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KABCO-to-MAIS Translators - 2022 Update

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16. Abstract

This report documents the process of revising a family of KABCO-to-MAIS translators developed for NHTSA's 2010 crash cost estimates (Blincoe et al., 2015). KABCO and MAIS are two injury rating systems. KABCO ratings represent police-reported injury severity as assessed by law enforcement responding to investigate the scene. The MAIS (Maximum Abbreviated Injury Scale) represents the maximum injury severity of an occupant at an Abbreviated Injury Scale (AIS) level. AIS is an anatomically based injury severity scoring system that classifies injury on a 6-level severity scale. NHTSA maintains nationally representative crash databases that are primarily based on police-reported crash records in which injuries are categorized only by KABCO ratings. These crash databases include the Fatality Analysis Reporting System (FARS), the General Estimates System (GES), and Crash Research Sampling System (CRSS). However, NHTSA periodically published crash cost estimates based on the more precise MAIS injury rating. To use the established MAIS-based crash cost, most of NHTSA's regulatory impact analyses also disaggregate the corresponding safety populations by MAIS rating to estimate their economic values. KABCO-to-MAIS translators are tools NHTSA uses to convert KABCO injuries to their MAIS equivalent injuries, which lets researchers derive costs for specific crash populations using the MAIS-based unit costs. Furthermore, the KABCO-to-MAIS translators allow injury data from more than one dataset to be compared and combined for injury research under a standardized injury rating. This revision establishes translators that reflect the most current real-world crash environments.

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Introduction

This report documents the process of revising a family of KABCO-to-MAIS translators developed for NHTSA's 2010 crash cost estimates (Blincoe et al., 2015). KABCO[1] and MAIS[2] are two injury rating systems. KABCO ratings represent police-reported injury severity as assessed by law enforcement responding to investigate the scene. The MAIS (Maximum Abbreviated Injury Scale) represents the maximum injury severity of an occupant at an Abbreviated Injury Scale (AIS) level. AIS is an anatomically based injury severity scoring system that classifies injury on a 6-level severity scale. NHTSA maintains nationally representative crash databases that are primarily based on police-reported crash records in which injuries are categorized only by KABCO ratings. These crash databases include the Fatality Analysis Reporting System (FARS), the General Estimates System (GES), and Crash Research Sampling System (CRSS). However, NHTSA periodically published crash cost estimates based on the more precise MAIS injury rating. To use the established MAIS-based crash cost, most of NHTSA's regulatory impact analyses also disaggregate the corresponding safety populations by MAIS rating to estimate their economic values. KABCO-to-MAIS translators are tools NHTSA uses to convert KABCO injuries to their MAIS equivalent injuries, which lets researchers derive costs for specific crash populations using the MAIS-based unit costs. Furthermore, the KABCO-to-MAIS translators allow injury data from more than one dataset to be compared and combined for injury research under a standardized injury rating. This revision establishes translators that reflect the most current real-world crash environments. To distinguish different versions of translators in this report, the current translators represent those developed for the 2010 crash cost report and are noted as the T0-series while the revised version is noted as the T-series.

[1] K: killed, A: Incapacitating Injury, B: Non-Incapacitating Injury, C: Possible Injury, O: No Injury. In addition, the attribute U represents "Injured, Unknown Severity" and Unk represents both "Unknow if Injured" and "Not Reported".

[2] MAIS represents the maximum injury severity of an occupant at an AIS level, i.e., the highest single AIS for a person with one or more injuries. AIS is a classification system developed and published by the Association for the Advancement of Automotive Medicine for assessing impact injury severity and is used for coding single-injury and more than one injury or assessing cumulative effects of more than one injury. AIS ranks individual injuries by body region on a scale of 1 to 6: 1=minor, 2=moderate, 3=serious, 4=severe, 5=critical, and 6=maximum (untreatable). MAIS 0 means no injury.

Current Translators (T0-series)

The current T0-series translators, established for the NHTSA's 2010 cost estimates, are expected to be continuously used until the revised T-series translators are officially published. The T0-series translators were based on the 2000-2008 Crashworthiness Data Systems (CDS) and 1982–1986 National Accident Sampling System (i.e., nicknamed Old-NASS). The average of CDS cases combined with the average of non-CDS cases in Old-NASS of the selected databases years served as the annual baseline crash cases for developing the T0-series translators. Of these two databases, CDS is a nationally representative sample of passenger vehicle (PV) crashes where at least one PV was towed due to damage from the crash site. PVs are vehicles with gross vehicle weight ratings less than or equal to 10,000 pounds including passenger cars, SUVs, and light trucks and vans. CDS is a stratified, multistage, unequal selection probability design sample (Zhang & Chen, 2013). The data system collects detailed, in-depth crash, vehicle, and occupant information in addition to those recorded in the police crash report by investigating motor vehicle crashes through interviews, medical records, vehicle inspection, and scene inspection. Detailed injury information using AIS was recorded only for occupants in PVs. In contrast, Old-NASS was also a nationally representative sampling system of crashes on public roadways, but for all crash severity levels and all vehicle types. As the nickname indicates, Old-NASS is an older dataset compared to CDS and does not reflect the vehicle technology improvements and driver behavior over time. Therefore, to balance between the representation of crashes and modernity of vehicles and to reflect MAIS injury coding updates between CDS and Old-NASS, these two databases were combined to derive the T0-series. Because these two databases were combined, T0-series mixed the 1998 version of MAIS in CDS with 1990 and older versions in Old-NASS.

The T0-series translators included an overall translator applicable to all police-reported crash populations in the United States and several translators, each for a specific sub-crash population. They are as follows.

1. T0, for all people in both CDS cases and non-CDS cases
2. $T0_{CDS,}$ for all people in CDS cases
3. $T0_{non\text{-}CDS}$, for all people in non-CDS cases
4. $T0_{non\text{-}CDS,\ Occupants}$, for all occupants excluding motorcyclists in non-CDS cases
5. $T0_{non\text{-}CDS,\ non\text{-}Occupants}$, non-occupants, motorcyclists, pedestrians, and cyclists in non-CDS cases[3]

For (4) above, the translator was further separated into two subpopulations by belt use status: $T0_{non\text{-}CDS,\ Occupants\ Belted}$ for belted subpopulation and $T0_{non\text{-}CDS,\ Occupants\ Unbelted}$ for unbelted. Furthermore, a translator for CDS-equivalent cases from Old-NASS ($T0_{Old\text{-}NASS,\ CDS\text{-}Equivalent}$) was also developed for comparison purposes and was not specifically used in the 2010 crash cost report. However, $T0_{CDS,\ Old\ NASS}$ is used for the revision process. Of these translators, T0 was based on CDS cases and non-CDS cases from Old-NASS, $T0_{CDS}$ was based solely on CDS, and the remaining translators with "non-CDS" imbedded in the subscripted index were all based on Old-NASS data. Figure 1 depicts the family of current translators. The Supplemental Data section presents these translators.

