Operations and Travel Information Sharing (OTIIS) Project Phase II: Operations Evaluation Report

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15. Supplementary Notes

16. Abstract

The North/West Passage (NWP) corridor travels along I-90 and I-94 from Washington to Wisconsin, passing through eight states and covering nearly 2000 miles. The Operational and Travel Information Integration Sharing (OTIIS) Project aims to research, develop, and test under operational conditions a technology solution that will provide travelers with key route planning, weather and safety information along the entire corridor. Phase I of the OTIIS project developed the system and performed an operational test. This report summarizes Phase II, which included operating and maintaining the system for an evaluation phase from April 2015 – December 2016. The report includes a brief overview of the development of the system, a description of the system, experiences from operations of the system, system usage analytics, and conclusions. The research team concluded that that during Phase II, the OTIIS system provided more than 12,000 users with the ability to see road conditions and plan their trips seamlessly along the NWP corridor. In general the OTIIS website usage has grown over the life of the system, despite limited media exposure. Usage statistics and analytics have shown that media efforts are necessary to inform users of the system and grow its usage. Potential future enhancements include expansion to non I-90/94 routes, improvements to the mobile app, and public launching of the mobile app.

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1) INTRODUCTION

The North/West Passage (NWP) corridor travels along I-90 and I-94 from Washington to Wisconsin, passing through eight states and covering nearly 2000 miles[1] as shown in Figure 1. Since 2002, the North/West Passage Corridor Coalition member agencies have worked together to promote safe, efficient, and seamless travel along this major east-west freight and tourism corridor. Building on nearly 10 years of research to share and integrate data among the states, the coalition partnered with the Western Transportation Institute (WTI) of Montana State University (MSU) and Athey Creek Consultants to develop the Operational and Travel Information Integration Sharing (OTIIS) Project. In the first phase of this project the team successfully researched, developed, and tested a technology solution that:

- Provides commercial and passenger vehicle drivers with a single, integrated source of information to promote safety and mobility for the entire corridor;
- Provides transportation agencies with information and tools to plan and coordinate operations and incident response activities; and
- Utilizes Application Programming Interface (API) technologies to leverage and share information.

The overall project also:

- Investigated how traveler information can modify driver behavior and enhance safety along rural multi-state corridors;
- Investigated sustainable business models to maintain and operate OTIIS; and
- Investigated public education / marketing plans for greater utilization of the Corridor website.

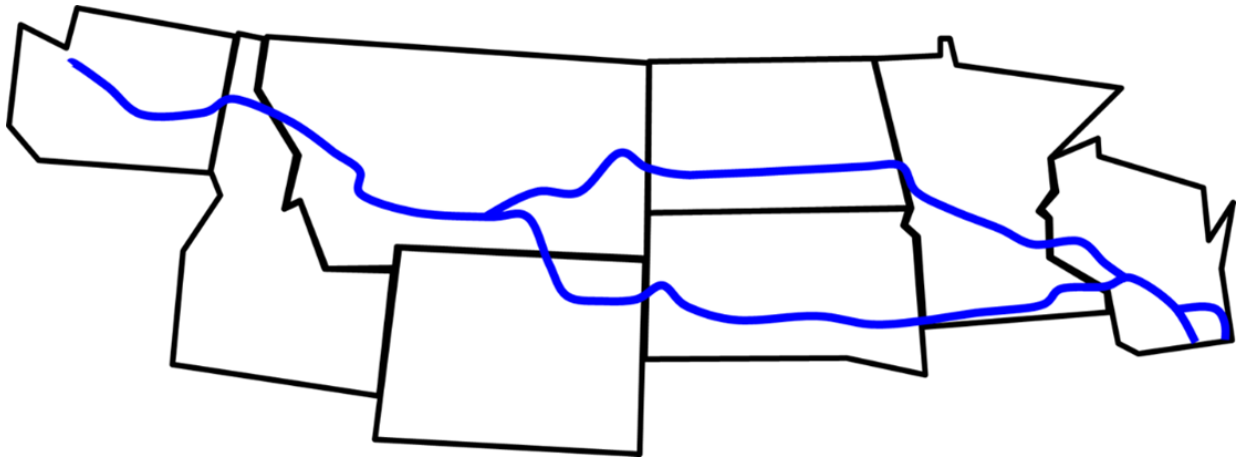

Figure 1: North/West Passage Corridor (during OTIIS system development)

[1] Wisconsin is no longer part of the North/West Passage Pooled Fund Study, but was during the development of the OTIIS system.

Phase I of the OTIIS project developed the system and performed an operational test, while Phase II included operating and maintaining the system for an evaluation phase.

The tasks completed to accomplish the objectives of the Phase I project included:

Task 1: Develop Concept of Operations Document, which provided a high-level, living-document with a user-oriented perspective on how OTIIS was intended to work for conceptual reference throughout the project;

Task 2: *Investigate Positive Methods to Influence Driver Behavior*, which was a project long effort, using various methods and working closely with human factors experts to design OTIIS to intentionally promote positive driver behavior influences;

Task 3: Develop Requirements Document, which translated the concept of operations document into a series of statements describing what the system shall do for software development uses;

Task 4: Develop Prototype Information Delivery Mechanism, which provided highly visual and interactive means to gain feedback from the technical panel and usability testers on how OTIIS would look and operate;

Task 5: Development and Coding, which created the software required to produce the OTIIS system and all of its components;

Task 6: Conduct Use and Usability Analysis, which performed user group studies to examine the manner in which users interact with the website and information provided;

Task 7: Investigate Private Sector Opportunities and Business Sustainability Model, which investigated potential sustainable business models and private sector possibilities to operate OTIIS in the future;

Task 8: Develop User Survey Tool, which developed surveys that were used to solicit feedback from DOT personnel and travelers who have visited the OTIIS website regarding aspects such as its utility and potential improvements;

Task 9: Develop Marketing Plan, which developed a plan to assist State Public Information Officers to expand the awareness and utilization of the Corridor website; and

Task 10: *Develop, Deploy and Operate an Information & Coordination Tool*, which linked each of the 8 states, and currently displays corridor wide event information, improves safety and mobility for travelers, and improves coordination between state agencies.

This evaluation report primarily covers project activities and findings from Phase II of the OTIIS project with: 1) a brief overview of the development of the system, 2) a description of the system, 3) experience from operations of the system, 4) system usage analytics, and 5) conclusions and future directions. For more information on the project, the North/West Passage Pooled Fund, and any Phase I information not covered in this report visit: www.nwpassage.info/projects/mcom/.

2) SYSTEM DEVELOPMENT

The earliest vision for the OTIIS system stemmed from the initial scope of work. It aimed to research, develop, and test under operational conditions a technology solution that would provide travelers with the information they need when and where they need it, so they could make decisions to improve safety, mobility, and enjoyment for long range or short range trips along the corridor. This initial vision was further sculpted in the early stages of the project using input from the NWP Steering Committee and state-of-the-art reviews related to trends in travel information and technology, existing travel information systems both public and private, and future possibilities for travel information. The OTIIS system vision was then developed using a systems engineering approach that defined the *Concept of Operations* and *Requirements* documents. Figure 2 shows early vision ideas for the OTIIS system from the *Concepts of Operations*.

