# Appendix A - Detailed Costs



### **Existing Bridge Rehabilitation**

	Structure Width	36.5 FT	
	Structure Length	2529 FT	
t3	Deck Area	92,309 SF	
S	Estimated \$\$/SF - Substructure Rehab	\$ 200/SF	
ě			
Ē	Steel Surface Area	500,000 SF	
Structure Costs	Estimated \$\$/SF - Super Painting	\$ 20/SF	
22			
	Misc. Superstructure Repair	\$ 50/SF	
	Total Estimated Structure Cost	\$ 33,080,000	
	Trackwork		
	Bridge Rail, Timbers, Tie Plates, Spikes	\$2,000,000	5,000 feet @ \$400 per foot
ts	Approaches Rail, Ties, Ballast, Earthwork	\$3,016,000	10,400 feet @ \$290 per foot
Rail Costs			
l	Signals		
22	Remove, Protect, Reconnect Existing Equipment	\$500,000	
		\$ 5,516,000	
	Underwater Inspection	\$ 80,000	
sts	In-depth Inspection	\$ 250,000	
S	Remaining Fatigue Life Analysis	\$ 72,000	
Other Costs	Update Load Rating	\$ 96,000	
₹	Mobilization	\$ 2,700,000	Assume 7% of (Structure + Rail) Cost
	Base Construction Cost	\$ 41,794,000	
# >	Base Cost Including Inflation	\$ 41,790,000	
a Co	Contingency	\$ 14,630,000	Assume 35% of Base Cost Plus Inflation
Total Cost Summary	Base Cost Including Inflation and Contingency	\$ 56,420,000	
ο S	Design Design	1 7 - 7 - 7 - 7	Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection		Assume 10% of Base Cost Plus Inflation Plus Contingency
		. , ,	3 ,
	TOTAL ESTIMATED COST	\$ 68,270,000	





# Alternative 2: Reconstruct Existing 2-Track Bridge\*

(2013 Dollars)						
Structure Type	Structu	ıre Cost	Rail Cost	Other	Costs	Anticipated Total Cost for New Structure
	Low	High		Low	High	
1. Steel Tied Arch	\$62,520,000	\$93,250,000	\$5,516,000	\$68,707,750	\$98,429,300	\$137 _ \$197 M
2. Steel Through Arch	\$69,780,000	\$103,440,000	\$5,516,000	\$75,447,750	\$107,879,300	\$151 _ \$217 M
3. Extradosed	\$142,660,000	\$194,980,000	\$5,516,000	\$143,027,750	\$192,779,300	\$291 _ \$393 M
3a. Partial Extradosed	\$97,720,000	\$141,060,000	\$5,516,000	\$101,367,750	\$142,759,300	\$205 _ \$289 M
4. Concrete Deck Arch	\$74,830,000	\$107,580,000	\$5,516,000	\$80,117,750	\$111,719,300	\$160 _ \$225 M
4a. Standard Girder Structure with Concrete Arch Façade Elements	\$71,610,000	\$99,720,000	\$5,516,000	\$77,137,750	\$104,439,300	\$154 _ \$210 M

<sup>\*</sup>These costs and the bridge and tunnel types discussed herein are conceptual in nature, and therefore evaluations of cost at this stage of the project development must be considered to be very preliminary, and should not be used for funding or programming purposes. None of the alternatives described in this report have been sufficiently engineered to determine costs based on estimated structural quantities, anticipated erection methods, right-of way implications, expected schedule durations, and potential effects of inflation based on the anticipated timing of the beginning of construction. At this stage of development, only preliminary level of cost evaluation can be made that differentiates the alternatives on the basis of anticipated construction cost. A 35% contingency is included in the cost of bridge or tunnel options.

### Alternative 2: Steel Tied Arch

Year of Estimate: 2013 Construction Year: 2017 Inflation Rate: . %

		Low	High	
	Structure Width	38.5 FT	38.5 FT	
	Structure Length - Tied Arch	280 FT	280 FT	
t <del>s</del>	Deck Area - Tied Arch Span	10,780 SF	10,780 SF	
Š	Estimated \$\$/SF - Tied Arch Span	\$ 500/SF	\$ 700/SF	
Structure Costs	Structure Length - Approaches	7,420 FT	7,420 FT	Const Length = 7700 FT
gr Gr	Deck Area - Approaches	285,670 SF	285,670 SF	
Ţ	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
Ň	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 62,520,000	\$ 93,250,000	
	Trackwork			Į.
	Bridge Rail, Timbers, Tie Plates, Spikes	\$2,000,000	\$2,000,000	5,000 feet @ \$400 per foot
t t	Approaches Rail, Ties, Ballast, Earthwork	\$3,016,000	\$3,016,000	10,400 feet @ \$290 per foot
Rail Costs				
<u> </u>	Signals			
æ	Remove, Protect, Reconnect Existing Equipment	\$500,000	\$500,000	
	Total Estimated RR Cost	\$ 5,516,000	\$ 5,516,000	
	Drainage, Signing, Landscaping, etc.	\$ 3,130,000	\$ 4,660,000	Assume 5% of Structure Cost
sts	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
S	Right of Way Acquisition	\$	\$	
Other Costs	Maintenance & Protection of Traffic	\$ 2,720,000	\$ 3,950,000	Assume 4% of (Structure + Rail) Cost
₹	Mobilization	\$ 4,760,000	\$ 6,910,000	Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 1,360,000	\$ 1,980,000	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 83,713,750	\$ 120,715,300	
# >	Base Cost Including Inflation	\$ 83,710,000	\$ 120,720,000	
Cos	Contingency	\$ 29,300,000		Assume 35% of Base Cost Plus Inflation
Total Cost Summary	Base Cost Including Inflation and Contingency	\$ 113,010,000	\$ 162,970,000	
Tot Su	Design	\$ 12,430,000	. , ,	Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection	\$ 11,300,000		Assume 10% of Base Cost Plus Inflation Plus Contingency
	- ·		. , ,	, , , , , , , , , , , , , , , , , , ,
	TOTAL ESTIMATED COST	\$ 136,740,000	\$ 197,200,000	



ELEVATION

### Alternative 2: Steel Through Arch

Year of Estimate: 2013 Construction Year: 2017 Inflation Rate: . %

		Low	High	
	Structure Width	40.5 FT	40.5 FT	
	Structure Length - Through Arch	610 FT	610 FT	
\$	Deck Area - Through Arch Span	24,705 SF	24,705 SF	
ပ္လ	Estimated \$\$/SF - Through Arch Span	\$ 500/SF	\$ 700/SF	
ē	Structure Length - Approaches	7,090 FT	7,090 FT	Const Length = 7700 FT
Structure Costs	Deck Area - Approaches	287,145 SF	287,145 SF	
Ž	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
22	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 69,780,000	\$ 103,440,000	
	Trackwork			
	Bridge Rail, Timbers, Tie Plates, Spikes	\$2,000,000	\$2,000,000	5,000 feet @ \$400 per foot
23	Approaches Rail, Ties, Ballast, Earthwork	\$3,016,000		10,400 feet @ \$290 per foot
Rail Costs				
≝	Signals			
22	Remove, Protect, Reconnect Existing Equipment	\$500,000	\$500,000	
	Total Estimated RR Cost	\$ 5,516,000	\$ 5,516,000	
	Drainage, Signing, Landscaping, etc.	\$ 3,490,000	\$ 5.170.000	Assume 5% of Structure Cost
ts:	Utility Relocation	\$ 3,707,750		Surface Utility Survey
Š	Right of Way Acquisition	\$	\$	, ,
ē	Maintenance & Protection of Traffic	\$ 3,010,000	\$ 4,360,000	Assume 4% of (Structure + Rail) Cost
Other Costs	Mobilization	\$ 5,270,000	\$ 7,630,000	Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 1,510,000	\$ 2,180,000	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 02 282 750	\$ 132,745,300	
٠.,	Base Construction Cost  Base Cost Including Inflation		\$ 132,743,300	
Sos:		\$ 32,300,000		Assume 35% of Base Cost Plus Inflation
Total Cost Summary	Contingency		. , ,	ASSUME 55% OF Dase Cost Plus inflation
Sur	Base Cost Including Inflation and Contingency		\$ 179,210,000	440/ 50 0 10 1 5 5 6 7
"	Design	\$ 13,700,000		Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection	\$ 12,460,000	\$ 17,920,000	Assume 10% of Base Cost Plus Inflation Plus Contingency
	TOTAL ESTIMATED COST	\$ 150,740,000	\$ 216,840,000	



ELEVATION

### Alternative 2: Full Extradosed

		Low	High	
	Structure Width	51.5 FT	51.5 FT	
	Structure Length - Extradosed	2460 FT	2460 FT	
ŧ	Deck Area - Extradosed Spans	126,690 SF	126,690 SF	
S	Estimated \$\$/SF - Extradosed Spans	\$ 700/SF	\$ 900/SF	
ē	Structure Length - Approaches	5,240 FT	5,240 FT	Const Length = 7700 FT
큥	Deck Area - Approaches	269,860 SF	269,860 SF	
Structure Costs	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
.∞	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 142,660,000	\$ 194,980,000	
	Trackwork			
	Bridge Rail, Timbers, Tie Plates, Spikes	\$2,000,000	\$2,000,000	5,000 feet @ \$400 per foot
£3	Approaches Rail, Ties, Ballast, Earthwork	\$3,016,000	\$3,016,000	10,400 feet @ \$290 per foot
Rail Costs	, , , ,		. , ,	, = :
=	Signals			
8	Remove, Protect, Reconnect Existing Equipment	\$500,000	\$500,000	
	Total Estimated RR Cost	\$ 5,516,000	\$ 5,516,000	
	Drainage, Signing, Landscaping, etc.	\$ 7,130,000	\$ 9 750 000	Assume 5% of Structure Cost
ts	Utility Relocation	\$ 3,707,750	. , ,	Surface Utility Survey
Š	Right of Way Acquisition	\$	\$ 1,7113,300	
Other Costs	Maintenance & Protection of Traffic	\$ 5,930,000	\$ 8.020.000	Assume 4% of (Structure + Rail) Cost
ŧ	Mobilization	\$ 10,370,000		Assume 7% of (Structure + Rail) Cost
J	Construction Staking/Survey	\$ 2,960,000		Assume 2% of (Structure + Rail) Cost
	Dana Carata atian Cast	ć 170 272 7F0	ć 240 7FF 200	
	Base Construction Cost		\$ 240,755,300	
ost	Base Cost Including Inflation		\$ 240,760,000	
Total Cost Summary	Contingency	. , ,	. , ,	Assume 35% of Base Cost Plus Inflation
ig ig	Base Cost Including Inflation and Contingency		\$ 325,030,000	
F 0	Design			Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection	\$ 24,070,000	\$ 32,500,000	Assume 10% of Base Cost Plus Inflation Plus Contingency
	TOTAL ESTIMATED COST	\$ 291,200,000	\$ 303 280 000	

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						#	<b>5</b>	# # #	<u>.</u>
Ĺ	180'-0"	300′-0°	300/-0*	300′-0*	300'-0"	300′-0*	300-0	300'-0'	180°-0"

### Alternative 2: Partial Extradosed

		Low	High	
	Structure Width	51.5 FT	51.5 FT	
	Structure Length - Extradosed	715 FT	715 FT	
ţ	Deck Area - Extradosed Spans	36,823 SF	36,823 SF	
လို	Estimated \$\$/SF - Extradosed Spans	\$ 700/SF	\$ 900/SF	
ē	Structure Length - Approaches	6,985 FT	6,985 FT	Const Length = 7700 FT
Ę	Deck Area - Approaches	359,728 SF	359,728 SF	
Structure Costs	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
25	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 97,720,000	\$ 141,060,000	
	Trackwork			
	Bridge Rail, Timbers, Tie Plates, Spikes	\$2,000,000	\$2,000,000	5,000 feet @ \$400 per foot
ts .	Approaches Rail, Ties, Ballast, Earthwork	\$3,016,000	\$3,016,000	10,400 feet @ \$290 per foot
Rail Costs				
i i	Signals			
8	Remove, Protect, Reconnect Existing Equipment	\$500,000	\$500,000	
	Total Estimated RR Cost	\$ 5,516,000	\$ 5,516,000	
	Drainage, Signing, Landscaping, etc.	\$ 4,890,000	\$ 7,050,000	Assume 5% of Structure Cost
sts	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
Ŝ	Right of Way Acquisition	\$	\$	
Other Costs	Maintenance & Protection of Traffic	\$ 4,130,000	\$ 5,860,000	Assume 4% of (Structure + Rail) Cost
₹	Mobilization	\$ 7,230,000	\$ 10,260,000	Assume 7% of (Structure + Rail) Cost
_	Construction Staking/Survey	\$ 2,060,000	\$ 2,930,000	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 125 253 750	\$ 177,125,300	
+ >	Base Cost Including Inflation		\$ 177,130,000	
Total Cost Summary	Contingency	\$ 43,840,000		Assume 35% of Base Cost Plus Inflation
le al	Base Cost Including Inflation and Contingency		\$ 239,130,000	
Tot Sun	Design	\$ 18,600,000		Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection	\$ 16,910,000		Assume 10% of Base Cost Plus Inflation Plus Contingency
			. , ,	5 ,
	TOTAL ESTIMATED COST	\$ 204,600,000	\$ 289,340,000	

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### Alternative 2: Deck Arch

		Low	High	
	Structure Width	36.5 FT	36.5 FT	
	Structure Length - Deck Arch	2550 FT	2550 FT	
ts t	Deck Area - Deck Arch Spans	93,075 SF	93,075 SF	
Structure Costs	Estimated \$\$/SF - Deck Arch Spans	\$ 400/SF	\$ 550/SF	
ē	Structure Length - Approaches	5,150 FT	5,150 FT	Const Length = 7700 FT
ą	Deck Area - Approaches	187,975 SF	187,975 SF	
ž	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
22	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 74,830,000	\$ 107,580,000	
	Trackwork			
	Bridge Rail, Timbers, Tie Plates, Spikes	\$2,000,000	\$2,000,000	5,000 feet @ \$400 per foot
S.	Approaches Rail, Ties, Ballast, Earthwork	\$3,016,000	\$3,016,000	10,400 feet @ \$290 per foot
Rail Costs				
ĕ	Signals			
8	Remove, Protect, Reconnect Existing Equipment	\$500,000	\$500,000	
	Total Estimated RR Cost	\$ 5,516,000	\$ 5,516,000	
	Drainage, Signing, Landscaping, etc.	\$ 3,740,000	\$ 5.380.000	Assume 5% of Structure Cost
şţ	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
Š	Right of Way Acquisition	\$	\$	, ,
ě	Maintenance & Protection of Traffic	\$ 3,210,000	\$ 4,520,000	Assume 4% of (Structure + Rail) Cost
Other Costs	Mobilization	\$ 5,620,000	\$ 7,920,000	Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 1,610,000	\$ 2,260,000	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 98 233 750	\$ 137,625,300	
<b>+</b> \	Base Cost Including Inflation		\$ 137,630,000	
Total Cost Summary	Contingency	\$ 34,380,000		Assume 35% of Base Cost Plus Inflation
<u>a</u> (	Base Cost Including Inflation and Contingency	- , ,	\$ 185,800,000	Passante 35% of base cost rius initiation
Sur Sur	Design	\$ 14,590,000	. , ,	Assume 11% of Base Cost Plus Inflation Plus Contingency
•	Construction Management / Inspection	\$ 13,260,000		Assume 11% of Base Cost Plus Inflation Plus Contingency Assume 10% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection	\$ 13,260,000	\$ 16,380,000	Assume 10% of base cost Plus inflation Plus Contingency
	TOTAL ESTIMATED COST	\$ 160,460,000	\$ 224,820,000	



