



Bridge Project Scoping

Dustin Thomas | Bridge Repair Scoping Engineer

May 17, 2017



Bridge Office | mndot.gov/bridge

Bridge Office Scoping Personnel

Scoping of New Bridges Preliminary Plans Unit	Larry Aamodt
Scoping of Bridge Repair Projects Bridge repair scoping reports, BRIM support, repair or replace decision support	 Dustin Thomas

Outline

- Bridge Planning
- BRIM planning tool
- Bridge Repair Projects and BPIG
- Bridge Scoping Cost Estimate Spreadsheet
- ABC

CHIP – Capital Highway Investment Plan

- Detail MnDOT capital investments over the next ten years on the state highway network – 1st four years is the STIP, years 5-10 CHIP
- Compare planned and programmed projects with the investment priorities established in MnSHIP, and explain any change in direction or outcomes
- Allow districts to coordinate with local units of government on future investment
- CHIP years 5-10 from letting – planned projects
- Goal is to complete scoping in year 5, initial scoping when enter the CHIP
- SPP – Statewide Performance Program - NHS routes
- DRMP – District Risk Management Program – non-NHS routes
- Updated annually
- <http://www.dot.state.mn.us/planning/10yearplan/index.html>

STIP – State Transportation Improvement Program

- Years 1-4 from letting
- Projects are considered programmed
 - Fully scoped
 - Fiscally constrained
- Preliminary and Final Design Phases
- Updated annually
- <http://www.dot.state.mn.us/planning/program/stip.html>



BRIM - Bridge Replacement & Improvement Management

- Spreadsheet Tool for Planning
 - Estimate long-range needs
 - Forecast future condition in comparison with performance measures
 - Develop list of candidate bridges to scope and program
 - Generated in Bridge Office and reviewed by Districts on annual basis

Bridges																
Review	Relative weights of hazards (a copy of the information entered at left)										Sum	Ranking				
All	25.0	20.0	15.0	10.0	10.0	5.0	10.0	5.0			100	Rank of BPI score				
Other	Scaled BPI times relative weight										Raw R score	Importance factor	BPI score	Entire state		Each district
brkey	rwDeck	rwSuper	rwSubs	rwScour	rwFracC	rwFatigu	rwOverW	rwOverH	rRawSco	rImporta	rScore	staterank	distran			
5895	5	5	8	1	0	0	6	2	25	1.33	1	1	1			
9800	5	2	11	6	6	0	6	5	41	1.39	18	2	2			
4667	8	2	1	2	0	0	2	5	19	1.00	19	3	1			
5900	13	5	11	1	0	5	2	2	38	1.21	24	4	1			
6690	8	2	9	7	0	0	6	5	36	1.16	26	5	1			
6515	9	2	4	10	10	1	4	5	45	1.32	27	6	3			
09001	5	8	8	7	0	1	0	5	34	1.05	30	7	1			
6517	5	2	5	10	10	1	6	5	44	1.20	33	8	4			

BRIM - Bridge Replacement & Improvement Management

- Risk Assessment – Bridge Planning Index (BPI)
 - Risk of Service Interruption
 - Traffic Restrictions due to increase maintenance, increased inspection, emergency repairs, etc
 - Load Posting
 - Unplanned Bridge Closure
 - Probability x Consequence
 - Deterioration of the deck or other bridge elements, hit from an over height truck, scour, fatigue
 - ADT, detour length, route classification, bridge length
 - BPI Score for each bridge
 - Score of 1 (highest priority)
 - Score of 100 (lowest priority)
 - BPI Rank for each bridge on District or Statewide basis

BRIM - Bridge Replacement & Improvement Management

- Scoping
 - Work type – replace, redeck, overlay, only preventive maintenance
 - Timeframe – matches CHIP and MnSHIP time periods
 - Costs - unit costs for each work type applied to square foot of deck area

