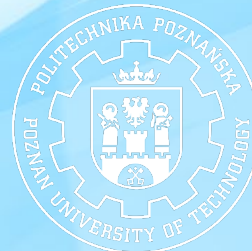


# National Transportation Data & Analytics Solution

Powered by IEEE and NPMRDS

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Presented By: **Patrick F. Russoniello**



# National Transportation Data & Analytics Solution (NTDAS)

## *What Is it and How Can It Help Your Institution?*

- Powerful platform that provides a unique, robust, and high-quality transportation dataset combined with advanced analytics tools, enabling valuable insights to empower academic research, publishing and instruction
- Robust data set brings several billions of speed and travel time observations to your fingertips, enabling multi-disciplinary applications for both academic research and teaching purposes, leading to profound insights and advancements across the transportation and mobility industry spectrum



# About NPMRDS

The National Performance Management Research Data Set (**NPMRDS**) is a vehicle probe-based travel time dataset relied upon by the Federal Highway Administration (FHWA) performance measurement programs.

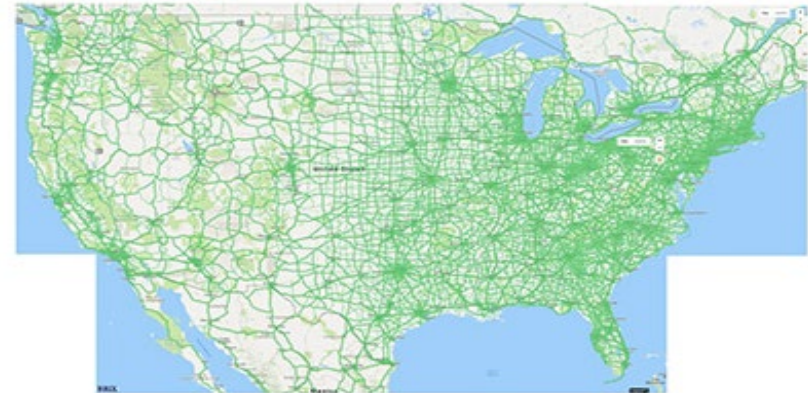
- **Geographical Coverage:** Across 400,000 road segments of the U.S. National Highway System including select Canadian and Mexican border crossings and the full U.S. Traffic Message Channel (TMC) network. The TMC is a digital data traffic program for delivering traffic and travel information to motor vehicle drivers, providing up to date, real-time information on traffic for U.S. roadways.
- **Data Source:** Vehicle probes
- **Metrics:** Speed, travel time
- **Modal Coverage:** Truck and passenger car
- **Coverage years:** Present day back to 2017
- **Lowest Temporal Resolution:** 5 minutes
- 3▪ **Data Latency:** Updated monthly

## NPMRDS Network

- 400,000 segments, 474,000 directional miles



**TMC Network - Further enhances data with arterial roads**  
- 690,000 segments, 1.4 million directional miles



# Overview of the Platform

The **National Transportation Data & Analytics Solution** platform is equipped with state-of-the-art, deep dive analytics tools allowing users to:

- Conduct advanced analysis, research, and performance generation using probe data
- Analyze traffic conditions across one or more stretches of road
- Evaluate the congestion health across roadways
- Gain insight into several statistics like speed, buffer time index, planning time index, and travel time index
- Visualize comprehensive data on maps or other interactive graphics
- Download raw data for offline analysis and create and download reports

The screenshot displays a dashboard with a dark background and a grid of tool cards. Each card features an icon, a title, a brief description, and links for 'Tutorial', 'Help', and 'History'. A 'What's New' badge in the top right corner indicates the date 5/8/24. At the bottom, a 'REPORT TEMPLATES' card is partially visible.

