Bridge Rehabilitation

Best Practices With:

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&

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Overview

- Plan & design intentions
- Field review
- A look into an active contract
- Aspects of our bridge rehabs
- Contractor’s means and methods
Due to the nature of rehabilitation projects, the exact extent of reconstruction work cannot always be accurately determined prior to the commencement of work. These contract documents have been prepared based on limited field inspection and other information available at the time. Actual field conditions may require modifications to construction details and work quantities. It is the Contractor’s responsibility to perform the work in accordance with field conditions.

All dimensions of new construction on rehabilitation projects are subject to existing conditions. It is required that all dimensions which may affect materials and quantities as shown on these plans be verified by the Contractor prior to ordering the materials and the commencement of work.

The RCE and the Contractor are to jointly conduct a field inspection to determine any necessary extra work items prior to beginning work on bridge. Any necessary repairs to the existing structure, in the opinion of the Engineer, are to be paid for as extra work. If such work is not called for in these plans or in the Special Provisions for this project. Otherwise, payment is to be paid at the unit price bid for the appropriate items.
Plans and Design Intensions

Due to the nature of rehabilitation projects, the exact extent of reconstruction work cannot always be accurately determined prior to the commencement of work. These contract documents have been prepared based on limited field inspection and other information available at the time. Actual field conditions may require modifications to construction details and work quantities. It is the Contractor’s responsibility to perform the work in accordance with field conditions.

KEY POINTS:
- Limited field review when assembling plans
- Field conditions may require modifications to construction details
- Field conditions may require modifications to work quantities
Review

Ground Penetrating Radar

Hilti PS 1000
Plan Ahead
### Adjust

#### 4048090 GPR results

**P026813**

**US 21 Wilson Blvd. Bridge over I-20**

**Span 1** | **Span 2** | **Span 3** | **Span 4**
---|---|---|---
Left | Right | Left | Right | Left | Right | Left | Right
1.2” | 1.4” | 1.5” | 1.4” | 0.6” | 1.2” | 1.2” | 1.2”
1” | 1.2” | 1.2” | 1” | 0.4” | 0.8” | 0.6” | 1”
1.4” | 1” | 1.4” | 1.4” | 1.2” | 1” | 1” | 1.6”
1.2” | 1.4” | 1.2” | 1.1” | 1.4” | 0.5” | 0.5” | 1”
0.4” | 1.2” | 1.2” | 1.2” | 0.8” | 0.8” | 0.8” | 0.6”
1” | 1.2” | 1.2” | 1.2” | 1” | 1” | 0.8” | 0.25”
1.4” | 0.8” | 1” | 0.8” | 0.8” | 1” | 0.25”

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**Proposed cover with grade change of 0.75”**

**Span 1** | **Span 2** | **Span 3** | **Span 4**
---|---|---|---
Left | Right | Left | Right | Left | Right | Left | Right
1.95 | 2.15 | 2.25 | 2.15 | 1.15 | 1.95 | 1.95 | 1.95
1.75 | 1.95 | 1.95 | 1.75 | 1.15 | 1.55 | 1.35 | 1.75
2.15 | 1.75 | 2.15 | 2.15 | 1.95 | 1.75 | 1.75 | 2.35
1.95 | 2.15 | 1.95 | 1.85 | 2.15 | 1.15 | 1.75 | 1.75
1.15 | 1.95 | 1.95 | 1.95 | 1.55 | 1.55 | 1.35 | 1.35
1.75 | 1.95 | 1.95 | 1.75 | 1.35 | 1.35 | 1.35 | 1.35
1.15 | 1.95 | 1.95 | 1.75 | 1.55 | 1.35 | 1.75 | 1.75
2.15 | 1.55 | 1.55 | 1.55 | 1.55 | 1.55 | 1.55 | 1.55
Planes and Design Intensions

KEY POINTS:
- Check and record existing dimensions of bearing assemblies
- Check and record existing elevations of the bridge deck, armor plates, etc. as the information will be needed during construction.
Structure Verification

Bearing Assemblies:
Dimensions jointly gathered by Archer Western & SCDOT prior to AW’s shop drawing submittals
Survey Notes:
- Check and record elevations for deck and joints
- Consider taking mid-span grade shots for larger spans.
- Consider mid points for multi-lane bridges to verify existing cross slopes.
Plans and Design Intensions

KEY POINTS:
• Review the bridge before beginning construction.
• Review constantly through the stages of construction.
• Know the full extent of the work ahead.
• Extra Work ??? / Change Orders ???
• Bid Build ??? Unit prices will be used for each appropriate item.