[3] NHTSA also examined the subpopulation specifically for pedestrians and cyclists. This translator was not used and therefore is not provided in this note.

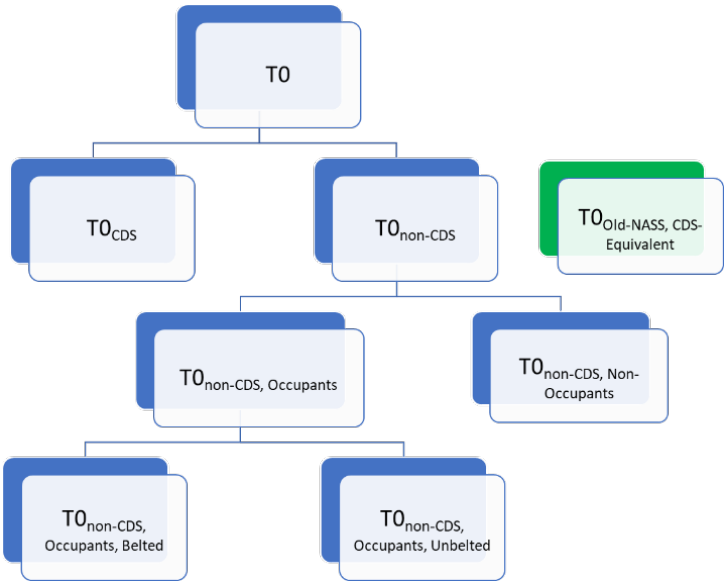

Figure 1. Current Family of KACBO-to-MAIS Translators (T0-series)

Fundamental Methodology for T0-Series Translators

The fundamental methodology for deriving the T0-series translators was to cross-tabulate KABCO and MAIS injuries from CDS and Old-NASS, the two nationally representative crash databases recorded both KABCO and MAIS injury rating systems. All occupants were included in the analysis. Fatalities were identified and separated from MAIS 0-6 non-fatal injuries. To reduce the uncertainty stemming from the small sample of rare but serious injuries, MAIS 6 non-fatal injuries were combined with MAIS 5 non-fatal injuries into MAIS 5 injury level in this process. Then, there were two imputations to address two types of unknowns for each KABCO level. The first one is for occupants with MAIS coded as unknown. These unknowns were distributed among known MAIS 0-6 according to their relative ratios with 6 representing fatality. The second imputation is for occupants with MAIS coded as "Injured, Severity Unknown." These occupants were distributed among injured categories, i.e., MAIS 1 to 6.

For police-reported injury severity, other than K, A, B, C, and O, there is another symbol U that represents "Injured, Severity Unknown." As a result, the police-reported injury scale has 6 levels. In all, MAIS injuries have 7 levels, MAIS 0-6 (6 represents fatalities). A KABCO-to-MAIS translator thus can be mathematically expressed by a 7x6 matrix as follows.

$$\begin{bmatrix} O_0 & C_0 & B_0 & A_0 & K_0 & U_0 \\ O_1 & C_1 & B_1 & A_1 & K_1 & U_1 \\ O_2 & C_2 & B_2 & A_2 & K_2 & U_2 \\ O_3 & C_3 & B_3 & A_3 & K_3 & U_3 \\ O_4 & C_4 & B_4 & A_4 & K_4 & U_4 \\ O_5 & C_5 & B_5 & A_5 & K_5 & U_5 \\ O_6 & C_6 & B_6 & A_6 & K_6 & U_6 \end{bmatrix}$$

Where, the character in each column represents the corresponding police-reported severity. The subscripted numbers in each row represent MAIS levels with 6 for fatality. For each column, the sum of the 7 elements (or translation factors) is equal or rounded to 1 (or 100%). For example, for K injuries, $\sum_{i=0}^{6} K_i = 1$. Of these 7 elements, K_0 is the portion of fatalities that would be translated into MAIS 0 injuries, K_1 is the portion to MAIS 1 injuries, K_5 is the portion to MAIS 5 (and MAIS 6 injuries), and K_6 is the portion translated to fatality. The individual element in the matrix is also referred as the MAIS i factor for a specific KABCO. For examples, the element A_1 is the MAIS 1 factor for police-reported "A" injuries and B_2 is the MAIS 2 factor for "B" injuries. Finally, the fatalities were derived from FARS. FARS is a census of fatalities. Therefore, fatalities were not translated into non-fatal MAIS injuries. To reflect this ideal, K_0 to K_5 were set to be 0 and K_6 to be 1.

Revision Process

Ideally, the revision would follow the described methodology above and directly use the most currently available real-world crash data for KABCO and MAIS tabulations. Since there is no updated version of Old-NASS, this could be done by replacing CDS portion in T0-series with CISS, i.e., combining CISS and Old-NASS counts. However, Old-NASS now is 37 to 41 years old (as this is written). Over this time, vehicle occupants have become better protected due to increased belt use and more crashworthiness safety features. Additionally, many crash avoidance technologies have been implemented that can not only avoid crashes but mitigate crash severity. Furthermore, AIS has experienced several revisions to reflect the improvement of emergency response systems and medical treatments overtime. For example, Old-NASS was based on a pre-1993 AIS version while the 2000-2008 CDS was based on the AIS 1993 version (updated 1998). CISS records the AIS 2015 version. Given these concerns regarding the representativeness of Old-NASS of current vehicle safety designs and current crash environment, we decided not to directly incorporate Old-NASS cases with CDS (or CISS) cases as we did for the T0-series. Instead, we first derive the CDS-portion of translator and then establish other portions of translators by scaling the relative relationship between CDS and non-CDS cases and between non-CDS subpopulations from Old-NASS.