### Alternative 2: Multi-Girder with Arch Façade

		Low	High	
	Structure Width	36.5 FT	36.5 FT	
	Structure Length - Deck Arch	00 FT	00 FT	
	Deck Area - Deck Arch Spans	SF	SF	
\$	Estimated \$\$/SF - Deck Arch Spans	\$ 000/SF	\$ 000/SF	
Structure Costs	Structure Length - Approaches	7,700 FT	7,700 FT	Const Length = 7700 FT
e	Deck Area - Approaches	281,050 SF	281,050 SF	
Ę	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
Ž	Estimated Retaining Walls	SF	SF	
25	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Precast Arch Facades	15400 LF	15400 LF	
	Estimated \$/LF - Arch Facades	\$ 1,000 /LF		Includes fabrication, erection, post-tensioning
	Total Estimated Structure Cost	\$ 71,610,000	\$ 99,720,000	
	Trackwork			
	Bridge Rail, Timbers, Tie Plates, Spikes	\$2,000,000	\$2,000,000	5,000 feet @ \$400 per foot
S.	Approaches Rail, Ties, Ballast, Earthwork	\$3,016,000		10,400 feet @ \$290 per foot
ost	11 / /		. , ,	, = : .
Rail Costs	Signals			
S <sub>a</sub>	Remove, Protect, Reconnect Existing Equipment	\$500,000	\$500,000	
	Total Estimated RR Cost	\$ 5,516,000	\$ 5,516,000	
	Drainage, Signing, Landscaping, etc.	\$ 3,580,000	\$ 4.990.000	Assume 5% of Structure Cost
t;	Utility Relocation	\$ 3,707,750		Surface Utility Survey
Š	Right of Way Acquisition	Ś	Ś	
Other Costs	Maintenance & Protection of Traffic	\$ 3,090,000	\$ 4.210.000	Assume 4% of (Structure Plus Rail) Cost
l ŧ	Mobilization	\$ 5,400,000		Assume 7% of (Structure Plus Rail) Cost
	Construction Staking/Survey	\$ 1,540,000	\$ 2,100,000	Assume 2% of (Structure Plus Rail) Cost
	Base Construction Cost	¢ 04 442 7E0	\$ 128,355,300	
	Base Cost Including Inflation		\$ 128,355,300	
osi any	-			
Total Cost Summary	Contingency			Assume 35% of Base Cost Plus Inflation
Sur	Base Cost Including Inflation and Contingency	\$ 127,490,000		
ļ .,	Design Construction Management (Inspection			Assume 11% of (Base Cost Plus Inflation Plus Contingency)
	Construction Management / Inspection	\$ 12,750,000	\$ 17,330,000	Assume 10% of (Base Cost Plus Inflation Plus Contingency)
	TOTAL ESTIMATED COST	\$ 154,260,000	\$ 209,680,000	







# Alternative 3: 4-Track Rail Bridge\*

(2013 Dollars)										
Structure Type	Type Structure Cost Rail Cost Other Costs					Anticipated Total Cost for New Structure				
	Low	High		Low	High					
1. Steel Tied Arch	\$113,680,000	\$169,540,000	\$68,775,000	\$172,577,750	\$225,599,300	\$355 _ \$464 M				
2. Steel Through Arch	\$124,060,000	\$183,890,000	\$68,775,000	\$185,117,750	\$241,819,300	\$378 _ \$494 M				
3. Extradosed	\$229,910,000	\$314,240,000	\$68,775,000	\$299,287,750	\$378,709,300	\$598 _ \$762 M				
3a. Partial Extradosed	\$157,490,000	\$227,340,000	\$68,775,000	\$232,107,750	\$298,109,300	\$458 _ \$594 M				
4. Concrete Deck Arch	\$139,400,000	\$200,430,000	\$68,775,000	\$193,527,750	\$251,329,300	\$402 _ \$521 M				
4a. Standard Girder Structure with Concrete Arch Façade Elements	\$120,120,000	\$172,480,000	\$68,775,000	\$175,657,750	\$225,419,300	\$365 _ \$467 M				

<sup>\*</sup>These costs and the bridge and tunnel types discussed herein are conceptual in nature, and therefore evaluations of cost at this stage of the project development must be considered to be very preliminary, and should not be used for funding or programming purposes. None of the alternatives described in this report have been sufficiently engineered to determine costs based on estimated structural quantities, anticipated erection methods, right-of way implications, expected schedule durations, and potential effects of inflation based on the anticipated timing of the beginning of construction. At this stage of development, only preliminary level of cost evaluation can be made that differentiates the alternatives on the basis of anticipated construction cost. A 35% contingency is included in the cost of bridge or tunnel options.

### Alternative 3: Steel Tied Arch

Year of Estimate: 2013 Construction Year: 2017 Inflation Rate: . %

		Low	High	
	Structure Width	70 FT	70 FT	
	Structure Length - Tied Arch	280 FT	280 FT	
£	Deck Area - Tied Arch Span	19,600 SF	19,600 SF	
၂ ႏ	Estimated \$\$/SF - Tied Arch Span	\$ 500/SF	\$ 700/SF	
e e	Structure Length - Approaches	7,420 FT	7,420 FT	Const Length = 7700 FT
Ē	Deck Area - Approaches	519,400 SF	519,400 SF	
Structure Costs	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
25	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 113,680,000	\$ 169,540,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000	\$1,600,000	4 @ \$400K each
	Crossover (#20)	\$6,400,000	\$6,400,000	8 @ \$800K each
	Remove Turnout	\$25,000	\$25,000	1 @ \$25K
sts	Remove Crossover	\$200,000	\$200,000	4 @\$50K each
8	Signals			
Rail Costs	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
_	RO & AF Interlockings	\$16,000,000	\$16,000,000	2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000	\$5,000,000	2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000	\$ 250,000	Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 5,680,000	\$ 8,480,000	Assume 5% of Structure Cost
sts	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
కి	Right of Way Acquisition	\$ 1,780,000	\$ 1,780,000	Assume Width excluding Rail expansion
Other Costs	Maintenance & Protection of Traffic	\$ 7,300,000	\$ 9,530,000	Assume 4% of (Structure + Rail) Cost
l ₹	Mobilization	\$ 12,770,000	\$ 16,680,000	Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 3,650,000	\$ 4,770,000	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 217,342,750	\$ 284,004,300	
# >	Base Cost Including Inflation	\$ 217,340,000	\$ 284,000,000	
Cos	Contingency	\$ 76,070,000	, , , , , , , , , , , , , , , , , , , ,	Assume 35% of Base Cost Plus Inflation
Total Cost Summary	Base Cost Including Inflation and Contingency	\$ 293,410,000	\$ 383,400,000	- Martin David Cook ( No. ) Martin Martin
Tot Su	Design	\$ 32,280,000		Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection	\$ 29,340,000		Assume 10% of Base Cost Plus Inflation Plus Contingency
				Assume 2070 of buse cost in as initiation in the contingently
	TOTAL ESTIMATED COST	\$ 355,030,000	\$ 463,910,000	



ELEVATION

### Alternative 3: Steel Through Arch

		Low	High	
	Structure Width	72 FT	72 FT	
	Structure Length - Through Arch	610 FT	610 FT	
t t	Deck Area - Through Arch Span	43,920 SF	43,920 SF	
So	Estimated \$\$/SF - Through Arch Span	\$ 500/SF	\$ 700/SF	
é	Structure Length - Approaches	7,090 FT	7,090 FT	Const Length = 7700 FT
Ē	Deck Area - Approaches	510,480 SF	510,480 SF	
Structure Costs	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
8	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 124,060,000	\$ 183,890,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000		4 @ \$400K each
	Crossover (#20)	\$6,400,000	\$6,400,000	8 @ \$800K each
	Remove Turnout	\$25,000	\$25,000	1 @ \$25K
sts	Remove Crossover	\$200,000		4 @\$50K each
Rail Costs	Signals			
kail	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
•	RO & AF Interlockings	\$16,000,000	\$16,000,000	2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000		2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000	\$ 250,000	Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 6,200,000	\$ 9.190.000	Assume 5% of Structure Cost
sts	Utility Relocation	\$ 3,707,750		Surface Utility Survey
Other Costs	Right of Way Acquisition	\$ 3,560,000		Assume Width excluding Rail expansion
ē	Maintenance & Protection of Traffic	\$ 7,710,000	\$ 10,110,000	Assume 4% of (Structure + Rail) Cost
妄	Mobilization	\$ 13,500,000		Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 3,860,000	\$ 5,050,000	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 231,372,750	\$ 302,714,300	
# >	Base Cost Including Inflation		\$ 302,710,000	
Total Cost Summary	Contingency			Assume 35% of Base Cost Plus Inflation
<u> </u>	Base Cost Including Inflation and Contingency		\$ 408,660,000	
or ⊒o	Design Design			Assume 11% of Base Cost Plus Inflation Plus Contingency
•	Construction Management / Inspection			Assume 10% of Base Cost Plus Inflation Plus Contingency
				-
	TOTAL ESTIMATED COST	\$ 377,950,000	\$ 494,480,000	



ELEVATION

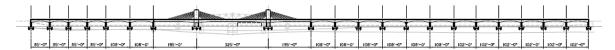
### Alternative 3: Full Extradosed

		Low	High	
	Structure Width	83 FT	83 FT	
	Structure Length - Extradosed	2460 FT	2460 FT	
ţ	Deck Area - Extradosed Spans	204,180 SF	204,180 SF	
Sos	Estimated \$\$/SF - Extradosed Spans	\$ 700/SF	\$ 900/SF	
e (	Structure Length - Approaches	5,240 FT	5,240 FT	Const Length = 7700 FT
in in	Deck Area - Approaches	434,920 SF	434,920 SF	
Structure Costs	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
St	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 229,910,000	\$ 314,240,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000	\$1,600,000	4 @ \$400K each
	Crossover (#20)	\$6,400,000	\$6,400,000	8 @ \$800K each
	Remove Turnout	\$25,000	\$25,000	1 @ \$25K
sts	Remove Crossover	\$200,000	\$200,000	4 @\$50K each
Rail Costs	Signals			
Rail	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
_	RO & AF Interlockings	\$16,000,000	\$16,000,000	2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000	\$5,000,000	2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000	\$ 250,000	Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 11,500,000	\$ 15,710,000	Assume 5% of Structure Cost
Other Costs	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
೦	Right of Way Acquisition	\$ 13,350,000	\$ 13,350,000	Assume Width excluding Rail expansion
řer	Maintenance & Protection of Traffic	\$ 11,950,000	\$ 15,320,000	Assume 4% of (Structure + Rail) Cost
D#	Mobilization	\$ 20,910,000	\$ 26,810,000	Assume 7% of (Structure + Rail) Cost
_	Construction Staking/Survey	\$ 5,970,000	\$ 7,660,000	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 366,072,750	\$ 466,314,300	
# >	Base Cost Including Inflation	\$ 366,070,000	\$ 466,310,000	
ar Co	Contingency			Assume 35% of Base Cost Plus Inflation
Total Cost Summary	Base Cost Including Inflation and Contingency		\$ 629,520,000	
Tot Su	Design			Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection			Assume 10% of Base Cost Plus Inflation Plus Contingency
			. , ,	<b>3</b> ,
	TOTAL ESTIMATED COST	\$ 597,970,000	\$ 761,720,000	

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į	1807-0 <sup>4</sup>	300'-0"	3007-0*	300′−0⁴	3001-0*	3001-0*	300-0	300'-0'	180°-0"

### Alternative 3: Partial Extradosed

		Low	High	
	Structure Width	83 FT	83 FT	
	Structure Length - Extradosed	715 FT	715 FT	
t t	Deck Area - Extradosed Spans	59,345 SF	59,345 SF	
S	Estimated \$\$/SF - Extradosed Spans	\$ 700/SF	\$ 900/SF	
ė	Structure Length - Approaches	6,985 FT	6,985 FT	Const Length = 7700 FT
Ē	Deck Area - Approaches	579,755 SF	579,755 SF	
Structure Costs	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
8	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 157,490,000	\$ 227,340,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000	\$1,600,000	4 @ \$400K each
	Crossover (#20)	\$6,400,000	\$6,400,000	8 @ \$800K each
	Remove Turnout	\$25,000	\$25,000	1 @ \$25K
sts	Remove Crossover	\$200,000	\$200,000	4 @\$50K each
Rail Costs	Signals			
ail	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
_	RO & AF Interlockings	\$16,000,000	\$16,000,000	2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000	\$5,000,000	2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000	\$ 250,000	Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 7,870,000	\$ 11,370,000	Assume 5% of Structure Cost
Other Costs	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
S	Right of Way Acquisition	\$ 13,350,000	\$ 13,350,000	Assume Width excluding Rail expansion
Ĕ	Maintenance & Protection of Traffic	\$ 9,050,000	\$ 11,840,000	Assume 4% of (Structure + Rail) Cost
퓽	Mobilization	\$ 15,840,000	\$ 20,730,000	Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 4,530,000	\$ 5,920,000	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 280,612,750	\$ 363,774,300	
# >	Base Cost Including Inflation	\$ 280,610,000	\$ 363,770,000	
a Ç	Contingency	\$ 98,210,000	\$ 127.320.000	Assume 35% of Base Cost Plus Inflation
Total Cost Summary	Base Cost Including Inflation and Contingency		\$ 491,090,000	
ρ J.	Design			Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection			Assume 10% of Base Cost Plus Inflation Plus Contingency
				- '
I	TOTAL ESTIMATED COST	\$ 458,370,000	\$ 594,220,000	



