

USE CASE SUMMARIES

The **National Transportation Data & Analytics Solution (NTDAS)** is a powerful platform that provides a unique, robust, and high-quality transportation dataset combined with advanced research tools. To inspire the development of data-supported analytics, the platform includes over 50 potential use cases on a variety of topics that range traffic engineering to the impact of traffic and congestion on animal habitats.

FUNDAMENTALS OF TRAFFIC ENGINEERING

Estimating Travel Times

By using NTDAS, it is possible to estimate travel time using the average speed. Information is provided on estimating “dynamic” and “instantaneous” travel times using the Massive Data Downloader tool and other tools available in NTDAS.

Exploring Daily and Seasonal Traffic Patterns

The amount of demand for road travel and the performance of the traffic on the road follow the seasonal, weekly, and daily activity patterns of road use is one of the fundamental principles of traffic control.

Understanding Level of Service of a Roadway

The Level of Service (LoS) of a roadway is a subjective concept based on either vehicle density (for highways) or vehicle delay (for signalized arterials) and the Massive Data Downloader allows users to examine the raw data being used to illustrate the changing traffic situations while learning how to manage and analyze large data sets.

Performance Measures for Quantifying and Comparing Amounts of Congestion

Congestion is the primary indicator of poorly operating roads and traffic patterns. NTDAS includes Travel Time Index, Buffer Index, and Planning Time Index which provide useful information when quantifying and comparing congestion. The Corridor Time Comparison tool offers a way to visualize congestion performance measures.

Evaluation of Roads with Uninterrupted Traffic Flows

There are two basic types of road facilities; those with uninterrupted flow, in which traffic control does not normally cause the major movements of traffic to stop, (ex: a freeway) and those with interrupted flow, where stops are expected (ex: a road with traffic lights). The NTDAS Congestion Scan tool permits several different performance measures to be calculated.

Evaluation of Roads with Interrupted Flow

Interrupted flow facilities are roads where traffic control devices are used that cause traffic on the major through movements to occasionally stop. These devices include traffic lights, stop signs, and roundabouts.

Evaluation of Attainment of Planning and Policy Goals for Travel Time

The “15-minute city” is a vision for community planning that aspires to achieve a city where most daily trips can be reached within 15 minutes of travel time and focuses on making alternatives to personal vehicles by enhancing public transportation.

Evaluation of Road User Costs

The user cost associated with a road is sometimes estimated, typically with the use of travel times. The NTDAS contains a user cost calculator. After the user has selected a route, the user cost can be calculated for a desired date and time range.

Impact of Pavement Condition on Traffic Speeds

Rougher pavement tends to reduce speed and are less safe, since tires have less traction with a rougher pavement surface especially during adverse weather conditions as drivers must use greater distance to slow down, making the task of driving more difficult. The International Roughness Index quantifies pavement roughness. Each road segment on the state highway system is grouped into three categories: low, moderate, and high pavement wear.

Toll Road Pricing

As drivers seek an alternative route to toll roads, the data provided by NTDAS directly reflects the type and locations of vehicles flowing through a particular area where the frequency of slow-down situations reflects the congestion. It also provides an indication of vehicle presence to determine how the introduction or increase in tolls affected the tolled and nearby local roads.

Speed Distributions Differences Between Passenger Cars/Trucks

Vehicles are classified according to their typical weight and number of axles, and the FHWA defines 13 classes of vehicles. The Corridor Speed Bin tool produces a visualization of the distribution of speeds for different segments along a route.

Evaluating Alternative Fuel Stations (Electric Vehicles)

Alternative vehicle fuel, especially electric vehicles (EVs) is being touted as a means to reduce fossil fuel dependency and improve air quality. The placement of electric vehicle charging stations in areas of high congestion may prove to improve the air quality in a region as well as provide a low-cost fueled vehicle to underserved communities.

EQUITY CONSIDERATIONS/ALTERNATIVE MOBILITY

Transportation Infrastructure Improvements in Historically Disadvantaged Communities

When data from NTDAS is paired with disadvantaged and underserved demographics data, the analyst can begin to identify areas most in need of improvement. Underserved or disadvantaged communities may reap the benefits of multimodal roadway systems and initiatives like Complete Streets, LEED Neighborhoods, and Safe Routes to School, promote studies concerning children’s safety walking and biking to school.

