

ACTION MEMORANDUM TO THE SECRETARY (OR DEPUTY SECRETARY)

From: Finch Fulton
Deputy Assistant Secretary for Transportation Policy
6-8186

Through: John Kramer
Assistant Secretary for Budget and Programs/Chief Financial Officer
6-8512

Prepared by: Paul D. Teicher
Senior Policy Analyst
6-4114

Subject: Safety Data Initiative Report to Congress

ACTION REQUIRED

The Office of the Assistant Secretary for Transportation Policy (OST-P) requests that the Secretary approve to transmit and sign the Safety Data Initiative (SDI) Report to Congress.

SUMMARY

This report responds to a Congressional request to “the Secretary to provide a spend plan and report detailing how the \$5,500,000 provided in fiscal year 2018 for safety data and automated vehicle safety data initiatives will improve our Nation’s safety.” The report to Congress was requested in Senate Report 115–268 accompanying the Transportation, and Housing and Urban Development, and Related Agencies Appropriations Bill, 2019. The funds are administered by OST-P, and were dedicated to the Secretarial SDI.

BACKGROUND

The Safety Data Initiative seeks to build USDOT and the surface transportation safety community's capacity to better identify systemic factors contributing to safety risks through the use of data. To do so, the SDI focuses on integrating data and leveraging private sector data sources, creating captivating and intuitive data visualizations, and using advanced analytic techniques and methods. Led by OST-P in close coordination with other parts of USDOT, the SDI has been a collaborative effort to fully leverage new opportunities while minimizing duplication.

The appropriations report to Congress outlines the activities under the SDI, how the funds are being used, and its effect on our Nation's safety.

The Report to Congress had no deadline.

RECOMMENDATION

OST-P recommends the Secretary's approval to transmit and sign the Safety Data Initiative Report to Congress.

The Secretary

APPROVED:

John L. Chao

DISAPPROVED:

COMMENTS:

DATE:

12-11-2020



THE SECRETARY OF TRANSPORTATION
WASHINGTON, DC 20590

December 11, 2020

The Honorable Richard C. Shelby
Chairman
Committee on Appropriations
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

The U.S. Department of Transportation (DOT) is pleased to submit this report to Congress requested in Senate Report 115–268 accompanying the Transportation, and Housing and Urban Development, and Related Agencies Appropriations Bill, 2019. The Senate Report requested “the Secretary to provide a spend plan and report detailing how the \$5,500,000 provided in fiscal year [FY] 2018 for safety data and automated vehicle safety data initiatives will improve our Nation’s safety.” The enclosed report responds to this request.

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With the funding, DOT will build upon the lessons learned to date to continue supporting the transportation safety community's ability to improve roadway safety by:

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The enclosed report further details how the funding provided in FY 2018 for safety data and automated vehicle safety data initiatives will improve our Nation's safety.

Similar letters have been sent to the Vice Chairman of the Senate Committee on Appropriations; the Chairwoman and Ranking Member of the House Committee on Appropriations; the Chairman and Ranking Member of the Senate Appropriations Subcommittee on Transportation, Housing and Urban Development, and Related Agencies; and the Chairman and Ranking Member of the House Appropriations Subcommittee on Transportation, Housing and Urban Development, and Related Agencies.

Sincerely,



Elaine L. Chao



THE SECRETARY OF TRANSPORTATION
WASHINGTON, DC 20590

December 11, 2020

The Honorable Patrick J. Leahy
Vice Chairman
Committee on Appropriations
United States Senate
Washington, DC 20510

Dear Senator Leahy:

The U.S. Department of Transportation (DOT) is pleased to submit this report to Congress requested in Senate Report 115--268 accompanying the Transportation, and Housing and Urban Development, and Related Agencies Appropriations Bill, 2019. The Senate Report requested "the Secretary to provide a spend plan and report detailing how the \$5,500,000 provided in fiscal year [FY] 2018 for safety data and automated vehicle safety data initiatives will improve our Nation's safety." The enclosed report responds to this request.

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Sincerely,



Elaine L. Chao



THE SECRETARY OF TRANSPORTATION
WASHINGTON, DC 20590

December 11, 2020

The Honorable Susan M. Collins
Chairman, Subcommittee on Transportation, Housing
and Urban Development and Related Agencies
Committee on Appropriations
United States Senate
Washington, DC 20510

Dear Madam Chairman:

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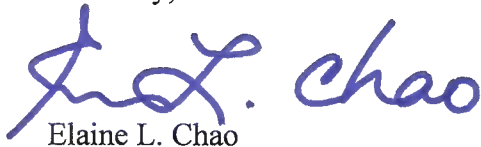
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Sincerely,



Elaine L. Chao



THE SECRETARY OF TRANSPORTATION
WASHINGTON, DC 20590

December 11, 2020

The Honorable Jack Reed
Ranking Member, Subcommittee on Transportation,
Housing and Urban Development, and Related Agencies
Committee on Appropriations
United States Senate
Washington, DC 20510

Dear Senator Reed:

The U.S. Department of Transportation (DOT) is pleased to submit this report to Congress requested in Senate Report 115–268 accompanying the Transportation, and Housing and Urban Development, and Related Agencies Appropriations Bill, 2019. The Senate Report requested “the Secretary to provide a spend plan and report detailing how the \$5,500,000 provided in fiscal year [FY] 2018 for safety data and automated vehicle safety data initiatives will improve our Nation’s safety.” The enclosed report responds to this request.

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Sincerely,



Elaine L. Chao



THE SECRETARY OF TRANSPORTATION
WASHINGTON, DC 20590

December 11, 2020

The Honorable Nita M. Lowey
Chairwoman
Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

Dear Chairwoman Lowey:

The U.S. Department of Transportation (DOT) is pleased to submit this report to Congress requested in Senate Report 115–268 accompanying the Transportation, and Housing and Urban Development, and Related Agencies Appropriations Bill, 2019. The Senate Report requested “the Secretary to provide a spend plan and report detailing how the \$5,500,000 provided in fiscal year [FY] 2018 for safety data and automated vehicle safety data initiatives will improve our Nation’s safety.” The enclosed report responds to this request.

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Sincerely,



Elaine L. Chao



THE SECRETARY OF TRANSPORTATION
WASHINGTON, DC 20590

December 11, 2020

The Honorable Kay Granger
Ranking Member
Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

Dear Congresswoman Granger:

The U.S. Department of Transportation (DOT) is pleased to submit this report to Congress requested in Senate Report 115–268 accompanying the Transportation, and Housing and Urban Development, and Related Agencies Appropriations Bill, 2019. The Senate Report requested “the Secretary to provide a spend plan and report detailing how the \$5,500,000 provided in fiscal year [FY] 2018 for safety data and automated vehicle safety data initiatives will improve our Nation’s safety.” The enclosed report responds to this request.

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Sincerely,



Elaine L. Chao



THE SECRETARY OF TRANSPORTATION
WASHINGTON, DC 20590

December 11, 2020

The Honorable David E. Price
Chairman, Subcommittee on Transportation,
Housing and Urban Development and Related Agencies
Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

Dear Chairman Price:

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Elaine L. Chao



THE SECRETARY OF TRANSPORTATION
WASHINGTON, DC 20590

December 11, 2020

The Honorable Mario Diaz-Balart
Ranking Member, Subcommittee on Transportation,
Housing and Urban Development and Related Agencies
Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

Dear Congressman Diaz-Balart:

The U.S. Department of Transportation (DOT) is pleased to submit this report to Congress requested in Senate Report 115–268 accompanying the Transportation, and Housing and Urban Development, and Related Agencies Appropriations Bill, 2019. The Senate Report requested “the Secretary to provide a spend plan and report detailing how the \$5,500,000 provided in fiscal year [FY] 2018 for safety data and automated vehicle safety data initiatives will improve our Nation’s safety.” The enclosed report responds to this request.

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Elaine L. Chao



U.S. Department of Transportation

SDi | SAFETY DATA INITIATIVE

SUMMARY REPORT



Data
Visualization



Predictive
Insights



Data
Integration



U.S. Department of Transportation

Report to Congress: *Safety Data Initiative*

**Senate Report 115-268, Departments of Transportation and
Housing and Urban Development, and Related Agencies
Appropriations Bill, 2019**

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Legislative Request

Source: Senate Report 115-268, Departments of Transportation and Housing and Urban Development, and Related Agencies Appropriations Bill, 2019 at page 19, under the Transportation Planning, Research, and Development (TPR&D) heading.

The Committee on Appropriations directs the Secretary to provide a spend plan and report detailing how the \$5,500,000 provided in fiscal year 2018 for safety data and automated vehicle safety data initiatives will improve our Nation's safety.



Introduction

The United States Department of Transportation (USDOT or Department) Safety Data Initiative (SDI) began in 2017 and seeks to build USDOT and the surface transportation safety community's capacity to help identify systemic factors contributing to safety risks through the use of data. To do so, the SDI focuses on integrating data and leveraging private sector data sources, creating captivating and intuitive data visualizations, and using advanced analytic techniques and methods. Led by the Office of the Secretary of Transportation (OST) in close coordination with other parts of USDOT, the SDI has been a collaborative effort to help leverage new opportunities while minimizing duplication of existing safety data program activities.

Our approach included launching a series of pilot projects to test our ability to conduct advanced analysis on transportation risks while seeking new ways to find answers to fundamental roadway safety questions. With each pilot, we have learned important lessons that will inform our work going forward, and we have sought validation of each pilot from transportation safety experts, particularly those who will use our tools.

The scope of the document is broader than the legislative request and encompasses both safety activities to be performed, and safety activities already completed, in support of the SDI. This report describes the activities performed during Phase I of the SDI, and the outcomes and lessons learned from those activities.¹ Additionally, the report outlines the activities for Phase II of the SDI over fiscal year (FY) 2021, and responds to Congressional request to “provide a spend plan and report detailing how the \$5.5 million [in Congressional funds] provided in FY 2018 for safety data and automated vehicle (AV) safety data initiatives will improve our Nation's safety.” The Department allocated these \$5.5 million in funds solely to support the SDI. These funds were not used for AV safety data research due to the availability of other funding sources for AV safety research. Additional OST resources were also used beyond the \$5.5 million.²



¹ Phase I is comprised of the pilot projects, as well as the engagement and planning efforts, in the calendar year 2017-2019 timeframe. Phase II began in calendar year 2019 and continues.

² Expenditures are further described in the Spend Plan section of the report.

Results from Phase I of the SDI show the potential for these techniques to open new ways to understand transportation risk, and informed our actions in Phase II. The SDI has already shown promise through unique insights and valuable tools that address transportation safety.



The Waze Pilot Project demonstrated the potential for crowd-sourced traffic data to illuminate safety risk patterns and inform decision making.



The Solving for Safety Data Visualization Challenge harnessed the creativity of the private sector to compete in the development of real solutions to safety problems.



The Fatality Analysis Reporting System (FARS) Visualization Pilot Project expanded our understanding of data visualization and produced usable tools to advance safety.



