

Plan Overview

A Data Management Plan created using DMP Tool

DMP ID: <https://doi.org/10.48321/D1D37C>

Title: Smarter Intersections Pilot Project

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Template: SMART Grants Stage 1 Data Management Plan (DMP)

Project abstract:

The Smarter Intersections Pilot Project is deploying and testing smart infrastructure technology in College Station, Texas to achieve to main goals: 1) Improve intersection safety and mobility for vulnerable road users *pedestrians, bicyclists, and those using other mobility devices, including people with mobility and visual disabilities; and 2) Demonstrate that the technology functions as proposed. The project is using Cellular Vehicle-to-Everything (C-V2X) units at five intersections in tandem with on-board units (OBUs) in transit and emergency response vehicles to alert VRUs using crosswalks and bike lanes of turning buses and emergency vehicles through auditory and visual cues. It is also exploring incorporating that information into a Smart Phone application that blind/low-vision people can use to navigate an intersection. Further, the project is simulating how the information can be communicated to an automated shuttle approaching an intersection.

Start date: 09-15-2023

End date: 03-15-2025

Last modified: 06-09-2025

Smarter Intersections Pilot Project

Dataset and Contact Information

Please provide as much of the the following information as possible:

1. Name of the project;
2. Grant number;
3. Name of the person submitting this DMP;
4. ORCID of the person submitting this DMP (need an ORCID? Register here: <https://orcid.org/>);
5. Email and phone number of the person submitting this DMP;
6. Name of the organization for which the person submitting this DMP is working;
7. Email and phone number for the organization;
8. Link to organization or project website, if applicable; and,
9. Date the DMP was written.

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2. SMARTFY22N1P1G52
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8. tti.tamu.edu
9. December 13, 2023 Updated June 9, 2025

Data Description

Please provide as much information as possible:

1. Provide a description of the data that you will be gathering in the course of your project or data from a third party that you will re-use, if any;
 1. If there will be no data collected or re-used from another source, state that this is case;
2. Address the expected nature, scope, and scale of the data that will be collected, as best as you can at this stage;
3. As best as you can, describe the characteristics of the data, their relationship to other data, and provide sufficient detail so that reviewers will understand any disclosure risks that may apply;
 1. If data might be sensitive, please describe how you will protect privacy and security, if you know that now;
 2. You may need to update your DMP later to add more detail;
4. Discuss the expected value of the data over the long-term.

1. Five different types of data were collected and analyzed as part of the Stage 1 Smarter Intersections Pilot Project. These data sources were the intersection traffic signal controller data logs, the City of College Station intersection video surveillance system, the Texas Department of Transportation (TxDOT) Crash Record Information System (CRIS), the results of the simulation of communicating with an automated shuttle and a fire truck, and the results from interviews and surveys with pedestrians, bicyclists, blind/low vision individuals, and bus operators. Each of these data sources are described in this section, including the scope,

scale, and use in the evaluation plan, and Implementation Report and data package. As noted, there were no crashes recoded in CRIS involving buses, pedestrians, or bicyclists at the five pilot intersections the year before the pilot project or the four-month demonstration. As a result, no crash data is included in the final data package.

Intersection Traffic Signal System and Controller Data Logs

Data logs were processed daily for each of the five pilot intersections during the four month demonstration period. The data logs include time stamps of each bus onboard unit (OBU) approaching the intersection, the status of the traffic signal cycle, the status of the audio alert and bus sign illumination, the status of the end of the alert and illumination, and other data. The data was used to assess that the system worked properly. The logs were compared with onsite visual observations to determine that the audio alerts and bus sign illuminations were occurring at the appropriate times. Examples of daily log files for each intersection are included in the final data package.

City of College Station Intersection Video Surveillance System

The City of College Station operates a video surveillance system at signalized intersections, including the five pilot intersections in this project. The city keeps the video for three days and then deletes it. The project used the video to collect counts of pedestrian, bicyclists, and individuals using other mobility devices traversing the crosswalks of interest at the five intersections. Video for November 28, 29, and 30, and December 11, 12, and 13, 2024, was obtained and analyzed by TTI researchers. The pedestrian and bicyclist values were compiled by the time periods of morning (7:00 a.m. – 10:00 a.m.), midday (10:00 a.m. – 3:00 p.m.), and afternoon (3:00 p.m. – 5:30 p.m.). Counts were also summarized for the night (9:00 p.m. – midnight) at the University Drive and Boyett Street intersection due to high levels of activity. The information was used to assist in scheduling the intercept surveys of pedestrians and bicyclists. The video was deleted after the summaries were completed as required by the City of College Station. A summary of the data by time period is provided in the project data package.

