Plan Overview

A Data Management Plan created using DMP Tool

DMP ID: https://doi.org/10.48321/D1E2E905BF

Title: Open Data Approach to Curbside Management

Creator: Dillon Fried - **ORCID:** 0009-0002-4951-2712

Affiliation: United States Department of Transportation (DOT) (transportation.gov)

Funder: United States Department of Transportation (DOT) (transportation.gov)

Funding opportunity number: 69A3552341059

Grant: SMARTFY22N1P1G35

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

Project abstract:

Develop a digital, data-driven curb management ecosystem to enable dynamic curbside management and operations. The ecosystem includes integrations to ensure digital curb inventory records are kept updated, and includes a collection of multi-faceted, open-source APIs to communicate to the public and curb users, Minneapolis' policies and regulations, real-time changes to curb usage, and provide a historical view of curb usage, impacts, and efficiencies.

Start date: 09-15-2023

End date: 03-15-2025

Last modified: 01-12-2026

Open Data Approach to Curbside Management

Project 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.**

1. Name of the project: Open Data Approach to Curbside Management
2. Grant number: SMARTFY22N1P1G35
3. Name of the person submitting this DMP: Dillon Fried
4. ORCiD of the person submitting this DMP: 0009-0002-4951-2712
5. Email and phone number of the person submitting this DMP: dillon.fried@minneapolismn.gov, 612.673.5862
6. Name of the organization for which the person submitting this DMP is working: Minneapolis Public Works
7. Email and phone number for the organization: smartcurbs@minneapolismn.gov
8. Link to organization or project website, if applicable:
https://www2.minneapolismn.gov/government/departments/public-works/
9. Date the DMP was written: December 2025 - January 2026

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;**
        1. **If you answered "No data" above, then you are finished and may skip the most of the steps and sections below, after you:**
            1. **Save your DMP as it exists;**
            2. **Submit it to your Grant Manager or the NTL staff for review.**
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.**

The primary data collection effort in Stage 1 (proof-of-concept) deployment was camera-based collection of curb use activity along our Nicollet Avenue pilot corridor. 53 solar-powered edge computing cameras were deployed along the corridor, with two to three cameras per block face. The cameras captured the following data:

- Vehicle dwell time (by space, day, time, and vehicle type)
- Curb use and occupancy (by space, day, time, and vehicle type)
- Double parking and other violations (by type of violation, by day, time, and vehicle type)

The data collection focus area was Nicollet Avenue in South Minneapolis from East 18th Street to East 29th Street, and a block of 26th Street in each direction from Nicollet Avenue. Paid parking in this corridor is limited to the two blocks north of Franklin Avenue. Before the project began in earnest, limited anecdotal observations and experiences about traffic congestion and curb activity were reported by corridor visitors and businesses. It is for this reason that unique data collection is required; re-use of existing data is not possible.

Leveraging cameras placed throughout the corridor, curb use activity was monitored and recorded during daytime hours (7:00 a.m. to 6:00 p.m.). Camera data collection began in earnest in Summer 2024, although much of Summer and Fall 2024 were used to test camera accuracy and make adjustments to location and aiming. Data collection in winter was minimal due to limited battery capacity in the winter and snow covering the solar panels. Data collection utilized edge computing to differentiate vehicle types into four categories: car, pickup truck, commercial vehicle (e.g., Amazon, FedEx), or motorcycle.

The purpose of the camera data collection effort was to understand the scope, scale, and specifics of curb use and demand at the curb, informing the future development of curb use policy and the integration and communication of curb data through open APIs. The cameras utilized edge computing to analyze images in real-time and stripped personally identifiable information before uploading it to the cloud, ensuring that any data reviewed did not contain personally identifiable information. The city and project team did not use or access the raw camera data; instead, only images that had been scrubbed were visible to the project team on the camera vendor’s dashboard.

In addition to the camera-based collection of curb use data, the city worked to collect robust data on existing curb rules and regulations to build a comprehensive digital GIS/map-based twin (i.e., curb inventory) of the pilot corridor. The initial curb digital twin inventory data was collected via a LiDAR scan, performed by a third-party contractor. This was validated against the curb inventory data from INRIX, and manual inventory field data collected.