Overall, we examined five different KABCO-to-MAIS CDS-portion translators using 2000-2015 CDS and 2017-2019 CISS (2019 was the most current available year of data for CISS at the beginning of the translator analysis and the new cost study). The establishment of five CDS-portion translators was intended to discern the impact of significant changes over the years in CDS and between CDS and CISS by controlling for specific changes and then to enable selection of the most appropriate one. The significant changes that were controlled for were AIS revisions and injury reporting scope variations. NHTSA's CDS and CISS coding and editing manuals (NHTSA, 2010, 2014, 2015, 2020a, 2020b, 2019, and 2021) documented yearly changes in these details.

CDS reported two versions of AIS: the AIS 1990 version/updated in 1998 (noted as MAIS 1998 for translators) from 2000-2015 and AIS 2005 version/updated 2008 (noted as MAIS 2008) from 2010 onward. Other than AIS revision, CDS implemented injury reporting criterion changes in 2009 by limiting the injury reporting to occupants in PVs less than 11 years old when the crashes occurred. CISS is a modernized version of CDS but with a completely different sampling design. Its crash sample included cases where at least one PV was towed and not "towed due to damage" as imposed in CDS. With this, CISS would contain relatively more less severe crashes than would CDS. In addition, CISS injury reporting is applicable to all involved vehicles and without the age constraint that was implemented in the 2009- to 2015 CDS. Furthermore, CISS collects crashes that involved at least one PV towed from the crash site. The criterion is different from that for CDS that requires that at least one PV was towed due to damage. The 2019 CISS was the first year of CISS that provided information allowing CDS cases (towed due to damage) to be distinguished from non-CDS cases (towed not specified due to damage). It shows that 99 percent of 2019 CISS crashes were CDS cases. We expect that the 1 percent of non-CDS cases in 2019 most likely is similar for 2017 and 2018 CISS. The inclusion of an overall of 1 percent non-CDS cases is not expected to significantly impact the KABCO-to-MAIS results that were derived only from CDS cases. Therefore, CDS cases and CISS cases are considered interchangeable here. Table 1 summarizes the 5 CDS translators we examined and their corresponding MAIS version and data sources.

Table 1. CDS-Portion of KABCO-to-MAIS Translators by MAIS Version and Data Source

Translators	MAIS Versions	Years of Data	Data Sources
T0-series	Mixed MAIS 1990 and older versions	1982 - 1984 2000 - 2008	Old-NASS CDS
Examined 1	MAIS 1990, Updated 1998	2000 - 2008	CDS
Examined 2	MAIS 1990, Updated 1998	2009 – 2015	CDS*
Examined 3	MAIS 1990, Updated 1998	2000 - 2015	CDS**
Examined 4	MAIS 2005 (Updated 2008)	2000 - 2015	CDS**
Examined 5	MAIS 2015	2017 – 2019	CISS

* Injury reporting criterion change starting in 2009
** Combining two different injury reporting criteria

After comparing these five translators and considering the changes to the most current versions of MAIS, the examined translators 4 and 5 are reasonable candidates for replacing the CDS in T0-series. However, we decided using 2017 to 2019 Crash Investigation Sampling System (CISS; NHTSA's CISS coding and editing manuals, NHTSA 2020a, 2020b, 2019). Both Translators 4 and 5 have a similar distribution for "O" injuries and MAIS 1 injuries are overreported in "O" injuries compared to $T0_{CDS}$. For K, A, B and C injuries, Translator 5 assigns more of these injuries to MAIS 0 then does Translator 4. This is consistent with the generally downward injury severity trend due to vehicle safety improvements and medical advancements. Nevertheless, the sample size based on 3 years of CISS is a concern especially for MAIS 4-5 injuries and fatalities. Therefore, we recommend that the CISS-based translators be revised when more years of data are available. To identify the revised translators comparable to those shown in Figure 1, the word "CDS" would be replaced by "CISS." This portion of translator is noted as T_{CISS}.

As mentioned, for the non-CISS portion, there is no other database that can substitute for Old-NASS and T_{CISS} was established by from 2017-2019 CISS using the methodology described below. The non-CISS portions of translators were scaled from T_{CISS} based on the relationship between $T0_{Old\text{-}NASS,\ CDS\text{-}Equivalent}$ and $T0_{non\text{-}CDS}$ and the relative ratios between Old-NASS-based translators for sub-crash populations and $T0_{non\text{-}CDS}$. The revised T-series translators are shown in Figure 2.

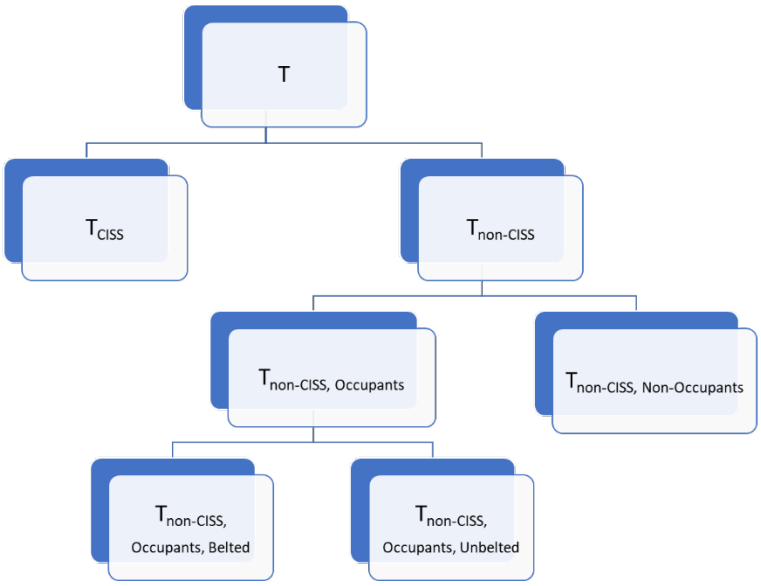

Figure 2. Revised KABCO-to-MAIS Translators (T-series)

The following describes the revisions and assumptions made for each individual step in deriving the T-series of KABCO-to-MAIS translators.