Bridges										
All										
Review										
Other										
					Cost estimation					
					Improved bridge size (ft)			Final Cost w/o paint		
					Final decision		Bridge length	Bridge width	Deck area	Final Cost w/o paint
					Action	Period				
brkey	facility	featint	action	period	newlen	newwid	newarea	finalcost		
6525	TH 56	BIG CANNON RIVER	Replace	2038-43	254	43	10922	2,031,492		
59002	TH 23	JUD DITCH # 1	Superstr	2022-27	63	51	3213	487,500		
62015	TH 51 (Snelling)	Como Avenue (CSAH 75)	Replace	2028-37	190	88	16720	3,109,920		
9805	I 94 WB ON RAMP	12TH STREET EAST	Replace	2022-27	277	27	8081	300,001		
52009	TH 960D	US 169	ReOvly	2022-27	148	106	15692	436,031		
2571	TH 65	BRAMBLE CREEK	Replace	2022-27	42	33	1386	257,796		
5327	US 59	RED LAKE RIVER	Replace	2022-27	361	70	25270	4,960,140		
53824	CR 60	I 90	Overlay	2022-27	216	34	7344	161,499		
76001	US 12	CHIPPEWA RIVER	OPM	0	155	48	7482	-		

BRIM - Bridge Replacement & Improvement Management

- Expert review process allows District input

Bridges												
Review			Action and timing selection						Remarks			
All						Engineer over-ride		Final decision				
Other												
			Action		Period		Action		Period		Scoping remarks	Programming remarks
brkey	facility	featint	gridact	gridper	enract	engryea	action	period	engnotes	prognotes		
9859	CSAH 35	I 90	Redeck	2019-27			Redeck	2019-27				
79002	US 61 NB	WHITEWATER RIVER	Redeck	2028-34		2019-27	Redeck	2019-27			corridor project	
79004	US 61 SB	SNAKE CREEK & TWP F	OPM	0			OPM	0				
9063	US 61 SB	CEDAR CREEK	Repl/Rehab	2019-27			Repl/Rehab	2019-27				
74807	I 35 SB	UP RR	Repl/Rehab	2019-27			Repl/Rehab	2019-27				
6468	TH 56	ROSE CREEK	Repl/Rehab	2028-34			Repl/Rehab	2028-34				
24815	I 90 WB	UP RR & DITCH	Redeck	2028-34	Superstr		Superstr	2028-34	fatigue details			
55005	US 52 NB	CSAH 1	Repl/Rehab	2012-18			Repl/Rehab	2012-18				
24808	I 90 EB	I 35	Redeck	2028-34			Redeck	2028-34				
9728	I 90 EB	I&M RAIL & CSAH 46	Redeck	2019-27			Redeck	2019-27				
55021	US 52 NB	WILLOW CREEK	Repl/Rehab	2			Repl/Rehab	2028-34				
50004	TH 16	DEER CREEK	Overlay	2			Overlay	2019-27				
9062	US 61 NB	CEDAR CREEK	Repl/Rehab	2			Repl/Rehab	2019-27				
66816	I 35 NB	CSAH 11	Repl/Rehab	2			Repl/Rehab	2028-34				
9890	US 63 NB	I 90	Repl/Rehab	2			Repl/Rehab	2019-27				
6525	TH 56	BIG CANNON RIVER	Repl/Rehab	2			Repl/Rehab	2028-34				
6865	TH 3	CANNON RIVER	Repl/Rehab	2			Repl/Rehab	2019-27				
55009	US 52 NB	TH 63	Repl/Rehab	2019-27			Repl/Rehab	2019-27				

BRIM - Bridge Replacement & Improvement Management

- RSL - Remaining Service Life
 - # of years until deck reaches poor condition
 - Forecast future condition for a given investment scenario (i.e. % poor in 10 years)
 - Tool to predict Federal condition targets are achieved (FAST Act)
- Deck Deterioration Curves developed through research of historical MnDOT deck condition data
 - Curves are based on historical policy changes in bridge deck design (rebar coating, depth of rebar, overlays, etc.), ADT, location (Metro vs Outstate)
 - Assumes no additional investment except for preventive maintenance

