

NORTH/WEST PASSAGE



July 2023

Communicating Route Restrictions to Third Party
Mapping/Navigation Providers

Project 17.4 – FINAL

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Cover photo provided courtesy of the Wyoming Department of Transportation.

1. INTRODUCTION

The North/West Passage (NWP) pooled fund study program focuses on developing effective methods for sharing, coordinating, and integrating traveler information, operational activities, and emerging technologies across state and provincial borders. Membership includes the states of Washington, Idaho, Montana, Wyoming, North Dakota, South Dakota, and Minnesota, as illustrated in Figure 1.

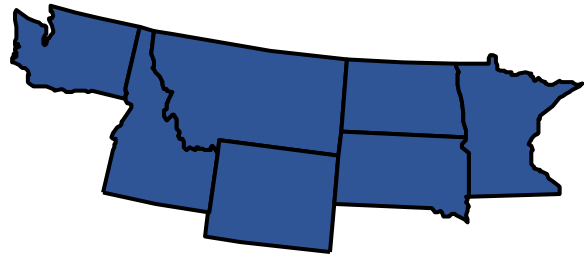


Figure 1: North/West Passage Members

During times when a stretch of highway is closed or when travel delays are excessive, travelers using third party mapping or navigation systems are sometimes advised to divert to routes that are not safe or appropriate for their travel. For example, during a winter storm the diversion routes may not be cleared of snow, the geometry of a local road may not support the size of the vehicle, or other unsafe conditions may exist. These situations have at times resulted in the need for emergency responders to attempt to rescue stranded motorists or for public agencies to manage related disruptions. This challenge could become more widespread as connected and automated vehicles use road closure and delay information to automatically reroute vehicles or advise drivers.

This project documented challenges experienced by NWP members that occur when travelers follow routing advice and divert trips to unsafe routes. The project also engaged with third party mapping and navigation providers to explore potential solutions to avoid or minimize situations where navigation systems advise drivers to divert onto inappropriate routes during highway closures or delays.

The sections of this report include:

- [2. Project Approach](#) – Describes the project tasks taken to complete this project.
- [3. Survey Summary and Challenges Reported](#) – Highlights the challenges NWP members reported related to motorists being routed onto inappropriate routes.
- [4. Outreach to Mapping and Navigation Companies](#) – Summarizes the approach for engaging with mapping and navigation companies and outreach meetings conducted.
- [5. Potential Mitigation Strategies](#) – Documents potential mitigation strategies and solutions as discussed with mapping and navigation companies.
- [Summary and Next Steps](#) – Provides an overview of the findings and recommendations for next steps.
- [Appendix A: Survey Questions](#) – Identifies the questions asked during the outreach survey of NWP members.

Project Purpose

- Document examples of travelers being routed to unsafe routes and the challenges these events create.
- Engage with mapping and navigation providers to explore solutions to mitigate situations where navigation systems advise drivers onto inappropriate routes.

- [Appendix B: Survey Responses](#) – Describes details of the survey responses and anecdotal feedback received from the NWP members.
- [Appendix C: Outreach Document](#) – Includes a two-page summary documenting the Project Background, Project Purpose, and Overview of Challenges.

2. PROJECT APPROACH

A series of tasks were completed for this project to prepare for and engage with third party mapping and navigation providers to explore potential solutions to avoid or minimize situations where navigation systems advise drivers to divert onto inappropriate routes during highway closures or delays.

An online survey was developed and sent to NWP member agencies to gather input on challenges experienced when navigation systems (e.g., equipped in the vehicle or on mobile devices operating in the vehicle) route motorists onto inappropriate routes.

Using the challenges defined through the survey, an outreach document (see [Appendix C](#)) was prepared and meetings with representatives from mapping and navigation providers were conducted to share challenges and facilitate discussions regarding potential mitigation strategies.

As a result of the outreach and discussions with mapping and navigation providers, several potential mitigation strategies were documented in [Section 5](#) of this document.

The final project task produced this document to summarize the information gathered.

See Figure 2 for the overall project approach.

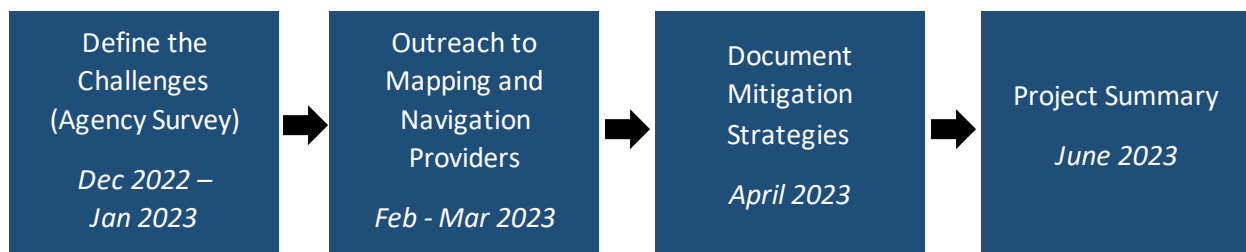


Figure 2: Project Approach

3. SURVEY SUMMARY AND CHALLENGES REPORTED

In order to understand this issue of travelers being routed to unsafe roads from the perspective of State Department of Transportation’s (DOTs), an online survey was sent to NWP member agencies to gather input on challenges experienced, the extent of disruptions, and resulting impacts. NWP members were asked to complete the survey and distribute it to their traveler information managers, state patrol, operations staff, and others in their agency who may have observed situations where navigation systems likely advised drivers onto an inappropriate route. The survey questions can be found in [Appendix A](#). [Appendix B](#) provides a summary of the survey responses received.

3.1 Respondents

Twenty-six (26) respondents from all seven of the NWP member states completed the survey. Within the seven states responding, a total of 10 entities were represented in the responses. See Table 1.

Table 1: Survey Respondents

State	Number of Responses (Entities)
Minnesota	1 (Minnesota DOT)
Montana	1 (Montana DOT)
North Dakota	8 (North Dakota DOT – 3, North Dakota Department of Emergency Services – 1, North Dakota State Highway Patrol – 3, North Dakota State Radio – 1)
South Dakota	10 (South Dakota DOT)
Idaho	1 (Worley Highway District)
Wyoming	1 (Wyoming DOT)
Washington	3 (Washington State DOT)
Not indicated	1
Total = 7 States	Total = 26 responses from 10 entities

3.2 Observations from Survey Responses

Observations from the survey responses include:

- Most challenges reported occurred during winter weather events (e.g., snow, ice, low visibility) when the primary route was closed.
- Relative to challenges experienced during winter weather events:
 - Motorists at times told law enforcement or DOT personnel that they had followed navigation system guidance onto roads where they became stranded.
 - When road weather conditions are bad enough to warrant interstate closures, the secondary road system is worse, and traffic should not be routed onto these secondary roads.
 - Rerouting traffic off interstates puts others at risk by requiring response personnel to rescue motorists from secondary roads.

When road weather conditions are bad enough to warrant interstate closures, the secondary road system is worse, and traffic should not be routed onto these secondary roads.

- These situations often divert resources (e.g., snowplow operators) off the primary route to assist motorists on secondary routes, further contributing to deteriorating road conditions and delay in re-opening primary routes.
- When closures due to road work resulted in motorists being routed onto secondary roads, local communities often reported experiencing more overall traffic and/or increased truck traffic.
- There were some instances of travelers taking routes with inadequate road geometries, for example when a semi-truck was routed through a single-lane tunnel, requiring agency personnel to stop traffic to help turn the truck around.
- The impact of each situation reported was most often indicated as “significant.”
- Many respondents reported specific locations where the instances occurred, often citing multiple instances when the same challenge or situation occurred.

3.2.1 Situations and Challenges Described

The survey also provided an opportunity for respondents to provide details about each situation they had encountered where their agency had observed that a navigation system had likely advised travelers to an inappropriate route.

Selected examples from the survey responses describing a range of situations and challenges encountered are noted below:

Example #1: Severe Weather Winter

- **Issue:** In December 2022, during a winter weather event that included snow, ice, high wind, low visibility, and sub-zero temperatures, the South Dakota DOT worked with emergency response partners to rescue multiple stranded motorists who reported following navigation guidance that routed them from I-90 and other state routes onto impassible routes due to snow.
- **Impact:** More than 20 vehicles in central and southwestern South Dakota became stranded on secondary routes, requiring assistance from emergency responders.
- **Significance:** The impact was significant as it caused the traveling public to become stranded on county roads and secondary highways in blizzard conditions and sub-zero temperatures. This caused numerous people to risk their lives trying to rescue them.

Example #2: Highway Patrol Commander Perspective

- **Issue:** Mapping software is taking motorists onto county, township, and minimum maintenance roadways. Highway Patrol have rescued motorists who have shown the map routes they were following. It often requires North Dakota DOT staff, law enforcement, and wreckers to travel to get to these motorists. Some needed to be rescued by snowmobile.
- **Impact:** The impact is significant in terms of the need to rescue. This has played out hundreds of times over the past three years. It is a constant problem during each closure event.
- **Significance:** Resources are taken away from the primary route to secondary routes. At times the Highway Patrol can't reach motorists that have ventured off the primary route. This issue puts

many people at risk, including those following the routes being generated and those who rescue stranded motorists.

Example #3: Construction Project

- **Issue:** A construction project in Minnesota had a detour in place, however the alternate route advised by a navigation system went through a local city. In a separate instance, vehicles were routed into another work zone on the alternate route.
- **Impact:** On multiple occasions, the Minnesota DOT was contacted because the route advised by the navigation system through a city could not support the increased traffic
- **Significance:** One instance generated a significant number of complaints from residents in a neighborhood that had semi-truck traffic driving through it, which led to negative TV stories. In another instance, vehicles following navigation systems were rerouted into a separate work zone where 15-minute delays were turned into 45-minutes.

Example #4: Semi-truck Stuck in Single Lane Tunnel

- **Issue:** Navigation systems have advised semi-trucks to take SD87 in South Dakota from the junction of US16 to Custer. This route has a width of 22' with several switchbacks and a single lane tunnel (Hood Tunnel).
- **Impact:** There have been multiple occasions that have resulted in semi-trucks being unable to maneuver through the route (tunnel) and stopping other surrounding traffic.
- **Significance:** Getting the trucks turned around was very disruptive. All other traffic had to be stopped for more than 60 minutes while the truck was turned around or backed out of the area.

Example #5: Closure Status Not Updated

- **Issue:** Navigation systems did not update to reflect the status of a closure.
- **Impact:** In Montana, a seasonal closure was not reflected in a navigation system, therefore vehicles were routed onto the closed, unmaintained road. In Washington State, a section of highway that had previously been closed due to a snow event had reopened, but the navigation system continued to direct traffic to take a 22-mile detour route on county roads.
- **Significance:** Navigation systems that operate with inaccurate closure information can route motorists toward unsafe road conditions and unnecessarily long detours.