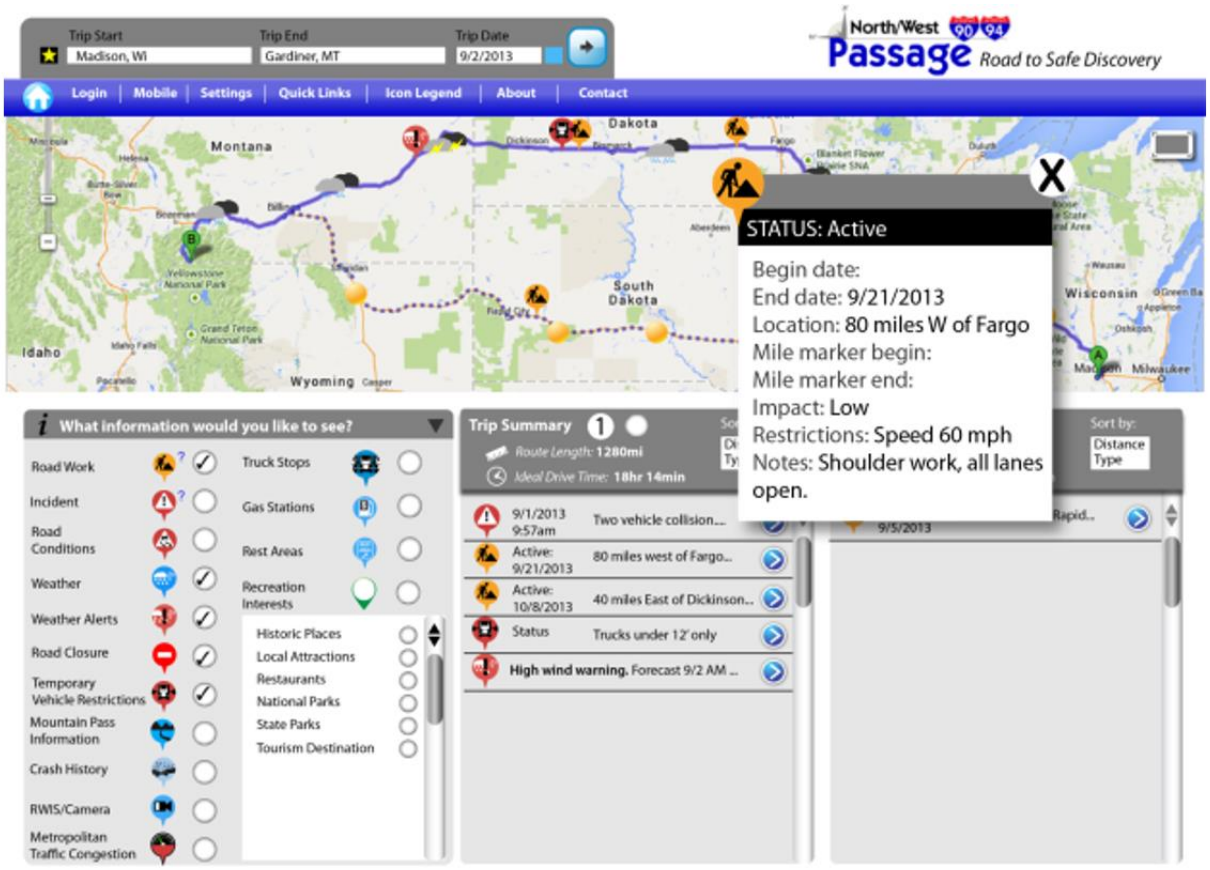

Figure 2: Early OTIIS Vision in Concept of Operations

The next step in the development of the OTIIS system was to create detailed graphical system mockups based on system engineering documents and NWP Steering Committee input. These mockups would be used to help the NWP Steering Committee understand how the system would look and operate and to conduct usability analysis testing. The usability analysis was led by MSU human factors engineering expert Dr. Nic Ward. The usability analysis involved general traveler and truck driver volunteers, who provided their feedback based largely on procedures involving visual mockups, like the example shown in Figure 3.

Figure 3: OTIIS Mockups for Usability Testing

The results of the usability analysis and feedback gathered from the NWP Steering Committee were used to improve the system design and the lessons learned were carried forward into the creation of the system. The actual coding and development of the OTIIS system was then launched, led by Dr. Mike Wittie, assistant professor at the MSU - Gianforte School of Computing.

3) SYSTEM DESCRIPTION

The overall OTIIS system was initially developed on local servers at MSU and was subsequently launched on cloud based hosting via Amazon Web Services (AWS). The current system components and structure are illustrated in Figure 4.

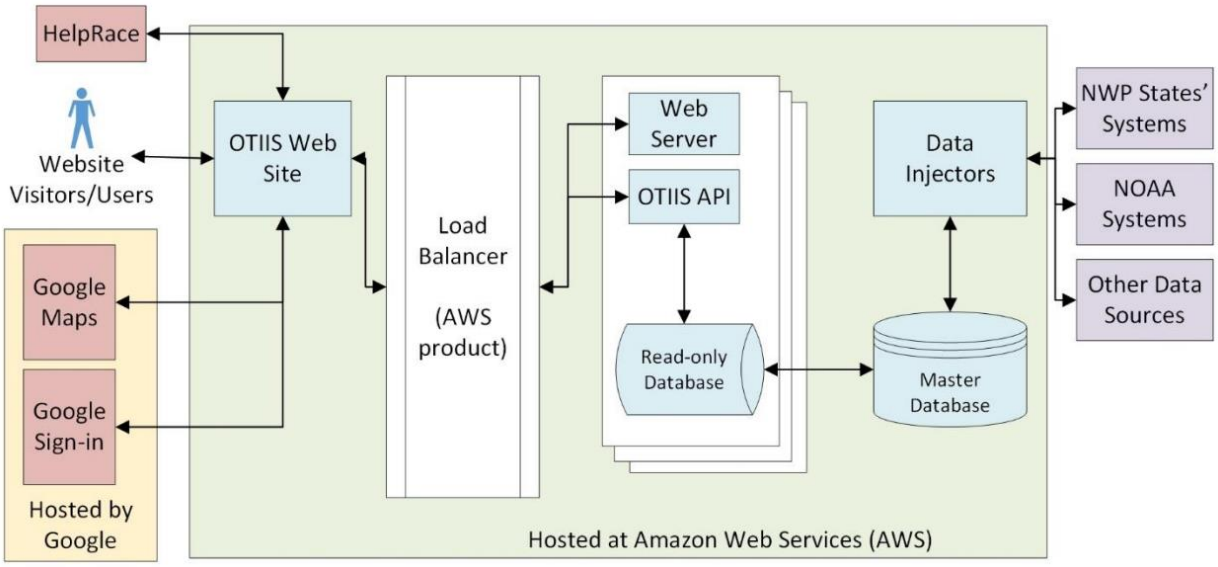

Figure 4: OTIIS Structure (Athey Creek, 2016)

For more detailed information on the structure of OTIIS, please see NWP Project 10.1, https://www.nwpassage.info/projects/phase10/.

The OTIIS website, www.roadstosafediscovery.com, is shown in Figure 5. Trip planning locations, optional waypoints, and travel date and time are entered in the top left corner of the website. The 22 selectable travel information layers are in the bottom left corner. The main background map shows the trip route options and the selected travel information layers. Trip route details are provided in the collapsible table showing the trip summary tables on the bottom right of the page. Users can select an event on the map or in the trip summary table to view more details and select their route using the route numbers. Users can also save trips to their profile or share using a website link.

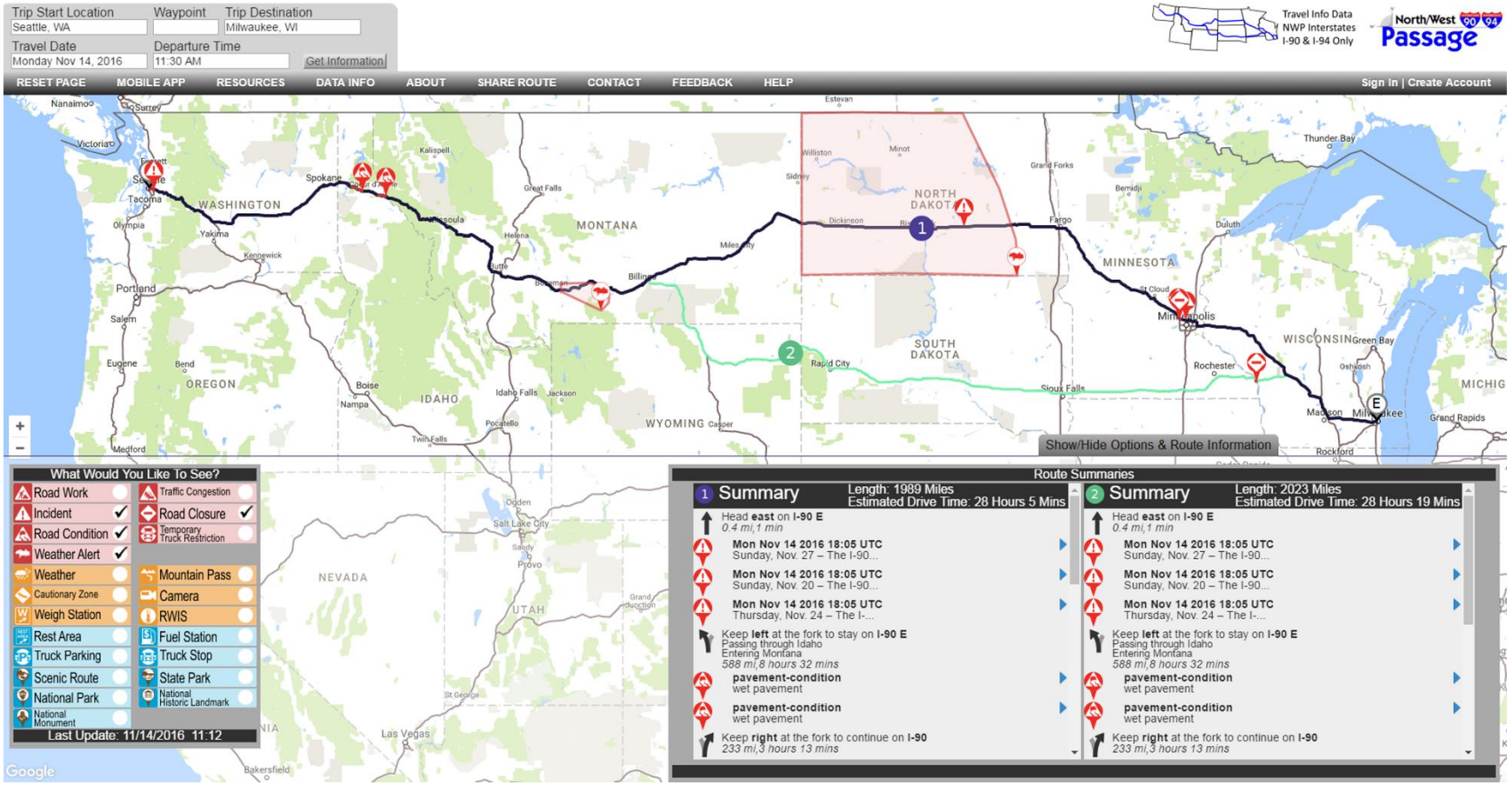

Figure 5: OTIIS Website

The OTIIS system is also available for mobile devices via an Android beta-test version mobile app and a mobile version of the website. Figure 6 shows the OTIIS beta-test version mobile app in the Google Play App Store.