The RCE and the Contractor are to jointly conduct a field inspection to determine any necessary extra work items prior to beginning work on bridge. Any necessary repairs to the existing structure, in the opinion of the Engineer, are to be paid for as extra work, if such work is not called for in these plans or in the Special Provisions for this project. Otherwise, payment is to be paid at the unit price bid for the appropriate items.
Field Review

Bid Items

Extra Work
Plans Typically Consist of:

- Estimated Quantities
- General Notes
- General Details
- Some Project Specific Details
- Existing Plans – Info. Only
- Possible Traffic Staging
SC FILE 4048090:
Three Bridge Rehabilitation Projects

P026813
US 21 over I-20

P026815
US 321 over I-20

P026818
S-1036 over SC 277
P026813
US 21 over I-20

Bridge Information:

• 53 years old
• Deck length = 275’
• Deck width = 66’ – 7”
• Overlaid width = 56’
• 4 spans
• Prestressed Conc. Beams
• No approach slabs

P026815
US 321 over I-20

Bridge Information:

• 54 years old
• Deck length = 265’
• Deck width = 66’ – 7”
• Overlaid width = 56’
• 4 spans
• Prestressed Conc. Beams
• No approach slabs

P026818
S-1036 over SC 277

Bridge Information:

• 45 years old
• Deck length = 326’
• Deck width = 76’ – 6”
• Overlaid width = 64’
• 4 spans
• Steel Girders
• Approach slabs
Scope of Work:
• Bridge jacking for bearing assembly replacement
• Substructure spall repairs and crack repairs
• Deck rehabilitation
  • Remove concrete median
  • Mill & Hydro-demo the deck surface
  • Full depth repairs and partial depth removal of deck surface
  • Overlay deck surface with VESLMC (Very Early Strength Latex Modified Concrete)
  • Perform joint rehabilitation
• Repaint structural steel
• Replace concrete median and repave asphalt tie-ins

Single Weekend Work
Fri 6PM – Mon 7AM
Initial Demolition

Mechanical Scarification + Hydro-Demolition
Initial Demolition

**Mechanical Scarification:**
- Quick
- Provides texture to help hydro-demolition

**Hydro-Demolition:**
- Relatively quick.
- Can remove sound and unsound concrete.
- Preserves the top mat of reinforcing steel.
Secondary Demolition

Full Depth Deck Patching:

- Full depth repair areas evident of spalling below deck surface

- In our field reviews, we’re also looking for cracking, rust stains, or efflorescence.

- Special provisions indicate to perform full depth patching when the removal of unsound concrete extends below \( \frac{1}{2} \) of the depth of the concrete deck. (Verify the true deck thickness)
Deck Preparation

Partial Depth Removal of Sound Concrete:

- Remove sound concrete to a depth of ¾” below any bars that appear not to be bonded to the existing concrete.

- Want to allow coarse aggregate to free-flow under the loose / exposed bars to ensure the best bond is achieved during overlay.

- #789 stone concrete mix – Proper gradation has 100% passing ¾” sieve.
Deck Preparation

Reinforcing Steel

• Replace reinforcing steel that are damaged during demolition process.

• Replace corroded reinforcing steel. (>10% sectional loss)
Deck Preparation

Clean & Soak

- Blast Clean entire deck surface prior to overlay. Free of debris.
- Options to waterblast or sandblast
- Thoroughly wet the cleaned surface to prevent the surface from drying out. Cover with polyethylene sheeting.
- Surface must be damp but free of standing water.
Overlay

Very Early Strength Latex Modified Concrete:

- Mix design will be provided and approved prior.
- Each mixing truck will be calibrated prior.
- Placement at appropriate temperature and weather conditions (45 and rising, max 85 deg.)
- Bonds well to hydro-demo surface.
- The overlay requires wet burlap curing for a minimum of 3 hours for VESLMC / until strength achieved.
Fast Track-Hydrodemolition

- 20k PSI Hydro-Demo Robot removes unsound and delaminated concrete
- Hydro-Demo is quick... Cleanup is the Challenge
Initial Clean

• Maximize water flow to robot (200GPM) to help with slurry removal

• Bulk demo debris removed with specialized Vac-Truck
Post Hydro Survey

• Survey deck for extents of full/partial depth repairs after initial clean
• Pre-existing condition survey is good indicator to quantity of repair
Post Hydro Survey Result
Full Depth Repair

• Minor Repairs
  – Small, localized areas
  – Typical section formwork detail suffices
  – Depending on project duration, often able to pour using LMC during overlay pour
Full Depth Repair

• Major Repairs
  – Full bay or span replacement
  – Structural integrity of remaining deck and substructure must be evaluated
  – Problem Areas
    • Unsupported length of deck overhang and parapet
    • Lateral torsional stability of outer girder lines
Major Full Depth Repairs
Major Repair Lessons Learned

• Field productivity and quality can be created from a well engineered repair plan
• Segmenting pours allows work to be completed with minimal shoring.
• Pour with high early concrete mixes to accelerate cure.
• Design protective decking to withstand the entire deadload of existing deck concrete.
Latex Overlay-Pre Pour

- Existing cross slope can cause issues with plan depth
  - Survey Points valuable for screed layout
  - Skid Steer Mill Fine Adjustments

- Cleanliness of existing deck before pour is crucial to longevity of LMC overlay.
  - 10k PSI Waterblaster Unit
Latex Overlay – During Pour

• Compact bridge deck paver (Bidwell 2450)
  – Easy to handle
  – Accurate Finish

• Plastic used to protect clean deck during pour
Latex Overlay – After Pour

- Place wet burlap and plastic sheeting to water cure ASAP
  - Initial hydration very important.
  - Thin overlay can dry out quickly especially with on hot and windy days
  - VES LMC is more resilient to this than Type 1 LMC
Questions?