



## Livewire Data Platform-A Solution for Energy Efficient Mobility Systems (EEMS) Data Sharing

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eems066

This presentation does not contain any proprietary, confidential, or otherwise restricted information.

# Overview

- Timeline
  - Project start date: 10/01/2018
    - <https://liveswire.energy.gov/> launched June 2019
  - Project end date: 9/30/2024
  - 25% complete
- Budget
  - Total project funding (current round of funding): \$5,130,000
    - DOE share: \$5,130,000
  - Funding for FY 2021: \$1,500,000
  - Funding for FY 2022: \$1,710,000
- Partners
  - Project leads
    - National Renewable Energy Laboratory (NREL)
    - Pacific Northwest National Laboratory (PNNL)
    - Idaho National Laboratory (INL)
  - Interactions/collaborations
    - EEMS research community
    - VTO-funded FOA awardees
    - Mobility researchers
- Barriers
  - Expansive community of relevant stakeholders
  - Difficulty in sourcing empirical real-world data applicable to new mobility technologies such as connectivity and automation

# What is Livewire

- A platform for sharing energy efficiency and mobility research data
- Growing catalog of transportation and mobility-related data funded by VTO and maintained by experts at NREL, INL, and PNNL
- [livewire.energy.gov](https://livewire.energy.gov)



The screenshot shows the Livewire Data Platform website. At the top is a navigation bar with the 'ENERGY.GOV' logo, 'LIVEWIRE DATA PLATFORM' branding, and links for Home, About, FAQ, Metrics, Projects, and Sign in. The main content area features a large, stylized graphic of a city street with a winding path, overlaid with a red dashed line and various icons representing different data types. The text on the page is organized into several sections: 'WHAT IS THE LIVEWIRE DATA PLATFORM?' (describing the platform's purpose), 'WHAT TYPE OF DATA ARE THERE?' (listing data categories like Urban Science and Connected Vehicles), 'HOW CAN I USE THE DATA?' (explaining the research goals), and 'CAN I UPLOAD DATA TO LIVEWIRE?' (providing instructions for data upload and contact information).

**WHAT IS THE LIVEWIRE DATA PLATFORM?**

The Livewire Data Platform makes it easy to search and share transportation and mobility-related data. The Livewire Data Platform supports the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy's Energy Efficient Mobility Systems (EEMS) Program goal of providing an affordable, efficient, safe, and accessible transportation future where mobility is decoupled from energy consumption.

**WHAT TYPE OF DATA ARE THERE?**

The Livewire Data Platform collects data to support EEMS research. These include behavioral, experimental, modeled, analytical, and raw data at the vehicle, traveler, and system level. Livewire Data Platform data aim to support research into:

- Urban Science
- Connected and Automated Vehicles
- Alternative Fueling Infrastructure
- Mobility Decision Science
- Multimodal Transportation
- Vehicle Efficiency

**HOW CAN I USE THE DATA?**

EEMS research investigates how disruptive forces like automated, connected, electric and/or shared vehicles will impact energy consumption in transportation. This information helps communities incorporate energy efficiency in mobility planning. If you work in the EEMS space, the Livewire Data Platform houses the data to support your projects and decision-making efforts.

**CAN I UPLOAD DATA TO LIVEWIRE?**

Livewire lets certain users upload data directly to the platform, where it will be stored and maintained by the Livewire team. This enables users to easily share data with other researchers in a matter of minutes. For more information about this feature, contact the Livewire team at [livewirecontact@liris.pnnl.gov](mailto:livewirecontact@liris.pnnl.gov).


**LIVEWIRE DATA PLATFORM**

# Relevance – Livewire is and will be Impactful

- Secure data management is an essential part of DOE's research infrastructure – it's a core capability that DOE and principal investigators (PIs) will always need. We know how to do this.
  - DOE has resources and insight to do this for all projects
  - Lower cost, better management capabilities, no silos, improved research

Livewire addresses technical and cultural challenges to enable research, collaboration, and data sharing by providing state-of-the-art data management capabilities and services

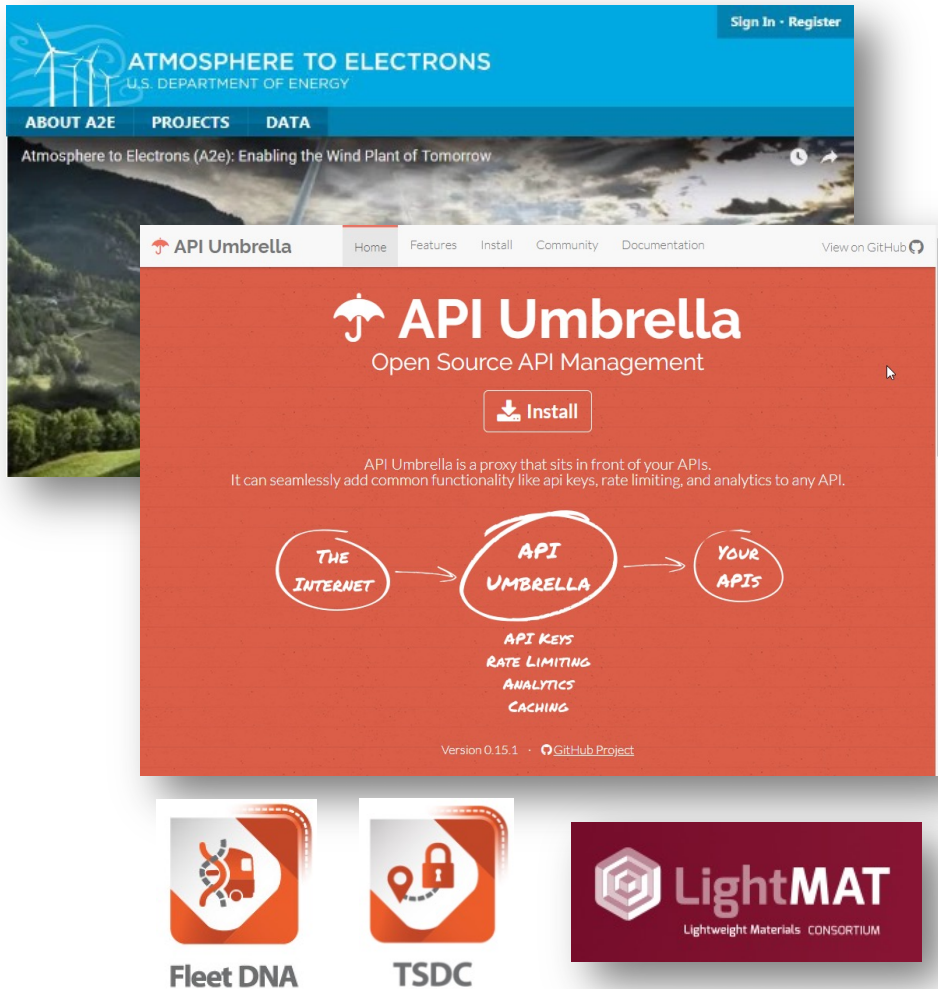
- Core services and platform capabilities include:
  - Free, secure data storage
  - Access management that allows data owners to control who sees their data
  - Data collection and preservation
  - Quality characterization
  - Detailed access and download metrics
  - Increased visibility of projects and data