Example #6: Trucks Routed Off the Interstate

- **Issue:** Trucks have been routed off the interstate and through towns and narrow streets due to navigation systems looking for shorter routes.
- **Impact:** This situation occurs daily on SH-46 and US-30 (Idaho) when trucks are traveling on the interstate heading to Nevada.
- **Significance.** This is significant because large trucks end up traveling through small towns and down narrow roads.

4. OUTREACH TO MAPPING AND NAVIGATION COMPANIES

This section provides an overview of outreach conducted with mapping and navigation companies to share challenges experienced by State DOTs and their public safety partners when navigation systems advise drivers to divert onto inappropriate routes during highway closures or delays.

Using results from the survey summarized in [Section 3](#), a two-page outreach document was prepared which summarized challenges experienced and specific instances where State DOTs, emergency responders, and motorists had been adversely impacted by being routed by navigation systems onto routes that were not appropriate, for instance when roads were impassible due to snow or inadequate geometry to support various vehicle types. See [Appendix C](#) for the two-page outreach document.

The following established commonly used mapping and navigation companies were invited to participate in outreach meetings or discussions with the research team: Waze, Google, Apple, TomTom, and Here Technologies.

Objectives of engaging with the mapping and navigation companies during these meetings were to:

- Share the purpose of this project effort;
- Share challenges experienced by transportation agencies and emergency responders; and
- Collectively brainstorm and discuss potential mitigation strategies.

Representatives from two mapping and navigation companies participated in the outreach webinars. Both companies represented solutions for general travelers that were not specific to a particular transportation sector.

The meetings resulted in several mitigation strategies and potential solutions being suggested and discussed. The potential mitigation strategies that were determined to be the most feasible and impactful are documented in [Section 5](#) of this report.

Items to note from the discussions include:

- Both mapping/navigation companies sharing their input suggested **including an additional phrase with the road closure report such as “do not reroute”** to advise when local rerouting should not occur. This was identified as a solution that could be activated during winter weather events (addressing challenges above) and also omitted during non-winter closures when local re-routing is appropriate.
- Mapping/navigation companies pull in live DOT feeds. However, the feeds usually provide information for major highways and interstates, not local or county roads. **It would be beneficial for routing to have additional data (e.g., closures) from local agencies.**
- It is important that the mapping/navigation companies verify the feeds each state provides to ensure they have all relevant information. **A list of all data feeds in the NWP corridor together with contact information for each NWP member agency is desired.**
- Travelers use a variety of apps for maps and navigation. **There are challenges with some apps used by travelers that don’t use live map information.**

- Within the NWP states there are many challenges with **not having good or reliable cell service in rural areas when using apps**. With data roaming, information may be static. So even if there was an urgent closure, without good cell service it may not show in the app used by the traveler.
- Mapping/navigation companies classify roads. The classification is typically used as routes are determined. For example, an unpaved road may not be classified or have a low classification to avoid travelers driving down these roads. **Reclassification of unsafe routes could assist in rerouting traffic to preferred routes**. The base map used by mapping/navigation companies would need to be updated to align with the assigned functional road class.
- Mapping/navigation companies may look at press releases to understand and update maps based on seasonal closures. Having a **streamlined process of seasonal closure information** for mapping/navigation companies is desired to assist with routing travelers.
- Many apps that are developed utilize base map information from mapping providers, however it is then up to that app developer to develop algorithms to route traffic. There are also **challenges with map updates**. An app developer may purchase once a year, so updates may not occur regularly.
- Mapping and navigation companies do not typically use the same Linear Reference Systems (LRS) that DOTs typically use (e.g., mile points or mile markers). **Lat/long indications of starting and ending points of events together with road names are preferred by mapping/navigation companies**.
- A **standard format for how each DOT provides information** is desired by mapping/navigation providers.
- There are different vehicle categories. Mapping and navigation companies could (and some do) provide truck specification restrictions, however those using the app need to ensure they are using the trucker specific app.
- If a primary route is closed during a snow weather event, it is assumed that the other roads (e.g., state roads, county roads, local roads) are impacted by the snow as well. Highways and interstates are typically plowed first during a snow event and local routes after. **A warning could be issued from the base map mapping/navigation providers that if a primary network is closed, the secondary routes are also impacted by the snow event, even if they are not formally closed.**

5. POTENTIAL MITIGATION STRATEGIES

In order to mitigate the risks of navigation systems routing drivers onto inappropriate roads, three conceptual approaches were identified:

- **Advise drivers of safe and appropriate diversion.** With the winter weather or roadwork related closures described above, there are safe alternate routes usually available if the driver and vehicle divert their travel far enough upstream of the event to circumvent the event.
- **Advise drivers to wait out events.** Often the safest solution is to wait for a winter weather event to end or for primary roads to be cleared and reopened. This may involve drivers delaying trip departures, waiting at a safe location for roadways to reopen, or turning around and returning to their origin to cancel or delay the trip.
- **Inform drivers of diversion route issues.** DOTs could provide information through outreach mechanisms (e.g., website, press releases) of other state DOT traveler information sources including local signing to consider in addition to navigation systems when traveling through an event.

This section describes two mitigation strategies identified and implemented by Wyoming DOT to address the challenges, as well as three potential mitigation strategies that were identified through the outreach with the mapping and navigation companies described in [Section 4](#).

Mitigation Strategy #1: Wyoming Outreach and Local Signing. After rescuing numerous stranded vehicles stuck in snow drifts during severe winter weather events, Wyoming DOT (WYDOT) has taken steps to help mitigate the issue. A video, [Choose Your Routes Wisely](#), produced by WYDOT provides outreach to educate the general public about this issue. In some locations, advisory signs are posted at road closure gates advising motorists to avoid following GPS navigation guidance. WYDOT also has the ability to link local road closures to their official mapping system and is finalizing agreements to feed their mapping data into several common GPS navigation systems. Other NWP states could adopt a similar approach of Internet outreach and local signing to mitigate the challenges described above.

Mitigation Strategy #2: Wyoming collaboration with local agencies to describe roads as closed electronically. WYDOT has also piloted a program that works with counties on an approach that is used when it is not safe or appropriate for vehicles to reroute onto local roads. The local roads are posted to mapping and navigation companies as closed even though no physical barriers are deployed on the roads stopping vehicles from entering. This approach creates a situation where the navigation companies recognize the local roads as closed and no longer recognize the local roads as alternates and the result is either detours that start further upstream or no recommended detours. The NWP states could individually or as a corridor consider this approach for mitigating the challenges described above. State DOTs along the corridor could reach similar agreements with counties and cities to identify parallel local roads as closed to mapping and navigation companies when Interstates or other routes are closed.

Mitigation Strategy #3: Additional Message Phrases or Event Attributes. A common suggestion from webinars conducted with both mapping/navigation providers was the concept of providing additional real-time messages with the road closure or event reports such as “Do not reroute.” This could be accommodated by DOT staff that enter information into a traveler information system selecting different

event attributes to describe the situation. In this approach, an attribute phrase could be added to the event description such as “Do not reroute” to alert the navigation and mapping companies not to perform local re-routing around this closure. When navigation systems recognize this phrase, they could possibly display a warning message to drivers and/or provide information about why local re-routing is not advised (such as a description that snow removal on local streets has not yet occurred).

Several concepts have been discussed surrounding this possible mitigation approach:

- Existing phrases as a possible solution. Discussions about this mitigation strategy explored the concept of using existing standardized phrases in the Institute of Transportation Engineers (ITE) Traffic Management Data Dictionary (TMDD), such as “no suitable detour available” or “no detour available.” However, discussions among the North/West Passage members identified concerns with adding these phrases to the description of the event as it would be telling the drivers there are no alternate routes when there are always alternate routes, they just might be further upstream and create longer paths of travel.
- A new approach to communicating with mapping/navigation providers. After the discussion about using existing phrases, the concept emerged that this mitigation strategy is more about communicating with the mapping and/or navigation provider (i.e., recommending the navigation system not reroute locally) and not about communications with the driver. This effectively creates a situation much like a connected vehicle, where data and messages communicate to an in-vehicle application not to the driver. In this situation, a message delivered to the navigation system could advise it not to reroute onto local roads, and the data exchange might result in these messages not being displayed to the drivers. FHWA is developing an overall national strategy for roadway digital infrastructure and this concept (i.e., communicating with mapping/navigation providers) can be introduced to this process. Further, connected vehicle standardized messages (e.g., the Traveler Information Message (TIM) could be used to communicate to the mapping/navigation companies and also used for broadcast by any roadside units (RSUs) deployed along the roadway.
- What are the alternatives to rerouting locally? The next question would be what additional information would benefit the navigation systems in these situations. One option might be:
 - Identification of the nearest upstream diversion point. If a message of “do not reroute locally” was delivered, it might support safe navigation if it was accompanied with the upstream intersection or exit that does offer the start of a safe and appropriate alternate route. Navigation systems could elect to route drivers onto this route as they approach it or could advise drivers to turn around and return to this location if they have already passed this alternate route.
- Additional phrases only in selected events. An advantage to this approach would be that in situations where local detour routes are appropriate (e.g., an Interstate closure for roadwork during non-winter months) DOTs might not send this supporting message and navigation systems might successfully route drivers onto local detours. This approach would give agencies the flexibility to select when local detours are not appropriate.

Mitigation Strategy #4: Road Reclassification. During the outreach with mapping and navigation companies, feedback suggested that some mapping and navigation companies classify roads for use in determining the best route for a traveler. In this strategy, the DOTs could work with the mapping and navigation providers to identify a universal approach to classifying which roads are not appropriate alternates to selected highways (e.g., if Classification A is closed due to a winter snow event, assume Classification B are impacted by the event as well). These classifications could then be available to mapping and navigation companies to support their routing algorithms.

Mitigation Strategy #5: Season Closure Information Exchange. Many agencies routinely provide seasonal closures. Mapping or navigation companies may have to review press releases each year to identify these closures. In this strategy, a series of routes not to be used as diversion routes due to seasonal closures could be developed by DOTs and posted for ingest by mapping or navigation companies. It is desired by mapping and navigation providers to include latitude/longitude locations with the seasonal closures to ensure the exact location is reflected on the base map. Mapping and navigation companies typically do not use LRS.

In addition to the mitigation strategies, to ensure mapping and navigation companies have all state DOT data feeds it was suggested to provide a contact or a link to the location in each NWP state for mapping and navigation companies to request this information.

