# FREIGHT ANALYSIS FRAMEWORK (FAF5) OVERVIEW, USES & IMPROVEMENTS

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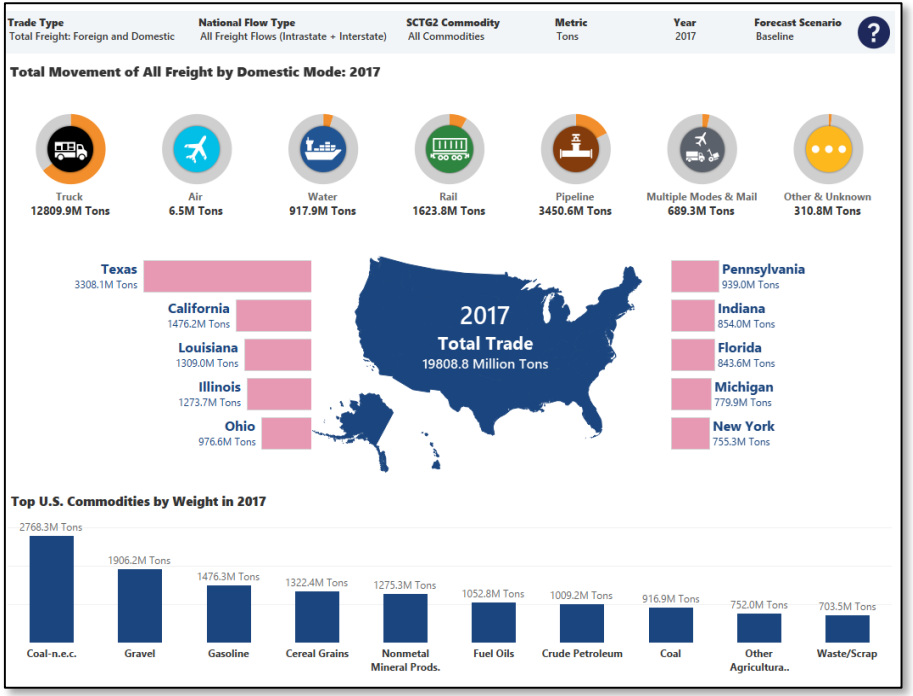
# OVERVIEW OF FAF5

# WHAT IS FAF?

**FAF5 FHWA Website:** https://ops.fhwa.dot.gov/freight/freight_analysis/faf/

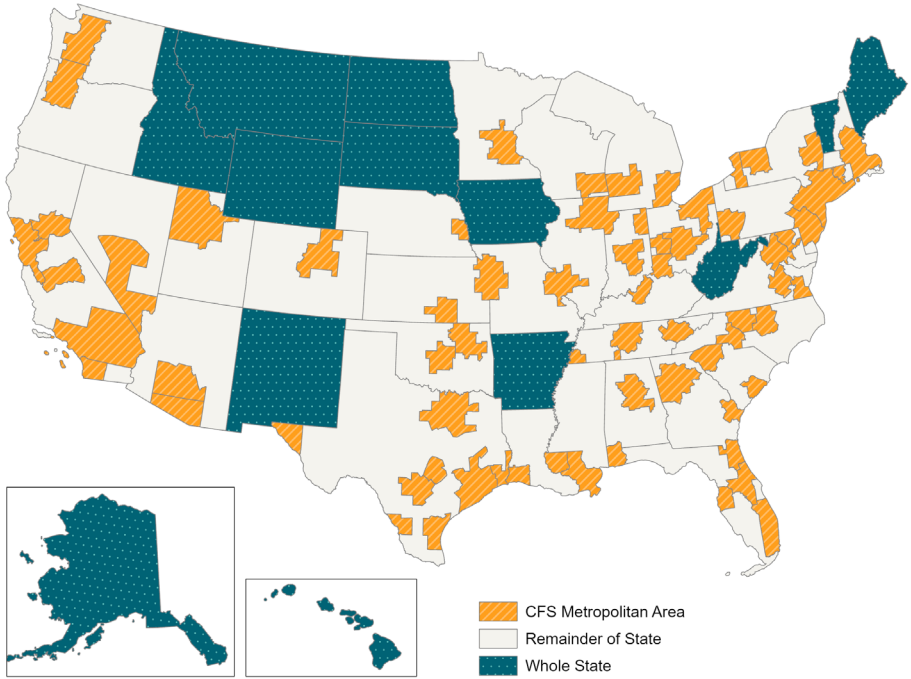



Source: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework (FAF), version 5.2.

- Attempt to provide a comprehensive picture of the what, where, and how of freight movement in the U.S.
- Joint program of FHWA, BTS, Census Bureau
- Updated every 5 years