BPIG: Introduction

Bridge **P**reservation and **I**mprovement **G**uidelines



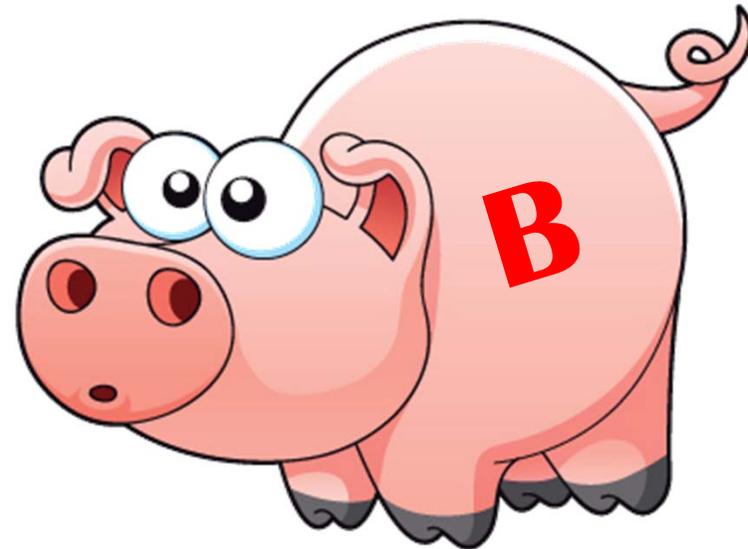
BRIDGE OFFICE
MINNESOTA DEPARTMENT OF TRANSPORTATION

