

TREDIS® Technical Documentation:

Data Sources and Default Values

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1 Purpose of This Document

This document has two purposes:

First, it indicates the sources for TREDIS's default factors for the most recent iteration of default values available.

Second, for the broader set of data contributing to final results, it discusses how these factors are incorporated into various modules and provides references to further information.

2 Why Default Values?

TREDIS is a fully multi-modal analysis system, designed to allow users maximum flexibility in defining transportation investment and policy scenarios, with the ultimate purpose of estimating how these scenarios affect transportation and economic outcomes. This flexibility across passenger and freight modes requires that users have the ability to model detailed transport characteristics such as operating performance, unit cost factors, freight and passenger loadings, safety, or emissions factors, among many other parameters.

But with this flexibility also comes a need to ensure that reasonable values are adopted to generate plausible results. Moreover, final results – economic impacts or benefit-cost ratios – can be sensitive to specific default factors. As such, it is critical to make such factors fully transparent to users (with references) and provide guidelines as to appropriate ranges and when to deviate from those ranges. This need for transparency extends further, to cover all data sources used to generate final results, even those that cannot be changed as part of an investment or policy scenario. As will be discussed, these include baseline economic data and relationships, market access and connectivity factors, economic forecasts, and freight flows. This document describes TREDIS default factors with precisely these goals in mind.

2.1 When to Use or Override Default Values

Analysts may rely on the default values for default fixed factors unless they have reason to override them. However, they should understand that it is fully appropriate to override the defaults when supported by research or data. In any of the following examples, it would be justifiable and even prudent to override the existing factors:

- The study involves types of vehicles (and associated operating cost factors) that are different from the default average. For example, a transit system uses mini-buses instead of standard buses or an airport only serves general aviation, rather than commercial aircraft.
- The study area has vehicle passenger occupancy rates or freight loads that are different from the assumed defaults.
- The study monetizes values in Canadian dollars, rather than U.S. dollars.
- The study is being done in a state or province that has wage and income levels significantly different from the assumed national average, and the applicable agency prefers to use values of time that reflect local wage rates.
- The sponsoring agency dictates that different assumptions be used.

However, even when these situations apply, the new factors should remain within a reasonable range.

3 TREDIS Data

TREDIS provides substantial data resources on region-specific economics, freight conditions, and mode factors. Much of the following assumes TREDIS is being used in the context of analyzing transportation changes in the US, but TREDIS has been deployed in other countries equally as well.

- **Economic Models** consist of detailed sector data and response factors specific to the study region that show the economic relationships between all the industries in the region. These are updated annually.
- **Economic Forecasts** are used to extend the model to future years. These are also specific to the study region and are updated annually.
- **Freight Flows** are tied to specific counties for regular TREDIS contracts. See the section below on other, more detailed analysis options.
- **Market Access and Connectivity Factors** are defined at the regional and county level and measure response to changes in access characteristics.
- **Transportation Cost Factors** are revised yearly for several categories of potential cost savings in a transportation system, specific to each mode and purpose.

Further details on Economic Models, Economic Forecasts, and Freight Flows can be found below in this section. Current Transportation Cost Factors are detailed, factor by factor, in the section on 4 Default Transportation Cost Factors.

For information on using TREDIS with smaller geographies or customized economic forecasts, please contact TREDIS staff at info@tredis.com.

3.1 Economic Models

For US applications, economic patterns are typically supplied by IMPLAN. For each study region defined in TREDIS, this source describes industry metrics for each of hundreds of sectors.

- *Output* is final sales, or total revenues, by industry. Depending on the industry, sales can be to any combination of other businesses, households, or the federal/state/local government.
- *Value-added* is a metric describing the value of goods sold by an industry over and above the value of goods purchased by it. It is generally used as a broad measure of value creation by an industry, including wages, employee benefits, profits, and tax payments. Summed across all industries, total regional value-added is precisely “Gross Regional Product.”
- *Income* represents total compensation (including benefits) to all employees of an industry, including business owners (proprietors).
- *Employment* is the total head count of workers in an industry, including self-employed, railroad workers, and agriculture workers. Because employment is measured as employee head count, it is important to note that a single individual with two part-time jobs is counted twice, regardless of which industries those jobs are in. Therefore, the job count is typically higher than full-time equivalent employment.

Beyond these industry metrics, IMPLAN data is used in a number of other places in TREDIS:

- **Economic Multipliers** are region-specific factors that translate a direct economic change into total economic impacts, including indirect (inter-industry supply-chain) effects, and induced (wage spending) effects. In IMPLAN, multiplier impacts are applied with source and target industry detail, meaning that it is possible to determine the effect of direct spending in

one sector. For example, it is possible to determine the effect of direct spending in construction on retail spending using multipliers.

- **Industry Make Tables** are region-specific factors that indicate which commodities a single industry uses to produce its final goods, as well as which commodities are made by the industry. As such, they translate industry activity to commodity activity, which is used in TREDIS's Freight Module, as well as in determining which industries are affected by projects affecting freight modes.
- **Tax Receipts Tables** are used to determine how changes in economic activity lead to changes in federal and state/local tax revenues. These are based on the current pattern of transfer payments in IMPLAN's social accounting structure.

Detailed descriptions and source information for all IMPLAN data is provided in the "Knowledge Base" section of IMPLAN's website, www.implan.com.

3.2 Freight Flows

The default TREDIS model of freight flows is based on FHWA's FAF model, which organizes the U.S. into regions. TREDIS also offers two other advanced sources of freight data fully integrated. First, vFreight™, a county-level disaggregation of FHWA's FAF which features further additional foreign trade data. Second, users may integrate their data from S&P Global's Transearch® dataset, which draws upon truck and rail waybill data.

Contact TREDIS staff for more information about these two options.

3.3 Economic Forecasts

The TREDIS forecasting module is typically supplied with Moody's Analytics projections, which include employment and value-added forecasts for each TREDIS industry at the county and sector level. As with many other defaults, custom forecasts may be available for your account. Please contact us for more information.

Moody's state and county forecasts are ultimately based on their U.S. national economic model. This national forecast is combined with state, metro, and county data to allocate growth forecasts down to sub-national regions. The benefit of this approach is geographic consistency – that is, employment and value-added always aggregate up (from counties to states and from states to country) without double-counting.

Allocations of employment and value-added to states and counties are made based on the same government data sources used by IMPLAN to develop current economic characteristics. These sources include Bureau of Labor Statistics (BLS), Current Employment Survey (CES), and the Quarterly Census of Employment and Wages (QCEW), and Bureau of Economic Analysis (BEA).

3.4 Market Access and Connectivity Factors

The TREDIS Market Access module estimates how transportation system changes affect the region's economic geography – i.e., how the region's economy improves if businesses have better access to labor, customers, suppliers, and international markets. See the technical documentation on TREDIS's Market Access Module for further description about the measurement options and the formulas used to calculate market access impacts.

3.5 Equity Context

The equity context report uses data from the most recent 5-year American Community Survey (ACS) tables. Variables from the county, state and national level are used. The following tables from the ACS are used:

Table ID	Table Description
B01003	Total Population
B03002	Hispanic or Latino Origin by Race
B05002	Place of Birth by Nativity and Citizenship Status
B08201	Household Size by Vehicles Available
B19001	Household Income in the Past 12 Months
B19013	Median Household Income in the Past 12 Months
S0101	Age and Sex
S1501	Educational Attainment
S1701	Poverty Status in the Past 12 Months
S1810	Disability Characteristics
S1902	Mean Income in the Past 12 Months

Unemployment figures are provided by the Economic Research Statistics program of the USDA.

3.6 Considerations

When reviewing the inputs used for TREDIS analysis that are provided by the system itself, the following considerations may be useful.

Constant dollar year valuations mean inflation is already accounted for in TREDIS. While the system typically calculates benefits and impacts over a long-time horizon, often decades, all TREDIS analysis is done in constant dollars. Findings on default values from earlier studies have been adjusted upward using a GDP deflator or PPI, as appropriate. Dollar values are always in the dollar year of the base economic data associated with the contract selected, which usually has the data year associated with it in the name. For example, a contract named “TREDIS 6 – 2023” will have default values in 2023 dollars and present all results in 2023 dollars.

TREDIS carefully distinguishes social benefits from business impacts. Though TREDIS uses the same basic transportation cost factors for both benefit cost analysis and economic impact analysis for consistency, results are presented consistently in terms of economic impacts, benefit-cost analysis, or another analytic framework. Time savings, often a major source of savings, is treated in the following way for social benefits and costs vs. economic impacts: Time savings for personal travel are classified as a social benefit value that affects benefit cost ratios but do not have any impact on the flow of income in the economy. Time savings for business travel are classified as a business operating cost change affecting both benefit cost ratios and economic impacts. Time savings for commuting have elements of both classifications (a social benefit for affected households, but also an element of wage rate impact for businesses).

Travel for business purposes includes fringe benefits in values of time. The valuation of business travel time is considered as the long-term business cost. While delay in the short-term may cause workers to put in more hours to complete deliveries, continued delays over a long-term period will require affected businesses to hire more workers to complete a given set of deliveries. Hence the need to add fringe benefit costs in the long-term business travel time value. Other classes of travel also have time valuations pegged to wage rates, but they do not lead to additional worker hiring so their values do not incorporate fringe benefits.

4 Default Transportation Cost Factors

TREDIS associates fixed factors directly with each contract based on the year of the IMPLAN economic data used. The fixed factors presented in this document are those that will be associated with contracts using 2024 IMPLAN economic data (typically with “2024” appearing in their name), and factors are for Data Year 2024.

Unless otherwise noted, all dollar figures given for Data Year 2024 are in 2024 dollars, and everywhere Data Year 2023 is given as reference, they are in 2023 dollars.

4.1 Average Crew Size

The number of crew members, including professional driver/pilot and supporting paid crew. (This should be customized for the applicable location and type of vehicles.)