CRIS Data

The Texas Transportation Code requires any law enforcement officer who, in the course of duty, investigates a motor vehicle crash that results in injury to or the death of a person or damage to the property of any one person to the apparent extent of \$1,000 or more, to submit a written report of that crash. TxDOT maintains a database of crash reports for crashes occurring on public roadways and the state highway system. The crash data for the five pilot intersections was examined one year prior to the pilot project (2023) and for the 4 months of the pilot operation (November 2024 to February 2025). The data was filtered to those crashes involving buses, pedestrians or bicyclists. There were no reported crashes involving buses, pedestrians, or bicyclists at any of the pilot intersections for the year before or during the pilot project. As a result, no crash data is included in the project data package. Examining crash data would be part of a Stage 2 at-scale deployment in Corpus Christi.

Data from Simulating Communication with an Automated Shuttle and a Fire Truck

The ability of the smarter intersection to send a message to an automated shuttle and to an emergency vehicle was simulated during the project. Similar approaches were used in both simulations. Since there is not an automated shuttle in College Station, TTI researchers worked with Beep personnel to develop and conduct a simulation with a TTI vehicle equipped with an OBU acting as an automated shuttle. It was not possible to equip an emergency vehicle with an OBU, so a TTI vehicle with an OBU led a College Station fire truck through one of the intersections to simulate the communication capabilities. In both cases the OBU was connected to a tablet and the messages sent from the traffic signal to the OBU and from the OBU to the traffic signal were recorded.

The results from the simulations of communicating with an automated shuttle and a fire truck were similar. The following messages were sent and received during the simulation: Signal Phase and Timing (SPaT), basic safety message (BSM), MAP message, signal request message (SRM), signal status message (SSM), personal safety message (PSM), and traveler information message (TIM). The results for each simulation are summarized in the Implementation Report and examples of the data from the automated shuttle simulation is included in the project data package as a .PCAP file.

Results of Interviews and Surveys

Interviews and surveys were conducted at different times during the Smarter Intersections Pilot Project to gain input and insight from pedestrians, bicyclists, and bus operators concerning the visual and audio alerts at the pilot intersections. Interviews were conducted with blind/low vision (B/LV) individuals to gain insight into a beta smartphone app alerting them to turning buses at the intersection and to obtain their reactions to testing the app at one of the pilot intersections. The results from the interviews and surveys were used in the Stage 1 evaluation to provide qualitative information on the benefits of the Smarter Intersection technologies.

TTI researchers followed the appropriate protocols for research involving human subjects in conducting these interviews and surveys. TTI utilizes the Texas A&M University Institutional Review Board (IRB) for all research projects involving human subjects. TTI researchers developed and submitted the protocol for each interview and survey used during the pilot project. The protocols included the recruiting methods, consent forms, the script or questions and any reimbursement to participants, information retention practices, and the time period. All TTI researchers conducting the interviews and surveys had up-to-date CITI training. The results from the different activities were summarized as part of the Stage 1 evaluation and included in the Implementation Report to provide qualitative information on the perceptions of the audio and visual alerts, the possible smartphone app for B/LV individuals, and other aspects of safety at the intersections. Copies of the interview scripts and surveys, along with a summary of the response are provided in the project data package. No personally identifiable information (PII) was collected during the interview process.

The data collected during the Smarter Intersections Pilot Project should be of benefit to others interest in improving the safety of signalized intersections for pedestrians, bicyclists, and other individual using mobility devices. It provides insight into one approach for enhancing the safety of intersections with turning buses.

Data Format and Metadata Standards Employed

Please provide as much information as you can:

- 1. Describe the anticipated file formats of your data and related files;**
- 2. To the maximum extent practicable, your DMP should address how you will use platform-independent and non-proprietary formats to ensure maximum utility of the data in the future;**
 - 1. If you are unable to use platform-independent and non-proprietary formats, you should specify the standards and formats that will be used and the rationale for using those standards and formats.**
- 3. Identify the metadata standards you will use to describe the data.**
 - 1. At least one metadata file should be a DCAT-US v1.1 (<https://resources.data.gov/resources/dcat-us/>) .JSON file, the federal standard for data search and discovery.**

The data and information gathered during the Smarter Intersections Pilot Project used basic and non-proprietary formats. While Excel spreadsheets (.XLSX) and Microsoft Word (.DOCX) were used for the data summaries, all documents are also provided in open-source formats such as comma separated (.CSV), and portable document format (.PDF). Project Open Data Metadata Schema guidelines were used to document and list the datasets generated by the intersection traffic system and controller data logs as .CSV files. This data includes the bus location information as the bus approaches the intersection, the signal status, and the actions taken by the system to alert pedestrians that a bus is turning at the intersection. The project also used USDOT DCAT metadata standards. TTI researchers ensured that the data provided is understandable and useable by others. Information on the purpose of the data collection, the methodology, and the use of the data in the project is provided in the project data package. Data provided does not include and private or confidential information.

