

INTRODUCTION

The Federal Highway Administration’s (FHWA’s) Next Generation National Household Travel Survey (NextGen NHTS) Origin–Destination (OD) Data Products are a source for national travel estimates that complement the traditional NHTS core data survey effort. The NHTS OD Data Products leverage in-vehicle and smartphone application–generated passive mobility data to summarize travel between 583 zones that encompass metropolitan statistical areas (MSAs) and non-MSA areas within each State and the District of Columbia. The NHTS OD Data Products provide annualized trip counts for truck and passenger travel, as well as monthly trip counts for 2021 and 2022 passenger travel.

The OD Data Products were constructed from raw mobile-device-location and GPS-device data obtained from multiple data providers. The data streams were recorded as anonymized individual records that indicated the date, time, and latitude and longitude coordinates of location sightings for each device. UMD first preprocessed the data to remove duplicate records/devices as well as records that did not meet minimum quality standards. They then employed algorithms, based on previous academic research and industry best practices, to identify local and long-distance trips and to impute attributes to the passenger data. Table 1 shows the attributes available for each national product.

Table 1. Attributes for national products.

Specification	National Truck	National Passenger
Trip Count	Annual	Annual
Coverage	50 States + DC	50 States + DC
Zone	FHWA’s 583 Zones	FHWA’s 583 Zones
Distance	8 categories	8 categories
Travel Mode (imputed)	N/A	Air, rail, vehicle, active transportation/ferries
Trip Purpose (imputed)	N/A	Work, non-work
Demographics (imputed)	N/A	N/A

NextGen NHTS OD Data Portal

The NextGen NHTS OD Data Products include intra- and interzonal travel across all 583 zones and separate files for truck and passenger travel. The data can be accessed through the NextGen NHTS OD Data Portal, available at <https://nhts.ornl.gov/od/>. The data portal can be used to access the data and associated documentation as well as to summarize data directly

using the Data Summary and Visual Analytics tools. The portal also provides data highlights at the national level.

Tool Resources

The following are available resources to help inform users how to use these tools:

- FHWA 583 Zones:
<https://www.fhwa.dot.gov/policyinformation/analysisframework/04.cfm>.
- NextGen NHTS Passenger OD Data Methodology Document (2020):
https://nhts.ornl.gov/od/assets/doc/2020_NextGen_NHTS_Passenger_OD_Data_Methodology_v2.pdf.
- NextGen NHTS Truck OD Data Methodology Document (2020):
https://nhts.ornl.gov/od/assets/doc/2020_NextGen_NHTS_Truck_OD_Data_Methodology_v2.pdf.
- 2021 Passenger OD Data Methodology Document Addendum:
https://nhts.ornl.gov/od/assets/doc/2021_NextGen_NHTS_Passenger_OD_Data_Methodology_Addendum.pdf.
- 2022 Passenger OD Data Methodology Document Addendum:
https://nhts.ornl.gov/od/assets/doc/2022_NextGen_NHTS_Passenger_OD_Data_Methodology_Addendum.pdf.
- 2021 Truck OD Data Methodology Document Addendum:
https://nhts.ornl.gov/od/assets/doc/2021_NextGen_NHTS_Truck_OD_Data_Methodology_Addendum.pdf.

Recommended System Settings

For the best user experience, the following are the recommended system settings:

- Browser: Chrome, Firefox, or Edge.
- Display Settings:
 - Scale: 100%.
 - Resolution: 1920p x 1080p.
- Orientation: Landscape.

Exported results are saved using the following formats:

- Charts (e.g., bar, area, pie, Sankey) and OD maps are exported as PNG image files.
- Data are exported in CSV files.

GETTING STARTED

Using the Data Summary Tool

The Data Summary tool provides users with a quick way to obtain high-level summary statistics for a specific Zone/State or the whole Nation. To access the tool, click on the “Summary”

button on the navigation bar (Figure 1), which will lead to the Data Summary tool’s home screen (Figure 2).