Mode	Data Year 2023	Data Year 2024
Taxi & TNC	1.0	1.0
Bus		
Bus Rapid Transit (BRT)	1.0	1.0
Passenger Bus	1.0	1.0
Truck		
All Trucks	1.0	1.0
Light/Medium Duty Truck	1.0	1.0
Tractor Trailer	1.0	1.0
Federal Grant Trucks	1.0	1.0
Train – Passenger		
Commuter Rail	2.0	2.0
Heavy Rail (Subway)	1.0	1.0
Light Rail Transit (LRT)	1.0	1.0
Passenger Rail (Intercity - Diesel)	2.0	2.0
Passenger Rail (Intercity - Electric)	2.0	2.0
Train – Freight Rail	2.0	2.0
Aircraft – Passenger		
All Aircraft	5.0	6.0
General Aviation	1.0	1.0
Air Taxi	1.0	1.0
Regional Jet	3.7	3.8
Commercial Jet	6.0	5.7
Jumbo Jet	8.1	8.0
Aircraft – Freight	2.0	2.0
Marine		
Marine Freight	20.0	20.0
Passenger Ferry	4.0	4.0

Bus and rail crew sizes modes are drawn from typical values for New York City, San Francisco, and Chicago, as reported in by Chester (2008).¹

Aircraft default crew sizes were drawn from Section 3 of the FAA's Benefit-Cost Analysis webpage, under "Economic Values for Evaluation of FAA Investment and Regulatory Decisions,"² dated November 2024. Regional Jet, Commercial Jet and Jumbo Jet are taken from (respectively) weighted averages values for all "Regional Jet", "Narrowbody" and "Widebody" activity reported in Section 3, Table 3-6, weighted by departures. The "All Aircraft" value reflects the "All Aircraft" crew size reported in this same table. Crew for Air Taxi and General Aviation are not tabulated by the FAA guidance and are assumed to be 1. Freight aircraft's reported crew size is almost uniformly 2 in the guidance (as it was in the past iteration), so that number is used for all freight air operations.

Marine Freight crew is notionally set at 20, though it is recommended to override this value depending on more detailed local information, as no definitive, well-researched figure is available. TREDIS uses 20 as a default because the figure of "20 to 30" is occasionally cited.³

¹ Chester, M. V. (2008). Life-cycle environmental inventory of passenger transportation in the United States. Available at <https://escholarship.org/uc/item/7n29n303>.

² See https://www.faa.gov/regulations_policies/policy_guidance/benefit_cost/; last updated November 5, 2024; accessed 3/27/25.

³ For example, as January 2025, Wikipedia cites "20 to 30" crew for a "bulk carrier" but does not give a clear citation for this figure.

4.2 Crew Time Cost

In \$/hour per crew member, the business cost of labor for professional drivers and paid crew (including cost of wages plus fringe benefits). These are also the values used for buffer time for freight truck modes.

Mode	Data Year 2023	Data Year 2024
Taxi	\$24.09	\$25.16
Bus	\$42.17	\$40.59
Truck		
All Trucks	\$35.02	\$36.90
Light/Medium Duty Truck	\$29.50	\$30.66
Tractor Trailer	\$37.73	\$39.90
Federal Grant Trucks	\$35.70	\$37.20
Train – Passenger	\$59.06	\$59.95
Train – Freight Rail	\$51.93	\$53.76
Aircraft – Passenger		
All Aircraft	\$71.30	\$76.95
General Aviation	\$118.92	\$137.60
Air Taxi	\$118.92	\$137.60
Regional Jet	\$85.53	\$95.07
Commercial Jet	\$72.60	\$78.60
Jumbo Jet	\$65.35	\$69.37
Aircraft – Freight	\$118.92	\$137.60
Marine	\$45.51	\$46.99

Crew wages are based on BLS National Occupational Employment and Wage Estimates (last updated by BLS with May 2024 values) by occupation, and Employer Cost for Employee Compensation (ECEC) series (last updated with June 2025 values) used to further estimate total cost to employers.

Aircraft crew wages reflect a combination of the wages for pilots and flight attendants, who are both represented in the crew factors reported in the section for 4.1 Average Crew Size. General Aviation and Air Taxi crews are assumed to be one pilot, alone. For all other Air modes, two pilots are assumed, and the rest of the crew is taken to be flight attendants, and the wage levels are weighted accordingly.

Freight truck wages are an employment-weighted average of “Heavy and Tractor-Trailer Truck Drivers” and “Light Truck Drivers.” Truck value for Federal Grants is taken from US DOT BCA Guidance dated December 2025.

For Data Year 2024, there is a reduction (in both real and nominal terms) from Data Year 2023 for Bus crew costs, reflecting the underlying data. For the OEWE May 2024 report, at the national level, the reported annual median wage was \$57,440 for the category *Bus Drivers, Transit and Intercity*, where for OEWE May 2023 this same number was \$60,170.

4.3 Average Passenger Occupancy

A number representing the total number of occupants, excluding professional drivers and supporting paid crew. (For private passenger car modes the driver is counted as an occupant and not a crew member.)

Mode	Data Year 2023	Data Year 2024
Passenger Car – All Purposes	1.521	1.521
Passenger Car – Business	1.111	1.111
Passenger Car – Commute	1.082	1.082
Passenger Car – Personal	1.794	1.794
Passenger Car – Federal Grants (No Split, Business, Personal)	1.521	1.521
Passenger Car – SOV	1.000	1.000
Passenger Car – HOV	2.667	2.667

For federal grants and all purposes, occupancy factors match the December 2025 USDOT BCA Guidance, which references NHTS 2022 data, unchanged from the previous year's USDOT BCA Guidance and so unchanged between Data Year 2023 and Data Year 2024.

Detailed purpose occupancy factors for cars are calculated from NHTS 2022 as well as passenger miles by car divided by vehicle miles for each trip purpose (with trips purposes coded from the WHY90 variable).

Passengers on all freight modes are zero by default, with crew reported separately.

Modes such as taxis, TNCs, all transit modes, passenger boats and aircraft allow input of passenger counts in TREDIS. Because occupancies vary widely by location, TREDIS does not use default occupancies per vehicle for these modes.

Many travel demand models regularly assign separate volumes for single occupancy vehicles (SOVs) and high occupancy vehicles (HOVs), although they may differ in the number of HOV categories modeled. TREDIS has generic SOV and HOV categories if users need to differentiate between the two kinds of travel. The default HOV occupancy is calculated from NHTS 2022 data for trips of all purposes that include a passenger in addition to the driver.

4.4 Passenger Time Cost

In \$/hour per occupant, the business opportunity cost or user valuation of the average passenger's time. These are also the buffer time costs for associated passenger vehicle and transit modes.

Modes	Data Year 2023	Data Year 2024	Factor in traveler benefits	Factor in economic impacts
Passenger and Transit Modes				
Business	\$45.01	\$46.75	X	X
Commute	\$30.97	\$32.13	User benefit	Wage Premium
Personal and No Split	\$15.49	\$16.06	X / *	-- / *
Federal Grant Application Modes				
Business	\$33.50	\$34.60	X	X
Personal	\$19.40	\$20.10	X	--
No Split	\$21.10	\$21.80	*	*
Out-of-Vehicle (Transit, Walking & Biking)				
Business	\$45.01	\$46.75	X	X
Commute	\$30.97	\$32.13	User benefit	Wage Premium
Personal	\$30.97	\$32.13	X	--
Federal Grant Applications	\$38.80	\$40.20	X	By Purpose
Air (& High-Speed Rail)				
All	\$57.03	\$59.76	*	*
Business	\$85.52	\$88.83	X	X
Commute	\$58.85	\$61.04	User benefit	Wage Premium
Personal	\$41.19	\$42.73	X	--
Federal Grant – Business**	\$83.30	\$86.00	X	X
Federal Grant – Personal**	\$51.50	\$53.50	X	--

* *Economic Impact No Split Values of Time are internally weighted across purposes by TREDIS.*

** *There are no default modes using these values, but they are included here for reference if a user needs to create custom modes for a grant application including long-distance travel.*

Values of time reflect hourly wage and salary levels for all occupations based on BLS wage data from the June 2025 release of BLS's Employer Costs for Employee Compensation (ECEC) report. Additional long-term business costs (beyond the user value of travel time) are included in commute and business trip purposes. All values are adjusted for inflation to reflect the 2024 dollar-year to be compatible with other factors.

TREDIS uses mean wage/salary information to consistently develop business, commute, and personal purpose values of time that can be used for economic impact analysis. If your project only affects a small number of travelers, you may consider using a median/wage and salary.

For BCA calculations for federal grant applications, personal time may be valued at a higher level based on median household income, while business time is based on median values rather than means. For most uses of TREDIS, we recommend use of default mean wage- and salary-based VOT.

All Federal Grant values are based on the December 2025 USDOT BCA Guidance document. Both commuting and personal travel time are treated as a non-money user benefit with a value set at 50% of the wage rate (no fringe added; 70% for personal air travel). This is in line with US DOT guidance on the value of time. For economic impact analysis only, there is an additional allowance for the effect of higher commuting cost on employer cost in the form of a wage rate premium valued at the other 50% of the wage rate per hour without fringe.

Business or “on the clock” travel includes fringe benefits, based on the ECEC data. (For references, see 4.2 Crew Time Cost.) For all civilian workers in the ECEC, fringe benefits are an additional 45.5% on top of wages and salaries (or 31.3% of total compensation).

Based on US DOT guidance in their analysis of the 2001 NHTS, the value of time for air travelers is been increased by 1.9 times for commute and personal times to reflect the higher income level observed for air travelers. For out-of-vehicle travel time (OVTT), TREDIS uses 200% of the in-vehicle value of time, in line with federal guidance.

For projects, with mode shift to walking or biking, it may be necessary to recognize a consistently high value of time for travelers in the base cases. Transit OVTT, walking, and biking values of time are developed based on the value of saving existing travelers in the mode time. Travelers moving from cars to bikes should not be penalized with a higher value of time.

4.5 Buffer Time Cost

In \$/hour, the business opportunity cost, or user valuation, of lost driver and passenger time due to unreliable travel conditions (i.e., effect of “schedule padding”).

This value represents the occupant time value, so for passenger travel, this is the value of time as described in 4.4 Passenger Time Cost. For crews, this is the crew time cost described in 4.2 Crew Time Cost.

Non-driver costs of freight unreliability are not included in buffer time, as they are covered in the freight logistics cost element, as discussed in 4.7 Freight Logistics Costs.