The Rural Speed Pilot Project successfully integrated new speed and legacy infrastructure data sets at the State level for unique analysis of how traffic speeds by roadway segment may affect safety.



The Pedestrian Fatality Model Pilot Project successfully integrated numerous disparate data sets and created models to help better understand pedestrian fatality risk, which has also resulted in an intuitive data visualization map.

Overarching Lessons from Phase I

1. Compelling use cases for safety data with key objectives and milestones will guide the future of the SDI.

Determining specific, tangible objectives with clear milestones will help determine what further research needs to be done; what data we want to leverage to perform that research; and how we can further positive partnerships with State and local governments and the private sector. Phase II incorporated purposeful scoping to reflect this lesson learned.

2. State and local capabilities, needs, and challenges are different.

Approaches that vary in complexity and content are necessary to further the state of the practice and use of safety data for policy and decision making. Some jurisdictions will benefit from basic visualizations; State and local governments may have data but do not have the resources to staff an extensive analytics team. Cities can drive innovation and execute promising practices such as High-Injury Networks.³ State and local governments often value best practices more than findings from research projects, and diagnostic tools are preferred over prescribing solutions.

³ High-injury networks are corridor level roadway safety analyses that highlight concentrations of severe injuries and deaths.

3. SDI partnerships with State and local governments allow for on-the-ground validation and opportunities for further insight.

Further validation with State and local governments could strengthen new safety tools and assist in more accurately assessing the usability and value of these tools. This validation will help us understand what partners find useful, confer benefits to the partner governments, and help USDOT better understand how to scale useful products nationwide. Partnering directly with State and local governments also supplements existing tools with additional State and local data.

4. Insights can be found by using new methods and data sets, including proprietary data.

New and emerging data sets provide an opportunity for new research and insights. To leverage these opportunities more effectively, we must get a solid understanding of the current data available and how the new data can supplement information gaps. There is substantial interest in leveraging proprietary data for safety purposes from both data users and owners, but significant barriers impede data sharing. For example, data owners, particularly regulated entities such as carriers and operators, are concerned about legal liability hurting their competitive edge, and how USDOT will use their data. There may be a need to clarify how to address these concerns so that sensitive data can be accessed and used. Investing in data management systems to house proprietary and sensitive data, such as USDOT's Secure Data Commons, can address some of these concerns while also providing cloud-computing environments to increase the computational resources needed to analyze those data.⁴

Activities for Phase II

Phase II of the SDI focuses on our State and local partners to make significant advances in leveraging new data sources, and new analytic techniques in the service of creating safer surface transportation networks. Market research on vendor capabilities related to safety research, analytics, and data management was performed through a Request for Information (RFI) helped to formulate how to invest the remaining funds via contracts. To identify and address important safety priorities, an SDI analytic agenda was developed for future research procurement activities, with a focus on precursors to crashes, intersections, non-fatal injury crashes, and pedestrian and bicyclist safety.

For Phase II, USDOT announced more than \$4 million in opportunities for our transportation stakeholder community⁵:

⁴ For more information on the Secure Data Commons, visit: <https://its.dot.gov/data/secure/>

⁵ The \$4 million in funds are from the \$5.5 million in FY 2018 appropriations. More information on how the \$5.5 million is being spent is in the Spend Plan section of the report.

- More than \$3 million Notice of Funding Opportunity (NOFO) focused on building the capacity of State, local and Tribal governments to use innovative data tools and information to improve roadway safety. In June 2020, nine applicants were selected for awards, of which eight established agreements with OST.⁶
- \$1 million will be made available through a Broad Agency Announcement (BAA) and follow-on contracts to explore approaches that use new data sources and/or data unavailable to the USDOT to gain novel, usable, and actionable insights focused on the SDI analytic agenda safety focus areas. In September 2020, four applicants received awards.⁷

Improving Safety

The SDI supports the transportation safety community's ability to improve the Nation's safety outcomes by:

- Enhancing State and local capacity to use safety tools for decision making through use cases. This includes locations with limited capacity.
- Developing safety tools through use cases that will be transferable, scalable, and replicable elsewhere. Better information will lead to better decision- and policy-making, better targeting of safety improvements, and maximizing available resources to reduce fatalities and serious injuries.
- Characterizing safety risks and the challenges we face better by leveraging new data sources to uncover insights.
- Encouraging innovative practices for data and research in order to understand safety risks better, and harnessing the latest developments in technological and software advances for safety purposes.
- Breaking down traditional institutional barriers to foster learning between transportation safety disciplines, USDOT offices, and the Federal, State, regional, and local government community focused on transportation.

⁶ Additional details are located later on in the report on page 26.

⁷ Additional details about the SDI analytic agenda are located later on in the report on page 28. Additional details about the BAA are located on page 26.

Background

Safety remains a stubborn problem on our Nation's roadways. In 2018, 36,560 people died in motor vehicle crashes. Future safety advances are expected from vehicle automation, but another type of technological advancement will also be helpful—the advent of *big data* and the use of advanced data analytics have the potential to provide actionable insights into roadway safety.

The USDOT initiated the SDI in 2017 to build upon and enhance existing safety efforts related to data, analysis, and policy making. Several Departmental components have participated in the initiative:

- Office of the Secretary of Transportation (OST)
- Federal Highway Administration (FHWA)
- Federal Motor Carrier Safety Administration (FMCSA)
- Federal Railroad Administration (FRA)
- Federal Transit Administration (FTA)
- National Highway Traffic Safety Administration (NHTSA)

The initiative aims to address transportation safety risks strategically through data-informed decision making, with a focus on three areas:

Data Integration

Integrating existing USDOT databases, other non-USDOT government data (e.g., Federal, State, local, etc.), and new private-sector data sources to answer safety questions.

Advanced Data Analysis

Using advanced analytic techniques to identify risk patterns and gain insight that will help anticipate and mitigate safety risk to reduce injuries and fatalities.

Data Visualization

Making data analysis and insights accessible to policy makers through clear, compelling data visualizations.

Through innovative, rigorous, and timely safety data analysis, insights can help policy and decision makers address surface transportation safety risks across surface transportation modes. By coordinating and collaborating with transportation stakeholders both within and outside of USDOT, the SDI seeks to augment work being performed elsewhere.

During Phase I of the SDI, which began in calendar year 2017, the Department undertook several pilot projects and a challenge to explore opportunities in the initiative's three focus areas. USDOT successfully completed these pilot projects in 2019, and convened an expert panel to validate these projects. The success of these projects is largely attributed to leveraging the

Department's subject matter experts in the operating administrations (OAs) through a collaborative, cross-modal approach.

In 2019, USDOT also held a meeting with stakeholders to seek their input into the initiative's next steps, which included informing an SDI analytic agenda that set priorities for future applied research.

In late 2019, USDOT began Phase II of the SDI by releasing the Notice of Funding Opportunity (NOFO) titled *State and Local Government Data Analysis Tools for Roadway Safety*, and a Broad Agency Announcement (BAA) titled *Conducting Innovative, Applied Research to Gain New Roadway Safety Insights and Tools*. These two funding opportunities closed in January 2020. The Department announced awards in June 2020 for the State and Local Government Data Analysis Tools for Roadway Safety, and the awardees will have approximately one year to complete the funded projects. The BAA awards were announced in September 2020.

The following sections outline SDI Phase I activities, as well as Phase II activities. The report responds to a Congressional request for "the Secretary to provide a spend plan and report detailing how the \$5,500,000 provided in FY 2018 for safety data and automated vehicle safety data initiatives will improve our Nation's safety."⁸



⁸ Senate Report 115–268 accompanying Transportation, and Housing and Urban Development, and Related Agencies Appropriations Bill, 2019 [To accompany S. 3023]
<https://www.congress.gov/115/crpt/srpt268/CRPT-115srpt268.pdf>

USDOT began the SDI by initiating several pilot projects, and a challenge in the three focus areas—data integration, advanced data analysis, and data visualization—to explore the possibilities of using data for innovative, new safety applications.

1. Waze Pilot Project
2. Solving for Safety Data Visualization Challenge
3. Fatality Analysis Reporting System (FARS) Visualization Pilot Project
4. Rural Speed Pilot Project
5. Pedestrian Fatality Model Pilot Project

Through these pilot projects, USDOT staff have learned about new methods of data integration, advanced data analysis, and data visualization without investing significant financial resources. Further, the Challenge engaged the private sector and academia in developing innovative analytical visualization tools.

Pilot Projects

Waze Pilot Project

Overview

The Waze pilot project focused on developing tools to leverage new private sector crowd-sourced data resource while also responding to specific safety problems. Waze is a GPS software application that drivers in motor vehicles use for navigation information such as current travel times and route details. USDOT established an agreement with Waze to archive nationwide traffic alerts and jam data on a secure, cloud-based platform (the Secure Data Commons (SDC)) through the Waze for Cities program.⁹ These data are aggregated to protect privacy, ensuring individual users and trips cannot be deduced from the Waze data provided to USDOT. The Volpe National Transportation Systems Center (Volpe Center) conducted the analysis for the Waze pilot.

The first part of the Waze pilot project sought to understand broad-scale crash patterns better and to develop early indicators of crash risk. Models based on Random Forests machine learning methods were trained on police-reported crashes to provide near-real time, granular estimates of crashes to inform safety policy and operations.