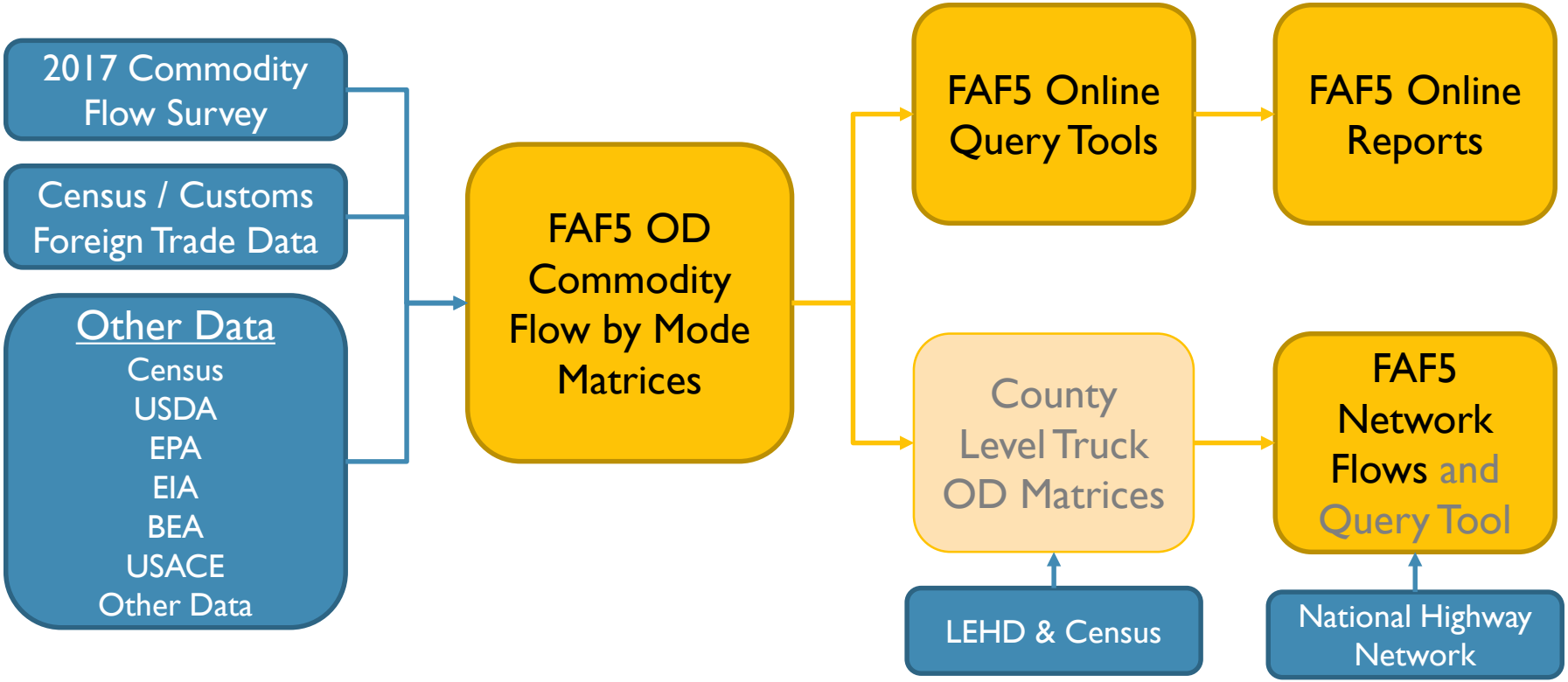
# WHAT INFORMATION IS INCLUDED IN FAF5?

- What / how much is moving?
  - 42 commodities
  - Tons, ton-miles, value of goods moved
- Where is it moving?
  - 132 FAF / CFS zones
  - Between states, metros, and abroad
- How is it moving?
  - 6 freight modes
- When is it moving?
  - 2017 base year & 3 forecast scenarios




Source: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework (FAF), version 5.1.

# FAF5 DATA FRAMEWORK



# CFS & OOS

- Commodity Flow Survey (CFS)
  - Shipper-based survey
  - Conducted by Census, jointly administered by BTS
  - Includes data from approximately 100,000 businesses, representative of key freight industries:
    - mining,
    - manufacturing,
    - wholesale trade,
    - retail and services, and some auxiliary establishments (e.g., warehouses)
  - Source for ~70% of FAF tonnage
- Out-of-Scope (OOS)
  - Commodity data from other sources
  - Key commodities (>50% OOS)
    - Crude petroleum
    - Logs
    - Coal-n.e.c.
    - Live animals/fish
    - Cereal grains
  - Other Commodities (>30% OOS)
    - Textiles/leather
    - Machinery
    - Electronics

# NEW IN FAF5!

## Origin-Destination Flows

- New data base year (2017)
- Updated data to horizon 2050 with 5-year increments
- New short-term forecasts for 2020, 2022, and 2023
- Revised annual estimates for 2018 and 2019
- Updated base year data and forecast data development processes