The TREDIS default cost valuation of buffer time assumes a reliability ratio value of 1.0 – that is, the value of an extra minute of buffer time is equal to the value of an extra minute of average travel time. This is based on a broad body of domestic and international research that finds values to be in the 0.8 to 1.4 range.⁴ For intercity trucking, a higher ratio may be warranted, as a national ATRI study found ratios concentrated in the 1.2 to 2.0 range.⁵

TREDIS calculates the total value of buffer time based on the passenger and crew value of time, number of passengers and crew per vehicle, and the amount of added buffer time (beyond average travel time). See 4.7 Freight Logistics Costs for other freight related costs of travel time variability beyond crew costs.

⁴ See Appendix A in Guidebook: Placing a Value on Travel Time Reliability, SHRP 2 Reliability Project L17: TRB, 2014. http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2_L17_Gap-Filling_Project_5_GuidebookPlacingAValueOnTimeReliability.pdf

⁵ See Table 9 (p.49) in Case Study: Analysis of Truck Trip Times across Two Supply Chains Using Truck GPS Data. Prepared by ATRI for the Federal Highway Administration, 2014.

4.6 Average Freight Cargo Loading

The average number of US tons of freight per vehicle per trip.

Mode	Data Year 2023	Data Year 2024
Truck		
All Trucks	11.80	11.67
Light/Medium Duty Truck	3.48	3.48
Tractor Trailer	17.50	17.50
Train – Freight Rail	3,562.00	3,562.00
Aircraft – Freight		
All Aircraft	45.24	44.64
General Aviation	1.46	2.16
Air Taxi	1.46	2.16
Regional Jet	0.39	4.49
Commercial Jet	15.54	11.81
Jumbo Jet	50.65	45.92
Marine – Freight	14,000.00	70,000.00

Light/Medium Duty Trucks are defined as trucks with a Gross Vehicle Weight Rating between 14,000 and 26,000 pounds, corresponding to FHWA’s truck Classes 4 through 6.

The Vehicle Inventory and Use Survey of 2021 (VIUS) reports on a large sample of trucks in the US and uses sample weights to represent all miles driven by trucks of various classes. VIUS reports on attributes including GVWR, the primary type of commercial activity, the body type of the vehicle, and the percentage of miles driven fully loaded and unloaded. These data were used to examine only trucks whose primary commercial activity was “transporting goods/products.”

VIUS does not report on either the actual max payload or the average payload carried. In order estimate average payload, the two most popular body types in VIUS coding were used – “Box Truck” and “Flatbed, stake, or platform.” These examples combinations of GVWR class and body type represented, together, 63% of all miles driven for all goods-transporting trucks of GVWR 14,000 through 26,000 pounds.

In each truck class, example payloads for that class and body type were examined, with their typical capacity estimated by taking the mid-point between the minimum and maximum capacities of example trucks in that class.

VIUS reports on the percentage of miles for each driven fully weighted and unloaded to determine an average loading. The balance of miles (partially loaded) were assumed to be at 75% of the maximum load. These three load factors were combined to calculate a weighting factor that was multiplied by the payload capacity to reach an average payload carried.

In the table below, figures are also provided for GVWR class 10,000 to 14,000 pounds, for reference. The body type “Pickup” was the predominant body type for that GVWR class; appropriate exemplars were chosen.

GVWR (lbs.)	Most Common Body Types of GVWR Class	Share of All Miles in Mode	Assumed Typical Capacity (Tons)	% of Capacity	Estimated Average Payload (Tons)
10,001 to 14,000	Pickup	N/A	3.21	54%	1.73
14,001 to 16,000	Box, flatbed, stake, or platform	15%	3.70	62%	2.29
16,001 to 19,500		16%	5.17	61%	3.17
19,501 to 26,000		32%	6.99	60%	4.20

The average payloads shown above for GVWR classes for 14,000 through 26,000 pounds were averaged together using their respective share in the total mode mileage, for a mode-average of 3.48 tons.

The **Tractor Trailer Truck** average freight loading factor reflects empirical research that uses weight-in-motion measures.⁶

For **All Trucks**, the factor uses a weighted average of the Tractor Trailer and Light/Medium Duty Truck factors, using the total mileage from comparative VMT for single-unit trucks vs. combination trucks as reported in FHYP Highway Statistics for 2024.

Rail data is from the Association of American Railroads.⁷

Marine Freight cargo factors for Data Year 2024 have been updated to reflect a rough approximation of a Panamax containership capable of carrying 5,000 Twenty-foot Equivalent Units (TEUs). One common assumption is that the average TEU will be 14 US tons,⁸ implying a total cargo weight of 70,000 US tons.

Air cargo factors were drawn from Section 3 of the FAA's Benefit-Cost Analysis webpage, under "Economic Values for Evaluation of FAA Investment and Regulatory Decisions,"⁹ dated November 2024. Regional Jet, Commercial Jet and Jumbo Jet are taken from (respectively) weighted averages values for all "Regional Jet", "Narrowbody" and "Widebody" activity reported in Section 3, Table 3-9, and average loading is the cargo capacity times the load factor, weighted by block hours. The cargo average tons for GA and Air Taxi are taken from the same calculation for all planes in Table 3-15.

⁶ Hernandez, S. (2017). Estimation of average payloads from weigh-in-motion data. *Transportation research record*, 2644(1), 39-47

⁷ <https://my.aar.org/Documents/Railroad-Statistics.pdf>

⁸ See for example <https://www.freightamigo.com/en/blog/logistics/understanding-teus-the-standard-measure-of-shipping-container-capacity/> or <https://www.mpc-container.com/about-us/industry-terms/>.

⁹ See https://www.faa.gov/regulations_policies/policy_guidance/benefit_cost/; last updated November 5, 2024; accessed 3/27/25.

4.7 Freight Logistics Costs

Freight logistics costs are calculated based on two categories of defaults:

- Regional commodity factors, which are defined by commodity, by region, and by directional flow (internal, incoming, outgoing, or through), and can be viewed in the *Travel* page, from the *Freight Logistics* window.
- Mode factors, which are defined by mode and can be changed from the *Modes* page, in the *Adjust Mode Factors* window.

There are two types of Freight Logistics Costs calculated by TREDIS: delay and reliability.

Freight Delay Costs are defined by the inventory carrying cost, which is a product of the Tons per Vehicle, the Value per Ton (weighted by commodity mix and commodity values for your region), and the Inventory Interest Rate.

Freight Reliability Costs calculations are more complex and incorporate more components. TREDIS Freight Reliability Costs are calibrated to be consistent at a national level with a benchmark from NCHRP 824.¹⁰ While TREDIS values vary by regional commodity characteristics, the following table shows the calibrated value components for comparison to the benchmark based on nation-wide FAF commodity mix, valuations, and tonnages.

	Description	Variable Factors	High Sensitivity Values	Medium Sensitivity Values
TREDIS Calculations	Cost of Goods and Other Supply Chain Costs	Commodity Mix, Value Per Ton, Tons per Vehicle, Inventory Cost Multiplier, Inventory Interest Rate	\$87	\$37
	Truck Utilization (Leasing)	Lease Cost Per Hour	\$10	\$10
	Dock Penalty	Late Dock Penalty, Late Penalty Fraction	\$50	\$50
	Total		\$147	\$97
NCHRP 824 Comparison¹¹	Total		\$147	\$109

¹⁰ NCHRP Report 824, Methodology for Estimating the Value of Travel Time Reliability for Freight System Users, TRB, 2016.

¹¹ Labor Cost is not included in Freight Logistics Cost and so is deducted from NCHRP 824 estimates as well (using the value of freight truck crew cost given by current USDOT BCA guidance).

For further details on how freight logistics costs are calculated using the default Mode Factors, see the *Travel Cost Module* document. For the per-ton values (as opposed to the per-vehicle values in the table above), see your project's *Freight Logistics* window.

Regional Commodity Factors

Regional commodity factors are defined by commodity, by region and by direction.

- Freight Mix – the percentage of freight made up by the commodity
- Time Sensitivity – whether the commodity is high, medium, or low sensitivity for freight purposes
- Value per Ton – the dollar value per US ton

Sources and Notes

Commodity mixes and valuations are determined by region, often on the county level, and by directional flow. Defaults are provided by TREDIS depending on your TREDIS subscription:

- Basic TREDIS subscriptions use Freight Analysis Framework (FAF) data to provide information on the commodity mix associated with each mode type; the FAF data is based on regions defined by USDOT.
- vFreight data subscribers have access to county-level detail on internal-inbound-outbound-through flows of freight.
- TREDIS fueled by Transearch allows corridor-specific freight flow data.

Since these vary by region, the default factors are not listed here. You can access the commodity factors being used in a project via the *Travel* page, in the *Freight Logistics* window.

Mode Factors and Inventory Interest Rate

Like other mode-defined factor, these are set via the *Modes* page from the *Adjust Mode Factors* window. The *Inventory Interest Rate* is set on the *Timing* page.

	Data Year 2023			Data Year 2024		
Factor	High	Medium	Low	High	Medium	Low
Inventory Cost Multiplier	13.5	25.5	0	13.5	25.5	0
Lease Cost Per Hour	\$14.46	\$14.46	\$0	\$15.70	\$15.70	\$0
Late Dock Penalty	\$294	\$294	\$0	\$302	\$302	\$0
Late Penalty Fraction	20%	20%	0%	20%	20%	0%
Inventory Interest Rate	8%			8%		

Sources and Notes

Inventory Cost Multiplier is used to adjust the inventory cost. For reference, NCHRP 824 implies supply chain costs per truck (assumed to be a combination truck carrying an average load of 17 tons) of \$80 for high-sensitivity goods and \$35 for medium-sensitivity goods. TREDIS adds commodity detail to these values by multiplying the cost of goods (in terms of the Inventory Carrying Cost per Ton) by an adjustment factor depending on the time sensitivity of the commodity.

Lease Cost Per Hour is the lease cost per hour for trucks. TREDIS considers that truck fleets may be expanded to increase the reliability of high-sensitivity and medium-sensitivity goods movements to allow additional schedule buffering. The logistics reliability cost value therefore includes 100% of the hourly lease costs for these vehicles, averaging \$15.70 in 2024 according to ATRI.

Late Dock Penalty is the penalty assessed if docking is late. NCHRP reports 824 and 925¹² of research identifies a \$250 average late dock penalty, which is adjusted here for inflation.

