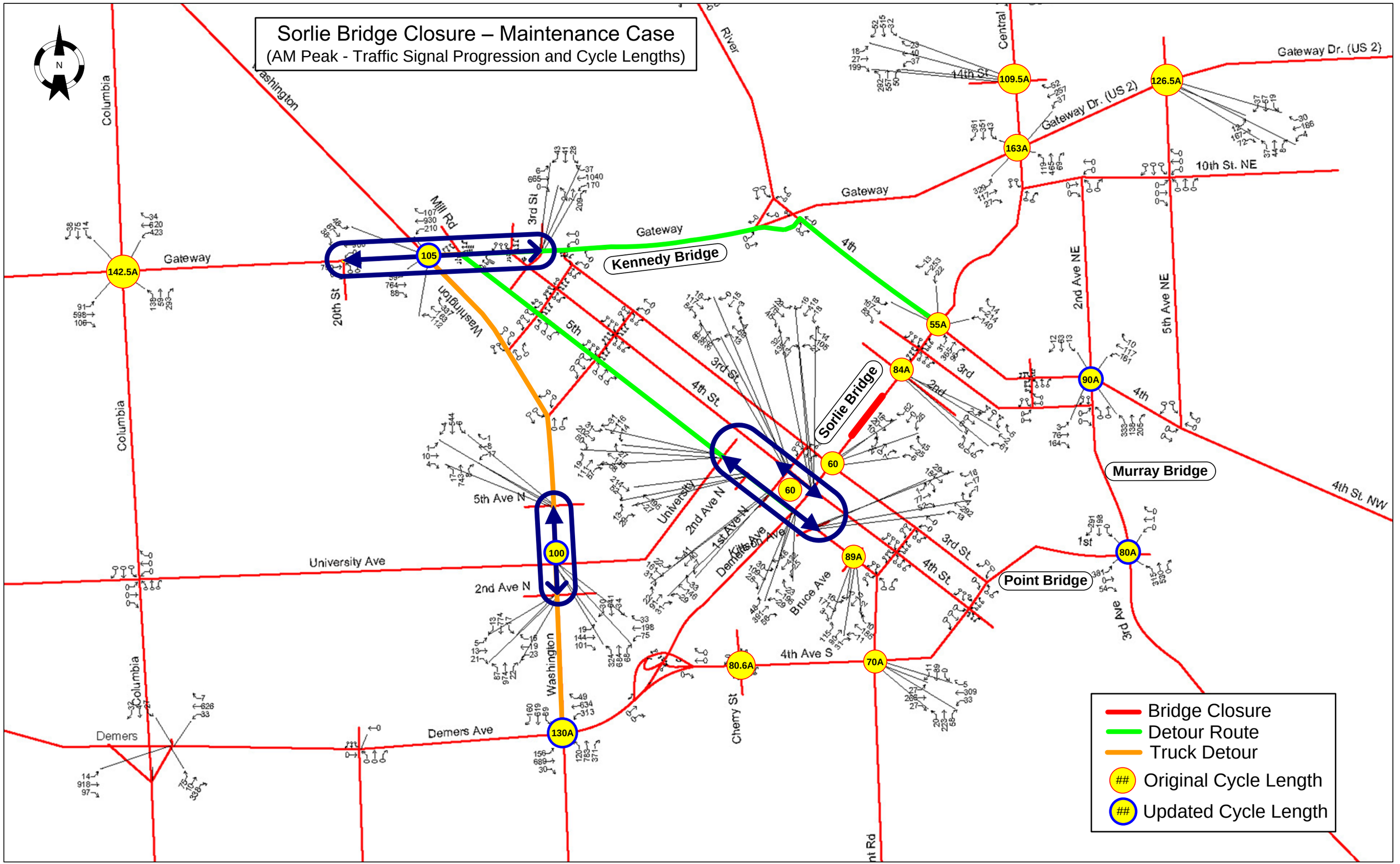
Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Sorlie Bridge Maintenance Closure

Westbound Traffic

Sorlie Bridge Closure – Maintenance Case

(AM Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Sorlie Bridge Closed - AM Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	130.0	100.0	100.0	100.0	142.5	105.0	105.0	105.0	105.0	80.6
Offset		17	96	28		10	98	14	66	
Φ1										
Max. Split	15.0		30.0		35.5		15.0	20.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	50.0	65.0	28.0	60.0	61.1	65.0	47.0	45.0	65.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	25.0		13.0				18.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	40.0	35.0	29.0	40.0	45.7		25.0	40.0	40.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	15.0	20.0			35.7	25.0	30.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	50.0	45.0	58.0	60.0	61.1	40.0	32.0	65.0	65.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	20.0						18.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	45.0	35.0	42.0	40.0	45.7	40.0	25.0	40.0	40.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan

Signal Timing Plans - Sorlie Bridge Closed - AM Peak - Maintenance Scenario - Grand Forks

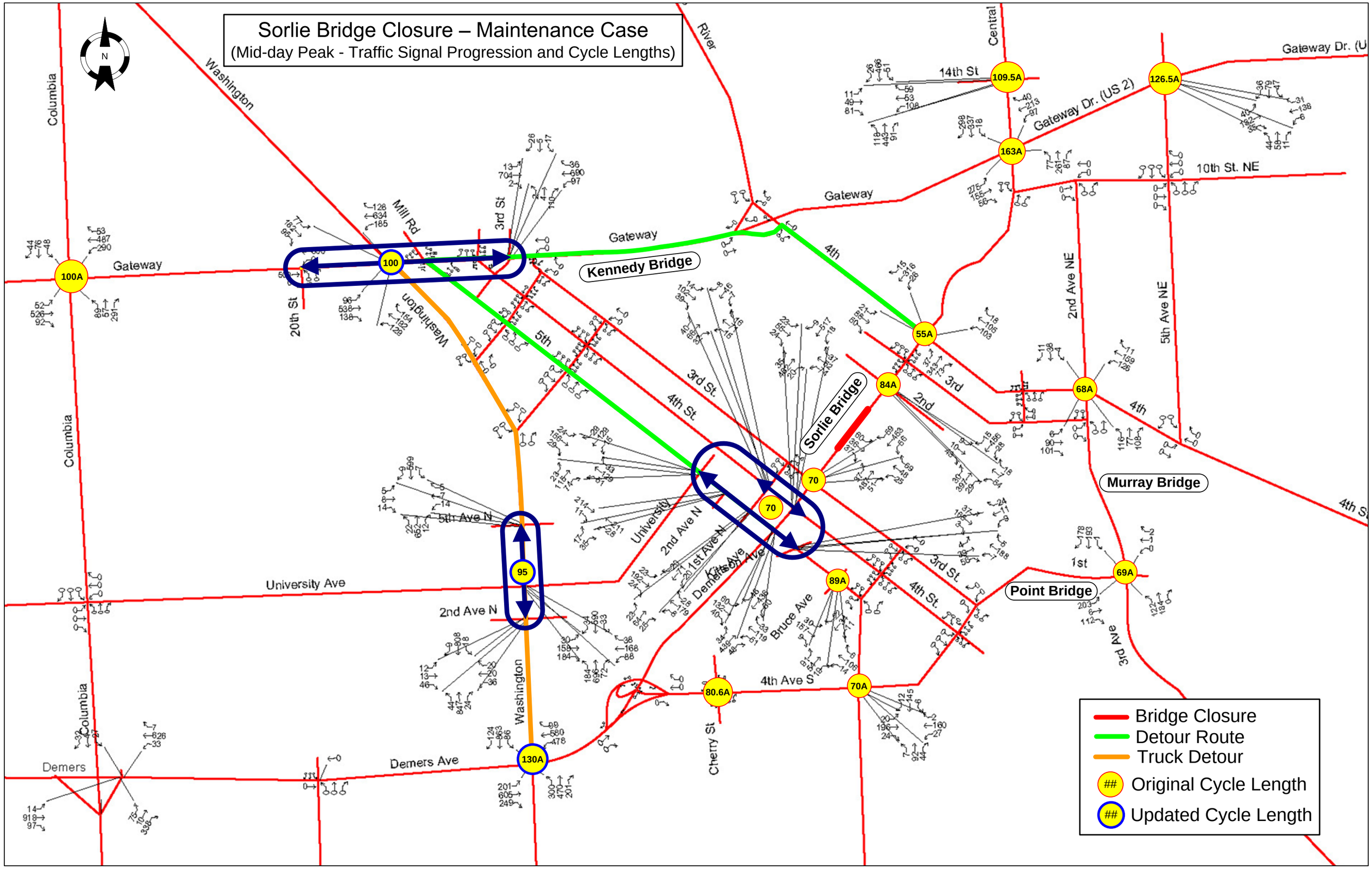
Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	89.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
Offset			40	10	0	39	38	10	10	10
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	44.5	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	44.5	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		44.5	35.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		44.5								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Changed to Uncoordinated	Original Timing Plan	Original Timing Plan	Original Timing Plan	Changed Offset	Changed Offset	Changed Offset	Original Timing Plan	Original Timing Plan	Original Timing Plan

Signal Timing Plans - Sorlie Bridge Closed - AM Peak - Maintenance Scenario - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	163.0	126.5	109.5	84.0	55.0	90.0	80.0
Offset							
Φ1							
Max. Split	25.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	36.5	52.5	50.0	34.5	25.0	40.0	45.0
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	25.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	36.5	42.5	35.0	49.5	30.0	50.0	35.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	45.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	36.5	52.5	50.0	34.5	25.0	40.0	45.0
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	45.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	36.5	42.5	35.0	49.5	30.0	50.0	35.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan		

Sorlie Bridge Closure – Maintenance Case

(Mid-day Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Sorlie Bridge Closed - MID Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	130.0	95.0	95.0	95.0	100.0	100.0	100.0	100.0	100.0	80.6
Offset		81	69	2		93	56	2	88	
Φ1										
Max. Split	29.0		20.0		23.0		15.0	25.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	42.0	60.0	31.0	55.0	33.0	60.0	42.0	35.0	60.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	28.0		15.0				15.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	31.0	35.0	29.0	40.0	44.0		28.0	40.0	40.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	17.0	15.0			23.0	20.0	25.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	54.0	45.0	51.0	55.0	33.0	40.0	32.0	60.0	60.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	22.0						18.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	37.0	35.0	44.0	40.0	44.0	40.0	25.0	40.0	40.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan Changed to Uncoordinated	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan

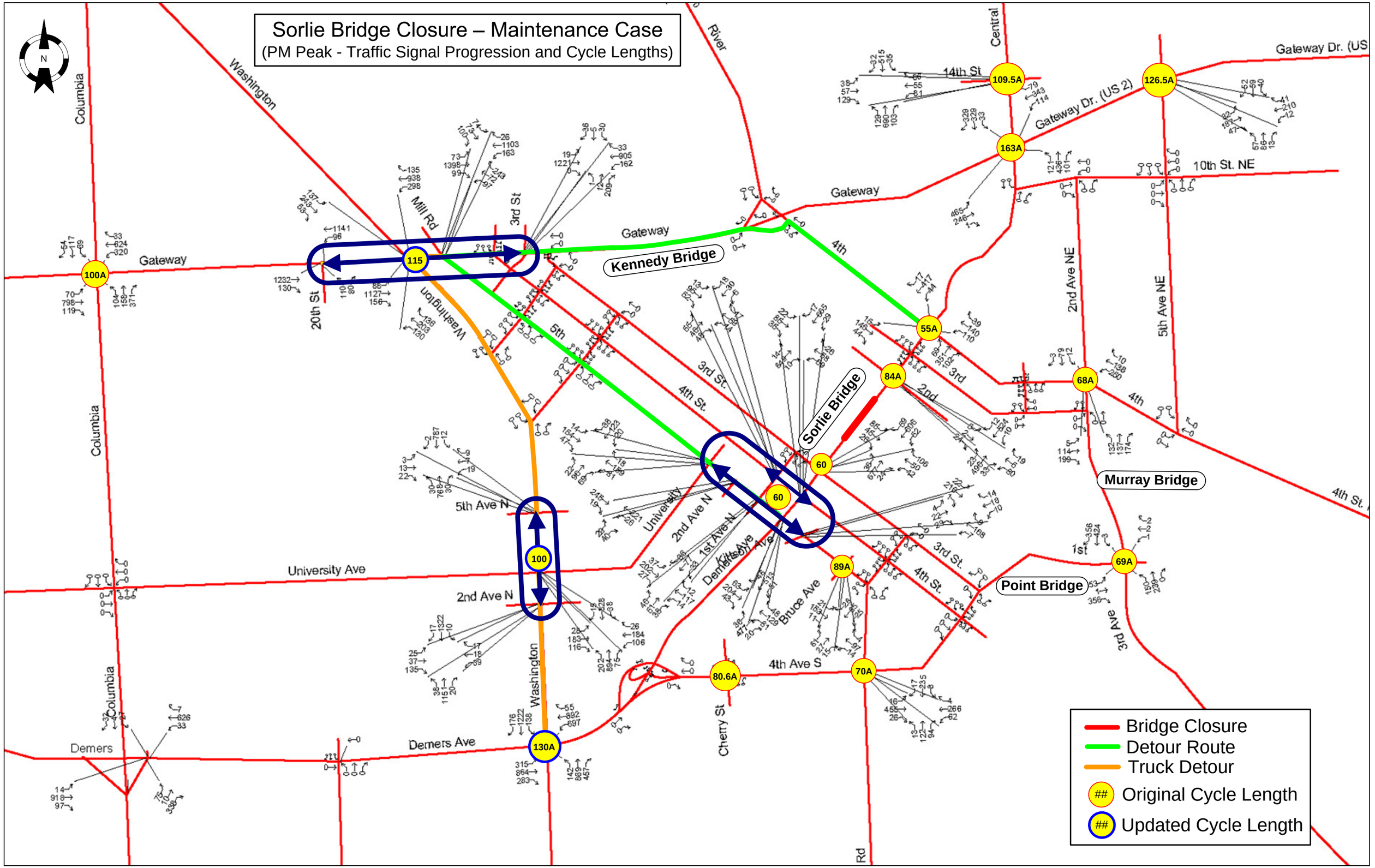
Signal Timing Plans - Sorlie Bridge Closed - MID Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	89.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset			35	0	69	43	55	0	0	0
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	44.5	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	44.5	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		44.5	42.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		44.5								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Changed to Uncoordinated	Original Timing Plan	Original Timing Plan	Original Timing Plan	Changed Offset	Changed Offset	Changed Offset	Original Timing Plan	Original Timing Plan	Original Timing Plan