6. SUMMARY AND NEXT STEPS

This project documented NWP members challenges with travelers routed to unsafe routes and engaged with third party mapping and navigation providers to explore potential solutions to avoid or minimize situations where navigation systems advise drivers to divert onto inappropriate routes during highway closures or delays.

NWP Challenges

Following are challenges that NWP members noted with travelers being routed onto unsafe routes.

- Most challenges reported occurred during winter weather events (e.g., snow, ice, low visibility) when the primary route was closed.
- Relative to challenges experienced during winter weather events:
 - Motorists at times told law enforcement or DOT personnel that they had followed navigation system guidance onto roads where they became stranded.
 - When road weather conditions are bad enough to warrant interstate closures, the secondary road system is worse, and traffic should not be routed onto these secondary roads.
 - Rerouting traffic off interstates puts others at risk by requiring response personnel to rescue motorists from secondary roads.
 - These situations often divert resources (e.g., snowplow operators) off the primary route to assist motorists on secondary routes, further contributing to deteriorating road conditions and delay in re-opening primary routes.
- Challenges related to non-winter weather events occur when closures due to road work result in motorists being routed onto secondary roads. Local communities often reported experiencing more overall traffic and/or increased truck traffic. There were some instances of travelers taking routes with inadequate road geometries. For example, a semi-truck routed through a single-lane tunnel required agency personnel to stop traffic to help turn the truck around.
- The impact of each situation reported was most often indicated as “significant”.
- NWP members reported specific locations where instances occurred, often citing multiple instances when the same challenge or situation occurred.

Potential Mitigation Strategies

Five potential mitigation strategies were defined above, two of which have already been implemented by WYDOT and could be expanded to other NWP states, and three that were identified based on input from mapping/navigation companies and input from NWP members. These mitigation strategies include:

- Mitigation Strategy #1: Wyoming Outreach and Local Signing;
- Mitigation Strategy #2: Wyoming collaboration with local agencies to describe roads as closed electronically;
- Mitigation Strategy #3: Additional Message Phrases or Event Attributes;
- Mitigation Strategy #4: Road Reclassification; and

- Mitigation Strategy #5: Season Closure Information Exchange.

In addition to the mitigation strategies, to ensure mapping and navigation companies have all state DOT data feeds, it was suggested to provide a contact or a link to the location in each NWP state for mapping and navigation companies to request this information.

Next Steps

The NWP members have approved another effort to this project (Project 18.3 Providing Recommended Routes to Mapping and Navigation Companies When There is Closure on the Primary Route) that will allow members to explore the documented mitigation strategies and engage a broader group of state DOTs. Mitigation strategies #3-#5 would all benefit if they were implemented nationally, with consistent communications to mapping/navigation providers that typically offer continental-wide navigation services. This project was presented on a national webinar of the AASHTO Committee of Transportation System Operations (CTSO) Community of Practice (COP) on Traveler Information in June 2023, and there was discussion and interest among members. In addition to this group, a future effort could seek to engage with ongoing FHWA efforts to develop a national strategy on roadway digital infrastructure.

Ultimately, it will be beneficial if there are mitigation approaches that each state and/or local agency can implement, when appropriate, while remaining consistent with an overall national approach.

Appendix A: Survey Questions

QUESTION 1: Contact Information (to be utilized if clarification or additional information on an answer is needed).

- Name:
- Agency:
- Email:

QUESTION 2: Have you encountered a situation where your agency has observed that a navigation system has likely advised travelers to an inappropriate route (e.g., roadway geometry doesn't support the vehicle size, route as not been cleared of snow, route goes through a local town or city)?

- Yes (*Go to QUESTION 3*)
- No (*Go to QUESTION 13*)

The North/West Passage Pooled Fund Study is interested in looking at situations where a navigation system has likely advised travelers to an inappropriate route under the following circumstances:

- There was a closure on the primary route (e.g., freeway, highway) and a defined detour route was in place.
- There was a closure on the primary route (e.g., freeway, highway) but a defined detour route was NOT in place.
- The primary route (e.g., freeway, highway) was experiencing travel delays.

The following questions will address each of these circumstances independently and provide an opportunity to expand on any other reasons that a navigation system may have advised travelers to an inappropriate route.

QUESTION 3: (NOTE: Ask Questions 4 – 13 for each situation below selected as Yes).

- Have you encountered any situations where a navigation system may have advised travelers to an inappropriate route due to a closure on the primary route (e.g., freeway, highway) while a defined detour route was in place?
 - Yes (*GO TO QUESTION 4*)
 - No (*Repeat QUESTION 3 for the next situation*)
- Have you encountered any situations where a navigation system may have advised travelers to an inappropriate route due to a closure on the primary route (e.g., freeway, highway) but a defined detour route was NOT in place?
 - Yes (*GO TO QUESTION 4*)
 - No (*Repeat QUESTION 3 for the next situation*)
- Have you encountered any situations where a navigation system may have advised travelers to an inappropriate route when the primary route (e.g., freeway, highway) was experiencing travel delays?
 - Yes (*GO TO QUESTION 4*)
 - No (*repeat QUESTION 3 for the next situation*)

- Are you aware of any other situations where a navigation system may have advised travelers to an inappropriate route?
 - Yes. Please describe the situation where a navigation system advised travelers to an inappropriate route. (*Go TO QUESTION 4*)
 - No (*Go TO QUESTION 14*)

QUESTION 4: What event caused the closure or delay on the primary route?

- Weather event (*GO TO QUESTION 5*)
- Maintenance activity (*GO TO QUESTION 7*)
- Construction. (*GO TO QUESTION 7*)
- Crash or similar disruptive incident. (*GO TO QUESTION 7*)
- Recurring congestion. (*GO TO QUESTION 7*)
- Other. Please describe. (*GO TO QUESTION 7*)

QUESTION 5: What is the likely reason(s) that a navigation system advised travelers to an inappropriate route due to a WEATHER EVENT? Select all that apply.

- Navigation systems do not receive reports for parallel routes operated by a city or county and therefore assumed a clear route on a parallel route.
- The parallel route advised by a navigation system is operated by a city or county and the weather response plan is not the same as a primary route (e.g., highway or freeway). For example, the primary route may be cleared of snow, but the parallel route has not been cleared.
- The alternate route advised by a navigation system goes through a local town or city that cannot support the increased traffic.
- The alternate route advised by a navigation system does not support all types of vehicles.
- The alternate route advised by a navigation system is shorter than the DOT defined route.
- The base map used by a navigation system is not correct.
- Other. Please describe.

QUESTION 6: What were the weather conditions?

- Snow
- Ice
- Rain
- Other. Please describe.

GO TO QUESTION 8.

QUESTION 7: What is the likely reason(s) that a navigation system advised travelers to an inappropriate route? Select all that apply.

- Navigation systems do not receive reports for parallel routes operated by a city or county and therefore assumed a clear route on a parallel route.

- The alternate route advised by a navigation system goes through a local town or city that cannot support the increased traffic.
- The alternate route advised by a navigation system does not support all types of vehicles.
- The alternate route advised by a navigation system is shorter than the DOT defined route.
- The base map used by a navigation system is not correct.
- Other. Please describe.

GO TO QUESTION 8.

QUESTION 8: How were you made aware of the situation where a navigation system advised travelers to an inappropriate route (e.g., roadway geometry doesn't support the vehicle size, route has not been cleared of snow, route goes through a local town or city)?

- Communication from a city or county
- Travelers contact DOT
- Observation by DOT traffic operations staff (e.g., monitoring congestion maps)
- Observation by DOT field staff
- Other. Please describe.

QUESTION 9: How often has this situation of where a navigation system advised travelers to an inappropriate route occurred in the past 3 years?

- 1 time
- 2 – 3 times
- 4 – 6 times
- More than 6 times
- Other. Please describe.

QUESTION 10: How impactful was the situation?

- Minor.
- Moderate.
- Significant.
- Other.

Please describe the situation and its impact.

QUESTION 11: Please describe the location and the month and year that this situation occurred. Describe each separate location if this situation has occurred more than once.

QUESTION 12: Are there photos available to assist in illustrating the situation of where a navigation system advised travelers to an inappropriate route?

- Yes. Please provide information for who to contact to request a photo.
- No

QUESTION 13: Has your agency established conversations, agreements, or procedures with any mapping or navigation companies?

- Yes. Please describe.
- No

QUESTION 14: Is there any additional information you would like to provide for the project to consider as the North/West Passage Pooled Fund Study documents situations where navigation systems may advise drivers onto inappropriate routes?

Appendix B: Survey Responses

Survey Respondents

Twenty-six (26) respondents from all seven of the NWP member states completed the survey. Within the seven states responding, a total of 10 entities were represented in the responses. See Table B-1.

Table B-1: Survey Respondents

State	Number of Responses (Entities)
Minnesota	1 (Minnesota DOT)
Montana	1 (Montana DOT)
North Dakota	8 (North Dakota DOT – 3, North Dakota Department of Emergency Services – 1, North Dakota State Highway Patrol – 3, North Dakota State Radio – 1)
South Dakota	10 (South Dakota DOT)
Idaho	1 (Worley Highway District)
Wyoming	1 (Wyoming DOT)
Washington	3 (Washington State DOT)
Not indicated	1
Total = 7 States	Total = 26 responses from 10 entities

Situations Encountered

Survey respondents were asked whether they have encountered any situations where a navigation system may have advised travelers to an inappropriate route (e.g., roadway geometry doesn't support the vehicle size, route as not been cleared of snow, route goes through a local town or city). All 26 respondents answered "yes" to this question.

Types of Situations Encountered

Next, survey respondents were asked to answer the following questions to indicate each type of situation they had encountered where a navigation system may have advised travelers to an inappropriate route. See Figure B-1.

- **Closure and defined detour route WAS in place.:** Have you encountered any situations where a navigation system may have advised travelers to an inappropriate route due to a closure on the primary route (e.g., freeway, highway) while a defined detour route was in place? 15 "yes" responses.
- **Closure and defined detour route was NOT in place:** Have you encountered any situations where a navigation system may have advised travelers to an inappropriate route due to a closure on the primary route (e.g., freeway, highway) but a defined detour route was NOT in place? 18 "yes" responses.
- **Travel delays:** Have you encountered any situations where a navigation system may have advised travelers to an inappropriate route when the primary route (e.g., freeway, highway) was experiencing travel delays? 8 "yes" responses.
- **Any other situation:** Are you aware of any other situations where a navigation system may have advised travelers to an inappropriate route? 7 "yes" responses.