Tool Name	Description	Links
<b>DASHBOARD</b>	Build and share personalized dashboards using a multitude of widgets that track performance metrics.	<a href="#">Tutorial</a> <a href="#">Help</a>
<b>MASSIVE DATA DOWNLOADER</b>	Download raw probe data from our archive for offline analysis.	<a href="#">Tutorial</a> <a href="#">Help</a> <a href="#">History</a>
<b>CONGESTION SCAN</b>	Analyze the rise and fall of congested conditions on a stretch of road.	<a href="#">Tutorial</a> <a href="#">Help</a> <a href="#">History</a>
<b>CORRIDOR SPEED BINS</b>	Visualize congestion measures by time spent at each speed on a stretch of road.	<a href="#">Help</a> <a href="#">History</a>
<b>CORRIDOR TIME COMPARISON</b>	View congestion metrics as a function of location on a road.	<a href="#">Help</a> <a href="#">History</a>
<b>TREND MAP</b>	Create animated maps of roadway conditions.	<a href="#">Tutorial</a> <a href="#">Help</a> <a href="#">History</a>
<b>PERFORMANCE CHARTS</b>	Chart performance metrics over time.	<a href="#">Tutorial</a> <a href="#">Help</a> <a href="#">History</a>
<b>PERFORMANCE SUMMARIES</b>	Report on Buffer Time Index, Planning Time Index, and other performance metrics.	<a href="#">Tutorial</a> <a href="#">Help</a> <a href="#">History</a>
<b>NPMRDS COVERAGE MAP</b>	Explore the coverage completeness of the NPMRDS on a month-by-month basis.	<a href="#">Tutorial</a> <a href="#">Help</a>
<b>USER DELAY COST ANALYSIS</b>	Put a dollar amount on how much a road's performance impacts its users.	<a href="#">Tutorial</a> <a href="#">Help</a> <a href="#">History</a>
<b>TUTORIALS</b>	Learn how to use each of the tools in the suite.	
<b>MAP-21</b>	Create a dashboard widget to monitor states', MPOs', and Urbanized Areas' performances against the new MAP-21 ruling.	<a href="#">Help</a>
<b>REPORT TEMPLATES</b>	Learn how to transform data from tools in our suite into professional storytelling reports, documents, and pamphlets.	

# Sampling of Disciplines and Uses

- Data is extremely relevant and beneficial to a wide range of research disciplines, areas of study and schools within a university.

## Direct uses

- Transportation
- Transportation Engineering
- Infrastructure
- Mobility Behavior
- Traffic Engineering
- Transportation Planning
- Transportation Modeling
- Civil Engineering
- Environmental Engineering
- Public policy and Planning
- Environmental Policy
- Environmental Sciences
- Environmental and Occupational Health
- Sustainability
- Urban Design
- Urban Planning
- Architecture
- Urban Infrastructure
- Urban and Regional Economics
- Economics
- Environmental and Resource Economics
- Economics Analysis of Environmental and Resource Policies
- Transportation Economics

## Interdisciplinary uses

- Industrial Engineering
- Mechanical Engineering
- Automotive Engineering
- Engineering
- Computer Science
- Automation
- Natural resources
- Human Behavior
- Social Justice
- Social Sciences
- Business
- Management Sciences
- Operations Research

# Beneficial for Research, Publishing and Teaching



**Advances Academic  
Research**



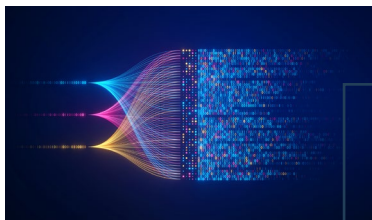
**Accelerates Learning**



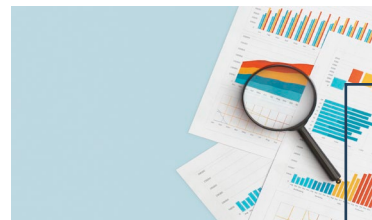
**Supports Research  
Publishing**



**Strengthens Classroom  
Teaching**



**Enables Machine Learning  
Applications**

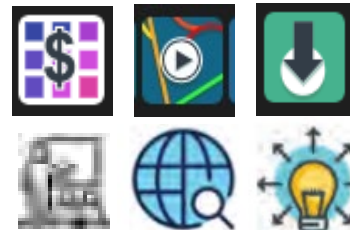


**Supports Research Writing  
and Publication**



# Use Cases to Enhance Classroom Teaching

- Includes 52 multi-disciplinary use cases from leading IEEE experts in transportation, mobility and related fields detailing how NT DAS can facilitate and enhance research projects.