Signal Timing Plans - Sorlie Bridge Closed - MID Peak - Maintenance - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	163.0	126.5	109.5	84.0	55.0	68.0	69.0
Offset							
Φ1							
Max. Split	25.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	36.5	52.5	50.0	34.5	25.0	34.0	34.5
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	25.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	36.5	42.5	35.0	49.5	30.0	34.0	34.5
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	45.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	36.5	52.5	50.0	34.5	25.0	34.0	34.5
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	45.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	36.5	42.5	35.0	49.5	30.0	34.0	34.5
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan

Sorlie Bridge Closure – Maintenance Case
(PM Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Sorlie Bridge Closed - PM Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	130.0	100.0	100.0	100.0	100.0	115.0	115.0	115.0	115.0	80.6
Offset		6	92	26		3	98	108	4	
Φ1										
Max. Split	15.0		23.0		23.0		20.0	20.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	45.0	60.0	33.0	60.0	33.0	70.0	52.0	50.0	70.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	30.0		15.0				21.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	40.0	40.0	29.0	40.0	44.0		22.0	45.0	45.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	18.0	15.0			23.0	20.0	30.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	42.0	45.0	56.0	60.0	33.0	50.0	42.0	70.0	70.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	21.0						21.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	49.0	40.0	44.0	40.0	44.0	45.0	22.0	45.0	45.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan Changed to Uncoordinated	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan

Signal Timing Plans - Sorlie Bridge Closed - PM Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	89.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
Offset			30	0	0	39	38	0	0	0
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	44.5	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	44.5	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		44.5	35.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		44.5								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Changed to Uncoordinated	Original Timing Plan	Original Timing Plan	Original Timing Plan	Changed Offset	Changed Offset	Changed Offset	Original Timing Plan	Original Timing Plan	Original Timing Plan

Signal Timing Plans - Sorlie Bridge Closed - PM Peak - Maintenance - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	163.0	126.5	109.5	84.0	55.0	68.0	69.0
Offset							
Φ1							
Max. Split	25.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	36.5	52.5	50.0	34.5	25.0	34.0	34.5
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	25.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	36.5	42.5	35.0	49.5	30.0	34.0	34.5
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	45.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	36.5	52.5	50.0	34.5	25.0	34.0	34.5
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	45.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	36.5	42.5	35.0	49.5	30.0	34.0	34.5
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan

Murray Bridge Closed (Maintenance Scenario)

Bridge Closure

- City of Grand Forks
  - Implement the alternate timing plans for the signalized intersections in Grand Forks.
  - Install the appropriate detour signs in Grand Forks.

- City of East Grand Forks
  - Contact Grand Forks, Mn/DOT, BNSF, and the media about the closure event.
  - Close the Murray Bridge (coordinate with Grand Forks) at 2nd Ave. E./3rd Ave. E. with Type III barricades.
  - Install the appropriate detour signs in East Grand Forks.

- Mn/DOT
  - Implement the alternate timing plans for the signalized intersections in East Grand Forks.

Bridge Reopening

- City of Grand Forks
  - Change the Grand Forks signal timing plans back to the original plans.
  - Remove the detour signs in Grand Forks.

- City of East Grand Forks
  - Clean and inspect the Murray Bridge.
  - Remove the Type III barricades and open the Murray Bridge (coordinate with Grand Forks).
  - Remove the detour signs in East Grand Forks.

- Mn/DOT
  - Change the East Grand Forks signal timing plans back to the original plans.

The remaining pages of this section contain detailed information regarding the following topics:

- Detour Sign Layouts
- Traffic Signal Timing Plans

DETOUR M4-8
NORTH M3-4
NE 2nd Ave D3-1
M5-1 (R)

DETOUR M4-8
NORTH M3-4
NE 2nd Ave D3-1
M6-1 (R)

DETOUR M4-8
NORTH M3-4
NE 2nd Ave D3-1
M6-1 (L)

END DETOUR
M4-8a

R11-2
ROAD CLOSED
5 - 8' Type III Barricades
Barricade Mounted

DETOUR M4-8
NORTH M3-4
NE 2nd Ave D3-1
M5-1 (L)

R9-9
SIDEWALK CLOSED
1 - 5' Type III Barricade
Barricade Mounted

DETOUR M4-8
NORTH M3-4
NE 2nd Ave D3-1
M6-1 (R)

DETOUR M4-8
NORTH M3-4
NE 2nd Ave D3-1
M5-1 (R)

R11-2
ROAD CLOSED
6 - 8' Type III Barricades
Barricade Mounted

DETOUR M4-8
NORTH M3-4
NE 2nd Ave D3-1
M6-1 (R)

DETOUR M4-8
NORTH M3-4
NE 2nd Ave D3-1
M5-1 (R)

DETOUR M4-8
NORTH M3-4
NE 2nd Ave D3-1
M6-1 (L)

ROAD CLOSED AHEAD
W20-3

DETOUR AHEAD
W20-2

Drawn by:
Michael G. Grundman

Reviewed by:
Shawn C. Birst

ATAC ADVANCED TRAFFIC ANALYSIS CENTER

Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Murray Bridge Maintenance Closure

Northbound Traffic

DETOUR M4-8
SOUTH M3-3
NE 2nd Ave D3-1
M6-1 (L)

DETOUR M4-8
SOUTH M3-3
NE 2nd Ave D3-1
M5-1 (L)

ROAD CLOSED AHEAD
W20-3

DETOUR AHEAD
W20-2

DETOUR M4-8
SOUTH M3-3
NE 2nd Ave D3-1
M6-1 (R)

DETOUR M4-8
SOUTH M3-3
NE 2nd Ave D3-1
M6-3

R11-2
ROAD CLOSED
5 - 8' Type III Barricades
Barricade Mounted

R9-9
SIDEWALK CLOSED
1 - 5' Type III Barricade
Barricade Mounted

R11-2
ROAD CLOSED
6 - 8' Type III Barricades
Barricade Mounted

DETOUR M4-8
SOUTH M3-3
NE 2nd Ave D3-1
M5-1 (R)

END DETOUR
M4-8a

DETOUR M4-8
SOUTH M3-3
NE 2nd Ave D3-1
M6-1 (R)

DETOUR M4-8
SOUTH M3-3
NE 2nd Ave D3-1
M5-1 (L)

DETOUR M4-8
SOUTH M3-3
NE 2nd Ave D3-1
M6-1 (L)

Drawn by:
Michael G. Grundman

Reviewed by:
Shawn C. Birst

ATAC ADVANCED TRAFFIC ANALYSIS CENTER

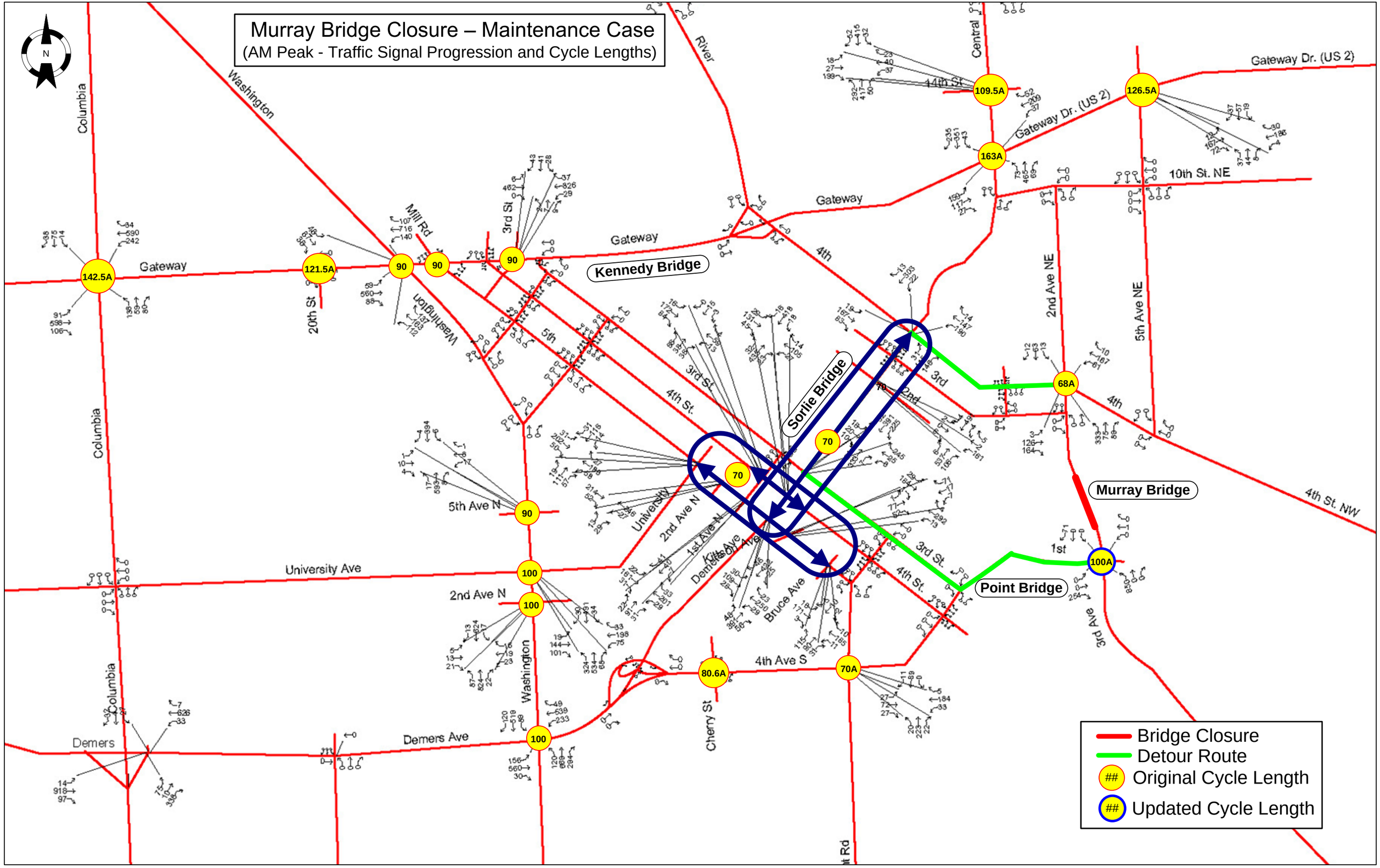
Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Murray Bridge Maintenance Closure

Southbound Traffic

Murray Bridge Closure – Maintenance Case

(AM Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Murray Bridge Closed - AM Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	100.0	100.0	100.0	90.0	142.5	121.5	90.0	90.0	91.4	80.6
Offset	28	11	92	10			0	12		
Φ1										
Max. Split	20.0		30.0		35.5		18.0	25.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	32.0	64.0	28.8	35.0	61.1	81.0	27.0	30.0	50.7	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	15.0		13.0				20.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	33.0	36.0	28.2	55.0	45.7		25.0	35.0	40.7	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	13.0	24.0			35.7	35.5	18.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	39.0	40.0	58.8	35.0	61.1	45.5	27.0	55.0	50.7	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	15.0						20.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	33.0	36.0	41.2	55.0	45.7	40.5	25.0	35.0	40.7	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan

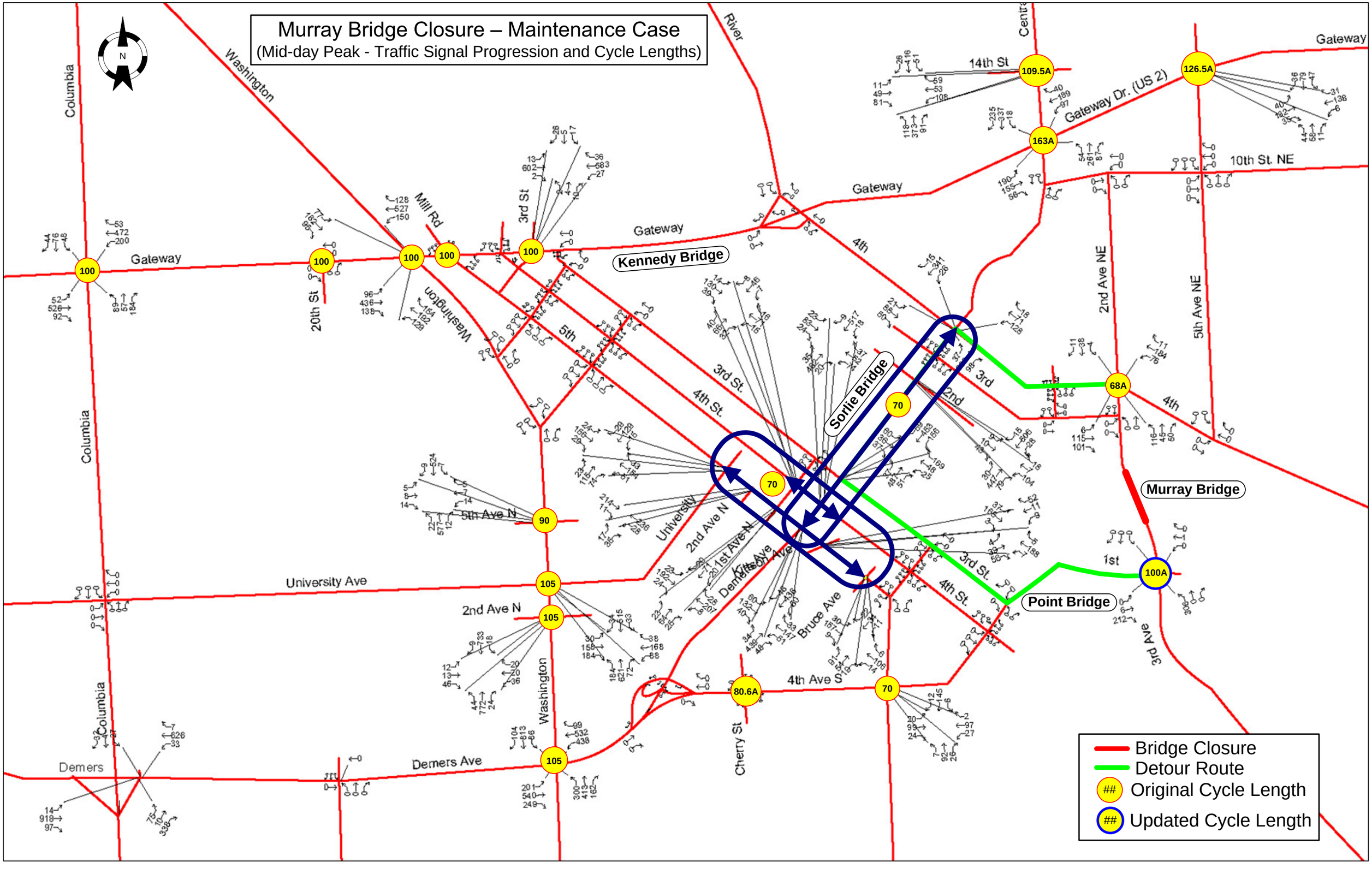
Signal Timing Plans - Murray Bridge Closed - AM Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset	0	22	40	62	16	5	6	62	62	62
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	35.0	30.0	40.0	40.0	40.0	30.0	35.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	35.0	40.0	30.0	30.0	30.0	40.0	35.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Original Timing Plan	Offset Ref. to 4&8 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow

Signal Timing Plans - Murray Bridge Closed - AM Peak - Maintenance Scenario - East Grand

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	163.0	126.5	109.5	70.0	70.0	68.0	100.0
Offset				11	11		
Φ1							
Max. Split	25.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	36.5	52.5	50.0	30.0	35.0	34.0	80.0
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	25.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	36.5	42.5	35.0	40.0	35.0	34.0	20.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	45.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	36.5	52.5	50.0	30.0	35.0	34.0	80.0
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	45.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	36.5	42.5	35.0	40.0	35.0	34.0	20.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
	Original Timing Plan	Original Timing Plan	Original Timing Plan	Offset Ref. to 4&8 Green	Offset Ref. to 4&8 Green	Original Timing Plan	

Murray Bridge Closure – Maintenance Case
(Mid-day Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Murray Bridge Closed - MID Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	105.0	105.0	105.0	90.0	100.0	100.0	100.0	100.0	100.0	80.6
Offset	21	8	0	0	0	85	0	13	25	
Φ1										
Max. Split	17.0		20.0		23.0		20.0	30.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	38.0	67.0	39.8	35.0	33.0	56.0	35.0	35.0	46.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	18.0		17.0				20.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	32.0	38.0	28.2	55.0	44.0		25.0	35.0	54.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	15.0	21.0			23.0	24.0	20.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	40.0	46.0	59.8	35.0	33.0	32.0	35.0	65.0	46.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	27.0						20.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	23.0	38.0	45.2	55.0	44.0	44.0	25.0	35.0	54.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan

Signal Timing Plans - Murray Bridge Closed - MID Peak - Maintenance Scenario - Grand Forks

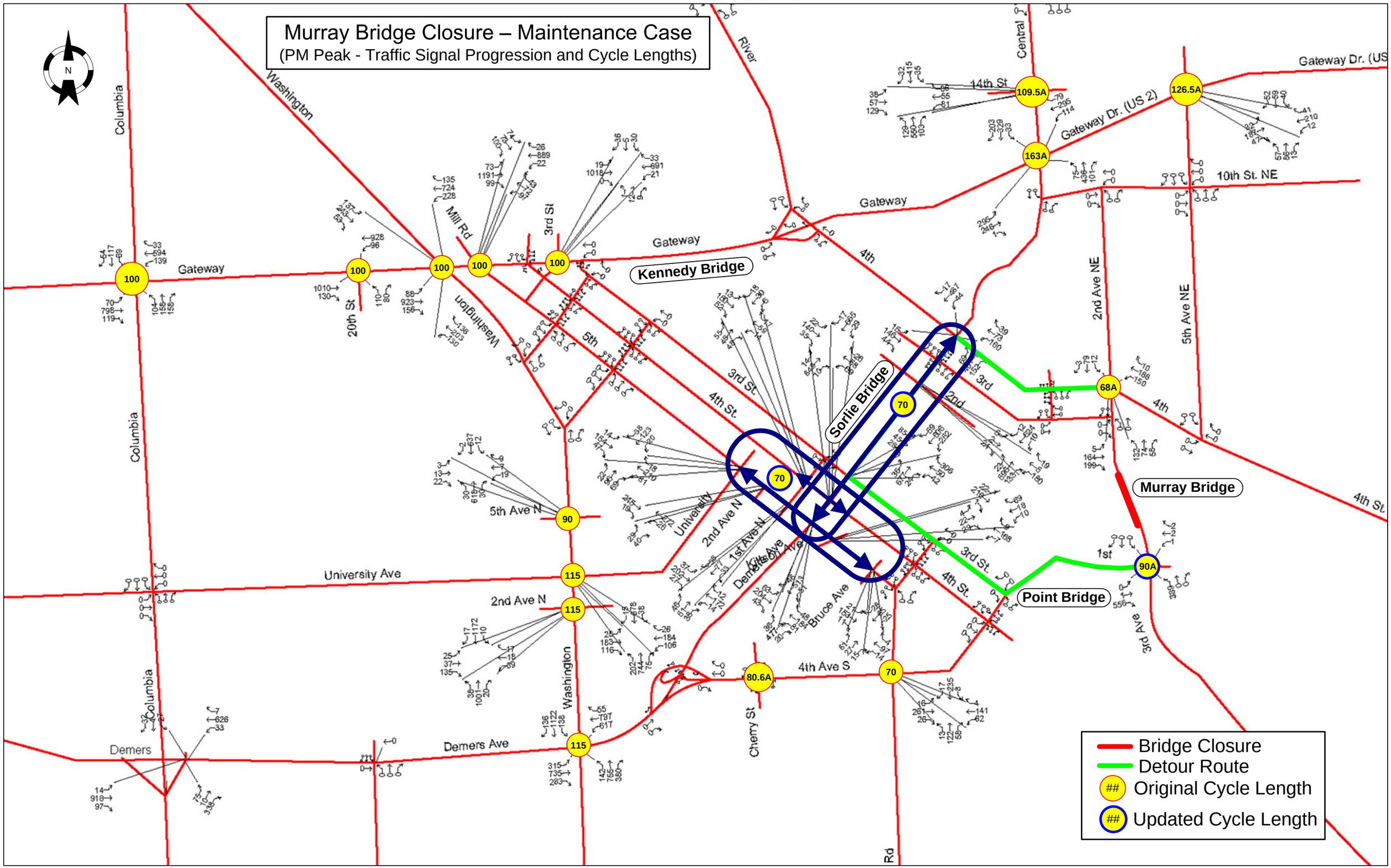
Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset	0	36	51	6	26	44	29	13	13	4
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	35.0	30.0	40.0	40.0	40.0	34.0	35.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	35.0	40.0	30.0	30.0	30.0	36.0	35.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Original Timing Plan	Offset Ref. to 4&8 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow

Signal Timing Plans - Murray Bridge Closed - MID Peak - Maintenance - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	163.0	126.5	109.5	70.0	70.0	68.0	100.0
Offset				14	22		
Φ1							
Max. Split	25.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	36.5	52.5	50.0	26.2	35.0	34.0	80.0
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	25.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	36.5	42.5	35.0	43.8	35.0	34.0	20.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	45.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	36.5	52.5	50.0	26.2	35.0	34.0	80.0
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	45.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	36.5	42.5	35.0	43.8	35.0	34.0	20.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
	Original Timing Plan	Original Timing Plan	Original Timing Plan	Offset Ref. to 4&8 Green	Offset Ref. to 4&8 Green	Original Timing Plan	

Murray Bridge Closure – Maintenance Case

(PM Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Murray Bridge Closed - PM Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	115.0	115.0	115.0	90.0	100.0	100.0	100.0	100.0	100.0	80.6
Offset	34	17	3	80	0	85	0	13	25	
Φ1										
Max. Split	18.0		23.0		23.0		20.0	30.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	37.0	78.0	47.0	35.0	33.0	56.0	35.0	35.0	46.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	21.0		15.0				20.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	39.0	37.0	30.0	55.0	44.0		25.0	35.0	54.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	18.0	22.0			23.0	24.0	20.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	37.0	56.0	70.0	35.0	33.0	32.0	35.0	65.0	46.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	29.0						20.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	31.0	37.0	45.0	55.0	44.0	44.0	25.0	35.0	54.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan	Original Timing Plan

Signal Timing Plans - Murray Bridge Closed - PM Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset	0	44	58	10	37	46	28	10	10	1
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	35.0	30.0	40.0	40.0	40.0	34.0	40.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	35.0	40.0	30.0	30.0	30.0	36.0	30.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Original Timing Plan	Offset Ref. to 4&8 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow

Signal Timing Plans - Murray Bridge Closed - PM Peak - Maintenance Scenario - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	163.0	126.5	109.5	70.0	70.0	68.0	90.0
Offset				12	0		
Φ1							
Max. Split	25.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	36.5	52.5	50.0	30.0	35.0	34.0	70.0
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	25.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	36.5	42.5	35.0	40.0	35.0	34.0	20.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	45.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	36.5	52.5	50.0	30.0	35.0	34.0	70.0
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	45.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	36.5	42.5	35.0	40.0	35.0	34.0	20.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
	Original Timing Plan	Original Timing Plan	Original Timing Plan	Offset Ref. to 4&8 Green	Offset Ref. to 4&8 Green	Original Timing Plan	

Kennedy Bridge Closed (Maintenance Scenario)

Bridge Closure

- City of Grand Forks
  - Implement the alternate timing plans for the signalized intersections in Grand Forks.

- NDDOT
  - Contact Grand Forks, East Grand Forks, Mn/DOT, BNSF, and the media about the closure event.
  - Close the Kennedy Bridge (coordinate with Grand Forks, East Grand Forks, and Mn/DOT) with Type III barricades at Gateway Dr.
  - Install the appropriate detour signs in Grand Forks.

- Mn/DOT
  - Contact East Grand Forks, Grand Forks, NDDOT, BNSF, and the media about the closure event.
  - Close the Kennedy Bridge (coordinate with Grand Forks, East Grand Forks, and NDDOT) with Type III barricades at Gateway Dr.
  - Install the appropriate detour signs in East Grand Forks.
  - Implement the alternate timing plans for the signalized intersections in East Grand Forks.