Bike Infrastructure Investment Support

When NTDAS data is paired with non-NTDAS bicycle count location data, analysts can begin to identify areas with high congestion where appropriate capital investment in bicycle infrastructure may mitigate intense congestion while providing a more equitable system with better options for all.

USE CASE SUMMARIES

Investments in Transit Infrastructure

Analysts can begin to identify areas with high congestion where appropriate capital investment in transit infrastructure may be a means of mitigating intense congestion while providing a more equitable system with better options for all.

Investment in Pedestrian Infrastructure

Areas of pedestrian access include signal enhancements, crosswalks, traffic calming measures, and more. New and improved pedestrian access opportunities align with the promotion of livable, equitable communities near high congestion areas where the presence of walkable communities will have an impact on the local population and extended transportation system.

Evaluating Alternative Fuel Stations (Electric Vehicles)

Electric vehicles (EVs) are being touted as a means to reduce fossil fuel dependency and improve air quality. The placement of electric vehicle charging stations in areas of high congestion may prove to improve the air quality in a region as well as provide a low-cost fueled vehicle to underserved communities.

EQUITY CONSIDERATIONS/ENVIRONMENT

Air Quality Issues in Unserved Communities

The Congestion Mitigation and Air Quality Improvement (CMAQ) Program provides funds to states for transportation projects designed to reduce traffic congestion and improve air quality, particularly in areas of the country that do not attain national air quality standards.

Cancer Risk Related to Air Quality

The Congestion Mitigation and Air Quality Improvement (CMAQ) Program provides funds to states for transportation projects designed to reduce traffic congestion and improve air quality. Cancer risk data can be used to develop metrics to compare changes in air quality as a function of congestion, the implementation of alternative means of travel, changes in vehicle fuel types, and weather patterns.

SAFETY

Crash-Related Congestion

Crash incidents have a major impact on the surface roadway infrastructure, and the NPMRDS data can characterize corridor travel speeds/times before, during, and after a crash incident. The NTAS platform can be used to develop metrics to measure potential impacts on the crash incident location, impact on surrounding roads, and the conditions at the time of the occurrence.

Evaluation of Speed Enforcement Activities

To better target locations for speed enforcement by state and local jurisdictions, you need to know the locations where drivers often operate vehicles at high speeds. To evaluate the effectiveness of speed enforcement, speed data could be used to measure whether driver speeds are in fact reduced by enforcement activities.

Evaluation of Emergency Response Routes

Congestion is one of the biggest challenges in operating emergency vehicles and can detrimentally impact emergency response times. Information from emergency vehicles could be used to compare the actual route performance against the predicted performance to evaluate the effectiveness of routing procedures.

EMERGENCY MANAGEMENT

Wildfire Threat to Communities

Understanding where traffic moves during a wildfire is necessary to avoid an area and in the creation of evacuation and wildfire mitigation plans, and changes in flow plans provided by the NTAS provide insight into how drivers and first responders can reliably travel to a particular location in need of services. The platform can also begin to identify areas where some communities may be at a greater risk because of transportation reliability in the area.

Flooding Due to Major Storm Events

Major rain events associated with flooding can cause significant damage to roadway infrastructure, impede traffic flow, and impact first responders. Paired with NPMRDS, stream depth data can be used to develop metrics to identify areas in need of improvement, incident response time, and weather patterns.

ANIMAL HABITATS

Impact on Bat Habitats and Food Sources

The Congestion Mitigation and Air Quality Improvement (CMAQ) program provides funds to states for transportation projects designed to reduce traffic congestion and improve air quality. NTAS data regarding land use and wetlands, can provide insight on how transportation changes and negative interaction with bats may be mitigated.

Impact on Amphibian Habitat

Amphibians have been a key indicator of environmental change, being indicators of a host of environmental changes due to their life stages relying on both aquatic and terrestrial systems, their permeable skin which is a sensitive organ, and their central position in food webs. NTAS data regarding land use and wetlands, can provide insight as to how an area reacts to transportation changes and how negative interaction with amphibians may be mitigated.