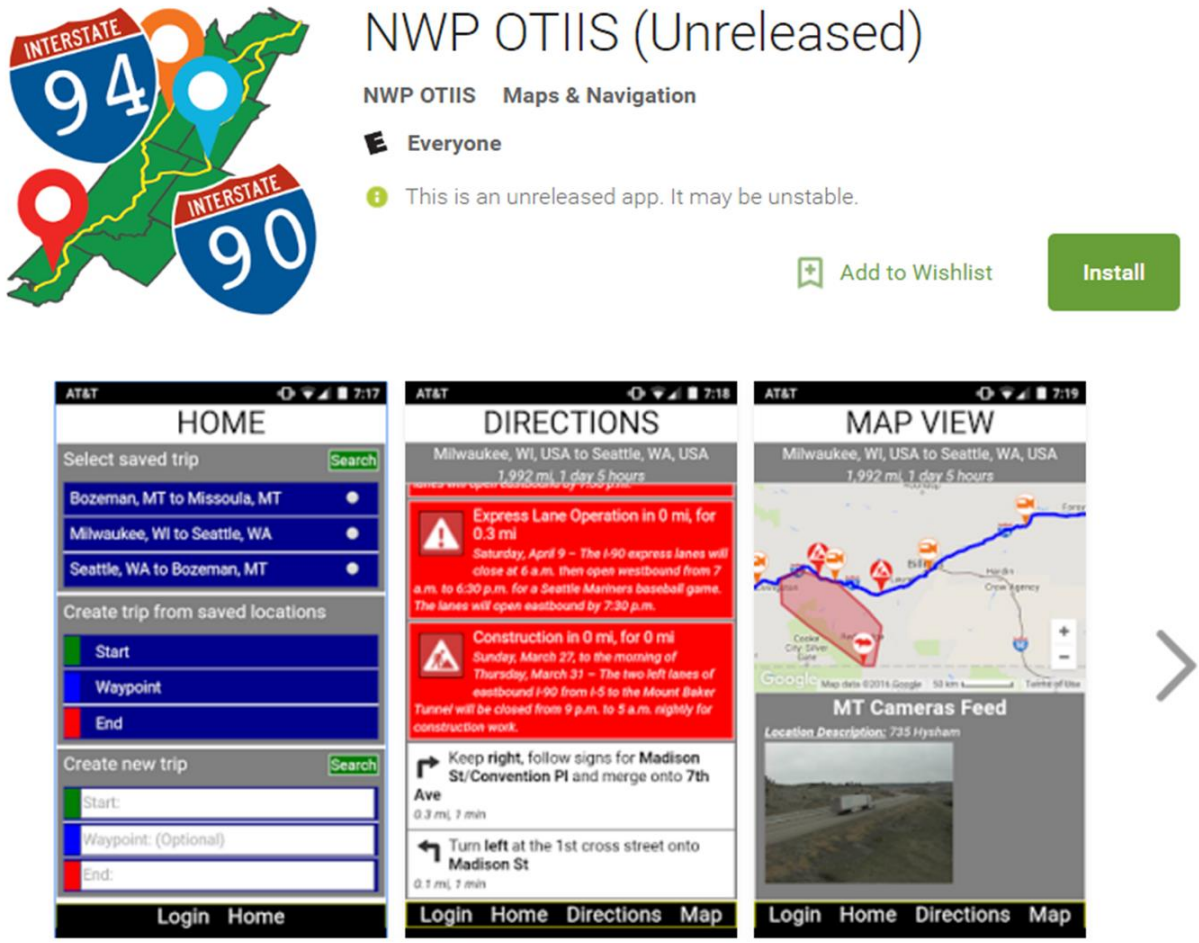

Figure 6: OTIIS Mobile App on the Google Play App Store

The mobile version of the website is available at www.roadstosafediscovery.com/mobile/ and is shown in Figure 7.

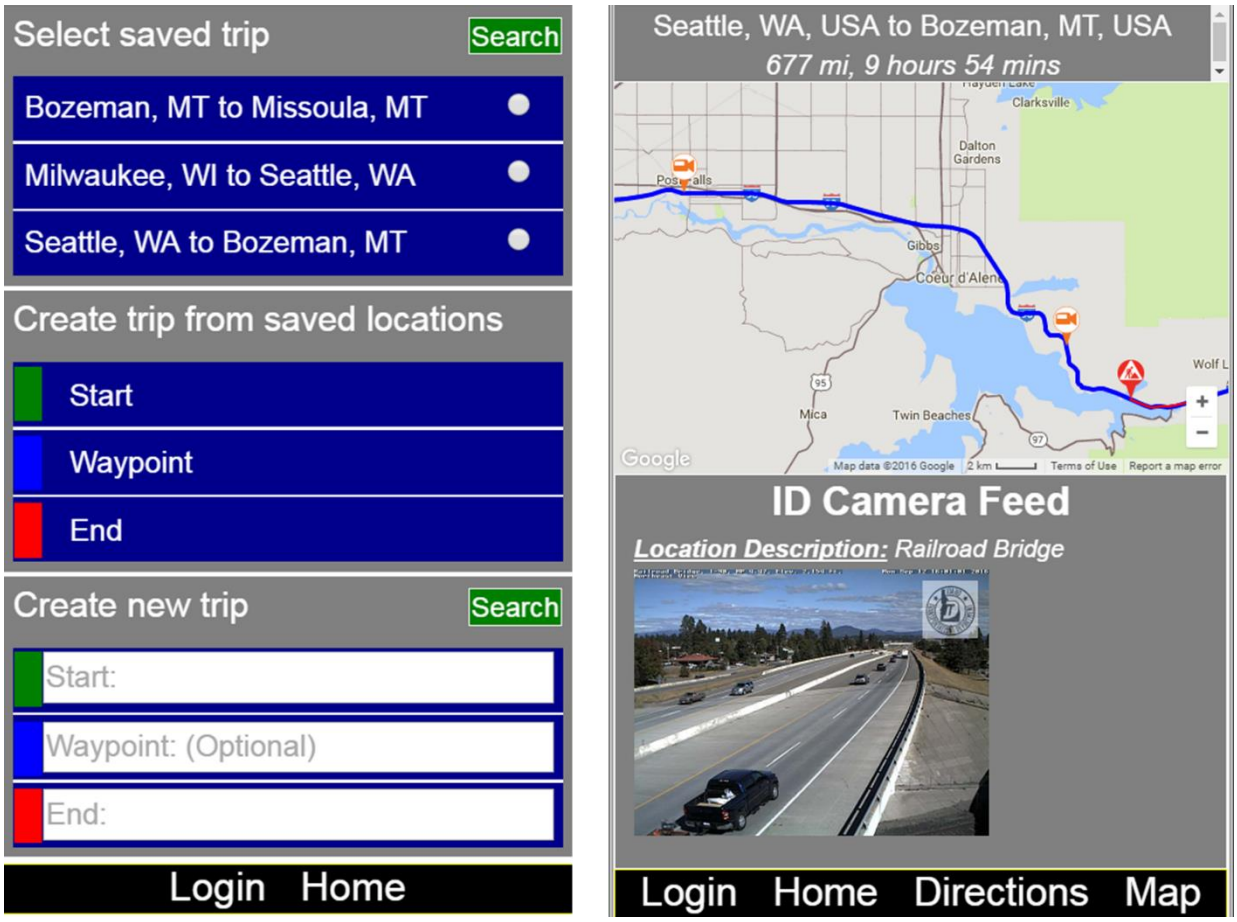

Figure 7: OTIIS Website Mobile Version

The OTIIS system makes use of an aggregated data API internally, but the API also enables sharing of the aggregate OTIIS data with outside sources or other systems.

4) OPERATIONS

The OTIIS development team has managed the primary website product since an operational test website was completed toward the end of Phase I in October, 2014. Figure 8 shows the overall timeline, phases, and products of the OTIIS project.