Access Policies

In general, data from DOT-funded projects must be made publicly accessible. Exceptions to this policy are: data that contain personally identifiable information (PII) that cannot be anonymized; confidential business information; or classified information. Protecting research participants and guarding against the disclosure of identities and/or confidential business information is an essential norm in scientific research. Your DMP should address these issues and outline the efforts you will take to provide informed consent statements to participants, the steps you will take to protect privacy and confidentiality prior to archiving your data, and any additional concerns. In general, in matters of human subject research, your DMP should describe how your informed consent forms will permit sharing with the research community and whether additional steps, such as an Institutional Review Board (IRB), may be used to protect privacy and confidentiality. Additionally, when working with, or conducting research that includes Indigenous populations or Tribal communities, researcher will adhere to the CARE Principles for Indigenous Data Governance <https://www.gida-global.org/care> and make an explicit statement to that effect in this portion of the DMP.

Please provide as much information as possible:

1. Describe any sensitive data that may be collected or used;
2. Describe how you will protect PII or other sensitive data, including IRB review, application of CARE Principles guidelines, or other ethical norms and practices;
 1. If you will not be able to deidentify the data in a manner that protects privacy and confidentiality while maintaining the utility of the dataset, you should describe the necessary restrictions on access and use;
3. Describe any access restrictions that may apply to your data;
4. If necessary, describe any division of responsibilities for stewarding and protecting the data among Principal Investigators or other project staff.

All of the data collection activities followed the appropriate guidelines for research involving human subjects. The video used from the City of College Station to count pedestrians, cyclists, and others at the five intersections was deleted immediately after completing the summary as required by the City of College Station. None of the participants in the interviews and surveys were individually identified. The protocol for the interviews and surveys was submitted to the TAMU IRB for review and approval. No work was initiated until approval was received. A summary of the results is provided in the Implementation Report and with the project data package.

Re-use, Redistribution, and Derivatives Products Policies

Recipients are reminded:

1. Data, as a collection of facts, cannot be copyrighted under US copyright law;
2. Projects carried out under a US DOT SMART Grants is federally funded; therefore, as stated in grant language:
 1. Recipients must comply with the US DOT Public Access Plan, meaning, among other requirements, project data must be shared with the public, either by the researchers or by US DOT;
 2. That by accepting US DOT funding through this grant, recipients have granted to US DOT a comprehensive non-exclusive, paid-up, royalty-free copyright license for all project outputs (publications, datasets, software, code, etc.). This includes all rights under copyright, including, but not limited to the rights to copy,

- distribute, prepare derivative works, and the right to display and/or perform a work in public; and,
3. In accordance with Chapter 18 of Title 35 of the United States Code, also known as the Bayh-Dole Act, where grant recipients elect to retain title to any invention developed under this grant, US DOT retains a statutory nonexclusive, nontransferrable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States any such invention throughout the world.

Please provide as much information as possible:

1. Describe who will hold the intellectual property rights for the data created or used during the project;
2. Describe whether you will transfer those rights to a data archive, if appropriate;
3. Identify whether any licenses apply to the data;
 1. If you will be enforcing terms of use or a requirement for data citation through a license, indicate as much in your DMP;
4. Describe any other legal requirements that might need to be addressed.

There are no intellectual property rights associated with any of the data collected, created, and used during the Smarter Intersections Pilot Project. None of the project data has intellectual property value. The data is publicly available in the project data package.

Archiving and Preservation Plan

Please provide as much information as possible:

1. State where you intend to archive your data and why you have chosen that particular option;
2. Provide a link to the repository;
3. You must describe the dataset that is being archived with a minimum amount of metadata that ensures its discoverability;
 1. Whatever archive option you choose, that archive should support the capture and provision of the US Federal Government DCAT-US Metadata Schema
<https://resources.data.gov/resources/dcat-us/>
4. In addition, the archive you choose should support the creation and maintenance of persistent identifiers (e.g., DOIs, handles, etc.) and must provide for maintenance of those identifiers throughout the preservation lifecycle of the data;
5. Your plan should address how your archiving and preservation choices meet these requirements.

The dataset will be cataloged with the fullest extent of metadata, including DCAT-US JSON metadata file. ROAS P supports the creation and maintenance of persistent identifiers through minting unique DOIs and linking creator and collaborators' ORICiDs. Archiving and preserving the Smarter Intersections Pilot Project data and implementation report in ROSA P and the Texas Digital Library Texas Data Repository fulfill our SMART Grant requirements for free, open access data with DCAT-US metadata and a persistent identifier.

Planned Research Outputs

Dataset - "FinalDocs"

This research project, Smarter Intersections Pilot Project, produced 725 CSV files of traffic signal data from five target intersections, which are saved in a ZIP file (04_CSVFiles_TrafficSignalLogs.zip) included in our data package.

Planned research output details

Title	Type	Anticipated release date	Initial access level	Intended repository(ies)	Anticipated file size	License	Metadata standard(s)	May contain sensitive data?	May contain PII?
FinalDocs	Dataset	2025-07-14	Open	ROSA P Texas Data Repository		None specified	DCAT-US	No	No