FEDERAL MOTOR CARRIER SAFETY ADMINISTRATION CRASH COST METHODOLOGY

This document outlines the Agency's updated methodology for calculating crash costs for fatal, injury, and non-injury crashes. The Federal Motor Carrier Safety Administration (FMCSA) revises these estimates following the release of new crash data from the National Highway Traffic Safety Administration (NHTSA).

The Agency uses crash cost values to assess and estimate the safety benefits of various regulatory initiatives. By publishing this methodology on FMCSA's website, stakeholders can access detailed information about how these crash cost values are derived, enhancing transparency. The latest crash cost estimates will be available in the FMCSA pocket guide.¹ FMCSA will review the methodology periodically and update it as new data sources become available.

Background

Crash costs are used in benefit-cost analyses (BCAs) to evaluate and quantify the impact of FMCSA's rulemaking actions on reducing the number of commercial motor vehicle (CMV) related crashes, injuries, and fatalities. The Agency developed a new crash cost methodology to ensure that its BCAs are technically sound, transparent, and reproducible. FMCSA updates crash cost estimates annually using inputs from NHTSA's Fatality Analysis Reporting System (FARS)² and Crash Reporting Sampling System (CRSS)³, which provide information on police-reported crashes, updated economic costs, and yearly updates on the Value of Statistical Life (VSL). FMCSA solicited and incorporated feedback from subject matter experts within the Agency and Department.

Previously, FMCSA's economists relied on a crash cost tool developed approximately 10 years ago. That crash cost tool was updated annually for the new VSL values provided by the Office of the Secretary of Transportation (OST) as well as the inflators (Consumer Price Index, real income, median weekly wage). The former methodology lacked adaptability, creating challenges for FMCSA in addressing questions from various stakeholders about analyses that quantify safety benefits. The Agency built on existing work from FMCSA, the Federal Highway Administration (FHWA), and NHTSA, to develop this new methodology.

Methodology

As mentioned previously, FMCSA relies on the FHWA report on Crash Costs for Highway Safety Analysis, which enumerates different methodologies that can be utilized to develop crash costs for various uses such as, but not limited to, BCAs for various DOT policies and

¹ FMCSA Pocket Guide, available at: <u>https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/2024-04/FMCSA%20Pocket%20Guide%202023-FINAL%20508%20-%20April%202024.pdf</u>

² Fatality Analysis Reporting System. Available at: <u>https://www.nhtsa.gov/research-data/fatality-analysis-reporting-system-fars</u>

³ Crash Report Sampling System. Available at: <u>https://www.nhtsa.gov/crash-data-systems/crash-report-sampling-system</u>

regulations.⁴ After careful consideration of various methodologies, FMCSA implemented an approach similar to that of the 'FHWA Safety BCA tool Crash Costs' detailed in Chapter 6 of the FHWA report, which uses NHTSA comprehensive cost estimates as a basis and develops a process for translating injuries from the KABCO scale (outlined in Table 1 below) to the Maximum Abbreviated Injury Scale (MAIS).⁵ Consistent with NHTSA's methodology as described in The Economic and Societal Impact of Motor Vehicle Crashes, 2019 (Revised),⁶ FMCSA developed a comprehensive cost estimate for each injury severity on the MAIS scale. The MAIS scale ranks injury severity in 7 categories, from MAIS 0 – no injury to MAIS 6 – Fatality, as shown in the table below:

Table 1: Scale Description						
MAIS Value	Injury Description	KABCO Scale	Injury Description			
0	No Injury	0	Property Damage Only			
1	Minor	С	Possible Injury			
2	Moderate	В	Non-incapacitating injury (Suspected Minor injury)			
3	Serious	А	Incapacitating injury (Suspected Serious)			
4	Severe					
5	Critical					
6	Maximum Fatal	K	Fatal			

https://safety.fhwa.dot.gov/hsip/docs/fhwasa17071.pdf, Accessed on July 2, 2024

⁵ The KABCO scale is less specific than the MAIS scale; ranking injury severity into 5 categories. The data used for injuries and fatalities is reported on the KABCO scale. Definition available here:

https://safety.fhwa.dot.gov/hsip/spm/conversion_tbl/pdfs/kabco_definitions.pdf, Accessed on July 2, 2024 ⁶Blincoe, L., Miller, T., Wang, J.-S., Swedler, D., Coughlin, T., Lawrence, B., Guo, F., Klauer, S., & Dingus, T. (2023, February). The economic and societal impact of motor vehicle crashes, 2019 (Revised) (Report No. DOT HS 813 403). National Highway Traffic Safety Administration.