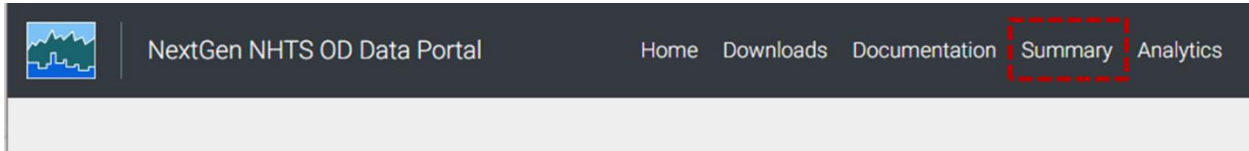


Figure 1. Data Summary tool button.

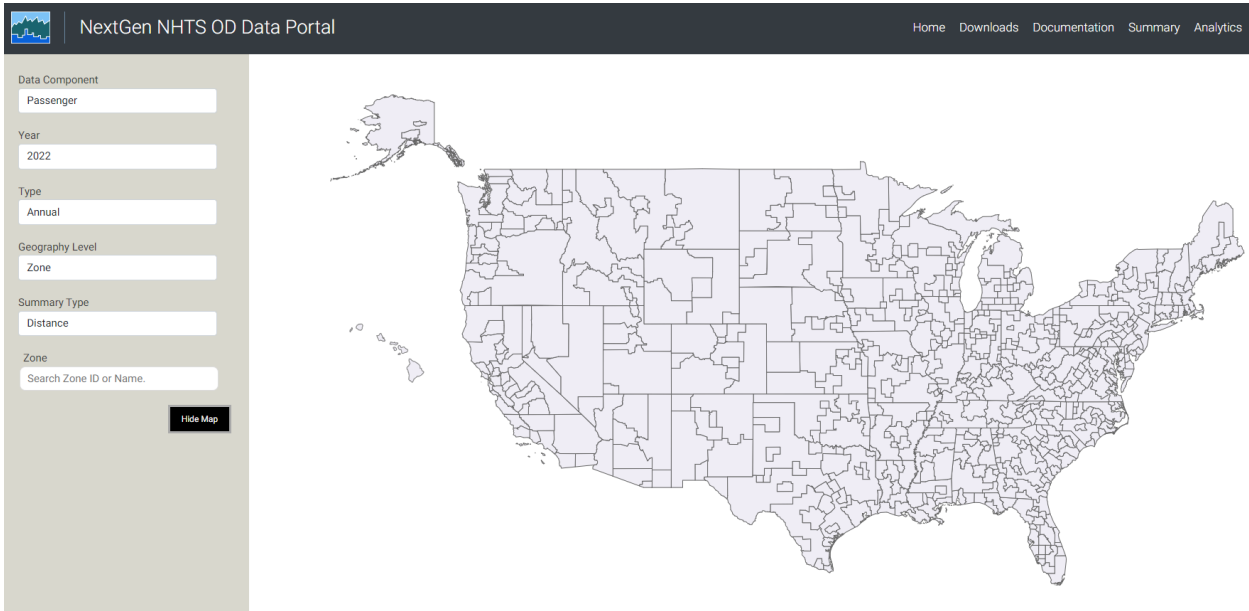


Figure 2. Data Summary tool home screen.

To summarize data, follow these steps:

1. Select the OD Data Component (i.e., passenger or truck) of interest in the panel to the left.
2. Select the Year and the Type (i.e., Annual or Monthly) of interest.
3. Select the Geography Level of interest (i.e., Zone, State, or National).
4. Select the Summary Type of interest (i.e., distance, mode, purpose, distance and mode, distance and purpose, top OD flows, origin flows, or destination flows).
5. Depending on the Geography Level selected in step 2, select a particular Zone or State either from the dropdown list in the panel or directly from the map.
6. Toggle the features bar at the left corner to switch the table or chart type (i.e., table, table bar chart, heatmap, bar chart, area chart, pie chart, or Sankey).
7. Customize the results as needed (selecting numbers or percentages, the chart axes, etc.).