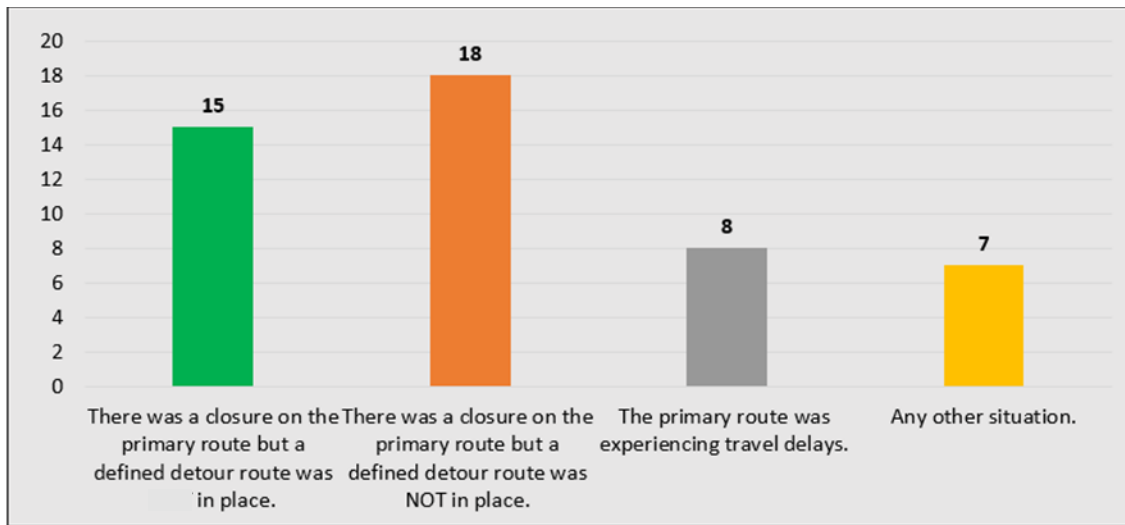


Figure B-1: Types of Situations Where Navigation Systems May Have Advised Travelers to an Inappropriate Route

Responses for “any other situation” included routing travelers onto gravel roads, farm roads, or onto roads with geometries that could not accommodate semi-trucks such as a low bridge, narrow streets, and a single-lane tunnel. Specific responses for “any other situation” included:

- Trucks have been routed off the interstate and through towns and narrow streets due to navigation looking for shorter routes.
- Navigation systems have advised semi-trucks onto a route with 22' width, several switchbacks, and a single lane tunnel. Getting the trucks turned around is very disruptive.
- Unsure if navigation is responsible, but a semi took a gravel road and got stuck.
- Low bridge on a route.
- There is a direct State Highway System route, yet navigation system routes drivers onto rural and farm roads.
- When an interstate has a forced closure, traffic will take a parallel US Highway.
- A previously closed section of highway had reopened to traffic but the navigation system had not updated and continued to direct traffic to the detour.

Details of Situations Encountered

A series of follow-up questions gathered details about each situation where respondents indicated a navigation system may have advised travelers to an inappropriate route. Follow-up questions asked about the type of event that caused the closure or delay (e.g., weather event, construction, crash, congestion), the likely reason(s) navigation systems advised travelers to an inappropriate route, how often the situation has occurred, how they were made aware of the situation, significance of the impact, and details about the event such as date and location it occurred.

Type of Event that Caused the Closure or Delay on the Primary Route

When asked what type of event caused the closure or delay on the primary route, most responses (33 responses) indicated that it was a weather event. See Figure B-2.

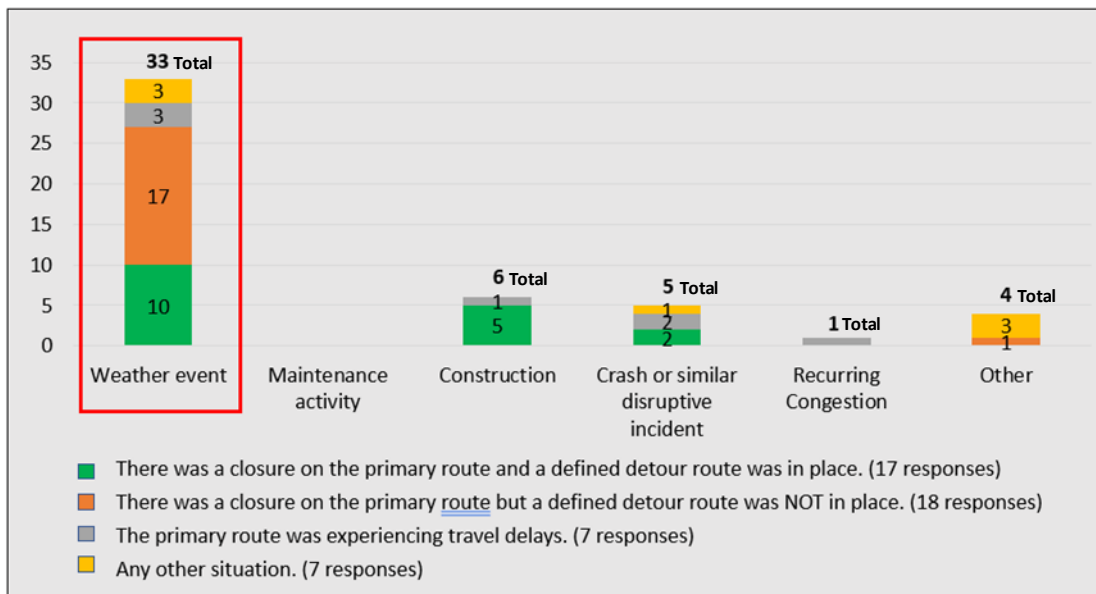


Figure B-2: Events that Caused the Closure or Delay on the Primary Route

The weather conditions associated with weather events were predominantly indicated as snow (22 responses) and other types of winter weather conditions (9 responses) such as snow, ice, low visibility, blowing snow, and snow-blocked roadways. See Figure B-3.

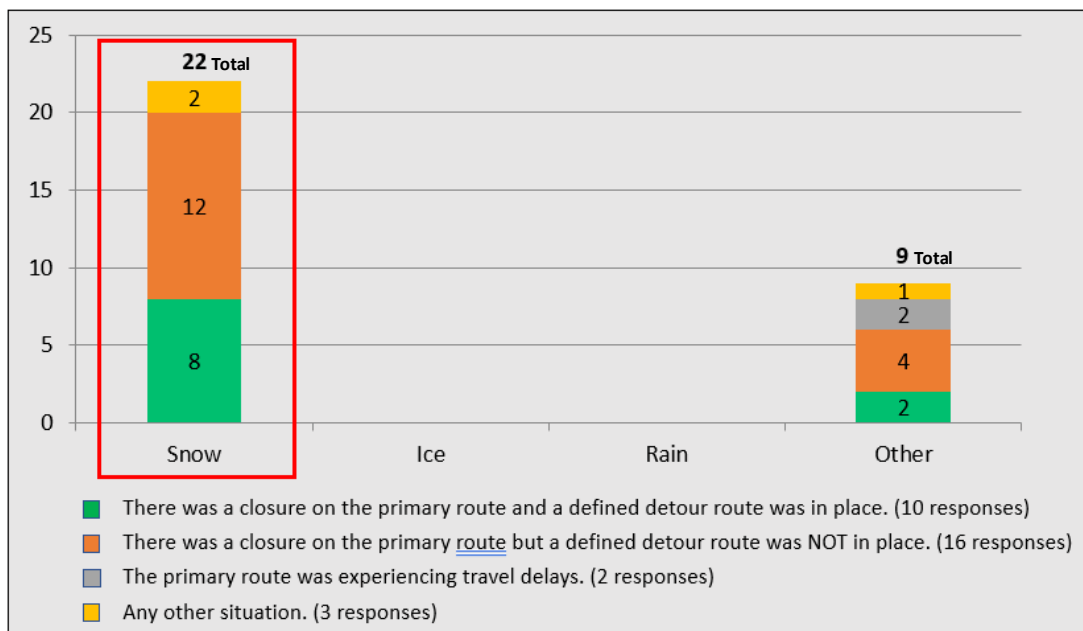


Figure B-3: Weather Conditions for Weather Events that Caused Closures or Delays on the Primary Route

Likely Reason(s) Navigation Systems Advised Travelers to Inappropriate Routes

Survey respondents were asked to indicate the likely reason(s) that a navigation system advised travelers to an inappropriate route, selecting all that applied from the following options:

- Navigation systems do not receive reports for parallel routes operated by a city or county and therefore assumed a clear route on a parallel route. (*Weather events only*)
- The alternate route advised by a navigation system goes through a local town or city that cannot support the increased traffic.
- The alternate route advised by a navigation system does not support all types of vehicles.
- The alternate route advised by a navigation system is shorter than the DOT defined route.
- The base map used by a navigation system is not correct.
- Other. Please describe.

Likely Reasons During Weather Events

For weather events, the most likely reasons why a navigation system advised travelers to in inappropriate route were “navigation systems do not receive reports for parallel routes operated by a city or county and therefore assumed a clear route on a parallel route” (20 responses) and “the alternate route advised by a navigation system goes through a local town or city that cannot support the increased traffic” (16 responses). See Figure B-4.

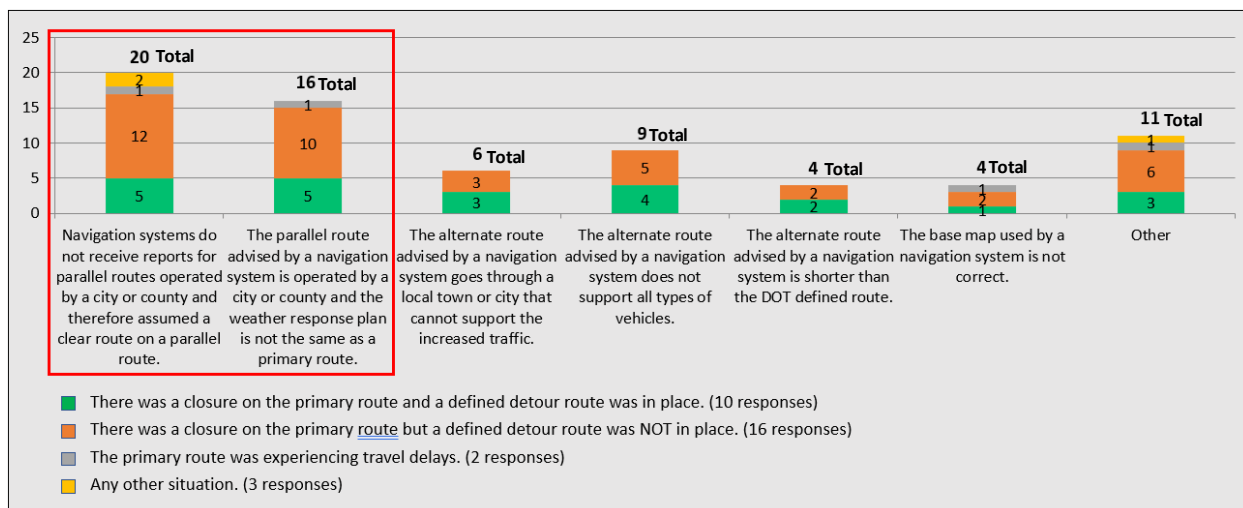


Figure B-4: Likely Reason(s) Navigation Systems Advised Travelers to Inappropriate Route (Weather Event)

Descriptions of “other” likely reasons a navigation system advised travelers to inappropriate routes during a weather event included:

When there was a closure on the primary route and a defined detour route WAS in place:

- The parallel and alternate routes advised by a navigation system were as bad or worse than the closed Interstate.
- The navigation system just picked up on the Interstate being closed and assumes other routes are ok if not marked closed, when in fact they are not ok.
- The navigation apps are aware of the road closure point and are routing traffic around the road closure point, onto the local network, and back onto the primary route where there is not a hard closure (non-gate locations).