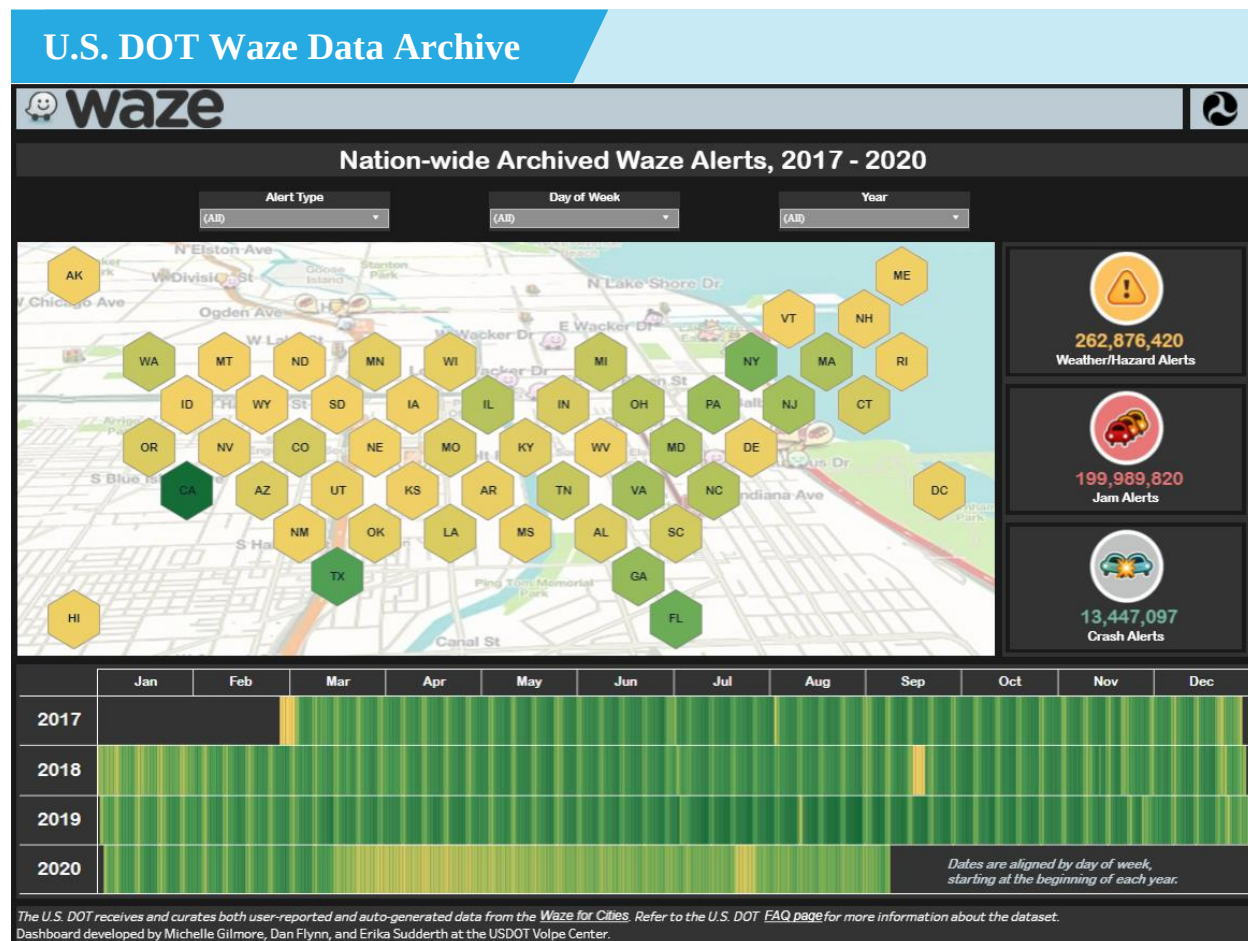
⁹ Formerly called the Connected Citizens Program

The data sources used included:

- The NHTSA Electronic Data Transfer system for Maryland, Virginia, Connecticut, and Utah crashes;
- Longitudinal Employer-Household Dynamics (LEHD) data;
- Roadway characteristics from the Highway Performance Monitoring Systems (HPMS); and
- Weather information from the Global Historical Climate Network (GHCN), made available through the National Oceanic and Atmospheric Administration (NOAA).

The work in the first part found that statewide crash models based on integrated Waze, traffic volume, census, and weather data give reliable hourly estimates of police-reportable crashes for the 1-mile area grids.

In the second part of the Waze pilot project, USDOT partnered with the Tennessee Highway Patrol and the City of Bellevue, Washington, as case studies to explore State and local applications of the Waze models.



U.S. DOT receives and curates both user-reported and auto-generated data from the Waze for Cities program. Refer to the U.S. DOT FAQ page for more information about the dataset.

<https://www.transportation.gov/office-policy/transportation-policy/faq-waze-data>

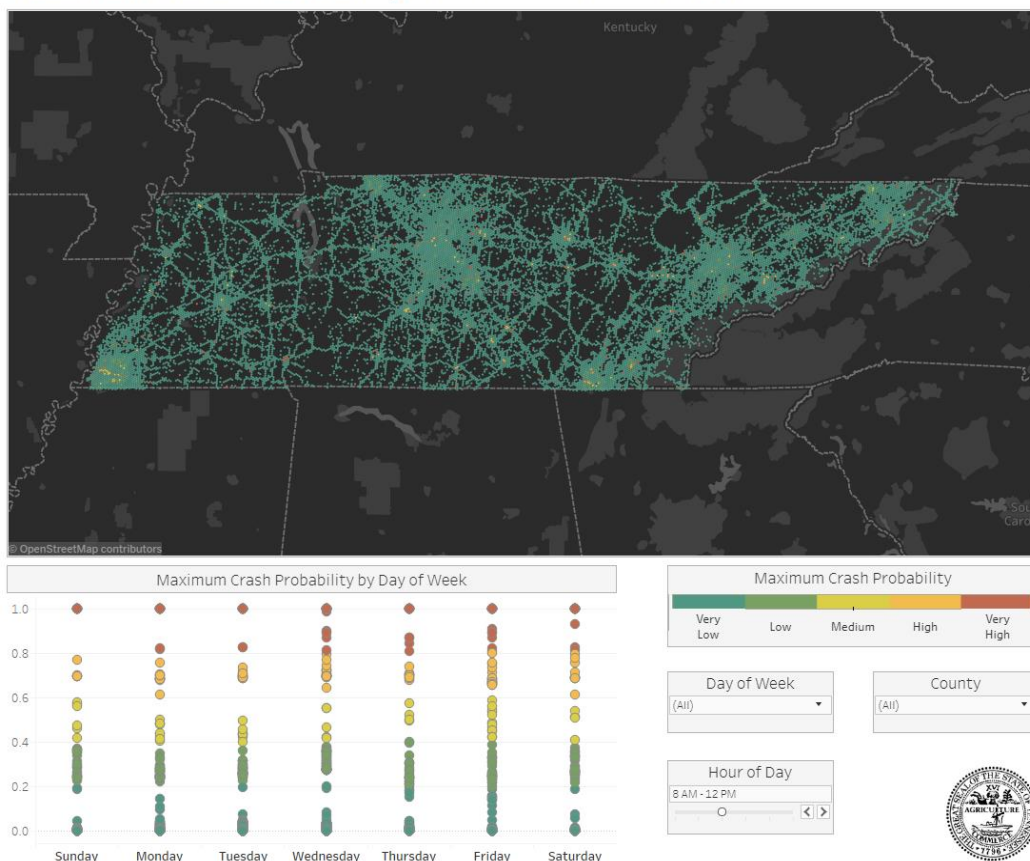
Case Study: Tennessee Highway Patrol

The Tennessee Highway Patrol (THP) uses a roadway crash prediction model as part of an Integrated Traffic Analysis Network, or TITAN, analytics platform. The crash model has been successfully used since 2014 to guide State troopers to areas with high crash propensity, based on predicted weather and scheduled special events for an upcoming week. The model runs at a large spatial scale (42-square-mile grids) over 4-hour time blocks.

The SDI Waze team integrated Waze data and modeled crashes at a much finer spatial (1-square mile) and temporal (1-hour) scale. The Waze data successfully increased the crash model resolution, without reducing overall accuracy. The new models provide a high-resolution option for THP troopers to use when scheduling patrols, particularly for urban areas, which will allow THP to target State trooper deployments to locations and at times where roadway crash risk is predicted to be the highest. Work from this case study has been submitted for consideration to be published in the Transportation Research Record.

Tennessee Case Study

Maximum Crash Probability - Model 05, May 6, 2019 - May 13, 2019 in Tennessee



Interactive dashboard that visualizes the outputs from a risk model used by the Tennessee Highway Patrol, which includes crash data and information from crowd-sourced Waze.



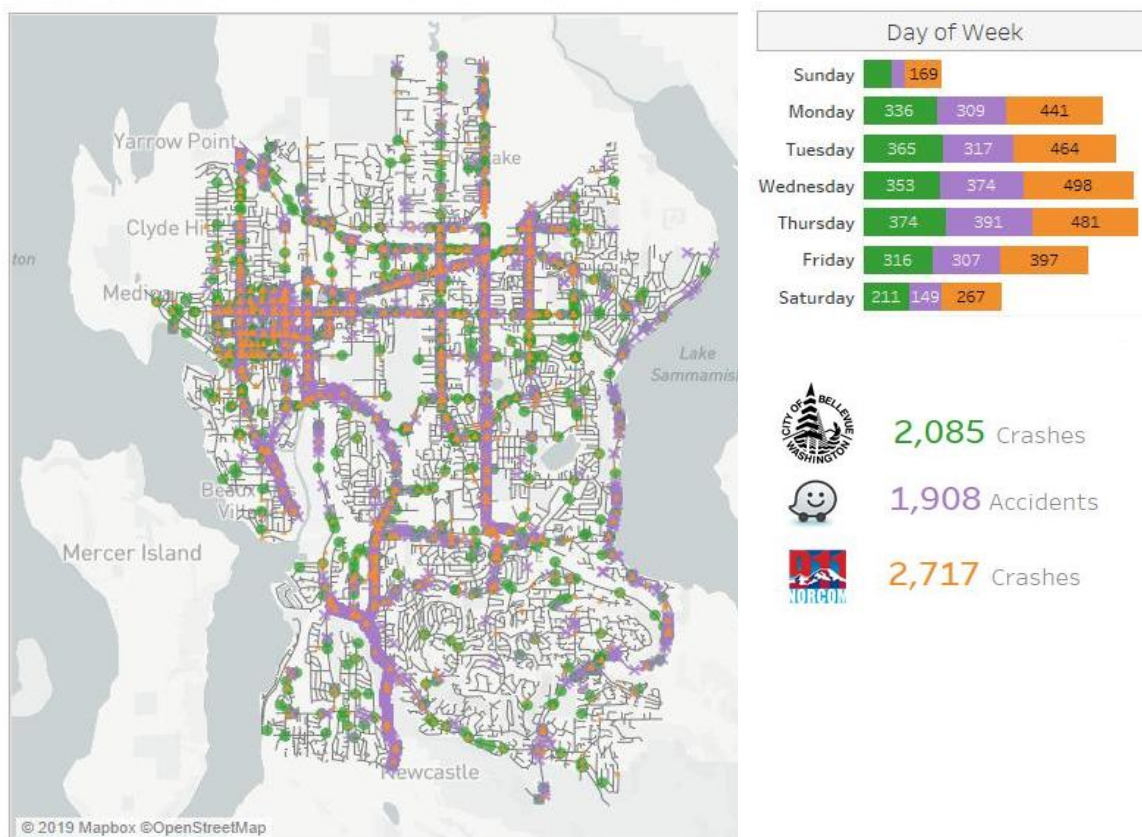
<https://www.transportation.gov/office-policy/transportation-policy/sdi-waze-project-summary-documents>

Case Study: Bellevue, Washington

The City of Bellevue, Washington collaborated with the Volpe Center to explore whether Waze event data can offer actionable insights to inform the Bellevue Vision Zero action plan. The team created interactive dashboards with an integrated view of Waze events and two crash data sets provided by the City of Bellevue. The tool highlights locations where police-reported crashes coincide with 911 or Waze crash alerts, as well as locations with unique reports that can help identify unreported traffic incidents. The dashboard tool could also support studies comparing crash reports with hospital records to build a more complete view of traffic-related injuries. The research team also developed crash estimation models and weighted crash metrics that provide a macro perspective to help the City of Bellevue to prioritize efforts to diagnose and address safety concerns at a micro (intersection) level.