### Alternative 3: Deck Arch

Structure Width	nflation Rate:	. %	Low	High	
Deck Area - Deck Arch Spans   173,400 SF   173,400 SF   5550/SF   Estimated \$5/SF - Deck Arch Spans   \$ 400/SF   \$ 550/SF   Structure Length - Approaches   \$ 5,150 FT   \$ 5,150 FT   Const Length = 7700 FT   Deck Area - Approaches   \$ 5,150 FT   \$ 5,150 FT   Const Length = 7700 FT   Deck Area - Approaches   \$ 5,200/SF   \$ 350,200 SF   S 350,200 SF		Structure Width	68 FT	68 FT	
Estimated \$\$/\$F - Deck Arch Spans   \$400/\$F   \$550/\$F     Structure Length - Approaches   \$350,000 \$F     Deck Area - Approaches   \$350,000 \$F     Estimated \$\$/\$F - Approaches   \$200/\$F   \$300/\$F     Estimated \$\$/\$F - Approaches   \$200/\$F   \$300/\$F     Estimated \$\$/\$F - Retaining Walls   \$F   \$F     Estimated \$\$/\$F - Retaining Walls   \$\$140/\$F   \$140/\$F     Total Estimated Structure Cost   \$139,000,000 \$200,430,000     Trackwork/Earthwork/Baillast   \$\$140/\$F   \$140/\$F     Turnout (#20)   \$\$1,600,000 \$24,400,000 \$15.7 miles @ \$1.55M per mile     Turnout (#20)   \$\$6,400,000 \$6,400,000 \$8 @ \$800k each     Remove Turnout   \$25,000 \$520,000 \$1 @ \$25K     Remove Turnout   \$25,000 \$200,000 \$4 @ \$50K each     Signals   \$\$10/\$F   \$\$100,000 \$\$16,000,000 \$2 @ \$8M each     Virginia & L'Enfant Interlockings   \$12,000,000 \$12,000,000 \$2 @ \$8M each     Siders Lane & Franconia Interlockings   \$5,000,000 \$2,000,000 \$2 @ \$25.00 \$2 @ \$2.5 m each     Cut Section (Code Change)   \$2,900,000 \$2,900,000 \$2 @ \$2.5 m each     Miscellaneous RR Cost   \$6,977,500 \$5,877,500 \$10,000,000 \$2 @ \$10		Structure Length - Deck Arch	2550 FT	2550 FT	
Estinated StySF - Retaining Walls   S 140/SF   S 140/SF   Total Estimated Structure Cost   S 139,400,000   \$ 200,430,000	t3	Deck Area - Deck Arch Spans	173,400 SF	173,400 SF	
Estimated Sty/SF - Retaining Walls   S140/SF   S140/SF   S140/SF   Total Estimated Structure Cost   \$139,400,000   \$200,430,000   S200,430,000   S200,000	လွ	Estimated \$\$/SF - Deck Arch Spans	\$ 400/SF	\$ 550/SF	
Estinated StySF - Retaining Walls   S 140/SF   S 140/SF   Total Estimated Structure Cost   S 139,400,000   \$ 200,430,000	ē	Structure Length - Approaches	5,150 FT	5,150 FT	Const Length = 7700 FT
Estimated Sty/SF - Retaining Walls   S140/SF   S140/SF   S140/SF   Total Estimated Structure Cost   \$139,400,000   \$200,430,000   S200,430,000   S200,000	Ē	Deck Area - Approaches	350,200 SF	350,200 SF	
Estimated Sty/SF - Retaining Walls   S140/SF   S140/SF   S140/SF   Total Estimated Structure Cost   \$139,400,000   \$200,430,000   S200,430,000   S200,000	ž	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
Total Estimated Structure Cost   \$139,400,000   \$200,430,000	22	Estimated Retaining Walls	SF	SF	
Trackwork/Earthwork/Ballast					
Construct Track		Total Estimated Structure Cost	\$ 139,400,000	\$ 200,430,000	
Turnout (#20)		Trackwork/Earthwork/Ballast			
Crossover (#20)		Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
Remove Turnout		Turnout (#20)	\$1,600,000	\$1,600,000	4 @ \$400K each
Remove Crossover   \$200,000   \$200,000   4 @\$50K each		Crossover (#20)	\$6,400,000	\$6,400,000	8 @ \$800K each
RO & AF Interlockings   \$16,000,000   \$16,000,000   2 @ \$8M each		Remove Turnout	\$25,000	\$25,000	1 @ \$25K
RO & AF Interlockings   \$16,000,000   \$16,000,000   2 @ \$8M each	sts	Remove Crossover	\$200,000	\$200,000	4 @\$50K each
RO & AF Interlockings   \$16,000,000   \$16,000,000   2 @ \$8M each	<u>8</u>	Signals			
Slaters Lane & Franconia Interlockings   \$5,000,000   \$5,000,000   2 @ \$2.5m each	ai	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
Cut Section (Code Change)   \$2,900,000   \$2,900,000   23 @ \$125K each     Miscellaneous RR Costs   \$250,000   \$250,000   Flagging, Agreements, etc.     Total Estimated RR Cost   \$68,775,000   \$68,775,000     Drainage, Signing, Landscaping, etc.   \$6,970,000   \$10,020,000   Assume 5% of Structure Cost     Utility Relocation   \$3,707,750   \$4,449,300   Surface Utility Survey     Right of Way Acquisition   \$1,570,000   \$10,770,000   Assume 4% of (Structure + Rail) Cost     Mobilization   \$14,570,000   \$18,840,000   Assume 7% of (Structure + Rail) Cost     Construction Staking/Survey   \$4,160,000   \$5,380,000   Assume 2% of (Structure + Rail) Cost     Base Construction Cost   \$245,912,750   \$318,664,300	_	RO & AF Interlockings	\$16,000,000		
Miscellaneous RR Costs   \$250,000   \$250,000   Flagging, Agreements, etc.		Slaters Lane & Franconia Interlockings	\$5,000,000		
Total Estimated RR Cost   \$68,775,000 \$68,775,000					
Drainage, Signing, Landscaping, etc.   \$6,970,000 \$10,020,000 Assume 5% of Structure Cost	L				
Utility Relocation   \$ 3,707,750   \$ 4,449,300   Surface Utility Survey		Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
Construction Staking/Survey         \$ 4,160,000         \$ 5,380,000         Assume 2% of (Structure + Rail) Cost           Base Construction Cost         \$ 245,912,750         \$ 318,664,300		Drainage, Signing, Landscaping, etc.	\$ 6,970,000	\$ 10,020,000	Assume 5% of Structure Cost
Construction Staking/Survey         \$ 4,160,000         \$ 5,380,000         Assume 2% of (Structure + Rail) Cost           Base Construction Cost         \$ 245,912,750         \$ 318,664,300	sts	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
Construction Staking/Survey         \$ 4,160,000         \$ 5,380,000         Assume 2% of (Structure + Rail) Cost           Base Construction Cost         \$ 245,912,750         \$ 318,664,300	S	Right of Way Acquisition	\$	\$	Assume Width excluding Rail expansion
Construction Staking/Survey         \$ 4,160,000         \$ 5,380,000         Assume 2% of (Structure + Rail) Cost           Base Construction Cost         \$ 245,912,750         \$ 318,664,300	her	Maintenance & Protection of Traffic	\$ 8,330,000	\$ 10,770,000	Assume 4% of (Structure + Rail) Cost
Base Construction Cost \$ 245,912,750 \$ 318,664,300	퓽	Mobilization	\$ 14,570,000	\$ 18,840,000	Assume 7% of (Structure + Rail) Cost
		Construction Staking/Survey	\$ 4,160,000	\$ 5,380,000	Assume 2% of (Structure + Rail) Cost
		Base Construction Cost	\$ 245,912,750	\$ 318,664,300	
Ö g Contingency \$86,070,000 \$111,530,000 Assume 35% of Base Cost Plus Inflation	# <b>&gt;</b>	Base Cost Including Inflation	\$ 245,910,000	\$ 318,660,000	
	nar Co	Contingency	\$ 86,070.000	\$ 111,530,000	Assume 35% of Base Cost Plus Inflation
Base Cost Including Inflation and Contingency \$ 331,980,000 \$ 430,190,000	를 칼				
Design \$ 36,520,000 \$ 47,320,000 Assume 11% of Base Cost Plus Inflation Plus Cont	5u S			. , ,	
Construction Management / Inspection \$ 33,200,000 \$ 43,020,000 Assume 10% of Base Cost Plus Inflation Plus Cont	<u> </u>	Ü			
TOTAL ESTIMATED COST \$ 401,700,000 \$ 520,530,000		TOTAL ESTIMATED COST	\$ 401 700 000	\$ 520 530 000	



### Alternative 3: Multi-Girder with Arch Façade

		Low	High	
	Structure Width	68 FT	68 FT	
	Structure Length - Deck Arch	00 FT	00 FT	
	Deck Area - Deck Arch Spans	SF	SF	
t3	Estimated \$\$/SF - Deck Arch Spans	\$ 000/SF	\$ 000/SF	
So	Structure Length - Approaches	7,700 FT	7,700 FT	Const Length = 7700 FT
e e	Deck Area - Approaches	523,600 SF	523,600 SF	
Ę	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
Structure Costs	Estimated Retaining Walls	SF	SF	
₹	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Precast Arch Facades	15400 LF	15400 LF	
	Estimated \$/LF - Arch Facades	\$ 1,000 /LF	\$ 1,000 /LF	Includes fabrication, erection, post-tensioning
	Total Estimated Structure Cost	\$ 120,120,000	\$ 172,480,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24.400.000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000		4 @ \$400K each
	Crossover (#20)	\$6,400,000		8 @ \$800K each
	Remove Turnout	\$25,000		1 @ \$25K
sts	Remove Crossover	\$200,000		4 @\$50K each
Ŝ	Signals	\$200,000	<b>\$200,000</b>	T & PSON COOK
Rail Costs	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
~	RO & AF Interlockings	\$16,000,000		2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000		2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000	\$ 250,000	Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 6,010,000	¢ 9 630 000	Assume 5% of Structure Cost
ts	Utility Relocation	\$ 3,707,750	. , ,	Surface Utility Survey
Other Costs	Right of Way Acquisition	\$ 3,707,730 \$		Assume Width excluding Rail expansion
<u>.</u>	Maintenance & Protection of Traffic	\$ 7,560,000		Assume 4% of (Structure Plus Rail) Cost
춫	Mobilization	\$ 13,220,000	. , ,	Assume 7% of (Structure Plus Rail) Cost
١	Construction Staking/Survey	\$ 3,780,000	1 -77	Assume 2% of (Structure Plus Rail) Cost
	Base Construction Cost	\$ 223,172,750		
st ∑	Base Cost Including Inflation	\$ 223,170,000		
<u> </u>	Contingency			Assume 35% of Base Cost Plus Inflation
Total Cost Summary	Base Cost Including Inflation and Contingency	\$ 301,280,000	\$ 385,680,000	
μō	Design			Assume 11% of (Base Cost Plus Inflation Plus Contingency)
	Construction Management / Inspection	\$ 30,130,000	\$ 38,570,000	Assume 10% of (Base Cost Plus Inflation Plus Contingency)
	TOTAL ESTIMATED COST	\$ 364,550,000	\$ 466,670,000	
	TO THE ESTIMATED COST	7 30-1,330,000	y .00,070,000	

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Alternative 4: A - Shallow Bore Jacked Tunnel

**B** - Shallow Submersed Tunnel

C - Deep Bore Tunnel

Inflation Rate	0%					
			ALTERNATE 4 A: Tunnel Approach with Shallow Bore Jacked Tunnel Segments Under the River	Tunnel Approach with Submersed Tunnel Segments	ALTERNATE 4 C: Tunnel Approach with EPBM Tunnel Deep Bore with Segmental Lining Below Top of Rock	
	Structure Width		88	88	88	2 tunnels - 44' diameter each
	Structure Length - Tunnel Approaches		41,000	41,000	41 000	Passenger Tunnel = 14,225' tunnel, 1 portal in VA - 1000' portal to grade Freight Tunnel = 25,950' tunnel, 2 portals one in VA one in DC, 2000' portal to grade
	Tunnel Approaches		\$2,665,000,000	\$2,665,000,000		Assumes EPBM or TBM excavation & lining - no open cut in crowded urban area
\$	Estimated \$/LF - Approaches		\$65,000	\$65,000		Cost presumes learning curve with about 8 miles of tunneling - better production after time
Š	Estimated Retaining Walls		-	-		eost presumes rearring curve with about 6 miles of turneling — better production after time
a.	Estimated \$/SF - Retaining Walls		-	-	-	
Structure Costs	Assembly Chamber/Jacking Pit		\$10,000,000	\$15,000,000	\$15,000,000	Slurry wall chambers required for jacking tunnel segments or TBM assembly/disassembly
Şt	Disassembly Chamber/Receiving Pit		\$10,000,000	\$15,000,000	\$15,000,000	
	Jet Grout River Bed	59,259	\$88,888,500			Jacking tunnel segments will require ground improvement to stand-up the face of excavation
	Estimated \$/CY - Jet Grout/Ground Freeze	1,500	1500			
	Fire Protection, Vent Plants & Equipment		\$100,000,000	\$100,000,000	\$260,000,000	
	Total Estimated Structure Cost		\$2,785,000,000	\$2,795,000,000	\$2,545,000,000	
	Trackwork/Earthwork/Ballast					
	Construct Track		\$24,400,000	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
	Turnout (#20)		\$1,600,000	\$1,600,000		4 @ \$400K each
	Crossover (#20)		\$6,400,000	\$6,400,000		8 @ \$800K each
	Remove Turnout		\$25,000	\$25,000		1 @ \$25K
osts	Remove Crossover		\$200,000	\$200,000	\$200,000	4 @\$50K each
Rail Costs	Signals					
8	Virginia & L'Enfant Interlockings		\$12,000,000	\$12,000,000		2 @ \$6M each
	RO & AF Interlockings		\$16,000,000 \$5,000,000	\$16,000,000 \$5,000,000		2 @ \$8M each
	Slaters Lane & Franconia Interlockings  Cut Section (Code Change)		\$2,900,000	\$2,900,000		2 @ \$2.5m each 23 @ \$125K each
	Miscellaneous RR Costs		\$ 250,000	\$ 250,000		Flagging, Agreements, etc.
	Total Estimated RR Cost		\$ 68,775,000	\$ 68,775,000		
_	Support of Earth		\$15,000,000	\$15,000,000		Soldier Pile/Lagging to top of rock then shotcrete & rock bolts down to invert
Ę	Decking Structural Excavation		\$3,500,000 \$10,000,000	\$3,500,000 \$10,000,000	\$3,500,000	Low rock PSI would permit rapid excavation by road header/excavator
Sta	Structural Excavation Structural Concrete		\$40,000,000	\$40,000,000	\$40,000,000	
P E	Structural Steel		\$25,000,000	\$25,000,000	\$25,000,000	
Underground Station	Architectural Works & Finishes		\$50,000,000	\$50,000,000	\$50,000,000	
ger	Fire Protection, Vent (MEP)		\$35,000,000	\$35,000,000	\$35,000,000	
Š	Passage Ways		\$10,000,000	\$10,000,000		NATM excavation methods or mole
	Total Estimated Underground Station Costs		\$188,500,000	\$188,500,000	\$188,500,000	
	Drainage, Signing, Landscaping etc		\$142,688,750	\$143,188,750	\$130,688.750	Assume 5% of Structure & Rail Cost
ş;	Utility Relocation		\$228,302,000	\$229,102,000		Assume 8% of Structure & Rail Cost
Other Costs	Right of Way Acquisition		\$25,000,000	\$25,000,000		In VA ROW - Cost for Egress in DC
þer	Maintenance & Protection of Traffic		\$114,151,000	\$114,551,000		Assume 4% of Structure & Rail Cost
₹	Mobilization		\$199,764,250	\$200,464,250	\$182,964,250	Assume 7% of Structure & Rail Cost
	Construction Staking/Survey		\$57,075,500	\$57,275,500	\$52,275,500	Assume 2% of Structure & Rail Cost
	Base Construction Cost		\$3,809,256,500	\$3,821,856,500	\$3,506,856,500	
<b>ಕ</b> ≻	Base Cost Including Inflation		\$3,809,256,500	\$3,821,856,500	\$3,506,856,500	
a G	Contingency		\$1,333,239,775	\$1,337,649,775	\$1,227,399,775	Assume 35% of Base Cost
Total Cost Summary	Base Cost Including Inflation and Contingency		\$5,142,496,275	\$5,159,506,275	\$4,734,256,275	
μō	Design		\$565,674,590	\$567,545,690		Assume 11% of Base Cost
	Construction Management/Inspection		\$514,249,628	\$515,950,628	\$473,425,628	Assume 10% of Base Cost
	Total Estimated Cost		\$6,222,420,493	\$6,243,002,593	\$5,728,450,093	
		_				

<sup>\*</sup>These costs and the bridge and tunnel types discussed herein are conceptual in nature, and therefore evaluations of cost at this stage of the project development must be considered to be very preliminary, and should not be used for funding or programming purposes. None of the alternatives described in this report have been sufficiently engineered to determine costs based on estimated structural quantities, anticipated erection methods, right-of way implications, expected schedule durations, and potential effects of inflation based on the anticipated timing of the beginning of construction. At this stage of development, only preliminary level of cost evaluation can be made that differentiates the alternatives on the basis of anticipated construction cost. A 35% contingency is included in the cost of bridge or tunnel options.





## Alternative 5: 4-Track Rail Bridge with Pedestrian /Bicycle Path\*

(2013 Dollars)							
Structure Type	Structure Cost		Rail Cost	Other	Anticipated Total Cost for New Structure		
	Low	High		Low	High		
1. Steel Tied Arch	\$138,040,000	\$205,870,000	\$68,775,000	\$216,977,750	\$281,109,300	\$424 _ \$55	56 M
2. Steel Through Arch	\$149,900,000	\$222,200,000	\$68,775,000	\$230,907,750	\$299,159,300	\$450 _ \$59	90 M
3. Extradosed	\$271,460,000	\$371,030,000	\$68,775,000	\$359,617,750	\$453,199,300	\$700 _ \$89	93 M
3a. Partial Extradosed	\$185,960,000	\$268,420,000	\$68,775,000	\$280,317,750	\$358,019,300	\$535 _ \$69	95 M
4. Concrete Deck Arch	\$170,150,000	\$244,640,000	\$68,775,000	\$243,857,750	\$314,169,300	\$483 _ \$62	28 M
4a. Standard Girder Structure with Concrete Arch Façade Elements	\$143,220,000	\$207,130,000	\$68,775,000	\$218,877,750	\$279,379,300	\$431 <u>\$</u> 55	55 M

<sup>\*</sup>These costs and the bridge and tunnel types discussed herein are conceptual in nature, and therefore evaluations of cost at this stage of the project development must be considered to be very preliminary, and should not be used for funding or programming purposes. None of the alternatives described in this report have been sufficiently engineered to determine costs based on estimated structural quantities, anticipated erection methods, right-of way implications, expected schedule durations, and potential effects of inflation based on the anticipated timing of the beginning of construction. At this stage of development, only preliminary level of cost evaluation can be made that differentiates the alternatives on the basis of anticipated construction cost. A 35% contingency is included in the cost of bridge or tunnel options.