1. Establish T_{CISS} directly from 2017-2019 CISS and assign all K to MAIS fatality (i.e., $K_6 = 1$, K_0 to $K_5 = 0$) as described in the methodology section.
2. For $T_{non\text{-}CISS}$, collectively for all non-CISS cases, we assumed that the ratio of a translator factor in T_{CISS} to that in $T_{non\text{-}CISS}$ is equal to the comparable ratio between $T0_{Old\text{-}NASS,\ CDS\text{-}Equivalent}$ and $T0_{non\text{-}CDS}$. This implies CISS and non-CISS preserves the difference between CDS and non-CDS from Old-NASS. The assumption can be simply described by the mathematical equation 1a below:

$$\frac{T_{non\text{-}CISS}}{T_{CISS}} = \frac{T0_{non\text{-}CDS}}{T0_{Old\text{-}NASS,\ CDS\text{-}Equivalent}} \quad \text{---------- Equation 1a.}$$

$T_{non\text{-}CISS}$, the numerator on the left side of Equation 1a, can be derived by transforming the equation above into the following function:

$$T_{non\text{-}CISS} = \mathbf{T_{CISS}} * \frac{T0_{non\text{-}CDS}}{T0_{Old\text{-}NASS,\ CDS\text{-}Equivalent}} \quad \text{---------- Equation 1b.}$$

Where $\frac{T0_{non\text{-}CDS}}{T0_{CDS}}$ can be treated as the scale factor that indexed to T_{CISS}.

Equation 1b presents the general concept of how to establish $T_{non\text{-}CISS}$. The detail implementation of Equation 1b was performed by individual translator factor, e.g., K_0 in $T_{non\text{-}CISS} = K_0$ in T_{CISS} * the ratio of K_0 in $T0_{non\text{-}CDS}$ to that in $T0_{CDS}$. For each K, A, B, C, and O, if the sum of the 7 MAIS translator factors is not equal to 1, then each MAIS translator factor was adjusted by the sum to confirm to the probability principle, $\sum_{i=0}^{6} \text{MAIS i} = 1$, for each of the KABCO injury levels. Equation 1b can be refined to the following Equation 1c to reflect the detail implementation for each KABCO level:

$$T_{non\text{-}CISS}^{MAIS\ i} = \left(T_{CISS}^{MAIS\ i} * \frac{T0_{non\text{-}CDS}^{MAIS\ i}}{T0_{Old\text{-}NASS,\ CDS\text{-}Equivalent}^{MAIS\ i}}\right) / \sum_{j=0}^{6} T_{non\text{-}CISS}^{MAIS\ j}, \text{ for i from 0 to 6 ------- Equation 1c.}$$

Where, $T_{\text{non-CISS}}^{\text{MAIS i}}$ represents the MAIS i translation factor of $T_{\text{non-CISS}}$ for a particular KABCO, and $\frac{T0_{\text{non-CDS}}^{\text{MAIS i}}}{T0_{\text{CDS}}^{\text{MAIS i}}}$ represents the scale factor that indexed to $T_{\text{CISS}}^{\text{MAIS i}}$.

Also, in Equation 1c, the term $T_{\text{CISS}}^{\text{MAIS i}} * \frac{T0_{\text{non-CDS}}^{\text{MAIS i}}}{T0_{\text{Old-NASS, CDS-Equivalent}}^{\text{MAIS i}}}$ is referred as the intermediate translator later when providing specific data to describe the process in detail. After $T_{\text{non-CISS}}$ (i.e., the revised version of $T0_{\text{non-CDS}}$) is established, $T_{\text{non-CISS, Occupants, Belted}}$ and $T_{\text{non-CISS, Occupants, Unbelted}}$ for belted and unbelted non-CISS occupants, respectively, can be derived by a process similar to that described by Equations 1a to 1c.

3. For $T_{\text{non-CISS, Occupants, Belted}}$, we assumed that the ratio of $T_{\text{non-CISS, Occupants, Belted}}$ to $T_{\text{non-CISS}}$ is equivalent to that derived from Old-NASS, i.e.,

$$\frac{T_{\text{non-CISS, Occupants, Belted}}}{T_{\text{non-CIS5}}} = \frac{T0_{\text{non-CDS, Occupants, Belted}}}{T0_{\text{non-CDS}}} \text{ ---------- Equation 2a.}$$

Equation 2a then can be transformed into Equation 2b below:

$$T_{\text{non-CISS, Occupants, Belted}} = \mathbf{T_{non\text{-}CISS}} * \frac{T0_{\text{non-CDS, Occupants, Belted}}}{T0_{\text{non-CDS}}} \text{ ---------- Equation 2b.}$$

Where, $\frac{T0_{\text{non-CDS, Occupants, Belted}}}{T0_{\text{non-CDS}}}$ is the adjustment factor that adjusts $T_{\text{non-CISS}}$ to its belted portion.

Similar to the discussion above for Step 2, the detailed implementation of Equation 2b is described by Equation 2c that is identical to Equation 1c except for the notation changes to specify that this step limits to belted occupants:

$$T_{\text{non-CISS, Occupants, Belted}}^{\text{MAIS i}} = (T_{\text{non-CISS}}^{\text{MAIS i}} * \frac{T0_{\text{non-CDS, Occupants, Belted}}^{\text{MAIS 1-6}}}{T0_{\text{non-CDS}}^{\text{MAIS 1-6}}}) / \sum_{j=0}^{6} T_{\text{non-CISS, Occupants, Belted}}^{\text{MAIS j}}$$

-------- Equation 2c.

4. For $T_{\text{non-CISS, Occupants, Unbelted}}$, this repeats the belted step above but by substituting "Belted" for "Unbelted":

$$\frac{T_{\text{non-CISS, Occupants, Unbelted}}}{T_{\text{non-CIS5}}} = \frac{T0_{\text{non-CDS, Occupants, Unbelted}}}{T0_{\text{non-CDS}}} \text{ ---------- Equation 3a.}$$

Then,

$$T_{\text{non-CISS, Occupants, Unbelted}} = \mathbf{T_{non\text{-}CISS}} * \frac{T0_{\text{non-CDS, Occupants, Unbelted}}}{T0_{\text{non-CDS}}} \text{ ---------- Equation 3b.}$$

Where, $\frac{T0_{\text{non-CDS, Occupants, Unbelted}}}{T0_{\text{non-CDS}}}$ can be considered the adjustment factor from $T_{\text{non-CISS}}$ for unbelted translators.