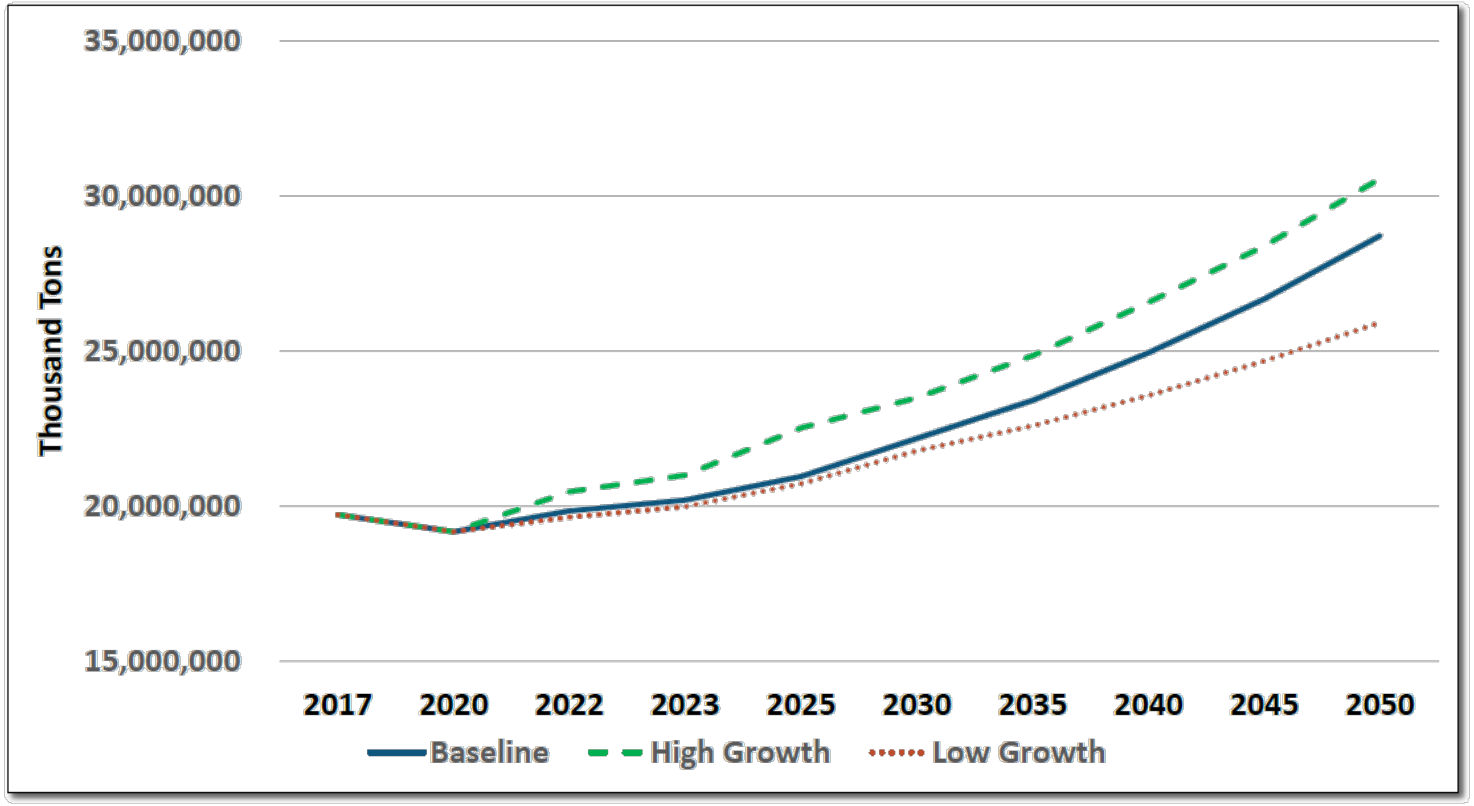
## Highway Network Flows

- Updated model highway network (dualized Interstates and included ramps)
- Added new truck flows by commodity groups
- Added new truck flows (domestic, imports, and exports)
- Overhauled highway network model and routing algorithms
- Added new customized model software and analysis capability

## Special Products and Data Tools

- Updated features for web-based data products
- Added new FAF data visualization tools
- Added new national truck flow maps
- Added new State-level truck flow maps
- Added new summary tables by FAF zones
- Added a new special tabulation of CFS 2017 for small areas

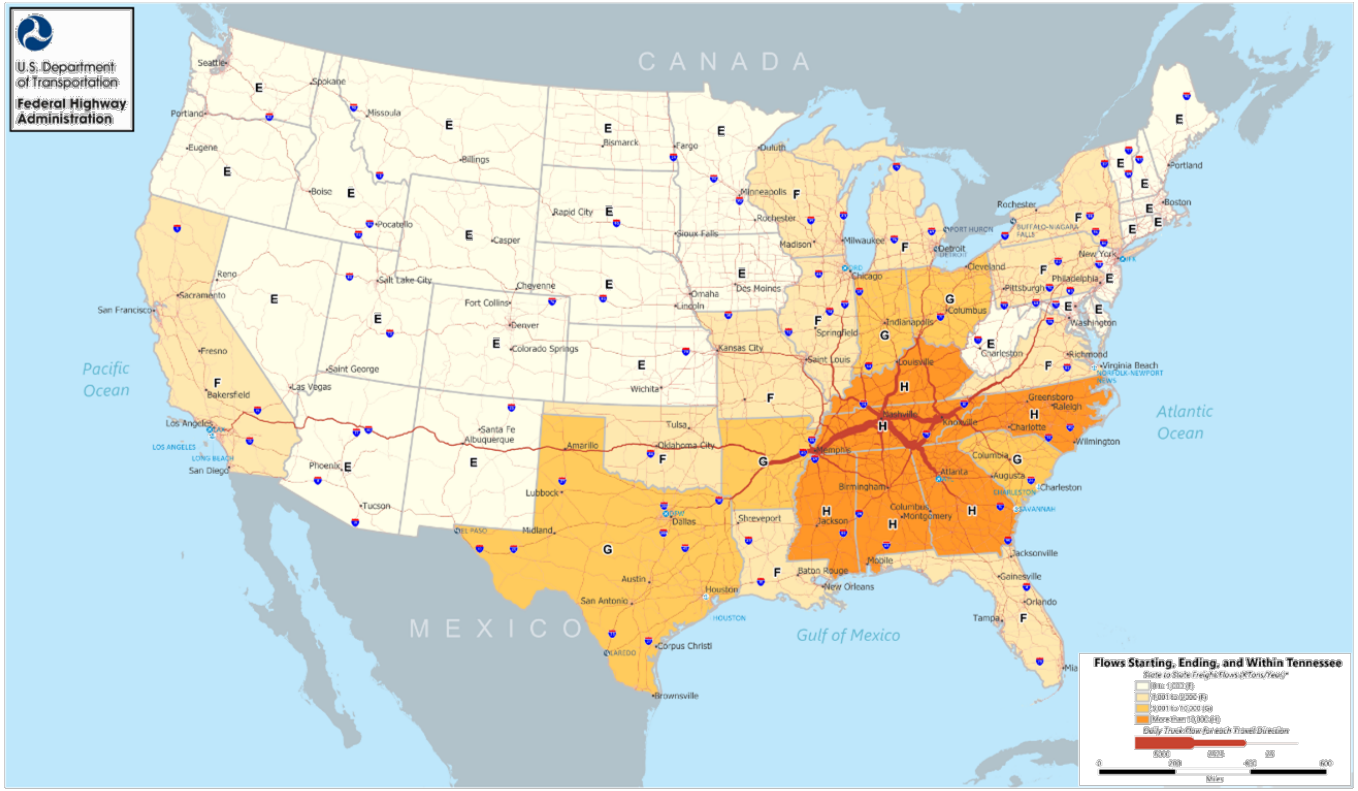
# FAF5 FORECAST SCENARIOS




Source: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework (FAF), version 5.2.

# FAF5 EXAMPLES

# TRUCKS TO, FROM, & WITHIN TENNESSEE, 2017




Note: Major flows include domestic and international freight moving by truck on highway segments with more than twenty-five FAF trucks per day and between places typically more than fifty miles apart.
Source: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework (FAF), version 5.1. Flows include 42 different commodities represented in FAF.
*State-to-State flows represent annual KTons of freight transported by trucks within Tennessee, and between Tennessee and other States. Flow does not include imports and exports that use Tennessee as the gateway; port and go out of the state.