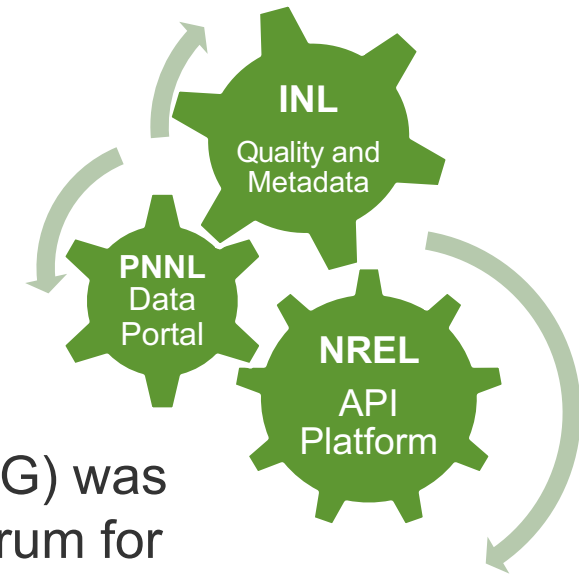
Input from  
stakeholders  
makes Livewire  
impactful



# Approach



- Leverage work done on successful data platforms
- First years were focused on platform development
- User-requested features followed
- After being funded in Fall 2021, Livewire is focused on:
  - Expanding access to more users
  - Growing catalog and features
  - User support
- Livewire Data Working Group (DWG) was established in 2021 to provide a forum for feedback and input from data owners and data users

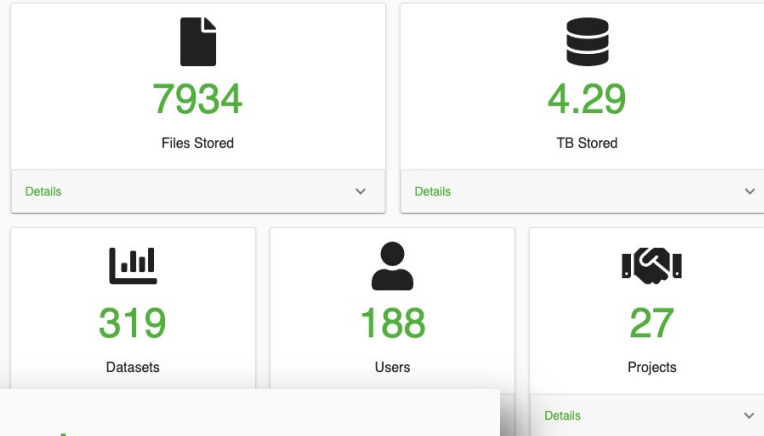


Collaborate to build a data platform that users want to use

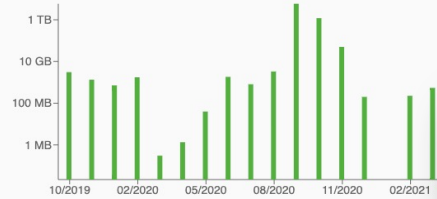
# Milestones

*Milestone Name/Description	*End Date	*Type
(INL) Demonstrate continued progress on the development of tools and processes to streamline the production of detailed dataset metadata and dataset quality characterization with publication of detailed metadata and quality characterization for 40 additional datasets through the Livewire Data Platform.	3/31/22	Quarterly Progress Measure (Regular)
(PNNL) Update the user and data access capabilities to enable:	3/31/22	Quarterly Progress Measure (Regular)
· public data including assigning digital object identifiers		
· automatic access to community datasets for approved domains		
(NREL) Demonstrate progress towards the addition of data priorities identified by the DWG to the Livewire catalog.	6/30/22	Quarterly Progress Measure (Regular)
· Automated and connected light-, medium-, and heavy-duty vehicle data		
· Electrified vehicle and charging infrastructure data		
(NREL, PNNL) Add one Tier 1 (Open) dataset and report on automatic approval of users with a target of 15 users.	6/30/22	Quarterly Progress Measure (Regular)
(NREL – Fleet DNA) Define specific analysis to help quantify dataset extent in terms of vehicle parameters.	6/30/22	Quarterly Progress Measure (Regular)
(PNNL) Develop self-service capability for large or ongoing data uploads that provides guaranteed delivery, high bandwidth, and security.	9/30/22	Quarterly Progress Measure (Regular)
(INL) Demonstrate continued progress on the development of tools and processes to streamline the production of detailed dataset metadata and dataset quality characterization with publication of detailed metadata and quality characterization for 110 additional datasets through the Livewire Data Platform.	9/30/22	Quarterly Progress Measure (Regular)
(NREL – Fleet DNA) Demonstrate analysis output that leverages the Livewire developed Fleet DNA relational database.	9/30/22	Quarterly Progress Measure (Regular)
(NREL – TSDC) Summarize TSDC activities—demonstrating steady growth in included datasets, data users, and publications enabled by access to TSDC-hosted data.	9/30/22	Quarterly Progress Measure (Regular)
(NREL, PNNL, INL) Host at least one dataset used for cross-agency collaboration	9/30/22	Annual Milestone (Stretch)

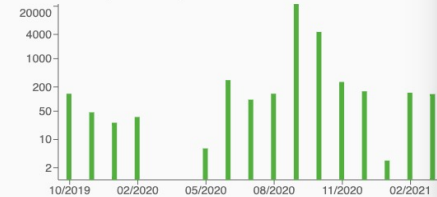
The Livewire Data Platform collects transportation and mobility-related data to support research in the Energy Efficient Mobility Systems Program. These metrics show what's powering Livewire, including the amount of datasets, files, storage capacity, and users within the platform.