Data Summary Tool Example

This example will produce an OD flow map showing the March 2021 air passenger trips destined to Miami-Fort Lauderdale-West Palm Beach, FL (33100_FL) Zone among the top 300 OD zone-to-zone OD pairs for Passenger-Air (excluding intra-zonal flows). The map will be exported as a picture. Figure 3 illustrates the steps of this example that will produce the resultant map.

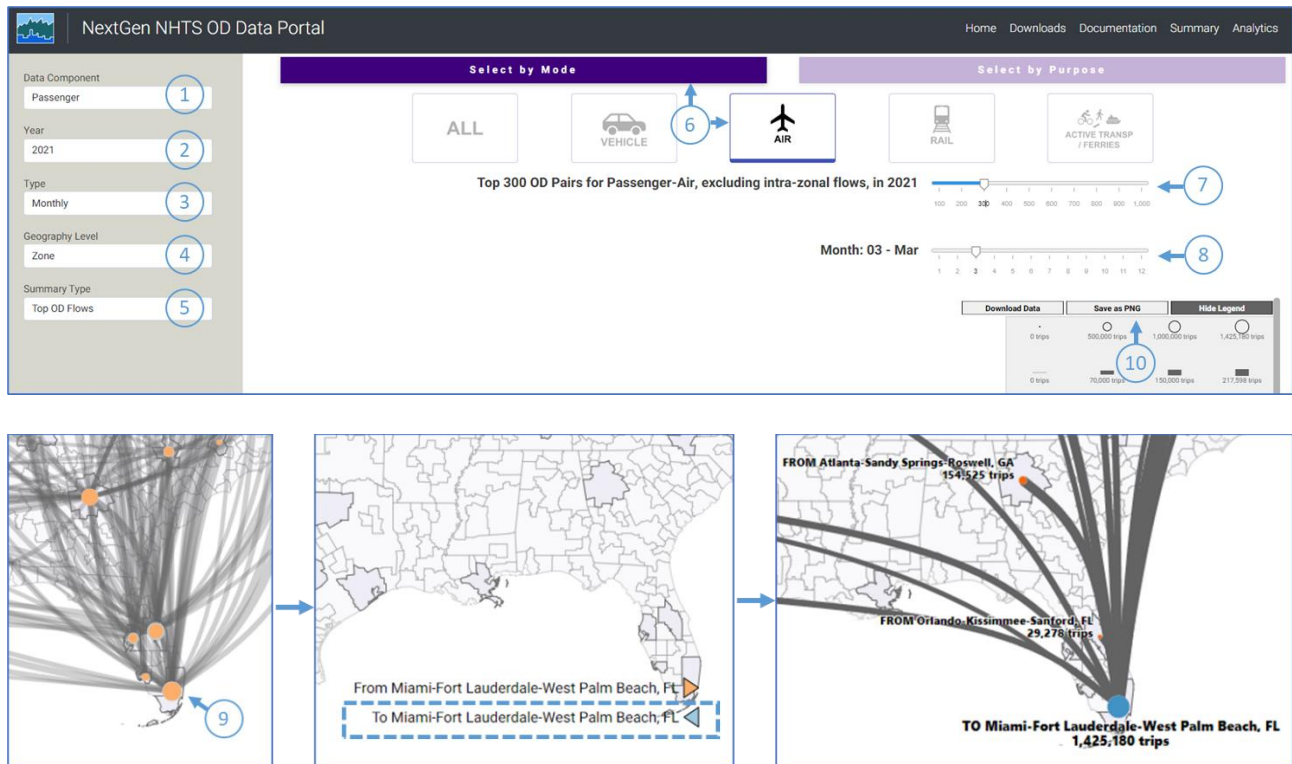


Figure 3. Data Summary tool example illustration.

