# Bridge Office Scoping Personnel

<table>
<thead>
<tr>
<th><strong>Scoping of New Bridges</strong></th>
<th>Larry Aamodt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preliminary Plans Unit</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Scoping of Bridge Repair Projects</strong></th>
<th>Dustin Thomas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridge repair scoping reports, BRIM support, repair or replace decision support</td>
<td></td>
</tr>
</tbody>
</table>
• Bridge Planning
• BRIM planning tool
• Bridge Repair Projects and BPIG
• Bridge Scoping Cost Estimate Spreadsheet
• ABC
MnSHIP – MN State Highway Investment Plan

• Capital investments over the next 20 years
• Compare needs to projected revenues
• Prioritize (i.e. preserve vs. expand, bridge vs. pavement, etc.)
• Updated every 4 years
• [http://www.dot.state.mn.us/planning/mnship/index.html](http://www.dot.state.mn.us/planning/mnship/index.html)
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](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
• 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

![Table of Bridge Information]
Expert review process allows District input
• 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 Preservation and Improvement Guidelines

BRIDGE OFFICE
MINNESOTA DEPARTMENT OF TRANSPORTATION
Fiscal Year 2016 through 2020
Bridge Preservation and Improvement Guidelines

Approved
Boulder Funke
Acting State Bridge Engineer

5/17/2017
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

Preservation
- Bridge Maintenance
  - Preventive Maintenance
  - Reactive Maintenance
- Major Preservation

Improvement
- Bridge Rehabilitation
- Bridge Replacement
BPIG: Preservation

<table>
<thead>
<tr>
<th></th>
<th>PRESERVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bridge Maintenance</td>
</tr>
<tr>
<td>General Scope</td>
<td>Maintain existing design features.</td>
</tr>
<tr>
<td>Typical Cost</td>
<td>Minor investment from District operating budget.</td>
</tr>
</tbody>
</table>

“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.”
• **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.
• 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.
### IMPROVEMENT

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

**Significant investment in a bridge that improves the condition, geometrics, or load-carrying capacity to a minimum standards.**
• 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.
• **Bridge replacement** involves removing a structure and building a new one to serve the same function.

• built to current bridge design and construction standards

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**BPIG: Replacement**

- **Preservation**
  - Bridge Maintenance
  - Major Preservation

- **Improvement**
  - Bridge Rehabilitation

- **Bridge Replacement**

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5/17/2017  Bridge Office  mndot.gov/bridge
BPIG: How to find it?

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

Bridges and Structures
Design, construction and maintenance resources

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)
• Planning level estimate and work type validation

• Contains pertinent project and inventory data

| 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 |

| Tentative Letting Date: | February 24, 2017 | State Project: | 0805-113 |
| Bridge Designer: | Stenberg | Current ADT: | 5800 |
| RT Rail Code: | 22 | Meets 10k? | x |
| LT Rail Code: | 22 | Meets 10k? | x |
| Inv. Ratings: | HS21.4 |
| After Constr.: | HS21.4 |
| Posted Speed: | 55 mph |

| SCOPE EST INCLUDES... | For FY 2017 |
| Major Preservation | X |
| Rehabilitation | |

SCOPING RECOMMENDATIONS BY ASST. DISTRICT BRIDGE ENGINEER | Year of Est.: 2016 |
## Bridge Scoping Cost Estimate Spreadsheet

- Contains typical bridge repair items and unit costs

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

- **Redeck worksheet**

<table>
<thead>
<tr>
<th>Bridge:</th>
<th>08010</th>
<th>Date of estimate:</th>
<th>April 8, 2016</th>
<th>Key:</th>
<th>User input req'd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed redeck width:</td>
<td>64.80’</td>
<td></td>
<td></td>
<td></td>
<td>User override permitted</td>
</tr>
<tr>
<td>Bridge length:</td>
<td>508.90’</td>
<td>New Deck SF:</td>
<td>32977 SF</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bridge Element</th>
<th>Includes</th>
<th>Conversion</th>
<th>Avg Low</th>
<th>Avg High</th>
<th>Used for BIP Est.</th>
<th>Square foot cost line item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Redeck</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2433.505/00005</td>
<td>REMOVE CONC SLAB, CURBS, OVERLAY, RAIL</td>
<td></td>
<td>5.55</td>
<td>15.00</td>
<td>10.00</td>
<td>10.00</td>
</tr>
<tr>
<td>2401.512/03636</td>
<td>BRIDGE SLAB CONCRETE (3YHPC-S)</td>
<td></td>
<td>15.00</td>
<td>25.50</td>
<td>20.00</td>
<td></td>
</tr>
<tr>
<td>2401.512/03630</td>
<td>BRIDGE SLAB CONCRETE (3YHPC-M)</td>
<td></td>
<td>15.00</td>
<td>25.50</td>
<td>25.00</td>
<td>25.00</td>
</tr>
<tr>
<td>x</td>
<td>NONMETALLIC FIBERS</td>
<td>4.0 LBS/SF</td>
<td>0.53</td>
<td>0.69</td>
<td>0.60</td>
<td>0.60</td>
</tr>
<tr>
<td>2401.541/00011</td>
<td>REINFORCEMENT BARS (EPOXY COATED)</td>
<td>7.7 LBS/SF</td>
<td>7.47</td>
<td>10.16</td>
<td>8.47</td>
<td>8.47</td>
</tr>
<tr>
<td>2404.501/00200</td>
<td>CONCRETE WEARING COURSE (3U17A)</td>
<td></td>
<td>2.80</td>
<td>6.95</td>
<td>4.40</td>
<td></td>
</tr>
<tr>
<td>2401.618/00300</td>
<td>BRIDGE DECK PLANING</td>
<td></td>
<td>0.58</td>
<td>0.69</td>
<td>0.65</td>
<td>0.65</td>
</tr>
<tr>
<td><strong>Base deck without joints and barriers:</strong></td>
<td></td>
<td></td>
<td>SUM:</td>
<td>46.93</td>
<td>84.50</td>
<td>69.12</td>
</tr>
</tbody>
</table>