When there was a closure on the primary route, but a defined detour route was NOT in place:

- The navigation system is rerouting travelers to adjacent state highways that are marked as impassable due to snowdrifts and stuck vehicles. Navigation apps seem to reroute travelers to these routes being they are not enforceable road closures like on the Interstate system.
- Interstate closed, all other routes marked as no travel advised.
- We had people getting stranded on county roads, because the state highways were impassable due to snow. Also, the reroutes from I-90 were sending people on secondary routes that were getting stuck because they were impassible.
- The system simply selected another route which ran parallel to I-90.
- Interstate closures due to weather events are well documented. The secondary routes may or may not be marked as closed. Third party navigation providers may or may not use the secondary route information.

When the primary route was experiencing travel delays:

- I believe when they departed their intended route, they were redirected by their navigation device.

Other Situations:

- I would assume the navigation system failed to receive or register that the previously closed section of highway had reopened.

Likely Reasons During Non-Weather Events

For non-weather events (construction, crash or similar disruptive incident, or other), the most likely reasons why a navigation system advised travelers to in inappropriate route were “the alternate route advised by a navigation system does not support all types of vehicles” (7 responses), “the alternate route advised by a navigation system is shorter than the DOT defined route” (6 responses) and “other” (8 responses). See Figure B-5.

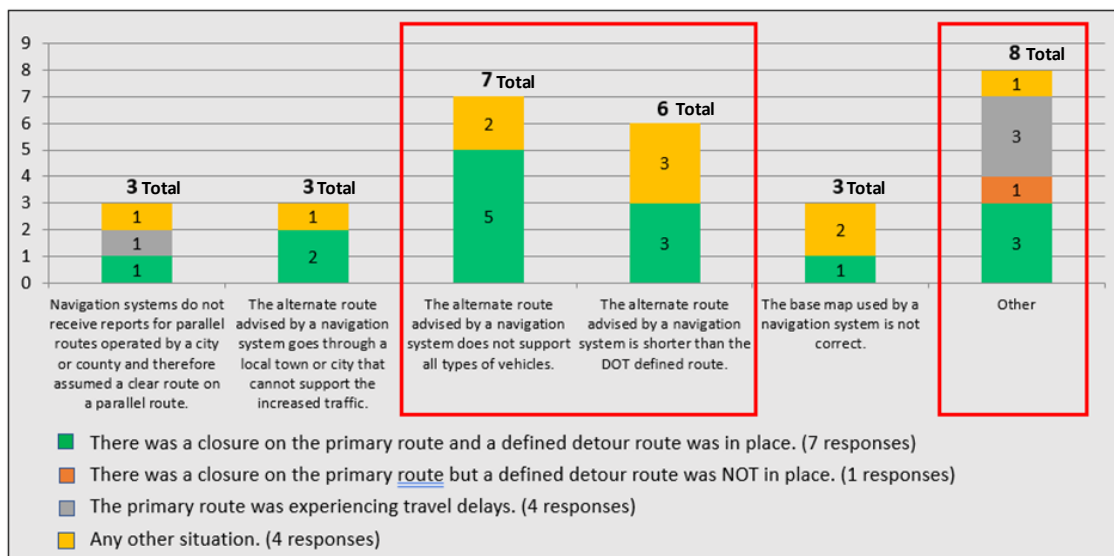


Figure B-5: Likely Reason(s) Navigation Systems Advised Travelers to Inappropriate Route (Non-Weather Event)

Descriptions of “other” likely reasons a navigation system advised travelers to inappropriate routes during a non-weather event included:

When there was a closure on the primary route and a defined detour route WAS in place:

- DOT detours use state routes. Often the designated state route detours are longer than using local roadway networks. Navigation systems find shorter local routes that might not support the intended traffic or vehicles.
- The detour was significantly different (distance) from the normal path and determined the traditional path was closed.
- The navigation companies use probe data to determine closures and are not able to account for head-to-head traffic for construction events on interstates. Because their probes do not go on the ribbon of road they expect, they conclude that the road is closed.

When there was a closure on the primary route, but a defined detour route was NOT in place:

- Navigation system did not update for the seasonal closure.

When the primary route was experiencing travel delays:

- The route given was still part of the scene.
- Locals don't like the alternate path provided by navigation.

Other Situations:

- Shortest distance as opposed to the shortest travel time.

Frequency of Situations

For each situation noted, respondents were asked to indicate how often the situation where a navigation system advised travelers to an inappropriate route had occurred in the past three years. Most responses indicated “more than 6 times” (14 responses), “2-3 times,” (12 responses) and “other” (11 responses). See Figure B-6.

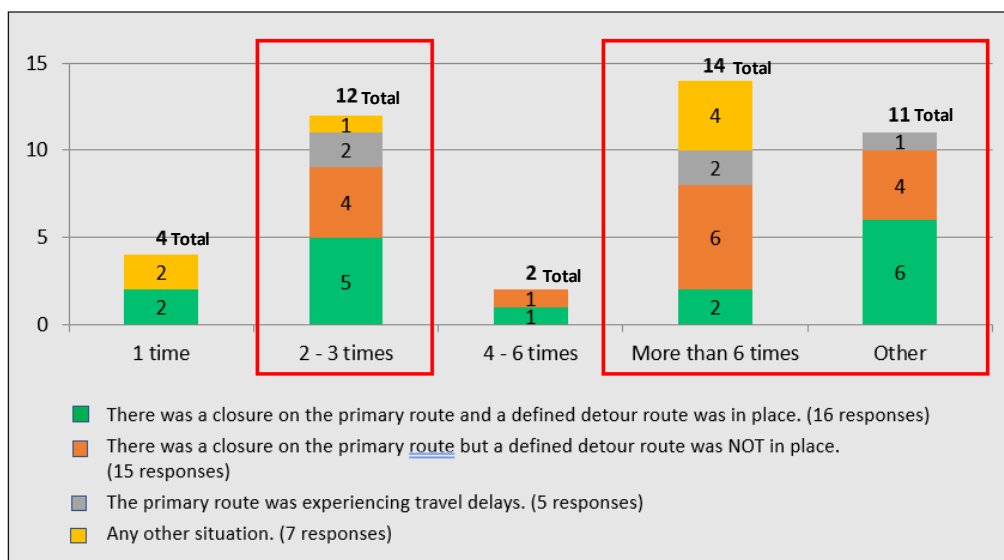


Figure B-6: Frequency of Situations Occurring in the Past Three Years

Descriptions of “other” responses included:

When there was a closure on the primary route and a defined detour route WAS in place:

- Over 50 times.
- I am the commander of the SE Region of the ND Highway Patrol. We have seen this play out hundreds of times over the past three years. It is a constant problem during each closure event.
- During the last closure event, there were 22 vehicles in one county that were stranded. I believe 9 of them required search and rescue operations. This is a very common occurrence.
- My experiences are more than 3 years ago, but I encountered this at least twice.
- Hard to say as people use this as a response to us when we ask why did you take this when the interstate was closed. This may be the system and it may be them lying to us.
- How often it happens, I don't have a good count. I just know that it happens from time to time, yet every time it happens, we hear about it.

When there was a closure on the primary route, but a defined detour route was NOT in place:

- My experiences were more than 3 years ago, but I witnessed this 3-4 times.
- All the time
- Very common.

When the primary route was experiencing travel delays:

- All the time

Other Situations:

- All the time

Significance of Impact

For each situation noted, survey respondents were asked to indicate how impactful it was. The highest number of responses (30 responses) indicated that the impact was “significant.” See Figure B-7.

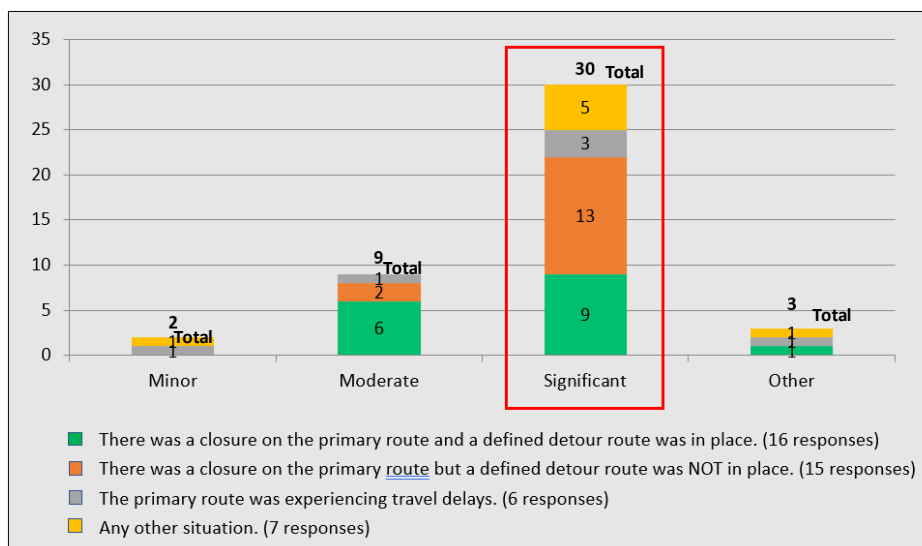


Figure B-7: Significance of the Impact

Situations and Challenges Described

As noted above, the survey provided an opportunity for respondents to provide details about each situation they had encountered where their agency had observed that a navigation system had likely advised travelers to an inappropriate route.

Table B-2 contains a series of tables that provide details for each situation reported by survey respondents. For each situation detailed in Table B-2, the following response details are provided:

- What caused the closure or delay on the primary route?
- Likely reason navigation system routed traveler to an inappropriate route?
- How were you made aware of the situation?
- How often has this situation occurred in the past 3 years?
- How impactful was the situation? Please describe.
- Description of the location, month, and year that this situation occurred.