### Alternative 5: Steel Tied Arch

Year of Estimate: 2013 Construction Year: 2017 Inflation Rate: . %

		Low	High	
	Structure Width	85 FT	85 FT	
	Structure Length - Tied Arch	280 FT	280 FT	
23	Deck Area - Tied Arch Span	23,800 SF	23,800 SF	
ا ق	Estimated \$\$/SF - Tied Arch Span	\$ 500/SF	\$ 700/SF	
, e	Structure Length - Approaches	7,420 FT	7,420 FT	Const Length = 7700 FT
Į į	Deck Area - Approaches	630,700 SF	630,700 SF	
Structure Costs	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
22	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 138,040,000	\$ 205,870,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000	\$1,600,000	4 @ \$400K each
	Crossover (#20)	\$6,400,000	\$6,400,000	8 @ \$800K each
	Remove Turnout	\$25,000	\$25,000	1 @ \$25K
Rail Costs	Remove Crossover	\$200,000	\$200,000	4 @\$50K each
<u> క</u>	Signals			
Sail	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
_	RO & AF Interlockings	\$16,000,000	\$16,000,000	2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000	\$5,000,000	2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000	\$ 250,000	Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 6,900,000	\$ 10,290,000	Assume 5% of Structure Cost
sts	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
కి	Right of Way Acquisition	\$ 15,130,000	\$ 15,130,000	Assume Width excluding Rail expansion
Other Costs	Maintenance & Protection of Traffic	\$ 8,270,000	\$ 10,990,000	Assume 4% of (Structure + Rail) Cost
l ₹	Mobilization	\$ 14,480,000	\$ 19,230,000	Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 4,140,000	\$ 5,490,000	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 259,442,750	\$ 340,224,300	
# >	Base Cost Including Inflation	\$ 259,440,000	\$ 340,220,000	
Cos	Contingency	\$ 90,800,000	,, -,	Assume 35% of Base Cost Plus Inflation
Total Cost Summary	Base Cost Including Inflation and Contingency	\$ 350,240,000	\$ 459,300,000	- Martin 2012 2. Base Gost Flag Hindren
Tot Su	Design	\$ 38,530,000		Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection	\$ 35,020,000		Assume 10% of Base Cost Plus Inflation Plus Contingency
				Assume 2070 of buse cost in as initiation in the contingently
	TOTAL ESTIMATED COST	\$ 423,790,000	\$ 555,750,000	



ELEVATION

### Alternative 5: Steel Through Arch

		Low	High	
	Structure Width	87 FT	87 FT	
	Structure Length - Through Arch	610 FT	610 FT	
t	Deck Area - Through Arch Span	53,070 SF	53,070 SF	
SO	Estimated \$\$/SF - Through Arch Span	\$ 500/SF	\$ 700/SF	
ē	Structure Length - Approaches	7,090 FT	7,090 FT	Const Length = 7700 FT
Ę	Deck Area - Approaches	616,830 SF	616,830 SF	
Structure Costs	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
22	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 149,900,000	\$ 222,200,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000	\$1,600,000	4 @ \$400K each
	Crossover (#20)	\$6,400,000	\$6,400,000	8 @ \$800K each
	Remove Turnout	\$25,000	\$25,000	1 @ \$25K
sts	Remove Crossover	\$200,000	\$200,000	4 @\$50K each
Rail Costs	Signals			
Sail Sail	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
_	RO & AF Interlockings	\$16,000,000	\$16,000,000	2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000	\$5,000,000	2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000	\$ 250,000	Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 7,500,000	\$ 11,110,000	Assume 5% of Structure Cost
Other Costs	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
S	Right of Way Acquisition	\$ 16,910,000	\$ 16,910,000	Assume Width excluding Rail expansion
Jer	Maintenance & Protection of Traffic	\$ 8,750,000	\$ 11,640,000	Assume 4% of (Structure + Rail) Cost
퓽	Mobilization	\$ 15,310,000		Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 4,370,000	\$ 5,820,000	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 275,222,750	\$ 361,274,300	
はゝ	Base Cost Including Inflation	\$ 275,220,000	\$ 361,270,000	
Total Cost Summary	Contingency	\$ 96,330,000	\$ 126,440,000	Assume 35% of Base Cost Plus Inflation
ᇍ	Base Cost Including Inflation and Contingency		\$ 487,710,000	
or Su	Design		. , ,	Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection			Assume 10% of Base Cost Plus Inflation Plus Contingency



### Alternative 5: Full Extradosed

		Low	High	
	Structure Width	98 FT	98 FT	
	Structure Length - Extradosed	2460 FT	2460 FT	
t t	Deck Area - Extradosed Spans	241,080 SF	241,080 SF	
80	Estimated \$\$/SF - Extradosed Spans	\$ 700/SF	\$ 900/SF	
, e	Structure Length - Approaches	5,240 FT	5,240 FT	Const Length = 7700 FT
Į	Deck Area - Approaches	513,520 SF	513,520 SF	
Structure Costs	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
55	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 271,460,000	\$ 371,030,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000	\$1,600,000	4 @ \$400K each
	Crossover (#20)	\$6,400,000	\$6,400,000	8 @ \$800K each
	Remove Turnout	\$25,000	\$25,000	1 @ \$25K
sts	Remove Crossover	\$200,000	\$200,000	4 @\$50K each
<u> </u>	Signals			
Rail Costs	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
_	RO & AF Interlockings	\$16,000,000	\$16,000,000	2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000	\$5,000,000	2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000	\$ 250,000	Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 13,570,000	\$ 18,550,000	Assume 5% of Structure Cost
sts	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
S	Right of Way Acquisition	\$ 26,700,000	\$ 26,700,000	Assume Width excluding Rail expansion
Other Costs	Maintenance & Protection of Traffic	\$ 13,610,000	\$ 17,590,000	Assume 4% of (Structure + Rail) Cost
l ₹	Mobilization	\$ 23,820,000		Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 6,800,000	\$ 8,800,000	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 428,442,750	\$ 546,684,300	
# >	Base Cost Including Inflation	\$ 428,440,000		
Cos Par	Contingency	, .,	1,,	Assume 35% of Base Cost Plus Inflation
Total Cost Summary	Base Cost Including Inflation and Contingency		\$ 738,020,000	- Television - Control of the Contro
Su	Design Design			Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection			Assume 10% of Base Cost Plus Inflation Plus Contingency
				a assume 2070 of base cost i las illiation i las contingently
	TOTAL ESTIMATED COST	\$ 699,850,000	\$ 893,000,000	

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### Alternative 5: Partial Extradosed

Structure Width	nflation Rate:	. %	Low	High	
Deck Area - Extradosed Spans   70,070 SF   70,070 SF		Structure Width	98 FT	98 FT	
Estimated \$5/\$F - Extradosed Spans   \$700/\$F   \$900/\$F		Structure Length - Extradosed	715 FT	715 FT	
Stimated ScySF - Retaining Walls   S 140/SF   S 140/SF   S 140/SF	t3	Deck Area - Extradosed Spans	70,070 SF	70,070 SF	
Stimated ScySF - Retaining Walls   S 140/SF   S 140/SF   S 140/SF	S	Estimated \$\$/SF - Extradosed Spans	\$ 700/SF	\$ 900/SF	
Stimated ScySF - Retaining Walls   S 140/SF   S 140/SF   S 140/SF	ě	Structure Length - Approaches	6,985 FT	6,985 FT	Const Length = 7700 FT
Stimated ScySF - Retaining Walls   S 140/SF   S 140/SF   S 140/SF	Ē	Deck Area - Approaches	684,530 SF	684,530 SF	
Stimated ScySF - Retaining Walls   S 140/SF   S 140/SF   S 140/SF	ž	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
Total Estimated Structure Cost   \$185,960,000 \$268,420,000	22	Estimated Retaining Walls	SF	SF	
Trackwork/Earthwork/Ballast		Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
Construct Track		Total Estimated Structure Cost	\$ 185,960,000	\$ 268,420,000	
Turnout (#20)		Trackwork/Earthwork/Ballast			
Crossover (#20)		Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
Remove Turnout		Turnout (#20)	\$1,600,000	\$1,600,000	4 @ \$400K each
Remove Crossover   \$200,000   \$200,000   4 @\$50K each		Crossover (#20)	\$6,400,000	\$6,400,000	8 @ \$800K each
RO & AF Interlockings   \$16,000,000   \$16,000,000   2 @ \$8M each		Remove Turnout	\$25,000	\$25,000	1 @ \$25K
RO & AF Interlockings   \$16,000,000   \$16,000,000   2 @ \$8M each	sts	Remove Crossover	\$200,000	\$200,000	4 @\$50K each
RO & AF Interlockings   \$16,000,000   \$16,000,000   2 @ \$8M each	8	Signals			
RO & AF Interlockings   \$16,000,000   \$16,000,000   2 @ \$8M each	aii ai	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
Cut Section (Code Change)   \$2,900,000   \$2,900,000   \$2 @ \$125K each	_	RO & AF Interlockings	\$16,000,000	\$16,000,000	2 @ \$8M each
Miscellaneous RR Costs   \$250,000   \$250,000   Flagging, Agreements, etc.		Slaters Lane & Franconia Interlockings	\$5,000,000	\$5,000,000	2 @ \$2.5m each
Total Estimated RR Cost   \$68,775,000   \$68,775,000   \$68,775,000		Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
Drainage, Signing, Landscaping, etc.   \$9,300,000   \$13,420,000   Assume 5% of Structure Cost		Miscellaneous RR Costs	\$ 250,000	\$ 250,000	Flagging, Agreements, etc.
Utility Relocation		Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
Social Construction Staking/Survey   \$5,090,000   \$6,740,000   Assume 2% of (Structure + Rail) Cost		Drainage, Signing, Landscaping, etc.	\$ 9,300,000	\$ 13,420,000	Assume 5% of Structure Cost
Social Construction Staking/Survey   \$5,090,000   \$6,740,000   Assume 2% of (Structure + Rail) Cost	sts	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
Social Construction Staking/Survey   \$5,090,000   \$6,740,000   Assume 2% of (Structure + Rail) Cost	S	Right of Way Acquisition	\$ 26,700,000	\$ 26,700,000	Assume Width excluding Rail expansion
Solution   Staking/Survey   \$5,090,000   \$6,740,000   Assume 2% of (Structure + Rail) Cost	Ē	Maintenance & Protection of Traffic	\$ 10,190,000	\$ 13,490,000	Assume 4% of (Structure + Rail) Cost
Base Construction Cost   \$327,552,750 \$425,594,300	₹				
Base Cost Including Inflation   \$327,550,000   \$425,590,000   Contingency   \$114,640,000   \$148,960,000   Assume 35% of Base Cost Plus Inflation		Construction Staking/Survey	\$ 5,090,000	\$ 6,740,000	Assume 2% of (Structure + Rail) Cost
Contingency  S 114,640,000  \$ 148,960,000  Assume 35% of Base Cost Plus Inflation  Base Cost Including Inflation and Contingency  Design  Construction Management / Inspection  \$ 44,220,000  \$ 574,550,000  \$ 63,200,000  Assume 11% of Base Cost Plus Inflation Plus Contingency  \$ 44,220,000  \$ 574,650,000  Assume 11% of Base Cost Plus Inflation Plus Contingency  \$ 57,460,000  Assume 10% of Base Cost Plus Inflation Plus Contingency		Base Construction Cost	\$ 327,552,750	\$ 425,594,300	
Construction Management / Inspection \$44,220,000 \$57,460,000 Assume 10% of Base Cost Plus Inflation Plus Contingency	ts ≿	Base Cost Including Inflation	\$ 327,550,000	\$ 425,590,000	
Construction Management / Inspection \$44,220,000 \$57,460,000 Assume 10% of Base Cost Plus Inflation Plus Contingency	g C	Contingency	\$ 114,640,000	\$ 148,960,000	Assume 35% of Base Cost Plus Inflation
Construction Management / Inspection \$44,220,000 \$57,460,000 Assume 10% of Base Cost Plus Inflation Plus Contingency	a a	Base Cost Including Inflation and Contingency			
Construction Management / Inspection \$ 44,220,000 \$ 57,460,000 Assume 10% of Base Cost Plus Inflation Plus Contingency	5 JS			. , ,	
TOTAL FITMATTD COST		-			
TIQUALENDIVIATED CONT		TOTAL ESTIMATED COST	\$ 535,050,000	\$ 695 210 000	



### Alternative 5: Deck Arch

		Low	High	
	Structure Width	83 FT	83 FT	
	Structure Length - Deck Arch	2550 FT	2550 FT	
t t	Deck Area - Deck Arch Spans	211,650 SF	211,650 SF	
Š	Estimated \$\$/SF - Deck Arch Spans	\$ 400/SF	\$ 550/SF	
ė	Structure Length - Approaches	5,150 FT	5,150 FT	Const Length = 7700 FT
Ē	Deck Area - Approaches	427,450 SF	427,450 SF	
Structure Costs	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
8	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 170,150,000	\$ 244,640,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000	\$1,600,000	4 @ \$400K each
	Crossover (#20)	\$6,400,000	\$6,400,000	8 @ \$800K each
	Remove Turnout	\$25,000	\$25,000	1 @ \$25K
sts	Remove Crossover	\$200,000	\$200,000	4 @\$50K each
Rail Costs	Signals			
Sail	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
_	RO & AF Interlockings	\$16,000,000	\$16,000,000	2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000	\$5,000,000	2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000	\$ 250,000	Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 8,510,000	\$ 12,230,000	Assume 5% of Structure Cost
Other Costs	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
S S	Right of Way Acquisition	\$ 13,350,000	\$ 13,350,000	Assume Width excluding Rail expansion
Ĕ	Maintenance & Protection of Traffic	\$ 9,560,000	\$ 12,540,000	Assume 4% of (Structure + Rail) Cost
Ē	Mobilization	\$ 16,720,000	\$ 21,940,000	Assume 7% of (Structure + Rail) Cost
_	Construction Staking/Survey	\$ 4,780,000	\$ 6,270,000	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 295,552,750	\$ 384,194,300	
# >	Base Cost Including Inflation	\$ 295,550,000	\$ 384,190,000	
la Ç	Contingency			Assume 35% of Base Cost Plus Inflation
Total Cost Summary	Base Cost Including Inflation and Contingency		\$ 518,660,000	
Zu Su	Design			Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection			Assume 10% of Base Cost Plus Inflation Plus Contingency
	TOTAL ESTIMATED COST	\$ 482,780,000	\$ 627,580,000	



### Alternative 5: Multi-Girder with Arch Façade

Inflation Rate:	. %	Low	High	]
	Structure Width	83 FT	83 FT	
	Structure Length - Deck Arch	00 FT	00 FT	
	Deck Area - Deck Arch Spans	SF	SF	
ts	Estimated \$\$/SF - Deck Arch Spans	\$ 000/SF	\$ 000/SF	
Structure Costs	Structure Length - Approaches	7,700 FT	7,700 FT	Const Length = 7700 FT
é	Deck Area - Approaches	639,100 SF	639,100 SF	
Ę	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
ž	Estimated Retaining Walls	SF	SF	
₽.	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Precast Arch Facades	15400 LF	15400 LF	
	Estimated \$/LF - Arch Facades	\$ 1,000 /LF	\$ 1,000 /LF	Includes fabrication, erection, post-tensioning
	Total Estimated Structure Cost	\$ 143,220,000	\$ 207,130,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000	\$1,600,000	4 @ \$400K each
	Crossover (#20)	\$6,400,000	\$6,400,000	8 @ \$800K each
	Remove Turnout	\$25,000	\$25,000	1 @ \$25K
sts	Remove Crossover	\$200,000	\$200,000	4 @\$50K each
Rail Costs	Signals			
ā	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
_	RO & AF Interlockings	\$16,000,000	\$16,000,000	2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000	\$5,000,000	2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000		Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 7,160,000	\$ 10,360,000	Assume 5% of Structure Cost
Other Costs	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
S	Right of Way Acquisition	\$ 13,350,000	\$ 13,350,000	Assume Width excluding Rail expansion
Эe	Maintenance & Protection of Traffic	\$ 8,480,000	\$ 11,040,000	Assume 4% of (Structure Plus Rail) Cost
ਝ	Mobilization	\$ 14,840,000	\$ 19,310,000	Assume 7% of (Structure Plus Rail) Cost
	Construction Staking/Survey	\$ 4,240,000	\$ 5,520,000	Assume 2% of (Structure Plus Rail) Cost
	Base Construction Cost	\$ 263,772,750	\$ 339,934,300	
ಕ ≻	Base Cost Including Inflation	\$ 263,770,000	\$ 339,930,000	
S	Contingency	\$ 92,320,000	\$ 118,980,000	Assume 35% of Base Cost Plus Inflation
Total Cost Summary	Base Cost Including Inflation and Contingency	\$ 356,090,000		
or os	Design		. , ,	Assume 11% of (Base Cost Plus Inflation Plus Contingency)
	Construction Management / Inspection			Assume 10% of (Base Cost Plus Inflation Plus Contingency)
	TOTAL ESTIMATED COST	\$ 430,870,000	\$ 555 280 000	
	TOTAL ESTIMATED COST	\$ <del>4</del> 50,670,000	7 555,200,000	

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# Alternative 6: 4-Track Rail Bridge with Pedestrian /Bicycle Path and Streetcar\*

(2010 Bolidis)														
Structure Type	Structu	re Cost	Rail Cost	Other	· Costs	Anticipated Total Cost for New Structure								
	Low	High		Low	High									
1. Steel Tied Arch	\$188,380,000	\$280,950,000	\$68,775,000	\$349,417,750	\$444,619,300	\$607 _ \$794 M								
2. Steel Through Arch	\$203,310,000	\$301,370,000	\$68,775,000	\$366,177,750	\$466,479,300	\$638 _ \$837 M								
3. Extradosed	\$343,480,000	\$469,460,000	\$68,775,000	\$504,907,750	\$631,089,300	\$917 _ \$1,169 M								
3a. Partial Extradosed	\$235,290,000	\$339,640,000	\$68,775,000	\$404,537,750	\$510,689,300	\$709 _ \$919 M								
4. Concrete Deck Arch	\$223,450,000	\$321,280,000	\$68,775,000	\$371,767,750	\$471,829,300	\$664 _ \$862 M								
4a. Standard Girder Structure with Concrete Arch Façade Elements	\$183,260,000	\$267,190,000	\$68,775,000	\$334,477,750	\$421,699,300	\$587 _ \$758 M								

<sup>\*</sup>These costs and the bridge and tunnel types discussed herein are conceptual in nature, and therefore evaluations of cost at this stage of the project development must be considered to be very preliminary, and should not be used for funding or programming purposes. None of the alternatives described in this report have been sufficiently engineered to determine costs based on estimated structural quantities, anticipated erection methods, right-of way implications, expected schedule durations, and potential effects of inflation based on the anticipated timing of the beginning of construction. At this stage of development, only preliminary level of cost evaluation can be made that differentiates the alternatives on the basis of anticipated construction cost. A 35% contingency is included in the cost of bridge or tunnel options.