## Fundamental of Traffic Engineering

- Estimating Travel Times
- Exploring Daily and Seasonal Traffic Patterns
- Understanding Level of Service of a Roadway
- Performance Measures for Quantifying and Comparing Amounts of Congestion
- Evaluation of Roads with Uninterrupted Traffic Flows
- Evaluation of Roads with Interrupted Flow
- Evaluation of Attainment of Planning and Policy Goals for Travel Time
- Evaluation of Road User Costs
- Impact of Pavement Condition on Traffic Speeds
- Toll Road Pricing
- Differences in Speed Distributions between Passenger Cars and Trucks
- Evaluating Impacts of Alternative Types of Traffic Control

## Equity Considerations/Alternative Mobility

- Transportation Infrastructure Improvements in Historically Disadvantaged Communities
- Bike Infrastructure Investment Support
- Investments in Transit Infrastructure
- Investment in Pedestrian Infrastructure
- Evaluating Alternative Fuel Stations (Electric Vehicles)

## Equity Considerations/Environment

- Air Quality Issues in Unserved Communities
- Cancer Risk Related to Air Quality

## Safety

- Crash-Related Congestion
- Evaluation of Speed Enforcement Activities
- Evaluation of Emergency Response Routes

## Emergency Management

- Wildfire Threat to Communities
- Flooding Due to Major Storm Events

## Animal Habitats

- Impact on Bat Habitats and Food Sources
- Impact on Amphibian Habitat
- Impact on Bird Populations
- Insect Habitat Impacts
- Tree Canopy Deterioration

## Local Environment

- Evaluating Roadway Microplastics Pollution
- Evaluating Heat Severity

## Rural Dynamics

- Assessing Congestion in National Parks
- Effects of Events in Rural Areas
- Analysis of Transportation Bottlenecks (Freight)

## Global Relevance

- Evaluating Border Crossings and Enforcement Checkpoints
- Congestion on a Global Level

## Urban Dynamics

- Political Districts and Capital Improvements
- Fuel Price Impacts on Road Performance
- Traffic Near Schools
- Population Migrations
- Employment Opportunities
- Relationship between Road Transportation System Performance and Property Values
- Impacts of Special Events
- Idling Policy
- Evaluating Roadside Marketing Strategies
- Modeling Visits from Heads of State
- Winter Operations
- Road Construction (Detours)
- Impact of Critical Road Network Disruptions – Long-Term Bridge Closures
- Impact of Critical Road Network Disruptions – Short-Term Bridge Closure

# About Use Cases.....

Equity Considerations/Alternative Mobility

## Equity Considerations/ Alternative Mobility

## Transportation Infrastructure Improvements in Historically Disadvantaged Communities



### Description

The Department of Transportation (USDOT) has put forth an ambitious Equity Action Plan for building a transportation system that works for all people, with equity and safety as one of the 2022–2026 priorities. The data provided by the NPMRDS directly reflects the type and reliability of vehicles flowing through a particular area, providing insight into equity in the transportation system. There are a number of ways that NPMRDS data can be used to determine congestion and/or reliability of the transportation system in a defined region. The NPMRDS data can characterize corridor travel speeds/times along a corridor or across a region (Figure 1). When paired with non-NPMRDS disadvantaged/underserved demographics data (Figure 2), the analyst can begin to identify areas most in need of improvement. There have been a number of initiatives like Complete Streets, LEED Neighborhoods, and Safe Routes

to School, which is an initiative that promotes studies concerning children’s safety and health and the broader impact of walking and biking to school. These programs are particularly important in underserved areas. The NPMRDS, coupled with demographic data, can provide some insight into how an area reacts to transportation changes.

### Supporting NPMRDS Data

The NTDS reports use average speed for 5-minute intervals for road segments. It is particularly sensitive to fluctuations in congestion. The average speed of traffic is mostly invariant to the flow rate when it is uncongested, but under congestion conditions, the speed decreases sharply as stop-and-go conditions emerge allowing a user to measure changes to the system along and near a transit corridor. The NPMRDS data is visualized in Figure 1 as a way to measure the monthly reliability across a defined area.



Figure 1: State-Wide Travel Time Reliability.

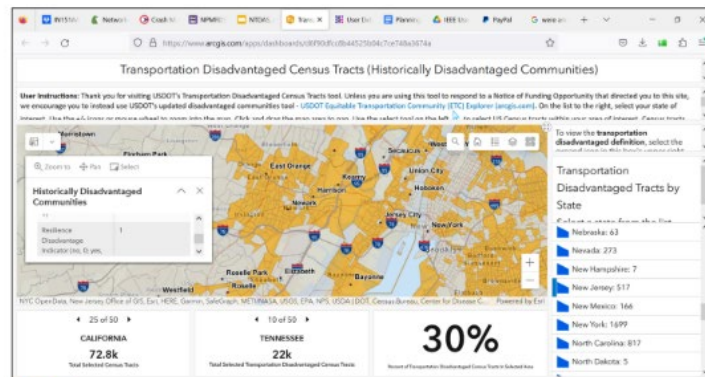


Figure 2: Northern New Jersey Historically Disadvantaged Communities.