In parallel, Equation 3c represents the detailed implementation of 3b for driving the unbelted potion of the translator.

$$T_{\text{non-CISS, Occupants, Unbelted}}^{\text{MAIS i}} = (T_{\text{non-CISS}}^{\text{MAIS i}} * \frac{T0_{\text{non-CDS, Occupants, Unbelted}}^{\text{MAIS 1-6}}}{T0_{\text{non-CDS}}^{\text{MAIS 1-6}}}) / \sum_{j=0}^{6} T_{\text{non-CISS, Occupants, Unbelted}}^{\text{MAIS j}}$$

-------- Equation 3c.

5. Similarly, for $T_{\text{non-CISS, non-Occupants}}$, again repeat the belted step by substituting "Belted" shown in Equations 2a, 2b, and 2c by "non-Occupants". The three comparable equations are:

   $$\frac{T_{\text{non-CISS, non-Occupants}}}{T_{\text{non-CIS5}}} = \frac{T0_{\text{non-CDS, non-Occupants}}}{T0_{\text{non-CDS}}}$$ ---------- Equation 4a.

   $$T_{\text{non-CISS, non-Occupants}} = \mathbf{T_{non\text{-}CISS}} * \frac{T0_{\text{non-CDS, non-Occupants}}}{T0_{\text{non-CDS}}}$$ ---------- Equation 4b.

   Where, $\frac{T0_{\text{non-CDS, non-Occupants}}}{T0_{\text{non-CDS}}}$ is the adjustment factor for deriving non-occupant potions of $T_{\text{non-CISS}}$.

   $$T^{\text{MAIS i}}_{\text{non-CISS, non-Occupants}} = (T^{\text{MAIS i}}_{\text{non-CISS}} * \frac{T0^{\text{MAIS 1-6}}_{\text{non-CDS, non-Occupants}}}{T0^{\text{MAIS 1-6}}_{\text{non-CDS}}}) / \sum_{j=0}^{6} T^{\text{MAIS j}}_{\text{non-CISS, non-Occupants}}$$

   --------- Equation 4c.

6. Finally, for T, i.e., the revised T0, it is the weighted combination of T_{CISS} and $T_{\text{non-CISS}}$. The corresponding weights are the proportions of CISS and non-CISS cases in 2017-2019 CRSS (NHTSA, 2021) and were derived separately by KABCO. T can be mathematically expressed as following:

   $$T = W_{CISS} * T_{CISS} + W_{\text{non-CISS}} * T_{\text{non-CISS}} = W_{CISS} * T_{CISS} + (1 - W_{CISS}) * T_{\text{non-CISS}}$$ ---------- Equation 5.

   Where, W_{CISS} and $W_{\text{non-CISS}}$ (= 1 - W_{CISS}) are weights.

In practice, W_{CISS} and $W_{\text{non-CISS}}$ were derived for each of the KABCO injury severity levels, i.e., Equation 5 was repeated for each of the KABCO levels.

Note that the revision process for non-CISS translators delineated the results from crash characteristics of any crash database that were used for this process. Therefore, to combine these translators, the combination weight should be based on the nationally representative crash database from which the KABCO injuries were derived. The typical example is specified in Step 6 above, which used 2017-2019 CRSS to derive weights for combining CISS and non-CISS portions. Weights from three years of data are expected to result in a relatively stable CISS to non-CISS ratio than those based on a single year. Thus, the resulted translator T is not expected to fluctuate greatly in near future. Nevertheless, we will continue monitoring the ratio and update the translators accordingly if we detect significant changes.

The Revised Translators (T-series)

Table 2 to Table 7 present six revised KABCO-to-MAIS translators by the order of their produced sequence as described above. These translators are in table format instead of a 7x6 matrix format. Section 5 provides the detail steps for deriving these translators. We note again that MAIS 0-5 distributions presented in these tables are non-fatal injuries and are based on AIS 2015 injury definitions.

Table 2. T_{CISS}

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	0.86231	0.33909	0.11560	0.05592	0.00000	0.42682
1	0.13249	0.57050	0.69558	0.32145	0.00000	0.46843
2	0.00484	0.06677	0.14142	0.30823	0.00000	0.06976
3	0.00037	0.02093	0.04018	0.23048	0.00000	0.02921
4	0.00000	0.00223	0.00599	0.05073	0.00000	0.00579
5	0.00000	0.00041	0.00027	0.02581	0.00000	0.00000
Fatality	0.00000	0.00007	0.00097	0.00739	1.00000	0.00000
Total	**1.00001**	**1.00000**	**1.00001**	**1.00001**	**1.00000**	**1.00001**

Source: 2017-2019 CISS

Table 3. $T_{non\text{-}CISS}$

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	0.96837	0.48604	0.17256	0.08253	0.00000	0.56884
1	0.03055	0.45438	0.67476	0.25167	0.00000	0.38645
2	0.00106	0.04459	0.11250	0.27431	0.00000	0.03383
3	0.00002	0.01434	0.03596	0.31920	0.00000	0.01059
4	0.00000	0.00039	0.00266	0.03532	0.00000	0.00029
5	0.00000	0.00027	0.00004	0.02998	0.00000	0.00000
Fatality	0.00000	0.00000	0.00153	0.00698	1.00000	0.00000
Total	**1.00000**	**1.00001**	**1.00001**	**0.99999**	**1.00000**	**1.00000**

Source: 2017-2019 CISS and 1982-1986 Old-NASS

Table 4. $T_{non\text{-}CISS,\ Occupants\ Belted}$

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	0.96179	0.53844	0.34551	0.34111	0.00000	0.91429
1	0.03764	0.42662	0.61614	0.33491	0.00000	0.06423
2	0.00054	0.01537	0.02322	0.22534	0.00000	0.01553
3	0.00003	0.01923	0.01273	0.08557	0.00000	0.00594
4	0.00000	0.00034	0.00240	0.01307	0.00000	0.00000
5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Fatality	0.00000	0.00000	0.00000	0.00000	1.00000	0.00000
Total	**1.00000**	**1.00000**	**1.00000**	**1.00000**	**1.00000**	**0.99999**

