Restoring Interstate Durability for the Economy and Safety 4 Maine (RIDES 4 ME) Network of Projects
Maine Department of Transportation

U.S. Department of Transportation (USDOT)
FY 2026 Nationally Significant Multimodal Freight and Highways Projects (INFRA) Grant Program

Funding Opportunity Number: NSMFHP-26-INFRA

BCA NARRATIVE

MDOT INFRA — BENEFIT-COST ANALYSIS

Technical Appendix

1. Executive Summary

The RIDES 4 ME Network of Projects proposes a $119.6 million reconstruction and safety improvement program across 66 directional miles of Interstate 295 and Interstate 95 in Maine. The Benefit-Cost Analysis demonstrates that the Project generates substantial, quantifiable economic benefits across four primary categories: avoided crash costs, reduced operations and maintenance expenditure under the No-Build scenario, avoided user delay costs from incident-driven detours, and reduced vehicle operating costs from those detours.

The analysis is prepared in accordance with USDOT's Benefit-Cost Analysis Guidance for Discretionary Grant Programs (December 2025 update) and uses the USDOT BCA Spreadsheet Template (December 23, 2025 version) as the primary quantitative model. All values are expressed in constant 2024 dollars, discounted at 7 percent real over a 30-year operational period beginning in 2033.

1.1 Summary of Results

Table 1 presents the discounted present value of all quantified benefit and cost categories. Detailed methodology and assumptions are provided in Sections 3 through 6.

Table 1. Summary of Discounted Benefits and Costs (7% Real, Constant 2024$, 30-Year Operational Period 2033–2062)

		7% NPV Summary	
	Total Benefits (Undiscounted)	Benefits	Costs
Capital Cost			($86,177,615)
Maintenance Cost Savings	$288,269,600	$69,397,783	
Safety	$217,248,449	$49,855,277	
Travel Time Savings	$232,151,518	$53,338,108	
Vehicle Operating Cost Savings	$2,115,011	$497,162	
Total	**$739,784,578**	**$173,088,330**	**($86,177,615)**

Net Present Value	**$86,910,715**
Benefit-Cost Ratio	**2.01**

1.2 Key Benefit Drivers

The three dominant benefit categories are:

- **Operations and Maintenance Cost Savings**

  The CY2025 recurring maintenance cost across all four project segments totals $36,957,641 annually, based on MaineDOT work-management system data. Under the No-Build scenario, this burden continues unchanged across the 30-year analysis period. Under the Build scenario, reconstructed pavement is expected to reduce recurring maintenance needs by approximately 26 percent, reflecting the elimination of pothole patching, small-area paving repairs, and other deterioration-driven maintenance activities that a newly constructed roadway does not require. This produces a net annual maintenance savings of approximately $9.61 million, generating a discounted benefit of **$69,397,783 NPV** over the 30-year analysis period.

- **Safety Benefits**

  The Project's safety treatments — cable median barrier and inside shoulder rumble strips on I-295, and shoulder rumble strips and pavement reconstruction across all four segments — are expected to produce material reductions in severe and fatal crashes. On I-295, the combined cable barrier and rumble strip treatment is estimated to reduce injury and fatal (KABC) crashes by 25.5 percent (CMF = 0.745) and cross-median crashes by approximately 88 percent (CMF = 0.119), per FHWA-HRT-17-071 (Srinivasan et al., 2017). Year-1 safety benefits total $6.68 million, growing at 1.0 percent annually with traffic volume, to a discounted **NPV of $49,855,277** over 30 years.

- **Travel Time Savings.**

  I-295 experiences approximately 52 incident events per year that require motorists to divert to alternative routes. Under the No-Build scenario, this incident frequency is assumed to continue; the Build scenario's reconstructed pavement is assumed to eliminate the deterioration-driven share of these events. Each event imposes a 30-minute delay on affected vehicles. Year-1 travel time savings total $6.70 million, growing with traffic volume to a discounted NPV of $53,338,108 over 30 years.