⁴ Crash Costs for Highway Safety Analysis, January 2018. Available at:

⁷ Ibid

⁸ Departmental guidance on Value of Statistical Life. Available at <u>https://www.transportation.gov/office-</u> policy/transportation-policy/revised-departmental-guidance-on-valuation-of-a-statistical-life-in-economic-analysis

⁹ Hagemann, Garrett, et al. *Delay and Environmental Costs of Truck Crashes*, March 2013.

Comprehensive costs include economic costs and costs associated with Quality Adjusted Life Years (QALY). Economic costs include lost productivity; medical costs; legal and court costs; emergency service costs; insurance administration costs; congestion costs; property damage; and workplace losses.⁷ In lieu of QALY estimates, FMCSA calculates the societal impact as a fraction of the VSL based on the severity of the injuries, as outlined in NHTSA's report. FMCSA took this approach as our analyses rely generally on VSL estimates and not on QALYs. DOT provides guidance on the VSL for use in BCAs.⁸

Similar to NHTSA, FMCSA divides economic costs into two components, injury costs on a perperson basis and non-injury costs on a per-crash basis. FMCSA bases non-injury economic crash cost estimates in this methodology on the 2013 report, *Delay and Environmental Costs of Truck Crashes*, due to its focus on large truck and bus crashes.⁹ These estimates of non-injury costs are slightly higher than those in the NHTSA and FHWA reports but are specific to CMVs. As such, these estimates are more likely to represent the cost of non-injury crashes -- also known as property damage-only (PDO) crashes -- in our sphere. FMCSA is working on a study to update these non-injury costs related to delay, emissions, and property damages. FMCSA expects the study results to be available in 2025.

The first step of estimating crash costs is to ascertain both the total number of crashes and the number of individuals injured, categorized by the severity of their injuries. FMCSA sourced data on non-fatal crashes and injuries from CRSS while sourcing data on fatal crashes and injuries from FARS. As mentioned earlier, these crash incident records are based on police accident reports, which include injury severity levels on a five-level scale known as KABCO (see table above for classification scale and definitions).

FMCSA tallies crashes by injury severity, based on the most severe injury sustained in each crash. For instance, if a crash involving two vehicles where one person sustained a fatal injury (K) and another sustained a non-fatal A-level injury (i.e., incapacitating), FMCSA categorizes this as a fatal (K) crash. After tallying all crashes according to the maximum injury severity, FMCSA examines the number of individuals injured within each severity category. For instance, the fatal crash in the example above is accounted for in the row for "K" and includes one K-level fatality and one A-level injury in the corresponding Person-Level Injury Sustained.

FMCSA utilizes the MAIS translator, developed by NHTSA, to convert crashes and injuries from the KABCO scale (five defined categories) to the MAIS scale (seven numeric values). The MAIS scale comprises seven different injury severity levels, offering more detailed information for each type of injury and leading to more accurate crash cost estimates. The number of crashes on the KABCO scale is multiplied by the MAIS translator to estimate the number of individual crashes by MAIS level. FMCSA then applies the same process to injured persons, translating injuries from the KABCO scale to the MAIS scale.

To calculate the total unit cost of a crash per person, FMCSA combines the economic injury costs and the QALY costs from the NHTSA report:

• Injury Economic Costs: Costs taken directly from the NHTSA report. These include medical expenses, lost productivity, legal costs, and other financial losses resulting from a crash.