Source: 2017-2019 CISS and 1982-1986 Old-NASS

Table 5. $T_{non\text{-}CISS,\ Occupants\ Unbelted}$

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	0.96925	0.49704	0.19194	0.16511	0.00000	0.54331
1	0.02964	0.44883	0.70931	0.42861	0.00000	0.42957
2	0.00110	0.04580	0.08734	0.23952	0.00000	0.02712
3	0.00001	0.00821	0.00719	0.11951	0.00000	0.00000
4	0.00000	0.00000	0.00183	0.02870	0.00000	0.00000
5	0.00000	0.00012	0.00000	0.01395	0.00000	0.00000
Fatality	0.00000	0.00000	0.00240	0.00461	1.00000	0.00000
Total	**1.00000**	**1.00000**	**1.00001**	**1.00001**	**1.00000**	**1.00000**

Source: 2017-2019 CISS and 1982-1986 Old-NASS

Table 6. $T_{non\text{-}CISS,\ non\text{-}Occupants}$

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	0.78963	0.23652	0.05678	0.02005	0.00000	0.21272
1	0.18665	0.59452	0.65741	0.16548	0.00000	0.59820
2	0.02169	0.10879	0.19057	0.30187	0.00000	0.13746
3	0.00202	0.04539	0.08656	0.40583	0.00000	0.05086
4	0.00000	0.01251	0.00525	0.05261	0.00000	0.00077
5	0.00000	0.00227	0.00017	0.03603	0.00000	0.00000
Fatality	0.00000	0.00000	0.00328	0.01813	1.00000	0.00000
Total	**0.99999**	**1.00000**	**1.00002**	**1.00000**	**1.00000**	**1.00001**

Source: 2017-2019 CISS and 1982-1986 Old-NASS

Table 7. T, All People All Crash Types

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	0.93125	0.39052	0.12585	0.06124	0.00000	0.46375
1	0.06623	0.52986	0.69183	0.30749	0.00000	0.44712
2	0.00238	0.05901	0.13621	0.30145	0.00000	0.06042
3	0.00014	0.01862	0.03942	0.24822	0.00000	0.02437
4	0.00000	0.00159	0.00539	0.04765	0.00000	0.00436
5	0.00000	0.00036	0.00023	0.02664	0.00000	0.00000
Fatality	0.00000	0.00005	0.00107	0.00731	1.00000	0.00000
Total	**1.00000**	**1.00001**	**1.00000**	**1.00000**	**1.00000**	**1.00002**

Source: 2017-2019 CISS and 1982-1986 Old-NASS

The Supplemental Data

This section provides supporting data that are used in establishing the new translators. These included the current translators and the total counts from 2017 to 2019 CISS that were used for deriving T_{CISS}. In addition, the section also presents detail calculations for revision steps that were outlined in Section 3.

Currently Used T0-series Translators

Table 8 to Table 13 present the translators currently used by NHTSA and are required for the revision process. After the publication of the new cost report and this report, we recommend using the revised translators. Some of these translators were specified and used in the 2010 crash cost estimates and various other research reports and regulatory analyses. However, some translators were used simply as background processing components. These translators were not officially published nor have they been used independently by themselves. In addition to presenting the complete family of currently used translators, this section also presents adjustment factors that were derived for establishing the revised translators.

Table 8. $T0_{CDS}$

MAIS	Police-Reported Injury Severity System					
	O	**C**	**B**	**A**	**K**	**U**
	No Injury	**Possible Injury**	**Non-Incapacitating**	**Incapacitating**	**Fatality**	**Injured, Severity Unknown**
0	0.81906	0.21864	0.09063	0.03761	0.00000	0.24293
1	0.17590	0.70150	0.75167	0.57800	0.00000	0.59608
2	0.00470	0.06736	0.11126	0.19238	0.00000	0.10392
3	0.00019	0.01012	0.03477	0.12590	0.00000	0.04061
4	0.00001	0.00208	0.00852	0.04446	0.00000	0.00474
5	0.00012	0.00013	0.00143	0.01712	0.00000	0.01173
Fatality	0.00000	0.00015	0.00170	0.00452	1.00000	0.00000
Total	**0.99998**	**0.99998**	**0.99998**	**0.99999**	**1.00000**	**1.00001**

Source: 2000-2008 CDS

Table 9. $T0_{non\text{-}CDS}$

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	0.95789	0.25810	0.07013	0.02286	0.00000	0.11796
1	0.04091	0.67155	0.79825	0.45370	0.00000	0.76305
2	0.00114	0.05769	0.10373	0.26670	0.00000	0.09278
3	0.00005	0.01196	0.02591	0.21006	0.00000	0.02071
4	0.00000	0.00012	0.00145	0.02187	0.00000	0.00191
5	0.00000	0.00014	0.00013	0.02010	0.00000	0.00000
Fatality	0.00000	0.00045	0.00039	0.00473	1.00000	0.00359
Total	**0.99999**	**1.00001**	**0.99999**	**1.00002**	**1.00000**	**1.00000**

Source: 1982-1986 Old-NASS

Table 10. $T0_{non\text{-}CDS,\ Occupants,\ Belted}$

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	0.94906	0.30019	0.15581	0.09624	0.00000	0.51152
1	0.05029	0.66197	0.80879	0.61500	0.00000	0.34217
2	0.00058	0.02088	0.02375	0.22316	0.00000	0.11495
3	0.00007	0.01684	0.01018	0.05736	0.00000	0.03135
4	0.00000	0.00011	0.00145	0.00824	0.00000	0.00000
5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Fatality	0.00000	0.00000	0.00000	0.00000	1.00000	0.00000
Total	**1.00000**	**0.99999**	**0.99998**	**1.00000**	**1.00000**	**0.99999**

Source: 1982-1986 Old-NASS

Table 11. $T0_{non\text{-}CDS,\ Occupants,\ Unbelted}$

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	0.95910	0.26551	0.07766	0.03942	0.00000	0.10822
1	0.03970	0.66728	0.83542	0.66601	0.00000	0.81473
2	0.00118	0.05961	0.08017	0.20072	0.00000	0.07145
3	0.00002	0.00689	0.00516	0.06779	0.00000	0.00000
4	0.00000	0.00000	0.00099	0.01532	0.00000	0.00000
5	0.00000	0.00006	0.00000	0.00806	0.00000	0.00000
Fatality	0.00000	0.00066	0.00061	0.00269	1.00000	0.00562
Total	**1.00000**	**1.00001**	**1.00001**	**1.00001**	**1.00000**	**1.00002**