In addition to analyzing a region at this level, additional tools can be developed for specific communities or regions, where the raw data can be further analyzed. This example data set shows the reliability across all of New Jersey but can be focused on an underserved region.

### Opportunities for Data Fusion

Construction in and around an underserved region can have short- and long-term impacts that may not be immediately apparent. Underserved or disadvantaged communities may reap the benefits of multimodal roadway systems that align with the promotion of livable, equitable

communities near high congestion areas where the presence of transit, bicycle, or pedestrian infrastructure will have an immediate impact on the local population. NPMRDS can be used in parallel with a number of different data sets to develop metrics to measure potential impacts on populations that are more dependent on public transportation systems.

### Example Data Source:

<https://usdot.maps.arcgis.com/apps/dashboards/d6f90dfcc8b44525b04c7ce748a3674a>



# Platform Demo

<https://ntdas.ritis.org/ieee>



# Next Steps...

- Distribute recording of meeting and slide deck
- Free, 4-week trial of the NTDAS platform in 2024:
  - We invite you to include additional faculty, researchers, librarians and students to participate
  - Anyone with an Institute/University email address can trial
  - Institute/University-wide webinar to promote trial?
- Annual Subscription to NTDAS provides access to all faculty, researchers, librarians and students with Institute/University email address



# Thank you!

## Questions?

For more information, contact Patrick F. Russoniello

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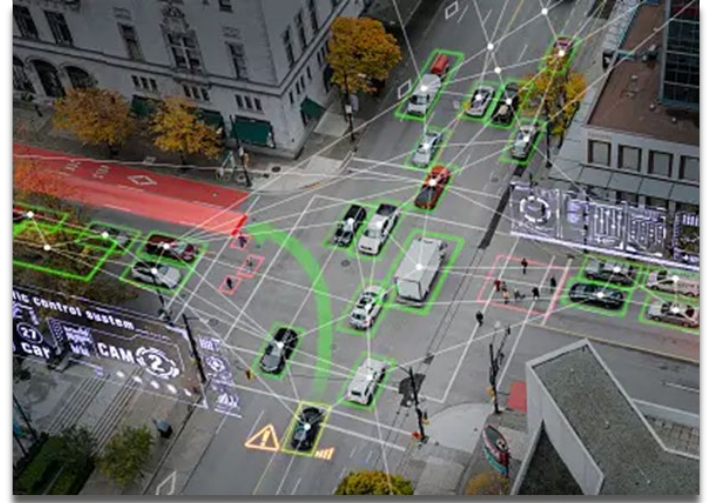


# Appendix

# About IEEE

## *Inspiring a Global Community of Innovation*

- IEEE is the world's largest technical professional organization dedicated to **advancing technology for the benefit of humanity**. IEEE is the place where the next great technology breakthroughs are born—the result of the innovative work of our members, authors, and volunteers. Our organization embodies the visions of its founders, applying them to the challenges of today and tomorrow.
- IEEE has now partnered with leading authorities in transportation and mobility data intelligence to bring a new research and analytics solution to academic institutions and non-profit organizations.



# National Performance Management Research Data Set (NPMRDS)

## Descriptive Metadata Document

### Revision 2.0

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# To Recap

- Exclusive **validation and endorsement** by Federal Highway Administration, making it the **industry-accepted authoritative data set**.
- NTDAS stands unrivaled, offering **unparalleled depth and breadth of data** that no other resource or platform can match.
- **Superior analytics platform** relied upon by the Federal Highway Administration and States' Department of Transportation to make **investment and policy decisions** that contribute to national performance goals.
- Descriptive Metadata Document empowers users with a comprehensive guide to **navigate and understand data sets** effectively, ensuring you can make **informed decisions with confidence**.
- 50 diverse and applicable use cases to inspire **new approaches to research, publishing and teaching**, opening doors to **unexplored opportunities**.