1.3 Unquantified Benefits

The following benefit categories were identified but excluded from the quantified BCR. Their exclusion is conservative and understates the total economic value of the Project:

- Freight reliability and supply-chain efficiency on I-95 (Primary Highway Freight System) and I-295 (primary north-south commercial corridor for Maine).
- Emissions reduction from improved pavement rolling resistance and reduced fuel consumption. Excluded per absence of a prescribed USDOT methodology for pavement reconstruction projects and lack of before/after IRI data for these segments.
- Social Cost of Carbon, excluded consistent with OMB Memorandum M-25-27.
- Pavement friction / skid resistance improvement effect on wet-surface crash reduction. A CMF of 0.87 applied to wet-surface crashes was considered but excluded from the

quantified model as a conservative assumption. The benefit is real but modest relative to the cable barrier and rumble strip treatments.

- Weigh-in-motion sensor benefits from improved overweight vehicle enforcement efficiency.
- Vehicle operating cost savings on I-295. Incremental detour mileage on I-295 is modest relative to highway mileage, producing a small VOC benefit that is immaterial to the overall BCR and is conservatively excluded from the quantified total. See Section 5.5.

2. Analysis Framework

2.1 Key Parameters

Table 2. BCA Framework Parameters

Parameter	Value	Source / Note
Discount rate	7.0% real	USDOT BCA Guidance
Dollar base year	Constant 2024 dollars	All undiscounted values in 2024$; template applies discounting.
Construction period	2027–2032 (6 years)	MaineDOT capital cost spending schedule
First year of operations	2033	
Operational analysis period	30 years (2033–2062)	Consistent with USDOT BCA Guidance for major pavement reconstruction.
Total project cost	$119,600,000	Inclusive of contingency.
Capital cost spending schedule	10% / 35% / 30% / 10% / 10% / 5% (2027–2032)	MaineDOT capital cost spending schedule, provided in current (2024) dollars.

2.2 Project Components

Table 3. Project Components and Key Traffic Characteristics

Component	WIN	Project Cost	AADT (2033)	Truck %	Primary Safety Treatments
I-295 SB, Yarmouth–Falmouth (22 mi)	26338.00	$28.0M	29,237	9%	Cable median barrier, rumble strips, pavement rehab, guardrail (33,500 LF)
I-295 NB, Topsham–Portland (22 mi)	26344.00	$28.0M	29,237	9%	Cable median barrier, rumble strips, pavement rehab, guardrail (33,000 LF)
I-95 SB, Newport–Pittsfield (7.5 mi)	26468.00	$20.0M	11,000	24%	Rumble strips, pavement rehab, guardrail (12,750 LF)

I-95 NB, Argyle–Howland (15 mi)	29472.00	$43.6M	5,027	16%	Rumble strips, pavement rehab, guardrail (5,200 LF)

2.3 Build and No-Build Scenarios

Build Scenario

All four components are constructed 2027–2032. From 2033, corridors operate with restored pavement, cable median barriers on I-295, MASH-compliant guardrail terminals across all segments, and functional shoulder rumble strips. The 4-inch high-polymer HMA structural section restores structural integrity to all four corridors, eliminating the deterioration-driven incidents and elevated maintenance burden that characterize the No-Build condition.

No-Build Scenario

Without the Project, all four corridors continue to deteriorate. Recurring annual maintenance is held at CY2025 actual levels throughout the analysis period. No cable median barriers, MASH guardrail terminals, or rumble strip restoration occur. Crash rates are held at the 2018–2025 average annual baseline and grow proportionally with traffic volume.

3. Safety Benefits

3.1 Crash History and Baseline

The crash baseline is drawn from MaineDOT Office of Safety crash summary reports for the eight-year period 2018–2025. Six reports were obtained: NB and SB for I-295 (Brunswick–Freeport–Yarmouth–Cumberland–Falmouth), and NB and SB for I-95 at Palmyra-Newport (Newport–Pittsfield) and Howland-Edinburg (Argyle–Howland). Crash counts are taken from each report's Section Detail page and individually reconciled to the stated totals. The full 8-year window is used; no year is excluded. The 2020 data reflects reduced COVID-19 traffic volumes and is retained for representativeness.