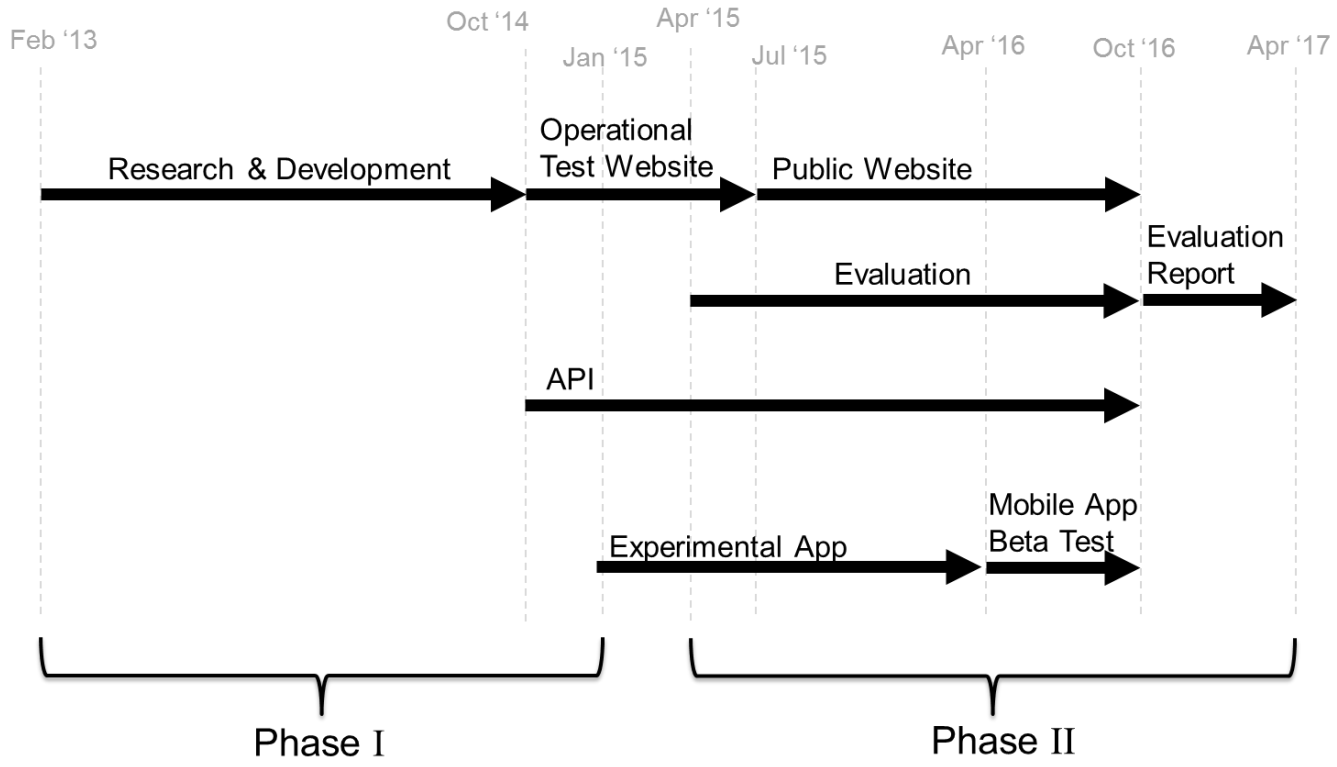

Figure 8: Phase Timelines

The operational test website was submitted to NWP Steering Committee members in October, 2014.During the remainder of Phase I, the team collected their feedback and implemented suggested improvements as feasible. At the conclusion of Phase I, the NWP Steering Committee recognized the value and potential benefits of the OTIIS system and supported ongoing research to produce a publically available system. Phase II was officially commenced in April, 2015, sponsored by the NWP and U.S. Department of Transportation - Federal Highway Administration (FHWA). The goals of Phase II were to make the system available publically, continue improvements, and perform an evaluation.

Experiences in Phase I led to the adoption of an Operation and Maintenance (O&M) plus Improvements model. Under this approach, the development team was funded for a certain amount of time per month, allowing team members to implement improvements of the system using any accumulated time that was not spent on routine O&M tasks. This method was successful and resulted in many improvements being completed. Improvement suggestions were typically provided by the NWP Steering Committee, and some were generated by the development team and public feedback. Table 1 shows the more significant improvements made and their request dates throughout the project (not including many minor edits, repairs, and troubleshooting).

Table 1: OTIIS Website Improvements

Request Date	Improvement
Dec., 2014	Add splash page with website overview and how-to-use tips
Dec., 2014	Automatically load default seasonal layer selections
Dec., 2014	Make camera images larger
Dec., 2014	Make route options different colors and show same colors in the tables
Dec., 2014	Make route alternatives selectable on map
Dec., 2014	Add a data information tab
Dec., 2014	Migrate to cloud services
Dec., 2014	Integrate with rural MN cameras not on MN511 feed
June, 2015	Integrate driving directions into road alerts
June, 2015	Make the user feedback survey link a timed pop-up window
June, 2015	Implement website analytics to monitor detailed usage statistics
Aug., 2015	Implement user feedback and support mechanism from Helprace
Aug., 2015	Make "Options and Route Advisories" tab collapsible
Aug., 2015	Automatically load seasonal default layers for Seattle to Milwaukee
Sep., 2015	Include waypoints in saved routes
Sep., 2015	Make list of saved routes accessible to logged-in users
Dec., 2015	Make multiple visual improvements to mobile app
Dec., 2015	Implement GPS functionality to mobile app
Feb., 2016	Implement changes related to search engine optimization
May, 2016	Create video tutorials for operations, maintenance, and monitoring

Experiences from operating and maintaining the system have illustrated the value in developing tools like the video tutorials created for this project. These videos preserve knowledge for any future expansions of OTIIS and transfer knowledge efficiently when new maintenance personnel are tasked with maintaining the system.

Public feedback was gathered through an online survey tool via links made available on the OTIIS website. Public feedback was very limited; over the course of the project there were a total of 16 survey responses, with 11 of them fully completed. Many of the respondents were made aware of the website from using an internet search engine, and some learned of the website from a friend. Respondents were primarily using the website for recreational trip planning, to learn about the website, or to experiment with the use of the system. Much of the feedback related to usefulness of the information; responses regarding ease of using the service were divided. Some respondents found the new website to be useful and easy to use, and some found it difficult to understand and navigate. This feedback resulted in the implementation of specific improvements in early 2016 to make the website easier to use and understand. Specifically, the team members made the route options tab collapsible, as some users found it took up too much of their screen and did not show enough of the map layer. Other users wanted to see information without having to enter trip details or make many selections, in a manner similar to the old version of the NWP travel information website. Changes were made to auto-load the seasonal default layers across the entire corridor without the need to first enter trip details.

The NWP Steering Committee chose to "soft-launch" the website publically on July 1, 2015. The soft launch process was chosen to allow each state to decide how to announce the OTIIS system; as a result no coordinated corridor-wide announcements were made. The press releases and media coverage of the OTIIS system included four major news release efforts and some reprinting of those efforts, including:

- Idaho Transportation Department News Release — Aug. 13, 2015
  - Highbeam.com reprint — Aug. 13, 2015
- Montana State University Press Release — Oct. 6, 2015
  - Travelagents.com reprint — Oct. 7, 2015
  - Belgrade, Montana News reprint — Oct. 9, 2015
  - ThinkHighways.com reprint — Nov. 10, 2015
  - ITS Rocky Mountain reprint — Nov. 30, 2015
- Steve Albert Podcast Interview on Transportation Radio — Dec. 10, 2015
  - TrafficTechnologyToday.com reprint — Dec. 11, 2015
  - ITS Smartbrief Newsletter reprint — Dec. 11, 2015
- Minnesota DOT / University of Minnesota News Release — Oct. 25, 2016
  - Transportation Communications Newsletter reprint — Oct. 25, 2016

5) USAGE AND ANALYTICS

Evaluation of the OTIIS system has consisted primarily of monitoring usage of the OTIIS website since its launch. Use of the OTIIS website has varied from month to month, as shown in Figure 9.