Manual data collection was also conducted, including street counts, behavioral observations, and user surveys, to understand curb conditions and their impacts as the project evolves. Data is summarized in a spreadsheet and GIS format. In Stage 2, our team proposes conducting additional manual data collection after the digital curb communication tool has been deployed with partner entities to understand the effects and impacts of the tool's deployment.

Furthermore, the city and project team engaged with a variety of stakeholders, documenting known issues and experiences. The city and project team also collect and analyze several data sets on the corridor, that included: parking meter payment data (from meters present on the far northern end of the corridor), transit infrastructure and ridership, parking enforcement, and curb inventory, as well as vehicle, walking, and biking volume information, among other data sets. Most of the data was stored in digital spreadsheet and GIS formats.

Moreover, Stage 1 work included air quality measurement along the pilot corridor. Air quality monitors were installed at the block level along the entire project corridor, and air quality data were collected throughout the corridor. Data analytics work was performed by City IT and the consultant to review the usefulness and applicability in assessing pollution levels associated with curb space reallocation and digital tool testing.

Along with curb data collection, a primary project task focused on improving system integration and increasing connectivity between the newly collected data and existing city systems and digital datasets (such as the curbside mapping effort initiated by the city in 2019) to create a digital twin that better reflects current curb inventory conditions. This task involved integrating the curb inventory with the city's asset management platform, OpenGov, utilizing an INRIX automation.

The city and project team developed curb-based application programming interfaces (APIs) during Stage 1. These APIs will be launched with one or more identified curb users in Stage 2, including the public. APIs are a collection of information about curb regulations, availability, and other metrics and data points related to curb space, useful to curb users.

Three fundamental APIs are being developed for deployment, collectively forming the backbone of the Curb Data Specification data architecture. The Curb API focuses on communicating curbside policies and regulations. Essentially, this is a channel to communicate the rules for any given stretch of curb space. Our team successfully hosted the Curbs API on our Open Data portal by the culmination of Stage 1. The Events API focuses on short-term events that impact any given stretch of curb, such as a snow emergency, special event or lane use permit that would temporarily change the stated policy or rules of that curb space. Lastly, the Metrics API is designed to share historical data related to curb usage, impacts, and efficiencies, helping the city and the private sector plan, analyze, and adapt curb behaviors and infrastructure for optimal usage.

The APIs are being developed and deployed leveraging open data standards and practices. Real-time data will be made available through vendor-developed APIs, and historical/archived data will be hosted on city-managed servers through the City's ESRI Open Data portal. This will provide both API and Excel spreadsheet data downloads. These APIs will comprise a valuable tool that the city will leverage for future dynamic and coordinated curb management, promoting access, safety, and other values into the future. The data communicated via the digital tool will standardize the understanding of curb policy across the city and among different curb users, both large and small. Specific use cases may include, among others, being able to communicate changes to curb regulations brought on by street closures, emergencies, or events in real-time, allocating and communicating specific flexible curb use zones throughout different times of the day and days of the week, and providing a foundation for being responsive to the coming way of connected and automated vehicles.

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.**

During the Stage 1 data collection task, video feeds were extracted from cameras in industry standard formats (e.g., mp4), and images will be extracted in industry standard formats (e.g., jpeg, png, etc.). Raw camera video and images will be accompanied by date and time stamp, and location information. This metadata is applied automatically via camera technology by default. Other metadata will include the camera name and type used to collect the videos and images, and the entity that collected the videos and images. No other metadata was expected or necessary. Actionable data metrics (including vehicle types, curb activity, dwell time, etc.) will be extracted, aggregated, and summarized from video feeds and still images through manual, algorithmic, and/or AI-based data processing methodologies.

Our team strived to use as much open-source data as possible, using formats such as .csv, .txt, and .pdf instead of proprietary formats such as .docx and .xlsx.

Curb inventory data was collected either manually or using smartphones or tablets. Metadata may include time stamp and location information, as well as device information.

Some ESRI file formats can be converted to CSV or TIFF, and where possible, we did so. However, as different layers of information can get lost during conversion, we intend to include the original ESRI file alongside any conversions in the final dataset. Additionally, there are open-source GIS tools that can open most ESRI file types.