# TOP 5 TRADING PARTNERS: TN

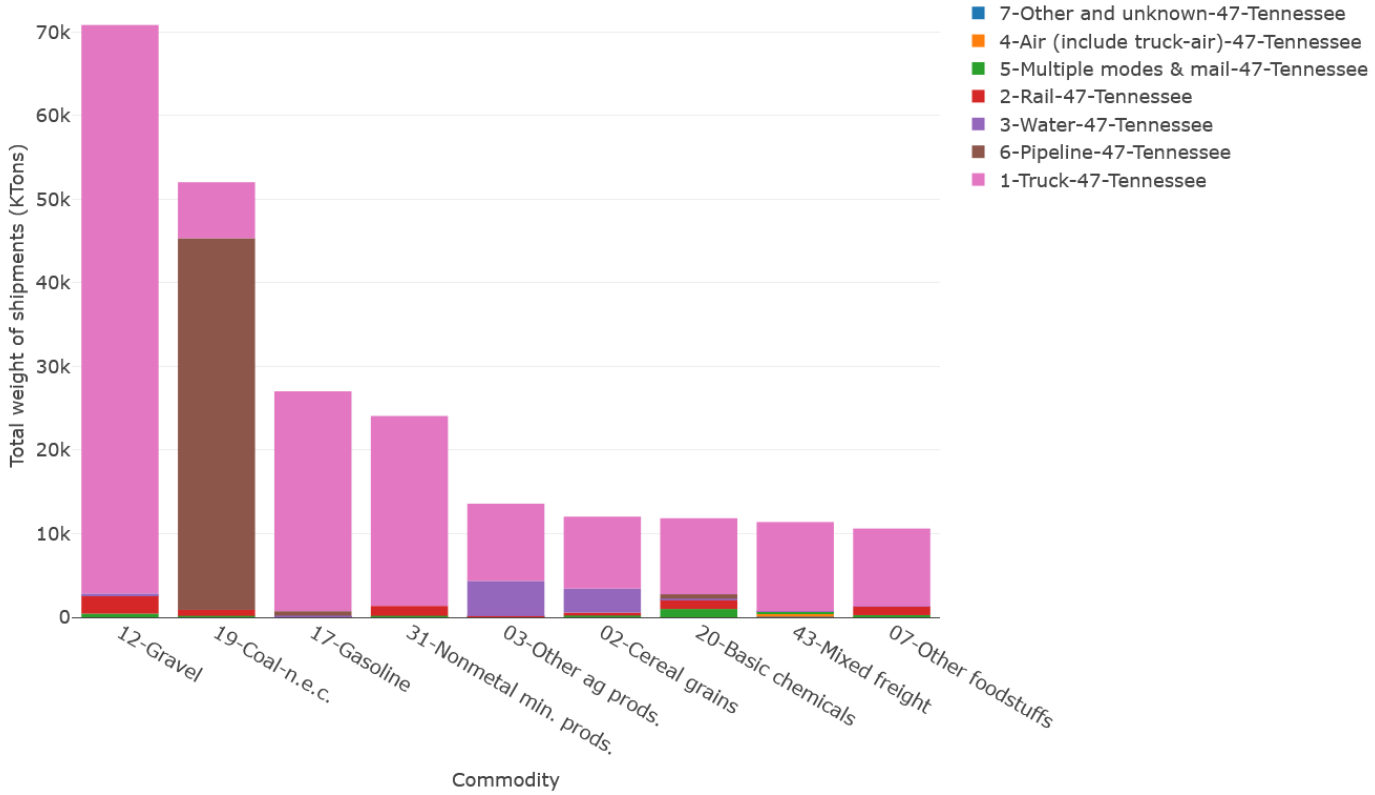
- Same states, but different ordering than in FAF4

| State | KTons | Percent of Total TN Tons |
|---|---|---|
| Tennessee | 211,879.0 | 58.7% |
| Alabama | 31,673.1 | 8.8% |
| Kentucky | 19,522.3 | 5.4% |
| Mississippi | 15,851.9 | 4.4% |
| Georgia | 12,387.9 | 3.4% |
| Top 5 Total | 291,314.1 | 80.8% |

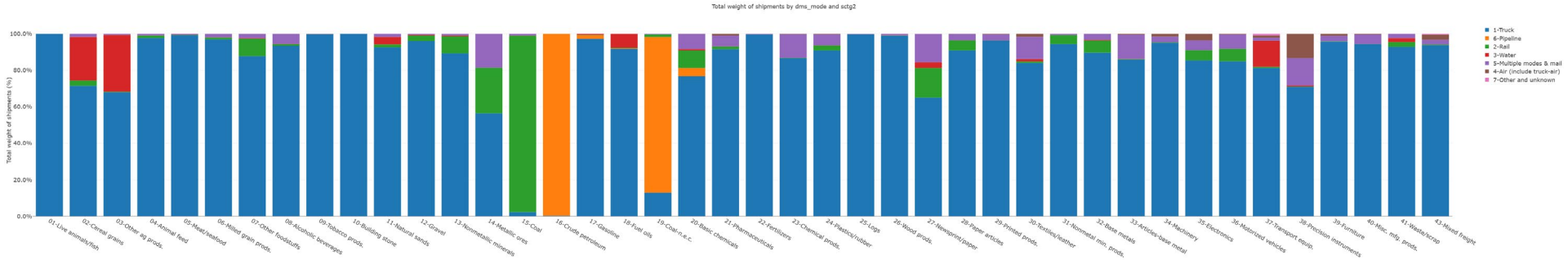
# TOP 10 COMMODITIES

| Within TN | | Outbound from TN | | Inbound to TN | |
|---|---|---|---|---|---|
| **Commodity** | **Tons** | **Commodity** | **Tons** | **Commodity** | **Tons** |
| Gravel | 64,095.8 | Coal-n.e.c. | 39,328.0 | Coal-n.e.c. | 46,103.2 |
| Gasoline | 22,699.7 | Other ag prods. | 7,825.5 | Coal | 10,745.1 |
| Nonmetal min. prods. | 18,650.6 | Coal | 7,546.8 | Base metals | 8,488.0 |
| Coal-n.e.c. | 12,720.9 | Cereal grains | 6,915.3 | Gasoline | 7,191.0 |
| Waste/scrap | 10,511.9 | Basic chemicals | 6,877.1 | Other foodstuffs | 6,950.5 |
| Fuel oils | 8,795.1 | Gravel | 6,763.4 | Plastics/rubber | 6,139.5 |
| Natural sands | 8,539.2 | Mixed freight | 6,744.1 | Mixed freight | 5,786.4 |
| Logs | 7,924.2 | Base metals | 6,720.9 | Wood prods. | 5,622.8 |
| Other ag prods. | 5,762.9 | Nonmetal min. prods. | 5,431.5 | Basic chemicals | 5,457.1 |
| Other foodstuffs | 5,239.5 | Other foodstuffs | 5,375.9 | Nonmetal min. prods. | 4,196.0 |

