Introduction

The Federal Highway Administration (FHWA) published a 2018 report in which national KABCO-level crash costs were derived and recommended[1]. Additionally, the report describes a method for updating the costs over time to account for the most recent economic conditions of each state, including Massachusetts. This memo provides the national crash costs provided by the FHWA report, the updated costs adjusted for Massachusetts as described in the report, and average costs for various facility types in Massachusetts. This memo was prepared using Massachusetts crash data from 2018 through 2022 as retrieved from MassDOT IMPACT[2] on February 2, 2025. This memorandum describes **Massachusetts crash costs in 2024 dollars**.

National Crash Costs by Crash Severity

The FHWA report derived and recommended comprehensive crash unit costs at each crash severity level. These crash costs are called "comprehensive" because they include both economic costs (i.e., lost wages, property damage, etc.) and costs from monetizing changes in quality-adjusted life years (QALY). National comprehensive crash costs, as recommended by FHWA, are provided below in **Table 1**, along with their economic and QALY components, in 2016 dollars.

Table 1 National Recommended KABCO Crash-Level Economic, QALY, and Comprehensive Costs in 2016 Dollars

Crash Severity	KABCO	Economic Crash Unit Costs	QALY Crash Unit Costs	Comprehensive Crash Unit Costs	Recommended Comprehensive Crash Unit Costs
Fatal Crash	K	$1,722,991	$9,572,411	$11,295,402	$11,295,400
Suspected Serious Injury Crash	A	$130,068	$524,899	$654,967	$655,000
Suspected Minor Injury Crash	B	$53,700	$144,792	$198,492	$198,500
Possible Injury Crash	C	$42,536	$83,026	$125,562	$125,600
Property Damage Only	O	$11,906	$0	$11,906	$11,900

Massachusetts-Specific Crash Costs by Severity

FHWA provides methods for either adjusting the national costs to Massachusetts or updating the crash costs using Massachusetts-specific crash distributions and the most recent economic indicators, including per capita income (PCI), Consumer Price Index (CPI), and Median Usual Weekly Earnings Index (MUWE). In the past, Massachusetts used the ratio of Massachusetts PCI to national PCI to convert national crash costs to Massachusetts crash costs and then used the CPI and MUWE to reflect the most

[1] Harmon, T., G. Bahar, & F. Gross. Crash Costs for Highway Safety Analysis. Report No. FHWA-SA-17-071. Federal Highway Administration, Washington, D.C. January 2018.

[2] MassDOT IMPACT was used to query crash data from 2018 through 2022.

recent economic conditions. This memo goes one step further by updating the underlying national crash severity distributions to reflect the Massachusetts-specific crash severity distributions. The following are the primary data sources for updating the crash costs to 2024 values.

1. MassDOT IMPACT was used to query crash data from 2018 through 2022.
2. Bureau of Labor Statistics (BLS) was used to obtain CPI and MUWE data for 2024.
3. Bureau of Economic Analysis (BEA) was used to obtain PCI data for 2023 (the most recent complete year at the time of this memo).

Table 2 presents the updated economic, quality-adjusted life-years (QALY), and comprehensive crash costs for Massachusetts in 2024 dollar values. Note the comprehensive crash costs are the sum of the economic and QALY crash costs.

Table 2 Summary of Massachusetts 2024 KABCO-Level Crash Costs

Severity	Economic Crash Unit Costs, 2024	QALY Crash Unit Costs, 2024	Comprehensive Crash Unit Costs, 2024	Recommended Comprehensive Crash Unit Costs, 2024
K	$2,802,716	$16,632,299	$19,435,015	$19,435,000
A	$208,586	$904,320	$1,112,906	$1,112,900
B	$90,540	$263,583	$354,124	$354,100
C	$66,751	$141,275	$208,026	$208,000
O	$20,898	$0	$20,898	$20,900

Average Costs by Facility Type

MassDOT developed average crash costs for standard facility types in the State. These are weighted based on average severity distributions of crashes at these facilities. VHB obtained crash proportions by querying crash data for 2018 through 2022 in IMPACT. For each facility type, the average total crash costs were calculated using **Equation 1**, the average KABC (sometimes referred to as fatal and injury, or FI) crash costs were calculated using **Equation 2**, average KAB crash costs were calculated using **Equation 3**, and the average KA crash costs were calculated using **Equation 4**.

$$\$_{Average,All}=\frac{N_{Crashes,K}*\$_{Mass,K}+N_{Crashes,A}*\$_{Mass,A}+N_{Crashes,B}*\$_{Mass,B}+N_{Crashes,C}*\$_{Mass,C}+N_{Crashes,O}*\$_{Mass,O}}{N_{Crashes,K}+N_{Crashes,A}+N_{Crashes,B}+N_{Crashes,C}+N_{Crashes,O}}$$

Equation 1 Calculation of Average Total Crash Costs

$$\$_{Average,FI}=\frac{N_{Crashes,K}*\$_{Mass,K}+N_{Crashes,A}*\$_{Mass,A}+N_{Crashes,B}*\$_{Mass,B}+N_{Crashes,C}*\$_{Mass,C}}{N_{Crashes,K}+N_{Crashes,A}+N_{Crashes,B}+N_{Crashes,C}}$$

Equation 2 Calculation of Average FI (KABC) Crash Costs

$$\$_{Average,KAB}=\frac{N_{Crashes,K}*\$_{Mass,K}+N_{Crashes,A}*\$_{Mass,A}+N_{Crashes,B}*\$_{Mass,B}}{N_{Crashes,K}+N_{Crashes,A}+N_{Crashes,B}}$$