• Non-Injury Economic Costs: These costs include costs related to delays and property damage. They originate from FMCSA's research on Delay and Environmental Costs of Truck Crashes

• QALY Costs: Sourced from the NHTSA report and derived from DOT's VSL guidance, which provides an estimate of the disutility factor for each MAIS level, valued as a fraction of the VSL. For fatalities, costs are assessed using DOT's full VSL estimate.

Table 2: Disutility Factors for MAIS Scale				
Severity	Fraction of VSL			
MAIS 6	1			
MAIS 5	0.593			
MAIS 4	0.266			
MAIS 3	0.105			
MAIS 2	0.047			
MAIS 1	0.003			
MAIS 0	0			

FMCSA computes the total person injury costs for each MAIS level by multiplying the personunit crash costs and the number of injuries sustained in all crashes categorized by respective MAIS levels. FMCSA then divides the resulting total person injury costs for fatal, injury, and non-injury crashes (also known as PDO crashes) by the number of crashes in each respective injury severity category to estimate the total person-unit crash cost for fatal (MAIS 6), injury (MAIS 1-5), and PDO crashes (MAIS 0). Crash costs include NHTSA economic and QALY costs and estimated per injured person or damaged vehicle while excluding congestion and property damage costs, which are calculated per crash. As mentioned previously, congestion and property damage cost estimates are sourced from FMCSA's 2013 report, "Delay and Environmental Costs of Truck Crashes."

FMCSA utilizes the per-unit fatal crash cost of congestion for MAIS 6 crashes, the per-unit injury crash cost of congestion for MAIS 1-5 crashes, and the per-unit PDO crash cost of congestion for MAIS 0 crashes. Associated property damage and congestion costs are considered to be non-injury economic costs. FMCSA adopts the mean property damage crash cost from the 2013 report as a per-unit cost associated with property damages, irrespective of crash severity. Finally, FMCSA sums up the person-unit cost per crash and the congestion and property damage cost per crash, resulting in a comprehensive cost of a fatal crash, injury crash, and non-injury crash. Although the methodology provides aggregate costs for each crash type (non-injury, injury, and fatal crash), it can provide a crash cost estimate for each MAIS level.

The table below shows the comprehensive cost estimate of a bus crash, a large truck crash, and a combined crash cost of a large truck and bus. The table is subject to change as FMCSA periodically reviews and updates the methodology as new data sources become available.

Table 3: Cost per Crash in 2022 Dollars					
Crash Type	Bus	Large Trucks	CMV* (Weighted Average)		
Cost per Non-Injury Crash	\$46,173	\$46,765	\$46,612		
Cost per Injury Crash	\$404,863	\$383,168	\$385,306		
Cost per Fatal Crash	\$13,824,830	\$14,578,771	\$14,535,460		

Note: While some vehicles classified as large trucks or buses are not CMVs, this analysis does not distinguish between those vehicles due to the difficulty in authoritatively determining whether a vehicle is being used for commercial purposes.

Summary

The methodology involves a six-step process to calculate comprehensive costs for crashes. This includes assessing crash data on the KABCO scale, converting it to the MAIS scale, determining economic and QALY costs for each severity level, calculating total costs for non-injuries, injuries, and fatalities, and then computing unit costs by dividing the total by the number of crashes. Finally, non-injury costs are added to each injury severity level to determine the overall costs of crashes.

- Step 1: Ascertain the number of crashes and number of non-injuries, injuries, and fatalities on the KABCO scale
- Step 2: Translate the crashes, non-injuries, injuries, and fatalities into the MAIS scale
- Step 3: Add economic costs of injuries and QALY costs for the respective MAIS level
- Step 4: Multiply the number of non-injuries (MAIS 0), injuries (MAIS 1-5), and fatalities (MAIS 6) by the costs in step 3 to come up with total person economic costs + QALY costs
- Step 5: Divide the total person economic costs + QALY costs by the number of crashes to come up with a unit cost for each injury severity level
- Step 6: Add the non-injury costs (congestion and property damage costs) to the unit cost for each injury severity level to compute comprehensive costs for non-injury, injury, and fatal crash