Follow these steps to produce this example map:

1. Select the “Passenger” as the Data Component.
2. Select “2021” as the Year of the NHTS OD data products in the panel to the left.
3. Select “Monthly” as the Type.
4. Select “Zone” as the Geography Level.
5. Select “Top OD Flows” as the Summary Type.
6. Select “Select by Mode” on the right side in the main section and then click “AIR”.
7. Set the value to “300” in the range slider bar.
8. Set the value to “03-March” in the Month slider bar.
9. In the map, click the orange circle for Miami-Fort Lauderdale-West Palm Beach, FL (33100_FL) Zone in Southeast corner of Florida and click the blue arrow for air trips coming “To Miami-Fort Lauderdale-West Palm Beach, FL.”
10. Below the range slider bar, click “Save as PNG” to download the map.

Using the Visual Analytics Tool

The Visual Analytics tool is a flexible user interface for selecting different combinations and aggregation levels of origin and destination geographies. To access the tool, click on the “Analytics” button on the navigation bar (Figure 4), which will lead to the Visual Analytics tool’s home screen (Figure 5).

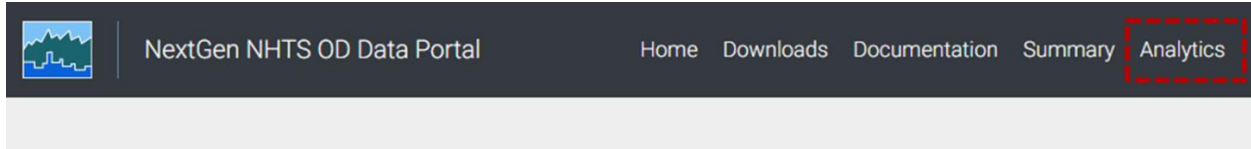


Figure 4. Visual Analytics tool button.