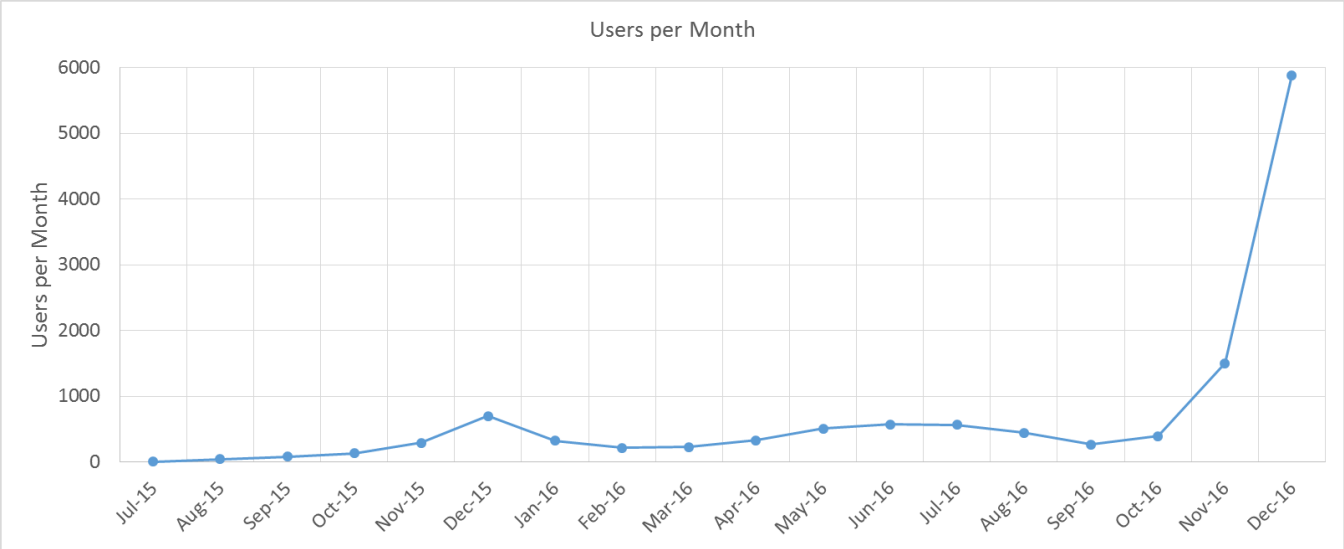

Figure 9: Website Users per Month

Usage first began to increase as people became aware of the system through the Idaho Transportation Department and Montana State University news releases in late summer and fall of 2015. The first peak usage period was observed in December 2015, which was the same month as WTI Director Steve Albert's interview regarding the system on Transportation Radio, which resulted in national media coverage. Usage declined following the winter 2015/16 season until spring 2016, approximately when certain search engine optimization activities were completed in an effort to make the website more easily discovered online. The next and largest usage increases were observed as the winter 2016/17 season began, which is also when the fourth and last major news release was produced by the Minnesota Department of Transportation and University of Minnesota.

5.1. Media and Weather Usage Impacts

A combination of factors including media efforts, major travel seasons, search engine optimization improvements, and significant weather events may explain the varying usage patterns observed throughout the project. Figure 10 shows OTIIS website users per month without the final December 2016 data point in order to display the more subtle changes in usage earlier in the project.

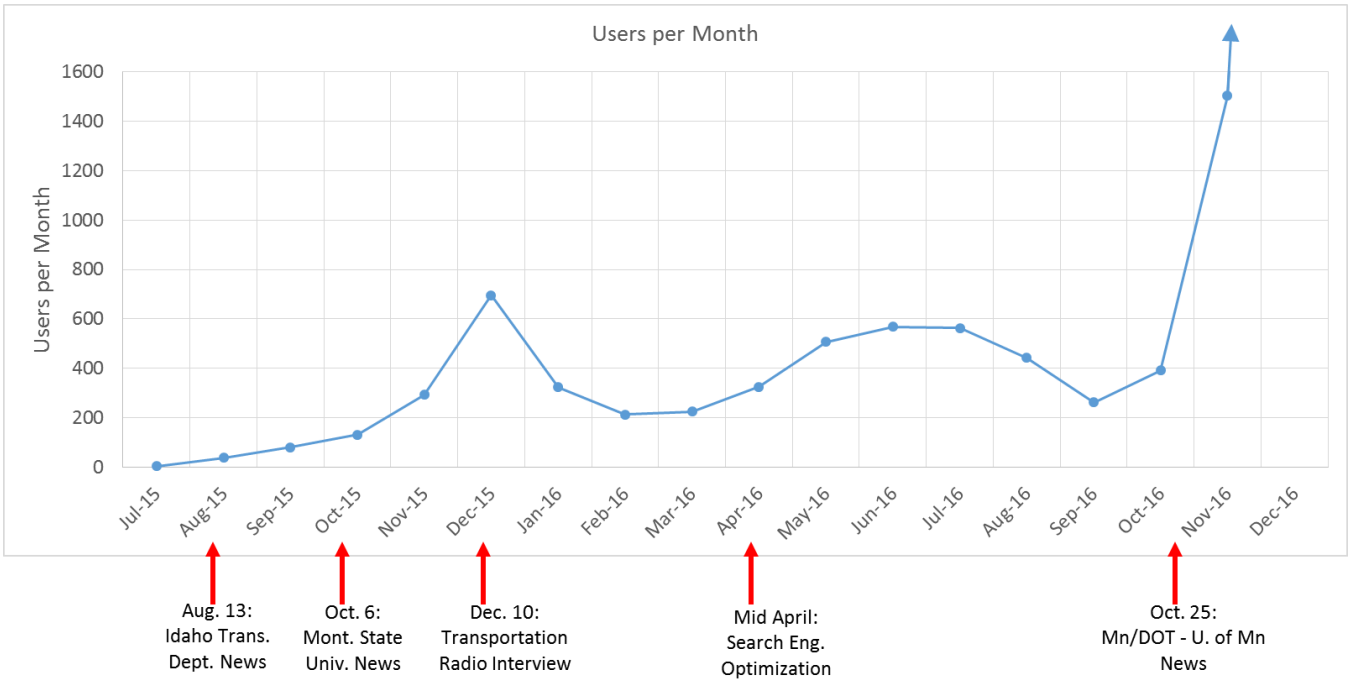

Figure 10: Website Users per Month and News Releases

The effects of the first three news releases are apparent early in the project, as users were likely first made aware of the system through the end of 2015. As the media efforts declined in 2016, the website usage also declined until the spring of 2016. The spring and summer travel months saw somewhat increased website usage, perhaps due to increased travel on the corridor and/or search engine optimization improvements completed by the development team. The website usage declined again in the fall of 2016 until November and December when usage increased 216% and 846% respectively. November and December 2016 usage is likely due to some combination of: a) impact of the first new media effort in 10 months, and b) users desiring travel information related to winter weather impacts.

Further evidence of the winter weather driven usage patterns can be observed by examining detailed trends of the daily number of user sessions in November and December 2016 and the timing of winter storms across the NWP in those months. Table 2 shows the dates of winter storms that impacted the NWP states during November and December 2016, which states were impacted, and the approximate total economic loss associated with the storm as a surrogate measure of storm severity.

Table 2: Winter Storms 2016 (NOAA, 2017 and Aon Benfield, 2017)

Storm Dates	NWP States Impacted (black)	Total Economic Impact ($)
11/17/16 - 11/22/16	WA, ID, MT, WY, ND, SD, MN, WI	Tens of Millions
11/27/16 - 11/30/16	WA, ID, MT, WY, ND, SD, MN, WI	275+ Million
12/06/16 - 12/07/16	WA, ID, MT, WY, ND, SD, MN, WI	--
12/11/16 - 12/13/16	WA, ID, MT, WY, ND, SD, MN, WI	Millions+
12/15/16 - 12/18/16	WA, ID, MT, WY, ND, SD, MN, WI	100+ Million
12/24/16 - 12/27/16	WA, ID, MT, WY, ND, SD, MN, WI	50+ Million

Storm dates and states impacted from NOAA. Economic Impact from Aon Benfield.

Figure 11 shows the daily number of user sessions in November and December 2016 with winter storm periods highlighted.

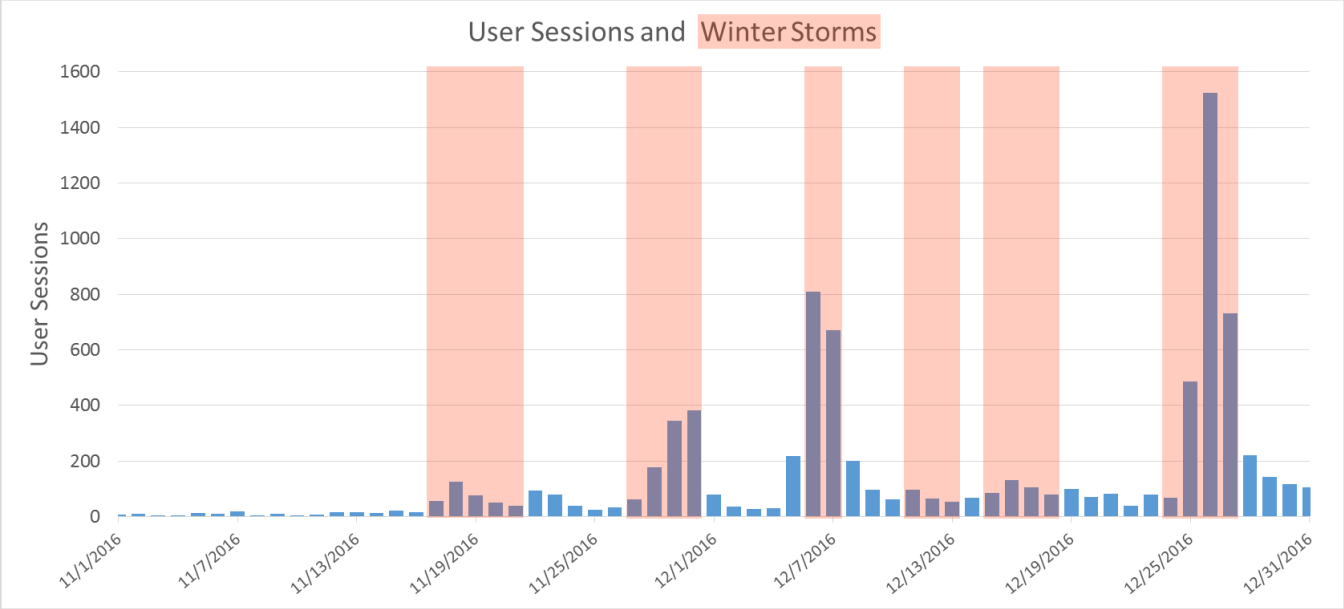

Figure 11: Website Users Session per Day and Winter Storms

Upon simple visual inspection, it appears that at least three of the winter storms correspond to periods of increased usage: November 27-30, December 6-7, and December 24-27.