Bellevue Case Study

Integrated 2018 Traffic Safety Data: Bellevue and NORCOM Crash Reports with Waze Accidents



Interactive dashboard that visualizes three sources of crash data in the City of Bellevue Washington, and summarizes the information by time of day and day of week.

<https://www.transportation.gov/office-policy/transportation-policy/sdi-waze-project-summary-documents>

Lessons Learned and Opportunities

- Crowd-sourced data from Waze can enhance other roadway data to illuminate safety risk patterns and inform decision making. Statewide crash models based on integrated Waze, traffic volume, census, and weather data give reliable hourly estimates of police-reportable crashes in 1-mile area grids.
- Waze alert data can provide important contextual information to inform State and local traffic safety applications.
- Access to the SDC and the computational resources necessary to utilize big data from private industry for traffic safety applications was crucial to project success, and through the SDC the current Waze analytic pipeline can be extended nationwide to any State or local area.
- The Waze pilot presents an opportunity to support crash propensity models and provide roadway safety insights through a nationwide data source for local governments and metropolitan planning organizations (MPO) that do not have extensive traffic monitoring resources, although potential data integration challenges exist at the local level.
- With additional validation, Waze data could offer estimates of unreported crashes. NHTSA estimates that 60 percent of property-damage-only crashes and 24 percent of injury-only crashes are not reported. While this does not directly relate to reducing roadway fatalities, the data offer insight into what conditions are correlated with higher crash risk.



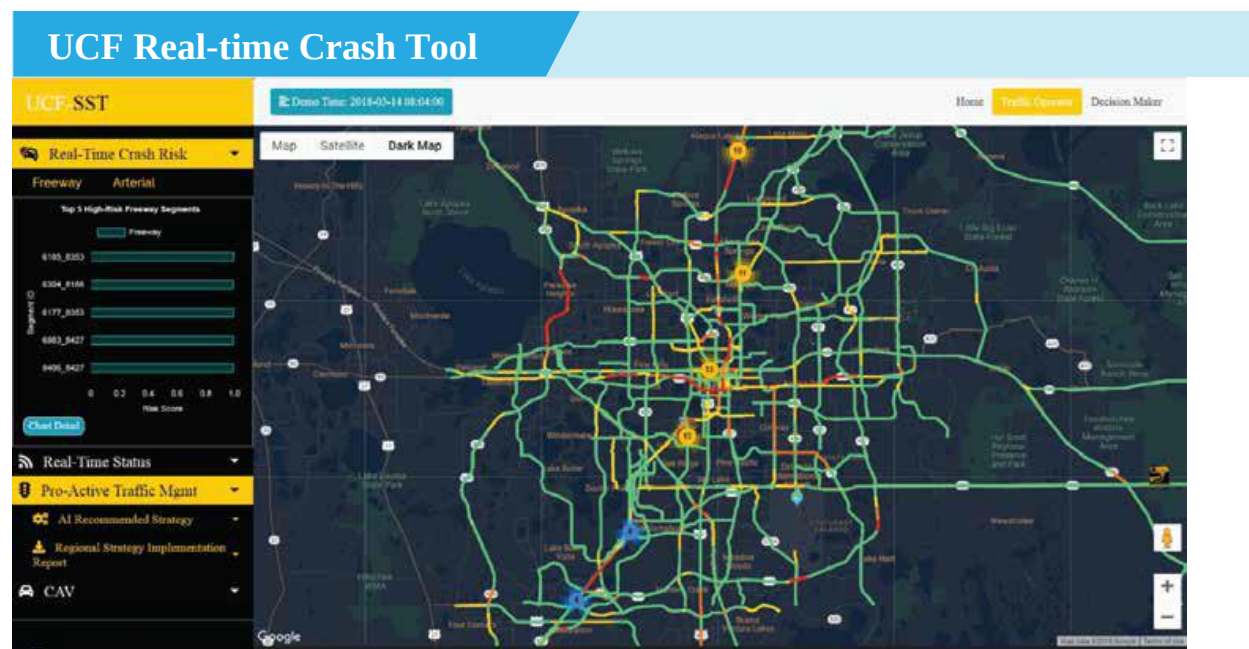
Solving for Safety Visualization Challenge

Overview

In 2018, USDOT's Bureau of Transportation Statistics (BTS) launched the Solving for Safety Visualization Challenge, a three-stage national competition in which solvers developed analytical tools, powered by visualizations, to reduce serious crashes on the Nation's roads, and competed for a total \$350,000 prize purse that was distributed in 2 stages¹⁰. A total of 54 solvers submitted ideation proposals with a focus on vulnerable system users; conflict point impacts (e.g., intersections and rail-grade crossings); and high-risk factors (e.g., young drivers, impairment, etc.). USDOT selected five semi-finalists to develop proofs of concept for their ideas, and two finalists, the University of Central Florida and Ford Motor Company, to develop full working analytical visualization tools. In November 2019, USDOT announced that the University of Central Florida had won the challenge and received a \$200,000 award.

University of Central Florida (Winner)

The University of Central Florida's *Real-Time Crash Risk Visualization Tools for Traffic Safety Management* integrates real-time data from sources that are primarily used for traffic management with static data, and uses advanced analytics, including machine learning and artificial intelligence (AI), to predict elevated crash risk in real time and suggest safety countermeasures that could be implemented in real time and in the longer term.



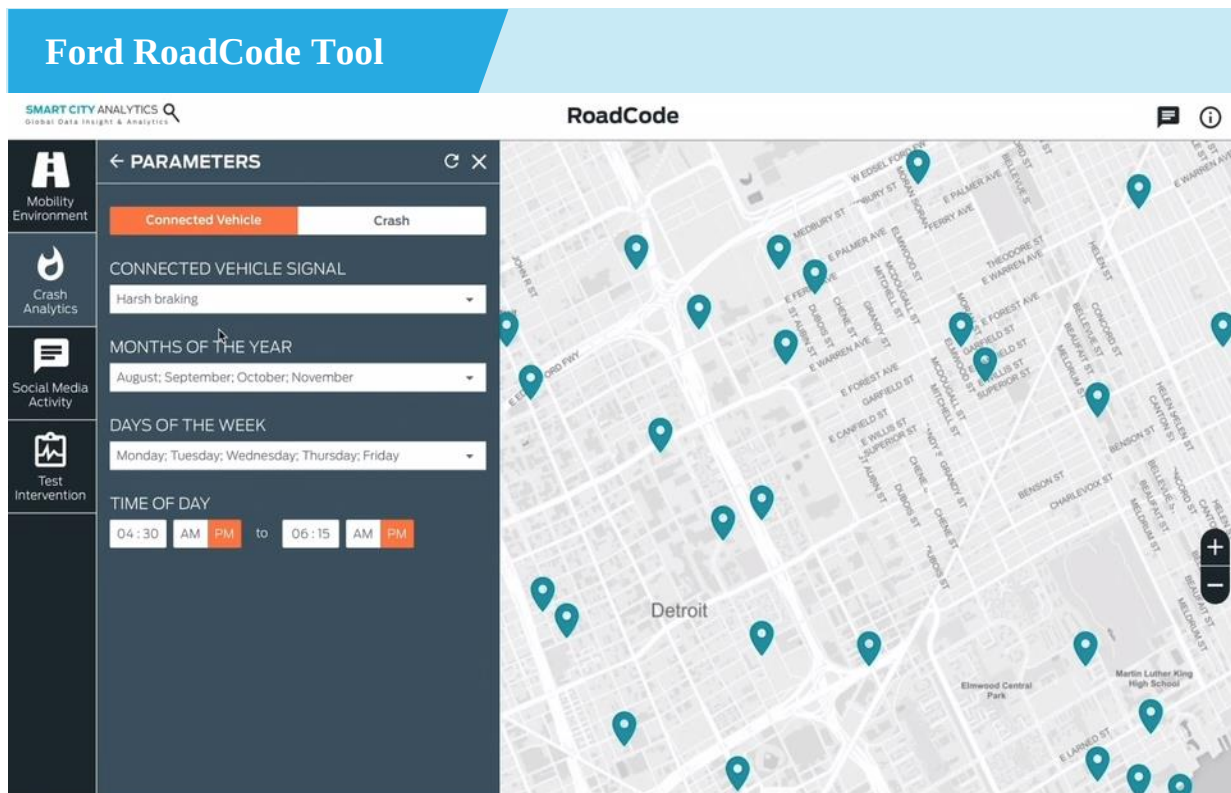
Interactive dashboard of the Orlando, Florida metropolitan region that visualizes a risk model that integrates crash data, traffic conditions, and other data to estimate real-time crash risk.

<https://www.transportation.gov/solve4safety/university-central-florida>

¹⁰ For more information visit <https://www.transportation.gov/policy-initiatives/solving-safety/solving-safety-visualization-challenge>

Ford Motor Company (Finalist)

Ford Motor Company's *RoadCode* tool combined traditional crash data with connected vehicle and driver behavior data, social media, and population data to help decision makers uncover insights about safety opportunity areas. As a finalist, Ford Motor Company received a \$50,000 award. After the Challenge, a division of Ford Motor Company began a commercialized version of the tool called *Safety Insights*.¹¹



Interactive dashboard of Detroit, Michigan that visualizes crash analytic outputs that use integrated traditional crash data with connected vehicle and driver behavior data, social media, and population.

 <https://www.transportation.gov/solve4safety/ford-motor-co>

¹¹ For more information visit <https://safetyinsights.ford.com/>

Lessons Learned and Opportunities

- The challenge incentivized the development of new analytical data visualization tools to understand risk at the system level and inform roadway safety strategies.
- By hosting a prize competition rather than awarding grants or contracts, USDOT lowered the burden of entry; leveraged the creativity of new, nontraditional stakeholders; and brought forward a broad range of ideas.
- USDOT learned from nontraditional stakeholders about new data sources, such as cell phones, probes, connected vehicles, and Intelligent Transportation Systems (ITS).
- The Challenge facilitated successful approaches to data integration using a variety of local, public, and private sector data.
- Tools developed through the challenge have the opportunity to be further developed, refined, and applied in other locations. Even projects that did not advance to the second and third stages showed promise and may prove to be useful in the future.