Table B-2: Details for Situations Where a Navigation System May Have Advised Travelers to an Inappropriate Route Due to a Closure on the Primary Route (e.g., freeway, highway) While a Defined Detour Route WAS in place.

What caused the closure or delay on the primary route?	*Likely reason navigation system routed traveler to an inappropriate route?	How were you made aware of the situation?	How often has this situation occurred in the past 3 years?	How impactful was the situation? Please describe.	Description of the location, month, and year that this situation occurred.
Weather event (snow)	B	Travelers contact DOT	2 - 3 times	Moderate. It created extra work during what was already stressful and busy time for TMC Operators as they were answer questions from the public and sometimes dealing with angry callers.	Washington State. No specific details.
Weather event (snow, ice, wind, low visibility)	A, B, F	They were stuck in the ditch due to the weather.	Over 50 times	Significant. When the roads all closed, they were still traveling and getting stuck.	South Dakota. Central South Dakota, December 2022.
Weather event (snow)	O - The parallel and alternate routes advised by a navigation system were as bad or worse than the closed Interstate.	Observation by DOT field staff	2 - 3 times	Significant. The added traffic on routes that had no travel advised posted caused multiple vehicles to become stuck in ditches and on the road itself. This caused more highways to be blocked. The plows were unable to clear the blocked roads and then more traffic would come behind stuck vehicles causing even more congestion and more vehicles stuck. The result was resources were used to preform rescues instead of clearing the road.	South Dakota. Pierre SD and all highways leading to and from this area. The last two storms in December 2022.
Weather event (snow)	E	Travelers contact DOT	1 time	Significant. Motorist ended up stuck in a major blizzard requiring an emergency rescue to retrieve.	South Dakota. SD1806 MRM 151. Dec 22'.

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What caused the closure or delay on the primary route?	*Likely reason navigation system routed traveler to an inappropriate route?	How were you made aware of the situation?	How often has this situation occurred in the past 3 years?	How impactful was the situation? Please describe.	Description of the location, month, and year that this situation occurred.
Weather event (snow)	O - Navigation system just picked up on Interstate being closed and assumes other routes are ok if not marked closed, when in fact they are not ok.	Observation by DOT field staff	Hard to say as people use this as a response when we ask why did you take this when the Interstate was closed. This may be the system and it may be them lying to us.	Significant. Numerous stuck/stalled/abandoned vehicles in snowbanks which required rescue missions, and towing companies.	South Dakota. December 2022, I-90 Jackson, Jones and Lyman Counties. Vehicles were driving on SD 248 when I-90 closed and told us their navigation system sent them that way. We also rescued people off of SD Hwy 53 which is a gravel road as they said their navigation also routed them that way.
Weather event (snow)	C, D	Fire department and sheriff's department	4 - 6 times	Significant. It caused trucks on the interstate to stack up in Dickinson rather than following the signs to the pre-setup parking area.	North Dakota. Dickinson ND December 2022.
Weather event (snow)	A, B, C, D	Communication from a city or county	More than 6 times	Significant. When travelers use alternate routes during snow storms, often times the alternate routes are more dangerous. This causes crashes or vehicles getting stuck.	North Dakota.
Weather event (Combination of snow and ice, with rain or snow falling. Blowing snow, blocked roadway.)	A, B, C, D, O - The navigation apps are aware of the road closure point and are routing traffic around the road closure point, onto the local network and back onto the primary	I have stopped and rescued motorists who have shown me the map routes they were following.	I am the commander of the SE Region of the ND Highway Patrol. We have seen this play out hundreds of times over the	Significant. We are taking resources away from the primary route to secondary routes. At times we can't reach the people that have ventured off the primary route. It could be a life or death situation for those following the navigation routing. The mapping software is taking	North Dakota. These are the locations that have caused problems in the SE Region for the ND Highway Patrol: - Hwy. 46 is a common route used to circumvent a closure of I-94. This route may take motorists onto Hwy. 32, Hwy. 1, Hwy. 281, Hwy. 30 to get back to I-94. Or, at

What caused the closure or delay on the primary route?	*Likely reason navigation system routed traveler to an inappropriate route?	How were you made aware of the situation?	How often has this situation occurred in the past 3 years?	How impactful was the situation? Please describe.	Description of the location, month, and year that this situation occurred.
	route where there is not a hard closure (non-gate locations).		past three years. It is a constant problem during each closure event.	motorists onto county, township and minimum maintenance roadways. It can take NDDOT, law enforcement and wreckers to travel to get to these motorists. Some need to be rescued by snowmobile.	times, motorists will be routed onto county and township roads to make their way back to I-94. - Hwy. 36 is a common route used to circumvent a closure of I-94. - Cass Co. Rd. 10 is a common route used to circumvent a closure of I-94.-Co. Rd. 81 in Cass and Traill counties is a common route used to circumvent a closure of I-29. - We have had to rescue motorists from every conceivable roadway off the primary routes to include state, county, township and minimum maintenance roadways.
Construction / Weather event	O - The navigation companies use probe data to determine closures and are not able to account for head-to-head traffic for construction events on interstates. Because their probes do not go on the ribbon of road they expect, they conclude that the road is closed.	<ul style="list-style-type: none"> • Communication from a city or county • Travelers contact DOT • Observation by DOT traffic operations staff • Observation by DOT field staff 	During the last closure event, there were 22 vehicles in one county that were stranded. I believe 9 of them required search and rescue operations. This is a very common occurrence.	Significant. Lives have been at risk and county personnel are distracted from other issues because they have to be pulled off of other tasks to pull cars and trucks out of snow drifts.	Wyoming. We have had issues associated with rock fall in a canyon, winter conditions every month in the winter and construction because we put vehicles head to head for interstate projects.

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What caused the closure or delay on the primary route?	*Likely reason navigation system routed traveler to an inappropriate route?	How were you made aware of the situation?	How often has this situation occurred in the past 3 years?	How impactful was the situation? Please describe.	Description of the location, month, and year that this situation occurred.
Construction	D, O - The detour was significantly different (distance) from normal path and determined the traditional path was closed.	<ul style="list-style-type: none"> • Communication from a city or county • Travelers contact DOT • Observation by DOT traffic operations staff • Observation by DOT field staff 	How often it happens, I don't have a good count, just know that it happens from time to time, yet every time it happens we hear about it.	The primary one I'm thinking about didn't affect too many vehicles, but it did send vehicles down a single lane forest road with significant ruts.	Washington State. I-90 Snoqualmie Pass just west of Easton (MP 63 - 75) Sept - Oct 2022.
Construction	C	Travelers contact DOT	2 - 3 times	Moderate. One instance generated a significant amount of complaints from residents in a neighborhood that had semi traffic driving through it. This led to negative TV stories. A different instance traffic was rerouted into a WZ, 15 minute delays turned to 45 minutes.	Minnesota. The one instance occurred for several months during a yearlong construction project.
Construction	D, E	Observation by DOT field staff	1 time	Moderate to significant. The road in question could not support commercial vehicle traffic (MT-472). Traveling public was upset because they had to backtrack.	Montana. Blue Slide Road (MT-472) and MT-200 at the town of Thompson Falls.
Crash or similar disruptive incident	A, C, D, E, F	Observation by DOT field staff	More than 6 times	Moderate. Accident on US 93 South of Twin Falls Idaho. Traffic was being routed via GPS onto Field roads and muddy and uncleared road in the Spring. Resulted in struck trucks and cars and lot of dust creation.	Idaho. Spring on US-93 in Idaho, south of Twin Falls.

What caused the closure or delay on the primary route?	*Likely reason navigation system routed traveler to an inappropriate route?	How were you made aware of the situation?	How often has this situation occurred in the past 3 years?	How impactful was the situation? Please describe.	Description of the location, month, and year that this situation occurred.
Crash or similar disruptive incident	D, E	<ul style="list-style-type: none"> • Communication from a city or county • Travelers contact DOT • Observation by DOT traffic operations staff • Observation by DOT field staff 	2 - 3 times	Moderate. Most time the roads are able to handle the short-term traffic of a detour situation. Minor inconveniences might happen.	North Dakota. Rural interstate incidents requiring a directional closure. DOT used designated interchanges with state routes to handle interstate traffic. These situations happen occasionally

*Key for “Likely reason navigation system routed traveler to an inappropriate route?”

- A - Navigation systems do not receive reports for parallel routes operated by a city or county and therefore assumed a clear route on a parallel route.
- B - The parallel route advised by a navigation system is operated by a city or county and the weather response plan is not the same as a primary route (e.g., highway or freeway). For example, the primary route may be cleared of snow, but the parallel route has not been cleared.
- C - The alternate route advised by a navigation system goes through a local town or city that cannot support the increased traffic.
- D - The alternate route advised by a navigation system does not support all types of vehicles.
- E - The alternate route advised by a navigation system is shorter than the DOT defined route.
- F - The base map used by a navigation system is not correct.
- O – Other

Table B-2: Details for Situations Where a Navigation System May Have Advised Travelers to an Inappropriate Route Due to a Closure on the Primary Route (e.g., freeway, highway) but a Defined Detour Route was NOT in Place

What caused the closure or delay on the primary route?	*Likely reason navigation system routed traveler to an inappropriate route?	How were you made aware of the situation?	How often has this situation occurred in the past 3 years?	How impactful was the situation? Please describe.	Description of the location, month, and year that this situation occurred.
Weather event (snow)	A, B, C, D, E, F	Observation by DOT field staff	More than 6 times	Moderate.	(No response)
Weather event (snow)	A, D	<ul style="list-style-type: none"> •Communication from a city or county •Travelers contact DOT •Observation by DOT traffic operations staff •Observation by DOT field staff 	Very common.	Significant. Life threatening situations.	Wyoming. We have had issues associated with rock fall in a canyon, winter conditions every month in the winter and construction because we put vehicles head-to-head for interstate projects.
Weather event (snow, ice, wind)	A, B, O - Navigation system is rerouting travelers to adjacent state highways that are marked as impassable due to snowdrifts and stuck vehicles. Navigation apps seem to reroute travelers to these routes being they are not enforceable road closures like on the Interstate system.	Observation by DOT field staff	2 - 3 times	Significant. Travelers and DOT staff's lives were put in danger due to motorists getting stuck and having to be rescued in -50 wind chill and blizzard conditions.	South Dakota. Dec. 2022 Winter Storms in the west/central portion of South Dakota. Jan. 2023 Winter Storm in eastern South Dakota.