Equation 3 Calculation of Average KAB Crash Costs

$$\$_{Average,KA}=\frac{N_{crashes,K}*\$_{Mass,K}+N_{crashes,A}*\$_{Mass,A}}{N_{crashes,K}+N_{crashes,A}}$$

Equation 4 Calculation of Average KA Crash Costs

where:

- $\$_{Average,All}$ is the average comprehensive cost for all crashes for the subject facility type;
- $\$_{Average,KA}$ is the average comprehensive cost for KA crashes for the subject facility type;
- $\$_{Average,KAB}$ is the average comprehensive cost for KAB crashes for the subject facility type;
- $\$_{Average,KABC}$ is the average comprehensive cost for KABC crashes for the subject facility type;
- $N_{Crashes,K}$ is the number of fatal crashes for the subject facility type;
- $\$_{Mass,K}$ is the comprehensive cost for a fatal crash in Massachusetts in 2024 dollars, $19,435,000 per **Table 2**;
- $N_{Crashes,A}$ is the number of suspected serious injury crashes for the subject facility type;
- $\$_{Mass,A\ is}$ the comprehensive cost for a suspected serious injury crash in Massachusetts in 2024 dollars, $1,112,900 per **Table 2**;
- $N_{Crashes,B}$ is the number of suspected minor injury crashes for the subject facility type;
- $\$_{Mass,B}$ is the comprehensive cost for a suspected minor injury crash in Massachusetts in 2024 dollars, $354,100 per **Table 2**;
- $N_{Crashes,C}$ is the number of possible injury crashes for the subject facility type;
- $\$_{Mass,C}$ is the comprehensive cost for a possible injury crash in Massachusetts in 2024 dollars, $208,000 per **Table 2**;
- $N_{Crashes,O}$ is the number of PDO crashes for the subject facility type (all crashes not coded as a fatal or injury crash); and
- $\$_{Mass,O}$ is the comprehensive cost for a PDO crash in Massachusetts in 2024 dollars, $20,900 per **Table 2**.

These average recommended comprehensive crash costs are displayed below in **Table 3** for the following facility types:

1. Urban Arterial 3-Leg Signalized Intersections (U3SG);
2. Urban Arterial 3-Leg Stop-Control Intersections (U3ST);
3. Urban Arterial 4-Leg Signalized Intersections (U4SG);
4. Urban Arterial 4-Leg Stop-Control Intersections (U4ST);
5. Urban 2 Lane Undivided Arterial Segments (U2UA);
6. Urban 2 Lane Undivided Arterial Segments by MassDOT District;
    a. District 1 (U2UAD1);
    b. District 2 (U2UAD2);
    c. District 3 (U2UAD3);
    d. District 4 (U2UAD4);
    e. District 5 (U2UAD5);
    f. District 6 (U2UAD6);
7. Urban 4 Lane Undivided Arterial Segments (U4UA);
8. Urban 4 Lane Divided Arterial Segments (U4DA); and
9. Rural 2 Lane Undivided Arterial and Collector Segments (R2UAC).

Table 3 Summary of Recommended Costs for KA, KAB, FI, and Total Crashes by Facility Type

Facility Type*	Recommended KA Crash Costs	Recommended KAB Crash Costs	Recommended FI Crash Costs	Recommended Total Crash Costs
U3SG	$3,100,400	$680,600	$460,800	$142,400
U3ST	$2,673,200	$642,100	$440,300	$132,300
U4SG	$2,546,300	$631,400	$432,900	$141,300
U4ST	$2,183,300	$560,300	$398,400	$148,200
U2UA	$3,572,600	$921,500	$616,300	$160,500
U2UAD1	$3,300,600	$872,300	$626,300	$155,600
U2UAD2	$5,059,900	$1,124,100	$740,400	$193,900
U2UAD3	$3,642,200	$950,300	$613,600	$144,400
U2UAD4	$3,120,800	$861,100	$593,800	$153,500
U2UAD5	$3,198,000	$855,400	$579,500	$161,400
U2UAD6	$4,057,500	$969,100	$626,300	$170,500
U4UA	$3,421,200	$855,000	$562,700	$153,100
U4DA	$4,529,500	$947,600	$661,300	$170,400
R2UAC	$5,399,800	$1,444,300	$1,087,900	$283,300
All Facilities	$3,582,900	$835,100	$573,600	$160,200

*Note: These facility type codes correspond to those in the list prior to the table.

Average Network Screening Costs

MassDOT uses Equivalent Property Damage Only (EPDO) costs to rank Highway Safety Improvement Program (HSIP) intersection clusters. Like the approach taken to estimate the costs in Table 4, MassDOT estimated weighted average crash costs for different severity combinations for crashes at intersections. The 2024 comprehensive crash costs from Table 2 were used for the individual severity levels. The MassDOT IMPACT Cross-Tabulation tool was used to obtain the distribution of crashes by KABCO severity and Relation to Junction. The analysis included crashes with the following Relation to Junction attributes:

- Five-point or more;
- Four-way intersection;
- T-intersection;
- Traffic circle; and
- Y-intersection.

Table 4 summarizes the average costs and EPDO for different severity categories. EPDO is calculated using **Equation 5**.

$$EPDO = \frac{\$_{\text{Severity Category}}}{\$_{\text{PDO}}} \frac{\$_{\text{Severity Category}}}{\$20{,}900}$$

Equation 5 Calculation of EPDO

Table 4 Average EPDO for intersection crash severity for use in network screening

KABCO Severity Combination	Average Crash Cost	EPDO
K+A	$2,789,100	133
K+A+B	$675,800	32
K+A+B+C	$464,800	22
K+A+B+C+O	$146,400	7
A+B+C	$338,100	16
B+C	$283,000	14
K	$19,435,000	930
A	$1,112,900	53
B	$354,100	17
C	$208,000	10
O	$20,900	1