3.3   Severity Method

The severity method is based on converting each crash to a "property damage only" (PDO) equivalency. The severity of a crash is determined by the most severe injury involved in the incident regardless of the number of injuries (for example, if a crash has one A type injury and six C type injuries, then it is classified as an A type crash). The equivalent property damage only (EPDO) index is calculated using calibrated coefficients based on crash cost data and was last calibrated in 1995 (8). The severity index (SI) is essentially the EPDO for the average crash and is calculated by dividing the EPDO by the number of crashes (see Appendix B for EPDO and SI equations). This method is generally biased towards locations that have more severe crashes (such as rural locations) and is sensitive to the severity of the injuries involved in crashes.

TABLE 3.1
North Carolina Crash Severity Scale

Crash Severity	Description
K	One or more people are killed at the scene or die within 30 days of the crash due to injuries received from the crash.
A	One or more people receive incapacitating injuries that prevent the individuals from performing their normal activities for 24 hours or longer.
B	One or more people receive non-incapacitating injuries that are apparent at the scene and will not prevent the individual from performing their normal activities for more than 24 hours.
C	One or more people complain of pain or momentary unconsciousness; however, the injuries are not visible or obvious at the scene of the crash.
PDO	No one is injured and only property is damaged.

Public Vehicular Area (PVA)

North Carolina defines a public vehicular area (PVA) as any area used by the public for vehicle traffic (excluding private property) at any of the following locations (see G.S. §20-4.01, 32):

- Hospitals (public or private)
- Colleges, Universities, or other schools
- Orphanages
- Churches
- Any business, residential, or municipal establishment providing parking for patrons, customers, or the public
- Any park or other facility maintained by any part of the State of North Carolina
- Any property owned by the federal government but under the jurisdiction of the State of North Carolina

Run off Road Crash

A crash where the vehicle left the roadway onto a shoulder or other non-travelway surface or area.

Rural Crash

There are three separate definitions for rural crashes:

(a) A crash that occurs outside the boundaries of a municipality,
(b) A crash that occurs outside a designated urban area, or
(c) A crash that is indicated on the North Carolina Collision Form (form DMV-349) as occurring in an area with less than 30% development.

The HSIP uses definition (a) to define a rural crash.

Severity Index (SI)

The severity index is a measure of the severity of a crash or series of crashes. For a single crash, the severity index is the EPDO index of the crash. For a series of crashes, the severity index is the average EPDO index per crash (see Appendix B).

Target Crash

A target crash is a crash that is targeted by a specific warrant. For example, an angle type crash would be a target crash for Warrant I-1 because it is considered to be a frontal impact crash.

APPENDIX B

FORMULAS

$$E_1 = \frac{(ADT)(T)}{(100 \times 10^6)} \qquad E_2 = \frac{(ADT)(T)(L)}{(100 \times 10^6)}$$

$$EPDO_1 = C_1(K + A) + C_2(B + C) + PDO$$

$$SI = \frac{EPDO_1}{N} \qquad ER_n = \frac{EPDO_1}{E_n}$$

$$CR_n = \frac{N}{E_n} \qquad CCR_n = R + X\left(\sqrt{\frac{R}{E_n}}\right) + \frac{1}{2E_n}$$

$$EPDO_2 = \frac{K(K_c)}{PDO_c} + \frac{A(A_c)}{PDO_c} + \frac{B(B_c)}{PDO_c} + \frac{C(C_c)}{PDO_c} + PDO$$

$$EPDO_3 = \frac{K(K_m)}{PDO_m} + \frac{A(A_m)}{PDO_m} + \frac{B(B_m)}{PDO_m} + \frac{C(C_m)}{PDO_m} + PDO$$

$$OBR_i > M_2 + C_3\left(\sqrt{\frac{M_2}{V}}\right) + \frac{1}{2V}$$

NOTE – If this inequality is true, then the location would be flagged for further investigation based on the Rate Quality Control Method (see subsection 3.5). However, this method, and therefore this formula, are not currently used in the HSIP.

$$OB_i > M_1 + \left[(C_3) * (S)\right]$$

NOTE – If this inequality is true, then the location would be flagged for further investigation based on the Classic Statistical Method (see subsection 3.6). However, this method, and therefore this formula, are not currently used in the HSIP.

Where:

A $\quad$ = $\quad$ Number of A-type crashes

A_c $\quad$ = $\quad$ Comprehensive cost for A-type crashes

A_m $\quad$ = $\quad$ Average monetary cost for A-type crashes

ADT $\quad$ = $\quad$ Average daily traffic

B $\quad$ = $\quad$ Number of B-type crashes

B_c $\quad$ = $\quad$ Comprehensive cost for B-type crashes

B_m $\quad$ = $\quad$ Average monetary cost for B-type crashes

C $\quad$ = $\quad$ Number of C-type crashes

C_c $\quad$ = $\quad$ Comprehensive cost for C-type crashes

C_m $\quad$ = $\quad$ Average monetary cost for C-type crashes

C_1 $\quad$ = $\quad$ EPDO constant for K and A type crashes (currently, 76.8)

C_2 $\quad$ = $\quad$ EPDO constant for B and C type crashes (currently, 8.4)

C_3 $\quad$ = $\quad$ Level of confidence (LOC) constant:

TABLE B.1
Constant Values by Level of Confidence

Level of Confidence	Constant
90.00 %	1.282
92.50 %	1.440
95.00 %	1.645
97.50 %	1.960
99.00 %	2.327
99.50 %	2.576
99.75 %	2.810

CR_n $\quad$ = $\quad$ Crash rate for intersections/bridges (crashes per 100 MEV) or sections/strips (crashes per 100 MVM)

CCR_n = $\quad$ Critical crash rate (intersections/bridges or sections/strips)

E_1 = Vehicle exposure for intersections and bridges for the study period (in 100 million entering vehicles, or 100 MEV)

E_2 = Vehicle exposure for sections (strips) for the study period (in 100 million vehicle miles, or 100 MVM)

E_n = Vehicle exposure for intersections/bridges (100 MEV) or sections/strips (100 MVM)

$EPDO_1$ = Equivalent property damage only index (crashes)

$EPDO_2$ = Equivalent property damage only index (comprehensive cost)

$EPDO_3$ = Equivalent property damage only index (average monetary cost)

ER_n = EPDO rate for intersections/bridges (crashes per 100 MEV) or sections/strips (crashes per 100 MVM)

K = Number of fatal crashes

K_c = Comprehensive cost for fatal crashes

K_m = Average monetary cost for fatal crashes

L = Length of study area (in miles)

M_1 = Mean frequency (or rate, or severity)

M_2 = Mean crash rate for locations with characteristics similar to those of location i

N = Number of total crashes

OB_i = Crash frequency (or rate, or severity) at location i (selected location)

OBR_i = Observed crash rate at location i

PDO = Number of property damage only crashes (non-injury type crashes)

PDO_c = Comprehensive cost for property damage only crashes (non-injury type crashes)

PDO_m = Average monetary cost for property damage only crashes (non-injury type crashes)

R = Average crash rate for the specific category of roadway

S   =   Standard deviation for all locations

SI   =   Severity index

T   =   Time period (in days)

V   =   Volume of traffic at location i (in the same units as OBR_i)

X   =   Constant which determines the level of probability
         (97.5% level of probability is currently used, therefore, X=1.960)