

2. TREATMENT OF THE VALUES OF LIFE AND INJURY IN ECONOMIC ANALYSIS

2.1 THE APPROACH

This section addresses the treatment of the values of life and injury in economic analyses that support regulatory actions or investment decisions by the FAA. It is based on guidance furnished by the Office of the Secretary of Transportation (OST) via memorandum dated August 8, 2016. This guidance provides recommendations to all modal administrators on the treatment of the values of life and injury in economic analyses.

The benefit of preventing a fatality is measured by what is conventionally called the Value of a Statistical Life (VSL), defined as the additional cost that individuals would be willing to bear for improvements in safety (that is, reductions in risks) that, in the aggregate, reduce the expected number of fatalities by one. This conventional terminology has often provoked misunderstanding on the part of both the public and decision-makers. What is involved is not the valuation of life as such, but the valuation of reductions in risks. While new terms have been proposed to avoid mis-understanding, for the purpose of conducting Benefit Cost Analyses the FAA, like all other modes within the U.S. Department of Transportation will maintain the common usage of the research literature and OMB Circular A-4 in referring to VSL.

2.2 VALUE OF LIFE

For analyses conducted in 2016, OST guidance suggests that \$9.6 million be used as the current estimate for the VSL, measured 2015 dollars. To address the issue of uncertainty, OST notes that the following range of values (\$5.4 million to \$13.4 million) should be used when conducting sensitivity analysis.

The VSL is updated from previous year estimates using the following formula:

$$VSL_T = VSL_0 * (P_T/P_0)*(I_T/I_0)^\varepsilon,$$

Where

0 = Original Base Year

T = Updated Base Year

P_t = Price Index in Year t

I_t = Real Incomes in Year t

ε = Income Elasticity of VSL.

The Price index is the Consumer Price Index for All Urban Consumers Current Series (CPI); Real income is measured by the index: Median Usual Weekly Earnings (MUWE), not seasonally adjusted. The income elasticity for the current update in VSL from 2015 dollars to 2016 is assumed to be .055. For analyses using base years prior to 2015, the appropriate VSL are found below in Table 2-1.

Table 2-1: Prior Year VSL

Guidance Year	Values (millions\$)	Base Year
2015	9.4	2014
2014	9.2	2013
2013	9.1	2013

2.3 VALUE OF INJURIES

Nonfatal injuries are far more common than fatalities and vary widely in severity, as well as probability. OST guidance has established a procedure for valuing averted injuries based on the current value of life and the Abbreviated Injury Scale (AIS). AIS is a comprehensive system for rating the severity of accident-related injuries that recognizes six levels of injury severity. It classifies nonfatal injuries into five categories depending on the short-term severity of the injury. A sixth category corresponds to injuries that result in death 30 or more days after the accident. The five nonfatal AIS categories are based primarily upon the threat to life posed by an injury. Table 2-2 gives an overview of the classification of different injuries by AIS level and their threat to life.

Table 2-2: Selected Sample of Injuries by the Abbreviated Injury Scale (AIS)

AIS Code	Injury Severity Level	Selected Injuries
1	Minor	Superficial abrasion or laceration of skin; digit sprain; first-degree burn; head trauma with headache or dizziness (no other neurological signs).
2	Moderate	Major abrasion or laceration of skin; cerebral concussion (unconscious less than 15 minutes); finger or toe crush/amputation; closed pelvic fracture with or without dislocation.
3	Serious	Major nerve laceration; multiple rib fracture (but without flail chest); abdominal organ contusion; hand, foot, or arm crush/amputation.
4	Severe	Spleen rupture; leg crush; chest-wall perforation; cerebral concussion with other neurological signs (unconscious less than 24 hours).
5	Critical	Spinal cord injury (with cord transection); extensive second- or third-degree burns; cerebral concussion with severe neurological signs (unconscious more than 24 hours).
6	Unsurvivable	Injuries, which although not fatal within the first 30 days after an accident, ultimately result in death.

To establish a valuation for each AIS injury severity level, the level is related to the loss of quality and quantity of life resulting from an injury typical of that level. This loss is expressed as a fraction of the value placed on an avoided fatality.¹ These disutility factors are reported in Table 2-3 along with their corresponding dollar values (based on a \$9.4 million value of a statistical life). The fractions shown in column 3 of Table 2-3 should be multiplied by the

¹ The disutility factors or fractions are based on work conducted by Rebecca S. Spicer and Ted R. Miller. "Final Report to the National Highway Traffic Safety Administration: Uncertainty Analysis of Quality Adjusted Life Years Lost." Pacific Institute for Research and Evaluation. February 5, 2010.

current VSL to obtain the values of preventing injuries of the types affected by the government action being analyzed. For example, if an analyst were seeking to estimate the value of a “serious” injury (AIS 3), he or she would multiply the Fraction of VSL for a serious injury (0.105) by the VSL (\$9.6 million) to calculate the value of the serious injury (\$1,008,000). Values for injuries in the future would be calculated by multiplying these Fractions of VSL by the future values of VSL as defined above.

Where specific information is available on separate injuries by AIS level, the Office of Aviation Policy and Plans (APO) recommends that the values of prevented injuries be estimated separately according to Table 2-3. Often, more than one injury will be associated with a person injured in an aviation accident. If the valuation is presented on a per victim basis, the value of prevented injury for each injury suffered by the same person should be aggregated.

Table 2-3: Relative Disutility Factors by Injury Severity Level for Use with 3% or 7% Discount rates

AIS Code	Description of Injury	Fractional Fatality Values	Value of Life	Dollar Value
AIS 1	Minor	0.003		\$28,800
AIS 2	Moderate	0.047		\$451,200
AIS 3	Serious	0.105		\$1,008,000
AIS 4	Severe	0.266		\$2,553,600
AIS 5	Critical	0.593		\$5,692,800
AIS 6	Fatal	1.000		\$9,600,000

2.4 ICAO INJURY CLASSIFICATIONS

Although the methodology specified above should be used when possible, aviation injury data are often incomplete and/or unavailable at the AIS level. Most frequently, aviation injuries are reported by the number of victims suffering "serious" and "minor" injuries as reported by the National Transportation Safety Board and defined by the International Civil Aviation Organization (ICAO). Under this classification, serious injury victims are typically (but not always) those with at least one injury at AIS 2 or higher, whereas minor injury victims typically (but not always) have injuries at the AIS 1 level only.

To calculate economic values for the ICAO serious injury categories, APO took a simple average of the disutility factors for AIS 2 through AIS 5 and used these values to create a simple average level of disutility. These values were then applied to current VSL to estimate the value of preventing serious injuries as defined by ICAO. Table 2-4 reports these values along with those values where there is direct match in terminology between AIS Codes and the NTSB Classifications.

Table 2-4: Relative Disutility Factors by Injury Severity Level Based on the NTSB Classification of Injuries for Use with 3% or 7% Discount rates

AIS Code (Description of Injury)	NTSB Classification	Modified Fractional Fatality Values Value of Life	Dollar Value
AIS 1 / Minor	Minor	0.003	\$28,800
AIS 2 / Moderate	Serious	0.253	\$2,428,800
AIS 3 / Serious			
AIS 4 / Severe			
AIS 5 / Critical			
AIS 6 / Fatal	Fatal	1.000	\$9,600,000