### Alternative 6: Steel Tied Arch

		Low	High	
	Structure Width	116 FT	116 FT	
	Structure Length - Tied Arch	280 FT	280 FT	
\$	Deck Area - Tied Arch Span	32,480 SF	32,480 SF	
so	Estimated \$\$/SF - Tied Arch Span	\$ 500/SF	\$ 700/SF	
ē (	Structure Length - Approaches	7,420 FT	7,420 FT	Const Length = 7700 FT
, ,	Deck Area - Approaches	860,720 SF	860,720 SF	
Structure Costs	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
55	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 188,380,000	\$ 280,950,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000		4 @ \$400K each
	Crossover (#20)	\$6,400,000		8 @ \$800K each
	Remove Turnout	\$25,000		1 @ \$25K
sts	Remove Crossover	\$200,000		4 @\$50K each
Rail Costs	Signals	7=00,000	7=00,000	
i <u>e</u>	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
~	RO & AF Interlockings	\$16,000,000	. , ,	2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000		2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000		23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000	. , ,	Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000		
	Drainage, Signing, Landscaping, etc.	\$ 9,420,000	\$ 14 DED DOD	Assume 5% of Structure Cost
	Utility Relocation	. , ,	. , ,	Surface Utility Survey
sts	Right of Way Acquisition	\$ 42,720,000		Assume Width excluding Rail expansion
Other Costs	Light Rail Trackwork and Catenary			3.1 miles @ \$2.5M per mile track, \$1.5M per mile catenary
her	Maintenance & Protection of Traffic			Assume 4% of (Structure + Rail) Cost
5	Mobilization	\$ 18,000,000		Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 5,140,000	. , ,	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost		\$ 486,284,300	
Total Cost Summary	Base Cost Including Inflation		\$ 486,280,000	
ŭ E	Contingency			Assume 35% of Base Cost Plus Inflation
ota um	Base Cost Including Inflation and Contingency	\$ 501,300,000	\$ 656,480,000	
μŏ	Design	\$ 55,140,000	\$ 72,210,000	Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection	\$ 50,130,000	\$ 65,650,000	Assume 10% of Base Cost Plus Inflation Plus Contingency
	TOTAL ESTIMATED COST	\$ 606,570,000	\$ 794,340,000	
		\$ 555,570,000	+ . 5 .,5 .5,500	



### Alternative 6: Steel Through Arch

		Low	High	
	Structure Width	118 FT	118 FT	
	Structure Length - Through Arch	610 FT	610 FT	
z,	Deck Area - Through Arch Span	71,980 SF	71,980 SF	
Š	Estimated \$\$/SF - Through Arch Span	\$ 500/SF	\$ 700/SF	
Total Cost Other Costs Rail Costs Structure Costs ::	Structure Length - Approaches	7,090 FT	7,090 FT	Const Length = 7700 FT
Ē	Deck Area - Approaches	836,620 SF	836,620 SF	
ž	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
\$	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 203,310,000	\$ 301,370,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000	\$1,600,000	4 @ \$400K each
	Crossover (#20)	\$6,400,000	\$6,400,000	8 @ \$800K each
	Remove Turnout	\$25,000	\$25,000	1 @ \$25K
sts	Remove Crossover	\$200,000	\$200,000	4 @\$50K each
8	Signals			
ai Sai	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
_	RO & AF Interlockings	\$16,000,000	\$16,000,000	2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000	\$5,000,000	2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000	\$ 250,000	Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 10,170,000	\$ 15,070,000	Assume 5% of Structure Cost
53	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
So	Right of Way Acquisition	\$ 44,500,000	\$ 44,500,000	Assume Width excluding Rail expansion
ž. O	Light Rail Trackwork and Catenary	\$ 24,900,000	\$ 29,880,000	3.1 miles @ \$2.5M per mile track, \$1.5M per mile catenary
Ĕ	Maintenance & Protection of Traffic	\$ 10,880,000	\$ 14,810,000	Assume 4% of (Structure + Rail) Cost
0	Mobilization	\$ 19,050,000	\$ 25,910,000	Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 5,440,000	\$ 7,400,000	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 390,732,750	\$ 512,164,300	
ಕ ≥	Base Cost Including Inflation	\$ 390,730,000	\$ 512,160,000	
<u>a</u> C	Contingency	\$ 136,760,000	\$ 179,260,000	Assume 35% of Base Cost Plus Inflation
ig gr	Base Cost Including Inflation and Contingency		\$ 691,420,000	
o s	Design		. , ,	Assume 11% of Base Cost Plus Inflation Plus Contingency
-	Construction Management / Inspection	\$ 52,750,000	\$ 69,140,000	Assume 10% of Base Cost Plus Inflation Plus Contingency

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### Alternative 6: Full Extradosed

		Low	High	
	Structure Width	124 FT	124 FT	
	Structure Length - Extradosed	2460 FT	2460 FT	
t t	Deck Area - Extradosed Spans	305,040 SF	305,040 SF	
So	Estimated \$\$/SF - Extradosed Spans	\$ 700/SF	\$ 900/SF	
é	Structure Length - Approaches	5,240 FT	5,240 FT	Const Length = 7700 FT
Ē	Deck Area - Approaches	649,760 SF	649,760 SF	
Structure Costs	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
25	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 343,480,000	\$ 469,460,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24 400 000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000		4 @ \$400K each
	Crossover (#20)	\$6,400,000		8 @ \$800K each
	Remove Turnout	\$25,000		1 @ \$25K
St	Remove Crossover	\$200,000		4 @\$50K each
Rail Costs	Signals	\$200,000	<b>\$200,000</b>	T & POOR COOL
. <u></u>	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
~	RO & AF Interlockings	\$16,000,000		2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000		2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000		23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000		Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 17,170,000	¢ 22 470 000	Assume 5% of Structure Cost
	Utility Relocation	\$ 3,707,750	. , ,	Surface Utility Survey
sts	Right of Way Acquisition	\$ 49,840,000		Assume Width excluding Rail expansion
S	Light Rail Trackwork and Catenary	\$ 49,840,000		3.1 miles @ \$2.5M per mile track, \$1.5M per mile catenary
Other Costs	Maintenance & Protection of Traffic	\$ 16,490,000		Assume 4% of (Structure + Rail) Cost
5	Mobilization	\$ 28,860,000		Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 8,250,000	. , , ,	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 561,472,750	\$ 715,844,300	
st √	Base Cost Including Inflation	\$ 561,470,000	\$ 715,840,000	
g E	Contingency	\$ 196,510,000	\$ 250,540,000	Assume 35% of Base Cost Plus Inflation
Total Cost Summary	Base Cost Including Inflation and Contingency	\$ 757,980,000	\$ 966,380,000	
7 3	Design	\$ 83,380,000	\$ 106,300,000	Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection	\$ 75,800,000	\$ 96,640,000	Assume 10% of Base Cost Plus Inflation Plus Contingency
	TOTAL ESTIMATED COST	\$ 917 160 000	\$ 1,169,320,000	
	TO THE ESTIMATED COST	7 717,100,000	7 1,103,320,000	



### Alternative 6: Partial Extradosed

		Low	High	
	Structure Width	124 FT	124 FT	
	Structure Length - Extradosed	715 FT	715 FT	
र	Deck Area - Extradosed Spans	88,660 SF	88,660 SF	
S	Estimated \$\$/SF - Extradosed Spans	\$ 700/SF	\$ 900/SF	
e e	Structure Length - Approaches	6,985 FT	6,985 FT	Const Length = 7700 FT
Ę	Deck Area - Approaches	866,140 SF	866,140 SF	
Structure Costs	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
8	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 235,290,000	\$ 339,640,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000		4 @ \$400K each
	Crossover (#20)	\$6,400,000		8 @ \$800K each
	Remove Turnout	\$25,000		1 @ \$25K
sts	Remove Crossover	\$200,000		4 @\$50K each
Rail Costs	Signals	7=00,000	7-11,111	
i <u>e</u>	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
<u> </u>	RO & AF Interlockings	\$16,000,000		2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000		2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000	\$ 250,000	Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 11,760,000	\$ 16 980 000	Assume 5% of Structure Cost
ιo.	Utility Relocation	\$ 3,707,750	1 -,,	Surface Utility Survey
ost	Right of Way Acquisition	\$ 49,840,000		Assume Width excluding Rail expansion
Other Costs	Light Rail Trackwork and Catenary	\$ 24,900,000		3.1 miles @ \$2.5M per mile track, \$1.5M per mile catenary
he	Maintenance & Protection of Traffic	\$ 12,160,000		Assume 4% of (Structure + Rail) Cost
ð	Mobilization	\$ 21,280,000		Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 6,080,000		Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 433 702 750	\$ 562,664,300	
. ب	Base Cost Including Inflation	\$ 433,792,730		
Total Cost Summary				Assume 35% of Base Cost Plus Inflation
ᆲ	Contingency			
Sur Gt	Base Cost Including Inflation and Contingency	\$ 585,620,000		
"	Design			Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection	\$ 58,560,000	\$ 75,960,000	Assume 10% of Base Cost Plus Inflation Plus Contingency
	TOTAL ESTIMATED COST	\$ 708,600,000	\$ 919,100,000	

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	85'-0"	85'-0"	85'-0	r 85'-0"	108'-0"	108:-01	195'-0'	325'-0"	195'-0"	108'-0"	106:-0'	108"-0"	1080-	108'-0'	108'-0"	102'-0'	102"-0"	102'-0"	1050,	102"-0"	102,-0.	

### Alternative 6: Deck Arch

	. %	Low	High	
Structure Costs	Structure Width	109 FT	109 FT	
	Structure Length - Deck Arch	2550 FT	2550 FT	
	Deck Area - Deck Arch Spans	277,950 SF	277,950 SF	
	Estimated \$\$/SF - Deck Arch Spans	\$ 400/SF	\$ 550/SF	
	Structure Length - Approaches	5,150 FT	5,150 FT	Const Length = 7700 FT
	Deck Area - Approaches	561,350 SF	561,350 SF	
	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
22	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 223,450,000	\$ 321,280,000	
	Trackwork/Earthwork/Ballast			
Rail Costs	Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000		4 @ \$400K each
	Crossover (#20)	\$6,400,000	\$6,400,000	8 @ \$800K each
	Remove Turnout	\$25,000	\$25,000	1 @ \$25K
	Remove Crossover	\$200,000	\$200,000	4 @\$50K each
	Signals			
	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
	RO & AF Interlockings	\$16,000,000	\$16,000,000	2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000		2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000		Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
Other Costs	Drainage, Signing, Landscaping, etc.	\$ 11,170,000	\$ 16,060,000	Assume 5% of Structure Cost
	Utility Relocation	\$ 3,707,750		Surface Utility Survey
	Right of Way Acquisition	\$ 36,490,000	\$ 36,490,000	Assume Width excluding Rail expansion
	Light Rail Trackwork and Catenary	\$ 24,900,000	\$ 29,880,000	3.1 miles @ \$2.5M per mile track, \$1.5M per mile catenary
	Maintenance & Protection of Traffic	\$ 11,690,000		Assume 4% of (Structure + Rail) Cost
	Mobilization	\$ 20,460,000		Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 5,840,000	\$ 7,800,000	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 406,482,750	\$ 527,634,300	
Total Cost Summary	Base Cost Including Inflation	\$ 406,480,000	\$ 527,630,000	
	Contingency	\$ 142,270,000	\$ 184,670,000	Assume 35% of Base Cost Plus Inflation
	Base Cost Including Inflation and Contingency		\$ 712,300,000	
	Design			Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection			Assume 10% of Base Cost Plus Inflation Plus Contingency
	TOTAL ESTIMATED COST	¢ 662 000 000	\$ 861,880,000	



#### Alternative 6: Multi-Girder with Arch Façade

nflation Rate:	. %	Low	High	Ţ
	Structure Width	109 FT	109 FT	
	Structure Length - Deck Arch	00 FT	00 FT	
	Deck Area - Deck Arch Spans	SF	SF	
t t	Estimated \$\$/SF - Deck Arch Spans	\$ 000/SF	\$ 000/SF	
S	Structure Length - Approaches	7,700 FT	7,700 FT	Const Length = 7700 FT
ē	Deck Area - Approaches	839,300 SF	839,300 SF	
횴	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
Structure Costs	Estimated Retaining Walls	SF	SF	
22	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Precast Arch Facades	15400 LF	15400 LF	
	Estimated \$/LF - Arch Facades	\$ 1,000 /LF		Includes fabrication, erection, post-tensioning
	Total Estimated Structure Cost	\$ 183,260,000	\$ 267,190,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000		15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000	\$1,600,000	4 @ \$400K each
	Crossover (#20)	\$6,400,000		8 @ \$800K each
10	Remove Turnout	\$25,000	\$25,000	1 @ \$25K
st	Remove Crossover	\$200,000	\$200,000	4 @\$50K each
Rail Costs	Signals			
Rai	Virginia & L'Enfant Interlockings	\$12,000,000		2 @ \$6M each
_	RO & AF Interlockings	\$16,000,000	\$16,000,000	2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000		2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000		Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 9,160,000	\$ 13,360,000	Assume 5% of Structure Cost
ts	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
SO.	Right of Way Acquisition			Assume Width excluding Rail expansion
Other Costs	Light Rail Trackwork and Catenary	\$ 24,900,000	\$ 29,880,000	3.1 miles @ \$2.5M per mile track, \$1.5M per mile catenary
Ě	Maintenance & Protection of Traffic			Assume 4% of (Structure Plus Rail) Cost
0	Mobilization			Assume 7% of (Structure Plus Rail) Cost
	Construction Staking/Survey	\$ 5,040,000	\$ 6,720,000	Assume 2% of (Structure Plus Rail) Cost
	Base Construction Cost	\$ 359,052,750	\$ 463,824,300	
ಕ ≥	Base Cost Including Inflation	\$ 359,050,000	\$ 463,820,000	
ခ်္ခ င	Contingency	\$ 125,670,000	\$ 162,340,000	Assume 35% of Base Cost Plus Inflation
Total Cost Summary	Base Cost Including Inflation and Contingency	\$ 484,720,000	\$ 626,160,000	
5 S	Design	\$ 53,320.000	\$ 68,880,000	Assume 11% of (Base Cost Plus Inflation Plus Contingency)
	Construction Management / Inspection			Assume 10% of (Base Cost Plus Inflation Plus Contingency)
•	TOTAL ESTIMATED COST	\$ 586 510 000	\$ 757,660,000	







# Alternative 7: 4-Track Rail Bridge with Pedestrian /Bicycle Path and Shared Streetcar/Auto Lanes\*

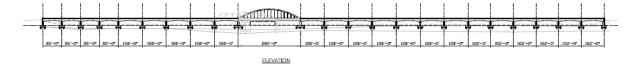
(2013 Dollars)

(2013 Dollars)							
Structure Type	Structu	ıre Cost	Rail Cost	Other	Costs	Anticipated To	
	Low	High		Low	High		
1. Steel Tied Arch	\$194,070,000	\$289,430,000	\$68,775,000	\$359,782,750	\$457,564,300	\$623 _ \$	\$816 M
2. Steel Through Arch	\$209,340,000	\$310,310,000	\$68,775,000	\$376,852,750	\$479,864,300	\$655 _ \$	\$859 M
3. Extradosed	\$353,170,000	\$482,710,000	\$68,775,000	\$518,992,750	\$648,484,300	\$941 _ \$	1,200 M
3a. Partial Extradosed	\$241,930,000	\$349,220,000	\$68,775,000	\$415,812,750	\$524,674,300	\$727 _ \$	\$943 M
4. Concrete Deck Arch	\$231,650,000	\$333,070,000	\$68,775,000	\$385,187,750	\$488,599,300	\$686 _ \$	\$890 M
4a. Standard Girder Structure with Concrete Arch Façade Elements	\$189,420,000	\$276,430,000	\$68,775,000	\$346,007,750	\$436,049,300	\$604 _ \$	\$781 M

<sup>\*</sup>These costs and the bridge and tunnel types discussed herein are conceptual in nature, and therefore evaluations of cost at this stage of the project development must be considered to be very preliminary, and should not be used for funding or programming purposes. None of the alternatives described in this report have been sufficiently engineered to determine costs based on estimated structural quantities, anticipated erection methods, right-of way implications, expected schedule durations, and potential effects of inflation based on the anticipated timing of the beginning of construction. At this stage of development, only preliminary level of cost evaluation can be made that differentiates the alternatives on the basis of anticipated construction cost. A 35% contingency is included in the cost of bridge or tunnel options.