Fiscal Year 2016 through 2020
Bridge Preservation and Improvement Guidelines

Approved

Beverly Farragher
Beverly Farragher
Acting State Bridge Engineer

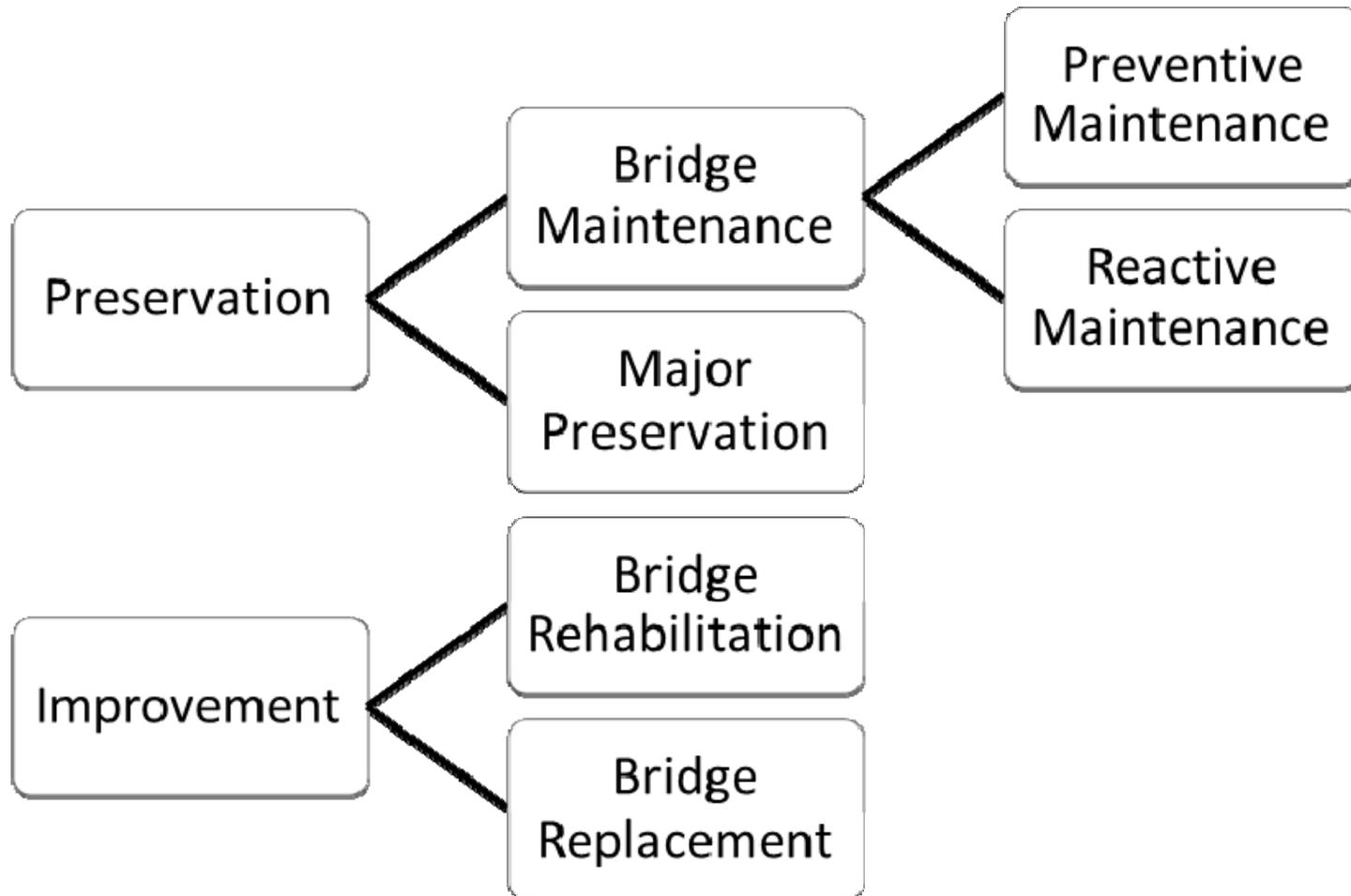
7/6/15
Date



BPIG: Purpose

- To assist Bridge Office and District personnel in identifying and prioritizing bridge preservation and improvement needs.
- Provide standard definitions and a basis for consistent decision making.
- Appropriate bridge design standards are established based on investment level.
- Expected outcomes in terms of slowed deterioration, improved condition, or service life extension.
- Guidance for bridge project scoping is provided, along with requirements and guidelines for the repair or reconstruction of critical bridge elements.

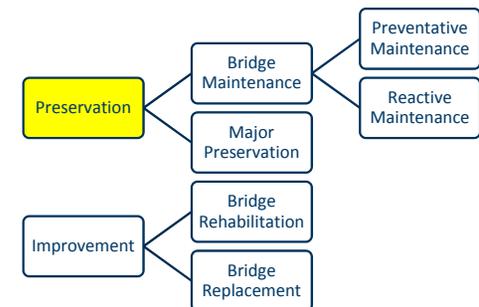
BPIG: Introduction



BPIG: Preservation

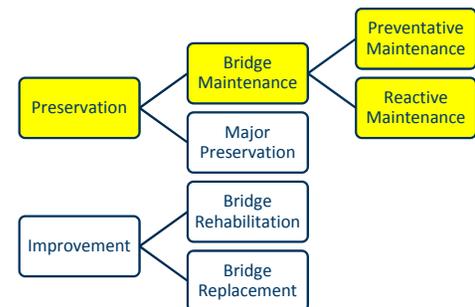
	PRESERVATION	
	Bridge Maintenance	Major Preservation
General Scope	Maintain existing design features.	Maintain existing design features and upgrading to minimum safety standards.
Typical Cost	<i>Minor investment from District operating budget.</i>	<i>Less than 30% of new bridge cost.</i>

“actions or strategies that prevent, delay or reduce deterioration of bridges or bridge elements, restore the function of existing bridges, keep bridges in good condition and extend their life.”