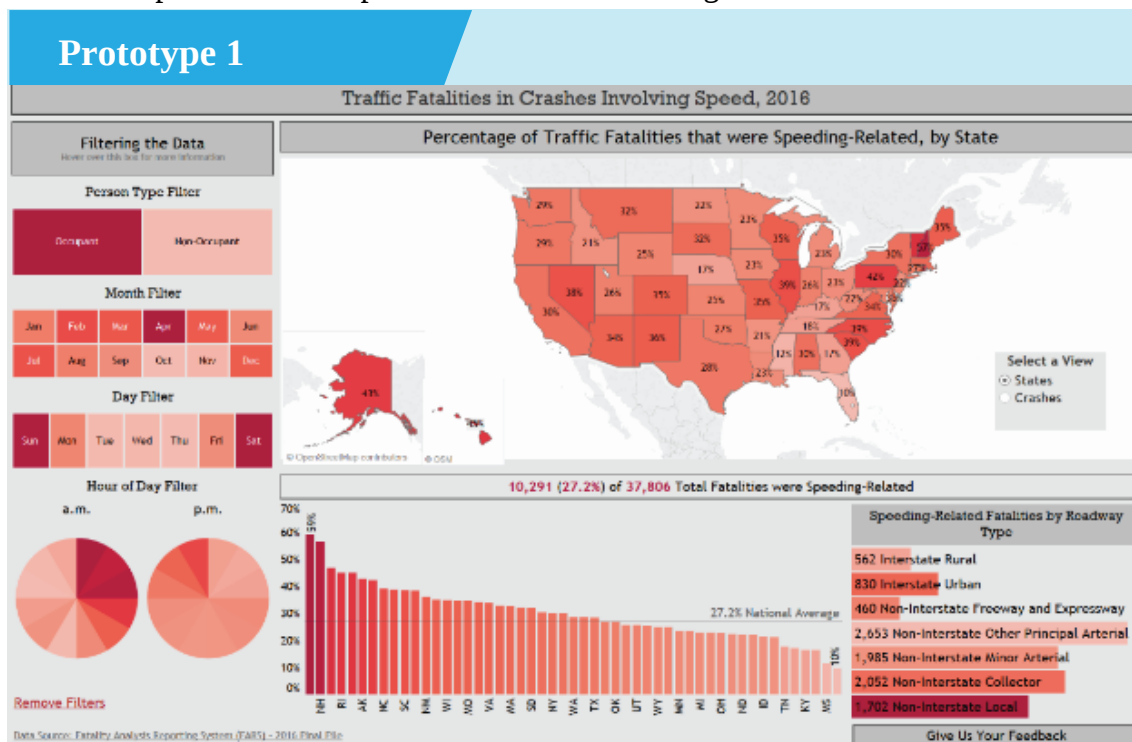


FARS Visualization Pilot Project

Overview

Each year, NHTSA releases the Fatality Analysis Reporting System (FARS) data set, which is a census of fatalities on public roadways and one of USDOT's preeminent roadway safety data sets. NHTSA has traditionally presented FARS data in its raw form, and in a series of 16 fact sheets on various safety focus areas. These fact sheets are updated annually following the FARS data release, and they present key highlights from the data in tables, charts, and narrative text.

In this pilot project, OST and NHTSA staff collaborated to develop two interactive and visually appealing dashboards using Tableau software that visualize FARS data in new ways. The dashboards also include U.S. Census data to allow better comparisons between States. These prototype dashboards focus on speeding-related and pedestrian fatalities. They were designed to be accessible to a wider audience than the transportation safety community, including those without technical skills working with data. The prototype dashboards include intuitive charts and color schemes that draw the user's eye to areas of importance. They empower users to ask and answer their own research questions about roadway fatalities by exploring the data with an interactive point-and-click interface. Based on the prototypes, NHTSA recently released revised dashboard for pedestrians and plans to continue advancing FARS data visualizations.¹²

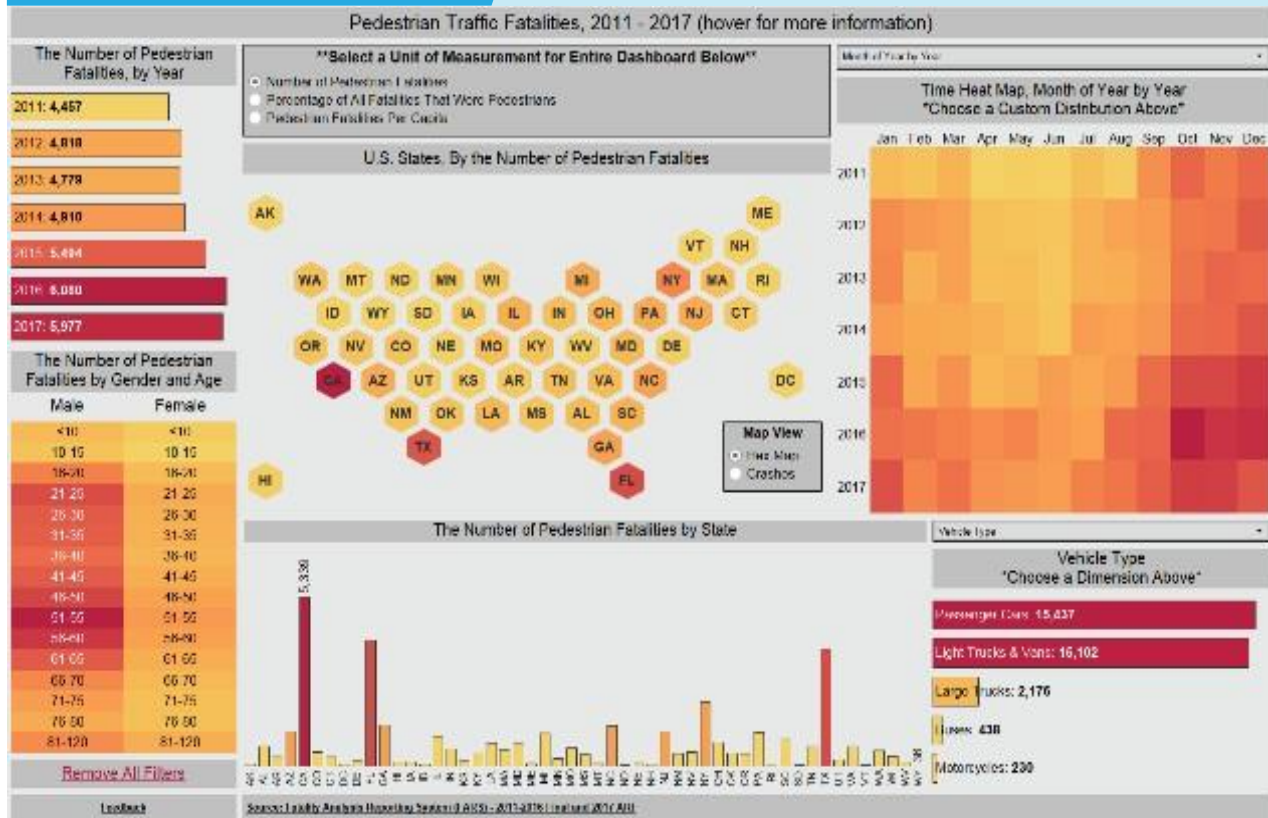


Interactive dashboard of the United States of America, divided into States, which visualizes traffic fatalities that were speeding related in 2016. Other data elements such as type of road and time of day are included.

https://icsw.nhtsa.gov/nhtsa/fars/speeding_data_visualization/

¹² See https://explore.dot.gov/views/DV_FARS_PD/Home?iid=1&isGuestRedirectFromVizportal=y&embed=y

Prototype 2



Interactive dashboard of the United States of America, divided into States, which visualizes pedestrian fatalities in traffic crashes from 2011-2017. Other data elements such as fatalities by gender and age are included.



https://explore.dot.gov/views/FARSPedestrianTrafficFatalities/Pedestrian?iframeSizedToWindow=true&%3Aembed=y&%3AshowAppBanner=false&%3Adisplay_count=no&%3AshowVizHome=no

Lessons Learned and Opportunities

- USDOT has rich data sets that enable a better understanding of traffic safety issues, but non-technical users can struggle to convert the data into usable information.
- The prototype FARS dashboards demonstrated the potential for developing new tools focused on improved visualization that make data more accessible to non-technical users, allowing them to explore areas of interest by filtering and sorting FARS data.
- Opportunities exist to expand on these initial efforts by updating these dashboards and developing similar dashboards focusing on other aspects of FARS data.

Rural Speed Pilot Project

Overview

In collaboration with Texas A&M University's Texas Transportation Institute, this pilot project sought to advance the state of the practice of crash estimation or prediction methods by investigating the association between crash risk and traffic speeds using traffic speed information from big data in statistical models. Current crash prediction methods, such as those in the first edition of the Highway Safety Manual (HSM),¹³ use traffic volume data along with geometric characteristics to predict the annual average crash frequency of roadway segments and intersections. However, this commonly used method omits speed-related factors from crash-predictive models, and recent research has made little progress toward incorporating speed into such models. The pilot project examined the correlation between traffic speeds and safety risk by integrating three databases for Ohio and Washington State. The databases used in this study include 2015 crash data from the Highway Safety Information System (HSIS), travel speed data from the National Performance Management Research Data Set (NPMRDS), and roadway information from the Highway Performance Monitoring System (HPMS).

The models developed combine traffic speed data with roadway geometrics, traffic operations, and weather data to generate annual and daily crash predictions on roadway segments for different rural roadway facility types (i.e., rural two-lane roadways). One of the products of this project is a prototype decision support tool that shows heat maps of rural roadways based on the model outcomes. The tool will have adaptability options for newer data sets (crash and speed data), and with refinement could be converted into a diagnostic tool. Chart visualizations through Dygraph features in R software were also made, which show traffic speeds and crashes over time on a roadway segment.

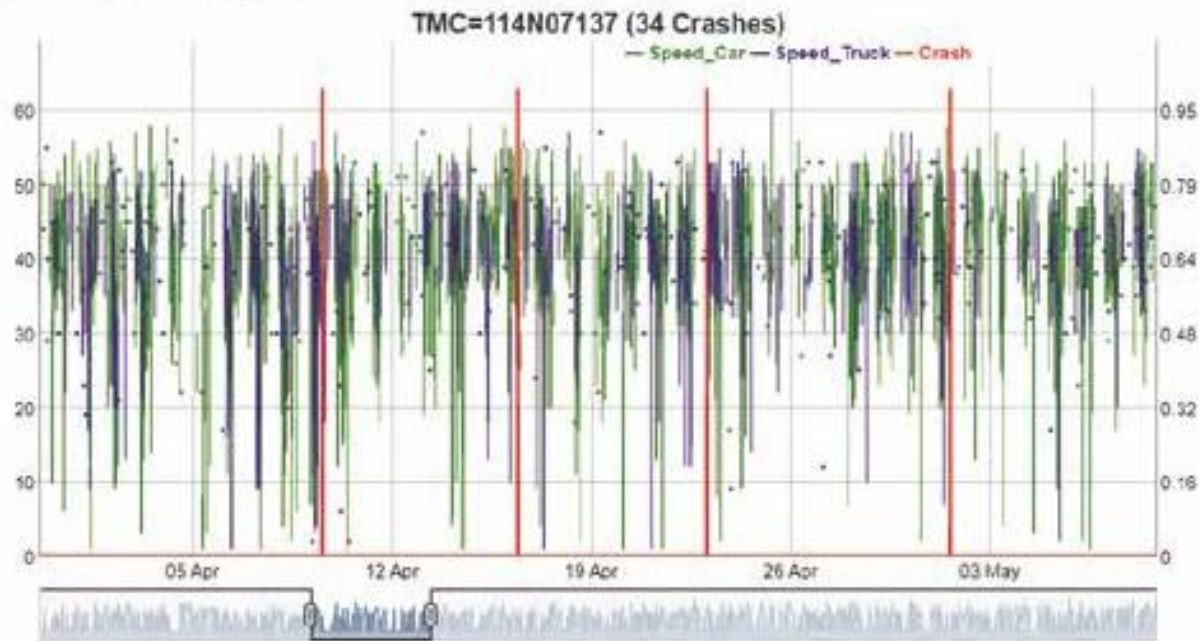
The Rural Speed Pilot Project found that certain speed measures were beneficial in quantifying safety risk. The project is a starting point for more in-depth investigation and continued progress in incorporating speed-related factors into crash-predictive models. Aspects of this work have been submitted for consideration to be published in *SoftwareX* and the *ITE Journal*. The decision support tool was also presented at the 2020 Transportation Research Board Annual Meeting.¹⁴