Bridge Reopening

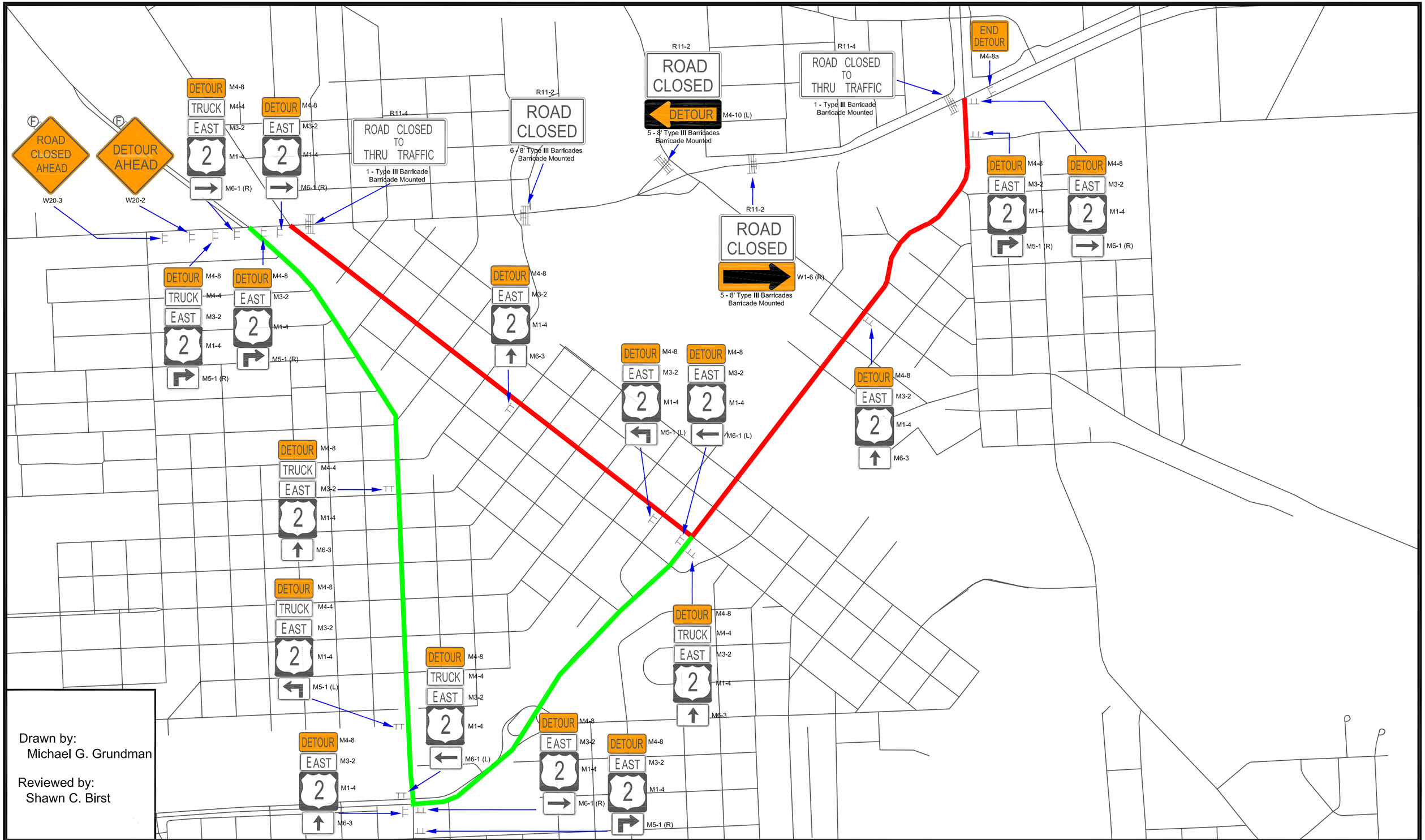
- City of Grand Forks
  - Change the Grand Forks signal timing plans back to the original plans.

- NDDOT
  - Clean and inspect the Grand Forks side of the Kennedy Bridge.
  - Remove the Type III barricades and open the Kennedy Bridge (coordinate with Grand Forks, East Grand Forks, and Mn/DOT).
  - Remove the detour signs in Grand Forks.

- Mn/DOT
  - Clean and inspect the East Grand Forks side of the Kennedy Bridge.
  - Remove the Type III barricades and open the Kennedy Bridge (coordinate with Grand Forks, East Grand Forks, and NDDOT).
  - Remove the detour signs in East Grand Forks.
  - Change the East Grand Forks signal timing plans back to the original plans.

The remaining pages of this section contain detailed information regarding the following topics:

- Detour Sign Layouts
- Traffic Signal Timing Plans



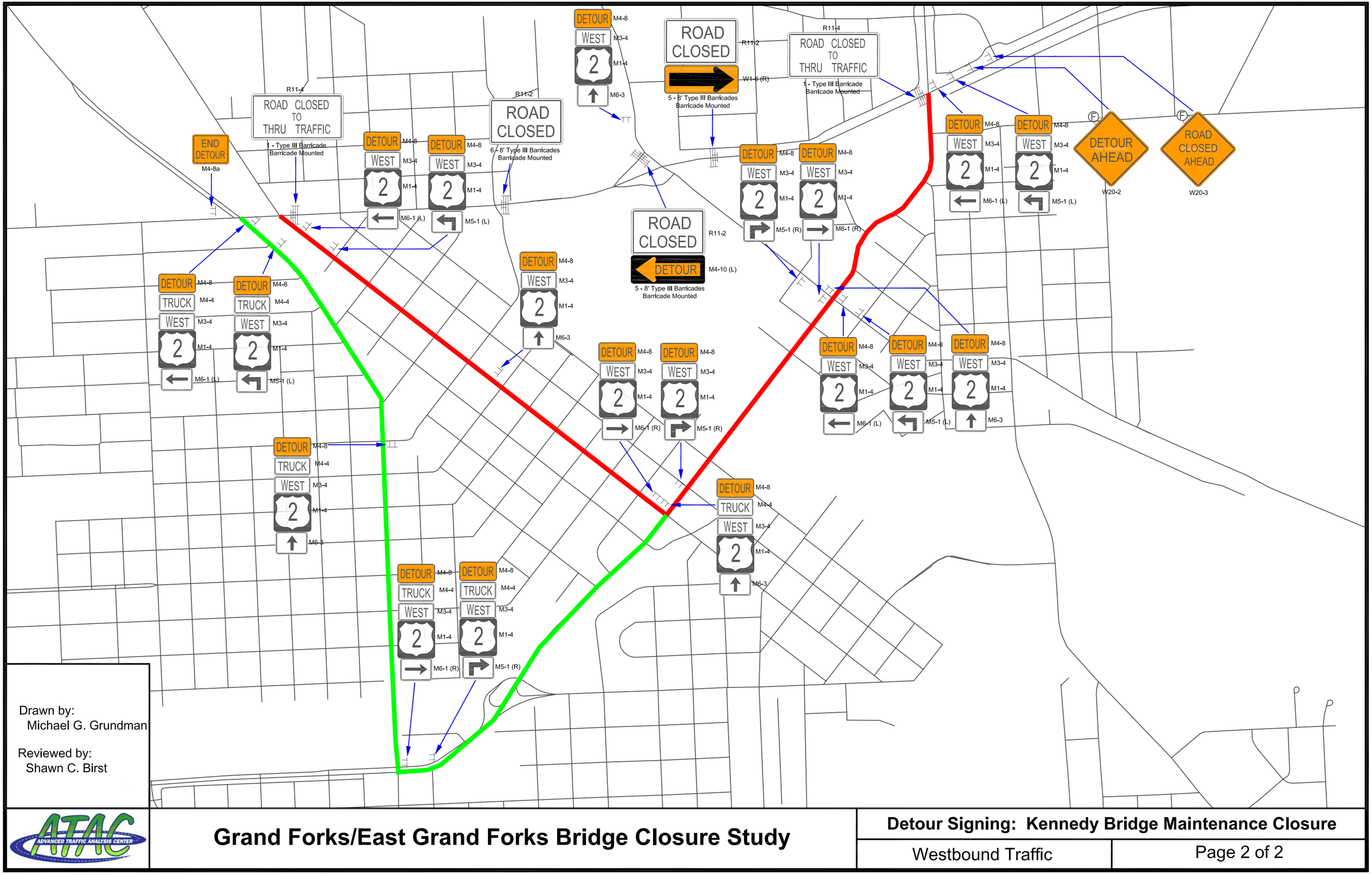
Drawn by:
Michael G. Grundman

Reviewed by:
Shawn C. Birst

Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Kennedy Bridge Maintenance Closure

Eastbound Traffic



Drawn by:
Michael G. Grundman

Reviewed by:
Shawn C. Birst

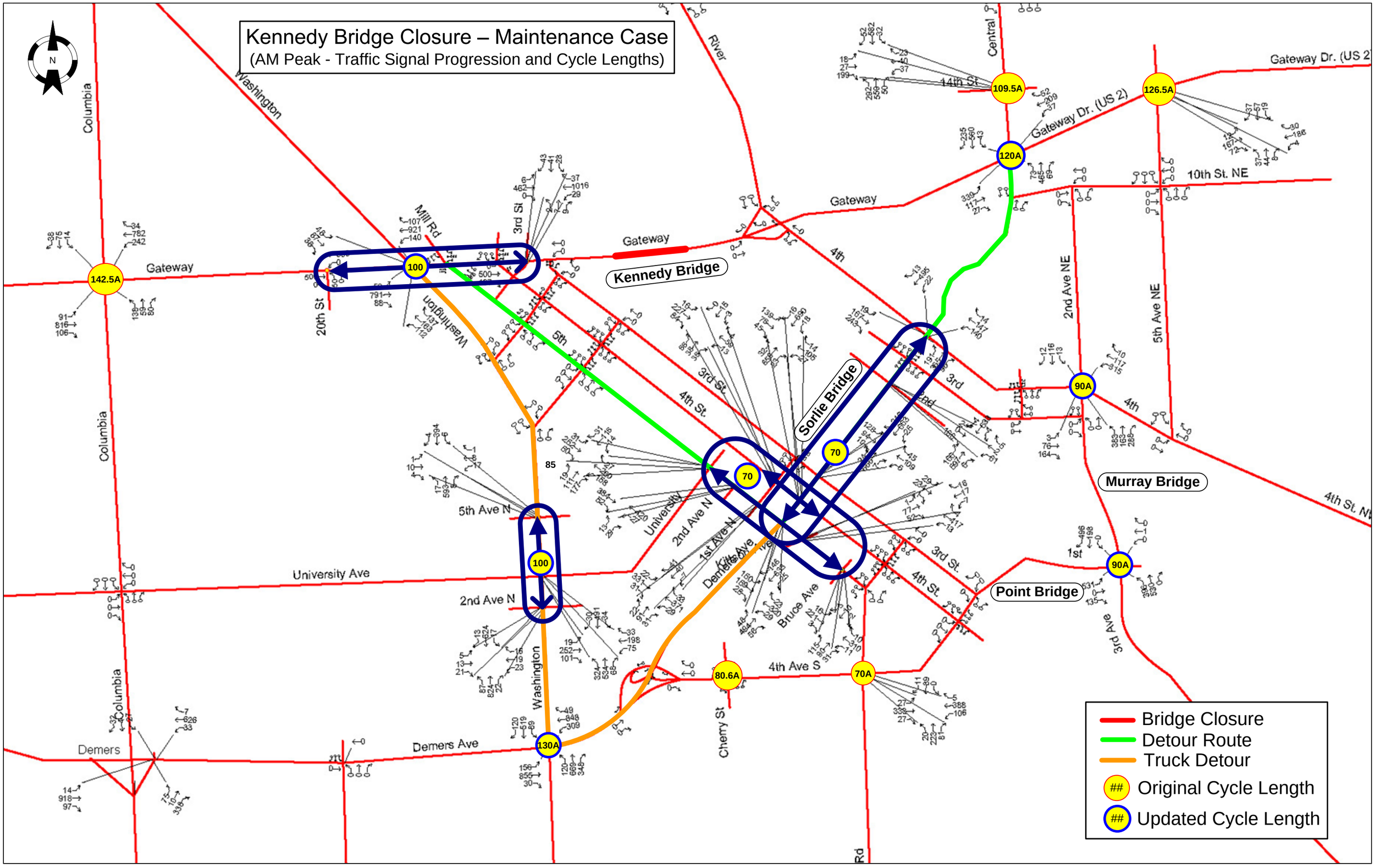
ATAC ADVANCED TRAFFIC ANALYSIS CENTER

Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Kennedy Bridge Maintenance Closure

Westbound Traffic

Kennedy Bridge Closure – Maintenance Case
(AM Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Kennedy Bridge Closed - AM Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	130.0	100.0	100.0	100.0	142.5	100.0	100.0	100.0	100.0	80.6
Offset		7	86	28		4	86	35	14	
Φ1										
Max. Split	15.0		27.0		35.5		15.0	25.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	45.0	60.0	28.0	60.0	61.1	60.0	35.0	35.0	50.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	25.0		15.0				20.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	45.0	40.0	30.0	40.0	45.7		30.0	40.0	50.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	25.0	25.0			35.7	20.0	15.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	35.0	35.0	55.0	60.0	61.1	40.0	35.0	60.0	50.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	15.0						25.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	55.0	40.0	45.0	40.0	45.7	40.0	25.0	40.0	50.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan

Signal Timing Plans - Kennedy Bridge Closed - AM Peak - Maintenance Scenario - Grand Forks