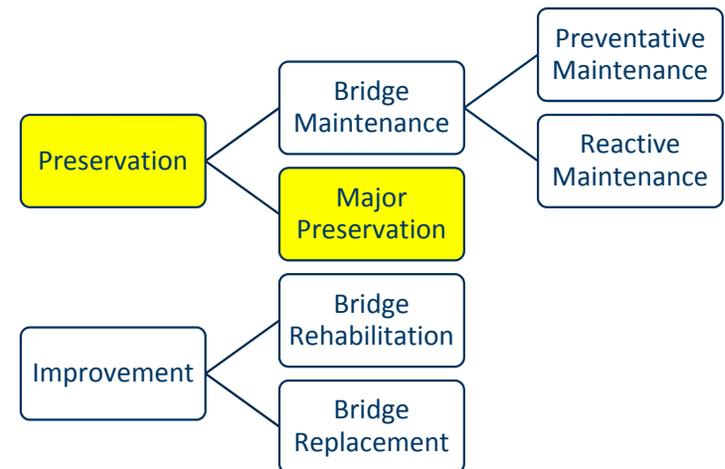
BPIG: Maintenance

- Bridge Maintenance generally performed by District Bridge Crews
- *Preventive Maintenance*
 - Bridge flushing, sweeping, debris removal, joint repair and reestablishment, graffiti removal, spot painting, and minor concrete and steel repairs.
- *Reactive Maintenance*
 - Replacement of missing plow fingers, repair of impact damage, deck spall repair and resetting misaligned bearings.



BPIG: Major Preservation

- Contract work beyond ordinary maintenance
- Extend service life by approximately 25 years
- Maintain existing design features and upgrade to min. safety standards
 - Meet barrier and end post policy
 - Load rating may not be more restrictive for permit vehicles
- Cost less than 30% of new bridge



BPIG: Major Preservation

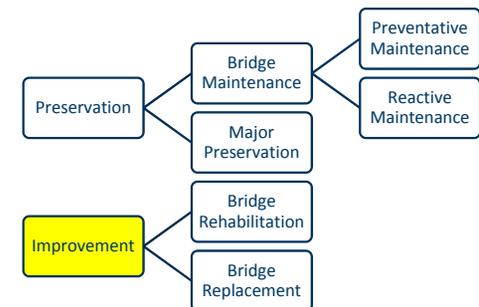
- Deck overlays and patching
- Barriers and end posts
- Expansion joint replacement
- Minor superstructure and substructure repair
- Painting, etc.



BPIG: Improvement

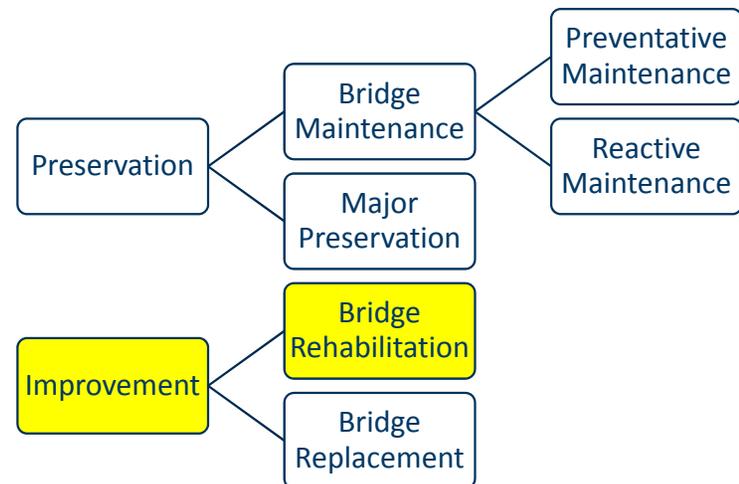
	IMPROVEMENT	
	Rehabilitation	Replacement
General Scope	Improve bridge condition, geometrics, safety and load-carrying capacity to minimum criteria.	Meet current design standards.
Typical Cost	<i>Between 30% to 70% of new bridge cost.</i>	<i>Consider replacement if rehabilitation approaches 70% of new bridge cost.</i>

Significant investment in a bridge that improves the condition, geometrics, or load-carrying capacity to a minimum standards.