¹³ For more information on the Highway Safety Manual visit <http://www.highwaysafetymanual.org/Pages/default.aspx>

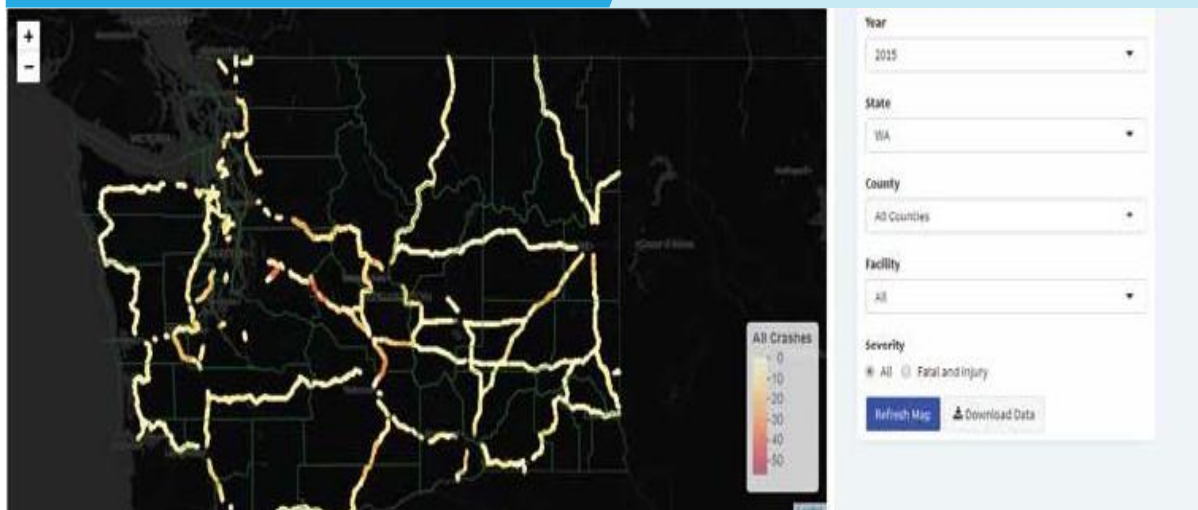
¹⁴ Incorporating Operating Speed in Statistical Road Safety Modeling: An Interactive Risk Assessment Tool. 2020 Transportation Research Board Annual Meeting. <https://annualmeeting.mytrb.org/InteractiveProgramArchive/Details/13931>

Dygraph Example

Top 10 High Risk Segments



Prototype Decision Support Tool



The first visual shows traffic speed information at a specific roadway segment, which includes interactive features to adjust the date range. Crashes on the roadway segment are also identified. The second visual is an interactive dashboard of the State of Washington that highlights safety risk based on statistical modeling results at the roadway segment level.

<https://www.transportation.gov/office-policy/transportation-policy/rural-speed-safety-pilot-project>

Lessons Learned and Opportunities

- Incorporating operational data such as traffic speeds into crash estimation or prediction methods can more accurately quantify safety risks at intersections and on roadway segments. The project successfully converted big data on traffic speeds from NPMRDS into variables that improved risk models, and found that:
 - Variability in daily average traffic speeds was associated with increased traffic crashes; and
 - Differences in traffic speeds between weekdays and weekends were correlated with increased traffic crashes.
- A beta decision support tool developed through this pilot project shows the highest risk highway segments based on the expected total crashes, and with additional refinement this tool has the potential to provide practitioners with valuable information in assessing safety risks on roadway segments.
- The new tool used bi-directional and directional prediction models, which will be useful to State DOTs currently using crash models that predict total crashes in both directions of travel on each roadway segment.
- With refinement, these tools could be used by State and local governments to understand roadway safety risks better and to permit a more effective allocation of resources for safety countermeasures that can reduce serious injuries and fatalities on rural roads.



Pedestrian Fatality Model Pilot Project

Overview

Characteristics of the transportation system and the built environment, including vehicular traffic and land-use characteristics associated with higher pedestrian activity, contribute to pedestrian fatality risks. This pilot project sought to understand and quantify pedestrian fatality risk better at the neighborhood-level (U.S. Census tract) on a national scale. The goal was to leverage cross-disciplinary data in novel ways to support prospective, risk-based assessments of pedestrian fatality risk, and support the creation of information that had the potential to inform policy and decision making.

This pilot project used geospatial tools to integrate a variety of Federal data sets—NHTSA FARS data, FHWA HPMS roadway data, intersection data from the Environmental Protection Agency (EPA) Smart Location Database, data on socio-demographics, travel patterns, and employment locations from the U.S. Census Bureau—and used statistical analysis to develop a pedestrian fatality risk model. These data sets had not been previously combined in this manner. USDOT developed a diagnostic, geospatial decision support tool that identified the neighborhoods with the highest risk of pedestrian fatalities based on the attributes of the Census tracts.

The methods and findings from this pilot project were peer reviewed and published in the journal *Accident Analysis & Prevention*.¹⁵

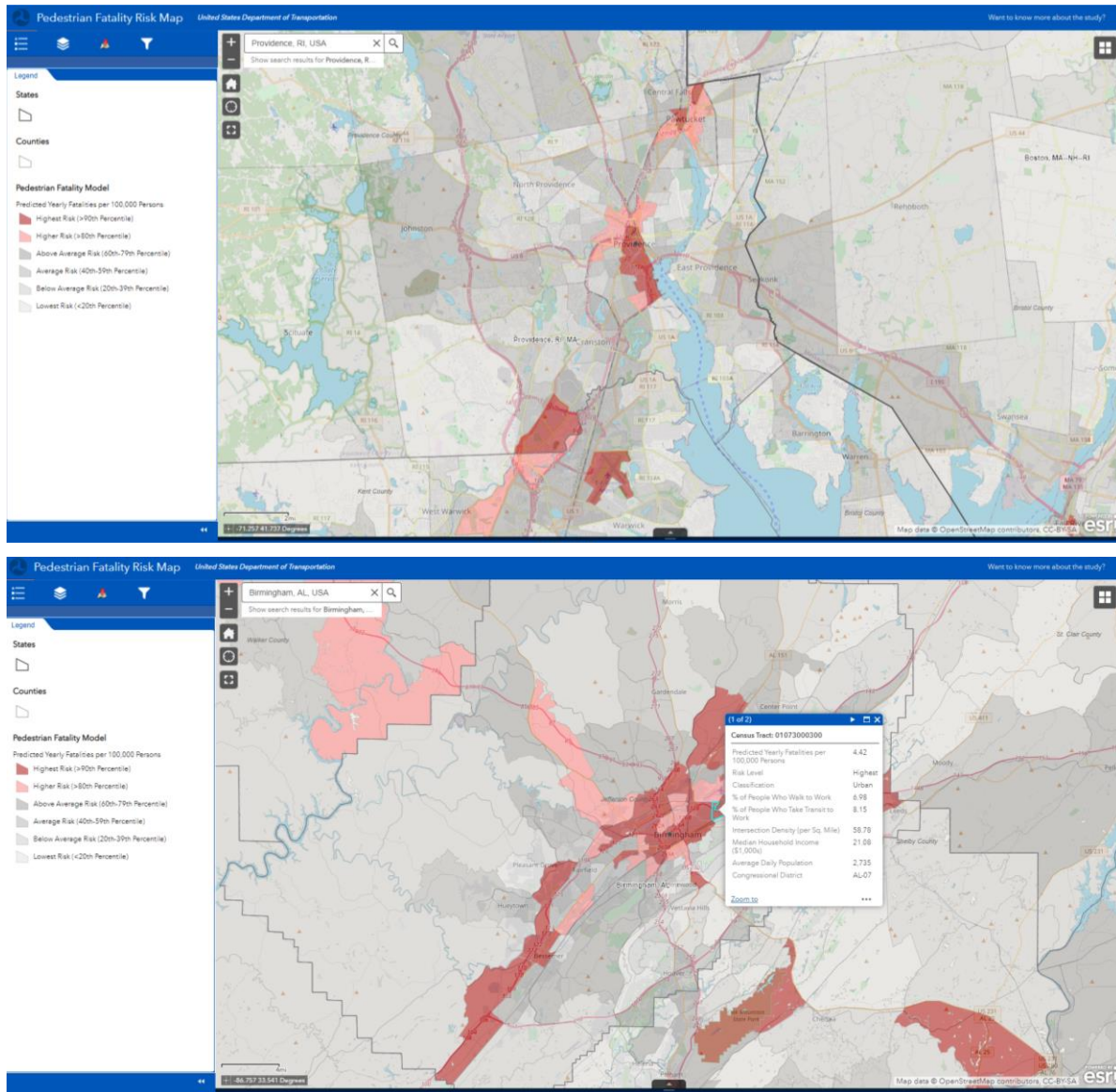
BTS developed a Pedestrian Fatality Risk Map, an interactive web-based decision support tool that allows users to visualize, filter, and explore the model results in an intuitive map. Census tracts are broken down by quintiles based on a ranking of a Census tract's estimated pedestrian fatality risk. The top 20 percent of higher risk neighborhoods are colored in red and pink, while the bottom 80 percent appear in shades of gray. The Pedestrian Fatality Risk Map was presented at the 9th International Visualization in Transportation Symposium: Visualization in Action, which was sponsored by the Transportation Research Board.



¹⁵ The Effects of Roadway and Built Environment Characteristics on Pedestrian Fatality Risk: A National Assessment at the Neighborhood Scale. *Accident Analysis & Prevention*. Volume 121, Pages 166-176. December, 2018.

Pedestrian Fatality Risk

The first map below shows the relative risk in the Providence, Rhode Island area by Census tract. The second map shows the Birmingham, Alabama area. The pedestrian fatality model predicts higher risk neighborhoods in many, but not all, parts of the city.