**Additions:** Left barrier and railing at length of 530.90’

<table>
<thead>
<tr>
<th>Metal Fence</th>
<th>Avg Low</th>
<th>Avg High</th>
<th>Used for BIP Est.</th>
<th>Included in redeck cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2401.513/01146</td>
<td>TYPE F (TL-4) RAILING CONCRETE (3Y46)</td>
<td>L F</td>
<td>$37.00</td>
<td>$60.00</td>
</tr>
<tr>
<td>2401.513/01246</td>
<td>TYPE MOD F (TL-4) RAILING CONCRETE (3Y46)</td>
<td>L F</td>
<td>$55.00</td>
<td>$70.00</td>
</tr>
</tbody>
</table>

5/17/2017 | Bridge Office | mndot.gov/bridge | 26
Bridge Scoping Cost Estimate Spreadsheet

• Replacement worksheet
• Unit cost for quick analysis
• Some projects will require more detailed cost estimate

<table>
<thead>
<tr>
<th>Bridge Replacement Cost Estimate</th>
<th>Made by:</th>
<th>Key:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridge Improvement Program</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year of Est.:</td>
<td>2016</td>
<td></td>
</tr>
<tr>
<td>Bridge #: 08010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proposed # of Lanes:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inpl Width: 64.8 ft</td>
<td>Proposed Width: 65</td>
<td></td>
</tr>
<tr>
<td>Inpl Length: 508.9 ft</td>
<td>Proposed Length: 509</td>
<td></td>
</tr>
<tr>
<td>Existing SF 32976.72</td>
<td>Sidewalks (yes/no):</td>
<td></td>
</tr>
<tr>
<td>Replacement SF 33085 SF</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pre-factored Typical Replace Unit Cost: $125.00/sf

| Add'l skew factor: | 1.1 |
| Add'l aesthetic factor: | 1 |
| Add'l high abut factor: | 1 |
| Add'l steel factor: | 1 |

Factored Unit Cost: $137.50/sf

Estimated Replacement Cost: $4,549,188
Approach Panel Cost: $31,680
Remove Old Bridge Cost @ $10/sf: $329,767
5% Mobilization: $491,063
5% Risk: $491,063
Total Estimated Unit Cost: $5,892,762
Say: $5,900,000
• Compare work required with cost criteria in BPIG

<table>
<thead>
<tr>
<th>Item Notes</th>
<th>Child needs to be funded by BIP</th>
<th>Cost with Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Traffic Control Needs Identified</td>
<td>$ -</td>
</tr>
<tr>
<td></td>
<td>Drainage Needs Identified</td>
<td>$ -</td>
</tr>
<tr>
<td></td>
<td>RTMC Needs Identified</td>
<td>$ -</td>
</tr>
<tr>
<td></td>
<td>Pavement Needs Identified</td>
<td>$ -</td>
</tr>
<tr>
<td></td>
<td>Other Needs Identified</td>
<td>$ -</td>
</tr>
</tbody>
</table>

**BRIDGE SCOPING COST ESTIMATE**

<table>
<thead>
<tr>
<th>Item Notes</th>
<th>Child needs to be funded by BIP</th>
<th>Cost with Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Subtotal Project Cost</td>
<td>$ 520,300</td>
</tr>
</tbody>
</table>

Escalation to year of letting: Year of Estimate: 2016 Inflated to year: 2017 Inflation factor from OTSM: 1.06

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

\[
\text{Ratio Rehab/Replace} = \frac{520,300}{5,892,762} = 8.8\%
\]
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 that 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
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

• [Link to website](http://www.dot.state.mn.us/bridge/abc/index.html)
Thank you!

Dustin Thomas, P.E.

dustin.thomas@state.mn.us

651.366.4562