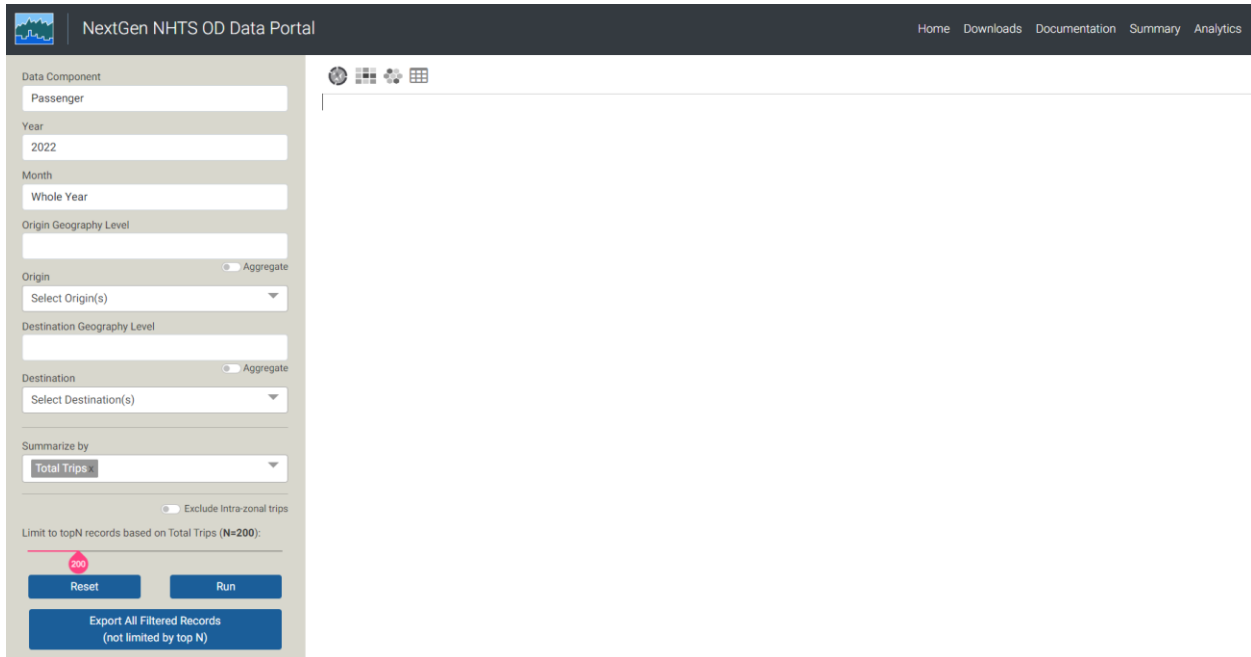


Figure 5. Visual Analytics tool home screen.

To summarize data, follow these steps:

1. Select the OD Data Component (i.e., passenger or truck) of interest in the panel to the left.
2. Select the Year and the Month (i.e., Whole Year or any month) of interest.
3. Select the Origin Geography Level of interest (i.e., Zone, State, or National, with the option to aggregate zones to State or National levels if needed).
4. Select the one or multiple Zones or States of interest as Origin(s), depending on the selected Origin Geography Level in step 2.
5. Select the Destination Geography Level of interest (i.e., Zone, State, or National, with the option to aggregate zones to State or National levels if needed).

6. Select the one or multiple Zones or States of interest as Destination(s), depending on the selected Destination Geography Level in step 4.
7. In “Summarize by” box, select a summary type from the dropdown list, containing the available topics based on Data Component and selected Geography Levels.
8. Define the scope of the analysis by using the range slider bar to indicate the number of top OD records for visualization.
9. Select “Run” to generate an initial output as the chord diagram. Also, the queried data can be downloaded by clicking the “Export All Filtered Records (not limited by top N)” button.
10. Customize the output using the visualization options (i.e., chord diagram, OD matrix, or State hexagon tile map).

Visual Analytics Tool Example

This example will show how to generate a chord diagram showing the distribution of annual passenger vehicle trips originated from Atlanta-Sandy-Springs-Roswell, GA (12060_GA) Zone to all other zones within State Georgia (excluding intra-zonal trips) in 2022. Figure 6 illustrates the steps of this example that will produce the resultant chord diagram.