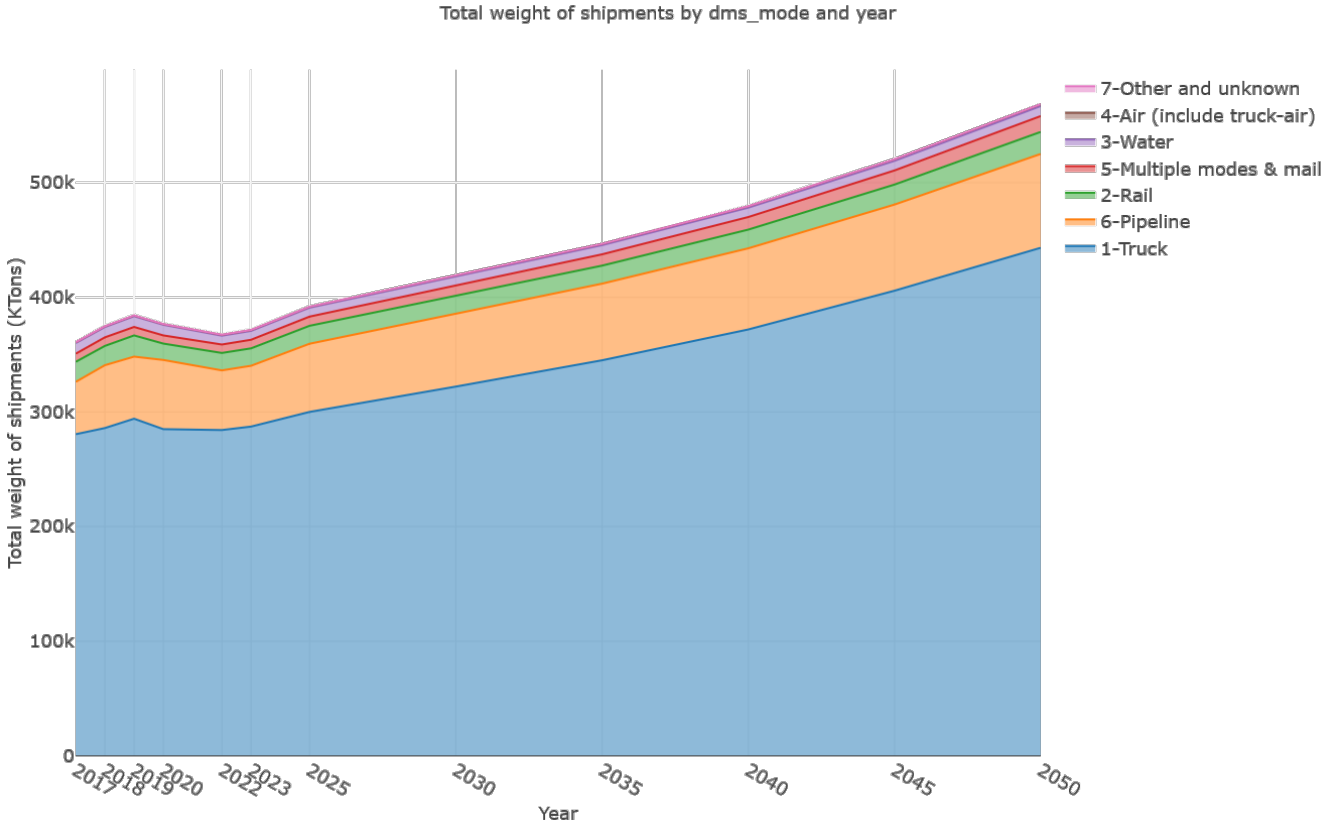
# TOP COMMODITIES FROM TN BY MODE



# COMMODITY MODE SHARES FROM TN



# TONNAGE ORIGINATING IN TN BY MODE & YEAR



# CALIPER'S ROLE IN FAF5

# FAF NETWORK FLOWS

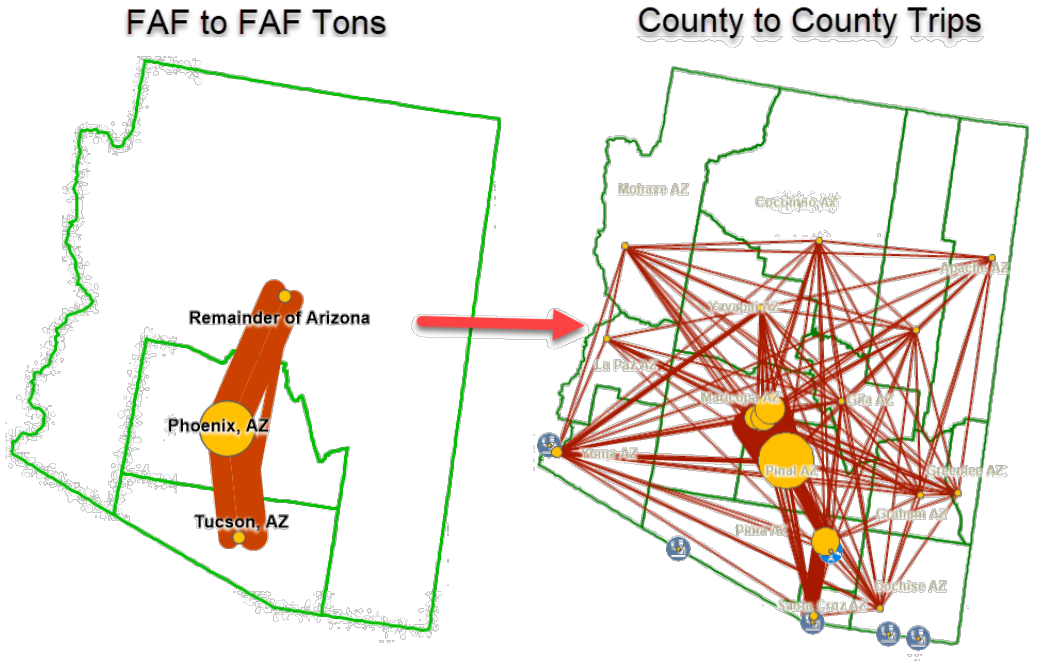
- The objective: to maximize the usefulness of the FAF5 data by disaggregating it to a more fine-grained zone system and by assigning those flows to a national road network.