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What caused the closure or delay on the primary route?	*Likely reason navigation system routed traveler to an inappropriate route?	How were you made aware of the situation?	How often has this situation occurred in the past 3 years?	How impactful was the situation? Please describe.	Description of the location, month, and year that this situation occurred.
Weather event (snow)	A	Observation by DOT field staff	More than 6 times	Significant. Vehicles were getting stuck and stranded, which required a rescue.	South Dakota. Generally when the parallel interstate has a forced closure the traffic goes North to a priority road. The priority road generally has the same issues as the interstate.
Weather event (snow)	A	South Dakota dispatch center via a 911 call	2 - 3 times	Significant. The incidents take snow plow operators away from their routes to rescue and take to a safe place.	South Dakota. Hwy 14 west of Ft Pierre was blocked, as I understand their navigation system sent them up Hwy 63 to 196th street which is a county gravel road. this happened twice on Dec 23 2022, one a semi, the other passenger car, both were stuck in a drift.
Weather event (snow)	A, B, O - We had people getting stranded on county roads because the state highways were impassable due to snow. Also, the reroutes from I-90 were sending people on secondary routes that were getting stuck because they were impassable.	Observation by DOT field staff	More than 6 times	Significant. This was causing the traveling public to get stranded on county roads and secondary highways in blizzard conditions and sub-zero temps. This caused numerous people to risk their lives trying to rescue them.	South Dakota. 196th Street and SD63 in Stanley County reroute from SD63 being impassable, - County Road CH2 and SD 63 in Jackson County reroute from SD63 being impassable, - 6 Vehicles on US Mile Marker 206 reroute from I-90 being Closed, - 14 Vehicles on SD 34 Mile Marker 153 Reroute from I-90 being Closed. All of these happened in December of 2022.

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What caused the closure or delay on the primary route?	*Likely reason navigation system routed traveler to an inappropriate route?	How were you made aware of the situation?	How often has this situation occurred in the past 3 years?	How impactful was the situation? Please describe.	Description of the location, month, and year that this situation occurred.
Weather event (snow)	B	Travelers contact DOT	2 - 3 times	Moderate. They ended up traveling on different routes because the interstate was closed.	South Dakota. Found stranded travelers on highways because the interstate was closed.
Weather event (snow)	A, B, D	Law enforcement reports (state highway patrol and county sheriff)	More than 6 times	Significant. Interstate highways were impassable and closed with gates. Secondary routes were in worse condition but not closed with gates. Navigation systems sent commercial trucks and other vehicles on the secondary routes that were impassable but not 'technically' closed. These vehicles became stranded.	North Dakota. According to law enforcement, this happens frequently during major interstate closures caused by winter storms.
Weather event (snow)	O - System simply selected another route which ran parallel to I 90.	Observation by DOT field staff	4 - 6 times	Significant. The use of a secondary roadway paralleling I-90 during a winter event is not recommended as I-90 is the route receiving the most attention. If it is so bad that it requires closing, the adjacent routes will be worse and traffic should never be routed onto them.	South Dakota. December 2022
Weather event (snow)	A	Motorists called 911 after following navigation system prompts and becoming stuck on minimum maintenance roads.	My experiences were more than 3 years ago, but I witnessed this 3-4 times.	Significant. It took a great deal of effort to locate and then rescue the motorists. Law enforcement, DOT, and tow trucks were needed.	North Dakota. Steele, ND are on gravel roads paralleling Interstate 94.

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What caused the closure or delay on the primary route?	*Likely reason navigation system routed traveler to an inappropriate route?	How were you made aware of the situation?	How often has this situation occurred in the past 3 years?	How impactful was the situation? Please describe.	Description of the location, month, and year that this situation occurred.
Weather event (snow)	A, B	Communication from NDHP personnel	More than 6 times	Significant. This has been significant due to the fact that the rerouting of traffic placed them in harms way and led to additional motorists becoming stranded.	North Dakota. SE Region - 2020, 2021, and 2022.
Weather event (Combination of snow and ice, with rain or snow falling. Blowing snow, blocked roadways.)	A, B, C, D, O - The navigation apps are aware of the road closure point and are routing traffic around the road closure point, onto the local network and back onto the primary route where there is not a hard closure (non-gate locations).	I have stopped and rescued motorists who have shown me the map routes they were following.	I am the commander of the SE Region of the ND Highway Patrol. We have seen this play out hundreds of times over the past three years. It is a constant problem during each closure event.	Significant. We are taking resources away from the primary route to secondary routes. At times we can't reach the people that have ventured off the primary route. It could be a life or death situation for those following the navigation routing. The mapping software is taking motorists onto county, township and minimum maintenance roadways. It can take NDDOT, law enforcement and wreckers to travel to get to these motorists. Some need to be rescued by snowmobile.	North Dakota. These are the locations that have caused problems in the SE Region for the ND Highway Patrol: - Hwy. 46 is a common route used to circumvent a closure of I-94. This route may take motorists onto Hwy. 32, Hwy. 1, Hwy. 281, Hwy. 30 to get back to I-94. Or, at times, motorists will be routed onto county and township roads to make their way back to I-94 - Hwy. 36 is a common route used to circumvent a closure of I-94. - Cass Co. Rd. 10 is a common route used to circumvent a closure of I-94. - Co. Rd. 81 in Cass and Traill counties is a common route used to circumvent a closure of I-29. We have had to rescue motorists from every conceivable roadway off the primary routes to include state, county, township and minimum maintenance roadways.

What caused the closure or delay on the primary route?	*Likely reason navigation system routed traveler to an inappropriate route?	How were you made aware of the situation?	How often has this situation occurred in the past 3 years?	How impactful was the situation? Please describe.	Description of the location, month, and year that this situation occurred.
Weather event (Snow, ice, flooding)	B, E, O - Interstate closures due to weather events are well documented. The secondary routes may or may not be marked as closed. Third party navigation providers may or may not use the secondary route information.	<ul style="list-style-type: none"> • Communication from a city or county • Travelers contact DOT • Observation by DOT traffic operations staff • Observation by DOT field staff Law enforcement 	More than 6 times	Significant. Priority is given to interstates. When conditions are bad enough to warrant interstate closures, the secondary system is in worse condition.	North Dakota. Several times during every winter season.
Seasonal closure due to snow.	O - Navigation system did not update for the seasonal closure.	Observation by DOT field staff	2 - 3 times	Significant. Driving around closure gates and continuing on a closed, unmaintained road is dangerous and could leave to injury or death.	Montana. Beartooth Scenic Highway during winter seasonal closures.

*Key for “Likely reason navigation system routed traveler to an inappropriate route?”

- A - Navigation systems do not receive reports for parallel routes operated by a city or county and therefore assumed a clear route on a parallel route.
- B - The parallel route advised by a navigation system is operated by a city or county and the weather response plan is not the same as a primary route (e.g., highway or freeway). For example, the primary route may be cleared of snow, but the parallel route has not been cleared.
- C - The alternate route advised by a navigation system goes through a local town or city that cannot support the increased traffic.
- D - The alternate route advised by a navigation system does not support all types of vehicles.
- E - The alternate route advised by a navigation system is shorter than the DOT defined route.
- F - The base map used by a navigation system is not correct.
- O – Other

Table B-3: Details for Situations Where a Navigation System May Have Advised Travelers to an Inappropriate Route When the Primary Route (e.g., freeway, highway) was Experiencing Travel Delays

What caused the closure or delay on the primary route?	*Likely reason navigation system routed traveler to an inappropriate route?	How were you made aware of the situation?	How often has this situation occurred in the past 3 years?	How impactful was the situation? Please describe.	Description of the location, month, and year that this situation occurred.
Weather event (all)	A, B, F	Observation by DOT field staff	All the time.	Significant.	South Dakota.
Weather event (snow, ice, slippery conditions, visibility, and road blocked)	O - I believe when they departed their intended route, they were redirected by their navigation device.	The stranded motorist said so.	More than 6 times	Significant. When they became stuck and stranded, they needed to be rescued, putting other peoples' lives in danger.	South Dakota. When interstate 90 closes, especially from Chamberlain West, the traffic comes North via Hwys. 45 & 47 to parallel Hwy. 14 to head West.
Construction	A	Communication from a city or county	2 - 3 times	Moderate.	Minnesota.
Crash or similar disruptive incident	O - The route given was still part of the scene	Fire department asked for additional road closure due to traffic on another road coming through the scene.	2 - 3 times	Significant. Scene on the interstate near south heart caused road to be closed with smoke impact and chemical cloud impact to Old 10. Old 10 was the alternate route and put the public in the scene and in danger.	North Dakota. Near the interstate where Old 10 curves away from the interstate. 2020.
Crash or similar disruptive incident	O - Unknown	Observations by LE.	(not answered)	Unknown	North Dakota. No specific event sticks out.
Congestion	O - Locals don't like the alternate path provided by navigation.	Communication from a city or county	More than 6 times	Minor.	Washington State. I-90 Easton to Cle Elum. Typically congested Fridays EB and Sundays WB.

*Key for "Likely reason navigation system routed traveler to an inappropriate route?"

- A - Navigation systems do not receive reports for parallel routes operated by a city or county and therefore assumed a clear route on a parallel route.
- B - The parallel route advised by a navigation system is operated by a city or county and the weather response plan is not the same as a primary route (e.g., highway or freeway). For example, the primary route may be cleared of snow, but the parallel route has not been cleared.
- C - The alternate route advised by a navigation system goes through a local town or city that cannot support the increased traffic.

- D - The alternate route advised by a navigation system does not support all types of vehicles.
 E - The alternate route advised by a navigation system is shorter than the DOT defined route.
 F - The base map used by a navigation system is not correct.
 O – Other

Table B-4: Details for Other Situations Where a Navigation System May Have Advised Travelers to an Inappropriate Route

Describe the situation where a navigation system advised travelers to an inappropriate route.	What caused the closure or delay on the primary route?	*Likely reason navigation system routed traveler to an inappropriate route?	How were you made aware of the situation?	How often has this situation occurred in the past 3 years?	How impactful was the situation? Please describe.	Description of the location, month, and year that this situation occurred.
Unsure if navigation is responsible but another semi took a gravel road and got stuck off of Hwy 63 south of Midland SD.	Weather event (snow)	A	Observation by DOT field staff	1 time	Minor.	South Dakota.
A previously closed section of highway had reopened to traffic but the navigation system had not updated and continued to direct traffic to the detour.	Weather event (snow)	O - I would assume the navigation system failed to receive or register that the previously closed section of highway had reopened.	Observation by DOT traffic operations staff (e.g., monitoring congestion maps)	1 time	Significant. This problem led to continued highway traffic taking a significantly long detour of 22 miles over mostly county roads when they no longer had to.	Washington State. The closed section of highway was US 2 milepost 84.5 to milepost 99 through Tumwater Canyon just west of Leavenworth, Washington. Even though it had reopened, the navigation service was directing traffic to a stretch of county road known as the Chumstick Highway.
When interstate 29 has a forced closure, traffic will take Hwy. 281 North which parallels I-29.	Weather event (Snow, ice, visibility, blocked road, forced	A	Observation by DOT field staff	More than 6 times	Significant. When they became stuck and stranded, they needed to be rescued,	South Dakota. When interstate 29 has a forced closure, traffic will take Hwy. 281 North which parallels I-29.