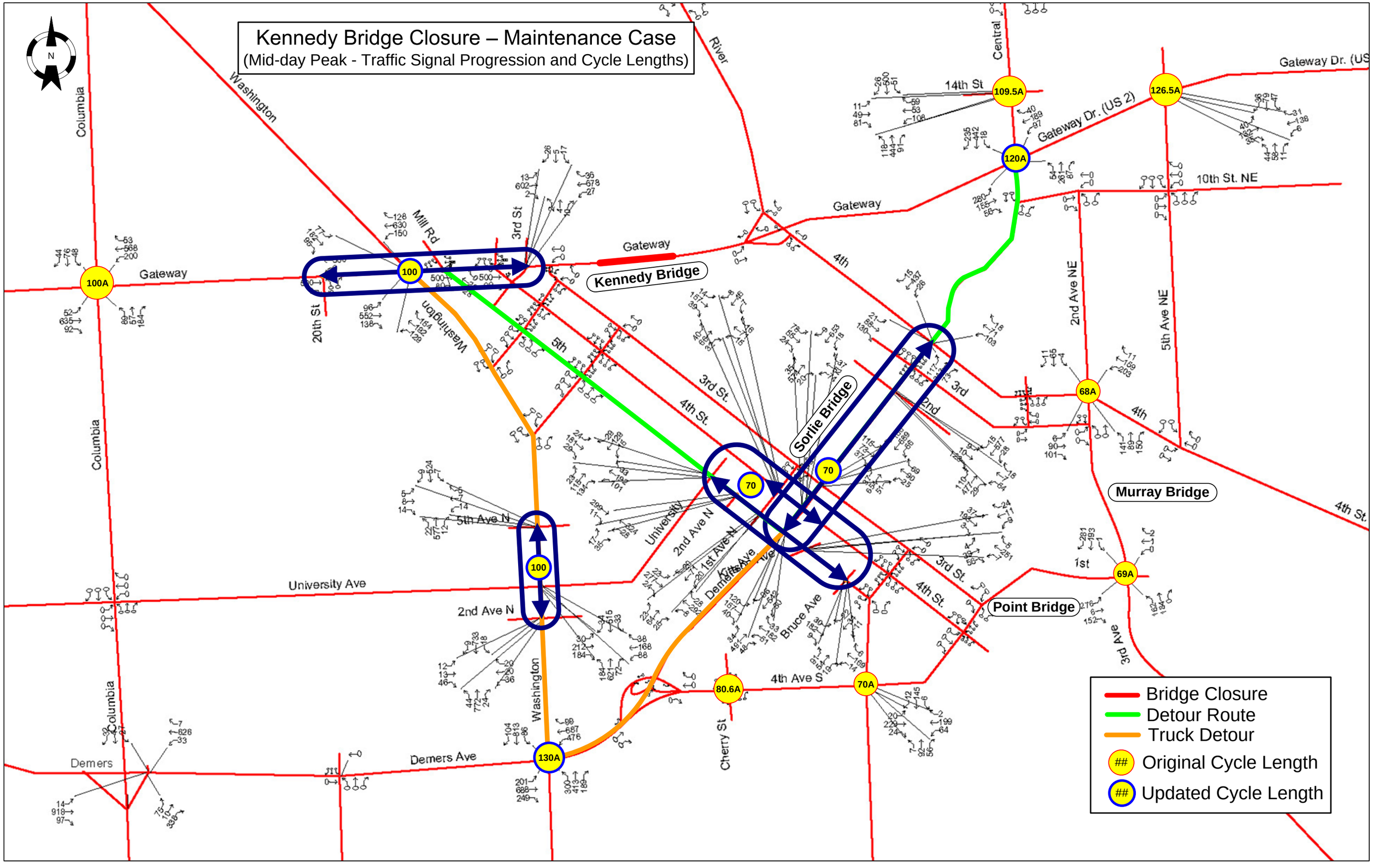
Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset		32	42	63	31	50	61	63	63	63
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	30.0	30.0	40.0	40.0	30.0	40.0	35.0	40.0	33.0	40.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	40.0	40.0	30.0	30.0	40.0	30.0	35.0	30.0	37.0	30.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
		Offset Ref. to 4&8 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow

Signal Timing Plans - Kennedy Bridge Closed - AM Peak - Maintenance Scenario - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	120.0	126.5	109.5	70.0	70.0	90.0	90.0
Offset				68	68		
Φ1							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	40.0	52.5	50.0	30.0	35.0	45.0	50.0
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	31.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	34.0	42.5	35.0	40.0	35.0	45.0	40.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	40.0	52.5	50.0	30.0	35.0	45.0	50.0
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	31.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	34.0	42.5	35.0	40.0	35.0	45.0	40.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
		Original Timing Plan	Original Timing Plan	Offset Ref. to 4&8 Green	Offset Ref. to 4&8 Green		

Kennedy Bridge Closure – Maintenance Case

(Mid-day Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Kennedy Bridge Closed - MID Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	130.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	80.6
Offset		4	87	16		32	0	48	35	
Φ1										
Max. Split	28.0		20.0		23.0		20.0	25.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	42.0	60.0	33.0	60.0	33.0	60.0	35.0	35.0	50.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	25.0		18.0				20.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	35.0	40.0	29.0	40.0	44.0		25.0	40.0	50.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	25.0	20.0			23.0	20.0	20.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	45.0	40.0	53.0	60.0	33.0	40.0	35.0	60.0	50.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	15.0						20.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	45.0	40.0	47.0	40.0	44.0	40.0	25.0	40.0	50.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan Changed to Uncoordinated	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan

Signal Timing Plans - Kennedy Bridge Closed - MID Peak - Maintenance Scenario - Grand Forks

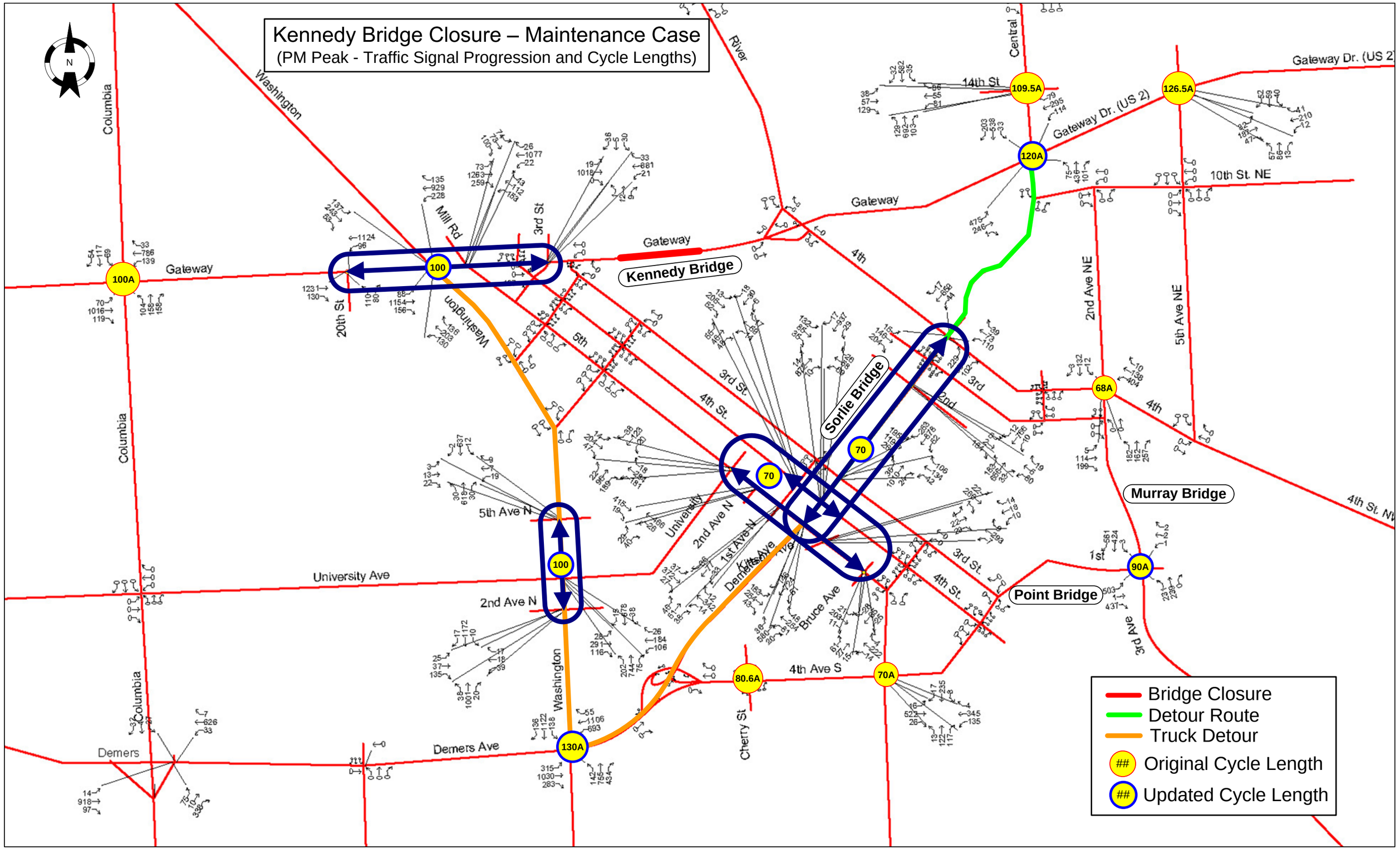
Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset		36	43	61	27	48	47	11	9	7
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	40.0	30.0	40.0	40.0	40.0	35.0	40.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	30.0	40.0	30.0	30.0	30.0	35.0	30.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
		Offset Ref. to 4&8 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow

Signal Timing Plans - Kennedy Bridge Closed - MID Peak - Maintence - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	120.0	126.5	109.5	70.0	70.0	68.0	69.0
Offset				1	22		
Φ1							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	40.0	52.5	50.0	35.0	35.0	34.0	34.5
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	31.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	34.0	42.5	35.0	35.0	35.0	34.0	34.5
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	40.0	52.5	50.0	35.0	35.0	34.0	34.5
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	31.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	34.0	42.5	35.0	35.0	35.0	34.0	34.5
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
		Original Timing Plan	Original Timing Plan	Offset Ref. to 4&8 Green	Offset Ref. to 4&8 Green	Original Timing Plan	Original Timing Plan

Kennedy Bridge Closure – Maintenance Case

(PM Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Kennedy Bridge Closed - PM Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	130.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	80.6
Offset		3	80	22		6	92	5	32	
Φ1										
Max. Split	15.0		25.0		23.0		15.0	20.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	42.0	60.0	31.0	60.0	33.0	60.0	38.0	40.0	50.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	30.0		15.0				17.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	43.0	40.0	29.0	40.0	44.0		30.0	40.0	50.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	20.0	15.0			23.0	20.0	23.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	37.0	45.0	56.0	60.0	33.0	40.0	30.0	60.0	50.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	20.0						25.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	53.0	40.0	44.0	40.0	44.0	40.0	22.0	40.0	50.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan (Changed to Uncoordinated)	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan

Signal Timing Plans - Kennedy Bridge Closed - PM Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset		38	52	5	22	36	36	8	8	5
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	30.0	30.0	40.0	40.0	30.0	40.0	35.0	40.0	30.0	40.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	40.0	40.0	30.0	30.0	40.0	30.0	35.0	30.0	40.0	30.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
		Offset Ref. to 4&8 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow

Signal Timing Plans - Kennedy Bridge Closed - PM Peak - Maintenance - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	120.0	126.5	109.5	70.0	70.0	68.0	90.0
Offset				2	13		
Φ1							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	40.0	52.5	50.0	30.0	35.0	34.0	47.0
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	31.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	34.0	42.5	35.0	40.0	35.0	34.0	43.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	40.0	52.5	50.0	30.0	35.0	34.0	47.0
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	31.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	34.0	42.5	35.0	40.0	35.0	34.0	43.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
		Original Timing Plan	Original Timing Plan	Offset Ref. to 4&8 Green	Offset Ref. to 4&8 Green	Original Timing Plan	

Kennedy Bridge 50% Closed (Maintenance Scenario)

Bridge Closure

- City of Grand Forks
  - Implement the alternate timing plans for the signalized intersections in Grand Forks.

- NDDOT
  - Contact Grand Forks, East Grand Forks, Mn/DOT, BNSF, and the media about the closure event.
  - Implement head to head traffic control signs (coordinate with Grand Forks, East Grand Forks, and Mn/DOT).

- Mn/DOT
  - Contact East Grand Forks, Grand Forks, NDDOT, BNSF, and the media about the closure event.
  - Implement head to head traffic control signs (coordinate with Grand Forks, East Grand Forks, and NDDOT).
  - Implement the alternate timing plans for the signalized intersections in Grand Forks.