Interactive dashboard of the United States of America, divided into Census tracts, which visualizes the pedestrian risk model to show both the expected pedestrian fatality rate per 100,000 persons as well as the relative risk of a given Census tract in comparison to other U.S. Census tracts.



<https://maps.dot.gov/BTS/PedestrianFatalityModel/>

Lessons Learned and Opportunities

- In urban areas, traffic on non-access-controlled arterial roadways was found to increase pedestrian fatality risk significantly.
- Tribal areas, and the Southern and Western regions of the United States, generally show higher levels of risk.
- Employment density in the retail sector was associated with increased pedestrian fatality risk in both urban and rural areas.
- Integrating disparate data sets into a single unit of analysis, in this case the U.S. Census tract, is very challenging and requires multiple transformations to create a useful data set. For example, the type of road and the annual average data traffic per square mile had to be calculated and aggregated up to the Census tract level.
- Decision support tools such as this can complement State and local government decision making by targeting higher risk areas where safety interventions such as roadway modifications, education, and heightened enforcement efforts can have the greatest benefits for pedestrians.

Stakeholder Engagement and Input into the SDI

Throughout the various projects contained in the SDI, USDOT has engaged a broad range of stakeholders—including representatives of Federal, State, local, and Tribal governments, MPOs, national nonprofit organizations, educational institutions, and the private sector—seeking to draw on their expertise and solicit their feedback on SDI projects and input to inform the future direction of the SDI.

Safety Data Forum

In June 2018, USDOT convened more than 60 stakeholders representing the types of stakeholders mentioned earlier, to share information about SDI pilot projects in progress, receive feedback on these projects, and discuss next steps on data-driven approaches to transportation safety. The meeting also included presentations from several State and local government stakeholders who discussed their safety data integration and visualization projects and best practices.

Safety Data Forum 2.0

In April 2019, USDOT brought together more than 60 stakeholders, some of whom had attended the first Safety Data Forum, to hear about the pilot projects' progress and findings, and provide more focused feedback on how these projects could be useful to State and local transportation safety professionals. USDOT also sought their input on a draft SDI analytic agenda, which

included identifying and prioritizing problem statements USDOT could consider for future applied research projects in four focus areas.

Expert Panel

In conjunction with the April 2019 Safety Data Forum 2.0, USDOT convened eight experts in transportation safety, representing perspectives of State and local governments, universities, and the private and nonprofit sectors, for a one-day meeting to seek external validation on each SDI pilot.

These expert panelists examined:

1. Statistical and analytical validity;
2. Extent to which the projects were innovative, as well as a potential value-add for State and local governments; and
3. The technological readiness for use and adoption.

The input received from these stakeholder engagement efforts and the expert panel informed the next phase of the SDI. The Department plans to continue engaging with diverse stakeholders, particularly State, local, and Tribal governments, which are the potential end users of the types of tools that USDOT would like to develop through applied research projects.

Overarching Lessons Learned from Phase I

Phase I was a promising first step to advance the use of data in transportation safety. We have been working closely with transportation stakeholders and the technology industry to ensure that we are developing useful information and actionable insights. We have hosted two Safety Data Forums that brought these stakeholders together to collaborate about the progress of the SDI thus far and how to target future projects. We also hosted an expert evaluation panel to take a deeper look at each pilot project. This has provided immeasurable value to the initiative while also leveraging the Department's power as a convener by bringing the technology industry and transportation stakeholders together in pursuit of advancing transportation safety.

Based on our experience with the SDI pilot projects, discussions among USDOT staff participating in the SDI, and input from expert panelists and other stakeholders, USDOT identified four lessons that helped shape subsequent SDI efforts.

Lesson 1

Compelling use cases for safety data with key objectives and milestones will guide the future of the SDI—Articulating key guiding principles and determining specific, tangible objectives will help determine: what further research is needed, what data we want to leverage to perform that research, and how we can further partnerships with State and local governments and the private sector. A compelling use case will consolidate efforts, promote cooperation, and form a shared responsibility of safety among stakeholders.

Lesson 2

State and local capabilities, needs, and challenges are different—Approaches that vary in complexity and content are necessary to further the use of safety data for policy and decision making. For example, some State and local governments need help with understanding how data can be used to benefit safety, so there is an opportunity for high impact with compelling visualizations and tools to integrate data. Other State and local governments may have data but do not have the resources for a full-time analytics team. Large cities drive innovation and implement promising practices such as identifying High-Injury Networks to prioritize interventions. Expert panelists shared that State and local governments value best practices (more so than findings from research projects), and that diagnostic tools are preferred over prescribing solutions. USDOT has a unique position to provide diagnostic tools at the national level, share best practices, and foster data sharing among the States.

Lesson 3

SDI partnerships with State and local governments allow for on-the-ground validation and opportunities for further insight—To assess usability of the tools, additional validation with State and local governments is needed. For example, the Tennessee Highway Patrol is using the Waze tool. Understanding how they are implementing it will help USDOT understand what partners find useful. This insight will help USDOT scale it nationally. Another benefit of partnering with State and local governments is to supplement existing tools with additional data. Some entities simply need help with basics. There is substantial potential value-add in providing integrated data sets and compelling visualizations. These entities may have data, but not analytic capacity. While others have data, it may not be integrated, or it may be of poor quality. Large cities can drive innovation with promising practices that USDOT could boost to great success.

Lesson 4

Insights can be found by using new methods and data sets, including proprietary data—Expert panelists expressed that recent research has been circular, and new studies often present previously known findings. Several noted emerging data sets provide an opportunity for new research and insights. To begin exploring this, USDOT needs a solid understanding of the current data, and how the new data can be used to supplement or complement the gaps. Stakeholders indicated substantial interest in leveraging proprietary data for safety purposes from both data users and owners, but significant barriers impede data sharing. For example, data owners are concerned about legal liability and potential use of data by regulators. There is a need to find solutions to these challenges.

Phase II

The Department is building on the knowledge gained through Phase I of the SDI, by strategically investing the resources appropriated by Congress in FY 2018 to support innovative approaches to leverage new data sources and improve the analytic capacity of USDOT and State and local governments. The work to advance the state of the practice at government agencies is producing valuable insights that can help save lives on our roadways. This section highlights the market research and agenda-setting work performed to inform Phase II procurement activities, the spend plan based on the lessons learned from Phase I, the RFI, and the SDI analytic agenda.

Request for Information

An essential part of the SDI has been to engage with the private sector and universities with data and analytics expertise that are eager to work with agencies to make use of new data sources, new analytic tools, and new visualization methods.

In 2018, USDOT laid the groundwork for Phase II procurements by issuing an RFI as market research to solicit feedback from the technology industry that helped inform the Department's understanding of current market capabilities for carrying out activities that support the SDI.¹⁶ The RFI laid out the work undertaken during the SDI, USDOT's current safety data challenges, and requested input on data integration, data exchange, data analysis, data visualization and management, partnerships, and innovative procurement methods.

More than 60 organizations responded, including consulting services, data vendors, engineering and construction firms, research organizations such as universities and nonprofits, technology companies, and small and disadvantaged businesses.

USDOT analyzed the RFI responses and identified several key takeaways from this vital input.

RFI Takeaways

- Compelling examples took sophisticated analytics and turned them into a product or tool for easy use.
- USDOT does much of what respondents described, but the RFI showed opportunities to apply data science and commercial-off-the-shelf software better and more frequently.
- Opportunities remain to deepen USDOT's available analytical toolsets.
- Some vendors have existing data such as exposure and speed data that could be used to integrate and leverage for safety uses.

¹⁶ For more information on the RFI visit <https://www.transportation.gov/office-policy/transportation-policy/advancing-data-systems-support-innovative-data-analytics-improve>

SDI Analytic Agenda

In 2019, USDOT initiated a process to develop an SDI analytic agenda to inform Phase II SDI investments by identifying the top transportation safety problems that lend themselves to being answered through applied research using data science and advanced analytical methods. The intent is that applied research in this area would be used to develop tools to provide new safety insights to help USDOT, as well as State and local practitioners, better understand and address transportation safety risks.

Through a literature review, data gap analysis, and internal discussions, USDOT identified four safety focus areas for inclusion in the SDI analytic agenda. USDOT presented an initial draft of this SDI analytic agenda to stakeholders who participated in the Safety Data Forum 2.0 in April 2019, and asked them to identify the top problem statements in the following focus areas.

Precursors to Crashes

A variety of factors contribute to motor vehicle crashes, including alcohol- and drug-impaired driving, speeding, and distraction, but our understanding of their relative contributions varies. Several untapped data sources could provide contextual information about near misses, close calls, and physical and socioeconomic environments, which will help to characterize risks and target interventions.

Pedestrian and Bicyclist Safety

The safety community continues to pursue a better understanding of why pedestrian and cyclist fatalities have generally been increasing in recent years, and though we lack good information about pedestrian and cyclist volumes and exposure to risk, new data sources present an opportunity to gain new insights.

Intersections

A wide variety of disparate data sources, including video, could potentially be integrated to gain new insights into intersection crashes at a network level; factors contributing to crashes; and countermeasures that could be used to improve safety at intersections.

Non-Fatal Injury Crashes

There are opportunities to improve the understanding of non-fatal injuries, including how circumstances and contributing factors of these crashes differ from fatal crashes, and to use advanced analytics to pull insights from large injury data sets.

Funding Activities

Informed by input received from industry through the RFI and stakeholder input on USDOT's analytic agenda, USDOT initiated two funding activities in November 2019 supported by the \$5.5 million in appropriations. The opportunities sought proposals for projects that will advance the state of the practice by using data, advanced analytics, and data visualization to address roadway safety problems.

Notice of Funding Opportunity

In November 2019, USDOT released a NOFO titled "State and Local Government Data Analysis Tools for Roadway Safety,"¹⁷ which focused on building the capacity of State, local, and Tribal governments to use innovative data tools and information to improve roadway safety. The NOFO made over \$3 million available for up to 12 awards. The \$3.05 million are from the \$5.5 million in FY 2018 appropriations. Eligible applicants included State or local governments; MPOs and regional governments; other political subdivisions of a State or local government; and Tribal governments. By the application deadline in January 2020, USDOT received 40 eligible applications. In June 2020, the following nine applicants were selected for an award, of which eight executed cooperative agreements with OST totaling \$3.05 million:

1. The **City of New Orleans** in Louisiana received \$402,791 to refine and expand USDOT's existing Pedestrian Fatality Risk Map to include risks to bicyclists, which will help the City make defined, targeted decisions around small-areas and corridor-level investments with the greatest potential to prevent serious injuries and fatalities for vulnerable road users.
2. The **Confederated Tribes and Bands of the Yakama Nation Department of Natural Resources** in Washington State received \$430,000 to build on an existing roadway data analysis tool developed by the University of Washington's STAR Lab, and develop a comprehensive roadway safety data visualization and evaluation platform to support decision making about where to invest in roadway safety countermeasures.
3. The **Connecticut Department of Transportation** received \$453,000 to develop a tool to improve the State's behavioral safety decision making by integrating crash and roadway information with data on citations, toxicology, and hospital injury data, and quantify the costs and benefits of behavioral safety countermeasures to inform decision-making.
4. The **Maryland Department of Transportation State Highway Administration** received \$358,500 to develop and implement a data analytics and visualization dashboard using mobile device location data and electric scooter trip data available from the City of Baltimore to provide a better understanding of pedestrian, bicycle, and electric scooter

¹⁷ Historical information about the USDOT SDI NOFO State and Local Government Data Analysis Tools for Roadway Safety can be found at <https://www.grants.gov/web/grants/view-opportunity.html?oppId=322472>

travel volumes and risk exposure.