BPIG: Rehabilitation

- Extend service life by approximately 50 years
- Improve to minimum rehabilitation standards
 - Condition, geometrics, load rating, barriers and end posts, etc.
- Cost < 70% of new bridge
- Design exception process



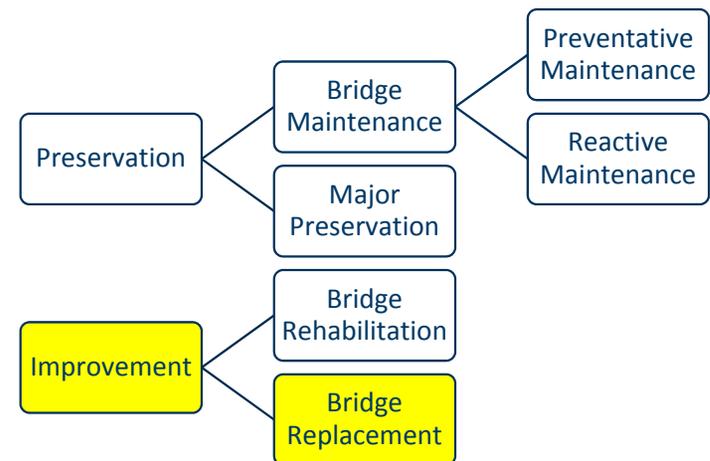
BPIG: Rehabilitation

- Deck Replacement
- Superstructure replacement
- Bridge widening
- Increase vertical clearance
- Substructure strengthening or replacement, etc.



BPIG: Replacement

- Bridge replacement involves removing a structure and building a new one to serve the same function.
 - built to current bridge design and construction standards



BPIG: How to find it?

- <http://www.dot.state.mn.us/bridge/construction.html>

Bridges and Structures

Design, construction and maintenance resources

Bridge Home

ABC

Design

Construction and Maintenance

Inventory

Hydraulics

Training

Contacts

Bridge construction

Resources

- [Standard Specifications for Construction](#)
- 2016 "SB" Bridge Special Provisions ([PDF](#), [Word](#)) - Revised May 2017
- 2014 "SB" Bridge Special Provisions ([PDF](#), [Word](#))
- [Bridge Construction Manual](#)
- [Bridge Preservation and Improvement Guidelines Fiscal Year 2016-2020](#) (PDF)

Bridge Scoping Cost Estimate Spreadsheet

- Planning level estimate and work type validation
 - Contains pertinent project and inventory data

MINNESOTA DEPARTMENT OF TRANSPORTATION

BRIDGE NO.: 08010 User Input

DIST. NO: 7

Type: 501

Reference Point: 055+00.090

BRIDGE SCOPING COST ESTIMATE

RDWY. AREA: 27889 SF T.H. TH 15 over COTTONWOOD RIVER

Length: 508.9' Rdwy Width: 64.8' Year Built: 1983

Other Features: parapet abutments, type-J barrier

Major Preservation X

Rehabilitation

Tentative Letting Date: February 24, 2017 State Project: 0805-113 SCOPE EST INCLUDES... For FY 2017