Google Analytics offers a useful tool for visualizing the geographic location of users. Comparing non-storm periods to winter-storm periods in November and December 2016, this tool shows that much of the website usage may have been driven by users in certain (storm-impacted) geographic areas. Figure 12 shows the geographic location of four periods including two non-storm periods (top) and two winter-storm periods (bottom), where the larger and darker circles represent more website user sessions during the given timeframe.

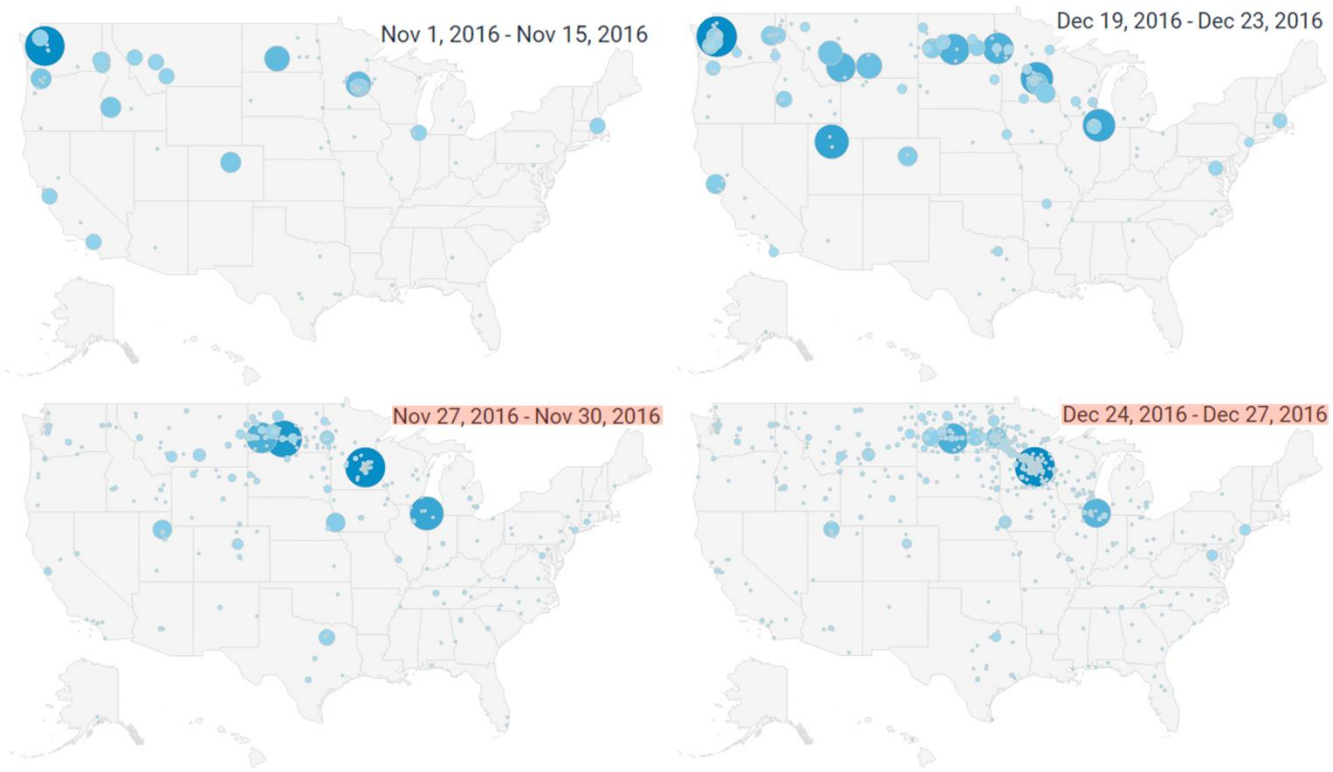

Figure 12: Geographic Location of Users Non-Storm (top) and Winter-Storm (bottom) Periods (Google Analytics)

During the non-storm periods, website usage was generally spread throughout the entire corridor, whereas during the winter-storm periods, usage was generally clustered on the eastern end of the corridor, especially in parts of ND and MN. This increase in ND and MN usage around winter-storm periods makes sense given the timing of the media effort disseminated by MnDOT and the University of MN in late October 2016.

The research team also conducted a correlation analysis to determine if, and to what extent winter storm severity in certain states and in total influenced website usage. For this analysis, 13 time periods were defined, including the six winter storm periods and the remaining seven non-storm periods that separate the winter storms, as shown in Table 3.

Table 3: Non-storm and Winter-storm Periods and Usage

Start date	Ave No. Sessions per Day
11/1/2016	11
11/17/2016	73
11/23/2016	44
11/27/2016	241
12/1/2016	78
12/6/2016	741
12/8/2016	120
12/11/2016	71
12/14/2016	68
12/15/2016	100
12/19/2016	74
12/24/2016	702
12/28/2016	146

	Average
Non-storm period	77
Winter-storm period	321

The research team compared the average number of user sessions between winter storm days and non-winter storm days. For the 38 non-storm days, the average was only 77 sessions, while for the 23 winter-storm day, the average was 321 sessions, which shows a large difference.

The average numbers of user sessions in each time period were correlated to average snowfall amounts listed in the "Select Storm Total Snowfall" data from the National Weather Service, Winter Storm Summaries (NOAA, 2017). These select snowfall totals provide the total snowfall depth for multiple locations across a winter storm impacted state. While perhaps not inclusive of all locations impacted, these totals provide an indication of the amounts of snowfall received and therefore a rough measure of the severity of impacts from a winter storm. These average snowfall totals for each state and for each winter storm period were included in the analysis, as well as the total for the entire NWP corridor. The total economic loss of each winter storm from Aon Benfield (shown in Table 2) was also included in the correlation analysis as another possible indicator of storm severity. All of the correlation data used in the analysis are provided in Appendix A. Table 4 shows the results of the correlation analysis with correlation coefficients greater than 0.5 highlighted.

Table 4: Correlation Analysis Results

	SPD	*WA*	*ID*	*MT*	*WY*	*ND*	*SD*	*MN*	*WI*	*NWP*	*EL*
SPD	1.000										
WA	0.405	1.000									
ID	0.142	0.845	1.000								
MT	0.412	0.708	0.877	1.000							
WY	0.150	0.397	0.744	0.740	1.000						
ND	0.692	0.262	0.244	0.392	0.620	1.000					
SD	0.410	0.508	0.623	0.706	0.734	0.658	1.000				
MN	0.143	0.266	0.381	0.609	0.276	0.076	0.657	1.000			
WI	-0.077	0.310	0.518	0.563	0.321	-0.170	0.595	0.762	1.000		
NWP	0.363	0.681	0.870	0.924	0.864	0.564	0.900	0.609	0.581	1.000	
EL	0.155	0.298	0.562	0.477	0.922	0.739	0.664	0.005	0.070	0.698	1.000

SPD (sessions per day); WA, ID, etc. (average select snowfall total); NWP (total ave. snowfall); EL (economic loss)

Positive correlations between website usage and snowfall amounts were found for practically all states and the NWP corridor in total. The strongest correlations between website usage and individual snowfall characteristics were for ND (0.692), MT (0.412), SD (0.410), WA (0.405), and the NWP in total (0.363). The amount of economic loss did not have a particularly strong correlation to website usage (0.155). Individual state and total NWP corridor snowfall amounts did however have strong correlations to economic loss.

In general the correlation analysis supports the notion that winter storms, and in particular snowfall amounts, do influence to some degree the amount of website traffic observed. This is especially true for ND, where the average select snowfall amount was highly correlated to overall website traffic.

5.2. General Usage Characteristics

During the time that Google Analytics was gathering data on OTIIS (4/9/16 through 12/31/16), 10,269 users registered 11,886 sessions on the website. Figure 13 shows the amount of website usage by the location of users.

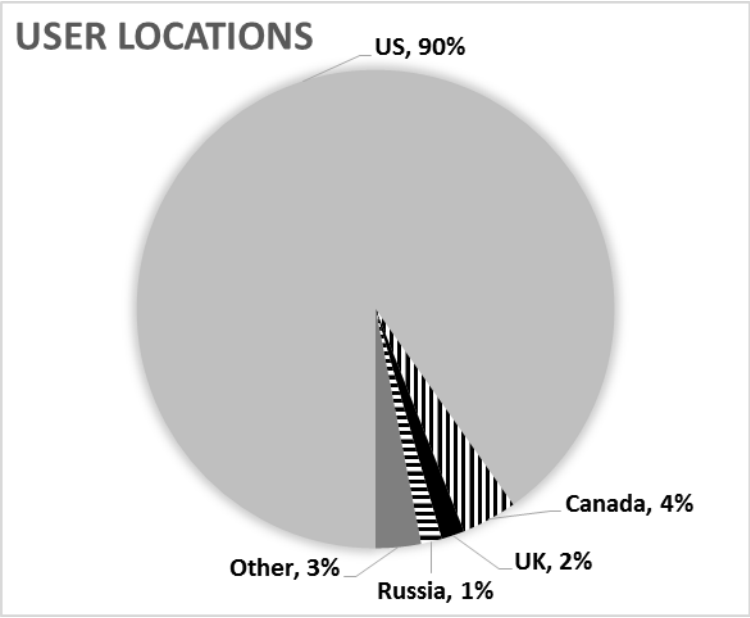

Figure 13: User Locations

As expected, the vast majority of website usage is from the US, with approximately 4% from Canada. Figure 14 shows the geographic locations of the Canadian website users.