#### Alternative 7: Steel Tied Arch

lation Rate:	. %	Low	High	]
	Structure Width	120 FT	120 FT	
	Structure Length - Tied Arch	280 FT	280 FT	
22	Deck Area - Tied Arch Span	33,460 SF	33,460 SF	
SO	Estimated \$\$/SF - Tied Arch Span	\$ 500/SF	\$ 700/SF	
ė	Structure Length - Approaches	7,420 FT	7,420 FT	Const Length = 7700 FT
Ę	Deck Area - Approaches	886,690 SF	886,690 SF	
Structure Costs	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
55	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 194,070,000	\$ 289,430,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000	\$1,600,000	4 @ \$400K each
	Crossover (#20)	\$6,400,000	\$6,400,000	8 @ \$800K each
	Remove Turnout	\$25,000	\$25,000	1 @ \$25K
Rail Costs	Remove Crossover	\$200,000	\$200,000	4 @\$50K each
<u> </u>	Signals			
Sai	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
_	RO & AF Interlockings	\$16,000,000	\$16,000,000	2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000	\$5,000,000	2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000	\$ 250,000	Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 9,700,000	\$ 14,470,000	Assume 5% of Structure Cost
ž.	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
SO	Right of Way Acquisition	\$ 45,835,000	\$ 45,835,000	Assume Width excluding Rail expansion
Other Costs	Light Rail Trackwork and Catenary	\$ 24,900,000	\$ 29,880,000	3.1 miles @ \$2.5M per mile track, \$1.5M per mile catenary
Ę	Maintenance & Protection of Traffic	\$ 10,510,000	\$ 14,330,000	Assume 4% of (Structure + Rail) Cost
0	Mobilization	\$ 18,400,000	\$ 25,070,000	Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 5,260,000	\$ 7,160,000	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 381,157,750	\$ 499,399,300	
Total Cost Summary	Base Cost Including Inflation	\$ 381,160,000	\$ 499,400,000	
၁ န	Contingency	\$ 133,410,000	\$ 174,790,000	Assume 35% of Base Cost Plus Inflation
重	Base Cost Including Inflation and Contingency	\$ 514,570,000		
5 3	Design	\$ 56,600,000	\$ 74,160,000	Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection			Assume 10% of Base Cost Plus Inflation Plus Contingency
	TOTAL ESTIMATED COST	¢ caa caa aaa	\$ 815,770,000	



#### Alternative 7: Steel Through Arch

Structure Length - Through Arch   122 FT   122 FT   121 FT   122 FT   122 FT   122 FT   122 FT   122 FT   122 FT   123	flation Rate:	. %	Low	High	
Page		Structure Width	122 FT	122 FT	
Estimated \$5/\$F - Through Arch Span   \$500/\$F   \$700/\$F   \$700/\$F   \$100   \$1		Structure Length - Through Arch	610 FT	610 FT	
Stimated S5/SF - Retaining Walls   \$140/SF	23	Deck Area - Through Arch Span	74,115 SF	74,115 SF	
Stimated S5/SF - Retaining Walls   \$140/SF	Š	Estimated \$\$/SF - Through Arch Span	\$ 500/SF	\$ 700/SF	
Stimated S5/SF - Retaining Walls   S 140/SF   S 140/S	ě	Structure Length - Approaches	7,090 FT	7,090 FT	Const Length = 7700 FT
Statimated Styler - Retaining Walls   S 140/SF   S 14	Ę	Deck Area - Approaches	861,435 SF	861,435 SF	
Stimated S5/SF - Retaining Walls   S 140/SF   S 140/SF   S 140/SF   Total Estimated S5/SF - Retaining Walls   S 140/SF	ž	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
Total Estimated Structure Cost   \$ 209,340,000 \$ 310,310,000	ᄶ	Estimated Retaining Walls	SF	SF	
Trackwork/Earthwork/Ballast		Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
Page   Construct Track   \$24,400,000   \$24,400,000   \$1.57 miles @ \$1.55M per mile		Total Estimated Structure Cost	\$ 209,340,000	\$ 310,310,000	
Turnout (#20)		Trackwork/Earthwork/Ballast			
Page   Crossover (#20)   \$6,400,000   \$6,400,000   \$8 @ \$800K each		Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
Remove Turnout		Turnout (#20)	\$1,600,000	\$1,600,000	4 @ \$400K each
Remove Crossover   \$200,000   \$200,000   4 @\$50K each		Crossover (#20)	\$6,400,000	\$6,400,000	8 @ \$800K each
RO & AF Interlockings   \$16,000,000   \$16,000,000   \$2@ \$8M each		Remove Turnout	\$25,000	\$25,000	1 @ \$25K
RO & AF Interlockings   \$16,000,000   \$16,000,000   2 @ \$8M each	sts	Remove Crossover	\$200,000	\$200,000	4 @\$50K each
RO & AF Interlockings   \$16,000,000   \$16,000,000   2 @ \$8M each	ຮ	Signals			
RO & AF Interlockings   \$16,000,000   \$16,000,000   \$2@ \$8M each	Sail	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
Cut Section (Code Change)   \$2,900,000   \$	-	RO & AF Interlockings	\$16,000,000	\$16,000,000	2 @ \$8M each
Miscellaneous RR Costs   \$250,000   \$250,000   Flagging, Agreements, etc.		Slaters Lane & Franconia Interlockings	\$5,000,000	\$5,000,000	2 @ \$2.5m each
Total Estimated RR Cost   \$68,775,000   \$68,775,000		Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
Drainage, Signing, Landscaping, etc.   \$10,470,000 \$15,520,000 Assume 5% of Structure Cost		Miscellaneous RR Costs	\$ 250,000	\$ 250,000	Flagging, Agreements, etc.
Utility Relocation		Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
Right of Way Acquisition		Drainage, Signing, Landscaping, etc.	\$ 10,470,000	\$ 15,520,000	Assume 5% of Structure Cost
Mobilization   \$19,470,000   \$26,540,000   Assume 7% of (Structure + Rail) Cost	22	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
Mobilization   \$19,470,000   \$26,540,000   Assume 7% of (Structure + Rail) Cost	So	Right of Way Acquisition	\$ 47,615,000	\$ 47,615,000	Assume Width excluding Rail expansion
Mobilization   \$19,470,000   \$26,540,000   Assume 7% of (Structure + Rail) Cost	5	Light Rail Trackwork and Catenary	\$ 24,900,000	\$ 29,880,000	3.1 miles @ \$2.5M per mile track, \$1.5M per mile catenary
Mobilization   \$19,470,000   \$26,540,000   Assume 7% of (Structure + Rail) Cost	흎	Maintenance & Protection of Traffic	\$ 11,120,000	\$ 15,160,000	Assume 4% of (Structure + Rail) Cost
Base Construction Cost   \$ 400,957,750   \$ 525,829,300	0	Mobilization	\$ 19,470,000	\$ 26,540,000	Assume 7% of (Structure + Rail) Cost
Base Cost Including Inflation		Construction Staking/Survey	\$ 5,560,000	\$ 7,580,000	Assume 2% of (Structure + Rail) Cost
Contingency Base Cost Including Inflation and Contingency Design Construction Management / Inspection  Contingency S 140,340,000 \$ 184,040,000 Assume 35% of Base Cost Plus Inflation \$ 541,300,000 \$ 709,870,000 Assume 11% of Base Cost Plus Inflation Plus Contingency \$ 59,540,000 \$ 78,090,000 Assume 11% of Base Cost Plus Inflation Plus Contingency \$ 54,130,000 \$ 70,990,000 Assume 10% of Base Cost Plus Inflation Plus Contingency		Base Construction Cost	\$ 400,957,750	\$ 525,829,300	
Construction Management / Inspection \$ 54,130,000 \$ 70,990,000 Assume 10% of Base Cost Plus Inflation Plus Contingency	z st	Base Cost Including Inflation	\$ 400,960,000	\$ 525,830,000	
Construction Management / Inspection \$ 54,130,000 \$ 70,990,000 Assume 10% of Base Cost Plus Inflation Plus Contingency	g c	Contingency	\$ 140,340,000	\$ 184,040,000	Assume 35% of Base Cost Plus Inflation
Construction Management / Inspection \$ 54,130,000 \$ 70,990,000 Assume 10% of Base Cost Plus Inflation Plus Contingency	重重				
Construction Management / Inspection \$ 54,130,000 \$ 70,990,000 Assume 10% of Base Cost Plus Inflation Plus Contingency	or os				
TOTAL ESTIMATED COST \$ 654,970,000 \$ 858,950,000					
		TOTAL ESTIMATED COST	\$ 654,970,000	\$ 858,950,000	

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85'-0'	85'-0'	85'-0'	85'-0'	1080.	108'-0"	1080-	85'-0"	440'-0"	85'-0'	1080.	1087-0*	1080,	1087-07	1080-	1080.	102'-0"	1050-	102'-0"	102'-0"	1050,	102'-0"	1

#### Alternative 7: Full Extradosed

		Low	High	
	Structure Width	128 FT	128 FT	
	Structure Length - Extradosed	2460 FT	2460 FT	
ts .	Deck Area - Extradosed Spans	313,650 SF	313,650 SF	
So	Estimated \$\$/SF - Extradosed Spans	\$ 700/SF	\$ 900/SF	
é	Structure Length - Approaches	5,240 FT	5,240 FT	Const Length = 7700 FT
Į į	Deck Area - Approaches	668,100 SF	668,100 SF	
Structure Costs	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
55	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 353,170,000	\$ 482,710,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24 400 000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000	. , ,	4 @ \$400K each
	Crossover (#20)	\$6,400,000		8 @ \$800K each
	Remove Turnout	\$25,000		1 @ \$25K
sts	Remove Crossover	\$200,000		4 @\$50K each
Rail Costs	Signals	\$200,000	<b>\$200,000</b>	1 G your cutii
=	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
~	RO & AF Interlockings	\$16,000,000		2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000		2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000		23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000		Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 17,660,000	¢ 24 140 000	Assume 5% of Structure Cost
	Utility Relocation	\$ 3,707,750		Surface Utility Survey
sts	Right of Way Acquisition	\$ 52,955,000		Assume Width excluding Rail expansion
Other Costs	Light Rail Trackwork and Catenary	\$ 24,900,000		3.1 miles @ \$2.5M per mile track, \$1.5M per mile catenary
Je.	Maintenance & Protection of Traffic	\$ 16,880,000		Assume 4% of (Structure + Rail) Cost
8	Mobilization	\$ 29,540,000		Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 8,440,000		Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 576,027,750	\$ 734,599,300	
ost _	Base Cost Including Inflation	\$ 576,030,000	\$ 734,600,000	
ž e	Contingency	\$ 201,610,000	. , ,	Assume 35% of Base Cost Plus Inflation
Total Cost Summary	Base Cost Including Inflation and Contingency	\$ 777,640,000	\$ 991,710,000	
r z	Design	\$ 85,540,000		Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection	\$ 77,760,000	\$ 99,170,000	Assume 10% of Base Cost Plus Inflation Plus Contingency
	TOTAL ESTIMATED COST	\$ 940 940 000	\$ 1,199,970,000	
	TO THE ESTIMATED COST	÷ 540,540,000	7 1,100,000	I



#### Alternative 7: Partial Extradosed

		Low	High	
	Structure Width	128 FT	128 FT	
	Structure Length - Extradosed	715 FT	715 FT	
t3	Deck Area - Extradosed Spans	91,163 SF	91,163 SF	
Š	Estimated \$\$/SF - Extradosed Spans	\$ 700/SF	\$ 900/SF	
ė.	Structure Length - Approaches	6,985 FT	6,985 FT	Const Length = 7700 FT
Ē	Deck Area - Approaches	890,588 SF	890,588 SF	
Structure Costs	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
ĸ	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 241,930,000	\$ 349,220,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000		4 @ \$400K each
	Crossover (#20)	\$6,400,000		8 @ \$800K each
	Remove Turnout	\$25,000		1 @ \$25K
its	Remove Crossover	\$200,000		4 @\$50K each
ő	Signals	\$200,000	<b>7200,000</b>	4 @ \$50K Cacii
Rail Costs	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
œ	RO & AF Interlockings	\$16,000,000		2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000		2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000		23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000	- , , ,	Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Designed Circuit Londons in the	\$ 12,100,000	ć 17 460 000	Assume 5% of Structure Cost
	Drainage, Signing, Landscaping, etc.	. , ,	, , ,	
sts	Utility Relocation	\$ 3,707,750 \$ 52,955,000		Surface Utility Survey
8	Right of Way Acquisition	\$ 52,955,000		Assume Width excluding Rail expansion
Other Costs	Light Rail Trackwork and Catenary  Maintenance & Protection of Traffic	\$ 24,900,000		3.1 miles @ \$2.5M per mile track, \$1.5M per mile catenary Assume 4% of (Structure + Rail) Cost
퓽	Mobilization	\$ 12,430,000		Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 6,210,000		Assume 2% of (Structure + Rail) Cost Assume 2% of (Structure + Rail) Cost
	Construction Staking/Survey			
	Base Construction Cost		\$ 577,079,300	
st √	Base Cost Including Inflation	\$ 444,760,000		
ma	Contingency			Assume 35% of Base Cost Plus Inflation
Total Cost Summary	Base Cost Including Inflation and Contingency	\$ 600,430,000	\$ 779,060,000	
7 3	Design	\$ 66,050,000	\$ 85,700,000	Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection	\$ 60,040,000	\$ 77,910,000	Assume 10% of Base Cost Plus Inflation Plus Contingency
	TOTAL ESTIMATED COST	\$ 726,520,000	\$ 042 670 000	
	TOTAL ESTIMATED COST	\$ /20,320,000	942,070,000 ډ	

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	85'-0"	85'-0'	85'-0	85'-0"	108'-0"	1080.	195'-0'	325'-O'	195'-0"	1080.	1060.	108'-0"	1080-	1080.	1080.	1050.	102"-0"	1050-	1050.	102'-0"	1050.	Γ