Source: 1982-1986 Old-NASS

Table 12. $T0_{non\text{-}CDS,\ non\text{-}Occupants}$

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	0.73701	0.10573	0.02212	0.00595	0.00000	0.02535
1	0.23585	0.73969	0.74557	0.31959	0.00000	0.67881
2	0.02201	0.11848	0.16845	0.31442	0.00000	0.21665
3	0.00477	0.03187	0.05979	0.28611	0.00000	0.05717
4	0.00035	0.00324	0.00274	0.03490	0.00000	0.00290
5	0.00000	0.00099	0.00053	0.02588	0.00000	0.00262
Fatality	0.00000	0.00000	0.00080	0.01316	1.00000	0.01651
Total	**0.99999**	**1.00000**	**1.00000**	**1.00001**	**1.00000**	**1.00001**

Source: 1982-1986 Old-NASS

Table 13. T0, All People All Crash Types

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	0.92534	0.23424	0.08336	0.03420	0.00000	0.21528
1	0.07258	0.68934	0.76745	0.55192	0.00000	0.62699
2	0.00198	0.06390	0.10884	0.20813	0.00000	0.10394
3	0.00008	0.01072	0.03187	0.14372	0.00000	0.03854
4	0.00000	0.00142	0.00619	0.03969	0.00000	0.00442
5	0.00003	0.00013	0.00101	0.01776	0.00000	0.01034
Fatality	0.00000	0.00025	0.00128	0.00458	1.00000	0.00048
Total	**1.00001**	**1.00000**	**1.00000**	**1.00000**	**1.00000**	**0.99999**

Source: 2000-2008 CDS and 1982-1986 Old-NASS

Table 14 below is the translator, $T0_{\text{Old-NASS, CDS-Equivalent}}$, which is a component required for developing adjustment factors as described in Step 1 of the revision process.

Table 14. $T0_{\text{Old-NASS, CDS-Equivalent}}$

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	0.82289	0.15964	0.04545	0.01408	0.00000	0.06790
1	0.17112	0.74752	0.79606	0.52679	0.00000	0.70957
2	0.00503	0.07658	0.12615	0.27242	0.00000	0.14676
3	0.00092	0.01548	0.02801	0.13788	0.00000	0.04383
4	0.00003	0.00061	0.00316	0.02856	0.00000	0.02945
5	0.00000	0.00019	0.00092	0.01573	0.00000	0.00070
Fatality	0.00000	0.00000	0.00024	0.00455	1.00000	0.00179
Total	**1.00000**	**1.00001**	**0.99999**	**1.00000**	**1.00000**	**0.99999**

Source: 2000-2008 CDS and 1982-1986 Old-NASS

CISS Occupants Counts

Table 15 provides the occupant data that retrieved from the 2017-2019 CISS. These were the imputed counts, i.e., after the imputation process that distributed two categories of unknowns. These were used for establishing T_{CISS}.

Table 15. All Occupant Counts from 2017-2019 CISS*

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	8,278,009	980,859	172,344	23,736	461	31,565
1	1,271,884	1,650,270	1,036,993	136,446	697	34,641
2	46,449	193,144	210,827	130,836	0	5,159
3	3,515	60,543	59,901	97,833	420	2,160
4	0	6,453	8,928	21,532	0	428
5	0	1,199	403	10,954	0	0
Fatality	0	188	1,439	3,138	49,477	0
Total	**9,599,857**	**2,892,655**	**1,490,835**	**424,476**	**51,055**	**73,953**

*Excluding cases with unknown police-reported injury severity

Detail Revision Steps

The following provides the detail calculations outlined in the Revision Process section for Step 2 to Step 5. Each step, calculations are presented in two tables showing critical results. The first table lists the scale factors and the second one shows the intermediate translator after applying the scale factors to the corresponding base translator that is the translator before adjusting the sum of MAIS translation factors for each of the KABCO level to 1.00000. In addition, for Step 6, Table 24 provides the weights that were used for combining T_{CISS} and $T_{non\text{-}CISS}$ to derive the overall translator, T.

For Step 2, $T_{non\text{-}CISS}$, Table 16 lists the scale factors, $\frac{T0_{non\text{-}CDS}}{T0_{Old\text{-}NASS,\ CDS\text{-}Equivalent}}$ (in Equation 1b), that would apply to the base translator T_{CISS}. Table 17 presents the intermediate $T_{non\text{-}CISS}$. The last row of Table 17 shows the column total, i.e., the sum of seven MAIS i factors for that police-reported injury severity. Dividing MAIS factors by this column total derives the final $T_{non\text{-}CISS}$ that is presented in Section 4, the Revised Translators (T-series). For example, for "O", MAIS 0 factor is 1.00378 and the column total is 1.03657. The MAIS 0 factor for "O" in $T_{non\text{-}CISS}$ thus is 0.96837 (= 1.00378/1.03657).

Table 16. Scale Factors for Deriving $T_{non\text{-}CISS}$

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	1.16406	1.61676	1.54301	1.62358	0.00000	1.73726
1	0.23907	0.89837	1.00275	0.86125	0.00000	1.07537
2	0.22664	0.75333	0.82228	0.97900	0.00000	0.63219
3	0.05435	0.77261	0.92503	1.52350	0.00000	0.47251
4	0.00000	0.19672	0.45886	0.76576	0.00000	0.06486
5	0.00000	0.73684	0.14130	1.27781	0.00000	0.00000
Fatality	**0.00000**	**0.00000**	**1.62500**	**1.03956**	**1.00000**	**2.00559**

Source: 1982-1986 Old-NASS

Table 17. Intermediate $T_{non\text{-}CISS}$

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	1.00378	0.54823	0.17837	0.09079	0.00000	0.74150
1	0.03167	0.51252	0.69749	0.27685	0.00000	0.50374
2	0.00110	0.05030	0.11629	0.30176	0.00000	0.04410
3	0.00002	0.01617	0.03717	0.35114	0.00000	0.01380
4	0.00000	0.00044	0.00275	0.03885	0.00000	0.00038
5	0.00000	0.00030	0.00004	0.03298	0.00000	0.00000
Fatality	0.00000	0.00000	0.00158	0.00768	1.00000	0.00000
Total	**1.03657**	**1.12796**	**1.03369**	**1.10005**	**1.00000**	**1.30352**

Source: 2017-2019 CISS and 1982-1986 Old-NASS

For Step 3, $T_{non\text{-}CISS,\ Occupants,\ Belted}$, in parallel to Step 2, Table 18 lists the scale factors $\frac{T0_{non\text{-}CDS,\ Occupants,\ Belted}}{T0_{non\text{-}CDS}}$ and Table 19 shows the intermediate translator results.