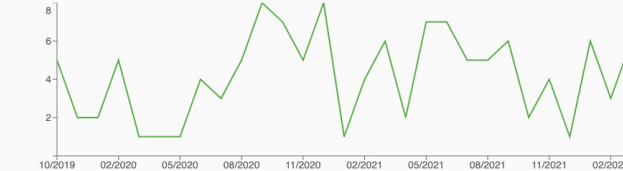
Downloaded Files (total of file sizes)



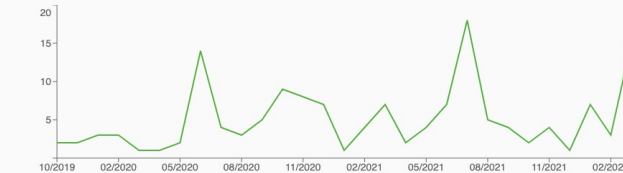
Downloaded Files (total file count)



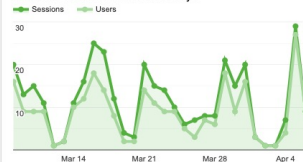
User Downloads (by unique user count)



Dataset Downloads (by unique dataset count)



Sessions / Users Over Last 30 Days



Pageviews Over Last 30 Days



# Technical Accomplishments and Progress

- User-facing site improvements
  - Updated metrics page (<https://livewire.energy.gov/metrics>) shows impact of data shared with usage and engagement metrics
  - Updated project and dataset search pages
  - Updated Frequently Asked Questions (FAQs)
  - Additional help text and Contact Us form
- Updated design to enable embedded media and images on project and dataset pages
  - Fulfilled FY21Q3 milestone

# Technical Accomplishments and Progress – Updated Access and Download Permissions

## Tier 1 - Open

- Project page viewable by all
- Data viewable and downloadable by all (*after logging in*)
- Data must undergo review and approval

Accessible to anyone, including adversaries

## Tier 2 - Privileged

- Project page viewable by all
- Data viewable and downloadable by members
  - Membership automatically granted to .gov and .mil
  - All other users request access through LDP

Accessible to .gov and .mil or by PI consent

## Tier 3 - Restricted

- Project page *may* be viewable by project members only
- Data viewable and downloadable by project members only
  - Users request access through LDP
  - Users granted access directly by PI
- May require logging in with 2FA token

Accessible with PI consent

# Technical Accomplishments and Progress

## Fleet DNA

### FLEETDNA

Fleet DNA is the National Renewable Energy Laboratory's (NREL) secure repository of commercial fleet transportation data used to:

- Help vehicle manufacturers and developers optimize vehicle designs based on specific, real-world vocational data
- Help fleet managers choose and implement advanced vehicle technologies for their fleets.

<http://www.nrel.gov/transportation/fleettestfleetdna.html> NREL s... [show more](#)

### Contacts

### Participating Organizations

### Datasets

REQUEST ACCESS

## Automated approval for users with .gov/.mil email accounts (community)

- Eliminates manual account approval
- Automatically grants community members access to Tier 2 datasets
- Allows users outside the community to request access to individual projects
- Shifts responsibility of access management to project leads
- **Fulfills FY22Q2 milestone**

## Public dataset additions

- Automatically mint Digital Object Identifiers (DOI) using DOE's OSTI E-Link web services
- Data is available to anyone, but login still required before downloading
- **Fulfills FY22Q2 milestone**

### Electric Vehicle Infrastructure Projection Tool (EVI-Pro) Lite

## Evi-Pro Lite API

[Summary](#) [API Details](#) [API Help](#) [Permissions](#)

### Description

This application programming interface provides output from NREL's EVI-Pro model and is used to power the EVI-Pro Lite tool at <https://afdc.energy.gov/evi-pro-lite>. These endpoints provide daily (24-hour) fleet-level charging load profiles for a variety of customizable scenarios.

### References

### Contacts

### Citation

Livewire Data Platform (LDP). *eviprolite/eviprolite.ds0*. Maintained by Livewire Data Platform for U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. DOI: 10.15483/1855624. Accessed: <DD Mon YYYY>.

charging behavior electric vehicles  
energy consumption/efficiency technology adoption