Late Penalty Fraction is the fraction of shipments assessed the penalty. TREDIS assumes that high-sensitivity and medium sensitivity goods risk paying this fee 20% of the time when facing unreliable conditions.

Inventory Interest Rate is the yearly interest rate used to calculate the cost of goods. The default is currently 8%, representing a common benchmark interest rate for private capital that might be available to shippers.

¹² NCHRP Report 925, Estimating the Value of Truck Travel Time Reliability, TRB, 2019.

4.8 Vehicle Mileage-based Operating Cost

In \$/mile, the average per-mile cost of vehicles' tires, maintenance, and depreciation for travel in free-flow conditions. (Fuel costs are treated separately.)

Mode	Data Year 2023	Data Year 2024
Auto		
AV TNC	\$0.251	\$0.258
Light-Duty EV	\$0.180	\$0.185
Passenger Car	\$0.195	\$0.200
Taxi & TNC	\$0.213	\$0.218
Bus		
Bus Rapid Transit (BRT)	\$2.689	\$2.850
Passenger Bus	\$1.752	\$1.810
Truck		
All Trucks	\$0.716	\$0.746
Light/Medium Duty Truck	\$0.716	\$0.746
Tractor Trailer	\$0.716	\$0.746
Federal Grant Modes		
Cars	\$0.401	\$0.413
Trucks	\$0.716	\$0.746
Train – Passenger		
Commuter Rail	\$6.124	\$5.690
Heavy Rail (Subway)	\$4.375	\$4.330
Light Rail Transit (LRT)	\$6.441	\$6.280
Passenger Rail (Intercity - Diesel)	\$9.485	\$9.613
Passenger Rail (Intercity - Electric)	\$13.417	\$13.683
Train – Freight Rail	\$12.445	\$12.692
Aircraft – Passenger		
All Aircraft	\$2.746	\$2.743
General Aviation	\$4.291	\$4.286
Air Taxi	\$4.291	\$4.286
Regional Jet	\$2.616	\$2.613
Commercial Jet	\$2.587	\$2.584
Jumbo Jet	\$3.521	\$3.517
Aircraft – Freight		
All Aircraft	\$7.055	\$7.047
General Aviation	\$5.500	\$5.494
Air Taxi	\$5.500	\$5.494
Regional Jet	\$5.192	\$5.186
Commercial Jet	\$8.766	\$8.756
Jumbo Jet	\$6.600	\$6.593
Marine		
Marine Freight	\$8.546	\$5.505
Passenger Ferry	\$30.171	\$31.470

Passenger Cars use AAA's 2024 Your Driving Cost publication. While AAA has released a 2025 publication, the latest USDOT BCA Guidance, dated December 2025, references the 2024 publication, so for consistency TREDIS references those values as well.

VOC includes maintenance, tires, and mileage-based depreciation, and mileage-based insurance costs (set at 10% of annual cost). Fixed costs of ownership related to depreciation, insurance, financing and licensing are removed from VOC and fuel is treated separately in TREDIS. For the Federal Grant Passenger Car mode, per-mile operating costs include all depreciation and no insurance, consistent with USDOT guidance.

Passenger Cars represent all kinds of passenger vehicles in TREDIS. The weighted average used from AAA's Your Driving Cost proportionally represents various kinds of passenger vehicles.

For private vehicle travel, TREDIS expects reductions in VMT to decrease vehicle utilization but does not attempt to predict changes in vehicle ownership due to changing travel patterns.

Light-Duty EVs use the same data source and methodology as the calculations for Passenger Cars, for only the EVs reported on in the AAA Your Driving Cost information.

Federal Grant Mode Cars reflect US DOT BCA December 2025 guidance, which relies on the 2024 edition of the AAA's Your Driving Cost publication. The number represents maintenance, tires, and depreciation (assuming an average of 15,000 miles driven per year), but not fuel use, since TREDIS accounts for that more precisely elsewhere.

Taxis, TNCs, and AV TNCs include the same costs as for Passenger Car, but also cleaning costs.¹³

Truck VOC costs are based on the American Trucking Research Institute's (ATRI) report, "An Analysis of the Operational Costs of Trucking: 2025 Update," dated July 2025. Costs of truck and trailer leases and purchase payments, repair and maintenance, insurance, permits and licenses, and tires are included. Costs for labor, fuel and tolls are included elsewhere in TREDIS. Costs for leases, purchases, insurance, permits and licenses are included because in the long-run the industry is expected to maintain a fleet size with roughly constant utilization.

Federal Grant Trucks reflect US DOT BCA December 2025 guidance, which rely on the same report, so the Federal Grant Truck and TREDIS's own All Trucks modes have the same VOC.

Transit modes (Bus, BRT, Light Rail, Heavy Rail, Commuter Rail and Passenger Ferry) use data from the National Transit Database (NTD). NTD reporting divides operating expenses into four expense functions: vehicle operations, vehicle maintenance, non-vehicle maintenance, and general administration. TREDIS factors are based on the vehicle maintenance category, as operations costs are expected to be mostly captured using fuel and crew costs, and non-vehicle maintenance and general administration are considered relatively fixed costs that are not affected by marginal changes in VMT. Changes in fixed costs should be modeled elsewhere in TREDIS. These six transit modes are estimated based on 3-year averages from 2022-2024 of all transit systems reporting the respective mode in the NTD. Maintenance costs are first calculated per vehicle revenue mile for each agency and then averaged across agencies. This unweighted average is more representative of the typical system, rather than being dominated by the large systems as the weighted average would be. Users should use direct cost information from transit agencies whenever possible.

¹³ Becker, H., Becker, F., Abe, R., Bekhor, S., Belgiawan, P. F., Compostella, J., & Axhausen, K. W. (2020). Impact of vehicle automation and electric propulsion on production costs for mobility services worldwide. *Transportation Research Part A: Policy and Practice*, 138, 105-126.

Intercity Diesel is based on costs from Amtrak’s annual Train Operations budget and NTS reported number of train miles, both for 2019-2023 fiscal years (where fiscal year 2023 ended in September 2023). Of the Train Operations budget, the proportion due to customer service and research spending is removed. Further, 50 percent of the Materials Expenses (which is reported by Amtrak in a separate category), are assumed to be train equipment and added to the VOC. The total VOC is divided by train miles, as reported by NTS, and put into 2024 dollars using the Rail Transportation PPI (from FRED).

Intercity Electric is based on Chapter 6 of the California High-Speed Rail Authority’s Revised 2012 Business plan with 2009 dollars brought up into 2024 dollars using the Rail Transportation PPI (from FRED).

Freight Rail is based on *Prices and Costs in the Railway Sector* by J.P. Baumgartner,¹⁴ with adjustments using the Rail Transportation PPI to 2024 dollars. TREDIS assumes a train composed of 2 locomotives and 35 cars.

Marine Freight is based on the per-hour VOC described in 4.9 Vehicle Time-based Operating Cost. Empirical measures of container ship speeds can vary year-to-year from around 14 to 15.5 knots, so we use a recent average of 14.9 knots.¹⁵

Passenger and freight air operating costs per mile are based on costs per hour; see 4.9 Vehicle Time-based Operating Cost for details. Speeds used were derived from the FAA guidance cited, Tables 3-7 and 3-10.

Mode	Passenger MPH	Freight MPH
All Aircraft	366	399
General Aviation	155	150
Air Taxi	155	150
Regional Jet	274	265
Commercial Jet	373	363
Jumbo Jet	483	424

4.9 Vehicle Time-based Operating Cost

In \$/hour, the average per-hour cost of operating costs such as vehicles’ tires, maintenance, and depreciation associated with marginal travel. This figure is only used if no VMT change is applicable. Fuel costs are treated separately, and operating costs do not include crew costs.

In some cases, where per-hour values are based on an assumed speed for the per-mile values, values will not match precisely because of rounding.

¹⁴ Baumgartner, J. P. (2001). *Prices and costs in the railway sector*. Lausanne: École polytechnique fédérale de Lausanne.

¹⁵ See <https://www.freightwaves.com/news/full-steam-ahead-why-container-ships-are-racing-across-the-pacific>.

TREDIS Data Sources and Default Values

Mode	Data Year 2023	Data Year 2024
Auto		
AV TNC	\$8.801	\$9.027
Light-Duty EV	\$6.301	\$6.469
Passenger Car	\$6.812	\$6.994
Taxi & TNC	\$7.442	\$7.633
Bus		
Bus Rapid Transit (BRT)	\$26.794	\$27.960
Passenger Bus	\$22.667	\$23.460
Truck		
All Trucks	\$28.790	\$30.030
Light/Medium Duty Truck	\$28.790	\$30.030
Tractor Trailer	\$28.790	\$30.030
Federal Grant Modes		
Cars	\$14.029	\$14.466
Trucks	\$28.790	\$30.030
Train – Passenger		
Commuter Rail	\$200.921	\$186.99
Heavy Rail (Subway)	\$84.324	\$82.52
Light Rail Transit (LRT)	\$88.849	\$87.50
Passenger Rail (Intercity - Diesel)	\$379.396	\$384.521
Passenger Rail (Intercity - Electric)	\$1,073.366	\$1,094.648
Train – Freight Rail	\$280.018	\$285.570
Aircraft – Passenger		
All Aircraft	\$1,005.000	\$1,003.890
General Aviation	\$667.276	\$666.539
Air Taxi	\$667.276	\$666.539
Regional Jet	\$717.027	\$716.235
Commercial Jet	\$965.969	\$964.903
Jumbo Jet	\$1,702.295	\$1,700.416
Aircraft – Freight		
All Aircraft	\$2,815.000	\$2,811.892
General Aviation	\$825.000	\$824.089
Air Taxi	\$825.000	\$824.089
Regional Jet	\$1,374.267	\$1,372.750
Commercial Jet	\$3,183.993	\$3,180.478
Jumbo Jet	\$2,800.017	\$2,796.926
Marine		
Marine Freight	\$213.640	\$94.396
Passenger Ferry	\$252.829	\$248.010

Passenger Car, Light-Duty EV, Taxi and TNC, and AV TNC factors are derived from per-mile consumption based on an assumed speed of 35 mph. This value is set with the expectation that TREDIS is used largely for major highway and arterial projects.

