METHODOLOGY

ATRI conducted an in-depth analysis of each of the 300 freight-significant highway locations using truck position and speed data derived from wireless onboard communications systems used by the trucking industry. The 300 locations analyzed by ATRI were first identified as freight-significant by the U.S. Department of Transportation, state Departments of Transportation, and trucking industry stakeholders including motor carriers, commercial drivers and State Trucking Associations. The locations were then assessed and validated using the GPS data.

The five steps in this analysis are as follows:

1. Identification of study population through extraction of relevant commercial truck data during all weekdays of the year 2019 at 300 specific locations using an extensive truck GPS database;
2. Application of data quality tools and techniques;
3. Application of a four-step analysis process that utilizes vehicle time, date and speed information;
4. Calculation of total freight congestion values and ranking (congestion index); and
5. Production of detailed congestion profiles for the 100 top ranked locations.

The final result of this analysis (a ranking of the top 100 monitored locations and the corresponding congestion profiles) is included in the "Research Outcomes" section of this report.

The "total freight congestion value" is calculated using a formula that measures the impact of congestion on average commercial truck speeds in each study area. This process assesses freight demand on each roadway segment in a monitored location by hour of the day. Truck speeds on each segment are collected and assigned to one of 24 one-hour time slots resulting in an average truck speed for each segment during each hour of the day. The "total freight congestion value" does not directly represent hours lost, or financial costs due to this delay, but is simply a means by which the researchers analyze and compare the relative level of severity at each individual location.

Figure 1 displays the calculations used to produce a "total freight congestion value" for an individual location; the methodology is described below:

1. Determine Free Flow Speed. The first step sets a free flow speed – a value at which congestion has no constraint on mobility. This research assumes a value of 55 MPH to signify free flow at all 300 locations. However, this assumption is limited as posted speed is not identified for all locations.

2. Determine Average Truck Speed and the Deviation from Free Flow. The second step determines the average truck speed and then subtracts it from the free flow speed to calculate the MPH below free flow.

3. Develop Hourly Freight Congestion Value. The value derived in Step 2 is multiplied, on an hour-by-hour basis, by the number of commercial trucks that were part of the corresponding hour block (truck volume data by hour). The product is the "hourly freight congestion value." Thus, commercial trucks not affected by delay produce a delay value of zero.

4. Develop Total Freight Congestion Value. The sum of all 24 "hourly freight congestion values" represents the "total freight congestion value" – which determines the congestion index ranking of a particular location. Using this methodology, the location with the highest rank therefore has the highest level of truck-significant congestion. Figure 1 displays the steps and equations for this methodology.

Figure 1. Calculating "Total Freight Congestion Value"

For Hour 1, complete steps 1-3:

Step 1: Free Flow = 55 MPH

Step 2: 55 MPH
– Average Truck Speed
MPH Below Free Flow

Step 3: MPH Below Free Flow
* Vehicle Volumes by Hour
Hourly Freight Congestion Value

Next, complete steps 1-3 for hours 2-24.

Then, calculate the sum of all 24 Hourly Freight Congestion Values.

Hour 1 Freight Congestion Value
+ Hour 2 Freight Congestion Value
+ Hour 3 Freight Congestion Value
↓
+ Hour 24 Freight Congestion Value
Total Freight Congestion Value

5. The report includes a year-over-year (Y-o-Y) measurement in peak average speed change. For the 2020 report this represents a percent change in the 2019 peak average speed from the 2018 peak average speed. This measure helps identify improvements or setbacks at individual locations, and allows locations to be measured against previous performance as a complement to the measurement through national ranking.