Notably, there is QGIS https://www.qgis.org/en/site/, an open-source software that is free to use, which allows opening files created in ESRI tools, which are not free.

Air quality data was collected with sensors, and will include data points like temperature, humidity, and particulate concentration. Metadata included information on the device used for data capture, as well as time, date, and location.

APIs developed and deployed by the city as part of any API testing are provided in industry standard API formats (e.g., XML, JSON, etc.) and will closely follow the OMF metadata curb data standards (OMF Curb Data).

The final data will have a DCAT-US v1.1 (https://resources.data.gov/resources/dcat-us/). JSON metadata file, which is the federal standard for data search and discovery to be compliant with the USDOT Public Access Plan.

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 the 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.**

No Personally Identifiable Information (“PII”) that permits the identity of an individual to whom the information applies to be reasonably determined or inferred, was knowingly and intentionally collected during data collection. All raw video and images captured were encrypted and/or aggregated for transmission and stored within secure cloud storage (owned and administered by the third-party data collection vendor).

Depending on the selected data collection vendor, raw video and images were uploaded to the cloud storage in (near) real-time, or manually extracted from individual cameras, downloaded, and Then, it was uploaded to cloud storage at a set interval over the course of the data collection period. Collected data will be retained and stored for the minimum required period of time during Stage 1, at which time it was deleted.

Air quality data and any other stakeholder or curb use data collected for the pilot corridor were free of confidential or personally identifiable information.

All other data shared via APIs to curb users comes from existing city systems and platforms currently in use (parking payments and enforcement, traffic, asset management, geospatial databases, etc.). This data is already in the public domain and is not confidential in nature. This data is owned and retained by the city in accordance with the city's data retention policy, and does not include any personally identifiable information or any copyright information. It is the intent of the city to apply the Creative Commons CC Zero license to any APIs that are deployed publicly (CC0).

The City of Minneapolis adheres to any applicable retention policies with all collected data throughout all Stage 1 and Stage 2 work. We did not have any access restrictions applying to the data collected, nor did we need to assign specific staff for data stewardship and/or protection purposes.

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.**

The city and project team did not experience any IP/IPR issues. No Personally Identifiable Information or any copyrighted data was knowingly collected. All data, video feeds, and images collected, and all data aggregated and summarized, were of curb use activity occurring in the public right-of-way and existing in the public domain.

During the Stage 1 data collection task, raw data was owned and retained by the data collection vendor, and by extension, via its contractual agreement, the city. The third-party data collection vendor acted as a proxy for the city in the project's data collection efforts. This third-party vendor was bound via contractual agreement to all city data collection, processing, storage, security, and privacy policies, standards, and requirements. No reuse of data occurred, other than for the

specific purposes of this project. The collected curb data was aggregated, summarized, and shared with the city in both Excel and GIS formats.

Curb inventory data collected and mapped on city systems is data that is already in the public domain and is not confidential in nature. All other data shared via APIs to curb users is either curb use data or data that comes from existing city systems and platforms currently in use (parking activity, traffic, asset management, geospatial databases, etc.).

Only data that is currently in the public domain will be shared via the digital communication tool. This data is owned and retained by the city in accordance with the city's data retention policy and does not include any personally identifiable information or any copyrighted information.

We did not encounter any license issues applicable to the data, nor were there any other applicable legal requirements related to the data that needed to be addressed.

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.**

No confidential or sensitive data was collected during Stage 1 data collection. Therefore, we did not experience any specific risks to data security. Care was taken during all data transfer and download processes. The city collaborated closely with data collection vendors to develop and refine the processes for data collection, transfer, processing, and evaluation, and assigned appropriate staff to oversee the deployment of this data collection process. Data collection vendors maintained secure storage of data on cloud-based storage, and in some cases, hard drives.

Vendors controlled access to the data and designated specific members of the city and project team as collaborators, providing access to the data as needed. The city and project team did not need or want access to raw data. The data collection vendor reviewed the raw data and provided an aggregate summary of the collected data to the city and project team. The city was responsible for storing the aggregate summary of the data in a flat file or RDBMS database. The city has a robust automated backup policy in place for both physical servers and RDBMS databases. The city was responsible for maintaining the provided data back-ups in accordance with applicable retention policies: (https://www.minneapolismn.gov/government/departments/clerk/information-governance/records-retention-schedules).