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Describe the situation where a navigation system advised travelers to an inappropriate route.	What caused the closure or delay on the primary route?	*Likely reason navigation system routed traveler to an inappropriate route?	How were you made aware of the situation?	How often has this situation occurred in the past 3 years?	How impactful was the situation? Please describe.	Description of the location, month, and year that this situation occurred.
	interstate closure)				putting other peoples' lives in danger.	
Low bridge on a route.	Crash or similar disruptive incident	A, D, E, F	Observation by DOT field staff	More than 6 times	Significant.	South Dakota.
Navigation systems have advised semi/trailer. I do not know the reason why navigation systems have advised travelers to use SD87 from the jct. of US16 to Custer. SD87 has a width of 22' with several switchbacks and a single lane tunnel. Getting the trucks turned around is very disruptive.	No closure	E	Travelers contact DOT	2 - 3 times	Significant. All other traffic had to be stopped for 60+ minutes while the truck was turned around or backed out of the area.	South Dakota. SD87 near the Hood Tunnel. Summer season.
Trucks have been routed off of the Interstate and through towns and narrow streets due to navigation looking for shorter routes.	Shortest route calculations.	C, D, E, F	Communication from a city or county	More than 6 times	Significant. Large trucks traveling through small towns and down narrow roads.	(State not indicated) Daily on SH-46 and US-30 when truck is traveling on Interstate heading to Nevada.
From Spokane, WA to the Coeur d'Alene Resort and Casino, Worley, ID. There is a direct State Highway System (WA. Highway 27 to WA. Highway 278 to Idaho SH-58 to US-95) yet navigation system routes drivers onto rural and farm roads from Rockford WA. on Stringham	Missile Base Road is not maintained for winter travel. Seasonal Farm Use Only.	O - Shortest distance to US-95 as opposed to the shortest travel time to the Coeur d'Alene Resort and Casino.	Land owners that are tired of pulling vehicles out of the mud and snow.	More than 6 times	Motorists can be stranded. Risk of death by hypothermia.	Idaho. From November to April of any year. Missile Base Road, Worley, Idaho.

Describe the situation where a navigation system advised travelers to an inappropriate route.	What caused the closure or delay on the primary route?	*Likely reason navigation system routed traveler to an inappropriate route?	How were you made aware of the situation?	How often has this situation occurred in the past 3 years?	How impactful was the situation? Please describe.	Description of the location, month, and year that this situation occurred.
Road to Setters Road to Drechsel Road then to Missile Base Road, (a summer use only farm road).						

*Key for “Likely reason navigation system routed traveler to an inappropriate route?”

- A - Navigation systems do not receive reports for parallel routes operated by a city or county and therefore assumed a clear route on a parallel route.
- B - The parallel route advised by a navigation system is operated by a city or county and the weather response plan is not the same as a primary route (e.g., highway or freeway). For example, the primary route may be cleared of snow, but the parallel route has not been cleared.
- C - The alternate route advised by a navigation system goes through a local town or city that cannot support the increased traffic.
- D - The alternate route advised by a navigation system does not support all types of vehicles.
- E - The alternate route advised by a navigation system is shorter than the DOT defined route.
- F - The base map used by a navigation system is not correct.
- O – Other

Conversations, Agreements, or Procedures with Mapping or Navigation Companies

Respondents were asked if their agency has established conversations, agreements, or procedures with any mapping or navigation companies, regarding this issue. Three (3 responses) respondents indicated “yes” while the remainder (16 responses) indicated “no.” Relevant comments related to this question included the following, with the respondent’s state noted after each comment:

- We are working on a direct feed to Google/WAZE (we will meet with their product managers on 1/23/2023), and we provide information to the SDX. (*Wyoming*)
- These have been more informal conversations. (*Minnesota*)
- 511 (*South Dakota*)
- Our traffic management center (TMC) made contact with a Google certified (?) vendor that has helped us correct erroneous information. (*Montana*)

Other Information to Consider

In a final open-ended question, survey respondents were asked for any additional information they would like to provide for the project to consider as NWP documents situations where navigation systems may advise drivers onto inappropriate routes. Responses included:

- When interstates are closed, navigation systems send travelers on highways since we can’t close highways.
- I am glad to see this issue is being addressed. Rerouting traffic onto side roads to avoid road closures on the interstate system is extremely dangerous. Often times the side roads are worse than the interstate system, causing motorists to become stranded in inclement weather.
- State highway patrol and county law enforcement would have more examples of these situations. Often DOT hears about the occasional private traveler blaming GPS when stranded in snowstorms. More often it is the commercial vehicles that are stuck in snow drifts after being rerouted from major highways.
- If interstates are closed, travelers feel they need to find a way around it. It really seems odd that if a two-lane primary road is blocked, travelers would turn down a county gravel road.
- Give the cell phone road alert at least every 2 hours.
- Navigation software is placing people at risk – those following the routes being generated and to those that have to rescue the motorists. People are blindly following their mapping software and do not take into consideration their safety or the safety of others when choosing to follow the navigation. Looking out their windshield is not deterring them, as the map says they can go. Common sense does not prevail anymore with the amount of technology people use in their daily life. Some common sense needs to be built into the mapping software somehow.

Appendix C: Outreach Document

North/West Passage Transportation Pooled Fund Study

Communicating Route Restrictions to Mapping/ Navigation Providers

February 23, 2023



Project Background

During times when a stretch of highway is closed or when travel delays are excessive, travelers using third party mapping or navigation systems are sometimes advised to divert to routes that are not safe or appropriate for their travel. For example, during a winter storm the diversion routes may not be cleared of snow, the geometry of a local road does not support the size of the vehicle, or other unsafe conditions exist.

This situation has at times resulted in the need for emergency responders to attempt to rescue stranded motorists or for public agencies to manage related disruptions. This challenge could become more widespread as connected and automated vehicles use road closure and delay information to navigate.

Project Purpose

The [North/West Passage Pooled Fund Study](#) membership includes the Idaho Transportation Department, the Minnesota Department of Transportation (DOT), Montana DOT, North Dakota DOT, South Dakota DOT, Washington State DOT, and Wyoming DOT. These member states are predominantly rural and face similar weather-related transportation issues. The purpose of this project is to engage with third party mapping and navigation providers to explore potential solutions to avoid or minimize situations where navigation systems advise drivers to divert onto inappropriate routes during highway closures or delays. This effort is leveraging experiences of public safety professionals and expertise of mapping and navigation companies, with an overall goal of improving road safety. The purpose of engaging is to accomplish the following:

- Share the purpose of this effort.
- Share challenges experienced by transportation agencies and emergency responders.
- Collectively brainstorm and discuss potential mitigation strategies.

Overview of Challenges

North/West Passage conducted a survey of its member agencies and law enforcement partners, to gather challenges experienced, the extent of disruptions, and impacts. Overview of responses:

- 26 respondents from seven states reported challenges, many citing specific locations.
- Most challenges occurred during weather events when the primary route was closed.
- Motorists often indicated that they had followed navigation system guidance onto roads where they became stranded.
- When road weather conditions are bad enough to warrant interstate closures, the secondary system is worse and traffic should not be routed onto these roads.
- Rerouting traffic off interstates puts others at risk by requiring response personnel to rescue motorists from secondary roads.
- These situations often divert resources (e.g., snowplow operators) off the primary route to assist on secondary route, further contributing to deteriorating road conditions and delay in re-opening primary routes.
- Closures due to road work also resulted in diversions onto inappropriate routes, with local communities experiencing more overall traffic and/or increased truck traffic.

For more information contact: Brandon Beise, North Dakota DOT, bbeise@nd.gov or
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North/West Passage Examples

Severe Weather Winter

Issue: In December 2022, during a winter weather event that included snow, ice, high wind, low visibility, and sub-zero temperatures, the South Dakota DOT worked with emergency response partners to rescue multiple stranded motorists who reported following navigation guidance that routed them from I-90 and other state routes onto impassible routes due to snow.

Impact: More than 20 vehicles in central and southwestern South Dakota became stranded on secondary routes, requiring assistance from emergency responders.

Significance: The impact was significant as it caused the traveling public to become stranded on county roads and secondary highways in blizzard conditions and sub-zero temperatures. This caused numerous people to risk their lives trying to rescue them.

Highway Patrol Commander Perspective

Issue: Mapping software is taking motorists onto county, township, and minimum maintenance roadways. Highway Patrol have rescued motorists who have shown the map routes they were following. It often requires North Dakota DOT staff, law enforcement, and wreckers to travel to get to these motorists. Some need to be rescued by snowmobile.

Impact: The impact is significant, in terms of the need to rescue. This has played out hundreds of times over the past three years. It is a constant problem during each closure event.

Significance: Resources are taken away from the primary route to secondary routes. At times the Highway Patrol can't reach motorists that have ventured off the primary route. This issue puts many people at risk, including those following the routes being generated and those who rescue stranded motorists.

Construction Project

Issue: A construction project in Minnesota had a detour in place, however the alternate route advised by a navigation system went through a local city. In a separate instance, vehicles were routed into another work zone on the alternate route.

Impact: On multiple occasions, the Minnesota DOT was contacted because the route advised by the navigation system through a city could not support the increased traffic

Significance: One instance generated a significant number of complaints from residents in a neighborhood that had semi-truck traffic driving through it, which led to negative TV stories. In another instance, vehicles following navigation systems were rerouted into a separate work zone where 15-minute delays were turned into 45-minutes.

Discussion: Mitigation Strategies

- How can transportation agencies work with mapping and navigation providers to help mitigate these issues?
- What additional information about road conditions would be useful for mapping and navigation providers to have? How could this information be communicated?
- What technological solutions might exist?



Wyoming DOT Outreach and Action

After rescuing numerous stranded vehicles stuck in snow drifts during severe winter weather events, Wyoming DOT (WYDOT) has taken steps to help mitigate the issue. A video, [Choose Your Routes Wisely](#), produced by WYDOT provides outreach to educate the general public about this issue. In some locations, advisory signs are posted at road closure gates advising motorists to avoid following GPS navigation guidance. WYDOT also has the ability to link local road closures to their official mapping system and is finalizing agreements to feed their mapping data into several common GPS navigation systems.