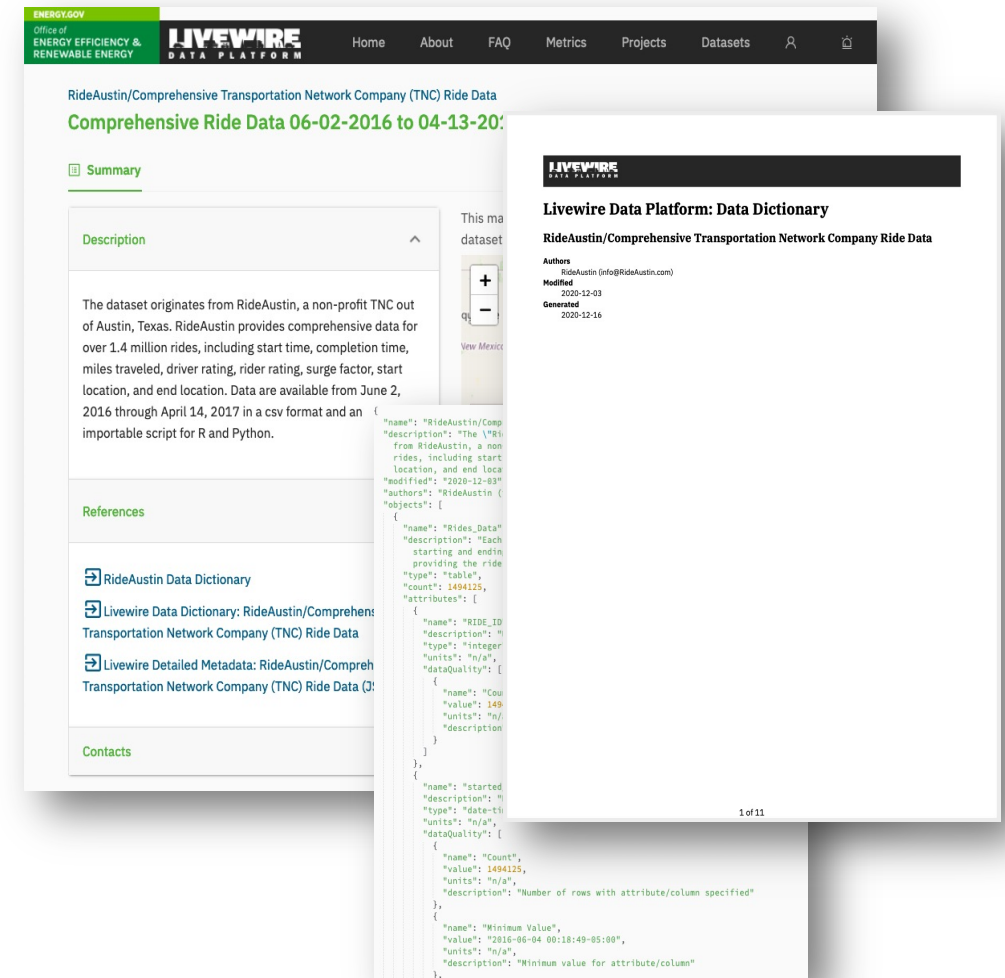
26  
Views

Data Access Method

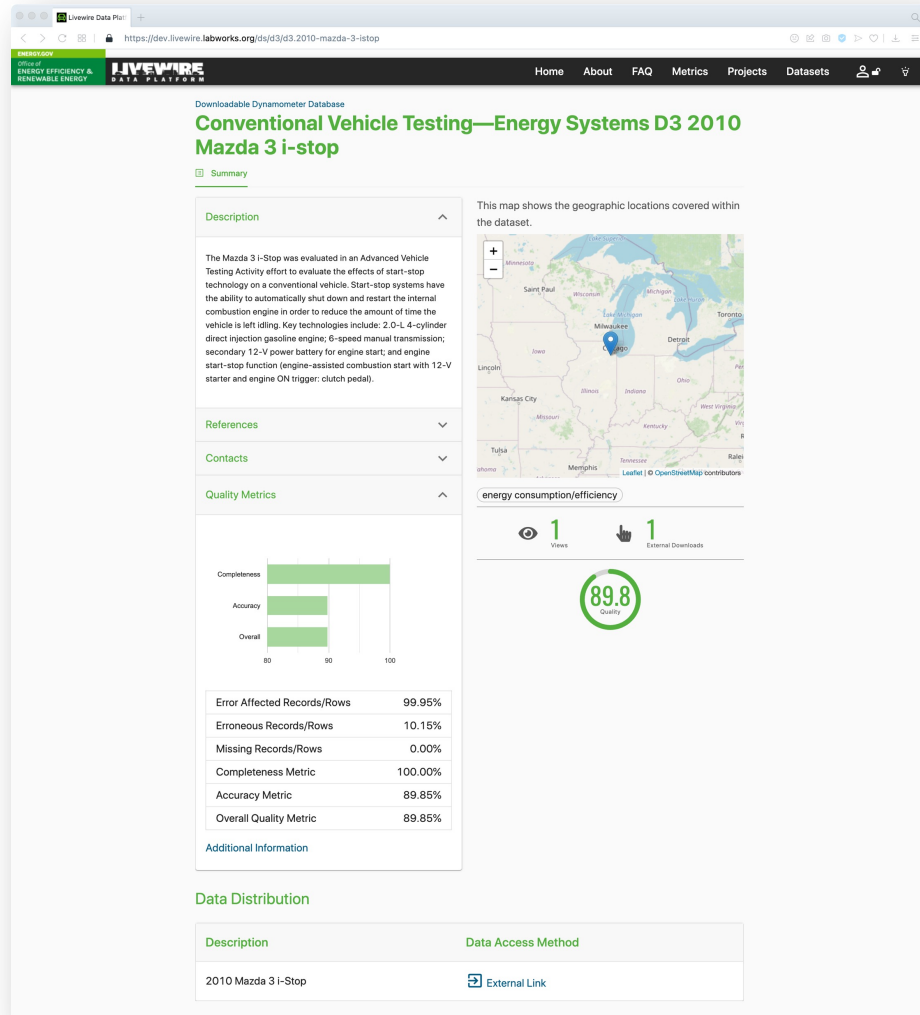


# Technical Accomplishments and Progress – Detailed metadata additions

- High-level metadata contains basic information displayed on page
- Low-level (detailed) metadata provides information about a dataset, including characterization of data quality
  - Summarized graphically on LDP dataset page
  - Published as downloadable PDF and JSON dictionaries (linked as references on each dataset page)
- Significant progress has been made on the automation of tools to create detailed metadata with focus on:
  - Scalability
  - Streamlining/automation of manual processes
  - Expansion of quality metrics



# Technical Accomplishments and Progress – Data Quality Characterization



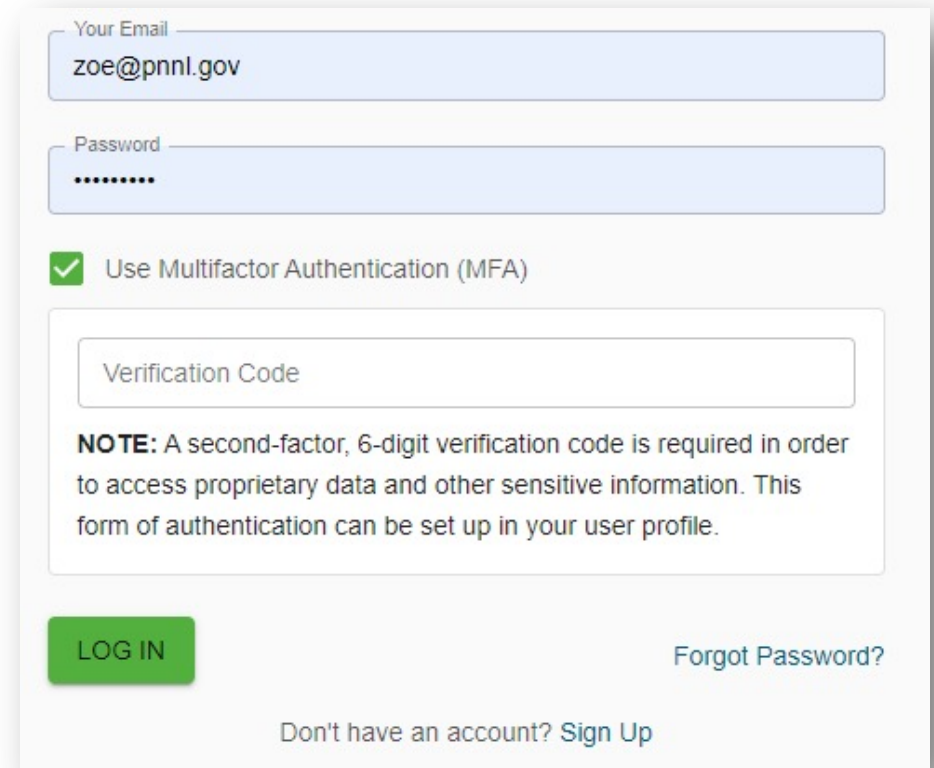
- Data quality characterization
  - Objective analysis of dataset for completeness, statistical outliers, likely errors, and impact of likely errors
  - Helps potential data users make choices
- Published detailed metadata and quality characterization for 41 datasets
  - 25 datasets from ANL's Downloadable Dynamometer Database (D3) project
  - 16 datasets from NREL's Transportation Secure Data Center (TSDC) project
  - About 13% of all Livewire datasets
  - **Fulfills FY22Q2 milestone**