Impact on Bird Populations

Most birds are protected under the federal Migratory Bird Treaty Act (MBTA), making it illegal to harm bird nests or the chicks that reside in them. Improved transportation systems align with the promotion of livable, equitable communities for humans but may have a negative impact on multiple species of animals and in particular birds.

Insect Habitat Impacts

Trees reduce the amount of stormwater runoff, which reduces erosion and pollution in our waterways, reduces the effects of flooding, and stabilizes the soil. Insect populations can be beneficial or destructive to established tree cover. The presence or absence of insect populations may be a result of air pollution or chemical runoff from roadways.

Tree Canopy Deterioration

Many species of wildlife depend on trees for habitats as they provide food, protection, and home for many birds and mammals, and the reduction of trees and tree dieback may be a result of air pollution or chemical runoff from roadways.

USE CASE SUMMARIES

URBAN DYNAMICS

Political Districts and Capital Improvements

Capital investment can be influenced by political lobbyists, allowing a means to compare improved or degraded transportation systems with respect to the politicians representing their region. Political influence can lead to improved transportation systems can help contribute to livable, equitable communities.

Fuel Price Impacts on Road Performance

Fuel prices tend to fluctuate in response to supply issues, which are often influenced by international events. The NTDAS includes annual average daily traffic (AADT) data. It is possible to evaluate changes in speed, which may correlate with fluctuating fuel price, with increased price likely encouraging reduced speeds or less road use, which may ultimately lead to high speeds where congestion is reduced.

Traffic Near Schools

It is sometimes necessary to cause congestion to reduce vehicle speed, near schools and public places. NTDAS data can be used to determine the speed of the transportation system in a defined region, especially one along a school route, where the corridor speed changes based on the time of day and time of year. By measuring this speed, a quantitative measure of the effectiveness of traffic calming strategies around a school can be better understood.

Population Migrations

Population density can help determine how many trips are being taken when a person leaves the house. Changes in congestion patterns or travel time reliability are indicators of the change in infrastructure use, helping to highlight areas where improvements may be needed. NTDAS data can provide insight to help improve future transportation systems or an alternative means.

Employment Opportunities

Major changes to surface transportation infrastructure have an impact on where people drive and the travel time to get there. Together, NTDAS data, employment growth data, and population growth data, can be used to better plan multimodal transportation systems and can characterize corridor congestion as a function of the planning time index.

Relationship between Road Transportation System Performance and Property Values

Access to transportation is a factor that influences property values. For commercial properties, it is desirable to have locations that are easily reached by customers and that have a high visibility. The planning time index values indicate how much time a traveler needs to spend to reach their destination on time 95% of the time.

Impacts of Special Events

Traffic management for special events often requires coordination between different agencies and jurisdictions and between transportation agencies, law enforcement, and other public services. It is beneficial to review traffic performance afterwards to assess whether the management strategies that were put in place were effective.

Idling Policy

Numerous policies are being put in place to reduce fossil fuel usage and improve air quality, specifically reducing the damage from idling vehicles. The NTDAS platform provides the % of Free Flow Speed represents congestion in the Historic Average Percent Congestion Trend Map tool.

Evaluating Roadside Marketing Strategies

Knowing how fast and how congested an area is allows analysts to focus on specific advertising methods. Understanding how, when, and where traffic and people are moving through the system can help shape different marketing strategies and provide insights into the potential success of the advertisement. Paired with known signage location, future placement may be supported by determining where congestion and speed are ideal for a particular type of product or advertisement approach.

Modeling Visits from Heads of State

In preparation for visits from heads of state, roadway access is often restricted or closed. To determine the impact of these types of visits in comparison to unplanned incidents like crashes, probe vehicle data can be used to measure traffic speed before, during, and after. The 24-hour Performance Chart shows the duration of the decrease and/or increase in speed throughout the day.

Winter Operations

In the northern states plow trucks and de-icing agents are used to keep roads clear, reduce traffic incidents, assure freight movement, and guarantee first responders can get to their destination in their time of need.

Road Construction (Detours)

Traffic conditions often degrade during construction projects. The number of lanes are often restricted and temporary detours may be made. Management of operational controls like dynamic message signs, local roadway signal timing, and police enforcement may be improved by understanding how congestion changes in and around a construction project before, during, and after a project.