#### Alternative 7: Deck Arch

nflation Rate:	. %	Low	High	
	Structure Width	113 FT	113 FT	
	Structure Length - Deck Arch	2550 FT	2550 FT	
s,	Deck Area - Deck Arch Spans	288,150 SF	288,150 SF	
ost	Estimated \$\$/SF - Deck Arch Spans	\$ 400/SF	\$ 550/SF	
e O	Structure Length - Shared Use Bridge	5,150 FT	5,150 FT	Const Length = 7700 FT
ţ	Deck Area - Approaches	581,950 SF	581,950 SF	-
Structure Costs	Estimated \$\$/SF - Shared Use Path	\$ 200/SF	\$ 300/SF	
St	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 231,650,000	\$ 333,070,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000	\$1,600,000	4 @ \$400K each
	Crossover (#20)	\$6,400,000	\$6,400,000	8 @ \$800K each
	Remove Turnout	\$25,000	\$25,000	1 @ \$25K
sts	Remove Crossover	\$200,000	\$200,000	4 @\$50K each
8	Signals			
Rail Costs	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
_	RO & AF Interlockings	\$16,000,000	\$16,000,000	2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000	\$5,000,000	2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000	\$ 250,000	Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 11,580,000	\$ 16,650,000	Assume 5% of Structure Cost
23	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
SO	Right of Way Acquisition	\$ 40,050,000	\$ 40,050,000	Assume Width excluding Rail expansion
Other Costs	Light Rail Trackwork and Catenary	\$ 24,900,000	\$ 29,880,000	3.1 miles @ \$2.5M per mile track, \$1.5M per mile catenary
Ę.	Maintenance & Protection of Traffic	\$ 12,020,000	\$ 16,070,000	Assume 4% of (Structure + Rail) Cost
0	Mobilization	\$ 21,030,000		Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 6,010,000	\$ 8,040,000	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 419,722,750	\$ 545,114,300	
장	Base Cost Including Inflation	\$ 419,720,000	\$ 545,110,000	
Total Cost Summary	Contingency	\$ 146,900,000	\$ 190,790,000	Assume 35% of Base Cost Plus Inflation
ᆵ	Base Cost Including Inflation and Contingency	\$ 566,620,000	\$ 735,900,000	
5 2	Design	\$ 62,330,000	\$ 80,950,000	Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection	\$ 56,660,000		Assume 10% of Base Cost Plus Inflation Plus Contingency
	TOTAL ESTIMATED COST	\$ 685,610,000	\$ 890,440,000	



#### Alternative 7: Multi-Girder with Arch Façade

Structure Width   113 FT   1		High	Low	. %	flation Rate:
Deck Area - Deck Arch Spans   SF   SF     Estimated \$5/\$F - Deck Arch Spans   \$ 000/\$F   \$ 000/\$F     Deck Area - Approaches   7,700 FT   7,700 FT   7,700 FT     Deck Area - Approaches   870,100 SF   870,100 SF     Estimated \$5/\$F - Approaches   \$ 200/\$F   \$ 300/\$F     Estimated \$5/\$F - Approaches   \$ 200/\$F   \$ 300/\$F     Estimated S5/\$F - Retaining Walls   \$ SF   \$ SF     Estimated \$5/\$F - Retaining Walls   \$ 140/\$F   \$ 140/\$F     Precast Arch Facades   \$ 1,000 / LF   \$ 1,000 / LF     Estimated \$5/\$F - Arch Facades   \$ 1,000 / LF   \$ 1,000 / LF     Estimated \$7/LF - Arch Facades   \$ 1,000 / LF   \$ 1,000 / LF     Estimated \$7/LF - Arch Facades   \$ 1,000 / LF   \$ 1,000 / LF     Estimated \$7/LF - Arch Facades   \$ 1,000 / LF   \$ 1,000 / LF     Estimated \$7/LF - Arch Facades   \$ 1,000 / LF   \$ 1,000 / LF     Estimated \$7/LF - Arch Facades   \$ 1,000 / LF   \$ 1,000 / LF     Estimated \$7/LF - Arch Facades   \$ 1,000 / LF   \$ 1,000 / LF     Estimated \$7/LF - Arch Facades   \$ 1,000 / LF   \$ 1,000 / LF     Estimated \$7/LF - Arch Facades   \$ 1,000 / LF   \$ 1,000 / LF     Estimated \$7/LF - Arch Facades   \$ 1,000 / LF   \$ 1,000 / LF     Estimated \$7/LF - Arch Facades   \$ 1,000 / LF   \$ 1,000 / LF     Estimated \$7/LF - Arch Facades   \$ 1,000 / LF   \$ 1,000 / LF   \$ 1,000 / LF     Estimated \$7/LF - Arch Facades   \$ 1,000 / LF   \$ 1,		113 FT	113 FT	Structure Width	
Structure Length - Approaches		00 FT	00 FT	Structure Length - Deck Arch	
Structure Length - Approaches		SF	SF	Deck Area - Deck Arch Spans	
Standard Syys		\$ 000/SF	\$ 000/SF	Estimated \$\$/SF - Deck Arch Spans	\$
Stimated Sylf - Nechalling Walls   Station	ength = 7700 FT	7,700 FT	7,700 FT	Structure Length - Approaches	S
Standard Syys		870,100 SF	870,100 SF	Deck Area - Approaches	ē
Stimated Sylf - Nechalling Walls   Station		\$ 300/SF	\$ 200/SF	Estimated \$\$/SF - Approaches	횴
Stimated Syle - Record   Standard   Standa		SF	SF	Estimated Retaining Walls	ž
Estimated \$/LF - Arch Facades   \$1,000 /LF   \$1,000 /LF   Includes fabrication, erection, post-tensioning   Total Estimated Structure Cost   \$189,420,000   \$276,430,000   \$276,430,000   \$176,000,000   \$276,430,000		\$ 140/SF	\$ 140/SF	Estimated \$\$/SF - Retaining Walls	22
Total Estimated Structure Cost   \$ 189,420,000 \$ 276,430,000		15400 LF	15400 LF	Precast Arch Facades	
Trackwork/Earthwork/Ballast	fabrication, erection, post	\$ 1,000 /LF I	\$ 1,000 /LF	Estimated \$/LF - Arch Facades	
Construct Track		\$ 276,430,000	\$ 189,420,000	Total Estimated Structure Cost	
Turnout (#20)				Trackwork/Earthwork/Ballast	
Crossover (#20)	es @ \$1.55M per mile	\$24,400,000	\$24,400,000	Construct Track	
Remove Turnout	0K each	\$1,600,000	\$1,600,000	Turnout (#20)	
Remove Crossover   \$200,000   \$200,000   4 @\$50K each	0K each	\$6,400,000	\$6,400,000	Crossover (#20)	
RO & AF Interlockings   \$16,000,000   \$16,000,000   2 @ \$8M each	K	\$25,000	\$25,000	Remove Turnout	10
RO & AF Interlockings   \$16,000,000   \$16,000,000   2 @ \$8M each	K each	\$200,000	\$200,000	Remove Crossover	ste
RO & AF Interlockings   \$16,000,000   \$16,000,000   2 @ \$8M each				Signals	<u> </u>
Slaters Lane & Franconia Interlockings   \$5,000,000   \$5,000,000   2 @ \$2.5m each			\$12,000,000	Virginia & L'Enfant Interlockings	Rai.
Cut Section (Code Change)   \$2,900,000   \$2,900,000   23 @ \$125K each			\$16,000,000	RO & AF Interlockings	
Miscellaneous RR Costs   \$250,000   \$250,000   Flagging, Agreements, etc.				Slaters Lane & Franconia Interlockings	
Total Estimated RR Cost   \$68,775,000   \$68,775,000				Cut Section (Code Change)	
Drainage, Signing, Landscaping, etc.   \$9,470,000 \$13,820,000 Assume 5% of Structure Cost	, Agreements, etc.				
Utility Relocation		\$ 68,775,000	\$ 68,775,000	Total Estimated RR Cost	
Right of Way Acquisition	5% of Structure Cost	\$ 13,820,000	\$ 9,470,000	Drainage, Signing, Landscaping, etc.	
Mobilization   \$18,070,000   \$24,160,000   Assume 7% of (Structure Plus Rail) Cost	Utility Survey	\$ 4,449,300	\$ 3,707,750	Utility Relocation	23
Mobilization   \$18,070,000   \$24,160,000   Assume 7% of (Structure Plus Rail) Cost	Width excluding Rail expan	\$ 40,050,000	\$ 40,050,000	Right of Way Acquisition	So
Mobilization   \$18,070,000   \$24,160,000   Assume 7% of (Structure Plus Rail) Cost				Light Rail Trackwork and Catenary	O
Mobilization   \$18,070,000   \$24,160,000   Assume 7% of (Structure Plus Rail) Cost	4% of (Structure Plus Rail)	\$ 13,810,000	\$ 10,330,000	Maintenance & Protection of Traffic	Ě
Base Construction Cost \$ 369,882,750 \$ 478,274,300					0
	2% of (Structure Plus Rail)	\$ 6,900,000	\$ 5,160,000	Construction Staking/Survey	
Base Cost Including Inflation \$ 369,880,000 \$ 478,270,000		\$ 478,274,300	\$ 369,882,750	Base Construction Cost	
0 10 120 400 000 0 127 200 000 400 400 400 400 400 400 400 400		\$ 478,270,000	\$ 369,880,000	Base Cost Including Inflation	t ≿
ပိ 🛱   Contingency   \$ 129,460,000   \$ 167,390,000   Assume 35% of Base Cost Plus Inflation	35% of Base Cost Plus Infla	\$ 167,390,000	\$ 129,460,000	Contingency	ခ် င
Base Cost Including Inflation and Contingency \$499,340,000 \$645,660,000					īg jā
Design \$ 54,930,000 \$ 71,020,000 Assume 11% of (Base Cost Plus Inflation Plus	11% of (Base Cost Plus Infl				5 S
Construction Management / Inspection \$ 49,930,000 \$ 64,570,000 Assume 10% of (Base Cost Plus Inflation Plus					
TOTAL ESTIMATED COST \$ 604,200,000 \$ 781,250,000	·				







# Alternative 8: 4-Track Rail Bridge with Pedestrian /Bicycle Path, Shared Streetcar/Auto Lanes and General Purpose Lanes\*

(2013 Dollars)						
Structure Type	Structu	ıre Cost	Rail Cost	Other	Costs	Anticipated Total Cost for New Structure
	Low	High		Low	High	
1. Steel Tied Arch	\$233,040,000	\$347,560,000	\$68,775,000	\$430,822,750	\$546,384,300	\$733 _ \$963 M
2. Steel Through Arch	\$250,700,000	\$371,610,000	\$68,775,000	\$450,112,750	\$571,624,300	\$770 _ \$1,012 M
3. Extradosed	\$419,660,000	\$573,580,000	\$68,775,000	\$615,542,750	\$767,644,300	\$1,104 _ \$1,410 M
3a. Partial Extradosed	\$287,470,000	\$414,960,000	\$68,775,000	\$492,932,750	\$620,524,300	\$849 _ \$1,104 M
4. Concrete Deck Arch	\$280,850,000	\$403,810,000	\$68,775,000	\$465,707,750	\$589,099,300	\$815 _ \$1,062 M
4a. Standard Girder Structure with Concrete Arch Façade Elements	\$226,380,000	\$331,870,000	\$68,775,000	\$415,197,750	\$522,379,300	\$710 _ \$923 M

<sup>\*</sup>These costs and the bridge and tunnel types discussed herein are conceptual in nature, and therefore evaluations of cost at this stage of the project development must be considered to be very preliminary, and should not be used for funding or programming purposes. None of the alternatives described in this report have been sufficiently engineered to determine costs based on estimated structural quantities, anticipated erection methods, right-of way implications, expected schedule durations, and potential effects of inflation based on the anticipated timing of the beginning of construction. At this stage of development, only preliminary level of cost evaluation can be made that differentiates the alternatives on the basis of anticipated construction cost. A 35% contingency is included in the cost of bridge or tunnel options.

#### Alternative 8: Steel Tied Arch

		Low	High	
	Structure Width	144 FT	144 FT	
	Structure Length - Tied Arch	280 FT	280 FT	
ts t	Deck Area - Tied Arch Span	40,180 SF	40,180 SF	
Š	Estimated \$\$/SF - Tied Arch Span	\$ 500/SF	\$ 700/SF	
Structure Costs	Structure Length - Approaches	7,420 FT	7,420 FT	Const Length = 7700 FT
Ē	Deck Area - Approaches	1,064,770 SF	1,064,770 SF	
Ž	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
₹ 5	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 233,040,000	\$ 347,560,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24 400 000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000		4 @ \$400K each
	Crossover (#20)	\$6,400,000		8 @ \$800K each
	Remove Turnout	\$25,000		1 @ \$25K
sts	Remove Crossover	\$200,000		4 @\$50K each
Š	Signals	7-00,000	7=00,000	
Rail Costs	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
<u>~</u>	RO & AF Interlockings	\$16,000,000		2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000		2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000		23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000		Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000		
	Drainage, Signing, Landscaping, etc.	\$ 11,650,000	¢ 17 290 000	Assume 5% of Structure Cost
	Utility Relocation	\$ 3,707,750		Surface Utility Survey
sts	Right of Way Acquisition			Assume Width excluding Rail expansion
8	Light Rail Trackwork and Catenary			3.1 miles @ \$2.5M per mile track, \$1.5M per mile catenary
Other Costs	Maintenance & Protection of Traffic	\$ 12,070,000		Assume 4% of (Structure + Rail) Cost
₹	Mobilization	\$ 21,130,000	. , , ,	Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 6,040,000		Assume 2% of (Structure + Rail) Cost
	J. ,		. , ,	,
	Base Construction Cost		\$ 589,359,300	
Total Cost Summary	Base Cost Including Inflation	\$ 448,510,000	\$ 589,360,000	
Total Cost Summary	Contingency	\$ 156,980,000	\$ 206,280,000	Assume 35% of Base Cost Plus Inflation
la gal	Base Cost Including Inflation and Contingency	\$ 605,490,000	\$ 795,640,000	
ĭ ∡	Design	\$ 66,600,000	\$ 87,520,000	Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection	\$ 60,550,000	\$ 79,560,000	Assume 10% of Base Cost Plus Inflation Plus Contingency
	TOTAL ESTIMATED COST	\$ 732 640 000	\$ 962,720,000	
	TOTAL ESTIMATED COST	\$ 732,640,000	7 عن کر کرن	



#### Alternative 8: Steel Through Arch

		Low	High	
	Structure Width	146 FT	146 FT	
	Structure Length - Through Arch	610 FT	610 FT	
t3	Deck Area - Through Arch Span	88,755 SF	88,755 SF	
	Estimated \$\$/SF - Through Arch Span	\$ 500/SF	\$ 700/SF	
ē	Structure Length - Approaches	7,090 FT	7,090 FT	Const Length = 7700 FT
Ē	Deck Area - Approaches	1,031,595 SF	1,031,595 SF	
Structure Costs	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
₹	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 250,700,000	\$ 371,610,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24 400 000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000		4 @ \$400K each
	Crossover (#20)	\$6,400,000		8 @ \$800K each
	Remove Turnout	\$25,000		1 @ \$25K
sts	Remove Crossover	\$200,000		4 @\$50K each
Rail Costs	Signals	7=00,000	+===,===	
i <u>e</u>	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
~	RO & AF Interlockings	\$16,000,000		2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000		2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000	. , , ,	23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000		Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 12,540,000	¢ 10 E00 000	Assume 5% of Structure Cost
	Utility Relocation	\$ 3,707,750	1 -,,	Surface Utility Survey
sts	Right of Way Acquisition	\$ 68,975,000		Assume Width excluding Rail expansion
Other Costs	Light Rail Trackwork and Catenary	\$ 24,900,000		3.1 miles @ \$2.5M per mile track, \$1.5M per mile catenary
Je Je	Maintenance & Protection of Traffic	\$ 12,780,000		Assume 4% of (Structure + Rail) Cost
ð	Mobilization	\$ 22,360,000		Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 6,390,000		Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 471,127,750	\$ 619,529,300	
ost	Base Cost Including Inflation	\$ 471,130,000	\$ 619,530,000	
Total Cost Summary	Contingency	\$ 164,900,000		Assume 35% of Base Cost Plus Inflation
L da	Base Cost Including Inflation and Contingency	\$ 636,030,000	\$ 836,370,000	
ı v	Design	\$ 69,960,000		Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection	\$ 63,600,000	\$ 83,640,000	Assume 10% of Base Cost Plus Inflation Plus Contingency
	TOTAL ESTIMATED COST	\$ 769,590.000	\$ 1,012,010,000	
		,,	. ,. ,,	

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85'-0'	85'-0'	85'-0'	85'-0'	1080.	1087-07	1080-	85'-0"	440'-0"	85'-0'	1080.	108:-0-	1080.	1087-07	1080-	1080.	1020-	1050-	102"-0"	1050-	1050.	1050.	