# Technical Accomplishments and Progress

## Site security

- Streamlined automated testing methods and expanded coverage of end-to-end tests
- Added test methods for new capabilities
  - Two factor authentication
  - Downloads of past orders
- Monthly security scans and review
- Log4j vulnerability scan
- Enabled multifactor authentication (MFA), required to support proprietary and sensitive datasets
  - **Fulfilled FY21Q4 milestone**

**Impact: Saves time, effort and improves availability of the site**



The screenshot shows a login interface with the following elements:

- Your Email:** A text input field containing "zoe@pnnl.gov".
- Password:** A text input field with masked characters "\*\*\*\*\*".
- Use Multifactor Authentication (MFA):** A checkbox that is checked, with a green checkmark icon to its left.
- Verification Code:** A text input field below the MFA checkbox.
- NOTE:** A text block stating: "A second-factor, 6-digit verification code is required in order to access proprietary data and other sensitive information. This form of authentication can be set up in your user profile."
- LOG IN:** A green button.
- Forgot Password?:** A blue link.
- Don't have an account? Sign Up:** A blue link.

# Technical Accomplishments and Progress

## Maintenance and updates

- Updated detailed metadata and quality characterization for 5 previously-processed datasets
- Migrated LDP code from internal PNNL Stash instance to *livewire-data-platform* GitHub organization
- Restructured front-end code to streamline managing core and LDP-specific changes
- Developed technical solution to improve UI responsiveness on datasets with large detailed metadata

**Impact: Consistency across data, increased efficiency, improved site performance for a better user experience**

# Technical Accomplishments and Progress – Targeted data

- Added 75 Fleet DNA datasets broken out by vocation and location
  - Included note on data quality
  - Restricted Fleet DNA datasets
- Developed relational database for Fleet DNA
- **Fulfilled FY21Q3 milestone**
- Addressed DWG priority of adding more electrified vehicle and charging infrastructure data with the addition of data from two new projects

<b>Fleet DNA</b>	
FLEETDNA	
Fleet DNA is the National Renewable Energy Laboratory's (NREL) secure repository of commercial fleet transportation data used to: • Help vehicle manufacturers and developers optimize vehicle designs based on specific, real-world vocational data • Help fleet managers choose and implement advanced vehicle technologies for their fleets. <a href="http://www.nrel.gov/transportation/fleettestfleetdna.html">http://www.nrel.gov/transportation/fleettestfleetdna.html</a> NREL s... <a href="#">show more</a>	
Contacts	▼
Participating Organizations	▼
Datasets	^
<b>Dataset (105)</b>	<b>Data Access Method</b>
Regional Haul Vehicles, Ohio—2017	Download
Regional Haul Vehicles, Colorado—2017	Download
Regional Haul Vehicles, Texas—2017	Download
Line Haul Freight, Washington, California, Colorado, Montana, Illinois, Kentucky, and states in between—2018	Download



# Responses to Previous Year Reviewers' Comments

- The reviewer was unclear who was represented in the Livewire Data Working Group from the project slide deck. It would be helpful to detail the participants in this group.
- Moving forward, the reviewer suggested that it would be good to consider expanding participation within the Livewire Data Working Group to other entities.

*Initial members of the DWG came from from five national labs (ANL, LBNL, ORNL, NREL, and INL). A broader group including PIs from university and industry partners was invited for subsequent meetings in order to further discuss the prospect of expanding Livewire's audience and solicit other feedback.*

- If proprietary data are downloaded, do users need to execute non-disclosure agreements (NDAs) for those data?

*Livewire provides the mechanisms to restrict access to proprietary and other moderately sensitive data and provides capability to vet and approve users requesting access to their data. The onus is on PIs to make sure that users have signed their project NDA. Data owners and users are required to agree and accept applicable agreements (e.g., user, non-disclosure). We will provide automated methods to validate users on a quarterly basis and easy access to NDAs for PI's and users that have access to proprietary data.*