Bridge Reopening

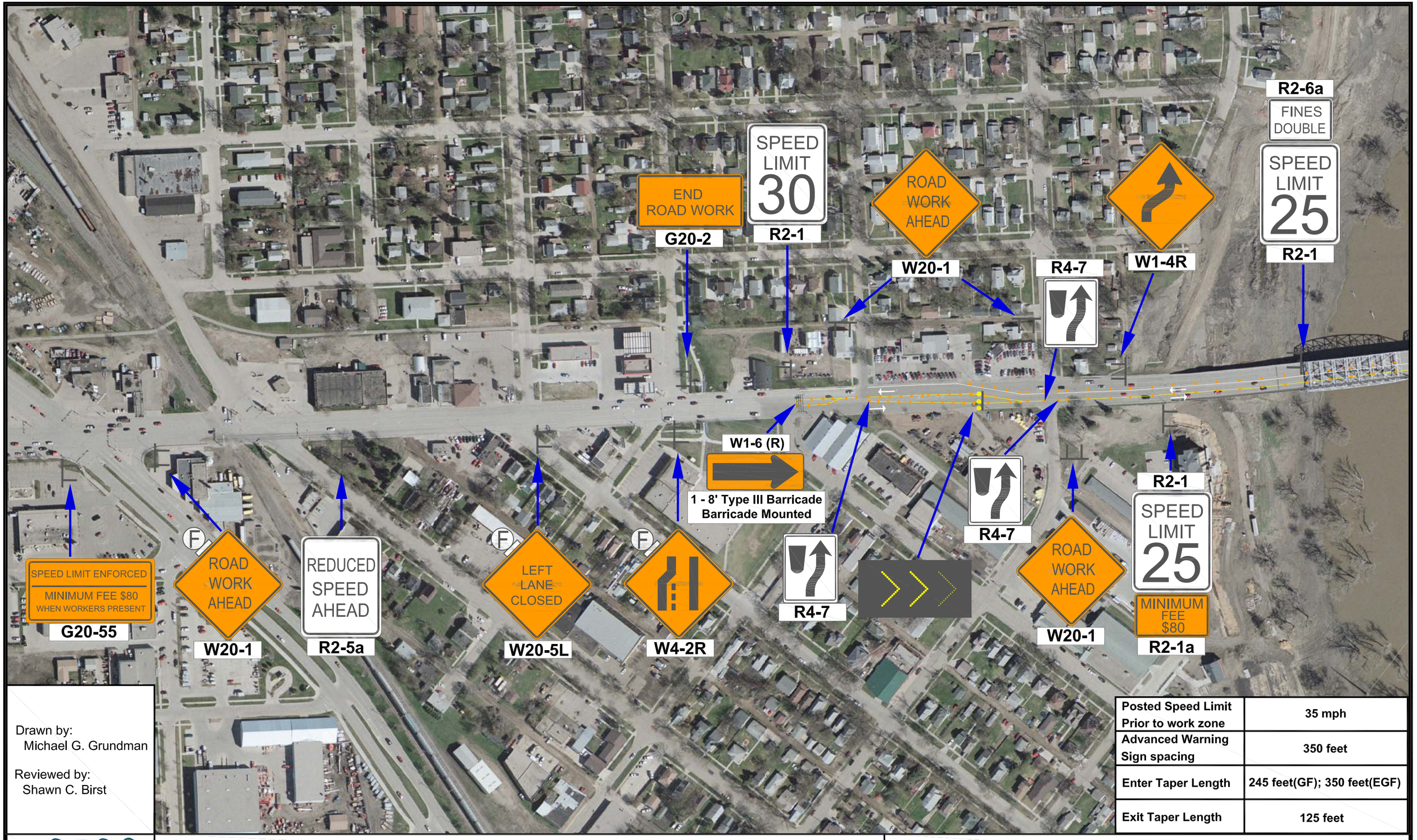
- City of Grand Forks
  - Change the Grand Forks signal timing plans back to the original plans.

- NDDOT
  - Clean and inspect the Grand Forks side of the Kennedy Bridge.
  - Remove traffic control signs and completely open the Kennedy Bridge (coordinate with Grand Forks, East Grand Forks, and Mn/DOT).

- Mn/DOT
  - Clean and inspect the East Grand Forks side of the Kennedy Bridge.
  - Remove traffic control signs and completely open the Kennedy Bridge (coordinate with Grand Forks, East Grand Forks, and NDDOT).
  - Change the Grand Forks signal timing plans back to the original plans.

The remaining pages of this section contain detailed information regarding the following topics:

- Detour Sign Layouts
- Traffic Signal Timing Plans



Drawn by:
Michael G. Grundman

Reviewed by:
Shawn C. Birst

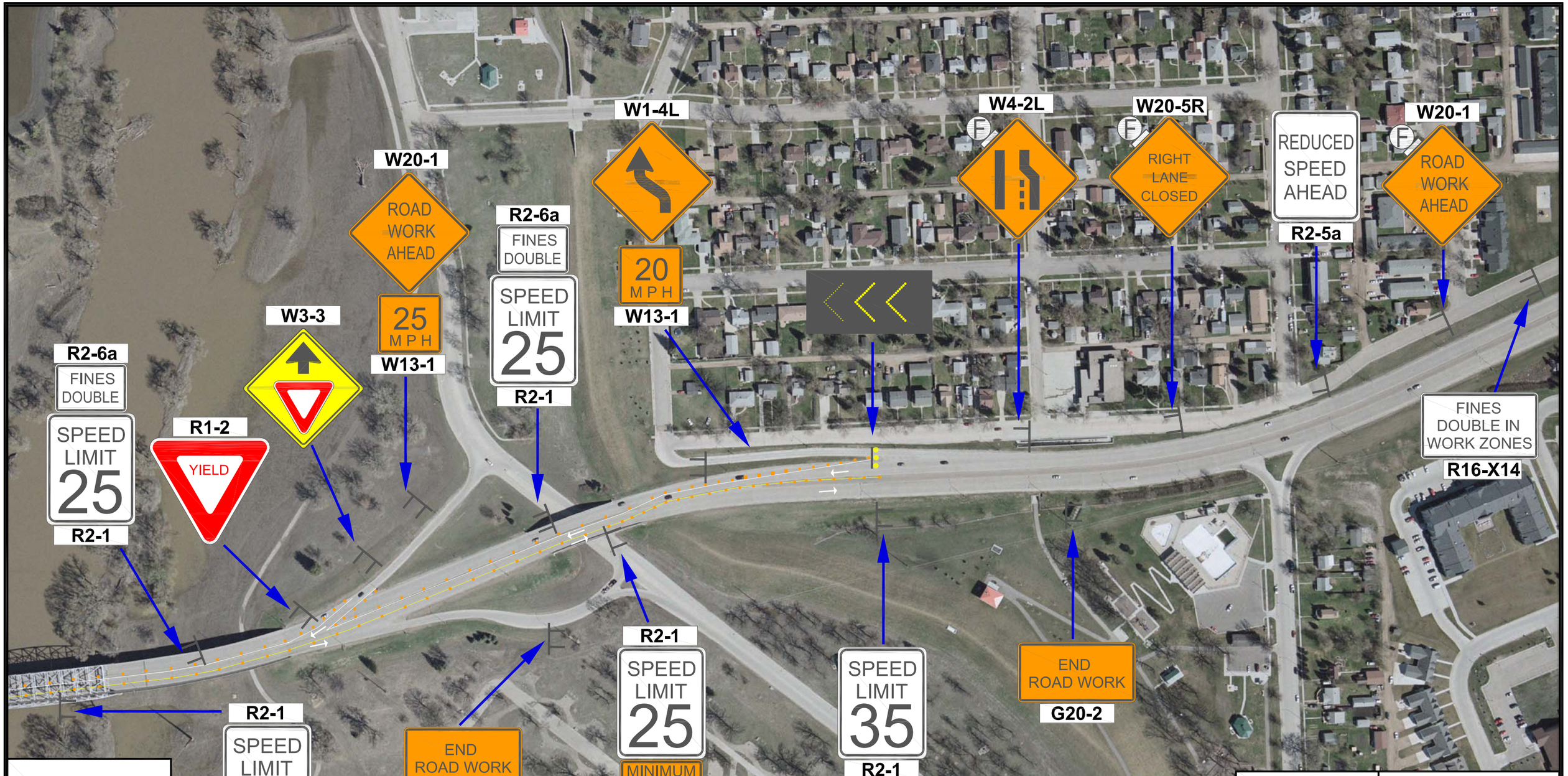
Posted Speed Limit Prior to work zone	35 mph
Advanced Warning Sign spacing	350 feet
Enter Taper Length	245 feet(GF); 350 feet(EGF)
Exit Taper Length	125 feet

ATAC ADVANCED TRAFFIC ANALYSIS CENTER

Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Kennedy Bridge Maintenance Closure (GF)

North Side Closed



Drawn by:
Michael G. Grundman

Reviewed by:
Shawn C. Birst

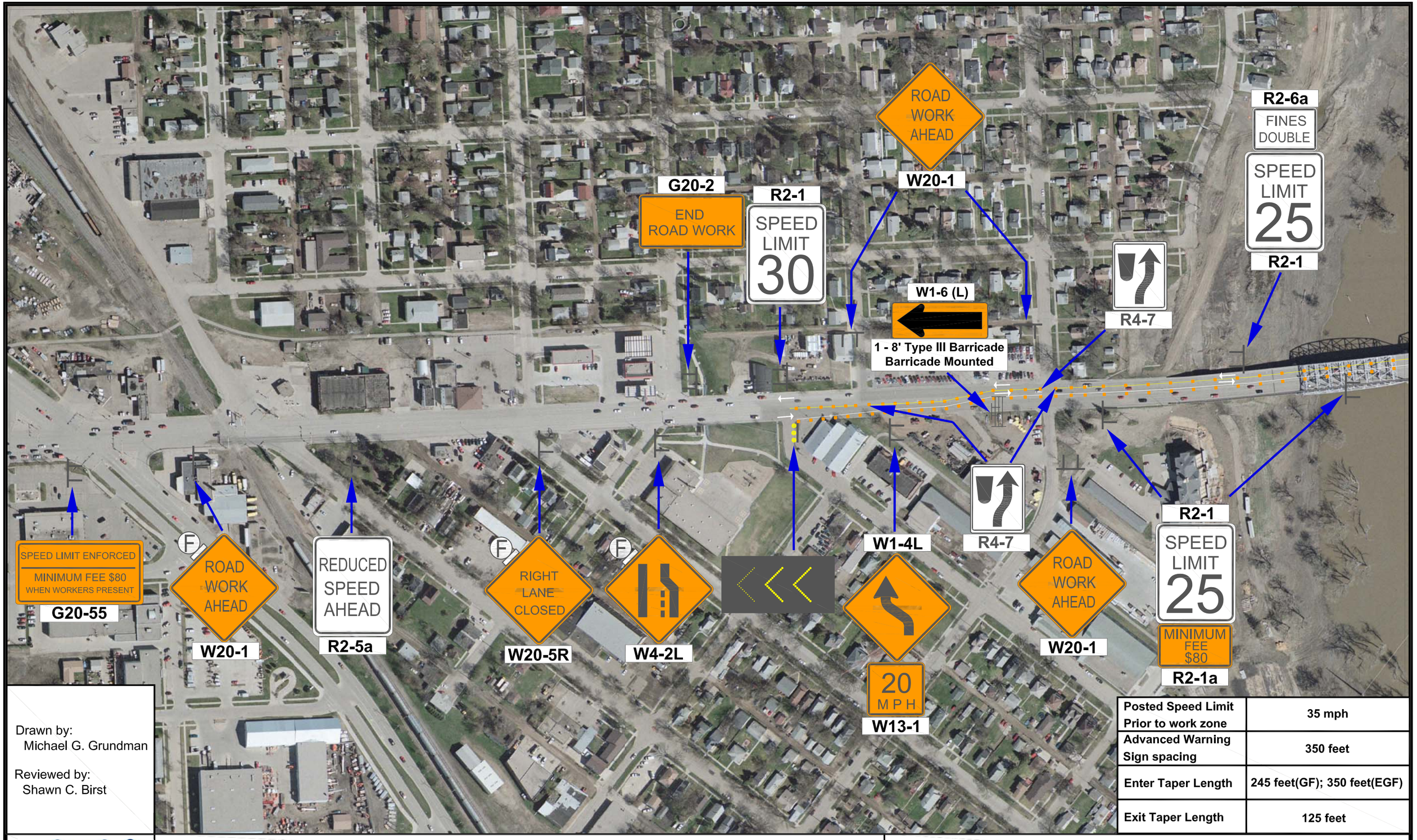
Posted Speed Limit Prior to work zone	35 mph
Advanced Warning Sign spacing	350 feet
Enter Taper Length	245 feet(GF); 350 feet(EGF)
Exit Taper Length	125 feet

ATAC ADVANCED TRAFFIC ANALYSIS CENTER

Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Kennedy Bridge Maintenance Closure (EGF)