5. The **Massachusetts Department of Transportation** received \$429,100 to expand an existing crash data portal to help regional transportation planners and law enforcement identify higher risk roadways and risk factors to target roadway safety improvements, and develop publicly available analytic tools and data visualizations.
6. **MetroPlan Orlando**, the MPO for the Orlando, Florida metropolitan area, received \$294,942 to build upon the University of Central Florida's safety data visualization tool (winner of USDOT's Solving for Safety Visualization Challenge). This tool uses real-time traffic conditions to estimate the likelihood of a crash at a specific location. It helps system operators monitor video feeds to identify crashes, deploy first responders, and clear crash scenes more quickly to reduce the probability of secondary crashes occurring.
7. The **North Carolina Department of Transportation** received \$384,500 to develop an AI tool for automated analysis of existing videolog data that would extract roadside hazards—such as trees, embankments, and steep slopes—on all rural roads in the State to help identify roadway segments in need of infrastructure safety improvements.
8. The **Regional Transportation Commission of Washoe County**, the MPO for the Reno, Nevada metropolitan area, received \$298,600 automatically to extract highly accurate road geometric features from mobile light-detection-and-ranging (LiDAR) data collected on area roadways, and use AI to create a data set that would be incorporated into GIS software for roadway safety analysis.

The **Virginia Department of Transportation (VDOT)** was selected to receive \$232,500 to develop a systemic safety analysis tool, which would identify and visualize locations with higher levels of risk that would benefit from eight low-cost roadway safety countermeasures, allowing for the implementation of these countermeasures at many sites with similar roadway features. VDOT declined the funding due to personnel changes at VDOT.



Broad Agency Announcement

In December 2019, USDOT published a BAA titled *Conducting Innovative, Applied Research to Gain New Roadway Safety Insights and Tools*.¹⁸ The intent of the BAA is to explore approaches that use new data sources and/or data unavailable to the USDOT to gain novel, usable, and actionable insights to answer the most pressing and persistent surface transportation safety problems and improve safety outcomes. Eligible applicants include: industrial/commercial concerns, including small businesses; accredited degree-granting colleges and universities; not-for-profit organizations; and State and local governments.

Overall, \$1 million will be available through the BAA and follow-on contracts, with awards to be conducted in two phases. The first phase consists of developing concept designs that address at least one of the research problem statements in the SDI analytic agenda's four focus areas: precursors to crashes, pedestrian and bicyclist safety, intersections, and non-fatal injury crashes. The safety research questions are as follow, and BAA respondents addressed one or more of these questions in their response to the BAA Request for Proposal.



¹⁸ Historical information about the USDOT SDI BAA Conducting Innovative, Applied Research to Gain New Roadway Safety Insights and Tools can be found at <https://beta.sam.gov/opp/2cb6d364bfe341fb8b024f88b9d6bb74/view>

Safety Research Questions

Topic	ID	Question
Precursors to Crashes	A1	To what extent can additional crash precursor data inform risk patterns for the most-likely crash scenarios? What are the characteristics of the most-likely crash scenarios? Can we identify patterns by examining crash precursors from these data?
Precursors to Crashes	A2	In order to understand precursors to crashes, there needs to be a better understanding of the baseline (i.e., normal state of driving)—what is this baseline? To what extent can additional data sources inform the baseline normal state of driving?
Ped-Bike Safety	B1	Where are pedestrian/bicyclist fatalities and serious injuries happening, and what are the behavioral factors, surrounding features, and characteristics of where these fatalities and serious injuries occur?
Ped-Bike Safety	B2	What combination of existing or emerging data sources can be used to create scalable, corridor-level models for pedestrian and bicyclist risk exposure? What can be done to determine more precisely pedestrian/bicyclist safety risk rates?
Intersections	C1	To what extent can additional intersection data elements inform safety risk and improve infrastructure design?
Intersections	C2	What additional data sources can be linked with intersection data to inform safety counter measures and what safety insights can be gathered?
Intersections	C3	What methodologies and sources can be used to estimate and identify existing intersection locations at a large scale (i.e., State, regional, local, or national-level)?
Non-fatal injury crashes	D1	What additional insights and risk factors can be gathered from linked data sources in non-fatal injury crashes?
Non-fatal injury crashes	D2	To what extent can non-fatal injury crashes inform the likelihood of fatal injury crashes in the same location?

By the application deadline in January 2020, USDOT received 23 eligible applications. In this initial phase, USDOT made four awards valued up to \$50,000 with a period of performance up to three months.

Vendors selected for Phase I awards

1. **Populus Technologies** received \$48,220 to take aggregated GPS data from millions of micromobility (e.g., scooters, bikeshare systems, etc.) trips and analyze their exposure along corridors at the city and regional level. Analysis of these data could provide a much more detailed picture of micromobility road-user exposure than is currently available for crash precursor research.
2. **U Group** received \$49,342 to use image processing methods on nationwide satellite data to perform automated intersection survey and classification to group similar intersections. The data produced will be used to explore the impact of intersection design and surrounding context on crash risk.
3. **KPMG** received \$49,945 to use aggregated onboard vehicle data from partner HERE, which includes elements such as wiper status, fog lamp use, speed, traffic speed, and hard braking information. The potential insights gained from the data could provide safety information on precursors to crashes through contextual information from data derived from vehicle operation.
4. The **University of Michigan Transportation Research Institute** received \$49,950 to expand upon an existing pedestrian and bicyclist risk and exposure model by leveraging additional public and proprietary data sets. Further work will examine expanding the model to States outside of Michigan.

Based on the progress made in Phase I, USDOT anticipates awarding up to three follow-on contracts in Phase II using the remaining funds from the \$802,543 available.

Spend Plan

In a FY 2019 Senate Report from the Appropriations Subcommittee for Transportation, Housing and Urban Development, and Related Agencies, Congress directed the Secretary to provide a spend plan and report detailing how the \$5,500,000 provided in FY 2018 for safety data and automated vehicle safety data initiatives will improve our Nation's safety.

Obligated Spending in FY 2018, FY 2019, and FY 2020 from \$5.5 Million		
Type of Spending	Purpose	Amount
Fiscal Year 2018		
Contracts, Interagency Agreements	Analytic and technical support services for Phase I pilots	\$750,000
Contract	Support for stakeholder engagement	\$23,963
Fiscal Year 2019		
Contracts, Interagency Agreements	Analytic and technical support services for Phase I pilots	\$412,500
Contract	Support for stakeholder engagement	\$63,483
Contract	Private sector data	\$30,000
Fiscal Year 2020		
Safety Tool NOFO Cooperative Agreements	Development and refinement of State and local safety tools	\$3,051,433
BAA Research Contracts Phase I	Applied roadway safety research using new data sources	\$197,457
Contracts	Technical and data management support	\$13,411
Subtotal Obligated Spending for FY 2018, FY 2019 and FY 2020		\$4,542,247
Anticipated Spending in FY 2021 from \$5.5 Million		
BAA Contracts Phase II	Follow on roadway safety research using new data sources	\$802,543
Contracts, Agreements	Analytic and technical support, follow on activities with safety tools	\$155,210
Total Obligated and Anticipated Spending for FY 2018 - FY 2021		\$5,500,000

Separate from the \$5.5 million in appropriations, \$350,000 in BTS appropriations were used to fund the Solving for Safety Challenge prize, and BTS also provided funds in FY 2017 and FY 2018 for pilot project activities.

In FY 2018, FY 2019, and FY 2020 USDOT obligated \$4,542,247 of the \$5.5 million for the SDI. The obligations funded data science and applied policy research for Phase I pilots, data purchases and stakeholder engagement, technical assistance, the SDI NOFO safety tool cooperative agreements, and the BAA research projects. USDOT will expend the remainder of the \$5.5 million FY 2018 funds in Phase II of the SDI through the BAA, follow on activities in support of the safety tool projects, and other applied policy research. The table above outlines the obligations to date, and anticipated spending in FY 2021.

Conclusion

The SDI seeks to improve roadway safety by leveraging and integrating new data; using advanced analytic techniques and methods; and creating compelling data visualizations that can provide new safety insights that decision makers can use to target roadway safety countermeasure investments.

During Phase I of the initiative, USDOT used several pilot projects to experiment with using new data, integrating data sets in new ways, utilizing advanced analytic methods, and visualizing the data. Through these projects, USDOT developed several new beta safety data tools that can be used to help target safety investments and maximize safety benefits. For our State and local government partners, the potential exists to leverage SDI products to address safety risks and reduce injuries and fatalities. The work performed during Phase I also led to important lessons learned that will inform our future projects. USDOT has used the knowledge and experience gained from these projects together with important input from diverse stakeholders representing Federal, State, local, and Tribal governments, MPOs, national nonprofit organizations, educational institutions, and the private sector, to inform additional activities.

In Phase II, USDOT is using this knowledge to invest the remaining FY 2018 appropriations strategically to advance the state of the practice. The funds available in the NOFO to develop safety tools are intended to build the capacity of State, local, and Tribal governments to implement and enhance innovative data tools and information to improve roadway safety. USDOT intends to share these tools and lessons learned with other State, local, and Tribal governments. The BAA applied research will use new data sources with the goal of gaining novel, usable, and actionable insights to answer the most pressing and persistent surface transportation safety problems and improve safety outcomes. These projects can result in the development of additional safety data tools by State, local, and Tribal governments to save lives on our Nation's roadways.

The SDI activities during Phase I and II support the transportation safety community's ability to improve roadway safety by:

- Enhancing State and local capacity to use safety tools for decision-making through use cases. This includes locations with limited capacity.
- Developing safety tools through use cases that will be transferable, scalable, and replicable elsewhere. Better information will lead to better decision- and policy-making, focus interventions, as well as inform resource allocation.
- Better characterizing safety risk and the challenges we face by leveraging new data sources to uncover insights.
- Encouraging innovative practices for data and research in order to better understand safety risks, and harnessing the latest developments in technological and software advances for safety purposes.
- Breaking down traditional institutional barriers to foster learning between transportation safety disciplines, USDOT offices, and the Federal, State, regional, and local government community focused on transportation.

Finally, USDOT will continue engaging with stakeholders, identifying new partnerships, and advancing projects that most effectively advance the state of the practice and save lives on the Nation's roadways.