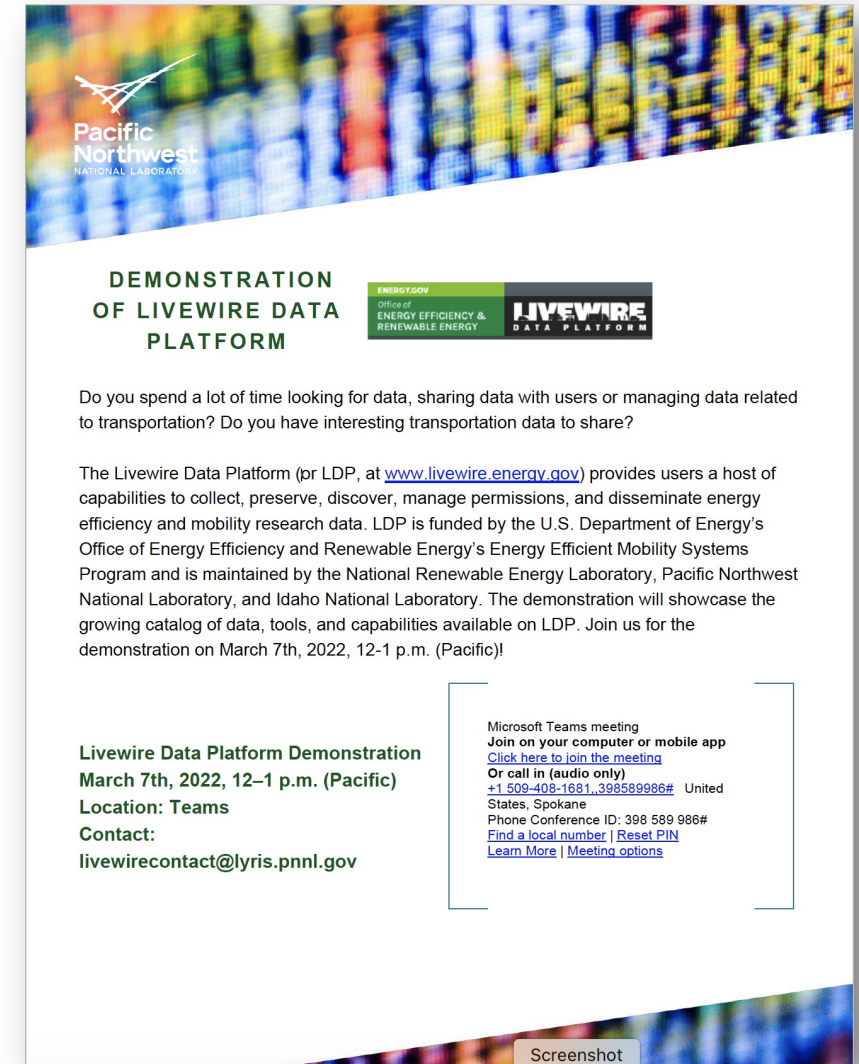
# Responses to Previous Year Reviewers' Comments

- How does DOE plan on marketing the platform in order to get more subscribers and data? Will this be marketed to practitioners (state and local DOTs, other federal departments, research institutions, etc.)?

*The Livewire project team is working closely with VTO tech leads to ensure Livewire is familiar to all the projects they manage and relevant partners. We continue other periodic outreach efforts to state organizations and to mobility researchers at PNNL and continue to periodic outreaches. We attend the monthly SMART PI mobility meetings to raise awareness of LDP capabilities.*

- Future work will require scaling up for larger and diverse groups. The reviewer opined that that may be challenging from a technology infrastructure, as well as a funding, perspective.

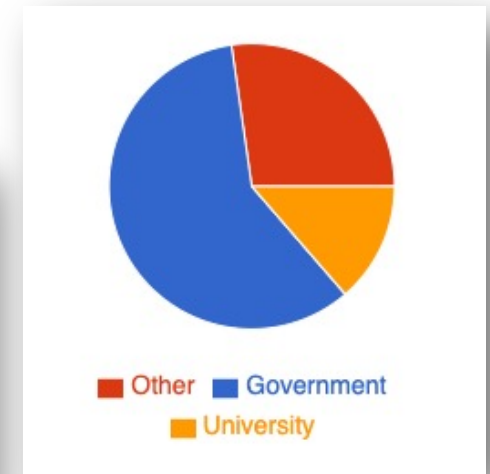
*We are pleased that DOE saw value and impact in Livewire and chose to continue to fund for an additional 3 years. The Livewire team is proactively working on solutions to facilitate rapid growth.*



# Collaboration and Coordination

- Collaboration is essential to Livewire's success
  - Strong collaboration within Livewire project team from INL, NREL, and PNNL
  - Partnership with EEMS, SMART, and TI
- Livewire Data Working Group established to help identify platform and data needs
  - Adding more automated and connected LDV and MDHD data
  - Adding more electrified vehicle and charging infrastructure data
  - Standardizing data across projects
  - Enabling querying and filtering data before downloading
  - Adding the ability to download subsets of data
  - **Addition of targeted data fulfilled FY21Q4 milestone**
- Data on Livewire and Livewire users come from more than 25 organizations, DOE, national labs, and many research partners

Participating Organizations	
<input type="checkbox"/> U.S. Department of Energy	13
<input type="checkbox"/> National Renewable Energy Laboratory	8
<input type="checkbox"/> Argonne National Laboratory	4
<input type="checkbox"/> Idaho National Laboratory	4
<input type="checkbox"/> Lawrence Berkeley National Laboratory	3
<input type="checkbox"/> U.S. Department of Transportation	3
<input type="checkbox"/> PATH Program, University of California, Berkeley	2
<input type="checkbox"/> American Center for Mobility (ACM)	1
<input type="checkbox"/> American Public Transportation Association	1



<input type="checkbox"/> Atlanta Regional Commission	1
<input type="checkbox"/> Atlas Public Policy	1
<input type="checkbox"/> CALSTART	1
<input type="checkbox"/> Carnegie Mellon University	1
<input type="checkbox"/> City and County of Denver	1
<input type="checkbox"/> City of Chicago	1
<input type="checkbox"/> City of Columbus	1
<input type="checkbox"/> City of New York	1
<input type="checkbox"/> City of Seattle	1
<input type="checkbox"/> Denver Metro Clean Cities	1
<input type="checkbox"/> EVgo	1
<input type="checkbox"/> Empire Cities Clean Cities	1
<input type="checkbox"/> Energetics	1
<input type="checkbox"/> Federal Highway Administration	1

# Collaboration and Coordination

- Project and data needs drive feature development and capabilities
  - Livewire team works closely with project teams and provides ongoing support
  - Each time Livewire addresses new needs presented by data owners, capabilities are streamlined and standardized and become part of the platform's core services



*"In our on-road CAV data collection project in collaboration with NREL, ANL set out to collect a large data set of production LD automated vehicles operating in various driving conditions. The data set contains over 2100 miles of driving data from two test vehicles. The aim of the project was to generate this data for a diverse audience of researchers."*

*[Livewire] was the perfect place to put the data to reach our potential audiences. As a new user to Livewire, we received exceptional support to organize and upload the data and get it live very quickly. We are very pleased with the prospect of getting researchers to use the data to help their research. We look forward getting feedback from data users and to the potential of new interactions with researchers that found our data on Livewire and who may want to collaborate with us further."*

- Mike Duoba, ANL



*"The Livewire platform has been an intuitive and convenient way to share EV [WATTS] project data with national labs and project partners. The ability to filter and search by keywords on the platform also makes the EV Watts data available to a wider array of researchers."*

- Yash Pavuluri and Ewan Prichard, Energetics



## Remaining Challenges and Barriers

- Livewire's API capabilities are not widely used; platform team needs to consider how to better communicate API capabilities and pursue opportunities to share via API
- More outreach to reach data users and data owners



# Proposed Future Research

- Add low level metadata and quality analysis to 110 datasets by 9/30/2022 (Q4 milestone), approaching complete dataset coverage by end of FY 2024
- Develop self-service capability for large or ongoing data uploads that provides guaranteed delivery, high bandwidth, and security by 9/30/2022 (Q4 milestone)
- Expand in-platform user capabilities such as
  - data standardization
  - search within and across datasets
  - advanced querying and filtering
  - real time analysis
  - online compute services for code sharing, machine learning and data reviews
- Continue targeted outreach with goals of:
  - Cross-agency collaboration (in conversation with DOT)
  - Additional data in DWG priority areas
  - Complex data formats such as big data, AI, and streaming data
- Demonstrate growth and continued impact of TSDC and Fleet DNA



Any proposed future work is subject to change based on funding levels.