North Side Closed



Drawn by:
Michael G. Grundman

Reviewed by:
Shawn C. Birst

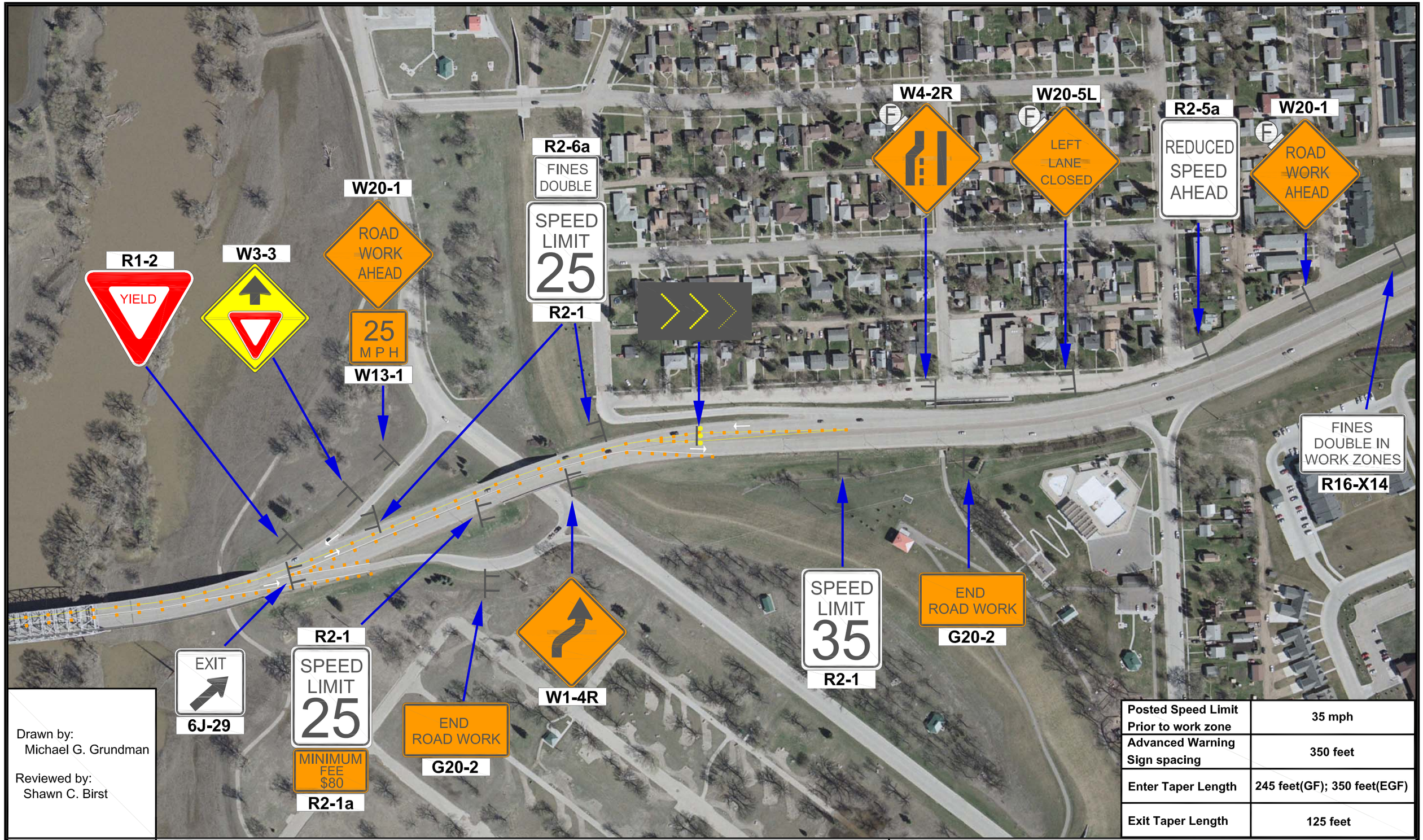
Posted Speed Limit Prior to work zone	35 mph
Advanced Warning Sign spacing	350 feet
Enter Taper Length	245 feet(GF); 350 feet(EGF)
Exit Taper Length	125 feet

ATAC ADVANCED TRAFFIC ANALYSIS CENTER

Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Kennedy Bridge Maintenance Closure (GF)

South Side Closed



Drawn by:
Michael G. Grundman

Reviewed by:
Shawn C. Birst

Posted Speed Limit Prior to work zone	35 mph
Advanced Warning Sign spacing	350 feet
Enter Taper Length	245 feet(GF); 350 feet(EGF)
Exit Taper Length	125 feet

ATAC ADVANCED TRAFFIC ANALYSIS CENTER

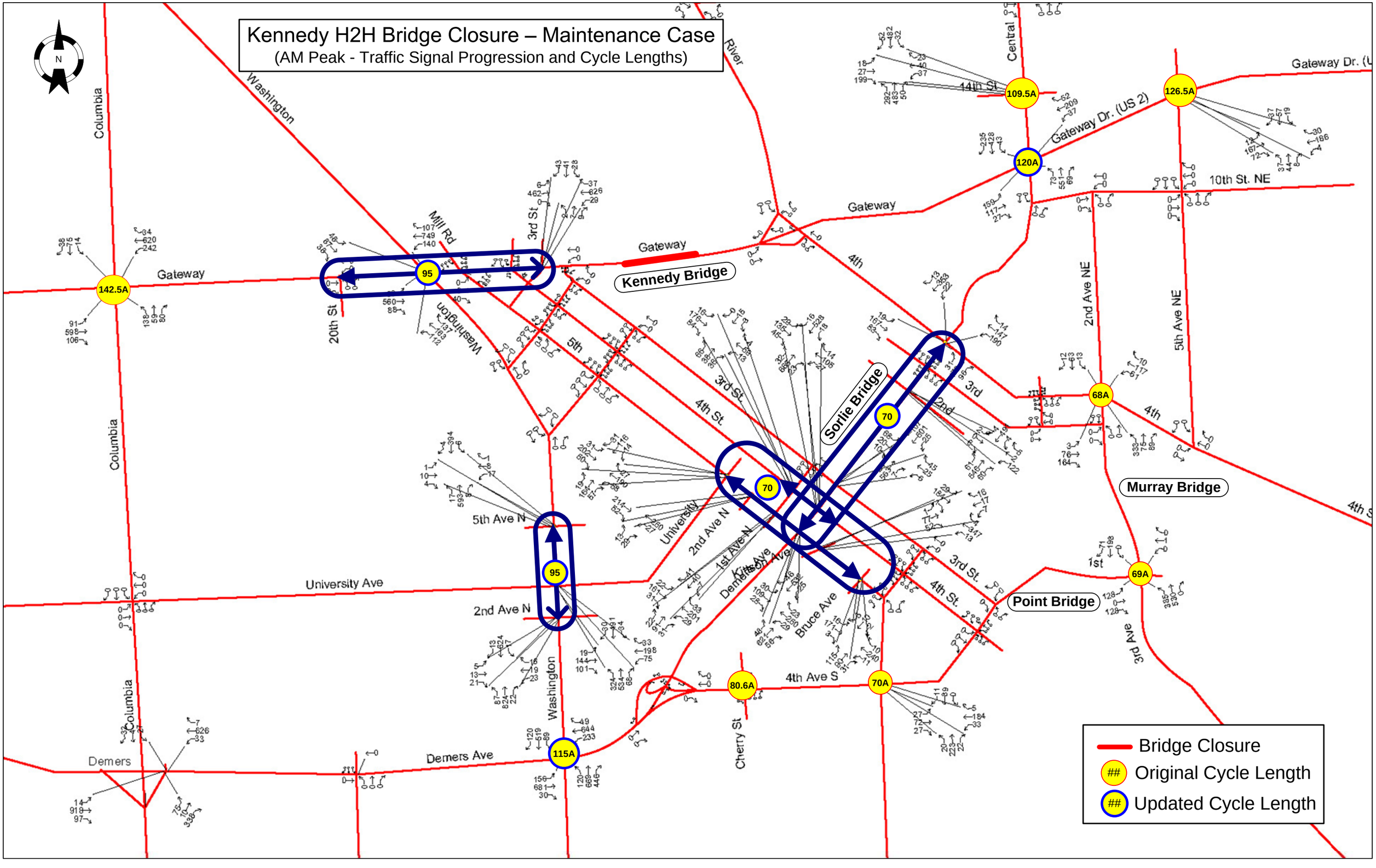
Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Kennedy Bridge Maintenance Closure (EGF)

South Side Closed

Kennedy H2H Bridge Closure – Maintenance Case

(AM Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Kennedy Bridge H2H - AM Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	115.0	95.0	95.0	95.0	142.5	95.0	95.0	95.0	95.0	80.6
Offset		8	0	31		39	6	42	16	
Φ1										
Max. Split	15.0		28.0		35.5		15.0	25.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	42.0	60.0	26.0	60.0	61.1	55.0	40.0	35.0	55.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	20.0		12.0				15.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	38.0	35.0	29.0	35.0	45.7		25.0	35.0	40.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	15.0	20.0			35.7	20.0	20.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	42.0	40.0	54.0	60.0	61.1	35.0	35.0	60.0	55.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	15.0						20.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	43.0	35.0	41.0	35.0	45.7	40.0	20.0	35.0	40.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan

Signal Timing Plans - Kennedy Bridge H2H - AM Peak - Maintenance Scenario - Grand Forks

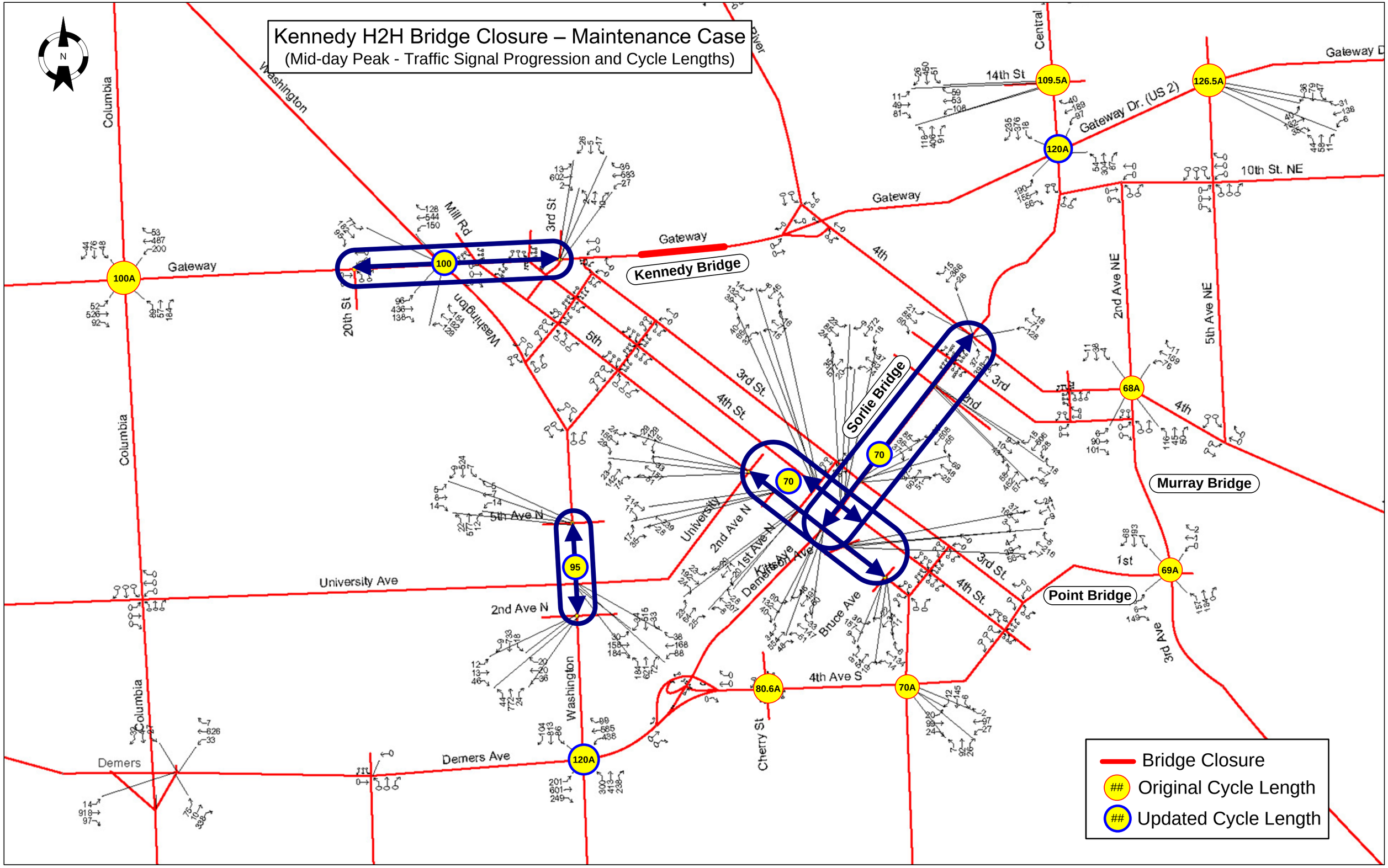
Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset		32	42	63	31	50	61	63	63	63
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	40.0	30.0	40.0	35.0	40.0	33.0	40.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	30.0	40.0	30.0	35.0	30.0	37.0	30.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Original Timing Plan	Offset Ref. to 4&8 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow

Signal Timing Plans - Kennedy Bridge H2H - AM Peak - Maintenance - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	120.0	126.5	109.5	70.0	70.0	68.0	69.0
Offset				68	68		
Φ1							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	45.0	52.5	50.0	30.0	30.0	34.0	34.5
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	15.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	45.0	42.5	35.0	40.0	40.0	34.0	34.5
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	45.0	52.5	50.0	30.0	30.0	34.0	34.5
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	25.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	35.0	42.5	35.0	40.0	40.0	34.0	34.5
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
		Original Timing Plan	Original Timing Plan	Offset Ref. to 4&8 Green	Offset Ref. to 4&8 Green	Original Timing Plan	Original Timing Plan

Kennedy H2H Bridge Closure – Maintenance Case

(Mid-day Peak - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Kennedy Bridge H2H - MID Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	120.0	95.0	95.0	95.0	100.0	100.0	100.0	100.0	100.0	80.6
Offset		92	85	16		29	0	48	35	
Φ1										
Max. Split	27.0		25.0		23.0		20.0	25.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	39.0	55.0	26.0	55.0	33.0	60.0	35.0	40.0	55.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	25.0		15.0				20.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	29.0	40.0	29.0	40.0	44.0		25.0	35.0	45.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	15.0	15.0			23.0	20.0	20.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	51.0	40.0	51.0	55.0	33.0	40.0	35.0	65.0	55.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	20.0						20.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	34.0	40.0	44.0	40.0	44.0	40.0	25.0	35.0	45.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan (Changed to Uncoordinated)	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan

Signal Timing Plans - Kennedy Bridge H2H - MID Peak - Maintenance Scenario - Grand Forks

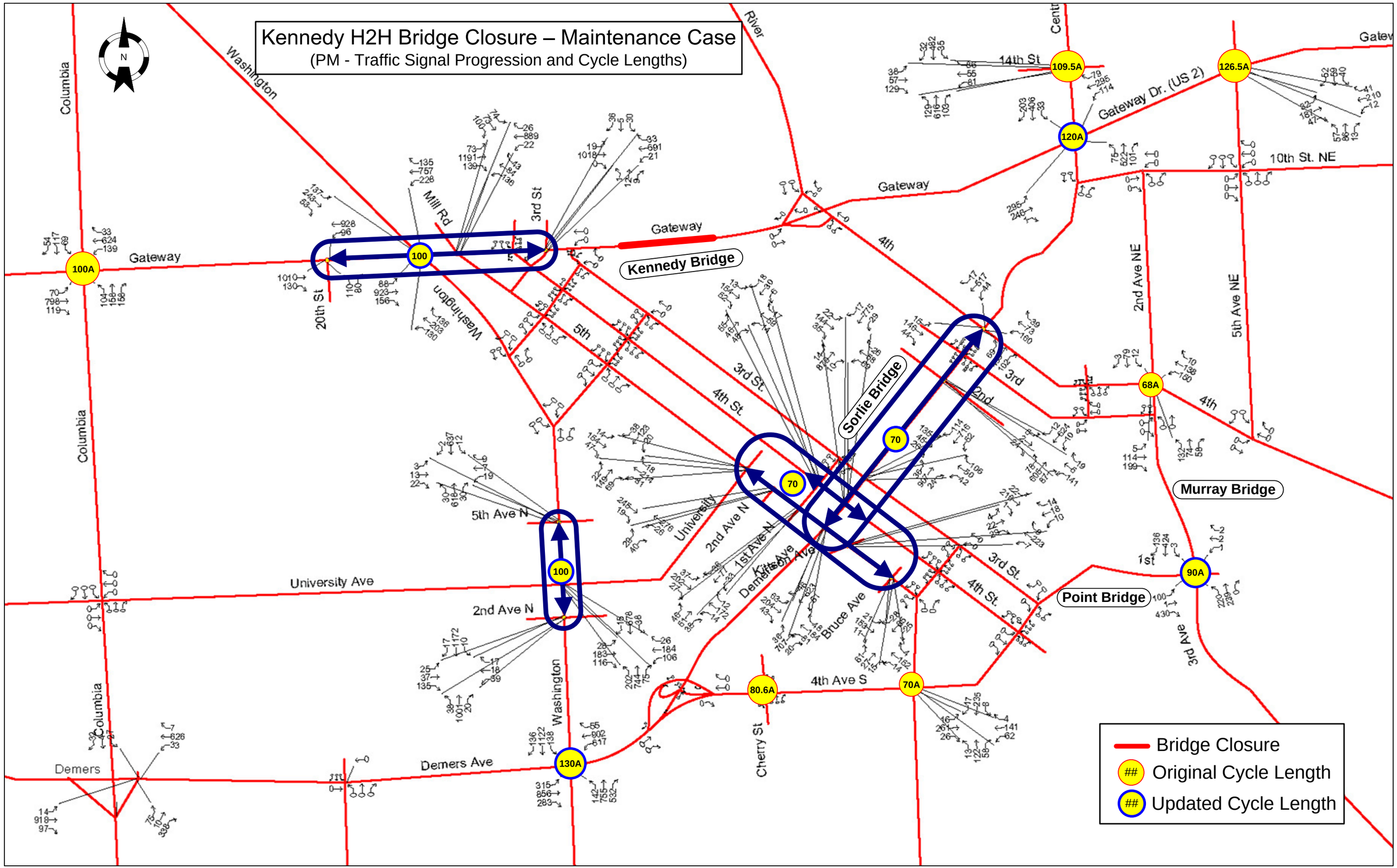
Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset		36	43	61	27	48	47	11	9	7
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	40.0	30.0	40.0	40.0	40.0	35.0	40.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	30.0	40.0	30.0	30.0	30.0	35.0	30.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Original Timing Plan (Changed to Uncoordinated)	Offset Ref. to 4&8 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow

Signal Timing Plans - Kennedy Bridge H2H - MID Peak - Maintenance - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	120.0	126.5	109.5	70.0	70.0	68.0	69.0
Offset				2	64		
Φ1							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	40.0	52.5	50.0	35.0	35.0	34.0	34.5
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	25.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	40.0	42.5	35.0	35.0	35.0	34.0	34.5
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	20.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	35.0	52.5	50.0	35.0	35.0	34.0	34.5
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	25.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	40.0	42.5	35.0	35.0	35.0	34.0	34.5
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
		Original Timing Plan	Original Timing Plan	Offset Ref. to 4&8 Green	Offset Ref. to 4&8 Green	Original Timing Plan	Original Timing Plan

Kennedy H2H Bridge Closure – Maintenance Case

(PM - Traffic Signal Progression and Cycle Lengths)



Signal Timing Plans - Kennedy Bridge H2H - PM Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Washington St. & Demers Ave.	Washington St. & 2nd Ave. N	Washington St. & University Ave.	Washington St. & 5th Ave. N	Gateway Dr.& Columbia Rd.	Gateway Dr.& 20th St.	Gateway Dr.& Washington Ave.	Gateway Dr.& 5th St.	Gateway Dr.& 3rd St.	Cherry St. & 4th Ave. S
Cycle Length	130.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	80.6
Offset		77	68	2		14	2	13	36	
Φ1										
Max. Split	15.0		25.0		23.0		15.0	20.0		
Min. Green	4.0		3.0		3.0		3.0	3.0		
Yellow/Red	3.5 / 1.2	/	3.0 / 1.0	/	3.3 / 2.2	/	3.5 / 1.0	3.4 / 2.2	/	/
Φ2										
Max. Split	46.0	65.0	31.0	60.0	33.0	60.0	40.0	40.0	60.0	41.1
Min. Green	10.0	12.0	15.0	10.0	12.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ3										
Max. Split	30.0		15.0				20.0			
Min. Green	4.0		3.0				3.0			
Yellow/Red	3.5 / 2.0	/	3.0 / 1.0	/	/	/	3.5 / 1.0	/	/	/
Φ4										
Max. Split	39.0	35.0	29.0	40.0	44.0		25.0	40.0	40.0	34.5
Min. Green	8.0	9.0	8.0	8.0	12.0		11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	/	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
Φ5										
Max. Split	20.0	20.0			23.0	20.0	25.0			
Min. Green	4.0	2.0			3.0	5.0	3.0			
Yellow/Red	3.5 / 1.2	3.5 / 1.2	/	/	3.5 / 2.2	3.3 / 2.2	3.5 / 1.0	/	/	/
Φ6										
Max. Split	41.0	45.0	56.0	60.0	33.0	40.0	30.0	60.0	60.0	41.1
Min. Green	10.0	12.0	15.0	10.0	18.0	11.0	11.0	10.0	8.0	12.0
Yellow/Red	3.2 / 2.5	4.0 / 1.0	3.5 / 2.2	4.0 / 1.0	3.9 / 2.2	3.3 / 2.2	3.2 / 3.1	3.4 / 2.2	3.5 / 2.2	3.9 / 2.2
Φ7										
Max. Split	20.0						20.0			
Min. Green	4.0						4.0			
Yellow/Red	3.5 / 2.0	/	/	/	/	/	3.5 / 1.0	/	/	/
Φ8										
Max. Split	49.0	35.0	44.0	40.0	44.0	40.0	25.0	40.0	40.0	39.5
Min. Green	8.0	9.0	8.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0
Yellow/Red	3.6 / 2.1	3.5 / 1.2	3.2 / 2.0	3.5 / 1.0	3.5 / 2.2	3.3 / 2.2	3.2 / 3.0	3.4 / 2.2	3.5 / 2.2	3.5 / 1.0
		Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan (Changed to Uncoordinated)	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Offset Ref. to 2&6 Yellow	Original Timing Plan

Signal Timing Plans - Kennedy Bridge H2H - PM Peak - Maintenance Scenario - Grand Forks

Intersection Name / Timing Plan	Belmont Rd. & 4th Ave. S	5th St. & Bruce Ave.	5th St. & Kittson Ave.	5th St. & Demers Dr.	5th st & 1st Ave. N	5th St. & 2nd Ave. N	5th St. & University Dr.	4th St. & Demers Dr.	4th St. & 1st Ave.	3rd St. & Demers Dr.
Cycle Length	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Offset		44	58	4	37	46	36	10	10	10
Φ1										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ2										
Max. Split	35.0	30.0	40.0	35.0	30.0	40.0	40.0	40.0	34.0	40.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ3										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ4										
Max. Split	35.0	40.0	30.0	35.0	40.0	30.0	30.0	30.0	36.0	30.0
Min. Green	10.0	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Yellow/Red	4.0 / 1.0	3.5 / 1.0	4.0 / 1.0	4.0 / 1.0	5.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0	4.0 / 1.0
Φ5										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ6										
Max. Split		30.0	40.0							
Min. Green		8.0	10.0							
Yellow/Red	/	3.5 / 1.0	4.0 / 1.0	/	/	/	/	/	/	/
Φ7										
Max. Split										
Min. Green										
Yellow/Red	/	/	/	/	/	/	/	/	/	/
Φ8										
Max. Split		40.0								
Min. Green		8.0								
Yellow/Red	/	3.5 / 1.0	/	/	/	/	/	/	/	/
	Original Timing Plan (Changed to Uncoordinated)	Offset Ref. to 4&8 Yellow (Changed from 2&6)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 4 Yellow (Changed from 2)	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow	Offset Ref. to 2 Yellow

Signal Timing Plans - Kennedy Bridge H2H - PM Peak - Maintenance - East Grand Forks

Intersection Name / Timing Plan	Gateway Dr. & Central Ave.	Gateway Dr. & 5th Ave. NE	14th St. & Central Ave.	2nd St. & Demers Ave.	4th St. & Demers Ave.	4th St. & 2nd Ave.	1st St. & 3rd Ave.
Cycle Length	120.0	126.5	109.5	70.0	70.0	68.0	90.0
Offset				15	18		
Φ1							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ2							
Max. Split	40.0	52.5	50.0	30.0	35.0	34.0	55.0
Min. Green	15.0	20.0	20.0	15.0	15.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ3							
Max. Split	20.0						
Min. Green	5.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ4							
Max. Split	45.0	42.5	35.0	40.0	35.0	34.0	35.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ5							
Max. Split	15.0	31.5	24.5				
Min. Green	5.0	5.0	10.0				
Yellow/Red	3.5 / 1.5	3.5 / 3.0	3.0 / 1.5	/	/	/	/
Φ6							
Max. Split	40.0	52.5	50.0	30.0	35.0	34.0	55.0
Min. Green	15.0	20.0	20.0	15.0	10.0	15.0	10.0
Yellow/Red	3.5 / 3.0	6.0 / 1.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
Φ7							
Max. Split	25.0						
Min. Green	10.0						
Yellow/Red	3.5 / 1.5	/	/	/	/	/	/
Φ8							
Max. Split	40.0	42.5	35.0	40.0	35.0	34.0	35.0
Min. Green	15.0	10.0	10.0	15.0	10.0	10.0	10.0
Yellow/Red	4.0 / 2.5	4.0 / 3.5	3.5 / 1.5	3.5 / 1.0	3.5 / 1.5	3.0 / 1.0	3.5 / 1.0
		Original Timing Plan	Original Timing Plan	Offset Ref. to 4&8 Green	Offset Ref. to 4&8 Green	Original Timing Plan	

Mallory Bridge Closed (Maintenance Scenario)

Bridge Closure

- Mn/DOT
  - Contact East Grand Forks, Grand Forks, NDDOT, BNSF, and the media about the closure event.
  - Close the Mallory Bridge (coordinate with East Grand Forks) at MN SH 220 with Type III barricades.
  - Install the appropriate detour signs in East Grand Forks.

Bridge Reopening

- Clean and inspect the Mallory Bridge.
- Remove the Type III barricades and open the Mallory Bridge (coordinate with East Grand Forks).
- Remove the detour signs in East Grand Forks.

The remaining pages of this section contain detailed information regarding the following topics:

- Detour Sign Layouts

Drawn by:
Michael G. Grundman

Reviewed by:
Shawn C. Birst

ADVANCED TRAFFIC ANALYSIS CENTER

Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Mallory Bridge Maintenance Closure

Northbound Traffic

Drawn by:
Michael G. Grundman

Reviewed by:
Shawn C. Birst

ADVANCED TRAFFIC ANALYSIS CENTER

Grand Forks/East Grand Forks Bridge Closure Study

Detour Signing: Mallory Bridge Maintenance Closure

Southbound Traffic