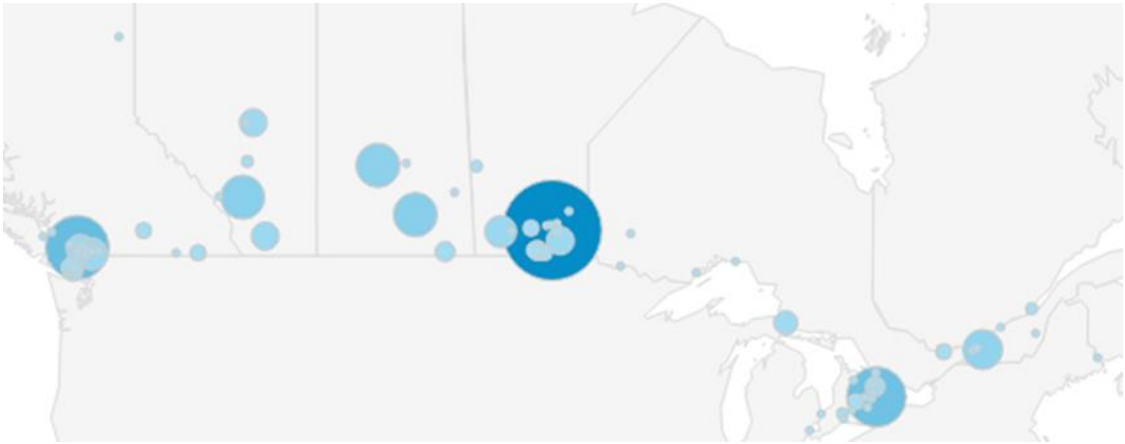

Figure 14: Geographic Location of Canadian Usage (Google Analytics)

Figure 15 displays other usage characteristics, including the type of device used to access the website, as well as the browser, the operating system, and the mobile operating system.

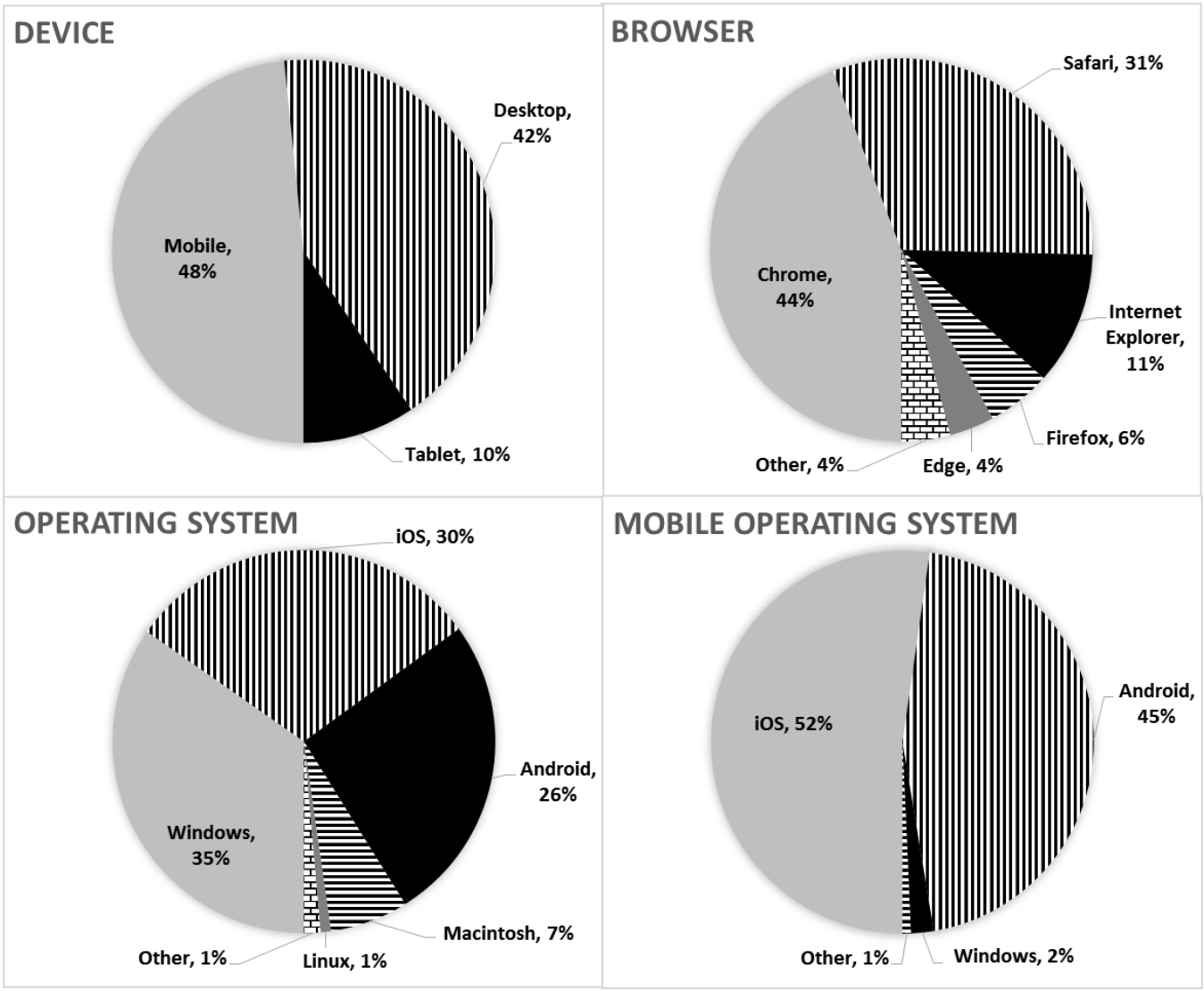

Figure 15: Devices, Browsers, and Operating Systems

Most users access the website by visiting the website address directly, as shown in Figure 16.

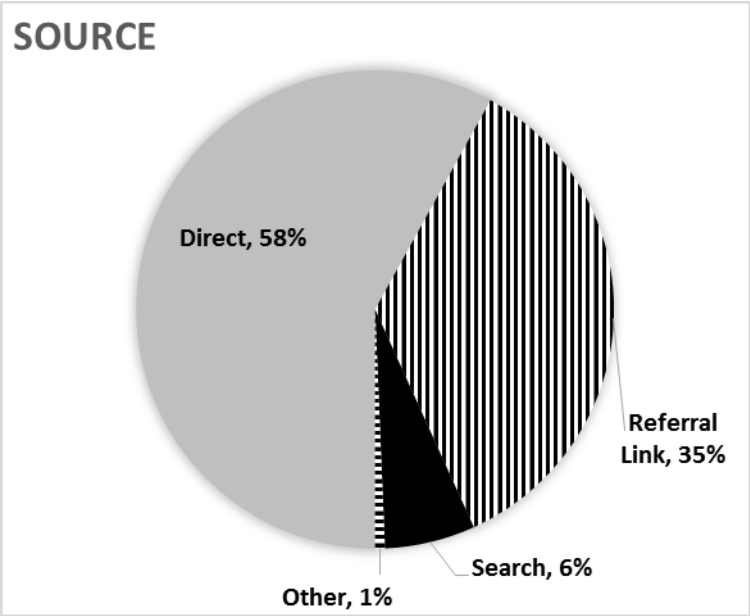

Figure 16: Website Visit Sources

The percentage of the referral links from each source is shown in Figure 17.