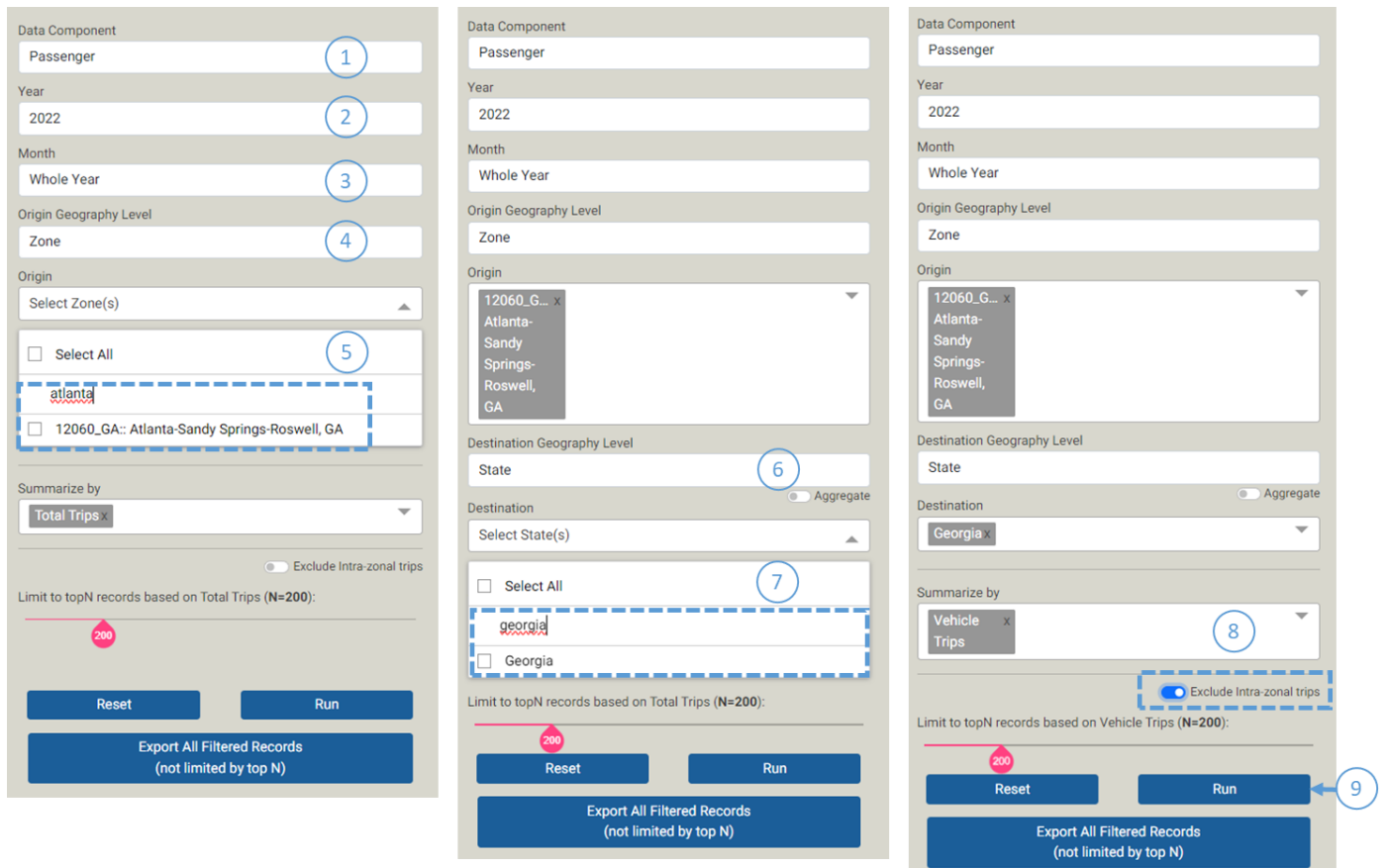


Figure 6. Visual Analytics tool example illustration.

Follow these steps to produce this example data download:

1. Select “Passenger” as the Data Component of the NHTS OD data products in the panel to the left.
2. Select “2022” as the Year.
3. Select “Whole Year” as the Month.
4. Select “Zone” as the Origin Geography Level.
5. Click “Select Zone(s)” and enter keyword “atlanta” in the search box of the Origin dropdown list; then, select “12060_GA:: Atlanta-Sandy Springs-Roswell, GA” as Origin.
6. Select “State” as the Destination Geography Level and keep the “Aggregate” toggle switch off so that all zones within Georgia will be individually selected.
7. In the Search bar of the Destination dropdown list, use a relevant keyword, such as “georgia”, to find “Georgia” and select it as the Destination.
8. Select “Vehicle Trips” in the dropdown list for the summary type in “Summarize by” and turn on the toggle switch to exclude intra-zonal trips.
9. Leave the default “200” value as is in the range slider bar because it will cover all the OD pairs for the query. Hit “Run” button to generate the chord diagram.

DEFINITIONS AND CONCEPTS

What are these FHWA zones and how are they defined?

The geography underlying this tool comprises 583 zones designated by FHWA. The 583 zones consist of 447 State-specific MSAs and 136 new zones created from the remaining non-MSA areas.

- For State-specific MSAs, the zone identifier contains the MSA identifier linked with the two-letter State abbreviation, such as 41180_MO, meaning the portion of the MSA 41180 (St. Louis, MO-IL) in Missouri.
- For newly created non-MSA zones, the zone identifier always starts with an uppercase letter “R” and is linked with the two-letter State abbreviation, such as RMO1_MO.