#### Alternative 8: Full Extradosed

		Low	High	
	Structure Width	152 FT	152 FT	
	Structure Length - Extradosed	2460 FT	2460 FT	
\$	Deck Area - Extradosed Spans	372,690 SF	372,690 SF	
Š	Estimated \$\$/SF - Extradosed Spans	\$ 700/SF	\$ 900/SF	
e O	Structure Length - Approaches	5,240 FT	5,240 FT	Const Length = 7700 FT
Į į	Deck Area - Approaches	793,860 SF	793,860 SF	
Structure Costs	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
55	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 419,660,000	\$ 573,580,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24.400.000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000		4 @ \$400K each
	Crossover (#20)	\$6,400,000		8 @ \$800K each
	Remove Turnout	\$25,000		1 @ \$25K
sts	Remove Crossover	\$200,000		4 @\$50K each
Rail Costs	Signals	7=00,000	+===,===	
<u></u>	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
<b>E</b>	RO & AF Interlockings	\$16,000,000		2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000		2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000		23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000	\$ 250,000	Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 20,980,000	\$ 28 680 000	Assume 5% of Structure Cost
	Utility Relocation	\$ 3,707,750		Surface Utility Survey
osts	Right of Way Acquisition	\$ 74,315,000		Assume Width excluding Rail expansion
Other Costs	Light Rail Trackwork and Catenary	\$ 24,900,000		3.1 miles @ \$2.5M per mile track, \$1.5M per mile catenary
her	Maintenance & Protection of Traffic	\$ 19,540,000		Assume 4% of (Structure + Rail) Cost
ర్	Mobilization	\$ 34,190,000		Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 9,770,000		Assume 2% of (Structure + Rail) Cost
	Deer Construction Cost	¢ (75 027 750		·
	Base Construction Cost	\$ 675,837,750	\$ 863,179,300	
ost ary	Base Cost Including Inflation	\$ 675,840,000	\$ 863,180,000	
Total Cost Summary	Contingency	\$ 236,540,000		Assume 35% of Base Cost Plus Inflation
ota um	Base Cost Including Inflation and Contingency	\$ 912,380,000		
Ėσ	Design	\$ 100,360,000		Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection	\$ 91,240,000	\$ 116,530,000	Assume 10% of Base Cost Plus Inflation Plus Contingency
	TOTAL ESTIMATED COST	\$ 1,103,980,000	\$ 1,410,000,000	



#### Alternative 8: Partial Extradosed

Structure Width			Low	High	
Deck Area - Extradosed Spans   108,323 SF   108,323 SF   5 900/SF   5 900/S		Structure Width	152 FT	152 FT	
Estimated \$5/\$F - Extradosed Spans   \$700/\$F   \$900/\$F		Structure Length - Extradosed	715 FT	715 FT	
Stimated S5/SF - Retaining Wails   S 140/SF   Total Estimated Structure Cost   S 287,470,000   \$414,960,000	ts	Deck Area - Extradosed Spans	108,323 SF	108,323 SF	
Statistical extension   Statistical   Stat	SO	Estimated \$\$/SF - Extradosed Spans	\$ 700/SF	\$ 900/SF	
Statistical extension   Statistical   Stat	ē (	Structure Length - Approaches	6,985 FT	6,985 FT	Const Length = 7700 FT
Stimated S5/SF - Retaining Wails   S 140/SF   Total Estimated Structure Cost   S 287,470,000   \$414,960,000	Ę	Deck Area - Approaches	1,058,228 SF	1,058,228 SF	
Statistical extension   Statistical   Stat	ž	Estimated \$\$/SF - Approaches	\$ 200/SF	\$ 300/SF	
Trackwork/Earthwork/Ballast	25	Estimated Retaining Walls	SF	SF	
Trackwork/Earthwork/Ballast   S24,400,000   \$24,400,000   \$1.7 miles @ \$1.55M per mile					
Construct Track		Total Estimated Structure Cost	\$ 287,470,000	\$ 414,960,000	
Construct Track		Trackwork/Earthwork/Ballast			
Turnout (#20)		·	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
Page   Crossover (#20)					
Remove Turnout		3 7	. , ,	. , ,	
Remove Crossover   \$200,000   \$200,000   4 @\$50K each		, ,			
RO & AF Interlockings   \$16,000,000   \$16,000,000   2 @ \$8M each	sts	Remove Crossover			
RO & AF Interlockings   \$16,000,000   \$16,000,000   2 @ \$8M each	8	Signals	, ,		0,111
RO & AF Interlockings   \$16,000,000   \$16,000,000   2 @ \$8M each	iii	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
Slaters Lane & Franconia Interlockings   \$5,000,000   \$5,000,000   2 @ \$2.5m each	Œ	RO & AF Interlockings	\$16,000,000	\$16,000,000	2 @ \$8M each
Miscellaneous RR Costs   \$250,000   \$250,000   Flagging, Agreements, etc.		Slaters Lane & Franconia Interlockings		\$5,000,000	2 @ \$2.5m each
Total Estimated RR Cost   \$68,775,000   \$68,775,000   \$68,775,000   \$68,775,000   \$74,315,000   \$20,750,000   \$3,707,750   \$4,449,300   \$3,707,750   \$4,449,300   \$3,707,750   \$4,449,300   \$3,707,750   \$4,449,300   \$3,707,750   \$4,449,300   \$3,707,750   \$4,449,300   \$3,707,750   \$4,449,300   \$3,707,750   \$4,449,300		Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
Drainage, Signing, Landscaping, etc.   \$14,370,000 \$20,750,000   Assume 5% of Structure Cost		Miscellaneous RR Costs	\$ 250,000	\$ 250,000	Flagging, Agreements, etc.
Utility Relocation		Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
Utility Relocation		Drainage Signing Landscaning etc	\$ 14 370 000	\$ 20 750 000	Assume 5% of Structure Cost
Right of Way Acquisition   \$74,315,000   \$74,315,000   \$3.1 miles @ \$2.5M per mile track, \$1.5M per mile catenary   \$24,900,000   \$29,880,000   \$3.1 miles @ \$2.5M per mile track, \$1.5M per mile catenary   Maintenance & Protection of Traffic   \$14,250,000   \$19,350,000   Assume 4% of (Structure + Rail) Cost   Mobilization   \$24,940,000   \$33,860,000   Assume 7% of (Structure + Rail) Cost   \$7,120,000   \$9,670,000   Assume 2% of (Structure + Rail) Cost   \$7,120,000   \$9,670,000   Assume 2% of (Structure + Rail) Cost   \$7,120,000   \$9,670,000   Assume 2% of (Structure + Rail) Cost   \$18,9847,750   \$676,009,300   \$86,000,000   Assume 2% of (Structure + Rail) Cost   \$181,950,000   \$676,000,000   \$10,	w			. , ,	
Mobilization   \$24,940,000   \$33,860,000   Assume 2% of (Structure + Rail) Cost	ost			. , ,	, ,
Mobilization   \$24,940,000   \$33,860,000   Assume 2% of (Structure + Rail) Cost	ő		. , ,		
Mobilization   \$24,940,000   \$33,860,000   Assume 7% of (Structure + Rail) Cost	.he	Maintenance & Protection of Traffic	. , ,		
Solution   Construction Staking/Survey   \$7,120,000   \$9,670,000   Assume 2% of (Structure + Rail) Cost	б	Mobilization	. , ,		
Base Cost Including Inflation   \$519,850,000 \$676,010,000		Construction Staking/Survey	\$ 7,120,000		
Base Cost Including Inflation   \$519,850,000 \$676,010,000		Race Construction Cost	\$ 510 847 750	\$ 676 000 200	
Contingency Base Cost Including Inflation and Contingency Design Construction Management / Inspection  S 181,950,000 S 236,600,000 S 236,600,0					
Construction Management / Inspection \$70,180,000 \$91,260,000 Assume 10% of Base Cost Plus Inflation Plus Contingency	ost	-		,,	A
Construction Management / Inspection \$70,180,000 \$91,260,000 Assume 10% of Base Cost Plus Inflation Plus Contingency	al C				
Construction Management / Inspection \$70,180,000 \$91,260,000 Assume 10% of Base Cost Plus Inflation Plus Contingency	Se oc				
	۳ ۵٬	ŭ			
TOTAL ESTIMATED COST \$ 849,180,000 \$ 1,104,260,000		Construction Management / Inspection	\$ /0,180,000	\$ 91,260,000	Assume 10% of Base Cost Plus Inflation Plus Contingency
		TOTAL ESTIMATED COST	\$ 849,180,000	\$ 1,104,260,000	

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- 1	1	1	1	1	1												1				Г.
857-07	85'-0"	857-05	851-01	1087-05	108'-0'	1957-01	3251-01	1951-05	108'-0"	108'-0'	1081-05	108:-05	108'-0'	108:-05	102'-0'	102-0	102'-0"	1050.	1021-01	102:-0*	1

#### Alternative 8: Deck Arch

		Low	High	
	Structure Width	137 FT	137 FT	
	Structure Length - Deck Arch	2550 FT	2550 FT	
ts	Deck Area - Deck Arch Spans	349,350 SF	349,350 SF	
So	Estimated \$\$/SF - Deck Arch Spans	\$ 400/SF	\$ 550/SF	
é	Structure Length - Shared Use Bridge	5,150 FT	5,150 FT	Const Length = 7700 FT
Ē	Deck Area - Approaches	705,550 SF	705,550 SF	
Structure Costs	Estimated \$\$/SF - Shared Use Path	\$ 200/SF	\$ 300/SF	
s	Estimated Retaining Walls	SF	SF	
	Estimated \$\$/SF - Retaining Walls	\$ 140/SF	\$ 140/SF	
	Total Estimated Structure Cost	\$ 280,850,000	\$ 403,810,000	
	Trackwork/Earthwork/Ballast			
	Construct Track	\$24,400,000	\$24,400,000	15.7 miles @ \$1.55M per mile
	Turnout (#20)	\$1,600,000		4 @ \$400K each
	Crossover (#20)	\$6,400,000	\$6,400,000	8 @ \$800K each
	Remove Turnout	\$25,000	\$25,000	1 @ \$25K
sts	Remove Crossover	\$200,000	\$200,000	4 @\$50K each
కి	Signals			
Rail Costs	Virginia & L'Enfant Interlockings	\$12,000,000	\$12,000,000	2 @ \$6M each
_	RO & AF Interlockings	\$16,000,000	\$16,000,000	2 @ \$8M each
	Slaters Lane & Franconia Interlockings	\$5,000,000	\$5,000,000	2 @ \$2.5m each
	Cut Section (Code Change)	\$2,900,000	\$2,900,000	23 @ \$125K each
	Miscellaneous RR Costs	\$ 250,000	\$ 250,000	Flagging, Agreements, etc.
	Total Estimated RR Cost	\$ 68,775,000	\$ 68,775,000	
	Drainage, Signing, Landscaping, etc.	\$ 14,040,000	\$ 20,190,000	Assume 5% of Structure Cost
y)	Utility Relocation	\$ 3,707,750	\$ 4,449,300	Surface Utility Survey
ost	Right of Way Acquisition	\$ 61,410,000	\$ 61,410,000	Assume Width excluding Rail expansion
Other Costs	Light Rail Trackwork and Catenary	\$ 24,900,000	\$ 29,880,000	3.1 miles @ \$2.5M per mile track, \$1.5M per mile catenary
‡	Maintenance & Protection of Traffic	\$ 13,990,000	\$ 18,900,000	Assume 4% of (Structure + Rail) Cost
0	Mobilization	\$ 24,470,000	\$ 33,080,000	Assume 7% of (Structure + Rail) Cost
	Construction Staking/Survey	\$ 6,990,000	\$ 9,450,000	Assume 2% of (Structure + Rail) Cost
	Base Construction Cost	\$ 499,132,750	\$ 649,944,300	
# >	Base Cost Including Inflation	\$ 499,130,000	\$ 649,940,000	
Total Cost Summary	Contingency	\$ 174,700,000	, , ,	Assume 35% of Base Cost Plus Inflation
<u> </u>	Base Cost Including Inflation and Contingency	\$ 673,830,000	\$ 877,420,000	
To To	Design	\$ 74,120,000	. , ,	Assume 11% of Base Cost Plus Inflation Plus Contingency
	Construction Management / Inspection	\$ 67,380,000		Assume 10% of Base Cost Plus Inflation Plus Contingency
			. , ,	Ů,
	TOTAL ESTIMATED COST	\$ 815,330,000	\$ 1,061,680,000	



#### Alternative 8: Multi-Girder with Arch Façade

Structure Width	
Deck Area - Deck Arch Spans   SF   SF	icture Width
Estimated \$5/\$F - Deck Arch Spans   \$000/\$F   \$7,700 FT   \$7,700	ıcture Length -
Structure Length - Approaches	k Area - Deck A
15400 LF	mated \$\$/SF - I
15400 LF	ıcture Length -
15400 LF	k Area - Approa
15400 LF	mated \$\$/SF - /
Precast Arch Facades   15400 LF	mated Retainin
Estimated \$/LF - Arch Facades   \$1,000 /LF   \$1,000 /LF   Includes fabrication, erection, post-tensioning   Total Estimated Structure Cost   \$226,380,000   \$333,870,000	mated \$\$/SF - I
Trackwork/Earthwork/Ballast   \$226,380,000 \$331,870,000	
Trackwork/Earthwork/Ballast	mated \$/LF - Aı
Construct Track	al Estimated Str
Turnout (#20)   \$1,600,000   \$1,600,000   \$4 @ \$400K each	ckwork/Earthw
Page	onstruct Track
Remove Turnout	ırnout (#20)
Remove Crossover   \$200,000   \$200,000   4 @\$50K each	ossover (#20)
RO & AF Interlockings   \$16,000,000   \$16,000,000   2 @ \$8M each	emove Turnout
RO & AF Interlockings   \$16,000,000   \$16,000,000   2 @ \$8M each	emove Crossove
RO & AF Interlockings   \$16,000,000   \$16,000,000   2 @ \$8M each	nals
Slaters Lane & Franconia Interlockings   \$5,000,000   \$5,000,000   2 @ \$2.5m each	rginia & L'Enfar
Summer   S	O & AF Interlock
Miscellaneous RR Costs   \$250,000   \$250,000   Flagging, Agreements, etc.	aters Lane & Fr
Total Estimated RR Cost   \$68,775,000 \$68,775,000	ut Section (Code
Drainage, Signing, Landscaping, etc.   \$11,320,000 \$16,590,000   Assume 5% of Structure Cost	
Utility Relocation	al Estimated RR
Right of Way Acquisition   \$61,410,000 \$61,410,000 Assume Width excluding Rail expansion	inage, Signing,
Second   S	ity Relocation
S 28,050,000   \$28,050,000	nt of Way Acqui
S 28,050,000   \$28,050,000	nt Rail Trackwor
S 28,050,000   \$28,050,000	intenance & Pro
Base Construction Cost   \$434,862,750 \$565,064,300	
Base Cost Including Inflation   \$434,860,000 \$565,060,000	struction Stakii
Contingency   \$152,200,000 \$197,770,000   Assume 35% of Base Cost Plus Inflation	e Construction
Design 3 04,360,000 3 63,310,000 Assume 11% of classe Cost Flus initiation Flus Contingen	e Cost Including
Design 3 04,360,000 3 63,310,000 Assume 11% of classe Cost Flus initiation Flus Contingen	itingency
Design 3 04,360,000 3 63,310,000 Assume 11% of classe Cost Flus mination Flus Contingen	
TOTAL ESTIMATED COST \$ 710,350,000 \$ 923,020,000	





## Preliminary Estimates of Long Bridge Utilities in ROW

		Unit Cost	Total Cost
Gas Line Marker/Valve	1	5000	\$5,000
Fire hydrant	2	5000	\$10,000
Traffic Signal Poles	6	25000	\$150,000
Electric Hand Holes	1	10000	\$10,000
Communications Box	1	25000	\$25,000
Electric MH	9	10000	\$90,000
Fiber Optic Marker	2	500	\$1,000
Light Pole	55	10000	\$550,000
Utility Pole	60	15000	\$900,000
Telephone MH	7	10000	\$70,000
GPS Pts / Posts	25	1000	\$25,000
Water Valves	27	4000	\$108,000
Water MH	2	10000	\$20,000
Misc Railroad Equipment	5	10000	\$50,000
	FT	Cost per FT	
Overhead Electric	4965	150	\$744,750
Underground Electric	505	1300	\$656,500
Underground Gas	65	4500	\$292,500
Water Lines	0		\$0
Underground Communication	0		\$0

\$3,707,750

### Included in Other Costs - Drainage, Signing, Landscaping, etc.

Signs	14
Catch Basin	9
Drainage MH	26







# LONG BRIDGE STUDY Bridge and Tunnel Concept Report

This material is based upon work supported by the Federal Railroad Administration under the Long Bridge Study American Recovery and Reinvestment Act of 2009 Grant dated December 9, 2011. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the Federal Railroad Administration and/or the U.S. Department of Transportation.