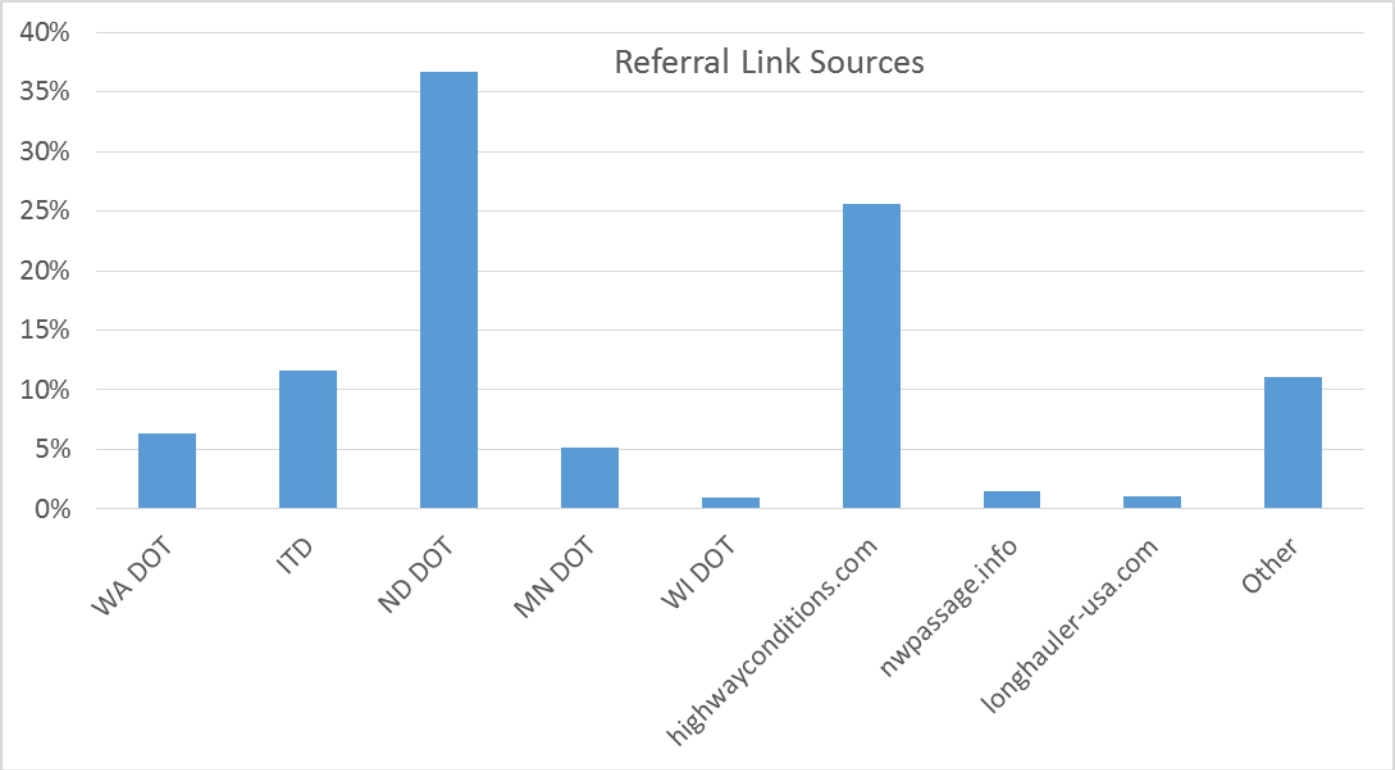

Figure 17: Referral Link Sources

The percentage of website visits from each search engine is shown in Figure 18.

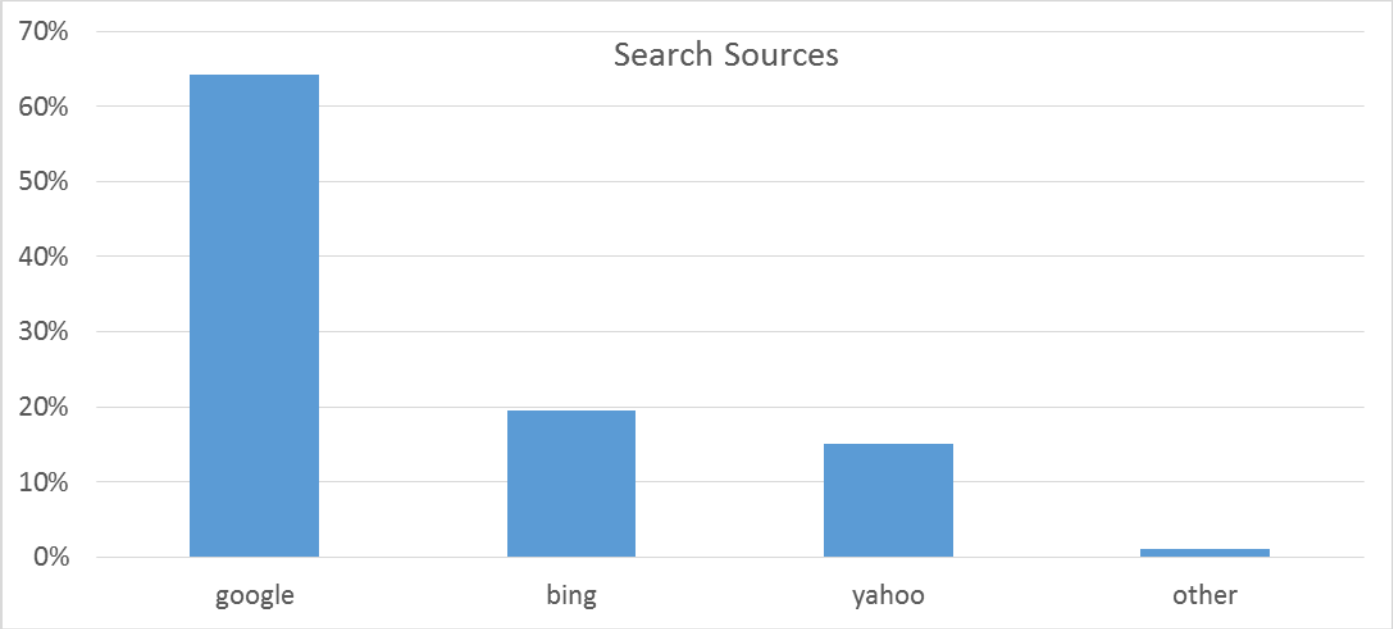

Figure 18: Search Sources

6) CONCLUSIONS

During Phase II, the OTIIS system has successfully provide more than 12,000 users with the ability to see road conditions and plan their trips seamlessly along the NWP corridor. Usage statistics and analytics have shown that media efforts are necessary to inform users of the system and grow its usage. In general the OTIIS website usage has grown over the life of the system, despite limited media exposure. Large spikes in usage were documented in November and December, 2016 (the last months observed in this evaluation).

Many improvements to the OTIIS system have been accomplished over the course of Phase II, and many improvement ideas remain documented, awaiting potential future funding opportunities. Some of the ideas that may help generate significant improvements to OTIIS in the future include:

- Create a streamlined functionality to print route information using a "print" button added to the menu bar.
- Establish a method to define and add fuel stations along the corridor to match the style of the current truck stops information.
- Investigate semantic analysis or suggested DOT data-feed event labeling changes to further improve instances when similar events in different states are categorized in different layers.
- Reduce icon clutter on wide zoom areas through methods like combining similar adjacent road conditions, or by defining limited camera views at wide zoom levels.
- Add a "news" pop-up or menu button to the website to inform users of improvements and new features that are added.
- Continue investigation into expanding information display to non-I90/94 routes, especially for major events.
- Create a method on the website to recruit mobile app beta testers.
- Continue mobile app improvements and publically launch the mobile app.
- Redirect mobile device users to the mobile browser version until mobile app launched.
- Create a "reload/refresh" button or "automatic/manual" toggle switch to allow multiple layer selections prior to the API requesting and reloading the routes after a single layer change selection.
- Create more map space on the website by making a smaller or collapsible top header bar.
- Improve aggregate data API request functionality beyond the current lat./long. type queries to an "area wide" type query (i.e. all data for states X, Y, Z).
- Explore aggregate data API opportunities for connected vehicle applications.
- Continue to explore opportunities to expand OTIIS and/or the OTIIS model to other states, corridors, or nationally.

7) REFERENCES

Aon Benfield. “2016 Annual Global Climate and Catastrophe Report.” Aon Benfield, 2017.

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National Oceanic and Atmospheric Administration (NOAA). “National Weather Service, Weather Prediction Center, Winter Storm Summaries.” www.wpc.ncep.noaa.gov/winter_storm_summaries/winter_storm_summaries.shtml Accessed January 5, 2017.

8) APPENDIX A: CORRELATION DATA

Start date	Ave No. Sessions per Day	Average Select Snowfall Totals (inches)									Economic Loss (millions)
		WA	ID	MT	WY	ND	SD	MN	WI	NWP Total	
11/1/2016	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
11/17/2016	73	0.0	4.7	5.5	7.0	3.1	5.0	13.4	3.8	42.4	25
11/23/2016	44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
11/27/2016	241	0.0	6.8	3.6	19.1	15.4	6.7	0.0	0.0	51.5	300
12/1/2016	78	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
12/6/2016	741	0.0	0.0	5.2	3.3	7.6	3.2	4.9	2.4	26.7	0
12/8/2016	120	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
12/11/2016	71	0.0	0.0	0.0	0.0	0.0	5.7	7.7	7.0	20.4	5
12/14/2016	68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
12/15/2016	100	5.0	23.3	10.6	15.1	0.0	5.5	6.7	7.2	73.4	125
12/19/2016	74	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
12/24/2016	702	5.4	10.0	5.1	4.2	11.6	6.0	4.2	0.0	46.4	75
12/28/2016	146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Non-storm period											
Winter-storm period											

Storm dates and select snowfall from NOAA, 2017. Economic Impact adapted from Aon Benfield, 2017.