Federal Grant Mode Cars are based on the VOC per mile figure, assuming travel at 35 mph.

Trucks factors are based on the American Trucking Research Institute's (ATRI) 2025 Operational Costs of Trucking report.

Federal Grant Mode Trucks use the same methodology and source as the TREDIS Truck mode.

Transit modes uses data from the National Transit Database (NTD) in a manner consistent with per-mile calculations.

Intercity Diesel factors assume an average speed of 40 mph.

Intercity Electric factors assume an average speed of 80 mph.

Freight Rail factors use the average line-haul speed of Class I railroads of 22.5 mph per the 2008 Transportation Statistics Annual Report published by BTS Table 3-4-8.

Marine Freight is based on reasonable assumptions for a Panamax bulk carrier. Belesis et al. (2024) find that the average daily opex for Panamax bulk carriers are \$5,664.¹⁶ Crew costs are assumed to be 15% of this and fuel costs are assumed to be 45%¹⁷, implying the average cost per hour is \$94.396. Projects typically modeled by TREDIS will not change the route or time efficiency of marine freight, and fuel costs and fuel efficiencies are significantly more important to marginal costs than marginal operating costs.

Passenger and freight air operating costs were drawn from Section 4 of the FAA's Benefit-Cost Analysis webpage, under "Economic Values for Evaluation of FAA Investment and Regulatory Decisions,"¹⁸ dated November 2024. Regional Jet, Commercial Jet and Jumbo Jet are taken from (respectively) weighted averages values for all "Regional Jet", "Narrowbody" and "Widebody" activity reported in Section 4, Tables 4-7 and 4-8, weighted by block hours. (GA and Air Taxi were derived from "Turboprop" planes.) Only the "Maintenance" item is used since fuel costs and crew costs are accounted for elsewhere in TREDIS.

¹⁶ Belesis, N. D., Kampouris, C. G., & Fousteris, A. E. (2024). Vessels' operating expenses: A key variable on companies' strategic decisions. *Corp. Bus. Strateg. Rev.* 5, 102-117.

¹⁷ See for example <https://www.shipfinex.com/blog/ship-operating-costs-maritime-vessel-expenses>.

¹⁸ See https://www.faa.gov/regulations_policies/policy_guidance/benefit_cost/; last updated November 5, 2024; accessed 3/27/25.

4.10 Fuel Per Mile

In gal/mile of gasoline, unless otherwise noted. Estimated gallons of fuel (or kWh) consumed per vehicle mile traveled.

Mode	Fuel Type	Data Year 2023	Data Year 2024
Auto			
AV TNC	Gasoline	0.0443	0.0427
Light-Duty EV	Electric	0.3202 kWh	0.2258 kWh
Passenger Car	Gasoline	0.0443	0.0427
Taxi & TNC	Gasoline	0.0443	0.0427
Bus			
Bus Rapid Transit (BRT)	Diesel	0.3409	0.3152
Passenger Bus	Diesel	0.2395	0.2354
Truck			
All Trucks	Diesel	0.1408	0.1338
Light/Medium Duty Truck	Diesel	0.1280	0.1242
Tractor Trailer	Diesel	0.1497	0.1406
Train – Passenger			
Commuter Rail	Diesel	3.2281	3.5411
Heavy Rail (Subway)	Electric	5.4968 kWh	5.4004 kWh
Light Rail Transit (LRT)	Electric	7.7520 kWh	7.7438 kWh
Passenger Rail (Intercity - Diesel)	Diesel	2.2000	2.2000
Passenger Rail (Intercity - Electric)	Electric	26.5700 kWh	26.5700 kWh
Train – Freight Rail	Diesel	7.8780	7.9554
Aircraft – Passenger			
All Aircraft	Aviation	2.3173	2.3173
General Aviation	Aviation	0.2337	0.2337
Air Taxi	Aviation	0.2337	0.2337
Regional Jet	Aviation	1.5226	1.5226
Commercial Jet	Aviation	2.1416	2.1416
Jumbo Jet	Aviation	3.9311	3.9311
Aircraft – Freight			
All Aircraft	Aviation	4.3485	4.3485
General Aviation	Aviation	0.2075	0.2075
Air Taxi	Aviation	0.2075	0.2075
Regional Jet	Aviation	1.1119	1.1119
Commercial Jet	Aviation	2.2843	2.2843
Jumbo Jet	Aviation	4.7735	4.7735
Marine			
Marine Freight	Maritime	48.0000	19.2012
Passenger Ferry	Maritime	9.8873	10.0602

Passenger Car and Truck factors are drawn from Table VM-1 of the 2024 FHWA Highway Statistics Series (updated February 2026). The ordinary Passenger Car mode in TREDIS represents all passenger vehicles. EVs' small share in the total stock of passenger vehicles means their high efficiency (in terms of miles-per-gallon equivalent) does not appreciably change the fuel efficiency of the country currently. For future years, the market share may grow and change the fuel use of US passenger vehicles overall, so users may consider using the regular passenger vehicle to represent only internal combustion engine vehicles and leveraging the new Light-Duty EV mode.

The **Light-Duty EV** factor is from EIA, Annual Energy Outlook 2025, Tables 39 and 40. The values represent weighted averages for all new EV passenger vehicles (cars and light trucks) estimated for 2028.

Transit (Bus, BRT, Light Rail, Heavy Rail, Commuter Rail, Passenger Ferry) factors are based on average consumption rates based on all transportation agencies reporting energy consumption from operations to the National Transit Database for years 2020-2024.

Passenger Rail (Intercity) Diesel factor is based on Amtrak's summary metrics provided in the Appendix of their FY2013-2017 Financial Plan.

Passenger Rail (Intercity) Electric factor is based on Lukaszewicz and Andersson (2009).¹⁹

Freight Rail factor is calculated based on information from Table 4-17 in BTS's National Transportation Statistics, using 5-year average of 2019-2023, per most recent data released in July 2025.

Marine Freight fuel-per-mile for Data Year 2024 have been updated to reflect an average assumed for Panamax ships. We assume 36 US tons per day of fuel burn²⁰. Empirical measures of container ship speeds can vary year-to-year from around 14 to 15.5 knots, so we use a recent average of 14.9 knots.²¹ Converted to US gallons per mile, this results in 19.2012 gallons of fuel per mile. Fuel consumption is often listed for faster speeds, but these are non-linear and the faster speeds do not necessarily reflect what is used in practice.

Aircraft fuel per mile rates were drawn from Section 3 of the FAA's Benefit-Cost Analysis webpage, under "Economic Values for Evaluation of FAA Investment and Regulatory Decisions,"²² dated November 2024. Regional Jet, Commercial Jet and Jumbo Jet are taken from (respectively) weighted averages values for all "Regional Jet", "Narrowbody" and "Widebody" factors reported in Section 3, Tables 3-6, 3-7, and 3-8 for passenger air and Tables 3-9, 3-10, and 3-11 for cargo air. (GA and Air Taxi were derived from "Turboprop" planes.) The fuel burn is reported per-hour; using the reported speeds a fuel-per-mile factor is derived.

¹⁹ Lukaszewicz, P., & Andersson, E. (2009). Green Train energy consumption. *Estimations on high-speed rail operations*. KTH Railway Group, publication, 901.

²⁰ See for example <https://medium.com/shipping-intel/voyage-cost-fuel-consumption-9442b036b4f0>, which cites a schedule of burn specifically for Panamax ships at different speeds, similar to the lower range for Panamax cited by <https://www.shipuniverse.com/big-5-breakdown-size-fuel-burn-and-carrying-capacity/>.

²¹ See <https://www.freightwaves.com/news/full-steam-ahead-why-container-ships-are-racing-across-the-pacific>.

²² See https://www.faa.gov/regulations_policies/policy_guidance/benefit_cost/; last updated November 5, 2024; accessed 3/27/25.

4.11 Congested Ratios for Fuel Efficiency

TREDIS models fuel use under congested conditions by using a ratio to scale fuel per mile used under free flow conditions (represented by the Fuel Per Mile field) to congested conditions, and then in turn to the unusual case where congested hours need to be considered.

For details on how these ratios are applied to the base Fuel Per Mile rates to find fuel consumption, see the section on fuel costs in the *Travel Cost Module* document. Note that in some unusual situations, VHT is used to calculate fuel consumption, but for any situation where VMT changes (and most other situations), VMT will be used the majority of the time. See the section of the *Travel Cost Module* documentation on the valuation of vehicle operating costs.

The modes in the table below are the only ones generally considered to be subject to congested costs. All other modes use the same consumption for congested and uncongested conditions as congestion is most relevant for road-based modes. Buses' regular operations are under stop and start conditions and are assumed to not be noticeably affected by congestion for most applications. Users should consider modifying defaults for projects that might significantly change drive cycles, such as dedicated bus lanes.

Congested Mile to Free Flow Mile Ratio

Congested Mile to Free Flow Mile Ratio reflects a fuel consumption penalty due to driving in congestion equal to 15 percent for passenger cars and 40 percent for trucks. A wide range of estimates exist, and we find that this one is reasonably conservative. Along with Zhang, Batterman, and Dion (2011),²³ other sources were considered.

Mode	Data Year 2023	Data Year 2024
Auto Modes	1.15	1.15
Truck Modes	1.40	1.40

Congested Hour to Congested Mile Ratio

Auto factors for passenger cars are derived from per-mile consumption based on an assumed speed of 35 mph. This value is set with the expectation that TREDIS is used largely for major highway and arterial projects.

Truck factors are derived from per-mile consumption based on an assumed speed of 50 mph. This value is set with the expectation that TREDIS is used largely for major highway and arterial projects.

Mode	Data Year 2023	Data Year 2024
Auto Modes	35	35
Truck Modes	50	50

4.12 Social Cost Values Applied to Crash Components

In \$/per occurrence. Value per occurrence is a factor in benefit-cost analysis, but not economic impacts.

TREDIS differentiates the social costs of crashes from the economic impact of crashes. See 4.13 Economic Impact Values Applied to Crash Components.

²³ Zhang, K., Batterman, S., & Dion, F. (2011). Vehicle emissions in congestion: Comparison of work zone, rush hour and free-flow conditions. *Atmospheric Environment*, 45(11), 1929-1939.