Table 4. Annual Crash Counts by Segment, 2018–2025

Segment	2018	2019	2020	2021	2022	2023	2024	2025	8-Yr Total	Avg/Yr
I-295 NB (WIN 26344.00)	98	143	81	99	115	131	132	141	940	117.5
I-295 SB (WIN 26338.00)	94	123	78	74	114	93	123	136	835	104.4
I-95 SB Newport-Pittsfield (WIN 26468.00)	8	15	9	14	15	13	17	21	112	14.0

I-95 NB Argyle-Howland (WIN 29472.00)	23	19	14	9	10	7	6	11	99	12.4
Combined In-Scope Total	**223**	**300**	**182**	**196**	**254**	**244**	**278**	**309**	**1,986**	**248.3**

3.2 KABCO Severity Distribution

Table 5. KABCO Severity Distribution — In-Scope Segments Combined, 2018–2025

Severity	I-295 NB	I-295 SB	I-95 SB Newport	I-95 NB Argyle	8-Yr Total	Avg/Yr
K — Fatal	3	3	0	2	8	1.0
A — Incapacitating Injury	9	12	1	2	24	3.0
B — Non-incapacitating	107	88	12	11	218	27.3
C — Possible Injury	103	93	12	16	224	28.0
PDO — Property Damage Only	717	639	87	68	1,511	188.9
Total	**940**	**835**	**112**	**99**	**1,986**	**248.3**

3.3 Crash Modification Factors

CMFs are applied using the HSM multiplicative method. CMFs targeting the same crash population are multiplied sequentially. CMFs are applied only to the crash population they specifically target.

3.3.1 Cable Median Barrier + Inside Shoulder Rumble Strips (I-295 Only)

Source: FHWA-HRT-17-071, Srinivasan et al., September 2017. Empirical Bayes before-after study, 455 treatment miles across Illinois, Kentucky, and Missouri. I-295 currently has no cable median barrier in the Yarmouth area. The applicable CMF set is Table 4 of FHWA-HRT-17-071 (before condition: no cable median barrier, no inside shoulder rumble strips).

Table 6. CMFs Applied — Cable Median Barrier + Rumble Strips, I-295 (FHWA-HRT-17-071, Table 4)

Crash Type	CMF	Std. Error	Application Note
Total crashes	1.247	0.034	Not used as a benefit — cable barriers increase total PDO crashes (barrier hits). All monetized benefit derives from injury/fatal and cross-median reductions below.

Injury and fatal (KABC)	0.745	0.040	Applied to K+A+B+C crashes on I-295 NB and I-295 SB separately. Statistically significant at 95% CL. Produces 25.5% reduction in injury crashes.
Cross-median (head-on + opp.-direction sideswipe)	0.119	0.053	Applied to head-on + opposite-direction sideswipe subset. Statistically significant at 95% CL. Fatal-weighted unit cost applied.

3.3.2 Shoulder Rumble Strips Alone (I-95 Segments)

Source: NCHRP Report 641, Torbic et al. (2009). CMF Clearinghouse Study ID 206. 5-star quality rating; included in the AASHTO Highway Safety Manual.

Applied to K and A (fatal and incapacitating injury) crash populations on I-95, where run-off-road fatal and injury crashes are concentrated.

Table 7. CMFs Applied — Shoulder Rumble Strips, I-95 Segments (NCHRP Report 641)

Crash Type	CMF	Std. Error	Application Note
Single-vehicle run-off-road — all severities	0.89	—	11% reduction on rural freeways.
Single-vehicle run-off-road — fatal + injury (SVROR FI)	0.84	—	Applied to K and A crash populations on I-95 SB Newport-Pittsfield and I-95 NB Argyle-Howland. B, C, and PDO crashes held at No-Build baseline.

3.3.3 Pavement Reconstruction — Surface Friction Restoration (Excluded from Quantified Model)

Pavement reconstruction restores surface friction across all four project segments, reducing the incidence of wet-weather and loss-of-control crashes. Published research indicates that improvements in pavement skid resistance are associated with meaningful reductions in wet-surface crash rates on interstate facilities. However, quantifying this benefit with confidence requires before/after skid number measurements for the specific project segments, which are not yet available. Accordingly, this benefit is excluded from the quantified safety calculation and treated as a conservative omission. Its exclusion understates the total safety benefit of the Project.

3.4 Year-1 Safety Benefit Calculation

Table 8 summarizes the Year-1 (2033) CMF-adjusted expected annual crashes and monetized safety benefit. The No-Build column reflects baseline crash rates monetized using USDOT BCA Guidance Appendix A, Table A-1a unit values. The Build column reflects crash rates after CMF application. The difference is the annual safety benefit, which grows at 1.0 percent annually with traffic volume through 2062.

Table 8. CMF-Adjusted Annual Safety Benefit, Year 1 (2033), Undiscounted 2024$

Segment / Treatment	Crash Population	Baseline Crashes/Yr	CMF	Build Crashes/Yr	No-Build Annual $	Build Annual $
I-295 NB	KABC	27.75	0.745	20.67	$11,606,493	$8,647,037
I-295 NB	Cross-median (subset)	0.25	0.119	0.03	$3,425,000	$407,575
I-295 NB	PDO (offset — increases)	117.50	1.247	29.02	$646,250	$805,874
I-295 SB	KABC	24.5	0.745	18.25	$11,333,161	$8,443,392
I-295 SB	Cross-median (subset)	0.13	0.119	0.01	$1,712,500	$203,788
I-295 SB	PDO (offset — increases)	104.38	1.247	25.78	$574,090	$715,890
I-95 SB Newport	K + A only	1.13	0.840	0.95	$3,344,985	$2,809,787
I-95 NB Argyle	K + A only	1.50	0.840	1.26	$3,414,600	$2,868,264
Net Annual Safety Benefit — Year 1					**$29,057,088**	**$22,896,357**
Net Annual Benefit (No-Build minus Build)					**$6,160,731**	**—**

Note: *PDO rows are offsets (cable barrier increases barrier-hit PDO crashes). The net benefit accounts for both the KABC reduction and the PDO increase. Figures in this table are presented at the segment and crash-population level for transparency; the Year-1 safety benefit used in the BCA model ($6,245,483) is calculated separately at the aggregate severity level and may differ modestly from the sum of rows above due to differences in how each approach combines crash-type reductions. Safety benefits grow at 1.0% annually with traffic volume.*

3.5 Monetization Values

Crash costs are monetized using USDOT BCA Guidance Appendix A, Table A-1a unit values (2024 dollars): K = $13,700,000; A = $1,302,300; B = $256,300; C = $122,400; PDO = $5,500.

4. Operations and Maintenance Cost Savings

4.1 No-Build Recurring Baseline

The No-Build recurring annual maintenance cost represents the cost of maintaining all four project segments under a scenario in which no capital reconstruction occurs. These costs are derived from CY2025 actual expenditures recorded in MaineDOT's work-management system at the work-report level, covering labor, equipment, and material charges per route segment. CY2025 reflects conditions on corridors with documented pavement deterioration, and the associated maintenance activities — including patrolling, incident response, surface repair, and guardrail maintenance — are characteristic of the elevated operational burden imposed by aging infrastructure in declining condition. Under the No-Build scenario, this burden is assumed to continue at the CY2025 level throughout the 30-year analysis period.

The No-Build maintenance baseline is held flat in nominal terms and not escalated, which is a conservative treatment. In practice, deteriorating pavement typically generates increasing maintenance demands over time as surface distress worsens, meaning the true No-Build cost trajectory likely rises above the CY2025 baseline in later years of the analysis period.

Table 9. Recurring Annual Maintenance Baseline (CY2025 Actuals)

Segment	Route Code / MP	CY2025 Cost
I-295 NB, Topsham–Portland (WIN 26344.00)	0295X, MP 8.47–32.01	$25,671,451
I-295 SB, Yarmouth–Falmouth (WIN 26338.00)	0295S, MP 20.58–44.15	$6,959,309
I-95 SB, Newport–Pittsfield (WIN 26468.00)	0095S, MP 147.74–154.88	$2,721,822
I-95 NB, Argyle–Howland (WIN 29472.00)	0095X, MP 199.84–215.31	$1,605,059
Total — All 4 Segments	**—**	**$36,957,641**

Source: *Work-order records. Traffic Management, IT operations, and street light costs are excluded, making this baseline conservative.*

4.2 Build Scenario O&M

Under the Build scenario, pavement reconstruction eliminates the deterioration-driven maintenance costs that characterize the No-Build condition. Routine corridor operations — including patrol, vegetation management, and non-pavement maintenance activities — continue under the Build scenario, but the elevated expenditures associated with aging pavement, incident response, and surface repair decrease materially following reconstruction. MaineDOT maintenance engineering guidance indicates that a newly reconstructed corridor requires approximately one-quarter less recurring maintenance than a corridor in the deteriorated condition reflected in the CY2025 baseline, reflecting the elimination of pothole patching, small-area paving repairs, and similar deterioration-driven activities. This analysis applies a 26 percent reduction, consistent with that guidance. The CY2025 baseline itself excludes several maintenance-relevant cost categories (traffic management, IT operations, and street lighting), making the No-Build baseline — and by extension the resulting savings estimate — conservative.

Table 9a. No-Build and Build Recurring Annual Maintenance, and Net Benefit

Scenario	Annual Cost
No-Build (CY2025 actual baseline)	$36,957,641
Build (74% of baseline)	$27,348,654
Net Annual O&M Benefit	**$9,608,987**

The net annual O&M benefit is calculated as the difference between the No-Build recurring baseline and the estimated Build maintenance cost, held flat across the 30-year analysis period. This produces a discounted benefit of **$69,397,783 NPV**. The savings are realized across all 44 directional miles of I-295 addressed by the Project, not concentrated in a single location.

5. Travel Time Savings and Vehicle Operating Cost Savings

5.1 Overview

Deteriorating pavement on the project corridors generates recurring incident events that require motorists to divert from the interstate to local routes. Each diversion event imposes travel time delay and incremental vehicle operating costs on affected vehicles. Under the Build scenario, pavement reconstruction eliminates the underlying cause of these deterioration-driven incidents, producing user cost savings equal to the avoided No-Build detour burden across the 30-year analysis period.

Detour routing and distances for all project segments are sourced from MaineDOT Bureau of Project Development field estimates and project coordination records. Incident frequency and delay assumptions are based on MaineDOT traffic operations data and are described in detail in Section 5.3.

5.2 Detour Data by Segment

Table 10. Detour Data by Segment

Segment / Sub-Segment	Detour Route	Hwy Mi	Detour Mi	Inc. Mi	Hwy Min	Detour Min	Inc. Time
I-295: Exit 10 (Falmouth) to Exit 15 (Yarmouth)	RTE 1	~4.2	4.50	(0.30)	~7	20	+15 min
I-295: Exit 15 (Yarmouth) to Exit 20 (Freeport)	RTE 1	~5.1	5.80	+0.70	~8	22.5	+17.5 min
I-295: Exit 24 (Freeport) to Exit 28 (Brunswick)	RTE 1	~4.68	5.25	+0.57	~7	29	+25 min

I-95 SB Newport–Pittsfield (WIN 26468.00)	RTE 100/11	7.5	9.0	+1.50	8	19	+11 min
I-95 NB Argyle–Howland (WIN 29472.00)	RTE 116	16.0	16.8	+0.80	15	25	+10 min

Note: *I-295 on-highway distances reflect MaineDOT-provided interstate mileage between interchanges. The resulting weighted-average incremental detour distance on I-295 (approximately +0.52 miles) is modest relative to the I-95 segments and produces a vehicle operating cost benefit that is immaterial to the overall BCR; it is conservatively excluded from the quantified total (see Section 1.3).*

5.3 Incident Frequency and Delay Assumptions

Table 11. Incident Frequency and Delay Assumptions, No-Build Scenario

Parameter	I-295	I-95 SB Newport	I-95 NB Argyle
Annual incident events — No-Build Year 1	52	20	9
Average delay per event (minutes)	30	11	10
Share of AADT affected per event	30%	25%	20%

Incident frequency reflects observed patrol and dispatch experience on the project corridors: I-295 experiences approximately one deterioration-driven incident event per week, while the I-95 segments experience a lower, traffic-proportional frequency. Average delay per event and the share of AADT affected reflect typical peak-period backup conditions on these corridors.

5.4 Travel Time Savings — Year-1 Calculation

Table 12. Year-1 (2033) Travel Time Savings by Segment, Undiscounted 2024$

Segment	AADT 2033	Vehicles Affected/Event	Delay (hr)	Events/Yr	Auto TT Cost/Event	Truck TT Cost/Event
I-295 (NB+SB combined)	29,237	8,771	0.50	52	$107,490	$14,683
I-95 SB Newport-Pittsfield	11,000	2,750	0.183	20	$8,353	$4,501
I-95 NB Argyle-Howland	5,027	1,005	0.167	9	$3,791	$997

Annual travel time savings per segment = (Auto TT Cost/Event × Events/Yr) + (Truck TT Cost/Event × Events/Yr). Combined Year-1 total: I-295 $6,352,964 + Newport $261,708 + Argyle $43,556 = $6,658,228. Discounted NPV over 30 years: $53,338,108.

