

FPM & N-CAST Background and Objectives

Measuring the performance of the transportation system is currently at the forefront of the national transportation dialogue. MAP-21 clearly reflects the criticality, by all levels of government, of improved transportation planning and management, including infrastructure and operations monitoring, identification of investment needs, and benefit-cost analyses of improvements.

Since 2002 ATRI has worked in collaboration with the Federal Highway Administration to design and implement the “Freight Performance Measures” Initiative (FPM) – a program that continuously generates and monitors a variety of performance measures related to the nation’s freight transportation system. Primarily, the program utilizes a near-real-time dataset, consisting of billions of truck global position system data points, to analyze truck travel data, patterns and performance.

A new element of the FPM initiative is a data analysis tool that displays average operating speeds for trucks that travel on interstate highways and other segments of the National Highway System (NHS). These averages are calculated using anonymous private-sector truck data from several hundred thousand unique freight trucks. Currently, data contained within the National Corridors Analysis and Speed Tool (N-CAST) covers a significant portion of the NHS; specifically N-CAST contains data for nearly all interstate mileage in the continental United States. Once N-CAST is publicly expanded to full coverage of the entire NHS, it will provide measures for 75% of the nation's heavy truck network.

N-CAST can provide analytical capabilities to Federal and State DOTs, MPOs and other transportation planners and analysts involved in highway performance monitoring. By utilizing this tool, transportation analysts can address multiple objectives, including where and when trucks are moving at slower than free-flow speeds, as well as mobility impediments along the transportation system.

The N-CAST is currently presented to the public as a beta product. Given the large scale of N-CAST, ATRI welcomes feedback on tool design and functionality. N-CAST is intended to provide a valuable source of freight performance measures for freight stakeholders and will be most successful with consistent engagement by tool users.

Using N-CAST: The National Corridors Analysis and Speed Tool

N-CAST provides FPM average operating speed data to multiple freight stakeholders in the form of shapefiles that can be easily downloaded for use in GIS applications. N-CAST allows users to access freight performance data on their local hard drives. By utilizing the N-CAST shapefiles, users can quickly assess the current state of freight mobility within their jurisdiction and begin to monitor trends in system performance over several months or years.

Data Description

The FPM database consists of billions of truck position data points. These data points are derived from wireless technology and global positioning systems used by the trucking industry as an operations management tool. Each public data point provided by ATRI contains, at the very least, a unique identifier, a latitude reading, a longitude reading and a time/date stamp. A significant portion of the database also contains the spot speed of the vehicle when the position read occurred.

Data Coverage

Currently, N-CAST covers the Interstate Highway System (IHS) and work is underway to expand the coverage to the entire NHS. As of October 2012, there were over 93,000 unique segments included in the N-CAST. Generally, roadways covered by N-CAST are divided into segments that are one-mile in length, and separate segments exist for each direction of travel. Each segment contains location information including the state, route type, route number, direction of travel and segment number. This location information is used to generate a unique segment identifier (segment ID) for each section of highway. Creating a unique segment ID is critical in order to aggregate FPM data and generate performance measures.

Data Processing

Raw truck position read data is processed for the N-CAST using both proprietary and off-the-shelf software, as well as significant back-office hardware. The processing procedures ensure that certain quality control tests are met and also standardize each data point into a common format. After the data goes through the first processing steps, several spatial analyses are performed that associate the data with specific locations of the N-CAST road network. Each individual truck position read that lies on the N-CAST is assigned the unique ID of the associated highway segment.

Once the data has been aggregated for each segment, the data is sorted into time bins, which allows for time-of-day analyses (weekends are excluded from the database). N-CAST sorts the truck position read data into five time bins:

- AM – AM Peak (6:00AM – 9:59AM)
- MD – Midday (10:00 AM – 2:59 PM)
- PM – PM Peak (3:00 PM – 6:59 PM)
- OP – Off-Peak (7:00 PM – 5:59 AM)
- AVG – Average of all hours (12:00 AM – 11:59 PM)

After the data is processed, spatially assigned, aggregated and sorted, the performance measures are calculated. There are three key N-CAST metrics that are calculated for each segment across the five time bins: average spot speed, standard deviation of spot speeds, number of position reads (sample size), and share of position reads in a time bin relative to the segment total.

Data Reporting

The resulting data generated by N-CAST is reported in shapefile format for distribution to freight stakeholders nationwide. Please refer to the N-CAST instructions for detailed steps on how to download and utilize the N-CAST shapefiles. Additionally, the instructions contain a data dictionary explaining every item reported by N-CAST. Beyond the information about the physical characteristics of each segment (location, length, time zone), N-CAST displays average spot speeds, share of total position reads, and sample reliability for every time bin within a segment. Average spot speed is reported in the shapefile as an indicator of average operational speed. Share of total position reads is also included to indicate the level of freight activity that occurs in each time period for a particular segment. The sample reliability for each time bin within a segment provides a guide to users on the characteristics of the sample used to calculate average speeds based on the sample size and sample standard deviation. Each of the five time bins (AM Peak, Midday, PM Peak, Offpeak, and Average) are assigned a reliability grade of A, B, or C. Time bins with a grade of A are the most reliable, indicating a sample with a relative standard error (RSE) of less than 30 and a sample size (N) of greater than 30. Bins with a grade of B have a mid-level reliability grade, having an RSE of less than 30 but an N that is less than or equal to 30. Time bins with a grade of C have the lowest reliability grade and have an RSE of 30 or more and an N of 30 or less.

Summary

- N-CAST is a valuable tool that allows freight transportation stakeholders to evaluate and monitor the performance of a significant portion of the nation's freight transportation network.
- N-CAST is sourced from the ATRI FPM database which contains billions of truck GPS position reads from hundreds of thousands of unique trucks.
- N-CAST covers nearly every mile of the IHS, totaling over 93,000 unique segments and is scalable to the National Highway System.
- The FPM data is processed, spatially assigned, aggregated, sorted, and analyzed to generate performance measures for the nation's highway system.
- N-CAST is delivered to the public through shapefiles that contain the following information:
 - Unique segment ID
 - Segment length
 - Segment time zone
 - Average spot speed for five time bins
 - Share of position reads for a particular time bin relative to the segment total
 - Sample reliability for each time bin