Social Cost of Fatalities and Injuries

Type of Occurrence	Data Year 2023	Data Year 2024
\$ per Fatality, All Modes and Purposes	\$13,200,000	\$13,700,000
\$ per A Injury, All Modes and Purposes	\$229,800	\$238,500
\$ per B Injury, All Modes and Purposes	\$1,254,700	\$1,302,300
\$ per C Injury, All Modes and Purposes	\$246,900	\$256,300
\$ per O Injury, All Modes and Purposes	\$118,000	\$122,400
\$ per U Injury, All Modes and Purposes	\$5,300	\$5,500

For Fatalities and Injuries, all values are from the December 2025 USDOT BCA Guidance on the value of statistical life (VSL).

Social Cost of Crash-Involved Vehicles

Mode	Data Year 2023	Data Year 2024
All Road Vehicles	\$5,367	\$5,480
All Rail	\$178,598	\$185,226
Aircraft – Passenger		
All Aircraft	\$4,400,000	\$4,513,533
General Aviation	\$229,428	\$235,552
Air Taxi	\$229,428	\$235,552
Regional Jet	\$1,782,569	\$1,828,564
Commercial Jet	\$3,540,896	\$3,632,261
Jumbo Jet	\$6,393,548	\$6,558,521
Aircraft – Freight		
All Aircraft	\$7,624,706	\$7,821,446
General Aviation	\$229,428	\$235,552
Air Taxi	\$229,428	\$235,552
Regional Jet	\$1,100,000	\$1,128,383
Commercial Jet	\$3,436,364	\$3,525,032
Jumbo Jet	\$9,775,862	\$10,028,108

Road factors, like fatality and injury costs, are from December 2025 US DOT BCA Guidance.

Rail factors for per-vehicle crash are from BTS's NTS table 2-43, where property-damage-only values are averaged over the last five years of data available (2020-2024), with the assumption that crashes involve a single train. See 4.14 Crash Rates for more on the meaning of “train” vs. “vehicle.”

Air factors were drawn from Section 5 of the FAA's Benefit-Cost Analysis webpage, under “Economic Values for Evaluation of FAA Investment and Regulatory Decisions,”²⁴ dated November 2024. Regional Jet, Commercial Jet and Jumbo Jet are taken from (respectively) weighted averages values for all “Regional Jet”, “Narrowbody” and “Widebody” losses reported in Section 5, Table 5-4 (for passenger) and Table 5-5 (for freight), weighted by crashes, adjusted to 2024 dollars using the Air Transportation PPI. Table 5-10 reports on restoration costs for General Aviation; the average cost, adjusted to 2024 dollars, is used for both passenger and freight, for GA and Air Taxi modes.

²⁴ See https://www.faa.gov/regulations_policies/policy_guidance/benefit_cost/; last updated November 5, 2024; accessed 3/27/25.

4.13 Economic Impact Values Applied to Crash Components

Total \$ per type of incident, with qualifications described in this section.

Type of Occurrence	Data Year 2023	Data Year 2024
\$ per Fatality, All Road Users	\$1,880,928	\$1,929,461
\$ per A Injury, All Road Users	\$195,143	\$200,179
\$ per B Injury, All Road Users	\$45,796	\$46,978
\$ per C Injury, All Road Users	\$25,072	\$25,720
\$ per O Injury, All Road Users	\$4,112	\$4,219
\$ per U Injury, All Road Users	\$27,190	\$27,893
\$ per Crash-Involved Vehicle, All Road Users	\$4,614	\$4,733

Estimating the economic impact of safety incidents takes initial costs from Blincoe et al. (2022),²⁵ which gives economic impacts in terms of the Maximum Abbreviated Injury Scale (MAIS), where TREDIS uses the KABCO (and U) scale to conform better with USDOT BCA Guidance. To translate between the MAIS and KABCO scale, a conversion is used based on Wang (2023).²⁶ These are converted to 2024 dollars using FRED's implicit price deflator.

The figures here are provided only for context, since numerous adjustments and considerations are taken into account before the economic impact is described; further details can be found in the Dynamic Regional Economic Simulation Model technical document.

²⁵ Blincoe, L., Miller, T. R., Wang, J. S., Swedler, D., Coughlin, T., Lawrence, B., ... & Dingus, T. (2022). *The economic and societal impact of motor vehicle crashes, 2019* (No. DOT HS 813 403).

²⁶ Wang, J. S. (2023). KABCO-to-MAIS translators-2022 update (No. DOT HS 813 420).

4.14 Crash Rates

All rates shown are per 100 million vehicle miles traveled.

Mode	Data Year 2023			Data Year 2024		
	Fatalities	Persons Injured	Crash-Involved Vehicles	Fatalities	Persons Injured	Crash-Involved Vehicles
Auto Modes	1.299	123.7	433.18	1.364	119.21	413.11
Truck Modes	0.364	16.24	197.46	0.364	16.21	194.59
Bus Modes	5.120	315.84	260.98	4.755	311.17	266.41
Train – Passenger						
Commuter Rail	8.155	21.39	21.93	9.067	14.67	21.87
Light Rail Transit	22.565	206.4	654.54	23.510	210.41	649.54
Heavy Rail	8.822	22.16	42.34	9.991	23.90	45.19
Passenger Rail	103.437	950.6	299.74	110.544	933.91	302.28
Train – Freight	103.437	950.6	299.74	110.544	933.91	302.28
Aircraft						
All Aircraft	3.404	2.18	11.11	3.250	2.09	10.79
General Aviation	11.226	6.67	36.87	10.447	6.33	35.03
Air Taxi	3.550	2.46	6.52	3.731	2.00	6.46
Regional Jet	0.016	0.23	0.35	0.013	0.22	0.35
Commercial Jet	0.016	0.23	0.35	0.013	0.22	0.35
Jumbo Jet	0.016	0.23	0.35	0.013	0.22	0.35
Active						
Bike	13.445	627.99	0.00	13.445	627.99	0.00
Pedestrian	28.930	282.07	0.00	28.930	282.07	0.00

Crash rates, unless otherwise noted, are from the Bureau of Transportation Statistics' (BTS) National Transportation Statistics (NTS), Chapter 2.

Auto mode crash rates are from Table 2-21a. Fatalities and injuries are factored up by the ratio of total fatalities (including those not occupying a vehicle) to the occupant fatalities reported in Table 2-19. Rates are averaged over the latest five years reported, 2019-2023, reported in June 2025.

If a project adds distance traveled for both passenger car and bike/pedestrian travel, fatalities and injuries may be overestimated, since crash rates consider current average outcomes per mile. Defaults are provided for both as the modeled changes will typically be shifts between modes or within-mode analysis. The rates do not account for safety-in-numbers for non-occupants or the fact that many projects that increase bike/ped volumes will include safety improvements. When improving safety, consider using crash count inputs rather than default rates. Alternatively, crash rates can be zeroed out or reduced if increased bike/ped traffic should not be considered to face increased crash risks beyond those represented by vehicular risks imposed on non-occupants.

Truck mode crash rates are from Table 2-23. Fatalities and injuries are factored up by the ratio of total fatalities (including those not occupying a vehicle) to the occupant fatalities reported in Table 2-19. The NTS doesn't distinguish between types of trucks over 10,000 pounds,

considering them all “large.” Rates are averaged over the latest five years reported, 2019-2023, reported in June 2025.

Passenger Bus, BRT, Light Rail Transit (LRT), Heavy Rail (Subway), and Commuter Rail information are from Table 2-33 and averaged over the latest five years reported, 2019-2023, reported in February 2025. This source has not been updated since the issue of Data Year 2022, and so the rates have not changed.

Passenger Rail (Intercity) and Freight Rail are based on Table 2-43 for fatalities and injuries and averaged over the latest five years reported, 2020-2024, reported in March 2025. For consistency with other modes, TREDIS considers 10 miles traveled by a single train as “10 vehicle miles traveled,” no matter the number of train cars, where National Transportation Statistics would label these “10 train miles traveled.”

TREDIS uses the NTS rates of fatalities and injuries, which are do not include those at highway-rail grade-crossing crashes. This is appropriate for TREDIS because TREDIS derives safety changes largely in terms of number of miles traveled; the number of grade crossings do not vary by the miles traveled and so are unlikely to be affected greatly by the number of miles trains travel. Users are encouraged to develop local factors relevant to their particular location if grade crossings are of interest.

Water mode incident rates are unavailable. NTS Chapter 2, Section F reports safety and property damage information within U.S. jurisdiction, but there is no way to calculate this data in terms of miles traveled. Ferry boats provide too small of a sample to calculate meaningful incident rates for marginal travel changes.

Air Carrier mode factors are based on Table 2-9, include Regional, Commercial, and Jumbo Jets. They and are averaged over the latest five years reported, 2019-2023, reported in February 2025.

General Aviation (GA) factors are based on Table 2-14 and are averaged over the latest five years reported, 2019-2023, reported in February 2025.

Air Taxi factors are based on Table 2-13 and are averaged over the latest five years reported, 2019-2023, reported in February 2025.

All Aircraft factors are averages of Air Carrier, GA, and Air Taxi, weighted by millions of miles flown.

Pedestrian and Bike modes reflect reporting in FARS of the number of fatalities and injuries experienced by pedestrians and pedalcyclists for the period from 2018-2022. NTS tables do not directly report the number of miles traveled by pedestrians and bicyclists. The NHTS 2017 and NHTS 2022 surveys provide a total number of miles traveled for light-duty private motor vehicle drivers (including both passenger car and many light trucks), bicyclists, and walkers. Averaging the two surveys together, the average light-duty miles per bike mile is about 395, and the same ratio for pedestrians is about 118. Using these ratios, we can estimate the number of pedestrian and bike miles traveled based on the total passenger car and light truck miles given in NTS Table 2-21a and Table 2-23 for the 2018-2022 (as reported in August 2024), respectively, and use the resulting mileage to find the fatalities and injuries per mile for pedestrians and bicyclists respectively.

See the note under Passenger Car on the interaction of these rates with those of Passenger Car.

Vehicles Per Crash

The number of PDO vehicles assumed per crash.

Mode	Data Year 2023	Data Year 2024
All Road Vehicles	1.77	1.77
All Active, Rail, Air and Marine Modes	1.00	1.00

When set, to convert to crashes to crash-involved vehicles (the variable required to calculate property damage), TREDIS uses Vehicles Per Crash.