# FAF5 OBJECTIVES

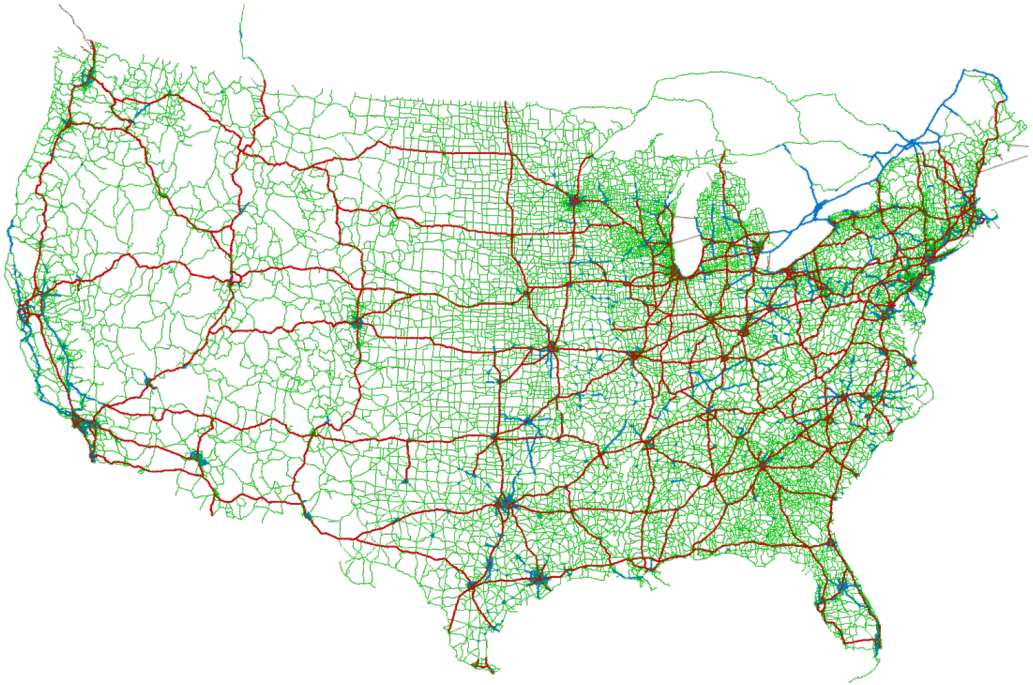
- More accurate truck flows
- More transparent process
- Robust querying tools for understanding commodity flows over the national network

# DISAGGREGATION OF COMMODITY FLOWS

- From 132 FAF zones to 3599 zones
  - Counties, sub-county for large counties, ports, airports, and border crossings
  - Commodity production & consumption functions
  - Tri-proportional gravity model to preserve aggregate FAF OD flows



# NEW NATIONAL NETWORK



- 580,000 route miles
- All NHS, STRAHNET and NHFN routes designated
- Fully routable with centroid connectors
- Congested speeds from NPMRDS where applicable
- Truck tolls compiled for 2017

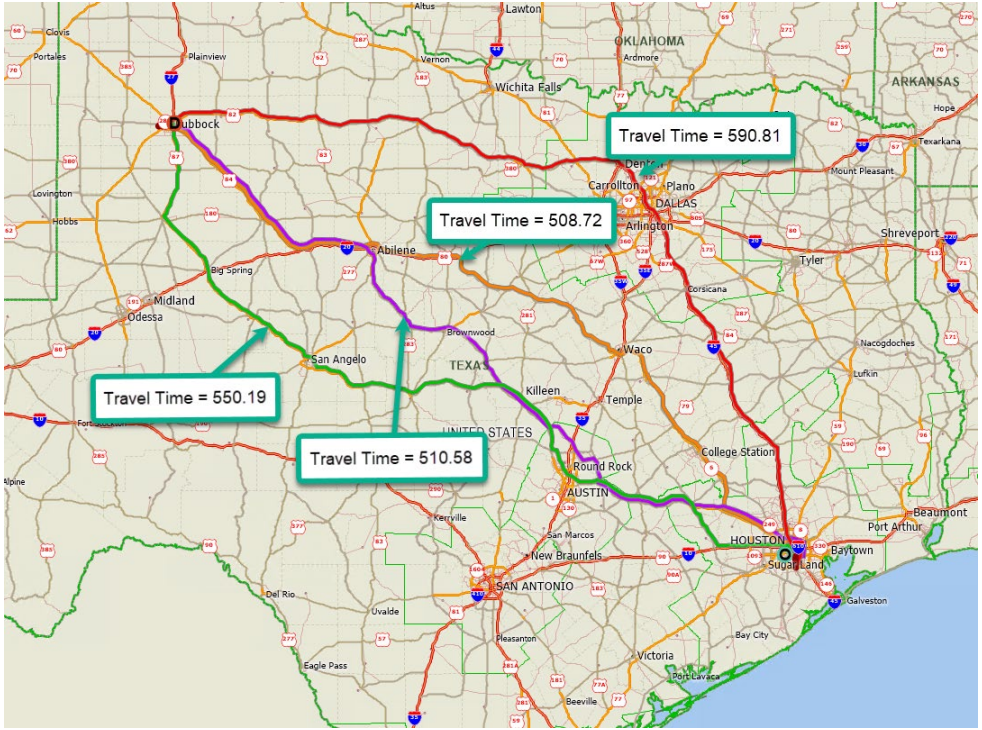
# NEW TRUCK ASSIGNMENT BY ROUTE CHOICE

- Intercity truck flows are not based on equilibrium
- Relevant alternative routes are enumerated
  - Routes can be viewed, edited, deleted & added
- Path-size logit is used to allocate shares to routes
- Path choices are based on congested travel times and tolls
- Limited calibration and validation to ATRI data

$$f_p = \frac{e^{\beta \cdot time_p + \gamma \cdot toll_p + \delta ln(S_p)}}{\sum_{p'} e^{\beta \cdot time_{p'} + \gamma \cdot toll_{p'} + \delta ln(S_{p'})}}$$