For more details, please refer to the website Traveler Analysis Framework – Planned Passenger Travel Origin Destination Zone Information, available at

<https://www.fhwa.dot.gov/policyinformation/analysisframework/04.cfm>.

What is in the national truck NHTS OD data product?

The national truck trip data product provides annualized truck trips within and between the 583 FHWA zones. For each OD pair, the total number of annualized truck trips is presented, followed by those trips disaggregated to 8 distance ranges (see Table 1).

Truck trips were estimated by the UMD team using truck GPS data and analysis support from ATRI and INRIX. The data reflect movements by freight trucks and light duty transportation trucks, making both intercity and local deliveries. The truck data do not include pickup trucks.

For truck trips, each trip’s distance was calculated by summing all road segment lengths along a reconstructed trip path based on map-matching and routing algorithms. For longer distance trips, the distance calculation includes all segments of that trip as well (including short stops at rest areas). Once the distance is estimated, the trip is then assigned to one of the eight distance ranges.

What is in the national passenger NHTS OD data product?

The national passenger trip data product provides annualized passenger trips within and between the 583 FHWA zones. For each OD pair, the total number of annualized passenger trips is presented, followed by those trips disaggregated to eight distance ranges. The data attributes include imputed travel mode and trip purpose, so the data file also provides disaggregated trip counts based on distance, travel mode, trip purpose, and combinations thereof (i.e., travel mode by distance and trip purpose by distance) (see Table 1).

Passenger trips were derived from smartphone application-generated passive mobility data obtained from multiple providers. The data were preprocessed to remove truck drivers. The actual definition of a trip varies based on the imputed mode:

- **Air trips:** Air trips reflect movement from the origin airport to the final destination airport (connecting flights are linked so that the OD data reflect origin airport and ultimate destination airport associated with each OD pair). The data include privately and publicly operated airports; however, most of the air trips in the data are commercial air trips. **All air trips reflect only the airport-to-airport movement by airplane**—access trips to the origin airport and egress trips from the destination airport are reported separately as trips in ground transportation mode.
- **Rail trips:** When the main segment of a trip was made by rail, the trip is considered a rail trip. Unlike air trips, however, rail trips consider all modes used from the origin of a trip to the final destination. For example, for one trip made by regional rail, the rail trip includes all intermediary links (the rail station-to-station trip segment *and* the access/egress trip legs, including those made by vehicle and active transportation/ferries modes as defined below). Rail trips also include those made by Amtrak, and these trips are also linked from true origin to the final destination (driving from home to station, Amtrak from station to station, then egress mode to final destination).
- **Vehicle trips:** For all non-air and non-rail trips, if the main segment of a trip was made by vehicle, it was coded as a vehicle trip. This definition includes private vehicle trips (personal cars, etc.) as well as public vehicle trips (transit buses, etc.) and include all modes used from the trip origin to the final destination. For example, one vehicle trip can include someone driving from home to work or the grocery store. It can also include a linked trip that consists of someone walking to a bus stop, taking a bus or series of buses (but no rail), then walking to the final trip destination.
- **Active Transportation/Ferries trips:** Travel by all other modes is combined into the final mode category. Walk and bike trips are the predominant modes, followed by ferry trips so this final category is labeled “active transportation/ferries.”. The name is shortened

as “active transp/ferries” in the tools and as “atf” as the variable name in the raw passenger data file. An “active transportation/ferries” trip represents the start and end movement from location to location and tends to represent unlinked trips, such as someone walking from home to the corner store.

For passenger trips, distance was first estimated using different methods based on the travel mode below and then assigned to one of the eight distance bands.

- **Air travel:** The geodetic distance between the origin and destination airports.
- **Rail and vehicle travel:** The sum of all road segment lengths along a reconstructed trip path based on the map-matching and routing algorithms.
- **Active Transportation/Ferries travel:** The length of the observed true trajectory from origin to destination.