Curb inventory data was owned and retained by the city on city servers (and/or applicable cloud-based servers) using the City's ESRI GIS enterprise account. We used the City’s existing Open Data Portal (https://opendata.minneapolismn.gov), built on the ESRI platform, to store the data for at least Stage 1. This provides an immediate opportunity for external stakeholder feedback. All other data shared via APIs to curb users

comes from existing city systems and platforms currently in use (parking payments and enforcement, traffic, asset management, geospatial databases, etc.). The city ensured that only data currently in the public domain is shared via the API-based digital communication tool. The data is owned and retained by the city on city servers (and backed up on cloud storage) in accordance with the city's data retention policy, and does not include any personally identifiable information or copyrighted material. Additionally, we will upload study data in the Department of Transportation's ROSA P repository to ensure compliance with the USDOT Public Access Policy.

Curb use and demand video and image data collected was aggregated and summarized in Excel, GIS, and other similar formats for city use. The city maintained the aggregate data throughout the project's life and as a historical baseline for curb management. All data collected was owned and retained by the city (or a third-party agent of the city, in accordance with the city's data retention policies), and does not include any personally identifiable information or copyright information. The city adheres to any applicable data retention policies regarding the data collected.

Curb inventory and regulation data (i.e., the "digital twin") will be retained, preserved, and hosted by the city on city-owned servers. The city has a robust automated backup policy in place for both physical servers and RDBMS databases. The city is responsible for maintaining those automated back-ups in accordance with relevant retention policies and archival requirements. The goal is to develop and maintain a robust digital twin for the entire City of Minneapolis. The digital twin will be monitored and regularly updated to ensure relevancy. This data will serve as the backbone of the applicable curb APIs developed, deployed, and hosted by the city for curb users as the program progresses to full-scale deployment in Stage 2.

Camera vendor data will be stored and made available through the City's Open Data Portal, which is stored on the City's existing RDBMS databases. This repository provides persistent identifiers for its published data and supports the capture and provision of the DCAT-US Metadata Schema (examples of existing catalog definitions can be found at https://opendata.minneapolismn.gov/api/feed/definition). Additionally, the final study datasets will be stored in the Department of Transportation's ROSA P repository to ensure compliance with the USDOT Public Access Policy. Where possible, any new datasets collected or utilized as part of this effort will also be stored in an RDBMS database hosted on city-owned servers. This allows the city to implement robust automated backup policies and flexibility in ensuring that the datasets are maintained with appropriate metadata, while also allowing the City to be flexible in pivoting to various archival formats as needed in the future.

Data shared via APIs to curb users come from existing city systems and platforms currently in use (parking payments and enforcement, traffic, asset management, geospatial databases, etc.). This data is already in the public domain and is not confidential in nature. This data is owned and retained by the city in accordance with the city's data retention policy, and does not include any personally identifiable information or any copyright information. It is the intent of the city to apply the Creative Commons CC Zero license to any APIs that are deployed publicly (CC0).

The dynamic digital twin and APIs are hosted and retained in perpetuity by the city during Stage 2 full-scale deployment. The APIs will be developed and deployed leveraging open data standards and practices. Real-time data will be made available through vendor-developed APIs, and historical/archived data will be hosted on city-managed servers through the City's Open Data portal. This will provide both API and Excel spreadsheet data downloads. These data sources will give the city a robust understanding of curb regulations and use, and will allow the city to flexibly manage the curb in response to changing dynamics of demand, and communicate curb regulations and availability in near real-time, leading to a host of access, economic, efficiency, equity, safety, climate-based, traffic, and other benefits.

Planned Research Outputs

Dataset - "An Open Data Approach to Curbside Management"

Dataset includes:

- Final Implementation Plan
- Air quality data
- Predictive curb occupancy data from ParkMobile/Arrive
- Manual inventory and occupancy data collection
- NexCity curb inventory and event data
- OpenData portal curb inventory and policy data
- INRIX curb inventory and location data

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?
An Open Data Approach to Curbside Management	Dataset	2026-01-14	Open	ROSA P		Creative Commons Zero v1.0 Universal	DCAT-US	No	No