Impact of Critical Road Network Disruptions – Long-Term Bridge Closures

Unplanned, long-term construction on bridges can have an impact on local regions and bridges close to the closure which may require long congestion mitigation. Bridge closure information can be combined with bridge count data through tolls or volume counts to determine what routes drivers are taking.

Impact of Critical Road Network Disruptions – Short-Term Bridge Closures

Failures in road systems can cause serious disruptions and may lead to the diversion of traffic to local roads. Comparing the scale of one network disruption versus another, could include the evaluation of network resiliency, to be better prepared for natural or manmade disasters and incidents in the future or as a means of evaluating the economic cost of the disruption, to help set a number on the value of investments in infrastructure.

USE CASE SUMMARIES

LOCAL ENVIRONMENT

Evaluating Roadway Microplastics Pollution

Microplastics are especially problematic because they come from a number of different sources, including car tires. Microplastics enter the water system and eventually end up in the ocean making it a global concern. By focusing on areas with high congestion, road runoff waste treatment strategies to reduce microplastics can be included in construction and maintenance policies.

Evaluating Heat Severity

According to the EPA, the frequency of heat waves has increased steadily in the past few years. Paved surfaces, in addition to roadway congestion, increases the amount of heat in the local area. Changes in traffic patterns, fuel types, or type of vehicle may impact changes in heat severity in a region.

RURAL DYNAMICS

Assessing Congestion in National Parks

During summer months, national parks have restricted entrances to reduce park traffic, control congestion, and help to better determine parking availability. The Congestion Percent Trend Map tool can show the speed along each route in the park so that park rangers can plan accordingly.

Effects of Events in Rural Areas

Special events in rural areas have a pronounced effect on roads as they may not be built to handle the amounts of traffic generated by these events. While the NTDAS data tends to focus on arterial highways, which excludes local roads that are included in the last mile of most trips. However, events that draw a large crowd are usually brought to the area via arterial highways. Events that take place over many hours or several days may affect the major roads in a region since the population increases as a result during the event time frame.

Analysis of Transportation Bottlenecks (Freight)

Bottlenecks are locations where a combination of capacity restrictions and an overabundance of traffic produce heavy delays, usually at interchanges, bridges, or access points to facilities. The Federal Highway Administration (FHWA) tracks the location and performance of freight bottlenecks. Once "hotspots" are identified, they can be targeted for investments and mitigation. This data can also be used for route planning and the location of facilities.

GLOBAL RELEVANCE

Evaluating Border Crossings and Enforcement Checkpoints

Approximately \$500 billion in goods are shipped by truck between the US, Canada, and Mexico. Cross-border traffic is often inspected to enforce laws against importation of illicit goods or undocumented entry by foreign citizens. These checkpoints cause congestion and traffic delays. Border crossings use either a checkpoint or a toll booth. Inbound checkpoints create the most delays which can extend out a mile or two from the border, but the congested areas are limited mainly to the locations of the checkpoints.

Congestion on a Global Level

Congestion not only imposes societal cost but also roadway pollution, which will have long-term impacts on populations. A number of these congestion issues and changing traffic patterns can be tied to policies, geometric changes, or fluctuations in fuel costs that affect congestion around the world. How congestion impacts a US city may be transferable to other areas of the world with similar congestion issues.

European Union (EU): Model Applications and Econometric Analysis

The multifaceted variables governing and influencing global transportation agencies encompass a number of factors, including economic consideration, policy dynamics, and societal influences. Nations continue to see avenues for enhancing their infrastructure systems through strategic capital investments and policy implementations. Challenges arise when different countries adopt distinct monitoring systems, complicating the comparison of improved systems with available data.

Asia (China): Traffic Map Analysis

Using travel applications like Google, Bing, and Apple Maps, global transportation agencies continue to optimize the maintenance and efficiency of their road networks. Challenges arise when different countries adopt distinct monitoring systems, complicating the comparison of improved systems with available data and the prediction of how a novel system might interact, especially in the absence of data. Once trained, AI or ML (machine learning) applications can be used to analyze traffic pattern changes and identify relationships across a region that may not morally be considered. The AI applications can then be transferable to other areas of the world where traffic mapping is available.

For more information, a free demo, or trial, please visit:
<https://ntdas.ieee.org/> or scan the QR code:

