4-12-2012

Bridge Life Cycle Cost Analysis for Sarah Mildred Long Bridge (PIN 16710.00), April 20, 2012

Maine Department of Transportation

DRAFT

Bridge Life Cycle Cost Analysis
for
Sarah Mildred Long Bridge
PIN 16710.00

April 20, 2012

Prepared for:

Maine Department of Transportation

by:

HNTB

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A. Introduction

The Maine Department of Transportation (MaineDOT, Department), in cooperation with the New Hampshire Department of Transportation (NHDOT), is planning improvements to the existing Sarah Mildred Long (SML) Bridge located on the U.S. Route 1 Bypass between Kittery, Maine and Portsmouth, New Hampshire. The SML Bridge is approximately 2,750 feet long and contains a movable lift span with an approximate horizontal opening of 200 feet. The bridge is a double-deck structure with the U.S. Route 1 Bypass roadway deck on the upper level and a railroad deck on the lower level. The bridge consists of five truss spans (the middle span is movable), fifteen New Hampshire approach spans and seven Maine approach spans. A separate retractable span (rail deck only) exists within the Maine approach spans. The bridge was opened in 1940.

Recently, construction cost estimates were developed for three methods of improving or replacing the SML bridge. The three options considered included 1.) rehabilitating the truss spans, 2.) bridge replacement with a single level network tied arch structure along a new alignment upstream, and 3.) bridge replacement with a two-level truss structure along a new alignment upstream. All of the options included complete replacement of the approach girder spans. Detailed information on each of these options, including conceptual plans, are summarized in two HNTB reports titled "Construction Cost Estimates for Sarah Mildred Long Bridge, PIN 16710.00", dated February 10, 2012 and “Bridge Replacement Options for Sarah Mildred Long Bridge, PIN 16710.00”, dated March 16, 2012.

As a follow-up to these previous cost estimate reports, and as requested by the Department, life cycle cost analyses (LCCA) have been compiled for the three options listed above.

It is important to note that previous LCCA have been completed for this project and were used as a starting point for this effort. The Connections Study completed a LCCA for the rehabilitation and two deck replacement options and NHDOT recently provided an updated version of the LCCA for those options. Using this information as reference, a new LCCA was completed for those two options and for the one deck replacement option.

The LCCA is an evaluation technique used to compare and evaluate the economic feasibility of various design alternatives over an assumed service life-cycle. The LCCA approach utilizes a total cost comparison of various design alternatives to evaluate the economic feasibility of each design alternative. This process is explained in greater detail in the Federal Highway Administration’s August 2002 publication entitled *Life-Cycle Cost Analysis Primer*.

The LCCA costs were developed using a deterministic analysis based on minimal design computation for each of the alternatives under consideration and on engineering judgment. Capital construction, ROW and engineering costs were taken from estimates previously developed by HNTB. Mechanical and electrical maintenance and rehabilitation costs were based upon the overall system complexity, movable span weight, number of yearly lifts required for each option, cost data from other comparable projects. All other maintenance, rehabilitation and replacement values were developed based on conceptual repair quantities and current industry pricing when available. Contingencies were applied as appropriate. Engineering judgment was used to make certain assumptions when necessary, such as the frequency of maintenance and rehabilitation activities, or the cost of unusual or unique construction activities.

The complete LCCA’s for each alternative, including development of maintenance and construction values, are provided in Appendix A, B and C of this report. These estimates are not intended to be relied upon as a true measure for future construction and maintenance costs, but rather are rationalized order-of-

magnitude costs to be used as part of a comprehensive rating and selection process to select a preferred alternative.

B. Assumptions and Criteria

For this assignment, the following assumptions were used and are common to all three alternatives:

- All life cycle costs evaluate a 100 year period beginning with construction in 2012.
- All values are presented in 2012 dollars and include construction costs, design engineering and construction inspection where appropriate.
- A real discount rate of 4.0% was applied to the 2012 base year costs to assess the present value dollar equivalent for activities occurring in the future. This value matches the Maine-New Hampshire Connections study. FHWA notes real discount rates typically range from 3% to 5% (Note: The real discount rate represents the prevailing rate of interest on borrowed funds, less inflation).
- Initial capital costs were taken from previous cost estimate reports developed by HNTB and dated February 10, 2012 and March 16, 2012.
- Design and construction engineering for life cycle rehabilitation activities have each been estimated as 7% of construction value.
- Where appropriate, a 15% contingency has been applied to construction and mobilization has been assumed as 10% of construction.
- Items with costs common to all three alternates, such as underwater inspections, have been excluded from this analysis.
- User costs are not incorporated in this analysis.
- The limits of highway maintenance item(s) have been set equal for all three options, regardless of actual construction limits.
- Bridge inspection costs include routine and fracture critical NBIS inspections on a bi-annual basis. Inspection costs have been annualized to simplify development of the LCCA.
- The limits of railroad track and tie maintenance extend from bridge to bridge abutment. The railroad will be responsible for the maintenance of all track off the bridge.
- Given the infrequent usage of the bridge by railroad traffic when compared to typical railroad tracks, an extended track work rehabilitation interval of 50 years has been assumed. Track work rehabilitation is limited to portions of the track located on the bridge.

C. Rehabilitation of Existing Bridge

Description of Alternative

The work will include the rehabilitation of the truss lift span and truss fixed spans, construction of new roadway deck on the truss spans, complete replacement of the girder approach spans (including the rail deck, retractable railroad span will be rehabilitated), highway approach and intersection improvements and rail approach improvements.

The main span and railroad approach structures will consist of concrete NEXT beams and steel plate girders respectively.

Additional details on the rehabilitation option can be found in HNTB's cost estimate report titled "Construction Cost Estimates for Sarah Mildred Long Bridge, PIN 16710.00", dated February 10, 2012.

Assumptions for Rehabilitation Alternate

In addition to the general assumptions and description noted above, further details and assumptions specific to the LCCA for this alternative are noted below:

1. Following completion of the rehabilitation, the existing bridge is assumed to have a remaining service life of 50 years. Once the service life is expended, the bridge is assumed to be replaced with a new two deck truss structure similar to the one considered as part of this evaluation.
2. This option will maintain the elevated roadway along the entire New Hampshire approach section. No new at grade intersections are required.
3. The Albacore Connector will remain open and signalized for this option. The LCCA has been developed based on the Albacore Connector, Connector Bridge and associated signals remaining in service.
4. Due to the minimal navigational clearance beneath the lift span afforded by the two-deck system, the retractable span is maintained in this option. The LCCA has been developed accordingly.
5. The first bridge repainting is assumed to occur at year 25. Touch-up painting is assumed to be necessary following this repainting and will occur on a 10 year cycle.
6. Highway signal operations and maintenance includes loop replacement on a 5 year cycle, signal head replacement on a 10 year cycle, and controller replacement on a 15 year cycle. These costs have been summed into a single item and annualized to simplify development of the LCCA.

D. One Deck System – Network Tied Arch

Description of Alternative

The work for the one deck system will include the complete replacement of the structure including the truss lift span, truss spans, girder approach spans as well as new highway and rail approaches and intersection improvements. The new bridge will be located upstream from the existing bridge.

The main structure is proposed to be a network tied arch consisting of three 315 foot long steel tied arches located over the main portion of the Piscataqua River channel. The middle span will be a vertical lift. All arch spans and towers are proposed to receive a metallized coating. The bridge typical section will include a single deck system with the roadway and railroad parallel on the same deck.

The main span and railroad approach structures will consist of concrete NEXT beams and steel plate girders respectively. The retractable span has been eliminated in this alternative.

Additional details on the one deck network tied arch option are provided in HNTB's cost estimate report titled "Bridge Replacement Options for Sarah Mildred Long Bridge, PIN 16710.00", dated March 16, 2012.

Assumptions for One Deck Tied Arch Alternate

In addition to the general assumptions and description noted above, further details and assumptions specific to the LCCA for this alternative are noted below:

1. The new structure will be designed for a service life of 100 years.
2. Similar to the previous report, the lower profile of the bridge roadway deck will result in significant modifications on the bridge approach areas, as follows:

a. A two-lane roundabout is proposed for the at-grade crossing of the Route 1 bypass with Market Street. As a result, the Albacore Connector and its associated signalized intersections are not required for this alternative. This is reflective in the LCCA for this alternative.

b. An at-grade crossing of the Route 1 bypass with the mainline railroad tracks is proposed. Operation and maintenance costs associated with this crossing are assumed to be the responsibility of the Department and are reflected in the LCCA for this alternate.

c. This alternative will allow for less approach structure, due to its lower profile. Less approach structure will require less ongoing maintenance. This is reflective in the LCCA.

3. The increased navigational clearance below the lift span provided by this alternative will allow for elimination of the retractable span. The reduced long term maintenance and rehabilitation costs associated with the elimination of the retractable span are reflected in the LCCA.

4. The structural steel for the new structure will be metallized. Therefore, the first bridge repainting is assumed to occur at year 40 with a second repainting at year 70. Repainting will be completed using conventional paint materials; field metallizing is not proposed. Touch-up painting is assumed to be necessary once the bridge is repainted. Touch-up painting is assumed to occur on a 10 year cycle.

E. Two Deck System – Truss

Description of Alternative

The two deck system is similar to the existing bridge structure type and similar to ongoing Memorial Bridge Replacement Project. Similar to the tied arch system, the work will include the complete replacement of the structure and its approaches. The new bridge will be located upstream from the existing bridge.

The main structure is proposed to be a modified truss using a Warren configuration without verticals. The structure will consist of three 315 foot-long modified steel truss spans located over the main portion of the channel. The middle span will be a vertical lift structure. All truss spans and towers are proposed to receive a metallized coating. The bridge typical section includes a two deck system with the roadway on the upper deck and the railroad on the lower deck.

The main span and railroad approach structures will consist of concrete NEXT beams and steel plate girders respectively. The railroad retractable span is required with this option.

Additional details on the two deck truss option are provided in HNTB's cost estimate report titled "Bridge Replacement Options for Sarah Mildred Long Bridge, PIN 16710.00", dated March 16, 2012.

Assumptions for Two Deck Truss Alternate

In addition to the general assumptions and description noted above, further details and assumptions specific to the LCCA for this alternative are noted below:

1. The new structure will be designed for a service life of 100 years.

2. This option will keep the roadway elevated along the entire New Hampshire approach section similar to the existing condition. As a result, at-grade crossings of the railroad and Market Street do not occur with this alternative. Also, the Albacore Connector will remain open and signalized for this alternative. This is reflective in the LCCA.

3. Due to the minimal navigational clearance beneath the lift span afforded by the two-deck system, the construction and maintenance of a new retractable span is included with this alternaitve. The LCCA has been developed accordingly.
4. The structural steel for the new structure will be metallized. Therefore, the first bridge repainting is assumed to occur at year 40 with a second repainting at year 70. Repainting will be completed using conventional paint materials; field metallizing is not proposed. Touch-up painting is assumed to be necessary once the bridge is repainted. Touch-up painting is assumed to occur on a 10 year cycle.
5. Highway signal operations and maintenance includes loop replacement on a 5 year cycle, signal head replacement on a 10 year cycle, and controller replacement on a 15 year cycle. These costs have been summed into a single item and annualized to simplify development of the LCCA.

F. Life Cycle Cost Analysis Results

The results of the Life Cycle Cost Analysis for each of the three bridge alternatives are provided in Table 1 below. Generally, the results show the differences in life cycle cost were not significant enough to overcome the differences in initial design and construction cost; the rehabilitation option is the most cost effective option from an initial capital cost and total life cycle cost perspective. Similarly, the two deck truss option was determined to be the most cost effective replacement option considering both initial capital cost and total life cycle cost. Complete LCCA's for each option can be found in Appendixes A, B and C.

Table 1: Total Life Cycle Cost Summary

	Rehabilitation	Two Deck Truss	One Deck Tied Arch
Initial Capital Cost[1]	$ 125,900,000	$ 163,000,000	$ 177,500,000
Total Life Cycle Cost[2]	$ 198,100,000	$ 206,300,000	$ 218,100,000

[1] Includes engineering inspection and right of way

[2] Based on agency costs only with a real discount rate of 4%.

In addition, the analysis shows the costs incurred throughout the life of the one deck tied arch option would be less than for the two deck truss option. However, these cost savings were not significant enough to overcome the higher initial capital cost associated with the tied arch option.

Whereas the calculated total life cycle costs for the three options are similar, a sensitivity analysis was completed as part of this assignment. The purpose of the sensitivity analysis was to understand the significance of uncertainty associated with various assumptions underlying the LCCA. In this analysis the real discount rate, as well as the assumed repair and maintenance costs for each option, were varied. Real discount rates of 3%, 4% and 5% were examined. Maintenance and rehabilitation costs were adjusted up and down by 10% to reflect the potential variability in the cost estimates.

As shown in Table 2, the analysis was found to be fairly sensitive to discount rate. Given the relatively long 100 year period being evaluated, this finding is not surprising. If a 3% discount rate is assumed the total life cycle costs for the two deck truss option is essentially equal to the rehabilitation option (total life cycle costs are within 1% of each other). When 4% and 5% real discount rates are utilized the rehabilitation remains the most cost effective from a total life cycle cost perspective.

Table 2: Total Life Cycle Cost By Discount Rate			
	Rehabilitation	**Two Deck Truss**	**One Deck Tied Arch**
Total Life Cycle Cost (3% Disc. Rate)[2]	$ 227,200,000	$ 224,300,000	$ 235,200,000
Total Life Cycle Cost (4% Disc. Rate)[2]	$ 198,100,000	$ 206,300,000	$ 218,100,000
Total Life Cycle Cost (5% Disc. Rate)[2]	$ 179,200,000	$ 195,100,000	$ 207,400,000

[2] Based on agency costs only

Following the discount rate evaluation, the effect of varying the calculated maintenance and rehabilitation was studied. All rehabilitation and maintenance costs were adjusted up and down by 10% to reflect the potential variability in the life cycle cost estimates. Note that for this evaluation initial capital costs were left unchanged. The results of this evaluation found the total life cycle costs for all three options are not particularly sensitive to variations in rehabilitation and maintenance costs. In other words, minor to moderate changes in life cycle costs would not be expected to change the overall conclusion of the LCCA.

The overall findings of the sensitivity analysis are illustrated in Figures 1, 2 and 3 which represent assumed discount rates of 3%, 4% and 5% respectively. Within each figure the cumulative life cycle cost the three options is graphed based on the assumed maintenance and rehabilitation cost for that option. The potential variations in these assumed costs, and their effect on cumulative life cycle cost, are represented by the variance bars for each bridge option. These bars represent the effect of increasing or decreasing costs by 10%.

Figure 1: Sensitivity Analysis - 3% Discount Rate, 10% Cost Variance

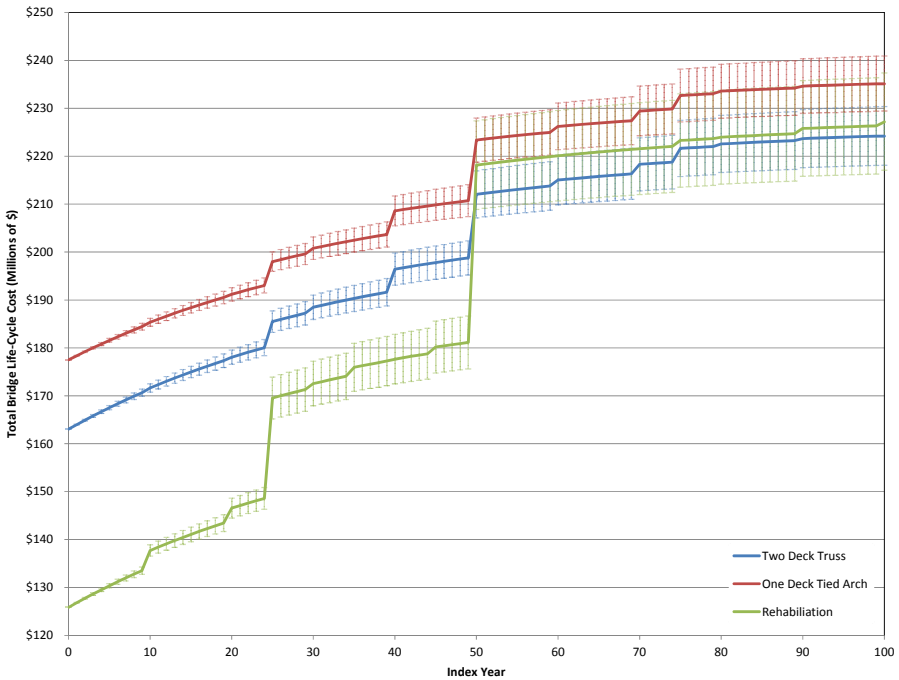


Figure 2: Sensitivity Analysis - 4% Discount Rate, 10% Cost Variance

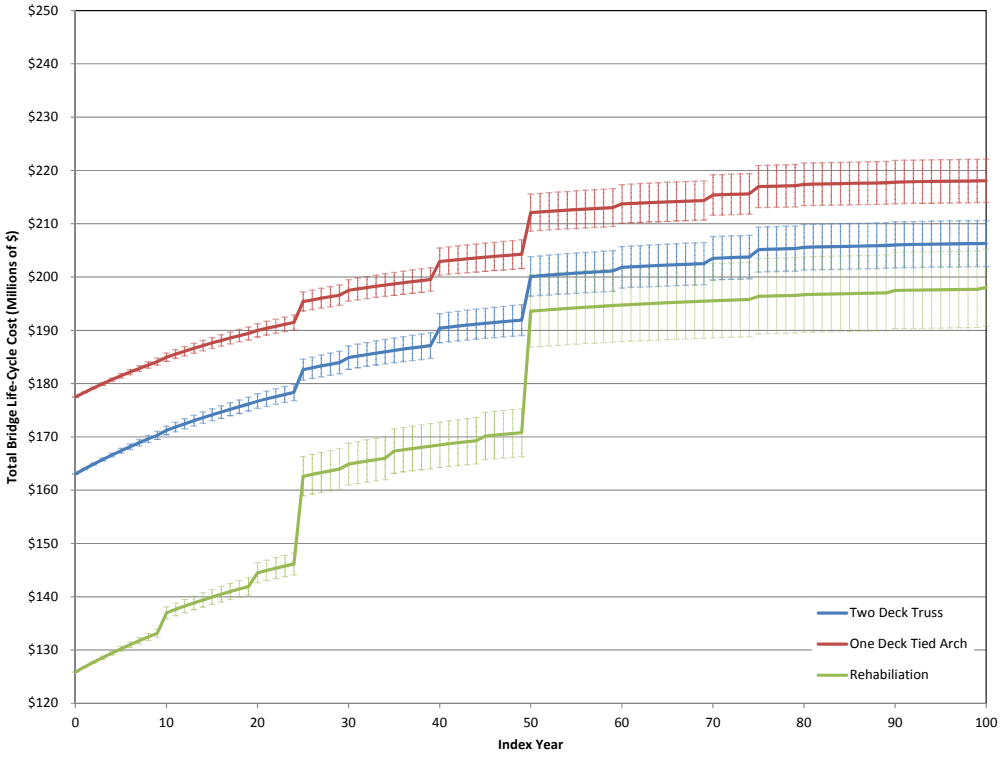
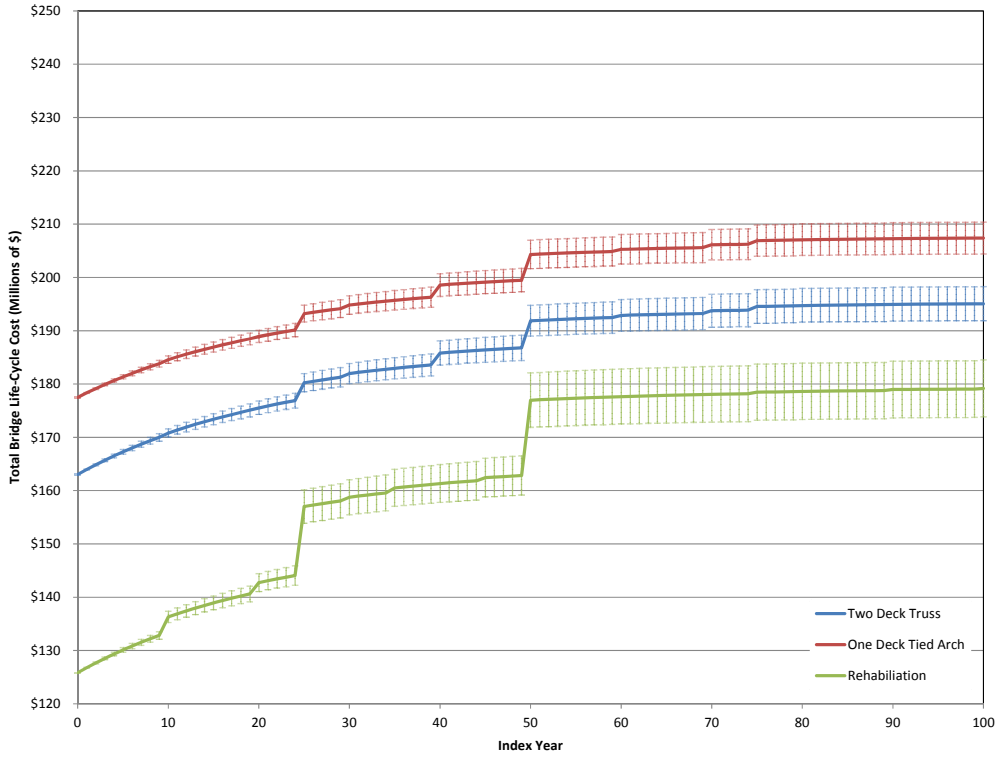


Figure 3: Sensitivity Analysis - 5% Discount Rate, 10% Cost Variance



The results of the life cycle costs analysis show that, for the selected real discount rate of 4%, the rehabilitation alternate is the most cost effective option considering initial construction and total life cycle costs. The two deck truss structure is the most cost effective replacement structure considering the same parameters.

The analysis also established that the results of the LCCA are relatively sensitive to the real discount rate selected. When a lower discount rate of 3% is assumed, the new two deck truss alternate becomes the most cost effective option when total life cycle costs are considered. However, the differences in total life cycle costs are deemed statistically insignificant.

Appendix A
LCCA – Rehabilitate Existing Bridge

HNTB The HNTB Companies	Made by K. Brayley	Date: 4/20/2012	Job No.: 57121-DS-001-001
	Checked by T. Cote	Date: 4/20/2012	Sheet Number: 1 of 26

Calculations for: MaineDOT PIN 16710.00 - Sarah Milded Long Bridge

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Discount Rate =	4.0%
Start Year =	2012

Work Activity	Calendar Year	Index Year	Discount Factor	2012 Cost (Construction & Eng.)	Present Value
Capital Cost - Bridge Structure	2012	0	1.000	$ 107,900,000	$ 107,900,000
Capital Cost - Engineering, Inspection and Right of Way	2012	0	1.000	$ 18,000,000	$ 18,000,000
O&M: Bridge Tenders	Annual	-	24.505[1]	$ 440,300	$ 10,789,551
O&M: Highway (Excl. Signals)	Annual	-	24.505[1]	$ 21,827	$ 534,871
O&M: Highway Signals	Annual	-	24.505[1]	$ 7,472	$ 183,101
O&M: Rail	Annual	-	24.505[1]	$ 11,340	$ 277,887
O&M: Bridge	Annual	-	24.505[1]	$ 15,793	$ 387,007
O&M: Elec./Mech. Maintenance, Lift Span	Annual	-	24.505[1]	$ 260,000	$ 6,371,300
O&M: Elec./Mech. Maintenance, Retractable Span	Annual	-	24.505[1]	$ 40,000	$ 980,200
O&M: Routine & Fracture Critical Inspections	Annual	-	24.505[1]	$ 187,673	$ 4,598,927
Rehabilitation: Touch-up Painting	2022	10	0.676	$ 4,320,000	$ 2,918,437
Rehabilitation: Highway Pavement Overlay	2022	10	0.676	$ 355,000	$ 239,825
Rehabilitation: Touch-up Painting	2032	20	0.456	$ 4,320,000	$ 1,971,592
Rehabilitation: Highway Pavement Overlay	2032	20	0.456	$ 355,000	$ 162,017
Rehabilitation: Bridge Repainting	2037	25	0.375	$ 14,400,000	$ 5,401,682
Rehabilitation: Elec. & Mech., Lift Span	2037	25	0.375	$ 5,300,000	$ 1,988,119
Rehabilitation: Elec. & Mech., Retractible Span	2037	25	0.375	$ 1,300,000	$ 487,652
Rehabilitation: Traffic & Barrier Gates	2037	25	0.375	$ 300,000	$ 112,535
Rehabilitation: Bridge Lighting	2037	25	0.375	$ 100,000	$ 37,512
Rehabilitation: Bridge Deck Patch and Pave	2037	25	0.375	$ 1,330,000	$ 498,905
Rehabilitation: Bridge Superstructure, Approach Spans	2037	25	0.375	$ 2,480,000	$ 930,290
Rehabilitation: Bridge Superstructure, Main Spans	2037	25	0.375	$ 14,400,000	$ 5,401,682
Rehabilitation: Bridge Substructure	2037	25	0.375	$ 1,100,000	$ 412,628
Rehabilitation: Fender System	2037	25	0.375	$ 2,200,000	$ 825,257
Rehabilitation: Highway Pavement Overlay	2042	30	0.308	$ 355,000	$ 109,453
Replacement: Railroad Ties	2042	30	0.308	$ 1,700,000	$ 524,142
Rehabilitation: Touch-up Painting	2047	35	0.253	$ 4,320,000	$ 1,094,755
Rehabilitation: Highway Pavement Overlay	2052	40	0.208	$ 355,000	$ 73,943
Rehabilitation: Touch-up Painting	2057	45	0.171	$ 4,320,000	$ 739,577
Replacement: Bridge Replacement (Two Deck Truss)	2062	50	0.141	$ 161,200,000	$ 22,682,874
Rehabilitation: Highway Pavement Overlay	2072	60	0.095	$ 355,000	$ 33,746
Rehabilitation: Highway Pavement Overlay	2082	70	0.064	$ 355,000	$ 22,798
Rehabilitation: Elec. & Mech., Lift Span	2087	75	0.053	$ 5,200,000	$ 274,475
Rehabilitation: Elec. & Mech., Retractible Span	2087	75	0.053	$ 1,300,000	$ 68,619
Rehabilitation:Bridge Deck Patch and Pave	2087	75	0.053	$ 1,300,000	$ 68,619
Rehabilitation: Traffic & Barrier Gates	2087	75	0.053	$ 300,000	$ 15,835
Rehabilitation: Bridge Lighting	2087	75	0.053	$ 100,000	$ 5,278
Rehabilitation: Fender System	2087	75	0.053	$ 2,200,000	$ 116,124
Rehabilitation: Highway Pavement Overlay	2092	80	0.043	$ 355,000	$ 15,401
Replacement: Railroad Ties	2092	80	0.043	$ 1,700,000	$ 73,753
Rehabilitation: Bridge Repainting	2102	90	0.029	$ 14,400,000	$ 422,048
Rehabilitation: Highway Pavement Overlay	2102	90	0.029	$ 355,000	$ 10,405
Replacement: Elec. & Mech., Lift Span	2112	100	0.020	$ 9,600,000	$ 190,080
Replacement: Elec. & Mech., Retractible Span	2112	100	0.020	$ 1,500,000	$ 29,700
Replacement: Counterweight Ropes	2112	100	0.020	$ 2,200,000	$ 43,560
Rehabilitation: Touch-up Painting	2112	100	0.020	$ 4,320,000	$ 85,536
Rehabilitation: Traffic & Barrier Gates	2112	100	0.020	$ 300,000	$ 5,940
Rehabilitation: Bridge Lighting	2112	100	0.020	$ 100,000	$ 1,980
Rehabilitation: Bridge Superstructure, Approach Spans	2112	100	0.020	$ 2,580,000	$ 51,084
Rehabilitation: Bridge Superstructure, Main Spans	2112	100	0.020	$ 11,700,000	$ 231,660
Replacement: Bridge Deck	2112	100	0.020	$ 13,700,000	$ 271,261
Rehabilitation: Bridge Substructure	2112	100	0.020	$ 1,700,000	$ 33,660
Replacement: Bridge Bearings	2112	100	0.020	$ 2,400,000	$ 47,520
Replacement: Fender System	2112	100	0.020	$ 4,400,000	$ 87,120
Rehabilitation: Highway Full Depth Reconstruction	2112	100	0.020	$ 2,710,000	$ 53,658
Residual Value	2112	100	0.020	$ (41,120,000)	$ (814,178)
			Total Life Cycle Cost =	**$**	**198,100,000**

Notes:

1) Based on discounting 100 years of annual payments to present value calculated as: $DR^{(100-1)} / (DR \times (1 + DR)^{100})$

2) LCCA totals are rounded to the nearest one hundred thousand.

3) See assumptions & summary document for all work activity frequency and ordering.

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: Residual Value

Assumptions -

Bridge Service Life =	100	Years
Initial Bridge Construction Cost =	$ 161,200,000	(Including Design and Construction Engineering)
Bridge age at beginning of service life =	1	
Bridge age at end of analysis period =	50	
Bridge age at end of service life =	100	

Calculated Residual Value at end of Analysis Period = $ 41,118,253

Residual Value is calculated as follows: $RV = RC \times \{ [BA(T_A) - BA(T_{SL})] / [BA(T_0) - BA(T_{SL})] \}^2$

Where:

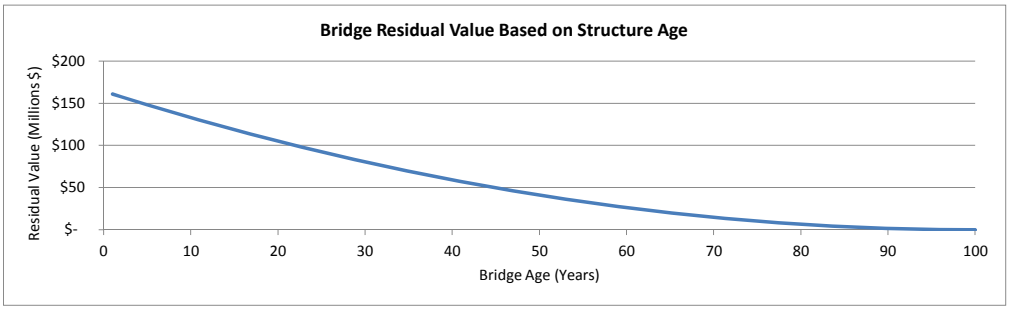
RV = Residual Value at End of Analysis Period

RC = Estimated Structure Replacement Cost

$BA(T_A)$ = Bridge Age at the end of the analysis period

$BA(T_{SL})$ = Bridge Age at the end of its service life

$BA(T_0)$ = Bridge Age at the beginning of its service life



Calculated Residual Value Based on Age of Structure

Bridge Age	Residual Value	Bridge Age	Residual Value	Bridge Age	Residual Value
1	$ 161,200,000	34	$ 71,644,444	67	$ 17,911,111
2	$ 157,959,882	35	$ 69,489,848	68	$ 16,842,037
3	$ 154,752,658	36	$ 67,368,146	69	$ 15,805,857
4	$ 151,578,329	37	$ 65,279,339	70	$ 14,802,571
5	$ 148,436,894	38	$ 63,223,426	71	$ 13,832,180
6	$ 145,328,354	39	$ 61,200,408	72	$ 12,894,684
7	$ 142,252,709	40	$ 59,210,285	73	$ 11,990,083
8	$ 139,209,958	41	$ 57,253,056	74	$ 11,118,376
9	$ 136,200,102	42	$ 55,328,722	75	$ 10,279,563
10	$ 133,223,140	43	$ 53,437,282	76	$ 9,473,646
11	$ 130,279,074	44	$ 51,578,737	77	$ 8,700,622
12	$ 127,367,901	45	$ 49,753,086	78	$ 7,960,494
13	$ 124,489,624	46	$ 47,960,331	79	$ 7,253,260
14	$ 121,644,240	47	$ 46,200,469	80	$ 6,578,921
15	$ 118,831,752	48	$ 44,473,503	81	$ 5,937,476
16	$ 116,052,158	49	$ 42,779,431	82	$ 5,328,926
17	$ 113,305,459	50	$ 41,118,253	83	$ 4,753,270
18	$ 110,591,654	51	$ 39,489,970	84	$ 4,210,509
19	$ 107,910,744	52	$ 37,894,582	85	$ 3,700,643
20	$ 105,262,728	53	$ 36,332,089	86	$ 3,223,671
21	$ 102,647,607	54	$ 34,802,490	87	$ 2,779,594
22	$ 100,065,381	55	$ 33,305,785	88	$ 2,368,411
23	$ 97,516,049	56	$ 31,841,975	89	$ 1,990,123
24	$ 94,999,612	57	$ 30,411,060	90	$ 1,644,730
25	$ 92,516,070	58	$ 29,013,039	91	$ 1,332,231
26	$ 90,065,422	59	$ 27,647,913	92	$ 1,052,627
27	$ 87,647,669	60	$ 26,315,682	93	$ 805,918
28	$ 85,262,810	61	$ 25,016,345	94	$ 592,103
29	$ 82,910,846	62	$ 23,749,903	95	$ 411,183
30	$ 80,591,776	63	$ 22,516,355	96	$ 263,157
31	$ 78,305,601	64	$ 21,315,702	97	$ 148,026
32	$ 76,052,321	65	$ 20,147,944	98	$ 65,789
33	$ 73,831,936	66	$ 19,013,080	99	$ 16,447
				100	$ -

~SAY = $ 41,120,000

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: O&M - Bridge Tenders

Annual Operator Labor Costs						
Bridge	Number of Full Time Operators on Bridge at All Times	Average Hourly Rate	Hours per Week	Overhead Burden	52 Weeks per Year	Total cost in 2010 Dollars
Sarah Mildred Long	2	$ 18.00	168	1.4	52	$ 440,294.40

SAY =	$440,300

HNTB The HNTB Companies	Made by	L. Meek	Date	4/18/2012	Job No.: 57121-DS-001-001
	Checked by	BMH	Date	4/19/2012	Sheet Number: 4 of 26
Calculations for: MaineDOT PIN 16710.00 - Sarah Milded Long Bridge					

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: Highway Striping, Intersection Maintenance and Highway Maintenance (excluding signals)

Assumptions:

1. Unit pricing is based on the HNTB report titled "Construction Cost Estimates For Sarah Mildred Long Bridge", Dated March 16, 2012 - Unless otherwise noted.
2. Since striping is an operation and maintenance activity no engineering costs have been applied.
3. Applied factors are as follows:

Incidentals & Contingency 15%

Frequency	1	Year Cycle

	2012 Unit Cost	
Striping	$0.65	LF of Striping

	Striping Length within O&M Limits		
	~~1 Deck~~	~~2 Deck~~	Rehab
Market Street	~~12000~~	~~12000~~	12000
Route 1 Bypass	~~17300~~	~~15700~~	15700
Albacore Connector	~~0~~	~~1500~~	1500
Quantity	**~~29300 LF~~**	**~~29200 LF~~**	**29200 LF**

Striping	~~$19,045~~	~~$18,980~~	$18,980
Incidentals & Contingency	~~$2,856.75~~	~~$2,847.00~~	$2,847.00
2012 Total Costs	**~~$21,902~~**	**~~$21,827~~**	**$21,827**

SAY =	**$21,900**

HNTB The HNTB Companies	Made by	L. Meek	Date	4/18/2012	Job No.: 57121-DS-001-001
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Calculations for: MaineDOT PIN 16710.00 - Sarah Milded Long Bridge					

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: O&M - Highway Signals

Assumptions:

1. Unit costs from discussions with Bruce Munger & Paul Godfrey
2. Applied factors are as follows:
   - Incidentals & Contingency 15%
   - Design and Construction Eng. & Insp. 14%
3. Signals O&M costs apply to Rehab and 2 Deck options only

	Unit	Quantity	Replacement Frequency	2012 Costs				
				Unit Cost	Incidentals & Contigency	Eng. & Insp.	Total Cost	Annualized Cost
Loops	Ea	11	**5**	$1,500	$225	N/A	**$18,975**	**$3,795**
Signal Controller	Ea	2	**15**	$15,000	$2,250	2,100	**$38,700**	**$2,580**
Signal Heads	Ea	17	**10**	$500	$75	70	**$10,965**	**$1,097**
							Total =	**$7,472**

SAY =	**$7,500**

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: O&M - Rail

Assumptions:	2 men x 4hrs/ea/mo. x 12 mo. x $90hr loaded =	$8,640
	1 vehicle @ $50 day/2 x12 days =	$300
	$200 misc.materials/mo. =	$2,400
		$11,340

SAY =	**$11,340**

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: Bridge O&M

Assumptions:

1. Bridge O&M includes daily and seasonal operations to maintain the bridges travel way and accessibility (shoulder sweeping, waterproofing, etc.).

Component	Deck Area (SF)	Unit Price($/SF)*	Subtotal
New Hampshire Approach Spans	39,024	$0.15	$5,854
Fixed Truss Spans	33,984	$0.15	$5,098
Lift Span	8,064	$0.15	$1,210
Maine Approach Spans	19,692	$0.15	$2,954
Albacore Connector	4,524	$0.15	$679
	∑ = 105,288	**Total Cost =**	**$15,793**

* Unit price taken from Maine - New Hampshire Connections Study

SAY = $15,800

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: O&M Lift Span Mechanical/Electrical Maintenance

Assumptions:

1. Totals on this sheet on a per year (annual) basis
2. Operation of span assumed to be consistent with present level of usage
3. Assume 3200 openings/year per Connections Study Technical Memo #3

Component	Qty	Unit Price($/unit)*	Subtotal
Lubricate machinery [2 ppl x 16 hrs]	12	$3,200.00	$38,400
Lubricate span/cwt guides [32 hrs]	4	$3,200.00	$12,800
Lubricate ropes [64 hrs]	4	$6,400.00	$25,600
Change reducer oil [16 hrs]	1	$1,600.00	$1,600
Reducer oil (for 2 reducers)	150	$75.00	$11,250
Lubricating greases	1	$5,000.00	$5,000
Nav. lamp maint [2 ppl 2 hrs ea]	10	$400.00	$4,000
General elect. maint [32 hrs]	12	$3,200.00	$38,400
Traffic signals maint	132	$400.00	$52,800
Generator routine service	1	$1,000.00	$1,000
Generator fuel	150	$4.50	$675
Estimated power for openings	3,200	$3.93	$12,576
Elevator inspection and maint.	2	$5,000.00	$10,000
Other routine repairs	1	$25,000.00	$25,000
Maint. material costs	1	$20,000.00	$20,000
		Total Cost =	**$259,101**

* Labor rate @ $100/hr
Est. power 30 kWh per opening
Traffic signals 6 3-head signals for bridge, 16 for intersections; service 2x year
Main span drive motors 100 hp each

SAY =	**$260,000**

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: O&M Retractable Span Mechanical/Electrical Maintenance

Assumptions:

1. Totals on this sheet on a per year (annual) basis.
2. Operation of span assumed to be consistent with present level of usage.

Component	Qty	Unit Price($/unit)*	Subtotal
Lubricate mech. systems [16 hrs]	4	$1,600.00	$6,400
Winterize system [16 hrs]	1	$1,600.00	$1,600
Return to service in spring [16 hrs]	1	$1,600.00	$1,600
Operate span [4 ppl 1/2 day ea.]	8	$1,600.00	$12,800
Nav. lamp maint [2 ppl 2 hrs ea]	6	$400.00	$2,400
Other routine repairs	1	$10,000.00	$10,000
Maint. material costs	1	$5,000.00	$5,000
		Total Cost =	**$39,800**

* Labor rate @ $100/hr

SAY = $40,000

HNTB The HNTB Companies	Made by J Carney	Date 4/18/2012	Job No.: 57121-DS-001-001
	Checked by T. Cote	Date 4/19/2012	Sheet Number: 10 of 26
Calculations for: MaineDOT PIN 16710.00 - Sarah Milded Long Bridge			

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: O&M - Bridge Inspection

Assumptions:

1. Cost estimate developed based on completing and NBIS Compliant Routine and Fracture Critical Inspection on a 2-year cycle. Inspection costs have been annualized for entry into LCCA sheet.
2. Inspection costs developed based on access from the bridge deck. No barge work has been included in this estimate.

Client Name: MaineDOT
Client Number: **16710.00**
HNTB Number: 57121-BL-001-001
Prepared By: J. Carney

Project Name: **LCCA Bridge Inspection Estimate - Truss Rehabilitation Option**
Project Location: Kittery, ME and Portsmouth, NH
Date: 4/18/2012

Task	Project Manager	QA/QC	Senior Structural Engineer	Structural Engineer	Traffic Engineer	CADD Technician	Total
Name							
Field Inspection Set-up & Preparations	16		12	14			42
Field Inspection from Barge & Lift (12 days)	0		108	108			216
Field Inspect w/ HI-Rail Lift- Lower Deck (4 days)	0	0	36	36			72
Field Inspect. Appr. Spans w/ UB-62 Snooper (4 days)			36	36			72
Field Inspect. Spans over Market St & Oak Terrace w/ Bucket Truck & Traffic Control (2 days)			18	18			36
Top of Deck Inspection			10	10			20
Tower Inspections - (4 days)			36	36			72
Office Report & Sketch Preparations	12	24	65	80		40	221
							0
TOTAL HOURS	28	24	321	338	0	40	751
LABOR RATE	$60.00	$50.00	$50.00	$45.00		$30.00	
DIRECT LABOR	$ 1,680.00	$ 1,200.00	$ 16,050.00	$ 15,210.00	$ -	$ 1,200.00	$ 35,340.00

Notes:

Direct Expenses

Mileage & Printing	$1,400.00
Lodging & Per Diem	$7,100.00
Barge & Manlift (Assumes 12 days use of barge & Lift)	$34,800.00
40' Manlift w/ High Rail Gear (4 days)	$4,800.00
UB-62 Snooper of Appr. Spans from Upper Deck (4 days)	$7,200.00
40' Lift Bucket Truck (2 days use over Market St & Oak Terrace)	$2,400.00
Rigging for Exterior Tower Inspection	$14,000.00
Traffic Control (w/ Snooper & Bucket Truck on Roadways)	$9,000.00
Flaggers / Police for Traffic Control	$4,200.00
TOTAL	$84,900.00

Total Engineering Cost

Direct Labor (see note 4)	$37,637.10
Overhead (144.90%)	$55,793.24
Fee (10%)	$9,343.03
Direct Expenses	$84,900.00
TOTAL	**$187,673.37**

GRAND TOTAL **$187,673.37**

ANNUALIZED COST ~ SAY = $94,500

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: Touch-up Painting

Assumptions:

1. Bridge painting includes only surface preparation & field painting.
2. Bridge painting calculated to represent a cost per pound of steel being painted.
3. Assuming highway approach members are replaced with concrete beams.
4. This item was assumed to be 30% of overall bridge painting cost occuring at an interval of 10 years

Full Bridge Painting = $ 14,400,000

Touch-up Painting = $ 4,320,000 includes 14% for PE & CE along with 10% Mob. And 15% contingency

SAY = $4,320,000

HNTB The HNTB Companies	Made by	L. Meek	Date	4/18/2012	Job No.: 57121-DS-001-001
	Checked by	BMH	Date	4/19/2012	Sheet Number: 12 of 26
Calculations for: MaineDOT PIN 16710.00 - Sarah Milded Long Bridge					

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: Highway Pavement Overlay and Reconstruction

Assumptions:

1. Unit pricing is based on the HNTB report titled "Construction Cost Estimates For Sarah Mildred Long Bridge", Dated March 16, 2012 - Unless otherwise noted.
2. Applied factors are as follows:
   - Incidentals & Contingency 15%
   - Design and Construction Eng. & Insp. 14%
3. Repair cycles will be 10 yr for Overlay & 50 yr for Full Depth Reconstruction based on recommendations from the Connections Study

Pavement Areas			
	~~1 Deck Tied-Arch~~	~~2 Deck Truss~~	Rehab
NH	~~206938~~	~~212741~~	212741
ME	~~82445~~	~~82623~~	82623
Total	~~289,383 s.f~~	~~295,364 s.f~~	295,364 s.f

	Thickness	Volumes		
		~~1 Deck Tied-Arch~~	~~2 Deck Truss~~	Rehab
Overlay				
HMA	1.5 in.	~~2,653 ton~~	~~2,708 ton~~	2,708 ton
Full Depth Construction				
HMA	8.5 in.	~~15,032 ton~~	~~15,343 ton~~	15,343 ton
Gravel (ABC-C)	11.5 in.	~~10,271 c.y.~~	~~10,484 c.y.~~	10,484 c.y.
Gravel (ASC-G)	10 in.	~~8,932 c.y.~~	~~9,116 c.y.~~	9,116 c.y.

	Unit	Frequency (Years)	2012 Unit Cost	2012 Total Construction Cost (with Incidentals & Contigency)			2012 Total Cost (Construction, Eng,, & Insp.)		
				~~1 Deck~~	~~2 Deck~~	Rehab	~~1 Deck~~	~~2 Deck~~	Rehab
Overlay									
HMA	Ton	10	$100	~~$305,058~~	~~$311,363~~	$311,363	**~~$347,766~~**	**~~$354,954~~**	**$354,954**
Full Depth Construction									
HMA	Ton		$100	~~$1,728,662~~	~~$1,764,390~~	$1,764,390	~~$1,970,674~~	~~$2,011,404~~	$2,011,404
Gravel (ABC-C)	CY		$29	~~$342,548~~	~~$349,628~~	$349,628	~~$390,505~~	~~$398,576~~	$398,576
Gravel (ASC-G)	CY		$25	~~$256,783~~	~~$262,090~~	$262,090	~~$292,732~~	~~$298,783~~	$298,783
Full Depth Construction Total		50					**~~$2,663,911~~**	**~~$2,708,763~~**	**$2,708,763**

Overlay Say = $355,000

Full Depth Say = $2,710,000

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: Rehabilitate Lift Span Electrical and Mechanical Systems

Assumptions:

1. Rehabilitate lift span mechanical and electrical systems. Ropes covered under separate item.
2. No major work on counterweight sheaves or sheave bearings.
3. Gates covered under separate item.
4. Rehab at year 25.

Component	Qty	Unit Price($/unit)*	Subtotal
Rehab span drive machinery	1	$1,550,000.00	$1,550,000
Rehab span locks	1	$250,000.00	$250,000
Rehab elevators	1	$100,000.00	$100,000
Rehab bridge control system	1	$1,514,450.00	$1,514,450
Replace aerial cable	1	$100,000.00	$100,000
Rehab CCTV system	1	$96,000.00	$96,000
Replace intercom system	1	$55,000.00	$55,000
Replace fire alarm system	1	$135,000.00	$135,000
Replace generator	1	$400,000.00	$400,000
		Subtotal =	$4,200,450
		Mobilization (10%) =	$420,045
		TOTAL CONSTRUCTION COSTS =	$4,620,495
		Engineering (7%) and Inspection (7%) =	$646,869
		TOTAL PROJECT COSTS =	$5,267,364
		PROJECT TOTAL =	**$5,300,000**

* Span drive machinery rehab 50% of replacement cost
Span lock cost from Bates bridge
Electrical control system rehab 50% of replacement cost
CCTV cost from Chelsea St.
Intercom system from Chelsea St.
Fire alarm system from Chelsea St.
Generator cost from Chelsea St.

SAY =	**$5,300,000**

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: Rehabilitate Retractible Span Mechanical and Electrical

Assumptions:

1. Rehab retractible span mechanical and electrical systems
2. Rehab at year 25.

Component	Qty	Unit Price($/unit)*	Subtotal
Rehabilitate Mechanical Systems	1	$456,696.00	$456,696
Rehabilitate Electrical Systems	1	$502,025.00	$502,025
		Subtotal =	$958,721
		Mobilization (10%) =	$95,872
		TOTAL CONSTRUCTION COSTS =	$1,054,593
		Engineering (7%) and Inspection (7%) =	$147,643
		TOTAL PROJECT COSTS =	$1,202,236
		PROJECT TOTAL =	**$1,300,000**

* Mechanical cost data from Transsystems estimate
Electrical cost estimate from Bates bridge

SAY =	**$1,300,000**

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: Rehabilitate Traffic and Barrier Gates

Assumptions:

1. Replace traffic and barrier gates.
2. Replace at year 25.

Component	Qty	Unit Price($/unit)*	Subtotal
Replace Warning Gates	1	$125,000.00	$125,000
Replace Barrier Gates	1	$92,500.00	$92,500
		Subtotal =	$217,500
		Mobilization (10%) =	$21,750
		TOTAL CONSTRUCTION COSTS =	$239,250
		Engineering (7%) and Inspection (7%) =	$33,495
		TOTAL PROJECT COSTS =	$272,745
		PROJECT TOTAL =	**$300,000**

* Unit pricing based on the HNTB report titled "Bridge Replacement Options For Sarah Mildred Long Bridge", Dated March 16, 2012

SAY = $300,000

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: Bridge Painting

Assumptions:

1. Bridge painting includes surface preparation, pollution control and proper disposal of waste along with traffic control, incidentals and mobilization costs.
2. Bridge painting calculated to represent a cost per pound of steel being painted.
3. All highway approach spans will be replaced with concrete NEXT beams, no painting required.
4. Arch span weights include both lift towers and both highway and rail superstructure steel.
5. Quantities are based on the HNTB report titled "Bridge Replacement Options For Sarah Mildred Long Bridge", Dated March 16, 2012.
6. Add 7% for PE and 7% for CE and 15% Contingency.

Component	Weight (lb)	Unit Price($/lb)*	Unit Price w/ Conti.	Contract Total
Approach HW Spans	N/A	$1.89	$2.18	N/A
Truss Spans	6,252,672	$1.89	$2.18	$11,836,608
Approach RR Spans	374,500	$1.89	$2.18	$708,946
Σ Sum =	6,627,172	**TOTAL CONSTRUCTION COSTS:**		**$ 12,545,554**
		Engineering (7%), Inspection (7%):		$ 1,760,000
		TOTAL PROJECT COSTS:		$ 14,305,554
		TOTAL PROJECT COSTS (SAY):		**$ 14,400,000**

* Bid price data taken from MaineDOT PIN 016816.00 - Memorial Bridge Paint Project Bid 12/11 (see summary below)
Unit cost calculated by dividing total bid cost by 6.2 million pounds of steel, steel weight from Memorial Bridge.
Use average bid price considering added complexity of painting and moveable structure.

Vendor	Total Bid	Unit Cost
Spartan Contracting LLC	$ 6,967,000	$ 1.12
Titan Industrial Services Inc.	$ 7,468,000	$ 1.20
Liberty-Alpha JV, LLC	$ 8,769,000	$ 1.41
Intech Contracting LLC	$ 9,474,960	$ 1.53
Allied Painting, Inc.	$ 9,498,020	$ 1.53
Tri-State Painting, Inc.	$ 9,635,622	$ 1.55
Hercules Painting Company, Inc.	$ 10,169,868	$ 1.64
TDA Construction	$ 10,794,000	$ 1.74
Amstar of Western New York, Inc.	$ 10,870,000	$ 1.75
Blastech Enterprises, Inc.	$ 11,477,550	$ 1.85
Atlas Painting & Sheeting Corporation	$ 12,189,000	$ 1.97
Vimas Painting Company Inc.	$ 12,747,300	$ 2.06
North Star Painting	$ 12,774,000	$ 2.06
Royal Bridge	$ 12,990,000	$ 2.10
Odyssey Contracting Corporation	$ 13,415,500	$ 2.16
ABHE & Svoboda, Inc.	$ 14,443,310	$ 2.33
Corcon Incorporated	$ 14,796,338	$ 2.39
MJ Painting Co.	$ 15,004,726	$ 2.42

	Year 2011		Year 2012	per RS Means
Low Bid Unit Cost =	$ 1.12	per lb	$ 1.17	per lb
Average Bid Unit Cost =	$ 1.82	per lb	$ 1.89	per lb
High Bid Unit Cost =	$ 2.42	per lb	$ 2.51	per lb

Note: For reference, the construction value of the 1999 re-painting of the maine span on the I-95 high level bridge over the piscataqua river, adjusted for inflation per RSMeans, cost $18,663,605.

SAY = $14,400,000

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: Rehabilitate Bridge Lighting

Assumptions:

1. Bridge Lighting includes street lights and navigational lighting.
2. Work includes repair and replacement of lighting components.
3. Lump sum price assumed from Maine - New Hampshire Connections Study.

Construction Cost	**$100,000**
TOTAL	**$100,000.00**

SAY =	**$100,000**

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: Rehab Bridge Deck Patch and Pave (all spans)

Assumptions:

1. Bridge patch and pave includes pavement removal, re-paving, patching concrete, and deck surface.
2. Girders are considered to have 100 year service life and are not anticipated to require major rehabiliation during their service life (see rehab approach structure).
3. Partial depth repairs have been assumed to be required over 5% of the deck area. Full depth repairs assumed 1% of deck.
4. Joint replacements are expected to occur at 25 year cycles and are estimated at $60,000 each.
5. Mobilization costs are taken as 10% of the project total.
6. A 15% contingency has been applied for items such as maintenance of traffic.

Component	Area	Unit Price($/SF)*	Unit Price w/ Conti.	Contract Total
New Hampshire Approach Spans	39,024	$5.68	$6.53	$254,838
Fixed Truss Spans	33,984	$5.68	$6.53	$221,925
Lift Span	8,064	$5.68	$6.53	$52,660
Maine Approach Spans	19,692	$5.68	$6.53	$128,594
Albacore Connector	4,524	$5.68	$6.53	$29,543
			SUBTOTAL =	$687,561
			Add Joints =	$360,000
			Mobilization (10%) =	$104,756
			TOTAL CONSTRUCTION COSTS =	$1,152,317
			Engineering (7%), Inspection (7%):	$170,000
			TOTAL PROJECT COSTS:	$1,322,317
			TOTAL PROJECT COSTS (SAY):	**$1,330,000**

* Unit price data taken from MaineDOT PIN 017929.00 & 017929.10 - I-295 NB & SB Bridge Rehab Project Bid 3/11 & 12/11 and MTA Contract 2012.01 Saco River Bridge Rehab Project Bid 1/12.

Unit cost derived by taking the sum of the average costs for all re-decking related items and then dividing by the square foot area of the bridges included in the estimate.

		Saco River Bid Prices
Item No.	Item Description	Average Bid Price
202.2	Removing Pavement Surface	$59,993
403.2081	HMA 12.5 MM	$167,510
508.14	High performance membrane	$121,600
518.5	Partial Depth Repairs	$234,850
518.51	Full Depth Repairs	$18,850
	Subtotal =	**$602,803**
	Deck Area =	**83,358**
	Subtotal =	**$7.23** **$/SF**

		I-295 SB Bid Prices 017929.10			Average Cost
Item No.	Item Description	CPM Const.	T. Buck	Lane Const.	
202.2	Removing Pavement Surface	$772,480	$363,520	$681,600	$605,867
403.2081	HMA 12.5 MM	$977,970	$908,115	$931,400	$939,162
508.14	High performance membrane	$300,000	$285,000	$287,000	$290,667
518.5	Repair Upward Surfaces to reinforcing	$355,300	$226,100	$206,720	$262,707
518.51	Repair Upward Surfaces below reinforcing	$110,625	$95,875	$78,175	$94,892
518.52	Repari Upward Surfaces (consider full depth)	$40,000	$63,000	$42,000	$48,333
				Subtotal =	**$2,241,627**
				Deck Area =	**449,856**
				Subtotal =	**$4.98** **$/SF**

		I-295 NB Bid Prices 017929.00				Average Cost
Item No.	Item Description	CPM Const.	Newman	Lane Const.	Wyman	
202.2	Removing Pavement Surface	$326,700	$290,400	$217,800	$272,250	$276,788
202.3	Removing Concrete Wearing Surface	$150,000	$57,740	$16,500	$300,000	$131,060
403.2081	HMA 12.5 MM	$42,500	$45,750	$42,500	$42,500	$43,313
508.14	High performance membrane	$140,000	$128,315	$252,500	$300,000	$205,204
518.5	Repair Upward Surfaces to reinforcing	$142,200	$145,360	$173,800	$110,600	$142,990
518.51	Repair Upward Surfaces below reinforcing	$45,990	$65,700	$73,000	$54,750	$59,860
518.52	Repari Upward Surfaces (consider full depth)	$27,300	$40,264	$52,500	$50,400	$42,616
					Subtotal =	**$901,830**
					Deck Area =	**187,061**
					Subtotal =	**$4.82**

Average Unit Price = $5.68 $/SF

SAY = $1,330,000

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Rehab Bridge Superstructure, Approach Spans

Assumptions:

1. Bridge superstructure rehab concrete girder repair and waterproofing.
2. Repair area is assumed to be 10% of area exposed and waterproofing area is assumed to be 100% of area exposed.
3. Mobilization costs are taken as 10% of the project total.
4. A 15% contingency has been applied for items such as maintenance of traffic.

Approach Structure Length =	1631	ft
Exposed structure cross-section perimeter =	80	ft
Area exposed =	130480	SF

Component	Surface Area	Unit Price($/SF)*	Unit Price w/ Conti.	Contract Total
Concrete Repair	13,048	$120.00	$138.00	$1,800,624
Waterproofing	130,480	$1.11	$1.28	$166,724
			SUBTOTAL =	$1,967,348

Mobilization (10%) =	$196,735
TOTAL CONSTRUCTION COSTS =	$2,164,083
Engineering (7%), Inspection (7%):	$310,000
TOTAL PROJECT COSTS:	$2,474,083
TOTAL PROJECT COSTS (SAY):	**$2,480,000**

SAY =	**$2,480,000**

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Rehabilitation: Bridge Superstructure, Main Spans

Assumptions:

1. Use 75% of the cost estimated to rehab existing SML truss and tower components for 50 year life in 2012 and scale for length of proposed bridg
2. Unit pricing is based on the HNTB report titled "Construction Cost Estimates For Sarah Mildred Long Bridge", Dated February 10, 201
2. Add 7% for PE and 7% for CE
3. Mobilization costs are taken as 10% of the project total
4. Contingency has not been included as the rehabiliations costs already have a contingency built-i

Total Existing Truss Span Length = 1168 ft
Total Proposed Span Length = 1168 ft

Component	Unit	Unit Price	Subtotal	
50 Year Superstructure Rehab	1	$11,475,146	$11,475,146	Includes towers, but not deck
Mobilization	1	$1,147,515	$1,147,515	
		TOTAL CONSTRUCTION COSTS:	**$12,622,660**	
		Engineering (7%), Inspection (7%):	$1,770,000	
		TOTAL PROJECT COSTS:	$14,392,660	
		SUPER REHAB COSTS (SAY):	**$14,400,000**	

Item No.	Item Description	Unit	Total Qty.	Unit Price	Contract Total
504.701	STR STEEL FAB & DEL, ROLLED	LB	779,400	$ 4.20	$3,273,480.00
504.71000	STR STEEL ERECTION	LB	779,400	$ 1.03	$804,340.80
504.7200	FLOOR BEAM REPAIR	LB	58,600	$ 24.00	$1,406,400.00
504.81	REM RIV & REPLACE W/ HIGH-STRENGTH E	EA	12,173	$ 264.00	$3,213,672.00
504.8101	REMOVAL OF STRUCTURAL STEEL	LB	779,400	$ 1.08	$841,752.00
504.811	STR STEEL REPAIR	LB	127,800	$ 30.00	$3,834,000.00
504.811	TOWER SHEATHING REPAIRS	LS	1	$ 1,920,000	$1,920,000.00
				Subtotal =	$15,293,645
				Adjust for 75% of Contract =	$11,470,234
				Adjust for Length Ratio =	$11,475,146
				Rehab Cost =	**$11,475,146**

* The values in the table above were derived from the HNTB estimate from 02/10/12

SAY = $14,400,000

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: Rehab Bridge Substructure

Assumptions:

1. Bridge substructure rehabilitation includes surface patching and waterproofing
2. The cost presented is based on the surface area of above grade substructure components.
3. It is assumed that 60% of substructure surface area is above grade and that 10% of that area will need repair every 25 years.
4. Using Transystems form work area calculations a ratio of surface are to substructure volume was developed and was used to develop approximate substructure surface areas based on calculated pier and abutment concrete volumes.
5. Mobilization costs are taken as 10% of the project total.
6. A 15% contingency has been applied.

* Typical unit prices for above-water pier and abutment repair range from $80-$100 per SF.
Carry $150/SF due to location of work above water and difficult access.

Note: Conversion ratio from substructure volume & substructure surface area = 0.071756 CY/SF

Volume of Piers, Approach Spans =	3454	CY	
Volume of Abt. & Ret. Walls, Approach Spans =	850	CY	
Volume of Piers, Main Spans =	2033	CY	
Surface Area of Piers, Approach Spans =	28881	SF	(Volume/Conversion Ratio)*60%
Surface Area of Abt. & Ret. Walls, Approach Spans =	7107	SF	
Surface Area of Piers, Main Spans =	16999	SF	
Total Surface Area =	52988	SF	
Repair Area =	5299	SF	

Component	Surface Area	Unit Price($/lb)*	Unit Price w/ Conti.	Contract Total
Substructure Repair	5,299	$150.00	$172.50	$914,041
			TOTAL CONSTRUCTION COSTS:	**$914,041**
			Engineering (7%), Inspection (7%):	$130,000
			TOTAL PROJECT COSTS:	$1,044,041
			TOTAL PROJECT COSTS (SAY):	**$1,100,000**

SAY = $1,100,000

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: Fender System Replacement and Rehabilitation

Assumptions:

1. Fender systems will be rehabilitated every 25 years and replaced every 50 years.
2. Replacement costs are assumed to be unchaged from original construction value. Fender rehabilitation assumed as 50% of initial construction cost.
3. Quantities and unit pricing is based on the HNTB report titled "Construction Cost Estimates For Sarah Mildred Long Bridge", Dated February 10, 2012.
4. Mobilization costs are taken as 10% of the project total.
5. A 15% contingency has been included in the unit price for each item.
6. Design and Construction Engineering taken as 7% of Construction Value

MARINE (FENDER SYSTEM) COMPONENTS - REPLACEMENT

ITEM NO.	ITEM DESCRIPTION	UNIT	TOTAL QNTY.	UNIT PRICE	UNIT PRICE w/ CONT.	CONTRACT TOTAL
501.700	Steel Pipe Piles (36" Dia., 1/2" Wall) Delivered	LF	2010	$ 250.00	$ 287.50	$ 577,875
501.7011	Steel Pipe Piles (36" Dia., 1/2" Wall) In-Place w/ Rock Socket	LF	2010	$ 150.00	$ 287.50	$ 577,875
501.702	Steel Pipe Piles (24" Dia., 1/2" Wall) Delivered	LF	830	$ 150.00	$ 287.50	$ 238,625
501.7031	Steel Pipe Piles (24" Dia., 1/2" Wall) In-Place w/ Rock Socket	LF	830	$ 130.00	$ 287.50	$ 238,625
501.921	Pile Installation Equipment	LS	1	$ 50,000.00	$ 287.50	$ 288
504.70	Structural Steel Fabrication & Delivery (260000 lbs)	LS	1	$ 494,000.00	$ 287.50	$ 288
504.71	Structural Steel Erection (260000 lbs)	LS	1	$ 156,000.00	$ 287.50	$ 288
506.9106	Fusion Bonded Epoxy Coating	SY	4800	$ 65.00	$ 287.50	$ 1,380,000
655.50	Cathodic Protection by Sacrificial Anodes	EA	68	$ 1,500.00	$ 287.50	$ 19,550
899.9010	Steel Frontal Panel w/ UHMW Wearing Surface	SF	6950	$ 70.00	$ 287.50	$ 1,998,125
899.9011	SCH 1450H - Hollow Cylinder Rubber Fender	EA	20	$ 16,000.00	$ 287.50	$ 5,750
899.9012	UE 600 - MV Rubber Fender	EA	280	$ 4,000.00	$ 287.50	$ 80,500

SUBTOTAL:	$ 3,484,500
Mobilization (10%):	$ 348,450
TOTAL CONSTRUCTION COSTS:	**$ 3,832,950**
Engineering (7%), Inspection (7%):	$ 540,000
TOTAL PROJECT COSTS:	$ 4,372,950
TOTAL PROJECT COSTS (SAY):	**$ 4,400,000**

MARINE (FENDER SYSTEM) COMPONENTS - REHABILITATION

ITEM NO.	ITEM DESCRIPTION	UNIT	TOTAL QNTY.	UNIT PRICE	UNIT PRICE w/ CONT.	CONTRACT TOTAL
501.700	Steel Pipe Piles (36" Dia., 1/2" Wall) Delivered	LF	2010	$ 250.00	$ 287.50	$ 577,875
501.7011	Steel Pipe Piles (36" Dia., 1/2" Wall) In-Place w/ Rock Socket	LF	2010	$ 150.00	$ 287.50	$ 577,875
501.702	Steel Pipe Piles (24" Dia., 1/2" Wall) Delivered	LF	830	$ 150.00	$ 287.50	$ 238,625
501.7031	Steel Pipe Piles (24" Dia., 1/2" Wall) In-Place w/ Rock Socket	LF	830	$ 130.00	$ 287.50	$ 238,625
501.921	Pile Installation Equipment	LS	1	$ 50,000.00	$ 287.50	$ 288
504.70	Structural Steel Fabrication & Delivery (260000 lbs)	LS	1	$ 494,000.00	$ 287.50	$ 288
504.71	Structural Steel Erection (260000 lbs)	LS	1	$ 156,000.00	$ 287.50	$ 288
506.9106	Fusion Bonded Epoxy Coating	SY	4800	$ 65.00	$ 287.50	$ 1,380,000
655.50	Cathodic Protection by Sacrificial Anodes	EA	68	$ 1,500.00	$ 287.50	$ 19,550
899.9010	Steel Frontal Panel w/ UHMW Wearing Surface	SF	6950	$ 70.00	$ 287.50	$ 1,998,125
899.9011	SCH 1450H - Hollow Cylinder Rubber Fender	EA	20	$ 16,000.00	$ 287.50	$ 5,750
899.9012	UE 600 - MV Rubber Fender	EA	280	$ 4,000.00	$ 287.50	$ 80,500

SUBTOTAL:	$ 3,484,500
Mobilization (10%):	$ 348,450
TOTAL CONSTRUCTION COSTS:	**$ 3,832,950**
ADJUST FOR REHABILITATION (50%):	**$ 1,916,475**
Engineering (7%), Inspection (7%):	$ 270,000
TOTAL PROJECT COSTS:	$ 2,186,475
TOTAL PROJECT COSTS (SAY):	**$ 2,200,000**

REHABILITATION SAY =	**$2,200,000**
REPLACEMENT SAY =	**$4,400,000**

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: Replacement of Railroad Track

Assumptions:

1. All new ties, running rail, guard rail, expansion joints and OTM to be used on new bridge and approaches.
2. Quantities and unit pricing is based on the HNTB report titled "Bridge Replacement Options For Sarah Mildred Long Bridge", Dated March 16, 2012, only items located on bridge have been included.
3. Mobilization costs are taken as 10% of the project total.
4. A 15% contingency has been included in the unit price for each item.

DESCRIPTION	UNIT	QUANTITY	UNIT COST	UNIT COST w/ Cont.	COST
RELAY 115 RE RAIL	LF	3,220	$ 17	$ 19	$ 61,100
REMOVE EXISTING TRACK - BRIDGES	TF	1610	$ 75	$ 86	$ 138,863
BRIDGE GUARD RAIL REINSTALLATION	TF	100	$ 25	$ 29	$ 2,875
TRACK SURFACING	TF	1610	$ 5	$ 6	$ 9,258
SCRAP TIE DISPOSAL	LS	1	$ 20,000	$ 23,000	$ 23,000
FURNISH AND INSTALL BRIDGE TIES	EA	1400	$ 525	$ 604	$ 845,250
RAIL EXPANSION JOINTS	EA	4	$ 17,500	$ 20,125	$ 80,500
MITER RAILS FURNISHED AND INSTALLED	EA	4	$ 35,000	$ 40,250	$ 161,000
				SUBTOTAL =	$ 1,321,845
				Mobilization (10%) =	$ 132,184
				TOTAL CONSTRUCTION COSTS =	$ 1,454,029
				Engineering (7%) and Inspection (7%) =	$ 203,564
				TOTAL PROJECT COSTS =	$ 1,657,593
				TOTAL PROJECT COSTS (S	$ 1,700,000

SAY = $1,700,000

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: Bridge Bearing Rehabilitation

Assumptions:

1. Elastomeric Bearings on approach structures will remain in place for duration of bridge service life. Bearings at main spans will be replaced for a cost equaling their original construction cost.
2. Jacking and temporary support of the fixed and movable spans will be required. Assume $750,000 per span.
3. Quantities and unit pricing is based on the HNTB report titled "Bridge Replacement For Sarah Mildred Long Bridge", Dated March 16, 2012.
4. Mobilization costs are taken as 10% of the project total.
5. A 15% contingency has been included in the unit price for each item.
6. Design and Construction Engineering taken as 7% of Construction Value

MAIN SPAN COMPONENTS (TAKEN FROM TIED ARCH OPTION, ALL OPTIONS SIMILAR)

ITEM NO.	ITEM DESCRIPTION	UNIT	TOTAL QNTY.	UNIT PRICE	UNIT PRICE w/ CONT.	CONTRACT TOTAL
523.52	BEARING INSTALLATION	EA	14	$ 1,000.00	$ 1,150.00	$ 16,100
523.5551	POT OR DISC BEARINGS, FIXED	EA	4	$ 8,500.00	$ 9,775.00	$ 39,100
523.5552	POT OR DISC BEARINGS, EXPANSION	EA	4	$ 10,000.00	$ 11,500.00	$ 46,000
523.XXXX	LIFT SPAN BEARING, FIXED	EA	2	$ 8,500.00	$ 9,775.00	$ 19,550
523.XXXX	LIFT SPAN BEARING, EXPANSION	EA	2	$ 10,000.00	$ 11,500.00	$ 23,000
523.XXXX	LIFT SPAN CENTERING DEVICE	EA	2	$ 4,000.00	$ 4,600.00	$ 9,200
524.XXXX	JACKING AND TEMPORARY STRUCTURAL SUPPORTS	SPAN	2	$ 750,000.00	$ 862,500.00	$ 1,725,000

SUBTOTAL:	$	1,877,950
Mobilization (10%):	$	187,795
TOTAL CONSTRUCTION COSTS:	**$**	**2,065,745**
Engineering (7%), Inspection (7%):	$	290,000
TOTAL PROJECT COSTS:	$	2,355,745
TOTAL PROJECT COSTS (SAY):	**$**	**2,400,000**

SAY = $2,400,000

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: Replace Bridge Deck

Assumptions:

1. Deck replacement includes removing existing concrete & pavement, construction of new deck, construction of new curbs, membrane, pavement, railing, joints and other incidentals.
2. Mobilization costs are taken as 10% of the project total.
3. A 15% contingency has been applied.

Component	Deck Area (SF)	Unit Price($/lb)*	Unit Price w/ Conti.	Contract Total
New Hampshire Approach Spans	39,024	$82.44	$94.81	$3,699,709
Fixed Truss Spans	33,984	$82.44	$94.81	$3,221,887
Lift Span	8,064	$164.88	$189.61	$1,529,031
Main Approach Sapns	19,692	$82.44	$94.81	$1,866,920
Albacore Connector	4,524	$82.44	$94.81	$428,902
			SUBTOTAL =	$10,746,450
			Mobilization (10%) =	$1,074,645
			TOTAL CONSTRUCTION COSTS =	$11,821,095
			Engineering (7%), Inspection (7%):	$1,660,000
			TOTAL PROJECT COSTS:	$13,481,095
			TOTAL PROJECT COSTS (SAY):	**$13,500,000**

* Bid price data taken from MaineDOT PIN 016686.00 - I-95 Over Kennebec River Bridge Redecking Project Bid 7/11 and MTA project 2012-05 Presumpscot River - Falmouth Spur Redecking.
Only items that were directly related to the deck replacing were considers, listed below.
Lift span unit price is increased by 200% due to required counter-balancing and light-weight concrete.

			I-95 Kennebec River			Falmouth Spur
Item No.	Item Description	Quantity	Low	High	Average	Average
202.17	Removing Existing Structural Concrete	2328 CY	$719,000	$1,000,000	$859,500	$241,500
202.18	Removing Existing Bituminous Pavement	9576 SY	$20,000	$17,500	$18,750	$13,292
403.208	HMA 12.5MM Surface	696 T	$343,962	$343,962	$343,962	$19,867
502.26	Structural Concrete Roadway and Sidewalk Slabs	2172 CY	$1,950,000	$2,500,000	$2,225,000	$583,500
502.49	Structural Concrete Curbs and Sidewalks	279 CY	$175,000	$175,000	$175,000	$190,167
503.12	Reinforcing Steel, F&D	13622 LB	$6,811	$7,764	$7,288	$219,067
503.13	Reinforcing Steel, Placing	13622 LB	$13,622	$40,866	$27,244	$142,083
507.0811	Steel Bridge Railing, 2 Bar	4529 LF	$460,000	$450,000	$455,000	$68,667
508.14	High Performance Waterproofing Membrane	9729 SY	$175,000	$175,000	$175,000	$53,333
520.21	Expansion Device - Gland Seal	1 EA	$16,000	$22,500	$19,250	$98,000
520.22	Expansion Device - Compression Seal	2 EA	$36,000	$43,000	$39,500	N/A
521.23	Expansion Device - Finger Joint Type B	1 EA	$42,000	$55,000	$48,500	N/A
521.23	Expansion Device - Finger Joint Type D	2 EA	$84,000	$110,000	$97,000	N/A
521.32	Fabric Trough	1 EA	$5,000	$11,000	$8,000	N/A
521.33	Fabric Curtain	8 EA	$40,000	$20,000	$30,000	N/A
524.4	Protective Sheilding	LUMP	$30,000	$575,000	$100,000	$170,602
			Subtotal =		**$ 4,628,994**	**$ 1,800,077**
			Area =		79,981	21834 SF, (see calc.)
			Unit Cost =		$57.88	$82.44 $/SF
			2012 Unit Cost =		$60.09	$82.44 $/SF

Use Presumspcost River Falmouth Spur estimate, unit price is more in the range of what comprable projects have for redecking prices.

Unit cost derived by taking the sum of the average costs for all re-decking related items and then dividing by the square foot area of the bridges included in the estimate.

SAY = $13,500,000

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: Replace Counterweight Ropes

Assumptions:

1. Replace (16) 1-3/4" Diameter counterweight ropes and sockets.
2. All tensioning and adjustment costs included.
3. Rope life shortened by undersized sheave, replace at 40 years.

Component	Qty	Unit Price($/unit)*	Subtotal
Counterweight rope replacement	1	$1,250,000.00	$1,250,000
		Subtotal =	$1,250,000
		Mobilization (10%) =	$125,000
		TOTAL CONSTRUCTION COSTS =	$1,375,000
		Engineering (7%) and Inspection (7%) =	$192,500
		TOTAL PROJECT COSTS =	$1,567,500
		PROJECT TOTAL =	**$1,600,000**

* Cost data from Mobile River Bridge bids, rounded down for smaller rope size.

SAY = $1,600,000

HNTB The HNTB Companies	Made by T. Cote	Date 4/18/2012	Job No.: 57121-DS-001-001
	Checked by	Date	Sheet Number:
Calculations for: MaineDOT PIN 16710.00 - Sarah Milded Long Bridge			

Life Cycle Cost Analysis - Bridge Rehabilitation Option

Development of costs for: Residual Value

Assumptions -

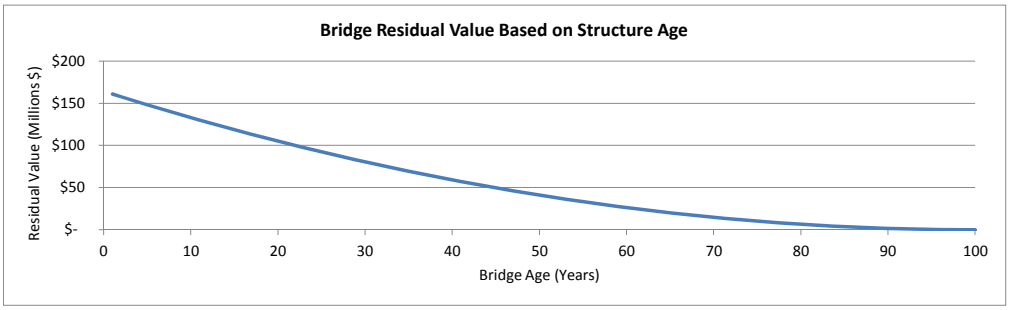
Bridge Service Life =	100	Years
Initial Bridge Construction Cost =	$ 161,200,000	(Including Design and Construction Engineering)
Bridge age at beginning of service life =	1	
Bridge age at end of analysis period =	50	
Bridge age at end of service life =	100	

Calculated Residual Value at end of Analysis Period = $ 41,118,253

Residual Value is calculated as follows: $RV = RC \times \{ [BA(T_A) - BA(T_{SL})] / [BA(T_0) - BA(T_{SL})] \}^2$

Where:

RV = Residual Value at End of Analysis Period
RC = Estimated Structure Replacement Cost
$BA(T_A)$ = Bridge Age at the end of the analysis period
$BA(T_{SL})$ = Bridge Age at the end of its service life
$BA(T_0)$ = Bridge Age at the beginning of its service life



Calculated Residual Value Based on Age of Structure

Bridge Age	Residual Value	Bridge Age	Residual Value	Bridge Age	Residual Value
1	$ 161,200,000	34	$ 71,644,444	67	$ 17,911,111
2	$ 157,959,882	35	$ 69,489,848	68	$ 16,842,037
3	$ 154,752,658	36	$ 67,368,146	69	$ 15,805,857
4	$ 151,578,329	37	$ 65,279,339	70	$ 14,802,571
5	$ 148,436,894	38	$ 63,223,426	71	$ 13,832,180
6	$ 145,328,354	39	$ 61,200,408	72	$ 12,894,684
7	$ 142,252,709	40	$ 59,210,285	73	$ 11,990,083
8	$ 139,209,958	41	$ 57,253,056	74	$ 11,118,376
9	$ 136,200,102	42	$ 55,328,722	75	$ 10,279,563
10	$ 133,223,140	43	$ 53,437,282	76	$ 9,473,646
11	$ 130,279,074	44	$ 51,578,737	77	$ 8,700,622
12	$ 127,367,901	45	$ 49,753,086	78	$ 7,960,494
13	$ 124,489,624	46	$ 47,960,331	79	$ 7,253,260
14	$ 121,644,240	47	$ 46,200,469	80	$ 6,578,921
15	$ 118,831,752	48	$ 44,473,503	81	$ 5,937,476
16	$ 116,052,158	49	$ 42,779,431	82	$ 5,328,926
17	$ 113,305,459	50	$ 41,118,253	83	$ 4,753,270
18	$ 110,591,654	51	$ 39,489,970	84	$ 4,210,509
19	$ 107,910,744	52	$ 37,894,582	85	$ 3,700,643
20	$ 105,262,728	53	$ 36,332,089	86	$ 3,223,671
21	$ 102,647,607	54	$ 34,802,490	87	$ 2,779,594
22	$ 100,065,381	55	$ 33,305,785	88	$ 2,368,411
23	$ 97,516,049	56	$ 31,841,975	89	$ 1,990,123
24	$ 94,999,612	57	$ 30,411,060	90	$ 1,644,730
25	$ 92,516,070	58	$ 29,013,039	91	$ 1,332,231
26	$ 90,065,422	59	$ 27,647,913	92	$ 1,052,627
27	$ 87,647,669	60	$ 26,315,682	93	$ 805,918
28	$ 85,262,810	61	$ 25,016,345	94	$ 592,103
29	$ 82,910,846	62	$ 23,749,903	95	$ 411,183
30	$ 80,591,776	63	$ 22,516,355	96	$ 263,157
31	$ 78,305,601	64	$ 21,315,702	97	$ 148,026
32	$ 76,052,321	65	$ 20,147,944	98	$ 65,789
33	$ 73,831,936	66	$ 19,013,080	99	$ 16,447
				100	$ -

~SAY = $ 41,120,000

Appendix B
LCCA – One Deck Network Tied Arch

HNTB The HNTB Companies	Made by K. Brayley	Date: 4/20/2012	Job No.: 57121-DS-001-001
	Checked by T. Cote	Date: 4/20/2012	Sheet Number: 1 of 24

Calculations for: MaineDOT PIN 16710.00 - Sarah Milded Long Bridge

Life Cycle Cost Analysis - Bridge Replacement, One-Deck Network Tied Arch Option

Discount Rate =	4.0%
Start Year =	2012

Work Activity	Calendar Year	Index Year	Discount Factor	2012 Cost (Construction & Eng.)	Present Value
Capital Cost - Bridge Structure	2012	0	1.000	$ 156,800,000.00	$ 156,800,000.00
Capital Cost - Engineering, Inspection and Right of Way	2012	0	1.000	$ 20,700,000.00	$ 20,700,000.00
O&M: Bridge Tenders	Annual	-	24.505[1]	$ 440,300.00	$ 10,789,551.06
O&M: Highway (Excl. Signals)	Annual	-	24.505[1]	$ 21,902.00	$ 536,708.49
O&M: Highway Signals	Annual	-	24.505[1]	$ -	$ -
O&M: Rail	Annual	-	24.505[1]	$ 11,340.00	$ 277,886.69
O&M: Railroad Crossing Signals	Annual	-	24.505[1]	$ 9,810.00	$ 240,394.04
O&M: Bridge	Annual	-	24.505[1]	$ 12,445.00	$ 304,964.71
O&M: Elec./Mech. Maintenance, Lift Span	Annual	-	24.505[1]	$ 226,000.00	$ 5,538,129.77
O&M: Routine & Fracture Critical Inspections	Annual	-	24.505[1]	$ 168,910.00	$ 4,139,139.38
Rehabilitation: Highway Pavement Overlay	2022	10	0.676	$ 350,000.00	$ 236,447.46
Rehabilitation: Highway Pavement Overlay	2032	20	0.456	$ 350,000.00	$ 159,735.43
Rehabilitation: Elec. & Mech., Lift Span	2037	25	0.375	$ 5,800,000.00	$ 2,175,677.45
Rehabilitation: Bridge Deck Patch and Pave	2037	25	0.375	$ 1,140,000.00	$ 427,633.15
Rehabilitation: Traffic & Barrier Gates	2037	25	0.375	$ 300,000.00	$ 112,535.04
Rehabilitation: Bridge Lighting	2037	25	0.375	$ 100,000.00	$ 37,511.68
Rehabilitation: Fender System	2037	25	0.375	$ 2,200,000.00	$ 825,256.96
Rehabilitation: Highway Pavement Overlay	2042	30	0.308	$ 350,000.00	$ 107,911.53
Replacement: Railroad Ties	2042	30	0.308	$ 1,700,000.00	$ 524,141.74
Rehabilitation: Bridge Repainting	2052	40	0.208	$ 14,880,000.00	$ 3,099,340.98
Rehabilitation: Highway Pavement Overlay	2052	40	0.208	$ 350,000.00	$ 72,901.17
Replacement: Elec. & Mech., Lift Span	2062	50	0.141	$ 10,700,000.00	$ 1,505,624.98
Replacement: Counterweight Ropes	2062	50	0.141	$ 2,600,000.00	$ 365,852.80
Rehabilitation: Touch-up Painting	2062	50	0.141	$ 4,464,000.00	$ 628,141.11
Rehabilitation: Traffic & Barrier Gates	2062	50	0.141	$ 300,000.00	$ 42,213.78
Rehabilitation: Bridge Lighting	2062	50	0.141	$ 100,000.00	$ 14,071.26
Rehabilitation: Bridge Superstructure, Approach Spans	2062	50	0.141	$ 1,690,000.00	$ 237,804.32
Rehabilitation: Bridge Superstructure, Main Spans	2062	50	0.141	$ 11,700,000.00	$ 1,646,337.60
Replacement: Bridge Deck	2062	50	0.141	$ 11,300,000.00	$ 1,590,052.55
Rehabilitation: Bridge Substructure	2062	50	0.141	$ 2,100,000.00	$ 295,496.49
Replacement: Bridge Bearings	2062	50	0.141	$ 2,600,000.00	$ 365,852.80
Replacement: Fender System	2062	50	0.141	$ 4,400,000.00	$ 619,135.51
Rehabilitation: Highway Full Depth Reconstruction	2062	50	0.141	$ 2,655,000.00	$ 373,591.99
Rehabilitation: Highway Pavement Overlay	2072	60	0.095	$ 350,000.00	$ 33,271.14
Replacement: Railroad Ties	2072	60	0.095	$ 1,700,000.00	$ 161,602.68
Rehabilitation: Touch-up Painting	2072	60	0.095	$ 4,464,000.00	$ 424,349.63
Rehabilitation: Bridge Repainting	2082	70	0.064	$ 14,880,000.00	$ 955,584.68
Rehabilitation: Highway Pavement Overlay	2082	70	0.064	$ 350,000.00	$ 22,476.79
Rehabilitation: Elec. & Mech., Lift Span	2087	75	0.053	$ 5,800,000.00	$ 306,145.26
Rehabilitation: Traffic & Barrier Gates	2087	75	0.053	$ 300,000.00	$ 15,835.10
Rehabilitation: Bridge Deck Patch and Pave	2087	75	0.053	$ 1,140,000.00	$ 60,173.38
Rehabilitation: Bridge Superstructure, Approach Spans	2087	75	0.053	$ 1,690,000.00	$ 89,204.40
Rehabilitation: Bridge Superstructure, Main Spans	2087	75	0.053	$ 11,700,000.00	$ 617,568.90
Rehabilitation: Bridge Substructure	2087	75	0.053	$ 2,100,000.00	$ 110,845.70
Rehabilitation: Bridge Lighting	2087	75	0.053	$ 100,000.00	$ 5,278.37
Rehabilitation: Fender System	2087	75	0.053	$ 2,200,000.00	$ 116,124.07
Rehabilitation: Touch-up Painting	2092	80	0.043	$ 4,464,000.00	$ 193,667.63
Rehabilitation: Highway Pavement Overlay	2092	80	0.043	$ 350,000.00	$ 15,184.51
Rehabilitation: Highway Pavement Overlay	2102	90	0.029	$ 350,000.00	$ 10,258.11
Rehabilitation: Touch-up Painting	2102	90	0.029	$ 4,464,000.00	$ 130,834.91
Residual Value	2112	100	0.020	$ -	$ -
				Total Life Cycle Cost =	**$ 218,100,000.00**

Notes:

1) Based on discounting 100 years of annual payments to present value calculated as: $DR^{(100-1)} / (DR \times (1 + DR)^{100})$

2) LCCA totals are rounded to the nearest one hundred thousand.

3) See assumptions & summary document for all work activity frequency and ordering.

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Option

Development of costs for: O&M Bridge Tenders

Annual Operator Labor Costs						
Bridge	Number of Full Time Operators on Bridge at All Times	Average Hourly Rate	Hours per Week	Overhead Burden	52 Weeks per Year	Total cost in 2010 Dollars
Sarah Mildred Long	2	$ 18.00	168	1.4	52	$ 440,294.40

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Option

Development of costs for: Highway Striping, Intersection Maintenance and Highway Maintenance (excluding signals)

Assumptions:

1. Unit pricing is based on the HNTB report titled "Construction Cost Estimates For Sarah Mildred Long Bridge", Dated March 16, 2012 - Unless otherwise noted.
2. Since striping is an operation and maintenance activity no engineering costs have been applied.
3. Applied factors are as follows:

Incidentals & Contingency 15%

Frequency	1	Year Cycle

	2012 Unit Cost	
Striping	$0.65	LF of Striping

	Striping Length within O&M Limits		
	1 Deck	~~2 Deck~~	~~Rehab~~
Market Street	12000	~~12000~~	~~12000~~
Route 1 Bypass	17300	~~15700~~	~~15700~~
Albacore Connector	0	~~1500~~	~~1500~~
Quantity	**29300 LF**	**~~29200 LF~~**	**~~29200 LF~~**

Striping	$19,045	~~$18,980~~	~~$18,980~~
Incidentals & Contingency	$2,856.75	~~$2,847.00~~	~~$2,847.00~~
2012 Total Costs	**$21,902**	**~~$21,827~~**	**~~$21,827~~**

SAY =	**$20,600**

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Option

Development of costs for: O&M - Rail

Assumptions:	2 men x 4hrs/ea/mo. x 12 mo. x $90hr loaded =	$8,640
	1 vehicle @ $50 day/2 x12 days =	$300
	$200 misc.materials/mo. =	$2,400
		$11,340

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Option

Development of costs for: O&M - Signal

Assumptions:	1 man x 6hrs/mo. x 12 mo. x $105hr loaded =	$7,560
	1 vehicle @ $50 day/.75 x12 days =	$450
	$150 misc.materials/mo. =	$1,800
		$9,810

SAY =	**$9,810**

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Optior

Development of costs for: Bridge O&M

Assumptions:

1. Bridge O&M includes daily and seasonal operations to maintain the bridges travel way and accessibility (shoulder sweeping, waterproofing, etc.).

Component	Deck Area (SF)	Unit Price($/SF)*	Subtotal
New Hampshire Approach Spans	30,885	$0.15	$4,633
Fixed Arch Spans	23,520	$0.15	$3,528
Lift Span	11,760	$0.15	$1,764
Maine Approach Spans	16,800	$0.15	$2,520
∑ =	**76,720**	**Total Cost =**	**$12,445**

* Unit price taken from Maine - New Hampshire Connections Study

SAY =	**$12,500**

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Option

Development of costs for: O&M Lift Span Mechanical/Electrical Maintenance

Assumptions:

1. Totals on this sheet on a per year (annual) basis
2. Operation of span assumed to be consistent with present level of usage
3. Arch span has 35' additional vertical clearance, requiring approx. 314 fewer annual lifts than 2-deck optio using data in Connections Study Memo Technical #3. Assume 2900 openings/yea

Component	Qty	Unit Price($/unit)*	Subtotal
Lubricate machinery [2ppl x 16 hrs]	12	$3,200.00	$38,400
Lubricate span/cwt guides [32 hrs]	4	$3,200.00	$12,800
Lubricate ropes [64 hrs]	4	$6,400.00	$25,600
Change reducer oil [16 hrs]	1	$1,600.00	$1,600
Reducer oil (for 2 reducers)	150	$75.00	$11,250
Lubricating Greases	1	$5,000.00	$5,000
Nav. lamp maint [2 ppl 2 hrs ea]	10	$400.00	$4,000
General elect. maint [32 hrs]	12	$3,200.00	$38,400
Traffic signals maint	36	$400.00	$14,400
Generator routine service	1	$1,000.00	$1,000
Generator fuel	150	$4.50	$675
Estimated power for openings	2,900	$5.90	$17,096
Elevator inspection and maint.	2	$5,000.00	$10,000
Other routine repairs	1	$25,000.00	$25,000
Maint. material costs	1	$20,000.00	$20,000
		Total Cost =	**$225,221**

* Labor rate @ $100/hr
Est. power 45 kWh per opening
Traffic signals 6 3-head signals for bridge; service 2x year
Main span drive motors 150 hp each

SAY =	**$226,000**

HNTB The HNTB Companies	Made by	J Carney	Date	4/18/2012	Job No.: 57121-DS-001-001
	Checked by	T. Cote	Date	4/19/2012	Sheet Number: 8 of 24
Calculations for: MaineDOT PIN 16710.00 - Sarah Milded Long Bridge					

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Option

Development of costs for: O&M - Bridge Inspection

Assumptions:

1. Cost estimate developed based on completing and NBIS Compliant Routine and Fracture Critical Inspection on a 2-year cycle. Inspection costs have been annualized for entry into LCCA sheet.
2. Inspection costs developed based on access from the bridge deck. No barge work has been included in this estimate.

Client Name: MaineDOT
Client Number: **16710.00**
HNTB Number: 57121-BL-001-001
Prepared By: J. Carney

Project Name: **LCCA Bridge Inspection Estimate - Network Arch Option**
Project Location: Kittery, ME and Portsmouth, NH
Date: 4/18/2012

Task	Project Manager	QA/QC	Senior Structural Engineer	Structural Engineer			CADD Technician	Total
Name								
Field Inspection Set-up & Preparations	16		12	14				42
Field Inspect w/ 80' Manlift on Deck for Arch Inspection	0		36	36				72
Field Inspect. Arch & Appr. Spans w/ UB-62 Snooper (8 days)	0	0	72	72				144
Field Inspect. Diverging RR Spans w/ HI-Rail UB-30 Snooper (2 days)			18	18				36
Field Inspect Appr. Spans @ Market St w/ UB-62 Snooper (3 days)			27	27				54
Top of Deck Inspection			12	12				24
Tower Inspections - (4 days)			36	36				72
Office Report & Sketch Preparations	12	24	65	76			40	217
								0
TOTAL HOURS	28	24	278	291	0	0	40	661
LABOR RATE	$60.00	$50.00	$50.00	$45.00			$30.00	
DIRECT LABOR	$ 1,680.00	$ 1,200.00	$ 13,900.00	$ 13,095.00	$ -	$ -	$ 1,200.00	$ 31,075.00

Notes:

Direct Expenses

Mileage & Printing	$1,000.00
Lodging & Per Diem	$5,940.00
80' Manlift on Bridge Deck	$10,000.00
UB-62 Snooper for Inspection of Arch & Approach Spans (11 days)	$19,800.00
Rigging for Exterior Tower Inspection	$14,000.00
Traffic Control (w/ Snooper & Manlift on Deck - Assume Manlift uses same MOT as Snooper)	$16,500.00
Flaggers / Police for Traffic Control	$7,700.00
UB-30 Snooper w/ HI Rail	$3,600.00
TOTAL	$78,540.00

Total Engineering Cost

Direct Labor (see note 4)	$33,094.88
Overhead (144.90%)	$49,059.84
Fee (10%)	$8,215.47
Direct Expenses	$78,540.00
TOTAL	**$168,910.19**

GRAND TOTAL **$168,910.19**

ANNUALIZED COST ~ SAY = $85,000

HNTB The HNTB Companies	Made by	L. Meek	Date	4/18/2012	Job No.: 57121-DS-001-001
	Checked by	BMH	Date	4/19/2012	Sheet Number: 9 of 24
Calculations for: MaineDOT PIN 16710.00 - Sarah Milded Long Bridge					

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Option

Development of costs for: Pavement O&M (beyond abutments)

Assumptions:

1. Unit pricing is based on the HNTB report titled "Construction Cost Estimates For Sarah Mildred Long Bridge", Dated March 16, 2012 - Unless otherwise noted.
2. Applied factors are as follows:
   - Incidentals & Contingency 15%
   - Design and Construction Eng. & Insp. 14%
3. Repair cycles will be 10 yr for Overlay & 50 yr for Full Depth Reconstruction based on recommendations from the Connections Study

Pavement Areas			
	1 Deck Tied-Arch	~~2 Deck Truss~~	~~Rehab~~
NH	206938	~~212741~~	~~212741~~
ME	82445	~~82623~~	~~82623~~
Total	289,383 s.f	~~295,364 s.f~~	~~295,364 s.f~~

	Thickness	Volumes		
		1 Deck Tied-Arch	~~2 Deck Truss~~	~~Rehab~~
Overlay				
HMA	1.5 in.	2,653 ton	~~2,708 ton~~	~~2,708 ton~~
Full Depth Construction				
HMA	8.5 in.	15,032 ton	~~15,343 ton~~	~~15,343 ton~~
Gravel (ABC-C)	11.5 in.	10,271 c.y.	~~10,484 c.y.~~	~~10,484 c.y.~~
Gravel (ASC-G)	10 in.	8,932 c.y.	~~9,116 c.y.~~	~~9,116 c.y.~~

	Unit	Frequency	2012 Unit Cost	2012 Total Construction Cost (with Incidentals & Contingency)			2012 Total Cost (Construction, Eng,, & Insp.)		
				1 Deck	~~2 Deck~~	~~Rehab~~	1 Deck	~~2 Deck~~	~~Rehab~~
Overlay									
HMA	Ton	10	$100	$305,058	~~$311,363~~	~~$311,363~~	**$347,766**	**~~$384,954~~**	**~~$384,954~~**
Full Depth Construction									
HMA	Ton		$100	$1,728,662	~~$1,764,390~~	~~$1,764,390~~	$1,970,674	~~$2,041,404~~	~~$2,041,404~~
Gravel (ABC-C)	CY		$29	$342,548	~~$349,628~~	~~$349,628~~	$390,505	~~$398,576~~	~~$398,576~~
Gravel (ASC-G)	CY		$25	$256,783	~~$262,090~~	~~$262,090~~	$292,732	~~$298,783~~	~~$298,783~~
Full Depth Construction Total		50					**$2,653,911**	**~~$2,708,763~~**	**~~$2,708,763~~**

Overlay Say = $350,000

Full Depth Recon. Say = $2,655,000

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Option

Development of costs for: Rehabilitate Lift Span Electrical and Mechanical Systems

Assumptions:

1. Rehabilitate lift span mechanical and electrical systems. Ropes covered under separate item.
2. No major work on counterweight sheaves or sheave bearings.
3. Gates covered under separate item.
4. Rehab at year 25.

Component	Qty	Unit Price($/unit)*	Subtotal
Rehab span drive machinery	1	$1,750,000.00	$1,750,000
Rehab span locks	1	$250,000.00	$250,000
Rehab elevators	1	$100,000.00	$100,000
Rehab bridge control system	1	$1,675,000.00	$1,675,000
Replace aerial cable	1	$100,000.00	$100,000
Rehab CCTV system	1	$96,000.00	$96,000
Replace intercom system	1	$55,000.00	$55,000
Replace fire alarm system	1	$135,000.00	$135,000
Replace generator	1	$400,000.00	$400,000
		Total Cost =	**$4,561,000**
		Mobilization (10%) =	$456,100
		TOTAL CONSTRUCTION COSTS =	$5,017,100
		Engineering (7%) and Inspection (7%) =	$702,394
		TOTAL PROJECT COSTS =	$5,719,494
		PROJECT TOTAL =	**$5,800,000**

* Span drive machinery rehab 50% of replacement cost
Span lock cost from Bates bridge
Electrical control system rehab 50% of replacement cost
CCTV cost from Chelsea St.
Intercom system from Chelsea St.
Fire alarm system from Chelsea St.
Generator cost from Chelsea St.

SAY = $5,800,000

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Option

Development of costs for: Rehabilitate Traffic and Barrier Gates

Assumptions:

1. Replace traffic and barrier gates.
2. Replace at year 25.

Component	Qty	Unit Price($/unit)*	Subtotal
Replace Warning Gates	1	$125,000.00	$125,000
Replace Barrier Gates	1	$92,500.00	$92,500
		Total Cost =	**$217,500**
		Mobilization (10%) =	$21,750
		TOTAL CONSTRUCTION COSTS =	$239,250
		Engineering (7%) and Inspection (7%) =	$33,495
		TOTAL PROJECT COSTS =	$272,745
		PROJECT TOTAL =	**$300,000**

* Unit pricing based on the HNTB report titled "Bridge Replacement Options For Sarah Mildred Long Bridge", Dated March 16, 2012

SAY =	**$300,000**

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Option

Development of costs for: Rehabilitate Bridge Lighting

Assumptions:

1. Bridge Lighting includes street lights and navigational lighting.
2. Work includes repair and replacement of lighting components.
3. Lump sum price assumed using data from Maine - New Hampshire Connections Study.

Construction Cost = $100,000

TOTAL = $100,000.00

SAY = $100,000

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Option

Development of costs for: Fender System Replacement and Rehabilitation

Assumptions:

1. Fender systems will be rehabilitated every 25 years and replaced every 50 years.
2. Replacement costs are assumed to be unchaged from original construction value. Fender rehabilitation assumed as 50% of initial construction cost.
3. Quantities and unit pricing is based on the HNTB report titled "Construction Cost Estimates For Sarah Mildred Long Bridge", Dated February 10, 2012.
4. Mobilization costs are taken as 10% of the project total.
5. A 15% contingency has been included in the unit price for each item.
6. Design and Construction Engineering each taken as 7% of construction value

MARINE (FENDER SYSTEM) COMPONENTS - REPLACEMENT

ITEM NO.	ITEM DESCRIPTION	UNIT	TOTAL QNTY.	UNIT PRICE	UNIT PRICE w/ CONT.	CONTRACT TOTAL
501.700	Steel Pipe Piles (36" Dia., 1/2" Wall) Delivered	LF	2010	$ 250.00	$ 287.50	$ 577,875
501.7011	Steel Pipe Piles (36" Dia., 1/2" Wall) In-Place w/ Rock Socket	LF	2010	$ 150.00	$ 172.50	$ 346,725
501.702	Steel Pipe Piles (24" Dia., 1/2" Wall) Delivered	LF	830	$ 150.00	$ 172.50	$ 143,175
501.7031	Steel Pipe Piles (24" Dia., 1/2" Wall) In-Place w/ Rock Socket	LF	830	$ 130.00	$ 149.50	$ 124,085
501.921	Pile Installation Equipment	LS	1	$ 50,000.00	$ 57,500.00	$ 57,500
504.70	Structural Steel Fabrication & Delivery (260000 lbs)	LS	1	$ 494,000.00	$ 568,100.00	$ 568,100
504.71	Structural Steel Erection (260000 lbs)	LS	1	$ 156,000.00	$ 179,400.00	$ 179,400
506.9106	Fusion Bonded Epoxy Coating	SY	4800	$ 65.00	$ 74.75	$ 358,800
655.50	Cathodic Protection by Sacrificial Anodes	EA	68	$ 1,500.00	$ 1,725.00	$ 117,300
899.9010	Steel Frontal Panel w/ UHMW Wearing Surface	SF	6950	$ 70.00	$ 80.50	$ 559,475
899.9011	SCH 1450H - Hollow Cylinder Rubber Fender	EA	20	$ 16,000.00	$ 18,400.00	$ 368,000
899.9012	UE 600 - MV Rubber Fender	EA	280	$ 4,000.00	$ 4,600.00	$ 1,288,000

SUBTOTAL:	$ 4,688,435
Mobilization (10%):	$ 468,844
TOTAL CONSTRUCTION COSTS:	**$ 5,157,279**
Engineering (7%), Inspection (7%):	$ 730,000
TOTAL PROJECT COSTS:	$ 5,887,279
TOTAL PROJECT COSTS (SAY):	**$ 5,900,000**

MARINE (FENDER SYSTEM) COMPONENTS - REHABILITATION

ITEM NO.	ITEM DESCRIPTION	UNIT	TOTAL QNTY.	UNIT PRICE	UNIT PRICE w/ CONT.	CONTRACT TOTAL
501.700	Steel Pipe Piles (36" Dia., 1/2" Wall) Delivered	LF	2010	$ 250.00	$ 287.50	$ 577,875
501.7011	Steel Pipe Piles (36" Dia., 1/2" Wall) In-Place w/ Rock Socket	LF	2010	$ 150.00	$ 172.50	$ 346,725
501.702	Steel Pipe Piles (24" Dia., 1/2" Wall) Delivered	LF	830	$ 150.00	$ 172.50	$ 143,175
501.7031	Steel Pipe Piles (24" Dia., 1/2" Wall) In-Place w/ Rock Socket	LF	830	$ 130.00	$ 149.50	$ 124,085
501.921	Pile Installation Equipment	LS	1	$ 50,000.00	$ 57,500.00	$ 57,500
504.70	Structural Steel Fabrication & Delivery (260000 lbs)	LS	1	$ 494,000.00	$ 568,100.00	$ 568,100
504.71	Structural Steel Erection (260000 lbs)	LS	1	$ 156,000.00	$ 179,400.00	$ 179,400
506.9106	Fusion Bonded Epoxy Coating	SY	4800	$ 65.00	$ 74.75	$ 358,800
655.50	Cathodic Protection by Sacrificial Anodes	EA	68	$ 1,500.00	$ 1,725.00	$ 117,300
899.9010	Steel Frontal Panel w/ UHMW Wearing Surface	SF	6950	$ 70.00	$ 80.50	$ 559,475
899.9011	SCH 1450H - Hollow Cylinder Rubber Fender	EA	20	$ 16,000.00	$ 18,400.00	$ 368,000
899.9012	UE 600 - MV Rubber Fender	EA	280	$ 4,000.00	$ 4,600.00	$ 1,288,000

SUBTOTAL:	$ 4,688,435
Mobilization (10%):	$ 468,844
TOTAL CONSTRUCTION COSTS:	**$ 5,157,279**
ADJUST FOR REHABILITATION (50%):	**$ 2,578,639**
Engineering (7%), Inspection (7%):	$ 370,000
TOTAL PROJECT COSTS:	$ 2,948,639
TOTAL PROJECT COSTS (SAY):	**$ 3,000,000**

REHABILITATION SAY =	**$3,000,000**
REPLACEMENT SAY =	**$5,900,000**

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Option

Development of costs for: Replacement of Railroad Track

Assumptions:

1. All new ties, running rail, guard rail, expansion joints and OTM to be used on new bridge and approaches.
2. Quantities and unit pricing is based on the HNTB report titled "Bridge Replacement Options For Sarah Mildred Long Bridge", Dated March 16, 2012, only items located on bridge have been included.
3. Mobilization costs are taken as 10% of the project total.
4. A 15% contingency has been included in the unit price for each item.

DESCRIPTION	UNIT	QUANTITY	UNIT COST	UNIT COST w/ Cont.	COST
RELAY 115 RE RAIL	LF	3,470	$ 17	$ 19	$ 65,843
REMOVE EXISTING TRACK - BRIDGES	TF	1610	$ 75	$ 86	$ 138,863
BRIDGE GUARD RAIL REINSTALLATION	TF	100	$ 25	$ 29	$ 2,875
TRACK SURFACING	TF	1735	$ 5	$ 6	$ 9,976
SCRAP TIE DISPOSAL	LS	1	$ 20,000	$ 23,000	$ 23,000
FURNISH AND INSTALL BRIDGE TIES	EA	1400	$ 525	$ 604	$ 845,250
RAIL EXPANSION JOINTS	EA	4	$ 17,500	$ 20,125	$ 80,500
MITER RAILS FURNISHED AND INSTALLED	EA	4	$ 35,000	$ 40,250	$ 161,000
				SUBTOTAL =	$ 1,327,307
				Mobilization (10%) =	$ 132,731
				TOTAL CONSTRUCTION COSTS =	$ 1,460,038
				Engineering (7%) and Inspection (7%) =	$ 204,405
				TOTAL PROJECT COSTS =	$ 1,664,443
				TOTAL PROJECT COSTS (SAY) =	$ 1,700,000

SAY = $1,700,000

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Option

Development of costs for: Replace Counterweight Ropes

Assumptions:

1. Replace (20) 2-1/8" Diameter counterweight ropes and sockets.
2. All tensioning and adjustment costs included.
3. Replace ropes at 50 years.

Component	Qty	Unit Price($/unit)*	Subtotal
Counterweight rope replacement	1	$2,000,000.00	$2,000,000
		Total Cost =	**$2,000,000**
		Mobilization (10%) =	$200,000
		TOTAL CONSTRUCTION COSTS =	$2,200,000
		Engineering (7%) and Inspection (7%) =	$308,000
		TOTAL PROJECT COSTS =	$2,508,000
		PROJECT TOTAL =	**$2,600,000**

* Cost data from Chelsea St. Bridge bids, rounded down for smaller rope size.

SAY = $2,600,000

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Option

Development of costs for: Replace Lift Span Electrical and Mechanical Systems

Assumptions:

1. Replace lift span mechanical and electrical systems. Ropes covered under separate item.
2. No major work on counterweight sheaves or sheave bearings.
3. Gates covered under separate item.
4. Replace at year 50.

Component	Qty	Unit Price($/unit)*	Subtotal
Replace span drive machinery	1	$3,500,000.00	$3,500,000
Replace span locks	1	$250,000.00	$250,000
Replace elevators	1	$500,000.00	$500,000
Replace bridge control system	1	$3,375,000.00	$3,375,000
Replace aerial cable	1	$100,000.00	$100,000
Replace CCTV system	1	$192,000.00	$192,000
Replace intercom system	1	$55,000.00	$55,000
Replace fire alarm system	1	$135,000.00	$135,000
Replace generator	1	$400,000.00	$400,000
		Total Cost =	**$8,507,000**
		Mobilization (10%) =	$850,700
		TOTAL CONSTRUCTION COSTS =	$9,357,700
		Engineering (7%) and Inspection (7%) =	$1,310,078
		TOTAL PROJECT COSTS =	$10,667,778
		PROJECT TOTAL =	**$10,700,000**

* Span drive machinery from Chelsea St.
Span lock cost from Bates bridge
Electrical control system from Mobile River + 25%
CCTV cost from Chelsea St.
Intercom system from Chelsea St.
Fire alarm system from Chelsea St.
Generator cost from Chelsea St.

SAY = $10,700,000

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Optior

Development of costs for: Touch-up Painting

Assumptions:

1. Bridge painting includes only surface preparation & field painting.
2. Bridge painting calculated to represent a cost per pound of steel being painted.
3. Assuming highway approach members are replaced with concrete beams.
4. This item was assumed to be 30% of overall bridge painting cost occuring at an interval of 10 years

Full Bridge Painting = $ 14,880,000

Touch-up Painting = $ 4,464,000 includes 14% for PE & CE along with 10% Mob. And 15% contingency

SAY = $4,464,000

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Optior

Development of costs for: Bridge Painting

Assumptions:

1. Bridge painting includes surface preparation, pollution control and proper disposal of waste along with traffic control, incidentals and mobilization costs.
2. Bridge painting calculated to represent a cost per pound of steel being painted is reduced by 20% to account for ease of painting members.
3. All highway approach spans will be replaced with concrete NEXT beams, no painting required.
4. Arch span weights include both lift towers and both highway and rail superstructure steel.
5. Quantities are based on the HNTB report titled "Bridge Replacement Options For Sarah Mildred Long Bridge", Dated March 16, 2012.
6. Add 7% for PE and 7% for CE and 15% Contingency.

Component	Weight (lb)	Unit Price($/lb)*	Unit Price w/ Conti.	Contract Total
Approach HW Spans	N/A	$1.89	$2.18	N/A
Arch Spans	7,881,968	$1.89	$2.18	$14,920,943
Approach RR Spans	715,000	$1.89	$2.18	$1,353,529
Σ Sum =	8,596,968	**TOTAL CONSTRUCTION COSTS:**		**$ 16,274,472**
		Engineering (7%), Inspection (7%):		$ 2,280,000
		TOTAL PROJECT COSTS:		$ 18,554,472
		TOTAL PROJECT COSTS (SAY):		**$ 18,600,000**
		Reduce 20%:		**$ 14,880,000**

* Bid price data taken from MaineDOT PIN 016816.00 - Memorial Bridge Paint Project Bid 12/11 (see summary below)
Unit cost calculated by dividing total bid cost by 6.2 million pounds of steel, steel weight from Memorial Bridge.
Use average bid price considering added complexity of painting and moveable structure.

Vendor	Total Bid	Unit Cost
Spartan Contracting LLC	$ 6,967,000	$ 1.12
Titan Industrial Services Inc.	$ 7,468,000	$ 1.20
Liberty-Alpha JV, LLC	$ 8,769,000	$ 1.41
Intech Contracting LLC	$ 9,474,960	$ 1.53
Allied Painting, Inc.	$ 9,498,020	$ 1.53
Tri-State Painting, Inc.	$ 9,635,622	$ 1.55
Hercules Painting Company, Inc.	$ 10,169,868	$ 1.64
TDA Construction	$ 10,794,000	$ 1.74
Amstar of Western New York, Inc.	$ 10,870,000	$ 1.75
Blastech Enterprises, Inc.	$ 11,477,550	$ 1.85
Atlas Painting & Sheeting Corporation	$ 12,189,000	$ 1.97
Vimas Painting Company Inc.	$ 12,747,300	$ 2.06
North Star Painting	$ 12,774,000	$ 2.06
Royal Bridge	$ 12,990,000	$ 2.10
Odyssey Contracting Corporation	$ 13,415,500	$ 2.16
ABHE & Svoboda, Inc.	$ 14,443,310	$ 2.33
Corcon Incorporated	$ 14,796,338	$ 2.39
MJ Painting Co.	$ 15,004,726	$ 2.42

	Year 2011		Year 2012	per RS Means
Low Bid Unit Cost =	$ 1.12	per lb	$ 1.17	per lb
Average Bid Unit Cost =	$ 1.82	per lb	$ 1.89	per lb
High Bid Unit Cost =	$ 2.42	per lb	$ 2.51	per lb

Note: For reference, the construction value of the 1999 re-painting of the maine span on the I-95 high level bridge over the piscataqua river, adjusted for inflation per RSMeans, cost $18,663,605.

SAY = $14,880,000

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Option

Development of costs for: Rehab Bridge Deck Patch and Pave (all spans)

Assumptions:

1. Bridge patch and pave includes pavement removal, re-paving, patching concrete, and deck surface.
2. Girders are considered to have 100 year service life and are not anticipated to require major rehabiliation during their service life (see rehab approach structure).
3. Partial depth repairs have been assumed to be required over 5% of the deck area. Full depth repairs assumed 1% of deck.
4. Joint replacements are expected to occur at 25 year cycles and are estimated at $60,000 each.
5. Mobilization costs are taken as 10% of the project total.
6. A 15% contingency has been applied for items such as maintenance of traffic.

Component	Area	Unit Price($/SF)*	Unit Price w/ Conti.	Contract Total
New Hampshire Approach Spans	30,885	$5.68	$6.53	$201,688
Fixed Arch Spans	23,520	$5.68	$6.53	$153,592
Lift Span	11,760	$5.68	$6.53	$76,796
Maine Approach Spans	16,800	$5.68	$6.53	$109,708
			SUBTOTAL =	$541,784
			Add Joints =	$360,000
			Mobilization (10%) =	$90,178
			TOTAL CONSTRUCTION COSTS =	$991,962
			Engineering (7%), Inspection (7%):	$140,000
			TOTAL PROJECT COSTS:	$1,131,962
			TOTAL PROJECT COSTS (SAY):	**$1,140,000**

* Unit price data taken from MaineDOT PIN 017929.00 & 017929.10 - I-295 NB & SB Bridge Rehab Project Bid 3/11 & 12/11 and MTA Contract 2012.01 Saco River Bridge Rehab Project Bid 1/12.

Unit cost derived by taking the sum of the average costs for all re-decking related items and then dividing by the square foot area of the bridges included in the estimate.

		Saco River Bid Prices
Item No.	Item Description	Average Bid Price
202.2	Removing Pavement Surface	$59,993
403.2081	HMA 12.5 MM	$167,510
508.14	High performance membrane	$121,600
518.5	Partial Depth Repairs	$234,850
518.51	Full Depth Repairs	$18,850
	Subtotal =	**$602,803**
	Deck Area =	**83,358**
	Subtotal =	**$7.23** **$/SF**

		I-295 SB Bid Prices 017929.10			Average Cost
Item No.	Item Description	CPM Const.	T. Buck	Lane Const.	
202.2	Removing Pavement Surface	$772,480	$363,520	$681,600	$605,867
403.2081	HMA 12.5 MM	$977,970	$908,115	$931,400	$939,162
508.14	High performance membrane	$300,000	$285,000	$287,000	$290,667
518.5	Repair Upward Surfaces to reinforcing	$355,300	$226,100	$206,720	$262,707
518.51	Repair Upward Surfaces below reinforcing	$110,625	$95,875	$78,175	$94,892
518.52	Repari Upward Surfaces (consider full depth)	$40,000	$63,000	$42,000	$48,333
				Subtotal =	**$2,241,627**
				Deck Area =	**449,856**
				Subtotal =	**$4.98** **$/SF**

		I-295 NB Bid Prices 017929.00				Average Cost
Item No.	Item Description	CPM Const.	Newman	Lane Const.	Wyman	
202.2	Removing Pavement Surface	$326,700	$290,400	$217,800	$272,250	$276,788
202.3	Removing Concrete Wearing Surface	$150,000	$57,740	$16,500	$300,000	$131,060
403.2081	HMA 12.5 MM	$42,500	$45,750	$42,500	$42,500	$43,313
508.14	High performance membrane	$140,000	$128,315	$252,500	$300,000	$205,204
518.5	Repair Upward Surfaces to reinforcing	$142,200	$145,360	$173,800	$110,600	$142,990
518.51	Repair Upward Surfaces below reinforcing	$45,990	$65,700	$73,000	$54,750	$59,860
518.52	Repari Upward Surfaces (consider full depth)	$27,300	$40,264	$52,500	$50,400	$42,616
					Subtotal =	**$901,830**
					Deck Area =	**187,061**
					Subtotal =	**$4.82**

Average Unit Price = $5.68 $/SF

SAY = $1,140,000

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Option

Development of costs for: Rehab Bridge Superstructure, Approach Spans

Assumptions:

1. Bridge superstructure rehab concrete girder repair and waterproofing.
2. Repair area is assumed to be 10% of area exposed and waterproofing area is assumed to be 100% of area exposed.
3. Mobilization costs are taken as 10% of the project total.
4. A 15% contingency has been applied for items such as maintenance of traffic.

Approach Structure Length =	1110	ft
Exposed structure cross-section perimeter =	80	ft
Area exposed =	88800	SF

Component	Surface Area	Unit Price($/SF)*	Unit Price w/ Conti.	Contract Total
Concrete Repair	8,880	$120.00	$138.00	$1,225,440
Waterproofing	88,800	$1.11	$1.28	$113,467
			SUBTOTAL =	$1,338,907

Mobilization (10%) =	$133,891
TOTAL CONSTRUCTION COSTS =	$1,472,797
Engineering (7%), Inspection (7%):	$210,000
TOTAL PROJECT COSTS:	$1,682,797
TOTAL PROJECT COSTS (SAY):	**$1,690,000**

SAY =	**$1,690,000**

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Optior

Development of costs for: Rehabilitation: Bridge Superstructure, Main Spans

Assumptions:

1. Use 75% of the cost estimated to rehab existing SML truss and tower components for 50 year life in 2012 and scale for length of proposed bridg
2. Unit pricing is based on the HNTB report titled "Construction Cost Estimates For Sarah Mildred Long Bridge", Dated February 10, 201
2. Add 7% for PE and 7% for CE
3. Mobilization costs are taken as 10% of the project total
4. Contingency has not been included as the rehabiliations costs already have a contingency built-i

Total Existing Truss Span Length = 1168 ft
Total Proposed Span Length = 945 ft

Component	Unit	Unit Price	Subtotal	
50 Year Superstructure Rehab	1	$9,284,258	$9,284,258	Includes towers, but not deck
Mobilization	1	$928,426	$928,426	
		TOTAL CONSTRUCTION COSTS:	**$10,212,683**	
		Engineering (7%), Inspection (7%):	$1,430,000	
		TOTAL PROJECT COSTS:	$11,642,683	
		SUPER REHAB COSTS (SAY):	**$11,700,000**	

Item No.	Item Description	Unit	Total Qty.	Unit Price	Contract Total
504.701	STR STEEL FAB & DEL, ROLLED	LB	779,400	$ 4.20	$3,273,480.00
504.71000	STR STEEL ERECTION	LB	779,400	$ 1.03	$804,340.80
504.7200	FLOOR BEAM REPAIR	LB	58,600	$ 24.00	$1,406,400.00
504.81	REM RIV & REPLACE W/ HIGH-STRENGTH E	EA	12,173	$ 264.00	$3,213,672.00
504.8101	REMOVAL OF STRUCTURAL STEEL	LB	779,400	$ 1.08	$841,752.00
504.811	STR STEEL REPAIR	LB	127,800	$ 30.00	$3,834,000.00
504.811	TOWER SHEATHING REPAIRS	LS	1	$ 1,920,000	$1,920,000.00
				Subtotal =	$15,293,645
				Adjust for 75% of Contract =	$11,470,234
				Adjust for Length Ratio =	$9,284,258
				Rehab Cost =	**$9,284,258**

* The values in the table above were derived from the HNTB estimate from 02/10/12

SAY = $11,700,000

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Option

Development of costs for: Rehab Bridge Substructure

Assumptions:

1. Bridge substructure rehabilitation includes surface patching and waterproofing
2. The cost presented is based on the surface area of above grade substructure components.
3. It is assumed that 60% of substructure surface area is above grade and that 10% of that area will need repair every 25 years.
4. Using Transystems form work area calculations a ratio of surface are to substructure volume was developed and was used to develop approximate substructure surface areas based on calculated pier and abutment concrete volumes.
5. Mobilization costs are taken as 10% of the project total.
6. A 15% contingency has been applied.

* Typical unit prices for above-water pier and abutment repair range from $80-$100 per SF.
Carry $150/SF due to location of work above water and difficult access.

Note: Conversion ratio from substructure volume & substructure surface area = 0.071756 CY/SF

Volume of Piers, Approach Spans =	3024	CY	
Volume of Abt. & Ret. Walls, Approach Spans =	1751	CY	
Volume of Piers, Main Spans =	7849	CY	
Surface Area of Piers, Approach Spans =	25286	SF	(Volume/Conversion Ratio)*60%
Surface Area of Abt. & Ret. Walls, Approach Spans =	14641	SF	
Surface Area of Piers, Main Spans =	65631	SF	
Total Surface Area =	105558	SF	
Repair Area =	10556	SF	

Component	Surface Area	Unit Price($/lb)*	Unit Price w/ Conti.	Contract Total
Substructure Repair	10,556	$150.00	$172.50	$1,820,871
			TOTAL CONSTRUCTION COSTS:	**$1,820,871**
			Engineering (7%), Inspection (7%):	$260,000
			TOTAL PROJECT COSTS:	$2,080,871
			TOTAL PROJECT COSTS (SAY):	**$2,100,000**

SAY = $2,100,000

HNTB The HNTB Companies	Made by	KEB	Date	4/18/2012	Job No.: 57121-DS-001-001
	Checked by	T. Cote	Date	4/19/2012	Sheet Number: 23 of 24
Calculations for: MaineDOT PIN 16710.00 - Sarah Milded Long Bridge					

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Optior

Development of costs for: Replace Bridge Deck

Assumptions:

1. Deck replacement includes removing existing concrete & pavement, construction of new deck, construction of new curbs, membrane, pavement, railing, joints and other incidentals.
2. Mobilization costs are taken as 10% of the project total.
3. A 15% contingency has been applied.

Component	Deck Area (SF)	Unit Price($/lb)*	Unit Price w/ Conti.	Contract Total
New Hampshire Approach Spans	30,885	$82.44	$94.81	$2,928,083
Fixed Arch Spans	23,520	$82.44	$94.81	$2,229,817
Lift Span	11,760	$164.88	$189.61	$2,229,817
Maine Approach Spans	16,800	$82.44	$94.81	$1,592,727
			SUBTOTAL =	$8,980,444
			Mobilization (10%) =	$898,044
			TOTAL CONSTRUCTION COSTS =	$9,878,489
			Engineering (7%), Inspection (7%):	$1,390,000
			TOTAL PROJECT COSTS:	$11,268,489
			TOTAL PROJECT COSTS (SAY):	**$11,300,000**

* Bid price data taken from MaineDOT PIN 016686.00 - I-95 Over Kennebec River Bridge Redecking Project Bid 7/11 and MTA project 2012-05 Presumpscot River - Falmouth Spur Redecking.
Only items that were directly related to the deck replacing were considers, listed below.
Lift span unit price is increased by 200% due to required counter-balancing and light-weight concrete.

			I-95 Kennebec River			Falmouth Spur
Item No.	Item Description	Quantity	Low	High	Average	Average
202.17	Removing Existing Structural Concrete	2328 CY	$719,000	$1,000,000	$859,500	$241,500
202.18	Removing Existing Bituminous Pavement	9576 SY	$20,000	$17,500	$18,750	$13,292
403.208	HMA 12.5MM Surface	696 T	$343,962	$343,962	$343,962	$19,867
502.26	Structural Concrete Roadway and Sidewalk Slabs	2172 CY	$1,950,000	$2,500,000	$2,225,000	$583,500
502.49	Structural Concrete Curbs and Sidewalks	279 CY	$175,000	$175,000	$175,000	$190,167
503.12	Reinforcing Steel, F&D	13622 LB	$6,811	$7,764	$7,288	$219,067
503.13	Reinforcing Steel, Placing	13622 LB	$13,622	$40,866	$27,244	$142,083
507.0811	Steel Bridge Railing, 2 Bar	4529 LF	$460,000	$450,000	$455,000	$68,667
508.14	High Performance Waterproofing Membrane	9729 SY	$175,000	$175,000	$175,000	$53,333
520.21	Expansion Device - Gland Seal	1 EA	$16,000	$22,500	$19,250	$98,000
520.22	Expansion Device - Compression Seal	2 EA	$36,000	$43,000	$39,500	N/A
521.23	Expansion Device - Finger Joint Type B	1 EA	$42,000	$55,000	$48,500	N/A
521.23	Expansion Device - Finger Joint Type D	2 EA	$84,000	$110,000	$97,000	N/A
521.32	Fabric Trough	1 EA	$5,000	$11,000	$8,000	N/A
521.33	Fabric Curtain	8 EA	$40,000	$20,000	$30,000	N/A
524.4	Protective Sheilding	LUMP	$30,000	$575,000	$100,000	$170,602
			Subtotal =	**$ 4,628,994**	**$ 1,800,077**	
			Area =	79,981	21834	SF, (see calc.)
			Unit Cost =	$57.88	$82.44	$/SF
			2012 Unit Cost =	$60.09	$82.44	$/SF

Use Presumspcost River Falmouth Spur estimate, unit price is more in the range of what comprable projects have for redecking prices.

Unit cost derived by taking the sum of the average costs for all re-decking related items and then dividing by the square foot area of the bridges included in the estimate.

SAY = $11,300,000

Life Cycle Cost Analysis - Bridge Replacement, One-Level Network Tied Arch Option

Development of costs for: Bridge Bearing Rehabilitation

Assumptions:

1. Bearings on approach structures will remain in place for duration of bridge service life. Bearings at main spans will be replaced for a cost equaling their original construction cost.
2. Jacking and temporary support of the fixed and movable spans will be required. Assume $800,000 per span.
3. Quantities and unit pricing is based on the HNTB report titled "Bridge Replacement For Sarah Mildred Long Bridge", Dated March 16, 2012.
4. Mobilization costs are taken as 10% of the project total.
5. A 15% contingency has been included in the unit price for each item.
6. Design and Construction Engineering taken as 7% of Construction Value

MAIN SPAN COMPONENTS (TAKEN FROM TIED ARCH OPTION, ALL OPTIONS SIMILAR)

ITEM NO.	ITEM DESCRIPTION	UNIT	TOTAL QNTY.	UNIT PRICE	UNIT PRICE w/ CONT.	CONTRACT TOTAL
523.52	BEARING INSTALLATION	EA	14	$ 1,000.00	$ 1,150.00	$ 16,100
523.5551	POT OR DISC BEARINGS, FIXED	EA	4	$ 8,500.00	$ 9,775.00	$ 39,100
523.5552	POT OR DISC BEARINGS, EXPANSION	EA	4	$ 10,000.00	$ 11,500.00	$ 46,000
523.XXXX	LIFT SPAN BEARING, FIXED	EA	2	$ 8,500.00	$ 9,775.00	$ 19,550
523.XXXX	LIFT SPAN BEARING, EXPANSION	EA	2	$ 10,000.00	$ 11,500.00	$ 23,000
523.XXXX	LIFT SPAN CENTERING DEVICE	EA	2	$ 4,000.00	$ 4,600.00	$ 9,200
524.XXXX	JACKING AND TEMPORARY STRUCTURAL SUPPORTS	SPAN	2	$ 800,000.00	$ 920,000.00	$ 1,840,000

SUBTOTAL:	$ 1,992,950
Mobilization (10%):	$ 199,295
TOTAL CONSTRUCTION COSTS:	**$ 2,192,245**
Engineering (7%), Inspection (7%):	$ 310,000
TOTAL PROJECT COSTS:	$ 2,502,245
TOTAL PROJECT COSTS (SAY):	**$ 2,600,000**

SAY = $2,600,000

Appendix C
LCCA – Two Deck Truss

HNTB The HNTB Companies	Made by K. Brayley	Date: 4/20/2012	Job No.: 57121-DS-001-001
	Checked by T. Cote	Date: 4/20/2012	Sheet Number: 1 of 27

Calculations for: MaineDOT PIN 16710.00 - Sarah Milded Long Bridge

Life Cycle Cost Analysis - Bridge Replacement, Two-Deck Truss Option

Discount Rate = 4.0%
Start Year = 2012

Work Activity	Calendar Year	Index Year	Discount Factor	2012 Cost (Construction & Eng.)	Present Value
Capital Cost - Bridge Structure	2012	0	1.000	$ 143,900,000	$ 143,900,000
Capital Cost - Engineering, Inspection and Right of Way	2012	0	1.000	$ 19,100,000	$ 19,100,000
O&M: Bridge Tenders	Annual	-	24.505[1]	$ 440,300	$ 10,789,551
O&M: Highway (Excl. Signals)	Annual	-	24.505[1]	$ 21,827	$ 534,871
O&M: Highway Signals	Annual	-	24.505[1]	$ 7,472	$ 183,101
O&M: Rail	Annual	-	24.505[1]	$ 11,340	$ 277,887
O&M: Bridge	Annual	-	24.505[1]	$ 15,468	$ 379,043
O&M: Elec./Mech. Maintenance, Lift Span	Annual	-	24.505[1]	$ 266,000	$ 6,518,330
O&M: Elec./Mech. Maintenance, Retractable Span	Annual	-	24.505[1]	$ 40,000	$ 980,200
O&M: Routine & Fracture Critical Inspections	Annual	-	24.505[1]	$ 175,404	$ 4,298,275
Rehabilitation: Highway Pavement Overlay	2022	10	0.676	$ 355,000	$ 239,825
Rehabilitation: Highway Pavement Overlay	2032	20	0.456	$ 355,000	$ 162,017
Rehabilitation: Elec. & Mech., Lift Span	2037	25	0.375	$ 5,200,000	$ 1,950,607
Rehabilitation: Elec. & Mech., Retractible Span	2037	25	0.375	$ 1,300,000	$ 487,652
Rehabilitation:Bridge Deck Patch and Pave	2037	25	0.375	$ 1,300,000	$ 487,652
Rehabilitation: Traffic & Barrier Gates	2037	25	0.375	$ 300,000	$ 112,535
Rehabilitation: Bridge Lighting	2037	25	0.375	$ 100,000	$ 37,512
Rehabilitation: Fender System	2037	25	0.375	$ 2,200,000	$ 825,257
Rehabilitation: Highway Pavement Overlay	2042	30	0.308	$ 355,000	$ 109,453
Replacement: Railroad Ties	2042	30	0.308	$ 1,700,000	$ 524,142
Rehabilitation: Bridge Repainting	2052	40	0.208	$ 14,400,000	$ 2,999,362
Rehabilitation: Highway Pavement Overlay	2052	40	0.208	$ 355,000	$ 73,943
Replacement: Elec. & Mech., Lift Span	2062	50	0.141	$ 9,600,000	$ 1,350,841
Replacement: Elec. & Mech., Retractible Span	2062	50	0.141	$ 1,500,000	$ 211,069
Replacement: Counterweight Ropes	2062	50	0.141	$ 2,200,000	$ 309,568
Rehabilitation: Touch-up Painting	2062	50	0.141	$ 4,320,000	$ 607,878
Rehabilitation: Traffic & Barrier Gates	2062	50	0.141	$ 300,000	$ 42,214
Rehabilitation: Bridge Lighting	2062	50	0.141	$ 100,000	$ 14,071
Rehabilitation: Bridge Superstructure, Approach Spans	2062	50	0.141	$ 2,580,000	$ 363,039
Rehabilitation: Bridge Superstructure, Main Spans	2062	50	0.141	$ 11,700,000	$ 1,646,338
Replacement: Bridge Deck	2062	50	0.141	$ 13,700,000	$ 1,927,763
Rehabilitation: Bridge Substructure	2062	50	0.141	$ 1,700,000	$ 239,211
Replacement: Bridge Bearings	2062	50	0.141	$ 2,400,000	$ 337,710
Replacement: Fender System	2062	50	0.141	$ 4,400,000	$ 619,136
Rehabilitation: Highway Full Depth Reconstruction	2062	50	0.141	$ 2,710,000	$ 381,331
Rehabilitation: Highway Pavement Overlay	2072	60	0.095	$ 355,000	$ 33,746
Replacement: Railroad Ties	2072	60	0.095	$ 1,700,000	$ 161,603
Rehabilitation: Touch-up Painting	2072	60	0.095	$ 4,320,000	$ 410,661
Rehabilitation: Bridge Repainting	2082	70	0.064	$ 14,400,000	$ 924,759
Rehabilitation: Highway Pavement Overlay	2082	70	0.064	$ 355,000	$ 22,798
Rehabilitation: Elec. & Mech., Lift Span	2087	75	0.053	$ 5,200,000	$ 274,475
Rehabilitation: Elec. & Mech., Retractible Span	2087	75	0.053	$ 1,300,000	$ 68,619
Rehabilitation: Traffic & Barrier Gates	2087	75	0.053	$ 300,000	$ 15,835
Rehabilitation:Bridge Deck Patch and Pave	2087	75	0.053	$ 1,020,000	$ 53,839
Rehabilitation: Bridge Superstructure, Approach Spans	2087	75	0.053	$ 1,020,000	$ 53,839
Rehabilitation: Bridge Superstructure, Main Spans	2087	75	0.053	$ 12,500,000	$ 659,796
Rehabilitation: Bridge Substructure	2087	75	0.053	$ 1,700,000	$ 89,732
Rehabilitation: Bridge Lighting	2087	75	0.053	$ 100,000	$ 5,278
Rehabilitation: Fender System	2087	75	0.053	$ 2,200,000	$ 116,124
Rehabilitation: Touch-up Painting	2092	80	0.043	$ 4,320,000	$ 187,420
Rehabilitation: Highway Pavement Overlay	2092	80	0.043	$ 355,000	$ 15,401
Rehabilitation: Highway Pavement Overlay	2102	90	0.029	$ 355,000	$ 10,405
Rehabilitation: Touch-up Painting	2102	90	0.029	$ 4,320,000	$ 126,614
Residual Value	2112	100	0.020	$ -	$ -
				Total Life Cycle Cost =	**$ 206,300,000**

Notes:

1) Based on discounting 100 years of annual payments to present value calculated as: $DR^{(100-1)} / (DR \times (1 + DR)^{100})$

2) LCCA totals are rounded to the nearest one hundred thousand.

3) See assumptions & summary document for all work activity frequency and ordering.

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: O&M - Bridge Tenders

Annual Operator Labor Costs						
Bridge	Number of Full Time Operators on Bridge at All Times	Average Hourly Rate	Hours per Week	Overhead Burden	52 Weeks per Year	Total cost in 2010 Dollars
Sarah Mildred Long	2	$ 18.00	168	1.4	52	$ 440,294.40

HNTB The HNTB Companies	Made by	L. Meek	Date	4/18/2012	Job No.: 57121-DS-001-001
	Checked by	BMH	Date	4/19/2012	Sheet Number: 3 of 27
Calculations for: MaineDOT PIN 16710.00 - Sarah Milded Long Bridge					

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Highway Striping, Intersection Maintenance and Highway Maintenance (excluding signals)

Assumptions:

1. Unit pricing is based on the HNTB report titled "Construction Cost Estimates For Sarah Mildred Long Bridge", Dated March 16, 2012 - Unless otherwise noted.
2. Since striping is an operation and maintenance activity no engineering costs have been applied.
3. Applied factors are as follows:

Incidentals & Contigency 15%

Frequency	1	Year Cycle

	2012 Unit Cost	
Striping	$0.65	LF of Striping

	Striping Length within O&M Limits		
	1 Deck	2 Deck	Rehab
Market Street	12000	12000	12000
Route 1 Bypass	17300	15700	15700
Albacore Connector	0	1500	1500
Quantity	**29300 LF**	**29200 LF**	**29200 LF**

Striping	$19,045	$18,980	$18,980
Incidentals & Contingency	$2,856.75	$2,847.00	$2,847.00
2012 Total Costs	**$21,902**	**$21,827**	**$21,827**

SAY =	**$21,900**

HNTB The HNTB Companies	Made by	L. Meek	Date	4/18/2012	Job No.: 57121-DS-001-001
	Checked by	BMH	Date	4/19/2012	Sheet Number: 4 of 27
Calculations for: MaineDOT PIN 16710.00 - Sarah Milded Long Bridge					

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for Highway Signal O&M

Assumptions:

1. Unit costs from discussions with Bruce Munger & Paul Godfrey
2. Applied factors are as follows:
   Incidentals & Contingency 15%
   Eng. & Insp. 14%
3. Signals O&M costs apply to Rehab and 2 Deck options only

	Unit	Quantity	Replacement Frequency	2012 Costs				
				Unit Cost	Incidentals & Contigency	Eng. & Insp.	2012 Total Unit Cost	Annualized Cost
Loops	Ea	11	**5**	$1,500	$225	N/A	**$18,975**	**$3,795**
Signal Controller	Ea	2	**15**	$15,000	$2,250	2,100	**$38,700**	**$2,580**
Signal Heads	Ea	17	**10**	$500	$75	70	**$10,965**	**$1,097**
								$7,472

SAY =	**$7,500**

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: O&M - Rail

Assumptions:	2 men x 4hrs/ea/mo. x 12 mo. x $90hr loaded =	$8,640
	1 vehicle @ $50 day/2 x12 days =	$300
	$200 misc.materials/mo. =	$2,400
		$11,340

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Bridge O&M

Assumptions:

1. Bridge O&M includes daily and seasonal operations to maintain the bridges travel way and accessibility (shoulder sweeping, waterproofing, etc.).

Component	Deck Area (SF)	Unit Price($/SF)*	Subtotal
New Hampshire Approach Spans	46,517	$0.15	$6,978
Fixed Truss Spans	23,520	$0.15	$3,528
Lift Span	11,760	$0.15	$1,764
Maine Approach Spans	16,800	$0.15	$2,520
Albacore Connector	4,524	$0.15	$679
	∑ = 103,120	**Total Cost =**	**$15,468**

* Unit price taken from Maine - New Hampshire Connections Study

SAY = $15,500

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Retractable Span Mechanical/Electrical Maintenance

Assumptions:

1. Totals on this sheet on a per year (annual) basis.
2. Operation of span assumed to be consistent with present level of usage.

Component	Qty	Unit Price($/unit)*	Subtotal
Lubricate mech. systems [16 hrs]	4	$1,600.00	$6,400
Winterize system [16 hrs]	1	$1,600.00	$1,600
Return to service in spring [16 hrs]	1	$1,600.00	$1,600
Operate span [4 ppl 1/2 day ea.]	8	$1,600.00	$12,800
Nav. lamp maint [2 ppl 2 hrs ea]	6	$400.00	$2,400
Other routine repairs	1	$10,000.00	$10,000
Maint. material costs	1	$5,000.00	$5,000
		Total Cost =	**$39,800**

* Labor rate @ $100/hr

SAY = $40,000

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Lift Span Mechanical/Electrical Maintenance

Assumptions:

1. Totals on this sheet on a per year (annual) basis
2. Operation of span assumed to be consistent with present level of usage
3. Assume 3200 openings/year per Connections Study Technical Memo #3

Component	Qty	Unit Price($/unit)*	Subtotal
Lubricate machinery [2ppl x 16 hrs]	12	$3,200.00	$38,400
Lubricate span/cwt guides [32 hrs]	4	$3,200.00	$12,800
Lubricate ropes [64 hrs]	4	$6,400.00	$25,600
Change reducer oil [16 hrs]	1	$1,600.00	$1,600
Reducer oil (for 2 reducers)	150	$75.00	$11,250
Lubricating greases	1	$5,000.00	$5,000
Nav. lamp maint [2 ppl 2 hrs ea]	10	$400.00	$4,000
General elect. maint [32 hrs]	12	$3,200.00	$38,400
Traffic signals maint	132	$400.00	$52,800
Generator routine service	1	$1,000.00	$1,000
Generator fuel	150	$4.50	$675
Estimated power for openings	3,200	$5.90	$18,864
Elevator inspection and maint.	2	$5,000.00	$10,000
Other routine repairs	1	$25,000.00	$25,000
Maint. material costs	1	$20,000.00	$20,000
		Total Cost =	**$265,389**

* Labor rate @ $100/hr
Est. power 45 kWh per opening
Traffic signals 6 3-head signals for bridge, 16 for intersections; service 2x year
Main span drive motors 150 hp each

SAY =	**$266,000**

HNTB The HNTB Companies	Made by	J Carney	Date	4/18/2012	Job No.: 57121-DS-001-001
	Checked by	T. Cote	Date	4/19/2012	Sheet Number: 9 of 27

Calculations for: MaineDOT PIN 16710.00 - Sarah Milded Long Bridge

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: O&M - Bridge Inspection

Assumptions:

1. Cost estimate developed based on completing and NBIS Compliant Routine and Fracture Critical Inspection on a 2-year cycle. Inspection costs have been annualized for entry into LCCA sheet.
2. Inspection costs developed based on access from the bridge deck. No barge work has been included in this estimate.

Client Name: MaineDOT
Client Number: **16710.00**
HNTB Number: 57121-BL-001-001
Prepared By: J. Carney

Project Name: **LCCA Bridge Inspection Estimate - Truss Replacement Option**
Project Location: Kittery, ME and Portsmouth, NH
Date: 4/18/2012

Task	Principal in Charge	Project Manager	QA/QC	Senior Structural Engineer	Structural Engineer	Traffic Engineer	CADD Technician	Total
Name								
Field Inspection Set-up & Preparations		16		12	14			42
Field Inspection from Barge & Lift (11 days)		0		99	99			198
Field Inspect w/ HI-Rail Lift- Lower Deck (4 days)		0	0	36	36			72
Field Inspect. Appr. Spans w/ UB-62 Snooper (4 days)				36	36			72
Field Inspect. Spans over Market St w/ Bucket Truck & Traffic Control (1 day)				10	10			20
Top of Deck Inspection				10	10			20
Tower Inspections - (4 days)				36	36			72
Office Report & Sketch Preparations		12	24	65	76		36	213
								0
TOTAL HOURS		28	24	304	317	0	36	709
LABOR RATE		$60.00	$50.00	$50.00	$45.00		$30.00	
DIRECT LABOR		$ 1,680.00	$ 1,200.00	$ 15,200.00	$ 14,265.00	$ -	$ 1,080.00	$ 33,425.00

Notes:

Direct Expenses

Mileage & Pri	$1,200.00
Lodging & Per Diem	$6,900.00
Barge & Manlift (Assumes 11 days use of barge & Lift)	$31,900.00
40' Manlift w/ High Rail Gear (4 days)	$4,800.00
UB-62 Snooper of Appr. Spans from Upper Deck (4 days)	$7,200.00
40' Lift Bucket Truck (1 day use over Market St)	$1,200.00
Rigging for Exterior Tower Inspection	$14,000.00
Traffic Control (w/ Snooper & Bucket Truck on Roadways)	$7,500.00
Flaggers / Police for Traffic Control	$3,500.00
TOTAL	$78,200.00

Total Engineering Cost

Direct Labor (see note 4)	$35,597.63
Overhead (144.90%)	$52,769.92
Fee (10%)	$8,836.75
Direct Expenses	$78,200.00
TOTAL	**$175,404.30**

GRAND TOTAL **$175,404.30**

ANNUALIZED COST ~ SAY = $88,200

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Rehabilitate Lift Span Electrical and Mechanical Systems

Assumptions:

1. Rehabilitate lift span mechanical and electrical systems. Ropes covered under separate item.
2. No major work on counterweight sheaves or sheave bearings.
3. Gates covered under separate item.
4. Rehab at year 25.

Component	Qty	Unit Price($/unit)*	Subtotal
Rehab span drive machinery	1	$1,500,000.00	$1,500,000
Rehab span locks	1	$250,000.00	$250,000
Rehab elevators	1	$100,000.00	$100,000
Rehab bridge control system	1	$1,500,000.00	$1,500,000
Replace aerial cable	1	$100,000.00	$100,000
Rehab CCTV system	1	$96,000.00	$96,000
Replace intercom system	1	$55,000.00	$55,000
Replace fire alarm system	1	$135,000.00	$135,000
Replace generator	1	$400,000.00	$400,000
		Subtotal =	$4,136,000
		Mobilization (10%) =	$413,600
		TOTAL CONSTRUCTION COSTS =	$4,549,600
		Engineering (7%) and Inspection (7%) =	$636,944
		TOTAL PROJECT COSTS =	$5,186,544
		PROJECT TOTAL =	**$5,200,000**

* Span drive machinery rehab 50% of replacement cost
Span lock cost from Bates bridge
Electrical control system rehab 50% of replacement cost
CCTV cost from Chelsea St.
Intercom system from Chelsea St.
Fire alarm system from Chelsea St.
Generator cost from Chelsea St.

SAY =	$5,200,000

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Rehabilitate Retractible Span Mechanical and Electrical

Assumptions:

1. Rehab retractible span mechanical and electrical systems
2. Rehab at year 25.

Component	Qty	Unit Price($/unit)*	Subtotal
Rehabilitate Mechanical Systems	1	$456,696.00	$456,696
Rehabilitate Electrical Systems	1	$502,025.00	$502,025
		Subtotal =	$958,721
		Mobilization (10%) =	$95,872
		TOTAL CONSTRUCTION COSTS =	$1,054,593
		Engineering (7%) and Inspection (7%) =	$147,643
		TOTAL PROJECT COSTS =	$1,202,236
		PROJECT TOTAL =	**$1,300,000**

* Mechanical cost data from Transsystems estimate
Electrical cost estimate from Bates bridge

SAY =	**$1,300,000**

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Rehabilitate Traffic and Barrier Gates

Assumptions:

1. Replace traffic and barrier gates.
2. Replace at year 25.

Component	Qty	Unit Price($/unit)*	Subtotal
Replace Warning Gates	1	$125,000.00	$125,000
Replace Barrier Gates	1	$92,500.00	$92,500
		Subtotal =	$217,500
		Mobilization (10%) =	$21,750
		TOTAL CONSTRUCTION COSTS =	$239,250
		Engineering (7%) and Inspection (7%) =	$33,495
		TOTAL PROJECT COSTS =	$272,745
		PROJECT TOTAL =	**$300,000**

* Unit pricing based on the HNTB report titled "Bridge Replacement Options For Sarah Mildred Long Bridge", Dated March 16, 2012

SAY =	**$300,000**

HNTB The HNTB Companies	Made by	L. Meek	Date	4/18/2012	Job No.: 57121-DS-001-001
	Checked by	BMH	Date	4/19/2012	Sheet Number: 13 of 27
Calculations for: MaineDOT PIN 16710.00 - Sarah Milded Long Bridge					

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Highway Pavement Overlay and Reconstruction

Assumptions:

1. Unit pricing is based on the HNTB report titled "Construction Cost Estimates For Sarah Mildred Long Bridge", Dated March 16, 2012 - Unless otherwise noted.
2. Applied factors are as follows:
   - Incidentals & Contingency 15%
   - Design and Construction Eng. & Insp. 14%
3. Repair cycles will be 10 yr for Overlay & 50 yr for Full Depth Reconstruction based on recommendations from the Connections Study

Pavement Areas			
	1 Deck Tied-Arch	2 Deck Truss	Rehab
NH	206938	212741	212741
ME	82445	82623	82623
Total	289,383 s.f	295,364 s.f	295,364 s.f

	Thickness	Volumes		
		1 Deck Tied-Arch	2 Deck Truss	Rehab
Overlay				
HMA	1.5 in.	2,653 ton	2,708 ton	2,708 ton
Full Depth Construction				
HMA	8.5 in.	15,032 ton	15,343 ton	15,343 ton
Gravel (ABC-C)	11.5 in.	10,271 c.y.	10,484 c.y.	10,484 c.y.
Gravel (ASC-G)	10 in.	8,932 c.y.	9,116 c.y.	9,116 c.y.

	Unit	Frequency (Years)	2012 Unit Cost	2012 Total Construction Cost (with Incidentals & Contigency)			2012 Total Cost (Construction, Eng,, & Insp.)		
				1 Deck	2 Deck	Rehab	1 Deck	2 Deck	Rehab
Overlay									
HMA	Ton	10	$100	$305,058	$311,363	$311,363	**$347,766**	**$354,954**	**$354,954**
Full Depth Construction									
HMA	Ton		$100	$1,728,662	$1,764,390	$1,764,390	$1,970,674	$2,011,404	$2,011,404
Gravel (ABC-C)	CY		$29	$342,548	$349,628	$349,628	$390,505	$398,576	$398,576
Gravel (ASC-G)	CY		$25	$256,783	$262,090	$262,090	$292,732	$298,783	$298,783
Full Depth Construction Total		50					**$2,653,911**	**$2,708,763**	**$2,708,763**

Overlay Say = $355,000

Full Depth Say = $2,710,000

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Rehabilitate Bridge Lighting

Assumptions:

1. Bridge Lighting includes street lights and navigational lighting.
2. Work includes repair and replacement of lighting components.
3. Lump sum price assumed using data from Maine - New Hampshire Connections Study.

Construction Cost =	**$100,000**
TOTAL =	**$100,000.00**

SAY =	**$100,000**

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Fender System Replacement and Rehabilitation

Assumptions:

1. Fender systems will be rehabilitated every 25 years and replaced every 50 years.
2. Replacement costs are assumed to be unchaged from original construction value. Fender rehabilitation assumed as 50% of initial construction cost.
3. Quantities and unit pricing is based on the HNTB report titled "Construction Cost Estimates For Sarah Mildred Long Bridge", Dated February 10, 2012.
4. Mobilization costs are taken as 10% of the project total.
5. A 15% contingency has been included in the unit price for each item.
6. Design and Construction Engineering taken as 7% of Construction Value

MARINE (FENDER SYSTEM) COMPONENTS - REPLACEMENT

ITEM NO.	ITEM DESCRIPTION	UNIT	TOTAL QNTY.	UNIT PRICE	UNIT PRICE w/ CONT.	CONTRACT TOTAL
501.700	Steel Pipe Piles (36" Dia., 1/2" Wall) Delivered	LF	2010	$ 250.00	$ 287.50	$ 577,875
501.7011	Steel Pipe Piles (36" Dia., 1/2" Wall) In-Place w/ Rock Socket	LF	2010	$ 150.00	$ 287.50	$ 577,875
501.702	Steel Pipe Piles (24" Dia., 1/2" Wall) Delivered	LF	830	$ 150.00	$ 287.50	$ 238,625
501.7031	Steel Pipe Piles (24" Dia., 1/2" Wall) In-Place w/ Rock Socket	LF	830	$ 130.00	$ 287.50	$ 238,625
501.921	Pile Installation Equipment	LS	1	$ 50,000.00	$ 287.50	$ 288
504.70	Structural Steel Fabrication & Delivery (260000 lbs)	LS	1	$ 494,000.00	$ 287.50	$ 288
504.71	Structural Steel Erection (260000 lbs)	LS	1	$ 156,000.00	$ 287.50	$ 288
506.9106	Fusion Bonded Epoxy Coating	SY	4800	$ 65.00	$ 287.50	$ 1,380,000
655.50	Cathodic Protection by Sacrificial Anodes	EA	68	$ 1,500.00	$ 287.50	$ 19,550
899.9010	Steel Frontal Panel w/ UHMW Wearing Surface	SF	6950	$ 70.00	$ 287.50	$ 1,998,125
899.9011	SCH 1450H - Hollow Cylinder Rubber Fender	EA	20	$ 16,000.00	$ 287.50	$ 5,750
899.9012	UE 600 - MV Rubber Fender	EA	280	$ 4,000.00	$ 287.50	$ 80,500

SUBTOTAL:	$ 3,484,500
Mobilization (10%):	$ 348,450
TOTAL CONSTRUCTION COSTS:	**$ 3,832,950**
Engineering (7%), Inspection (7%):	$ 540,000
TOTAL PROJECT COSTS:	$ 4,372,950
TOTAL PROJECT COSTS (SAY):	**$ 4,400,000**

MARINE (FENDER SYSTEM) COMPONENTS - REHABILITATION

ITEM NO.	ITEM DESCRIPTION	UNIT	TOTAL QNTY.	UNIT PRICE	UNIT PRICE w/ CONT.	CONTRACT TOTAL
501.700	Steel Pipe Piles (36" Dia., 1/2" Wall) Delivered	LF	2010	$ 250.00	$ 287.50	$ 577,875
501.7011	Steel Pipe Piles (36" Dia., 1/2" Wall) In-Place w/ Rock Socket	LF	2010	$ 150.00	$ 287.50	$ 577,875
501.702	Steel Pipe Piles (24" Dia., 1/2" Wall) Delivered	LF	830	$ 150.00	$ 287.50	$ 238,625
501.7031	Steel Pipe Piles (24" Dia., 1/2" Wall) In-Place w/ Rock Socket	LF	830	$ 130.00	$ 287.50	$ 238,625
501.921	Pile Installation Equipment	LS	1	$ 50,000.00	$ 287.50	$ 288
504.70	Structural Steel Fabrication & Delivery (260000 lbs)	LS	1	$ 494,000.00	$ 287.50	$ 288
504.71	Structural Steel Erection (260000 lbs)	LS	1	$ 156,000.00	$ 287.50	$ 288
506.9106	Fusion Bonded Epoxy Coating	SY	4800	$ 65.00	$ 287.50	$ 1,380,000
655.50	Cathodic Protection by Sacrificial Anodes	EA	68	$ 1,500.00	$ 287.50	$ 19,550
899.9010	Steel Frontal Panel w/ UHMW Wearing Surface	SF	6950	$ 70.00	$ 287.50	$ 1,998,125
899.9011	SCH 1450H - Hollow Cylinder Rubber Fender	EA	20	$ 16,000.00	$ 287.50	$ 5,750
899.9012	UE 600 - MV Rubber Fender	EA	280	$ 4,000.00	$ 287.50	$ 80,500

SUBTOTAL:	$ 3,484,500
Mobilization (10%):	$ 348,450
TOTAL CONSTRUCTION COSTS:	**$ 3,832,950**
ADJUST FOR REHABILITATION (50%):	**$ 1,916,475**
Engineering (7%), Inspection (7%):	$ 270,000
TOTAL PROJECT COSTS:	$ 2,186,475
TOTAL PROJECT COSTS (SAY):	**$ 2,200,000**

REHABILITATION SAY =	**$2,200,000**
REPLACEMENT SAY =	**$4,400,000**

Life Cycle Cos Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Railroad Trackwork & Signal

Assumptions:

1. All new ties, running rail, guard rail, expansion joints and OTM to be used on new bridge and approaches.
2. Quantities and unit pricing is based on the HNTB report titled "Bridge Replacement Options For Sarah Mildred Long Bridge", Dated March 16, 2012, only items located on bridge have been included.
3. Mobilization costs are taken as 10% of the project total.
4. A 15% contingency has been included in the unit price for each item.

DESCRIPTION	UNIT	QUANTITY	UNIT COST	UNIT COST w/ Cont.	COST
RELAY 115 RE RAIL	LF	3,470	$ 17	$ 19	$ 65,843
REMOVE EXISTING TRACK - BRIDGES	TF	1610	$ 75	$ 86	$ 138,863
BRIDGE GUARD RAIL REINSTALLATION	TF	100	$ 25	$ 29	$ 2,875
TRACK SURFACING	TF	1735	$ 5	$ 6	$ 9,976
SCRAP TIE DISPOSAL	LS	1	$ 20,000	$ 23,000	$ 23,000
FURNISH AND INSTALL BRIDGE TIES	EA	1400	$ 525	$ 604	$ 845,250
RAIL EXPANSION JOINTS	EA	4	$ 17,500	$ 20,125	$ 80,500
MITER RAILS FURNISHED AND INSTALLED	EA	4	$ 35,000	$ 40,250	$ 161,000
				SUBTOTAL =	$ 1,327,307
				Mobilization (10%) =	$ 132,731
				TOTAL CONSTRUCTION COSTS =	$ 1,460,038
				Engineering (7%) and Inspection (7%) =	$ 204,405
				TOTAL PROJECT COSTS =	$ 1,664,443
				TOTAL PROJECT COSTS (SAY) =	$ 1,700,000

SAY = $1,700,000

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Bridge Painting

Assumptions:

1. Bridge painting includes surface preparation, pollution control and proper disposal of waste along with traffic control, incidentals and mobilization costs.
2. Bridge painting calculated to represent a cost per pound of steel being painted is reduced by 20% to account for ease of painting members.
3. All highway approach spans will be replaced with concrete NEXT beams, no painting required.
4. Arch span weights include both lift towers and both highway and rail superstructure steel.
5. Quantities are based on the HNTB report titled "Bridge Replacement Options For Sarah Mildred Long Bridge", Dated March 16, 2012.
6. Add 7% for PE and 7% for CE and 15% Contingency.

Component	Weight (lb)	Unit Price($/lb)*	Unit Price w/ Conti.	Contract Total
Approach HW Spans	N/A	$1.89	$2.18	N/A
Truss Spans	7,530,795	$1.89	$2.18	$14,256,156
Approach RR Spans	766,500	$1.89	$2.18	$1,451,021
Σ Sum =	8,297,295	**TOTAL CONSTRUCTION COSTS:**		**$ 15,707,177**
		Engineering (7%), Inspection (7%):		$ 2,200,000
		TOTAL PROJECT COSTS:		$ 17,907,177
		TOTAL PROJECT COSTS (SAY):		**$ 18,000,000**
		Reduce 20%:		**$ 14,400,000**

* Bid price data taken from MaineDOT PIN 016816.00 - Memorial Bridge Paint Project Bid 12/11 (see summary below)
Unit cost calculated by dividing total bid cost by 6.2 million pounds of steel, steel weight from Memorial Bridge.
Use average bid price considering added complexity of painting and moveable structure.

Vendor	Total Bid	Unit Cost
Spartan Contracting LLC	$ 6,967,000	$ 1.12
Titan Industrial Services Inc.	$ 7,468,000	$ 1.20
Liberty-Alpha JV, LLC	$ 8,769,000	$ 1.41
Intech Contracting LLC	$ 9,474,960	$ 1.53
Allied Painting, Inc.	$ 9,498,020	$ 1.53
Tri-State Painting, Inc.	$ 9,635,622	$ 1.55
Hercules Painting Company, Inc.	$ 10,169,868	$ 1.64
TDA Construction	$ 10,794,000	$ 1.74
Amstar of Western New York, Inc.	$ 10,870,000	$ 1.75
Blastech Enterprises, Inc.	$ 11,477,550	$ 1.85
Atlas Painting & Sheeting Corporation	$ 12,189,000	$ 1.97
Vimas Painting Company Inc.	$ 12,747,300	$ 2.06
North Star Painting	$ 12,774,000	$ 2.06
Royal Bridge	$ 12,990,000	$ 2.10
Odyssey Contracting Corporation	$ 13,415,500	$ 2.16
ABHE & Svoboda, Inc.	$ 14,443,310	$ 2.33
Corcon Incorporated	$ 14,796,338	$ 2.39
MJ Painting Co.	$ 15,004,726	$ 2.42

	Year 2011		Year 2012	per RS Means
Low Bid Unit Cost =	$ 1.12	per lb	$ 1.17	per lb
Average Bid Unit Cost =	$ 1.82	per lb	$ 1.89	per lb
High Bid Unit Cost =	$ 2.42	per lb	$ 2.51	per lb

Note: For reference, the construction value of the 1999 re-painting of the maine span on the I-95 high level bridge over the piscataqua river, adjusted for inflation per RSMeans, cost $18,663,605.

SAY = $14,400,000

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Touch-up Painting

Assumptions:

1. Bridge painting includes only surface preparation & field painting.
2. Bridge painting calculated to represent a cost per pound of steel being painted.
3. Assuming highway approach members are replaced with concrete beams.
4. This item was assumed to be 30% of overall bridge painting cost occuring at an interval of 10 years

Full Bridge Painting = $ 14,400,000

Touch-up Painting = $ 4,320,000 includes 14% for PE & CE along with 10% Mob. And 15% contingency

SAY = $4,320,000

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Rehab Bridge Deck Patch and Pave (all spans)

Assumptions:

1. Bridge patch and pave includes pavement removal, re-paving, patching concrete, and deck surface.
2. Girders are considered to have 100 year service life and are not anticipated to require major rehabiliation during their service life (see rehab approach structure).
3. Partial depth repairs have been assumed to be required over 5% of the deck area. Full depth repairs assumed 1% of deck.
4. Joint replacements are expected to occur at 25 year cycles and are estimated at $60,000 each.
5. Mobilization costs are taken as 10% of the project total.
6. A 15% contingency has been applied for items such as maintenance of traffic.

Component	Area	Unit Price($/SF)*	Unit Price w/ Conti.	Contract Total
New Hampshire Approach Spans	46,517	$5.68	$6.53	$303,769
Fixed Truss Spans	23,520	$5.68	$6.53	$153,592
Lift Span	11,760	$5.68	$6.53	$76,796
Maine Approach Spans	16,800	$5.68	$6.53	$109,709
Albacore Connector	4,524	$5.68	$6.53	$29,543
			SUBTOTAL =	$673,409
			Add Joints =	$360,000
			Mobilization (10%) =	$103,341
			TOTAL CONSTRUCTION COSTS =	$1,136,750
			Engineering (7%), Inspection (7%):	$160,000
			TOTAL PROJECT COSTS:	$1,296,750
			TOTAL PROJECT COSTS (SAY):	**$1,300,000**

* Unit price data taken from MaineDOT PIN 017929.00 & 017929.10 - I-295 NB & SB Bridge Rehab Project Bid 3/11 & 12/11 and MTA Contract 2012.01 Saco River Bridge Rehab Project Bid 1/12.

Unit cost derived by taking the sum of the average costs for all re-decking related items and then dividing by the square foot area of the bridges included in the estimate.

		Saco River Bid Prices
Item No.	Item Description	Average Bid Price
202.2	Removing Pavement Surface	$59,993
403.2081	HMA 12.5 MM	$167,510
508.14	High performance membrane	$121,600
518.5	Partial Depth Repairs	$234,850
518.51	Full Depth Repairs	$18,850
Subtotal =		**$602,803**
Deck Area =		**83,358**
Subtotal =		**$7.23** **$/SF**

		I-295 SB Bid Prices 017929.10			Average Cost
Item No.	Item Description	CPM Const.	T. Buck	Lane Const.	
202.2	Removing Pavement Surface	$772,480	$363,520	$681,600	$605,867
403.2081	HMA 12.5 MM	$977,970	$908,115	$931,400	$939,162
508.14	High performance membrane	$300,000	$285,000	$287,000	$290,667
518.5	Repair Upward Surfaces to reinforcing	$355,300	$226,100	$206,720	$262,707
518.51	Repair Upward Surfaces below reinforcing	$110,625	$95,875	$78,175	$94,892
518.52	Repari Upward Surfaces (consider full depth)	$40,000	$63,000	$42,000	$48,333
				Subtotal =	**$2,241,627**
				Deck Area =	**449,856**
				Subtotal =	**$4.98** **$/SF**

		I-295 NB Bid Prices 017929.00				Average Cost
Item No.	Item Description	CPM Const.	Newman	Lane Const.	Wyman	
202.2	Removing Pavement Surface	$326,700	$290,400	$217,800	$272,250	$276,788
202.3	Removing Concrete Wearing Surface	$150,000	$57,740	$16,500	$300,000	$131,060
403.2081	HMA 12.5 MM	$42,500	$45,750	$42,500	$42,500	$43,313
508.14	High performance membrane	$140,000	$128,315	$252,500	$300,000	$205,204
518.5	Repair Upward Surfaces to reinforcing	$142,200	$145,360	$173,800	$110,600	$142,990
518.51	Repair Upward Surfaces below reinforcing	$45,990	$65,700	$73,000	$54,750	$59,860
518.52	Repari Upward Surfaces (consider full depth)	$27,300	$40,264	$52,500	$50,400	$42,616
					Subtotal =	**$901,830**
					Deck Area =	**187,061**
					Subtotal =	**$4.82**

Average Unit Price = $5.68 $/SF

SAY =	**$1,300,000**

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Rehab Bridge Superstructure, Approach Spans

Assumptions:

1. Bridge superstructure rehab concrete girder repair and waterproofing.
2. Repair area is assumed to be 10% of area exposed and waterproofing area is assumed to be 100% of area exposed.
3. Mobilization costs are taken as 10% of the project total.
4. A 15% contingency has been applied for items such as maintenance of traffic.

Approach Structure Length =	1696	ft
Exposed structure cross-section perimeter =	80	ft
Area exposed =	135680	SF

Component	Surface Area	Unit Price($/SF)*	Unit Price w/ Conti.	Contract Total
Concrete Repair	13,568	$120.00	$138.00	$1,872,384
Waterproofing	135,680	$1.11	$1.28	$173,369
			SUBTOTAL =	$2,045,753

Mobilization (10%) =	$204,575
TOTAL CONSTRUCTION COSTS =	$2,250,328
Engineering (7%), Inspection (7%):	$320,000
TOTAL PROJECT COSTS:	$2,570,328
TOTAL PROJECT COSTS (SAY):	**$2,580,000**

SAY =	**$2,580,000**

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Rehabilitation: Bridge Superstructure, Main Spans

Assumptions:

1. Use 75% of the cost estimated to rehab existing SML truss and tower components for 50 year life in 2012 and scale for length of proposed bridg
2. Unit pricing is based on the HNTB report titled "Construction Cost Estimates For Sarah Mildred Long Bridge", Dated February 10, 201
2. Add 7% for PE and 7% for CE
3. Mobilization costs are taken as 10% of the project total
4. Contingency has not been included as the rehabiliations costs already have a contingency built-i

Total Existing Truss Span Length = 1168 ft
Total Proposed Span Length = 945 ft

Component	Unit	Unit Price	Subtotal	
50 Year Superstructure Rehab	1	$9,284,258	$9,284,258	Includes towers, but not deck
Mobilization	1	$928,426	$928,426	
		TOTAL CONSTRUCTION COSTS:	**$10,212,683**	
		Engineering (7%), Inspection (7%):	$1,430,000	
		TOTAL PROJECT COSTS:	$11,642,683	
		SUPER REHAB COSTS (SAY):	**$11,700,000**	

Item No.	Item Description	Unit	Total Qty.	Unit Price	Contract Total
504.701	STR STEEL FAB & DEL, ROLLED	LB	779,400	$ 4.20	$3,273,480.00
504.71000	STR STEEL ERECTION	LB	779,400	$ 1.03	$804,340.80
504.7200	FLOOR BEAM REPAIR	LB	58,600	$ 24.00	$1,406,400.00
504.81	REM RIV & REPLACE W/ HIGH-STRENGTH E	EA	12,173	$ 264.00	$3,213,672.00
504.8101	REMOVAL OF STRUCTURAL STEEL	LB	779,400	$ 1.08	$841,752.00
504.811	STR STEEL REPAIR	LB	127,800	$ 30.00	$3,834,000.00
504.811	TOWER SHEATHING REPAIRS	LS	1	$ 1,920,000	$1,920,000.00
				Subtotal =	$15,293,645
				Adjust for 75% of Contract =	$11,470,234
				Adjust for Length Ratio =	$9,284,258
				Rehab Cost =	**$9,284,258**

* The values in the table above were derived from the HNTB estimate from 02/10/12

SAY = $11,700,000

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Replace Bridge Deck

Assumptions:

1. Deck replacement includes removing existing concrete & pavement, construction of new deck, construction of new curbs, membrane, pavement, railing, joints and other incidentals.
2. Mobilization costs are taken as 10% of the project total.
3. A 15% contingency has been applied.

Component	Deck Area (SF)	Unit Price($/lb)*	Unit Price w/ Conti.	Contract Total
New Hampshire Approach Spans	46,517	$82.44	$94.81	$4,410,091
Fixed Truss Spans	23,520	$82.44	$94.81	$2,229,837
Lift Span	11,760	$164.88	$189.61	$2,229,837
Main Approach Sapns	16,800	$82.44	$94.81	$1,592,741
Albacore Connector	4,524	$82.44	$94.81	$428,902
			SUBTOTAL =	$10,891,408
			Mobilization (10%) =	$1,089,141
			TOTAL CONSTRUCTION COSTS =	$11,980,549
			Engineering (7%), Inspection (7%):	$1,680,000
			TOTAL PROJECT COSTS:	$13,660,549
			TOTAL PROJECT COSTS (SAY):	**$13,700,000**

* Bid price data taken from MaineDOT PIN 016686.00 - I-95 Over Kennebec River Bridge Redecking Project Bid 7/11 and MTA project 2012-05 Presumpscot River - Falmouth Spur Redecking.
Only items that were directly related to the deck replacing were considers, listed below.
Lift span unit price is increased by 200% due to required counter-balancing and light-weight concrete.

			I-95 Kennebec River			Falmouth Spur
Item No.	Item Description	Quantity	Low	High	Average	Average
202.17	Removing Existing Structural Concrete	2328 CY	$719,000	$1,000,000	$859,500	$241,500
202.18	Removing Existing Bituminous Pavement	9576 SY	$20,000	$17,500	$18,750	$13,292
403.208	HMA 12.5MM Surface	696 T	$343,962	$343,962	$343,962	$19,867
502.26	Structural Concrete Roadway and Sidewalk Slabs	2172 CY	$1,950,000	$2,500,000	$2,225,000	$583,500
502.49	Structural Concrete Curbs and Sidewalks	279 CY	$175,000	$175,000	$175,000	$190,167
503.12	Reinforcing Steel, F&D	13622 LB	$6,811	$7,764	$7,288	$219,067
503.13	Reinforcing Steel, Placing	13622 LB	$13,622	$40,866	$27,244	$142,083
507.0811	Steel Bridge Railing, 2 Bar	4529 LF	$460,000	$450,000	$455,000	$68,667
508.14	High Performance Waterproofing Membrane	9729 SY	$175,000	$175,000	$175,000	$53,333
520.21	Expansion Device - Gland Seal	1 EA	$16,000	$22,500	$19,250	$98,000
520.22	Expansion Device - Compression Seal	2 EA	$36,000	$43,000	$39,500	N/A
521.23	Expansion Device - Finger Joint Type B	1 EA	$42,000	$55,000	$48,500	N/A
521.23	Expansion Device - Finger Joint Type D	2 EA	$84,000	$110,000	$97,000	N/A
521.32	Fabric Trough	1 EA	$5,000	$11,000	$8,000	N/A
521.33	Fabric Curtain	8 EA	$40,000	$20,000	$30,000	N/A
524.4	Protective Sheilding	LUMP	$30,000	$575,000	$100,000	$170,602
			Subtotal =		**$ 4,628,994**	**$ 1,800,077**
			Area =		79,981	21834 SF, (see calc.)
			Unit Cost =		$57.88	$82.44 $/SF
			2012 Unit Cost =		$60.09	$82.44 $/SF

Use Presumspcost River Falmouth Spur estimate, unit price is more in the range of what comprable projects have for redecking prices.

Unit cost derived by taking the sum of the average costs for all re-decking related items and then dividing by the square foot area of the bridges included in the estimate.

SAY =	**$13,700,000**

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Replace Retractable Span Electrical and Mechanical Systems

Assumptions:

1. Replace retractable span mechanical and electrical systems. Ropes covered under separate item.
2. No major work on counterweight sheaves or sheave bearings.
3. Gates covered under separate item.
4. Replace at year 50.

Component	Qty	Unit Price($/unit)*	Subtotal
Replace Mechanical Systems	1	$685,044.00	$685,044
Replace Electrical Systems	1	$502,025.00	$502,025
		Subtotal =	$1,187,069
		Mobilization (10%) =	$118,707
		TOTAL CONSTRUCTION COSTS =	$1,305,776
		Engineering (7%) and Inspection (7%) =	$182,809
		TOTAL PROJECT COSTS =	$1,488,585
		PROJECT TOTAL =	**$1,500,000**

* Unit pricing based on the HNTB report titled "Bridge Replacement Options For Sarah Mildred Long Bridge", Dated March 16, 2012
Mechanical system unit pricing presented above is the rehab cost increased by 50% to account for full replacement.

SAY =	**$1,500,000**

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Replace Lift Span Electrical and Mechanical Systems

Assumptions:

1. Replace lift span mechanical and electrical systems. Ropes covered under separate item.
2. No major work on counterweight sheaves or sheave bearings.
3. Gates covered under separate item.
4. Replace at year 50.

Component	Qty	Unit Price($/unit)*	Subtotal
Replace span drive machinery	1	$3,000,000.00	$3,000,000
Replace span locks	1	$250,000.00	$250,000
Replace elevators	1	$500,000.00	$500,000
Replace bridge control system	1	$3,000,000.00	$3,000,000
Replace aerial cable	1	$100,000.00	$100,000
Replace CCTV system	1	$192,000.00	$192,000
Replace intercom system	1	$55,000.00	$55,000
Replace fire alarm system	1	$135,000.00	$135,000
Replace generator	1	$400,000.00	$400,000
		Subtotal =	$7,632,000
		Mobilization (10%) =	$763,200
		TOTAL CONSTRUCTION COSTS =	$8,395,200
		Engineering (7%) and Inspection (7%) =	$1,175,328
		TOTAL PROJECT COSTS =	$9,570,528
		PROJECT TOTAL =	**$9,600,000**

* Span drive machinery from Chelsea St.
Span lock cost from Bates bridge
Electrical control system from Mobile River + 25%
CCTV cost from Chelsea St.
Intercom system from Chelsea St.
Fire alarm system from Chelsea St.
Generator cost from Chelsea St.

SAY =	$9,600,000

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Replace Counterweight Ropes

Assumptions:

1. Replace (20) 2" Diameter counterweight ropes and sockets.
2. All tensioning and adjustment costs included.
3. Replace ropes at 50 years.

Component	Qty	Unit Price($/unit)*	Subtotal
Counterweight rope replacement	1	$1,750,000.00	$1,750,000
		Subtotal =	$1,750,000
		Mobilization (10%) =	$175,000
		TOTAL CONSTRUCTION COSTS =	$1,925,000
		Engineering (7%) and Inspection (7%) =	$269,500
		TOTAL PROJECT COSTS =	$2,194,500
		PROJECT TOTAL =	**$2,200,000**

* Cost data from previous Memorial Bridge bids, escalate 3% annually

SAY = $2,200,000

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Rehab Bridge Substructure

Assumptions:

1. Bridge substructure rehabilitation includes surface patching and waterproofing
2. The cost presented is based on the surface area of above grade substructure components.
3. It is assumed that 60% of substructure surface area is above grade and that 10% of that area will need repair every 25 years.
4. Using Transystems form work area calculations a ratio of surface are to substructure volume was developed and was used to develop approximate substructure surface areas based on calculated pier and abutment concrete volumes.
5. Mobilization costs are taken as 10% of the project total.
6. A 15% contingency has been applied.

* Typical unit prices for above-water pier and abutment repair range from $80-$100 per SF.
Carry $150/SF due to location of work above water and difficult access.

Note: Conversion ratio from substructure volume & substructure surface area = 0.071756 CY/SF

Volume of Piers, Approach Spans =	3257	CY	
Volume of Abt. & Ret. Walls, Approach Spans =	340	CY	
Volume of Piers, Main Spans =	6614	CY	
Surface Area of Piers, Approach Spans =	27234	SF	(Volume/Conversion Ratio)*60%
Surface Area of Abt. & Ret. Walls, Approach Spans =	2843	SF	
Surface Area of Piers, Main Spans =	55304	SF	
Total Surface Area =	85381	SF	
Repair Area =	8538	SF	

Component	Surface Area	Unit Price($/lb)*	Unit Price w/ Conti.	Contract Total
Substructure Repair	8,538	$150.00	$172.50	$1,472,822
			TOTAL CONSTRUCTION COSTS:	**$1,472,822**
			Engineering (7%), Inspection (7%):	$210,000
			TOTAL PROJECT COSTS:	$1,682,822
			TOTAL PROJECT COSTS (SAY):	**$1,700,000**

SAY = $1,700,000

Life Cycle Cost Analysis - Bridge Replacement,Two-Level Truss Option

Development of costs for: Bridge Bearing Rehabilitation

Assumptions:

1. Elastomeric Bearings on approach structures will remain in place for duration of bridge service life. Bearings at main spans will be replaced for a cost equaling their original construction cost.
2. Jacking and temporary support of the fixed and movable spans will be required. Assume $750,000 per span.
3. Quantities and unit pricing is based on the HNTB report titled "Bridge Replacement For Sarah Mildred Long Bridge", Dated March 16, 2012.
4. Mobilization costs are taken as 10% of the project total.
5. A 15% contingency has been included in the unit price for each item.
6. Design and Construction Engineering taken as 7% of Construction Value

MAIN SPAN COMPONENTS (TAKEN FROM TIED ARCH OPTION, ALL OPTIONS SIMILAR)

ITEM NO.	ITEM DESCRIPTION	UNIT	TOTAL QNTY.	UNIT PRICE	UNIT PRICE w/ CONT.	CONTRACT TOTAL
523.52	BEARING INSTALLATION	EA	14	$ 1,000.00	$ 1,150.00	$ 16,100
523.5551	POT OR DISC BEARINGS, FIXED	EA	4	$ 8,500.00	$ 9,775.00	$ 39,100
523.5552	POT OR DISC BEARINGS, EXPANSION	EA	4	$ 10,000.00	$ 11,500.00	$ 46,000
523.XXXX	LIFT SPAN BEARING, FIXED	EA	2	$ 8,500.00	$ 9,775.00	$ 19,550
523.XXXX	LIFT SPAN BEARING, EXPANSION	EA	2	$ 10,000.00	$ 11,500.00	$ 23,000
523.XXXX	LIFT SPAN CENTERING DEVICE	EA	2	$ 4,000.00	$ 4,600.00	$ 9,200
524.XXXX	JACKING AND TEMPORARY STRUCTURAL SUPPORTS	SPAN	2	$ 750,000.00	$ 862,500.00	$ 1,725,000

SUBTOTAL:	$	1,877,950
Mobilization (10%):	$	187,795
TOTAL CONSTRUCTION COSTS:	**$**	**2,065,745**
Engineering (7%), Inspection (7%):	$	290,000
TOTAL PROJECT COSTS:	$	2,355,745
TOTAL PROJECT COSTS (SAY):	**$**	**2,400,000**

SAY = $2,400,000