Bridge Designer: Stenberg Current ADT: 5800

RT Rail Code: 22 Meets 10k? Inv. Ratings: HS21.4

LT Rail Code: 22 Meets 10k? After Constr.: HS21.4

Is the bridge Historic or Historic Eligible? Posted Speed: 55 mph

SCOPING RECOMMENDATIONS BY ASST. DISTRICT BRIDGE ENGINEER

Year of Est.: 2016

Bridge Scoping Cost Estimate Spreadsheet

- Contains typical bridge repair items and unit costs

	Comment	Bridge Element	Scope of work		Units	Planning Level Unit Cost	Planning Level Est Cost	
			Yes = X	Est Quantity				
SUPERSTRUCTURE	Prep	B-1	Scarify _____			sf	\$2.00	
		B-1	REMOVE CONCRETE WEARING COURSE	x	27905	sf	\$2.50	\$69,764
		B-1	BRIDGE DECK PLANING			sf	\$0.90	
	Deck Primary Repair	B-2	Redeck			sf	\$0.00	
			Overlay 10,000sf -	x	30099	sf	\$6.00	\$180,593
		B-2	Overlay 10,000sf +			sf	\$5.00	
		B-2	CHIP SEAL WEARING COURSE (TYPE 1)			sf	\$7.50	
		B-2	Other W.C. (See Comments) (polyester - 12/SF)			sf	\$12.00	
		B-2	SEAL CRACKS WITH EPOXY BY CHASE METHOD	x	3488	lin ft	\$1.67	\$5,813
		B-2	MMA FLOOD SEAL			sf	\$2.00	
	Railings	B-3	REMOVE AND PATCH TYPE A	x	500	sf	\$30.00	\$15,000
		B-3	REMOVE AND PATCH TYPE B	x	250	sf	\$55.00	\$13,750
		B-3	REMOVE AND PATCH TYPE C	x	20	sf	\$75.00	\$1,500
		B-6	Replace Railing			lin ft	\$200.00	
		B-6	Repair Railing (Type F)			lin ft	\$155.00	
B-6		RECONSTRUCT END POST	x	4	each	\$4,000.00	\$16,000	
B-6		SILANE 40 PERCENT			sf	\$1.00		

Bridge Scoping Cost Estimate Spreadsheet

- Redeck worksheet

Bridge:	08010	Date of estimate:	April 8, 2016	Key:	User input req'd			
Proposed redeck width:	64.80'				User override permitted			
Bridge length:	508.90'	New Deck SF:	32977 SF					
Include?	Bridge Element	Includes	Conversion	Avg Low	Avg High	Used for BIP Est.	Square foot cost line item	
	Redeck							
x	2433.505/00005	REMOVE CONC SLAB, CURBS, OVERLAY, RAIL		\$ 5.55	\$ 15.00	\$ 10.00	\$ 10.00	
	2401.512/03636	BRIDGE SLAB CONCRETE (3YHPC-S)		\$ 15.00	\$ 25.50	\$ 20.00		
x	2401.512/03630	BRIDGE SLAB CONCRETE (3YHPC-M)		\$ 15.00	\$ 25.50	\$ 25.00	\$ 25.00	
x		NONMETALLIC FIBERS	4.0 LBS/SF	\$ 0.53	\$ 0.69	\$ 0.60	\$ 0.60	
x	2401.541/00011	REINFORCEMENT BARS (EPOXY COATED)	7.7 LBS/SF	\$ 7.47	\$ 10.16	\$ 8.47	\$ 8.47	
	2404.501/00200	CONCRETE WEARING COURSE (3U17A)		\$ 2.80	\$ 6.95	\$ 4.40		
x	2401.618/00300	BRIDGE DECK PLANING		\$ 0.58	\$ 0.69	\$ 0.65	\$ 0.65	
	Base deck without joints and barriers:			SUM:	\$ 46.93	\$ 84.50	\$ 69.12	\$ 44.72
	Additions: Left barrier and railing at length of		530.90'					
	Metal Fence			Avg Low	Avg High	Used for BIP Est.	Included in redeck cost	
x	2401.513/01146	TYPE F (TL-4) RAILING CONCRETE (3Y46)	L F	\$ 37.00	\$ 60.00	\$ 60.00		
	2401.513/01246	TYPE MOD F (TL-4) RAILING CONCRETE (3Y46)	L F	\$ 55.00	\$ 70.00	\$ 65.00	\$ 65.00	

Bridge Scoping Cost Estimate Spreadsheet

- Replacement worksheet

- Unit cost for quick analysis
- Some projects will require more detailed cost estimate