December 2025 USDOT BCA Guidance uses the same source as previous editions, reporting this number as 1.77 for road. For all other modes, we assume 1 vehicle per crash.

4.15 Emissions Rates

Rates are provided in grams per vehicle mile traveled for volatile organic compounds (VOC), nitrous oxides (NO_x), sulfur dioxide (SO₂), and small particulates (PM_{2.5}). Emissions of CO₂ are calculated directly by using the fuel efficiency and a CO₂ production factor.

Mode	Data Year 2023				Data Year 2024			
	VOC	NO _x	SO ₂	PM _{2.5}	VOC	NO _x	SO ₂	PM _{2.5}
Auto								
Gasoline	0.2065	0.1464	0.0016	0.0088	0.2190	0.1412	0.0023	0.0081
Electric	0.0000	0.0000	0.0000	0.0041	0.0000	0.0000	0.0000	0.0020
Truck								
All Trucks	0.1758	1.8677	0.0041	0.0369	0.1915	1.3592	0.0040	0.0430
Light/Medium Duty	0.2458	0.5340	0.0026	0.0203	0.2284	0.4834	0.0032	0.0201
Tractor Trailer	0.1278	2.7813	0.0052	0.0483	0.1326	2.7576	0.0052	0.0797
Bus Modes	0.4678	2.0875	0.0061	0.0286	0.4201	1.9455	0.0065	0.0217
Train – Pass.								
Diesel	13.2721	275.3306	0.2014	8.6881	13.2721	275.3306	0.2014	8.6881
Electric	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Train – Freight	47.4458	984.4327	0.7199	31.0711	47.4458	984.4327	0.7199	31.0711
Aircraft	0	0	0	0	0	0	0	0
Marine Freight	0	0	0	0	0	10,947	12,023	1,409

For passenger cars and light trucks, light-duty EVs, medium-duty trucks, heavy-duty trucks, and buses, the TREDIS team developed national emissions inventories for the years 2025-2029 using MOVES5.0. Emissions rates were aggregated for each year, and the final rates took the average of the five evaluation years. The TREDIS emissions inventories use MOVES5.0 default inputs and were specified using all available road type combinations (i.e., urban/rural, restricted/unrestricted). The run specification and subsequent emissions rates include running, starting, and extended idle emissions processes for all pollutants. (Aggregating engine starts into a distance-based emissions rate may be imprecise for project-level analysis. However, in aggregate regional analysis generalized over time using MOVES5.0's national inputs, this assumption is appropriate.) Particulate matter includes brake wear and tire wear as well as exhaust emissions.

Rail (Diesel) are based on factors used by the Surface Transportation Board's Section on Environmental Analysis' in a 2008 draft environmental impact statement concerning CN's proposal to acquire control of EJ&E West Company.²⁷

Users are encouraged to use the Federal Railroad Administration's [LECT tool](#) for projects that would replace existing trains or locomotives for a more precise estimate of potential emissions savings.

Rail (Transit & Electric) are represented with zero emissions due to the inappropriateness of making assumptions on emissions from the electrical generation process which vary based on fuel mix and geography in ways that TREDIS cannot represent. If local information is available, these factors should be updated.

Marine Freight emissions are based on ICF International (2009).²⁸ For Data Year 2024, we have clarified that the vehicle modeled is a Panamax containership. The factors calculated use the specifications for a containership while cruising. Previously we did not extract specific factors given the range of vehicle types. VOC is not estimated.

Air modes have default emissions of zero since the criteria air pollutants are most damaging at local levels rather than when emitted at altitude.

4.16 Cost of Poor Pavement

TREDIS adjusts vehicle operating cost and fuel use by the amount of driving done on pavement deemed deficient or poor.

Vehicle Operating Cost Ratio

Vehicle Operating Cost Ratio on Poor Pavement is the ratio of the vehicle operating cost on each mile driven on poor pavement to the vehicle operating cost on each mile driven on non-deficient pavement.

Mode	Data Year 2023	Data Year 2024
Auto Modes	1.21	1.21
Truck Modes	1.19	1.19

The default ratio for vehicle operating costs uses ratios derived from "The Per-mile Costs of Operating Automobiles and Trucks,"²⁹ representing the difference between baseline and extremely rough pavement.

Fuel Ratio

Fuel Ratio on Poor Pavement is the ratio of fuel used on each mile driven on poor pavement to the vehicle operating cost on each mile driven on non-deficient pavement.

²⁷ See Surface Transportation Board (STB) Section on Environmental Analysis. Draft Environmental Impact Statement regarding CN Acquisition of EJ&E, Appendix K "Air Quality and Climate Analysis." Page 23. [http://www.stb.dot.gov/decisions/readingroom.nsf/UNID/61898F9CAD3C7508525748E006688AC/\\$file/11.00_AppendixK_July08.pdf](http://www.stb.dot.gov/decisions/readingroom.nsf/UNID/61898F9CAD3C7508525748E006688AC/$file/11.00_AppendixK_July08.pdf) (Accessed May 2015).

²⁸ ICF International. 2009. *Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories*, prepared for the US EPA Office of Policy, Economics, and Innovation, Sector Strategies Program, April 2009

²⁹ Barnes, G., & Langworthy, P. (2003). White Paper. Minnesota Dept of Transp. St. Paul. The Per-Mile Costs of Operating Automobiles and Trucks. On the web at <http://www.lrrb.org/media/reports/200319.pdf>.

TREDIS Data Sources and Default Values

Mode	Data Year 2023	Data Year 2024
Auto Modes	1.02	1.02
Truck Modes	1.03	1.03

The default ratio for the penalty for fuel use on poor pavement uses figures from NCHRP 720.³⁰ For Passenger Car, the average is taken of the types “medium car,” “van,” “SUV,” and “light truck,” averaging as well across the excess fuel use estimates at 35 mph and 55 mph. For Trucks, the “articulated truck” information was used, and averaged from estimates at 35 mph and 55 mph.

For all figures, the poor pavement is assumed to be defined as pavement with an IRI value of greater than 180 inches per mile (equivalent to a PSR of about 2.39).

³⁰ This can be found at <http://www.trb.org/Publications/Blurbs/166904.aspx>.

4.17 Fuel Costs

Fuel costs are prices and taxes (included in the price) used for surface transportation – cars, trucks, buses and other – in price or tax per gallon or kilowatt-hour (kWh).

Fuel Prices

Gasoline and Diesel prices are from AAA's price listings.³¹ The 2024 value use data collected on March 17, 2026, for "a month ago" from AAA's data. Because prices rose dramatically in March 2026, prices from the day of data collection were not used this year.

Electricity prices are from EIA's Electric Power Monthly report, Table 5.6.A. Average Price of Electricity to Ultimate Customers by End-Use Sector, November 2025, for All Sectors. These numbers are used because they represent prices users would experience when charging at home, the most likely place an electric vehicle is likely to be charged.

State	Gasoline 2023	Gasoline 2024	Diesel 2023	Diesel 2024	Electricity 2023	Electricity 2024
United States	3.0593	2.9170	3.0662	3.6510	0.1228	0.1373
Alabama	2.7467	2.6100	3.3983	3.3970	0.1141	0.1271
Alaska	3.2454	3.5120	3.4548	3.8280	0.2170	0.2275
Arizona	3.1879	3.1440	3.5463	3.5260	0.1188	0.1225
Arkansas	2.7389	2.4610	3.2230	3.3080	0.0915	0.0951
California	4.4278	4.5870	4.8758	5.0330	0.2242	0.2818
Colorado	2.9347	2.7700	3.2843	3.4590	0.1187	0.1269
Connecticut	3.0087	2.9030	3.7762	3.9720	0.2448	0.2357
Delaware	3.0019	2.8680	3.6252	3.8580	0.1343	0.1471
D.C.	3.1791	3.0960	3.6778	3.8810	0.1668	0.2210
Florida	3.1256	2.8380	3.5424	3.4840	0.1218	0.1307
Georgia	2.8821	2.7130	3.5522	3.5260	0.1105	0.1160
Hawaii	4.4307	4.4030	5.1719	5.1640	0.3451	0.3712
Idaho	3.1012	2.9640	3.4538	3.6520	0.0918	0.0963
Illinois	3.1782	2.9980	3.5308	3.6840	0.1199	0.1336
Indiana	2.8791	2.7720	3.5658	3.7250	0.1129	0.1258
Iowa	2.9337	2.4510	3.3983	3.4070	0.0861	0.0894
Kansas	2.7574	2.4670	3.2386	3.3410	0.1102	0.1121
Kentucky	2.7603	2.5940	3.2415	3.3200	0.1015	0.1068
Louisiana	2.7067	2.5010	3.2814	3.2100	0.0795	0.0928
Maine	3.0019	2.9100	3.8580	4.3540	0.1986	0.2457
Maryland	3.1187	2.9290	3.7041	3.7930	0.1487	0.1768
Massachusetts	2.9541	2.9050	3.7207	3.9330	0.2347	0.2672
Michigan	3.0223	2.9440	3.4665	3.7100	0.1313	0.1477
Minnesota	2.9736	2.5760	3.4626	3.5270	0.1134	0.1221
Mississippi	2.6123	2.4810	3.2269	3.2390	0.1083	0.1165
Missouri	2.7749	2.5200	3.2298	3.3260	0.1014	0.1040
Montana	2.9464	2.7450	3.3009	3.2520	0.1018	0.1070
Nebraska	2.8879	2.5780	3.2697	3.3720	0.0868	0.0900
Nevada	3.6320	3.6340	3.7002	3.8270	0.0999	0.0961
New Hampshire	2.8938	2.8460	3.7139	3.9750	0.2037	0.2330
New Jersey	2.9697	2.9430	3.6652	3.9180	0.1589	0.1875
New Mexico	2.8918	2.6330	3.4684	3.3730	0.0882	0.0869
New York	3.0973	2.9970	3.8697	3.9810	0.1839	0.2193
North Carolina	2.8451	2.7410	3.4713	3.4820	0.1175	0.1167
North Dakota	2.8938	2.5290	3.4743	3.4650	0.0751	0.0812

³¹ See <https://gasprices.aaa.com/state-gas-price-averages/>.