# PATH ENUMERATION

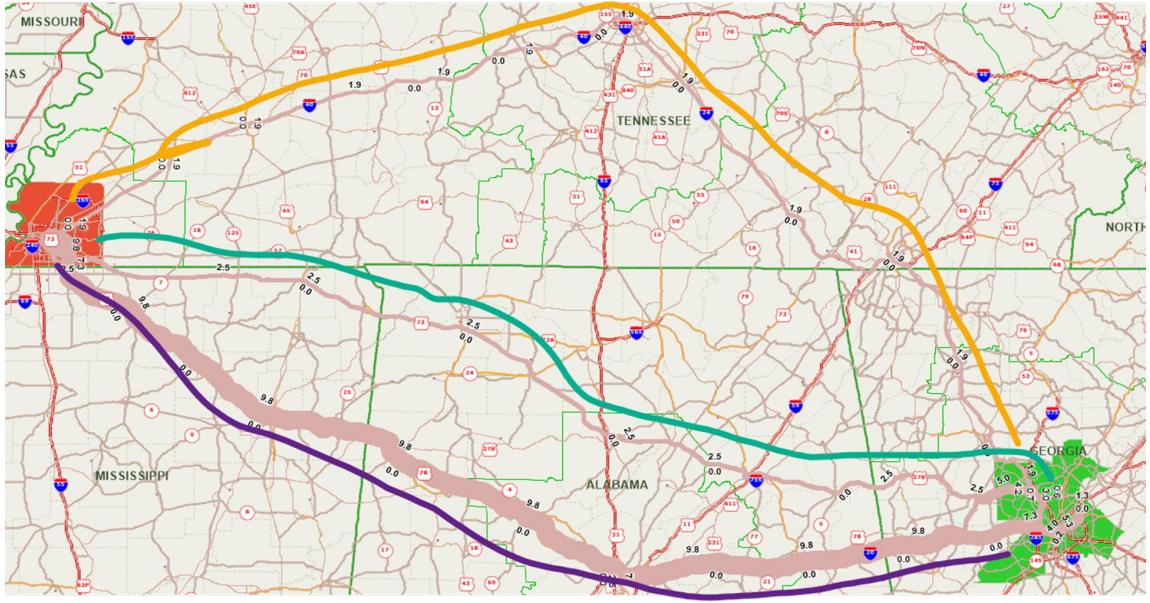
- Up to four paths generated for each OD pair
- Example: Lubbock, TX to Houston, TX



# ATRI VALIDATION

- Example: Memphis and Atlanta

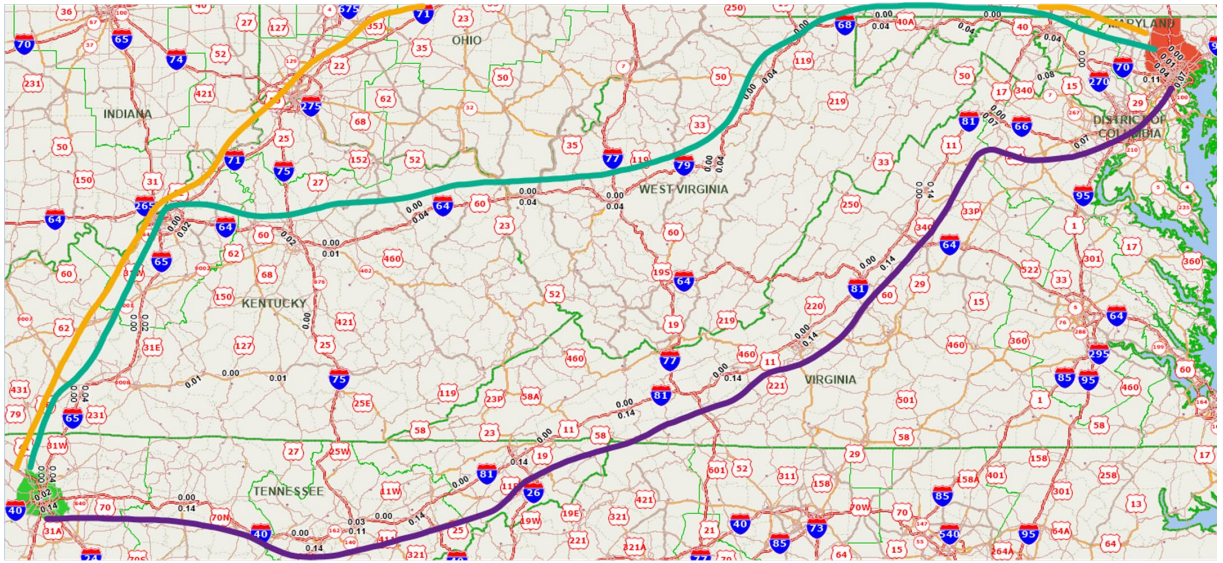
| | ATRI | FAF4 | FAF5 |
|---|---|---|---|
| | 76.7% | 100% | 69.0% |
| | 15.9% | 0% | 13.4% |
| | 4.1% | 0% | 17.6% |