Monetization rates (USDOT BCA Guidance Appendix A, Parameter Values tab): Personal travel VOT = $20.10/person-hour; Truck driver VOT = $37.20/vehicle-hour; Average vehicle occupancy = 1.34 persons/vehicle (weekday peak, Table A-3). Auto TT cost per event = Autos affected × 1.34 occupancy × $20.10 × delay hours. Truck TT cost per event = Trucks affected × $37.20 × delay hours.

5.5 Vehicle Operating Cost Savings

Vehicle operating cost savings reflect incremental mileage traveled on detour routes, valued at USDOT BCA Guidance Appendix A, Table A-4 rates: Light Duty Vehicles $0.56/mile; Commercial Trucks $1.23/mile.

Incremental detour mileage on I-295 is modest (weighted average approximately +0.52 miles across the three sub-segments), producing a Year-1 benefit of approximately $148,000. This category is immaterial to the overall BCR and is conservatively excluded from the quantified benefit total.

I-95 VOC savings reflect incremental detour mileage: Newport +1.50 miles; Argyle +0.80 miles. Year-1 combined I-95 VOC savings: approximately $65,500, growing with traffic volume. Discounted NPV over 30 years: **$497,162.** This category is also immaterial to the BCR but is included in the quantified total for completeness and transparency.

6. Capital Costs

Table 13. Capital Cost by Component

Component	WIN	Project Cost
I-295 SB, Yarmouth–Falmouth	26338.00	$28,000,000
I-295 NB, Topsham–Portland	26344.00	$28,000,000
I-95 SB, Newport–Pittsfield	26468.00	$20,000,000
I-95 NB, Argyle–Howland	29472.00	$43,600,000
Total	—	**$119,600,000**

6.1 Spending Schedule

Capital costs are stated in current (2024) dollars and are not escalated for inflation, consistent with the treatment of all other cost and benefit values in this analysis.

Table 14. Capital Cost Spending Schedule

Year	% of Total	$ Amount
2027	10%	$11,960,000
2028	35%	$41,860,000
2029	30%	$35,880,000
2030	10%	$11,960,000

2031	10%	$11,960,000
2032	5%	$5,980,000
Total	**100%**	**$119,600,000**

The spending schedule reflects the anticipated pace of construction, with the bulk of activity concentrated in 2028 and 2029 across all four project components, followed by close-out activity through 2032.

7. Data Sources and Citations

Crash data: MaineDOT Office of Safety crash summary reports, 2018–2025. Six reports: I-295 NB and SB (Brunswick–Freeport–Yarmouth–Cumberland–Falmouth); I-95 NB and SB at Palmyra-Newport (Newport–Pittsfield); I-95 NB and SB at Howland-Edinburg (Argyle–Howland). Section Detail page totals used for KABCO analysis.

Maintenance costs: MaineDOT CY2025 actual work-order records, by route segment.

Detour and incident data: MaineDOT Bureau of Project Development field estimates and traffic operations data, including on-highway and detour-route mileage, incident frequency, delay duration, and share of AADT affected per incident event.

CMF — Cable barrier + rumble strips: FHWA-HRT-17-071, Srinivasan et al., September 2017. Tables 3 and 4. Empirical Bayes before-after study.

CMF — Shoulder rumble strips: NCHRP Report 641, Torbic et al. (2009). CMF Clearinghouse Study ID 206. 5-star quality rating; HSM-included.

USDOT monetization values: USDOT BCA Guidance, November 2024 (December 2025 update). Appendix A Tables A-1a (crash costs), A-2 (VOT), A-3 (occupancy), A-4 (VOC). Parameter Values tab of USDOT BCA Spreadsheet Template, December 23, 2025 version.

AADT and truck percentages: MaineDOT traffic data, current-year counts with projected growth rates of 1.1 percent annually for I-295 and 0.5 percent annually for I-95.

Project cost: Project Narrative, July 2026. Total: $119.6M, inclusive of contingency. Federal request: $71,760,000.

Capital cost spending schedule: MaineDOT capital cost spending schedule by component and phase, provided in current (2024) dollars.