State	Gasoline 2023	Gasoline 2024	Diesel 2023	Diesel 2024	Electricity 2023	Electricity 2024
Ohio	2.9269	2.7360	3.4577	3.7140	0.1105	0.1323
Oklahoma	2.7165	2.2990	3.1149	3.1280	0.0837	0.0899
Oregon	3.5473	3.6910	3.7557	4.1550	0.1120	0.1138
Pennsylvania	3.2795	3.1130	3.9885	4.1630	0.1206	0.1533
Rhode Island	2.9249	2.8750	3.7236	3.9290	0.2462	0.2801
South Carolina	2.8207	2.5980	3.4129	3.3490	0.1091	0.1191
South Dakota	2.8928	2.5820	3.3467	3.3650	0.1087	0.1089
Tennessee	2.7048	2.5630	3.3282	3.3780	0.1099	0.1121
Texas	2.6639	2.5100	3.2152	3.1950	0.0959	0.1031
Utah	2.9970	2.7760	3.4460	3.6740	0.0834	0.1019
Vermont	3.0603	3.0000	3.6924	4.1030	0.1971	0.2016
Virginia	2.9804	2.8230	3.6116	3.6170	0.1032	0.1207
Washington	3.9106	4.1580	4.2700	4.7880	0.1026	0.1146
West Virginia	2.8957	2.8540	3.4967	3.6700	0.1111	0.1141
Wisconsin	2.8723	2.5590	3.3243	3.4540	0.1181	0.1324
Wyoming	2.9181	2.6950	3.3564	3.5120	0.0932	0.0957

Fuel Taxes

Fuel prices above are inclusive of state and federal taxes. For the purposes of benefit cost analysis and economic impact analysis the tax share of fuel prices are transfers between parties and are removed by the system. This is done based on the default values in the next table which users can also modify in TREDIS for scenario analysis. Tax rates on gasoline and diesel are from EIA's <https://www.eia.gov/petroleum/gasdiesel/> site, updated January 2026. Tax rates are given in dollars per gallon (\$/gal) in the following table.

State	Gasoline Tax 2023	Gasoline Tax 2024	Diesel Tax 2023	Diesel Tax 2024
United States	0.1840	0.1840	0.2440	0.2440
Alabama	0.2941	0.3100	0.3112	0.3275
Alaska	0.0872	0.0895	0.0872	0.0895
Arizona	0.1851	0.1900	0.1851	0.1900
Arkansas	0.2435	0.2500	0.2805	0.2880
California	0.6800	0.7092	0.8972	0.8732
Colorado	0.2744	0.2918	0.2988	0.3468
Connecticut	0.2435	0.2500	0.5104	0.4890
Delaware	0.2240	0.2300	0.2143	0.2200
D.C.	0.3438	0.3570	0.3438	0.3570
Florida	0.3837	0.4010	0.3922	0.4097
Georgia	0.3297	0.3405	0.3687	0.3805
Hawaii	0.1802	0.1850	0.1802	0.1850
Idaho	0.3214	0.3300	0.3214	0.3300
Illinois	0.6438	0.6640	0.7169	0.7390
Indiana	0.5114	0.5350	0.5844	0.6200
Iowa	0.2922	0.3000	0.3166	0.3250
Kansas	0.2439	0.2503	0.2633	0.2703
Kentucky	0.2708	0.2640	0.2416	0.2340
Louisiana	0.2038	0.2093	0.2038	0.2093
Maine	0.3059	0.3145	0.3104	0.3196
Maryland	0.4509	0.4621	0.4582	0.4694
Massachusetts	0.2676	0.2756	0.2676	0.2756
Michigan	0.4656	0.5340	0.4656	0.5340
Minnesota	0.3107	0.3270	0.3107	0.3270
Mississippi	0.1792	0.2140	0.1792	0.2140
Missouri	0.2678	0.2999	0.2678	0.2999

TREDIS Data Sources and Default Values

State	Gasoline Tax 2023	Gasoline Tax 2024	Diesel Tax 2023	Diesel Tax 2024
Montana	0.3287	0.3375	0.2971	0.3050
Nebraska	0.3049	0.3270	0.2990	0.3210
Nevada	0.2319	0.2381	0.2703	0.2775
New Hampshire	0.2321	0.2375	0.2321	0.2375
New Jersey	0.4378	0.4915	0.5060	0.5615
New Mexico	0.1838	0.1888	0.2228	0.2288
New York	0.2422	0.2418	0.2247	0.2238
North Carolina	0.3950	0.4125	0.3950	0.4125
North Dakota	0.2243	0.2303	0.2243	0.2303
Ohio	0.3750	0.3850	0.4578	0.4700
Oklahoma	0.1948	0.2000	0.1948	0.2000
Oregon	0.3896	0.4000	0.3896	0.4000
Pennsylvania	0.5717	0.5870	0.7217	0.7410
Rhode Island	0.3713	0.4112	0.3713	0.4112
South Carolina	0.2800	0.2875	0.2800	0.2875
South Dakota	0.2922	0.3000	0.2922	0.3000
Tennessee	0.2669	0.2740	0.2766	0.2840
Texas	0.1948	0.2000	0.1948	0.2000
Utah	0.3813	0.3855	0.3813	0.3855
Vermont	0.3086	0.3151	0.3214	0.3300
Virginia	0.3935	0.4160	0.4042	0.4270
Washington	0.5145	0.5904	0.5145	0.6204
West Virginia	0.3477	0.3570	0.3477	0.3570
Wisconsin	0.3204	0.3290	0.3204	0.3290
Wyoming	0.2338	0.2400	0.2338	0.2400

4.18 Emissions Costs

Costs of emissions are per metric ton. These national defaults are used for all contracts. These factors may be localized using the EPA's COBRA tool, which estimates the monetary damage from emissions produced in a specific county.

PM_{2.5}, SO₂, and NO_x damage factors are from the US DOT BCA Guidance, dated December 2025, which set emissions values for PM_{2.5}, SO_x and NO_x for years 2024 through 2055, all in 2024 dollars. After 2030, the values each year for these pollutants are constant. For convenience, the forecast values were extended backward using the 2024 values and extended out to horizon years using the 2030 values.

Forecast Year	PM _{2.5} 2023	PM _{2.5} 2024	SO _x 2023	SO _x 2024	NO _x 2023	NO _x 2024
2024	\$998,300	\$1,054,000	\$55,800	\$59,000	\$20,800	\$21,600
2025	\$1,011,100	\$1,054,000	\$56,800	\$59,000	\$21,100	\$21,600
2026	\$1,029,700	\$1,070,700	\$58,100	\$60,100	\$21,400	\$22,000
2027	\$1,048,800	\$1,087,800	\$59,500	\$61,100	\$21,800	\$22,500
2028	\$1,068,200	\$1,105,100	\$60,800	\$62,200	\$22,100	\$22,900
2029	\$1,087,900	\$1,122,600	\$62,300	\$63,400	\$22,500	\$23,300
2030-2055+	\$1,108,000	\$1,140,500	\$63,700	\$64,500	\$22,900	\$23,800

CO₂ costs are taken from the US DOT BCA Guidance, dated November 2024, which set values for CO₂ based on social cost of carbon (SCC) research for the years 2024 through 2054, all in 2023 dollars. These are inflated using the FRED implied deflator to 2024 dollars. For convenience, the forecast values were extended out to 2070 using the 2050 values, based on an assumption of compound growth.

Year	CO ₂ (SCC) 2023	CO ₂ (SCC) 2024	Year	CO ₂ (SCC) 2023	CO ₂ (SCC) 2024
2024	\$241	\$247	2047	\$338	\$346
2025	\$246	\$252	2048	\$344	\$353
2026	\$250	\$256	2049	\$348	\$357
2027	\$254	\$260	2050	\$353	\$362
2028	\$259	\$265	2051	\$357	\$366
2029	\$262	\$269	2052	\$362	\$371
2030	\$267	\$274	2053	\$366	\$375
2031	\$272	\$279	2054	\$370	\$379
2032	\$275	\$282	2055	\$375	\$384
2033	\$280	\$287	2056	\$381	\$390
2034	\$284	\$291	2057	\$386	\$396
2035	\$288	\$295	2058	\$392	\$402
2036	\$292	\$299	2059	\$398	\$408
2037	\$297	\$304	2060	\$404	\$414
2038	\$301	\$308	2061	\$410	\$420
2039	\$305	\$313	2062	\$416	\$426
2040	\$310	\$318	2063	\$422	\$432
2041	\$314	\$322	2064	\$428	\$439
2042	\$319	\$327	2065	\$435	\$445
2043	\$324	\$332	2066	\$441	\$452
2044	\$328	\$336	2067	\$448	\$459
2045	\$333	\$341	2068	\$454	\$465
			2069	\$461	\$472
			2070	\$468	\$479

VOC cost is taken from the US DOT BCA Guidance January 2020 edition, when it gave a single value in 2018 dollars. This number has not been provided or updated in subsequent guidance. The number provided in the January 2020 guidance has been converted to 2024 dollars and for metric tons and used all forecast years. VOCs are a precursor to ozone which is recognized as having serious health impacts. If the user wishes to exclude these damage costs and strictly use the values provided by US DOT, they can zero out these emission rates.

Year	VOC 2023	VOC 2024
All Years	\$2,778	\$2,838

Appendix A – CO₂ Production Factors

The CO₂ produced by consuming a gallon of fossil fuel or gasoline-gallon equivalent is not a factor that is updated on a yearly basis, although the mix of additives used to create gasoline can change over time. The factors in TREDIS used are given here for reference:

Fuel Type	CO ₂ Emissions
Gasoline	19.60 lbs. per gallon consumed
Diesel	22.40 lbs. per gallon consumed
Maritime	22.40 lbs. per gallon consumed
CNG	14.83 lbs. per GGE consumed
Aviation	19.75 lbs. per gallon consumed

Gasoline, Diesel, Maritime, and Aviation factors are from [EIA estimates](#) converted to pounds per gallon (where Aviation is an average of “Aviation Gasoline” and “Jet Fuel”).

CNG factor is from a calculation of 117.1 per thousand cubic feet multiplied by 0.12667 MCF per GGE, from [supplier estimates](#).

Fuel types not listed here are assumed to produce no CO₂.