<https://faginconstruction.com/>

# Summary

- Livewire leverages over **30 years** of experience from experts at **three national labs** to enable sharing, discovery, and preservation of transportation and mobility data
- Provides **easy** and **secure** access to a continuously growing catalog of energy efficiency and mobility data influenced by user input from the Livewire Data Working Group
- Livewire can support **proprietary data** and **NDAs**; data owners **control who can access** their data
- Livewire **removes barriers** to researchers finding and sharing the data they need *and* produce in answering important transportation questions
- Supports DOE and partner research to **reduce energy consumption, improve mobility access,** and **accelerate decarbonization** of the transportation sector by shifting the burden of data management to LDP
- Visit Livewire at <https://livewire.energy.gov/>

# Thank You

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**[www.nrel.gov](http://www.nrel.gov)**

NREL/PR-5400-82773

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# Technical Backup Slides

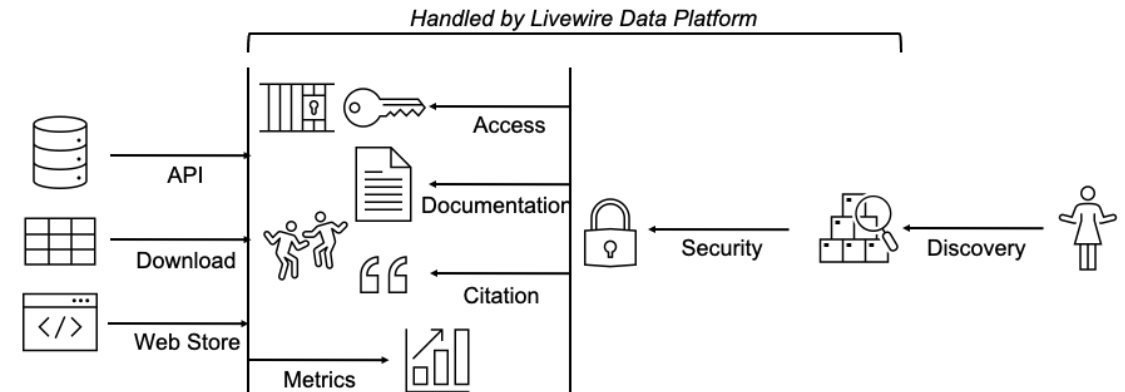
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(Include this “divider” slide if you are including backup technical slides [maximum of five]. These backup technical slides will be available for your presentation and will be included in Web PDF files released to the public.)

# Core services and benefits of sharing data via Livewire

- Storage
  - Livewire can host up to 10 TB of data per project at no cost, but also supports other methods for sharing data
- Secure data platform
  - Livewire adheres to federal security standards, handles authorization and authentication
- Access management and control
  - Data owners can restrict at project or dataset level
  - Can store data that requires NDA
- Detailed metrics on downloads and API usage

- Increased visibility of projects and data
  - Livewire can display digital object identifiers
  - Livewire can provide citation guidance/standard language





# Data download

Data hosted on the Livewire Data Platform can be sorted, filtered, and downloaded directly by logged-in users.

Drones, Delivery Robots, Driverless Cars, and Intelligent Curbs for Increasing Energy Productivity of First/Last Mile Goods Movement  
Energy Use of Drone, Delivery Robot, Driverless Car, and Intelligent Curb Optimization

[Summary](#)

**Description**

The dataset originates from a Carnegie Mellon University project on "Drones, Delivery Robots, Driverless Cars, and Intelligent Curbs for Increasing Energy Productivity of First/Last Mile Goods Movement" funded by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy's Vehicle Technologies Office (VTO). The project began in FY2019 and will continue to FY2022. Data include energy use of drone flights carrying various payloads at a 10 Hz resolution, energy use of delivery robots and driverless cars, and curb use optimization. In addition, local and network-wide energy impacts of those different first/last mile technologies will be estimated.

**References**

[M100 Flight Sheet](#)  
[Data Description Dictionary](#)

**Contacts**

Name	Role	Email
Costa Samaras	Project PI	csamaras@cmu.edu

**Data Files**

Description	Data Access
CMU M100 Drone Data	<a href="#">Multi-Download</a>

Select CMU Drone Data Files

Clear filters

<input checked="" type="checkbox"/>	Flight #	Data Type	File Type	File Size
<input checked="" type="checkbox"/>	f0009	raw	bag	794.62 KB
<input checked="" type="checkbox"/>	f0085	combined	bag	1.28 MB
<input checked="" type="checkbox"/>	f0089	combined	bag	81.7 KB
<input checked="" type="checkbox"/>	f0082	raw	bag	2.35 MB
<input checked="" type="checkbox"/>	f0180	raw	bag	2.23 MB
<input checked="" type="checkbox"/>	f0113	combined	bag	1.13 MB
<input checked="" type="checkbox"/>	f0235	raw	bag	1.83 MB
<input checked="" type="checkbox"/>	f0265	raw	bag	1.91 MB

72 files selected (72.94 MB)

< 1 2 3 4 5 6 7 8 9 >

How would you like to download the data?

Cancel [Zip](#) [Script](#)

# Using Livewire with APIs

Mobility Energy Productivity (MEP) Metric  
MEP Metric API

Summary API Details API Help

Description

MEP scores are available in major metropolitan areas throughout the United States. Users of the API or data downloads can obtain the MEP score for a given point in these areas or for a given point and specified mode of transportation and can also obtain the isochrone (as a GeoJSON polygon) for a given point, mode of transportation, and time.