Table 18. Scale Factors for Deriving $T_{non\text{-}CISS,\ Occupants,\ Belted}$

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	0.99078	1.16308	2.22173	4.20997	0.00000	4.33639
1	1.22928	0.98573	1.01320	1.35552	0.00000	0.44842
2	0.50877	0.36193	0.22896	0.83675	0.00000	1.23895
3	1.40000	1.40803	0.39290	0.27306	0.00000	1.51376
4	0.00000	0.91667	1.00000	0.37677	0.00000	0.00000
5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Fatality	**0.00000**	**0.00000**	**0.00000**	**0.00000**	**1.00000**	**0.00000**

Source: 1982-1986 Old-NASS

Table 19. Intermediate $T_{non\text{-}CISS,\ Occupants,\ Belted}$

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	0.95944	0.56530	0.38338	0.34745	0.00000	2.46671
1	0.03755	0.44790	0.68367	0.34114	0.00000	0.17329
2	0.00054	0.01614	0.02576	0.22953	0.00000	0.04191
3	0.00003	0.02019	0.01413	0.08716	0.00000	0.01603
4	0.00000	0.00036	0.00266	0.01331	0.00000	0.00000
5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Fatality	0.00000	0.00000	0.00000	0.00000	1.00000	0.00000
Total	**0.99756**	**1.04989**	**1.10960**	**1.01859**	**1.00000**	**2.69794**

Source: 2017-2019 CISS and 1982-1986 Old-NASS

For Step 4, $T_{non\text{-}CISS,\ Occupants,\ Unbelted}$, Table 20 and Table 21 are two tables showing the calculations for deriving this specific translator.

Table 20. Scale Factors for Deriving $T_{non\text{-}CISS,\ Occupants,\ Unbelted}$

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	1.00126	1.02871	1.10737	1.72441	0.00000	0.91743
1	0.97042	0.99364	1.04656	1.46795	0.00000	1.06773
2	1.03509	1.03328	0.77287	0.75261	0.00000	0.77010
3	0.40000	0.57609	0.19915	0.32272	0.00000	0.00000
4	0.00000	0.00000	0.68276	0.70050	0.00000	0.00000
5	0.00000	0.42857	0.00000	0.40100	0.00000	0.00000
Fatality	**0.00000**	**1.46667**	**1.56410**	**0.56871**	**1.00000**	**1.56546**

Source: 1982-1986 Old-NASS

Table 21. Intermediate $T_{non\text{-}CISS,\ Occupants,\ Unbelted}$

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	0.96959	0.49999	0.19109	0.14232	0.00000	0.52187
1	0.02965	0.45149	0.70618	0.36944	0.00000	0.41262
2	0.00110	0.04607	0.08695	0.20645	0.00000	0.02605
3	0.00001	0.00826	0.00716	0.10301	0.00000	0.00000
4	0.00000	0.00000	0.00182	0.02474	0.00000	0.00000
5	0.00000	0.00012	0.00000	0.01202	0.00000	0.00000
Fatality	0.00000	0.00000	0.00239	0.00397	1.00000	0.00000
Total	**1.00035**	**1.00593**	**0.99559**	**0.86195**	**1.00000**	**0.96054**

Source: 2017-2019 CISS and 1982-1986 Old-NASS

For Step 5, $T_{non\text{-}CISS,\ non\text{-}Occupants}$, Table 22 and Table 23 provide the scale factor and corresponding intermediate results in the process of deriving this translator.

Table 22. Scale Factors for Deriving $T_{non\text{-}CISS,\ non\text{-}Occupants}$

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	0.76941	0.40965	0.31541	0.26028	0.00000	0.21490
1	5.76509	1.10147	0.93401	0.70441	0.00000	0.88960
2	19.30702	2.05374	1.62393	1.17893	0.00000	2.33509
3	95.40000	2.66472	2.30760	1.36204	0.00000	2.76050
4	0.00000	27.00000	1.88966	1.59579	0.00000	1.51832
5	0.00000	7.07143	4.07692	1.28756	0.00000	0.00000
Fatality	**0.00000**	**0.00000**	**2.05128**	**2.78224**	**1.00000**	**4.59889**

Source: 1982-1986 Old-NASS

Table 23. Intermediate $T_{non\text{-}CISS,\ non\text{-}Occupants}$

MAIS	Police-Reported Injury Severity System					
	O	C	B	A	K	U
	No Injury	Possible Injury	Non-Incapacitating	Incapacitating	Fatality	Injured, Severity Unknown
0	0.74507	0.19911	0.05443	0.02148	0.00000	0.12225
1	0.17612	0.50048	0.63023	0.17728	0.00000	0.34379
2	0.02047	0.09158	0.18269	0.32339	0.00000	0.07900
3	0.00191	0.03821	0.08298	0.43476	0.00000	0.02923
4	0.00000	0.01053	0.00503	0.05636	0.00000	0.00044
5	0.00000	0.00191	0.00016	0.03860	0.00000	0.00000
Fatality	0.00000	0.00000	0.00314	0.01942	1.00000	0.00000
Total	**0.94357**	**0.84182**	**0.95866**	**1.07129**	**1.00000**	**0.57471**

Source: 2017-2019 CISS and 1982-1986 Old-NASS

For Step 6, T (the equivalent of T0), T is the weighted combination of T_{CISS} and $T_{non\text{-}CISS}$. The weights for CISS and non-CISS were derived from 2017-2019 CRSS for each of the KABCO severity level. Table 24 lists these weights by KABCO.

Table 24. Weights (W_{CISS}, W_{non_CISS}) for Deriving T

MAIS	Police-Reported Injury Severity System					
	O	**C**	**B**	**A**	**K**	**U**
	No Injury	**Possible Injury**	**Non-Incapacitating**	**Incapacitating**	**Fatality**	**Injured, Severity Unknown**
W_{CISS}	0.35	0.65	0.82	0.80	0.85	0.74
W_{non_CISS}	**0.65**	**0.35**	**0.18**	**0.20**	**0.15**	**0.26**

Source: 2017-2019 CRSS

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