Bridge Replacement Cost Estimate			Made by:	dlt	Key:
Bridge Improvement Program			Date:	4/8/2016	
			Year of Est.:	2016	
Bridge #:	08010		Proposed # of Lanes:		
Inpl Width:	64.8 ft		Proposed Width:	65	
Inpl Length:	508.9 ft		Proposed Length:	509	
Existing SF	32976.72		Sidewalks (yes/no):		
			Replacement SF	33085 SF	
Pre-factored Typical Replace Unit Cost:			\$125.00 /sf		
Add'l skew factor:		1.1	Note: Use factors 1.0 to 1.2		
Add'l aesthetic factor:		1	for all factors		
Add'l high abut factor:		1			
Add'l steel factor:		1			
Factored Unit Cost			\$137.50	/sf	
Estimated Replacement Cost:			\$4,549,188		Calculated using proposed width,length
Approach Panel Cost			\$31,680		
Remove Old Bridge Cost @ \$10/sf			\$329,767		Calculated using existing width, length
Subtotal			\$4,910,635		
5% Mobilization			\$491,063		
5% Risk			\$491,063		
Total Estimated Unit Cost:			\$5,892,762		
			Say:	\$5,900,000	

Bridge Scoping Cost Estimate Spreadsheet

- Compare work required with cost criteria in BPIG

		BRIDGE SCOPING COST ESTIMATE		\$520,300			
Item Notes	Child needs to be funded by BIP		Cost with Risk				
		Traffic Control Needs Identified	\$	-			
		Drainage Needs Identified	\$	-			
		RTMC Needs Identified	\$	-			
		Pavement Needs Identified	\$	-			
		Other Needs Identified	\$	-			
		Subtotal Project Cost	\$	520,300			
Escalation to year of letting:	Year of Estimate:	2016	Inflate to year:	2017	Inflation factor from OTSM:	1.06	\$ 551,518

Replacement cost from Replace Cost Estimate worksheet \$5,892,762

Ratio Rehab/Replace = $\frac{\$520,300}{\$5,892,762} = 8.8\%$

Increased Emphasis on Scoping

- Example of mill and overlay project turning into superstructure replacement
 - Original scope was mill and overlay
 - Deck chain drag survey performed a year prior to letting indicated much higher delamination than anticipated, leading to change in scope to a redeck
 - Load rating analysis of redeck performed during design indicated a low rating, leading to change in scope to superstructure replacement
 - There were also benefits to raising vertical clearance and pedestrian accommodations

Increased Emphasis on Scoping

- Condition of some elements requires more data and analysis
- Gather additional information during scoping
 - Pier cap and column delamination surveys
 - Pothole around exposed piles to check for corrosion
 - Deck delamination surveys
- Preservation project followed by replacement soon after – discovered poor condition of precast piles below ground (not visible)



Increased Emphasis on Scoping

- Shoring during repairs



5/17/2017

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Increased Emphasis on Scoping

- Pier in-fill walls



Benefits of Increased Emphasis on Scoping

- Better predict project costs to develop the proper budget
 - Less movement of project lettings
- Streamline repair recommendation process
 - Early load rating, pier analysis, delamination surveys, etc.
- Avoid scope change during design
 - “If I’d have known that information earlier, I would have done this instead”
- Early superstructure load rating and pier evaluation is critical!

Accelerated Bridge Construction

- ABC Implementation Memo
- ID projects early in scoping
 - Budget
 - Schedule
 - Design details
- 3 stage process
 - Stage 1 – automated initial screening
 - Stage 2 – site specific assessment form
 - Stage 3 –select alternatives and techniques
- <http://www.dot.state.mn.us/bridge/abc/index.html>



Internal Memo

January 13, 2017

To: All Managers

From: Nancy Daubenberg, Assistant Commissioner
Engineering Services Division

Mike Barnes, Assistant Commissioner
Operations Division

Subject: Implementation of Accelerated Bridge Construction

Thank you!

Dustin Thomas, P.E.

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