Contacts

Name	Role	Email
Venu Garikapati	Subject Matter POC	Venu.Garikapati@nrel.gov
Yi Hou	Database POC	Yi.Hou@nrel.gov

Data Files

Description

DOE-NREL MEP API

DOE-NREL Albuquerque, NM MEP

DOE-NREL Anchorage, AK MEP

DOE-NREL Atlanta, GA MEP

This map shows the geographic locations covered within the dataset.

Mobility Energy Productivity (MEP) Metric  
MEP Metric API

Summary API Details API Help

MEP Mobility Metric 0.1.0

[ Base URL: devstage.nrel.gov/api/mep ]  
<https://raw.githubusercontent.com/NREL/developer.nrel.gov/mep-api-docs/source/docs/transportation/mep-v1/spec.yml>

Query our API to return the MEP (mobility, energy, productivity) mobility metric for a given location. Our database currently has MEP scores for over 100 metropolitan areas throughout the U.S.A. Query the `/cities` endpoint to see a list of available cities.

NREL has developed a new quality of mobility metric known as the mobility, energy, productivity (MEP) metric. The MEP metric expands upon existing measures of mobility to include additional parameters such as energy consumption, total trip cost, and accessibility to opportunities (employment, health care, grocery, etc.). The resulting metric provides a robust assessment of the quality of mobility provided to each traveler at a given location, regardless of whether that traveler possesses their own mode of personal transportation.

Schemes

HTTPS

MEP

- GET `/v0/cities` Return the list of cities with mep scores and isochrones available.
- GET `/v0/city-boundary` Return the specified city boundary as a GeoJSON object.
- GET `/v0/score` Return the MEP score for a given location.
- GET `/v0/isochrones` Return isochrones by mode and time for a given location. This endpoint requires approval to access. Please email Yi.Hou@nrel.gov to request approval.
- GET `/v0/isochrones/by-grid-cell` Return isochrones by mode and time for a given location. This endpoint requires approval to access. Please email Yi.Hou@nrel.gov to request approval.
- GET `/v0/mep-breakdown` Return the constituent elements that comprise a MEP score by city grid cell. This endpoint requires approval to access. Please email Yi.Hou@nrel.gov to request approval.
- GET `/v0/bulk_data` Return bulk data download for entire city as csv.

- An API, or application programming interface, is a way for one application to provide data from its database to another in a standardized, machine-readable format.
- Accessing data via API automatically updates a user's content as database content changes
- Each endpoint represents a specific collection of data that a user can access

# Link to existing webpage

When data is stored or shared elsewhere, Livewire can link to that URL

- Projects and datasets still have landing pages on Livewire
- Data is discoverable

Transportation Secure Data Center Cleansed and Spatial Data Catalog

## 2011 Seattle Tolling Impact Survey

Summary Permissions BROWSE DATA

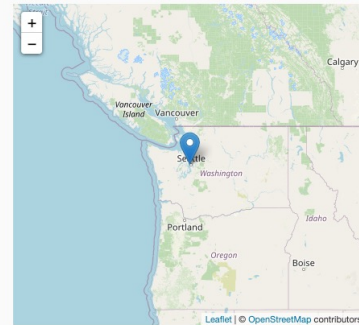
**Description**

The 2011 Tolling Impact Survey measured the impact of tolling on travel behavior in Seattle, Washington. The Volpe Center conducted the survey on behalf of the U.S. Department of Transportation and the Urban Partnership Agreement. The population surveyed included drivers, public transportation users, carpoolers, and vanpoolers using the SR-520 corridor in Seattle. The survey was conducted in two phases—before and after toll implementation—to evaluate related attitude changes. The survey assessed route changes, trip timing, trip purpose, and travel mode (i.e., single-occupancy vehicle, carpool, or public transportation).

**References**

**Contacts**

This map shows the geographic locations covered within the dataset.



travel survey travel behavior travel modes tolling

13 Views 6 External Downloads

**Data Files**

Description	Data Access Method
TSDC/Tolling/Seattle/Full Survey Data	<a href="#">External Link</a>
TSDC/Tolling/Seattle/Data by Person	<a href="#">External Link</a>
TSDC/Tolling/Seattle Spatial Data	<a href="#">External Link</a>

Transportation Secure Data Center

Home About Cleansed Data Spatial Data Publications Contact Us

Transportation and Mobility Research Transportation Secure Data Center

The Transportation Secure Data Center (TSDC) provides free access to detailed transportation data from a variety of travel surveys and studies conducted across the nation.

Data include global positioning system (GPS) readings for millions of miles of travel, along with vehicle characteristics and survey participant demographics. NREL screens the initial data for quality control, translates each data set into a consistent format, and interprets the data for spatial analysis. NREL's processing routines add information on vehicle fuel economy and road grades and join data points to the road network.

The TSDC turned 10 in 2020! Learn about its [dramatic growth and future enhancements](#).

**Cleansed Data by All Criteria**

To browse data from transportation studies and surveys by name, agency, date, and other criteria, use our [searchable and sortable data table](#).

Study Name	Year	Study Type	U.S. Department of Transportation	Participants	Distance (miles)	Speed (mph)	Altitude (feet)	GPS Accuracy (meters)
Seattle Tolling Impact Survey	2011	Travel Behavior	U.S. Department of Transportation	15,000	100,000	100	100	100
Seattle Tolling Impact Survey	2011	Travel Behavior	U.S. Department of Transportation	15,000	100,000	100	100	100
Seattle Tolling Impact Survey	2011	Travel Behavior	U.S. Department of Transportation	15,000	100,000	100	100	100
Seattle Tolling Impact Survey	2011	Travel Behavior	U.S. Department of Transportation	15,000	100,000	100	100	100


**Spatial Data**

To access latitude and longitude spatial data from transportation studies and surveys, you'll need to submit an application.

[LEARN HOW](#)

**All Data by State and Region**

Use the map to view available data from transportation studies and surveys by state. These data support applications that require detailed travel distance and/or speed information, but not detailed [latitude and longitude spatial data](#).



VIEW ALASKA VIEW HAWAII

Survey Results

- > 50,000
- > 20,000
- > 10,000
- > 5,000
- > 1,000
- < 1,000

With Vehicle GPS With Wearable GPS

© Mapbox © OpenStreetMap contributors

SHARE

# Additional Accomplishments: Scope and Growth of the TSDC



Includes hundreds of surveys / studies and millions of miles of travel data from across the U.S.

TSDC