# ATRI VALIDATION

- Example: Nashville and Baltimore

| | ATRI | FAF4 | FAF5 |
|---|---|---|---|
| | 75.6% | 100% | 77.8% |
| | 2.4% | 0% | 22.2% |
| | 2.4% | 0% | 0% |



# NATIONAL TRUCK FLOWS

**Estimated Average FAF Daily Volumes for Trucks on National Highway System 2017**

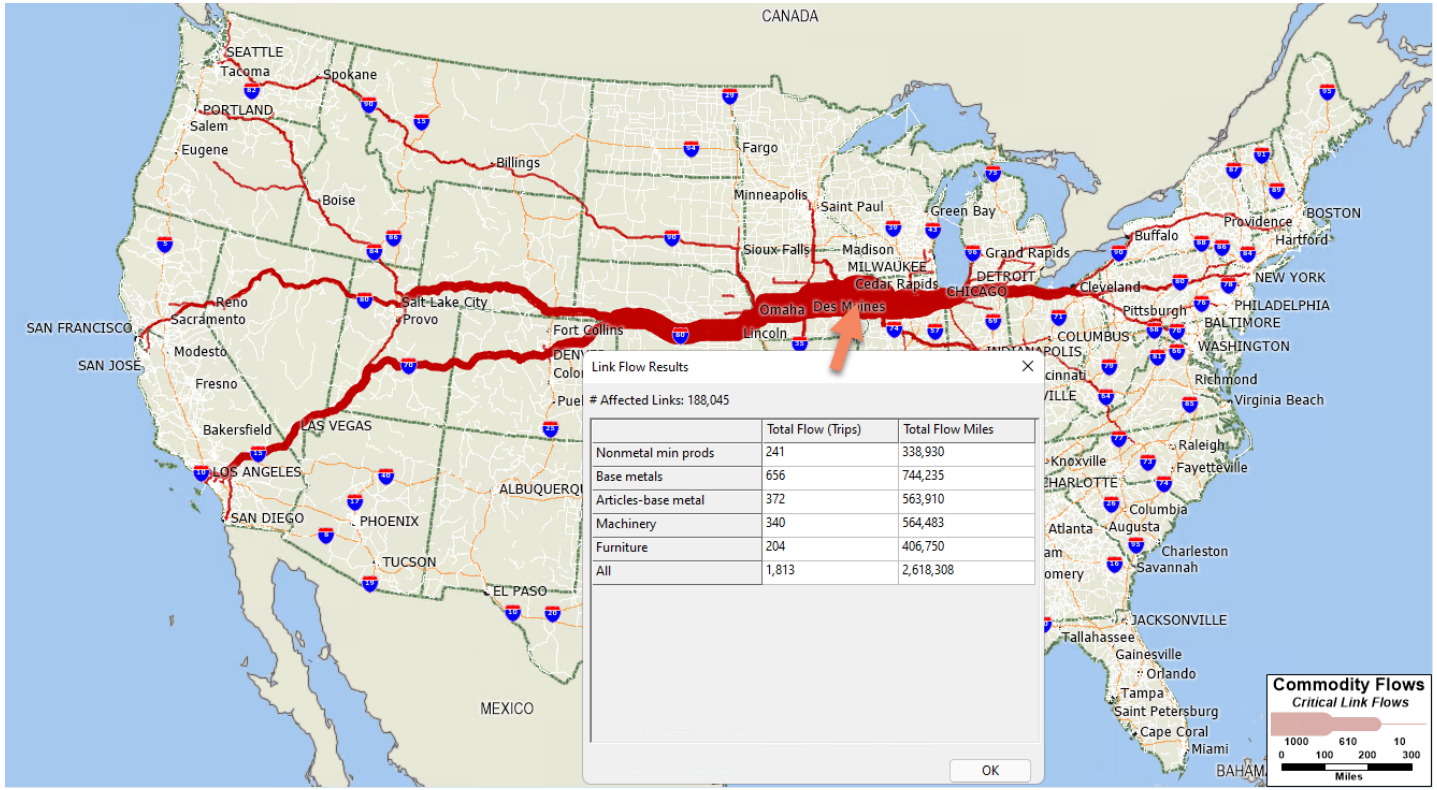

Note: Major flows include domestic and international freight moving by truck on highway segments with more than 25 FAF trucks per day and between places typically more than fifty miles apart.
Source: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework (FAF), version 5.1.
Flows include 42 different commodities represented in FAF.

# TRUCKS CARRYING STONE, GRAVEL, ORES

**Estimated Average FAF Daily Volumes for Trucks Carrying Solid Stone, Sand, Gravel, and Ores Commodities on National Highway System 2017**


Note: Major flows include domestic and international freight moving by truck on highway segments with more than 25 FAF trucks per day and between places typically more than fifty miles apart.
Source: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework (FAF), version 5.1.
Flows include Building stone (SCTG10), Natural Sands (SCTG11), Gravel (SCTG12), Nonmetallic minerals (SCTG13), Metallic ores (SCTF14), and Coal (SCTG15) commodities represented in FAF.

# DURABLE GOODS ON I-80 IN IOWA




| | Total Flow (Trips) | Total Flow Miles |
|---|---|---|
| Nonmetal min prods | 241 | 338,930 |
| Base metals | 656 | 744,235 |
| Articles-base metal | 372 | 563,910 |
| Machinery | 340 | 564,483 |
| Furniture | 204 | 406,750 |
| All | 1,813 | 2,618,308 |

# FINAL THOUGHTS

# CONSIDERATIONS FOR USING FAF5

## FAF5 Strengths

- Publicly available and user friendly
- Trusted, long-standing Federal data source
- Considers national and international trade
- Includes multimodal perspectives
- Includes 42 commodity group types
- Forecast assumptions are balanced
- Supports analysis at multiple scales
- Supports network flow analysis on the National Highway System, higher functional class roadways, and on multicounty corridors

## FAF5 Limitations

- Not tailored to a specific region
- Potential inconsistency with local growth scenarios
- Local roadways not fully captured
- May not have enough granularity for local-scale analysis; local-level analysis likely requires supplemental data
- Commodity details may be insufficient for some types of analyses

# CONTACTS

Vince Bernardin, PhD | Vice-President

vince@caliper.com | +1 812-459-3500