Investigate options for the preparation of coated steel bridge for maintenance re-coating.

Determine methods & materials suitable for implementation by bridge crews.

Evaluate the health & environmental effects with oversight agencies.

Advance promising methods to field applications.

Specifications & guidelines
Long-term Goal

- Reduce the number of priority repair needs due to the section loss of steel.
- Develop a sustainable spot painting program for bridge maintenance crews.
- Industry, research, & field trials lead to refinement of specifications & guidance.
- Extend the service life of existing coatings.
- Maintenance of coatings is included in off-the-shelf bridge management systems.
The Present Situation

- More than ½ of all structural repair needs discovered through the bridge inspection process are because of section loss.
- Bridge crews are not involved with maintaining the coating system.
- All coatings tested by NEPCOAT were applied to SP-10 surface.
- Approved coatings require SP-10 surfaces.
- Contract painting programs are not keeping up with the needs.
- Transportation agencies have not kept pace with methods & materials implemented in other industries.
Development up to Present

- Crews use shrouded hand tools to prepare steel for coating.
- Open dry abrasive blasting is prohibited in agreement with environmental and health & safety oversight agencies.
- The post Pb coating system was based on a moisture cure primer. The anticipated service life was over estimated.
- Estimates of service life with zinc-based primer systems seem realistic.
Potential Alternatives

- Increase funding of the bridge painting program and use existing specifications.
- Further develop the use of existing steel preparation techniques.
- Purchase Class A containment equipment for use by state crews.
- Investigate alternative corrosion protection systems.
- Use coatings designed for minimally prepared surfaces.
- Implement “dust-free” blasting strategies.
Field Trials

- Air Quality Monitoring
- Production rates
- Environmental concerns
- Containment design
- Equipment costs
- Implementability

0.1 to 10 microns
- 3 Air Quality Monitors DataRAMs
  - Respirable aerosols
  - Upwind, downwind, & inside containment
SSPS/NACE Guides

- Developed for various surface preparation methods
- Start with Begin Condition
- Coatings recommended for End Condition
  - SP-3 describes an end condition in SSPC-VIS 3 Power & Hand Tool Cleaning
  - SP-10 (Near-white metal) VIS 1 Dry Abrasive Blast
  - Numbering is not sequential
Wet Blasting

- 7,2000 psi
- 6 gal/minute
- Heated water
  - 180°F – thermal shock
- 0º Rotating tip
- 275 gal water tank
- Ground tarp
- SSPC-VIS 4 Waterjet
  - Begin Condition C
    - <10k psi
Findings

- Dust-free
- Restored profile
- End Condition G WJ-3
- PPE – face shield
- Waste water
  - filtration system

Pb bleeds

- Forced-air to dry
- Regains profile
- Production rate
  - 5 - 14 sq ft/minute
Feasibility

- **Equipment**
  - $27k - own
  - $5k/month - rent

- **Coating for SP-3**
  - One coat

- **Dry time**
  - Evaporation
  - Air dry crevices

- **Cl⁻ removal**

- **Waste water**
  - Reduced volume
  - Settlement basin?
Sponge Blasting

- Blast pot & Re-cycler
- 375 CFM compressor
- Sized grit embedded
  - Recyclable
    - 8 – 12 times
- Blast medium
  - $100 1.5 cu ft/bag
- Containment
  - Medium collection
- SSPC VIS 1
  - Dry Abrasive
  - Begin Condition G1, G2
**Comparing Abrasive Blasting Technologies**

**Conventional Abrasive Blasting Media**
1. Single-component, conventional abrasives are propelled to the surface using an air-driven system.
2. Upon impact conventional abrasives:
   - Absorb the high-speed collision by fracturing and ricocheting into the air.
   - Transfer heat to the substrate.
   - Strip the complete coating system.
3. Conventional abrasives release all fractured abrasives, contaminants, and coating layers as airborne dust.

**Conventional Abrasive Bonded Into Sponge Media**
1. Dual-component, Sponge Media abrasives are propelled to the surface using an air-driven system.
2. Upon impact Sponge Media abrasives:
   - Absorb collision energy.
   - Flatten and suppress the release of loosened surface contaminants.
   - Expose its abrasives with little abrasive fracturing and remove contaminants.
   - Selectively or completely strip the coating system and profile the substrate.
3. Sponge Media abrasives capture most of what would normally have become airborne dust.
Results

- Reduced emissions
- Creates profile
- Removes mill scale
- End Condition SP-10
- Rinse required
- PPE
  - HEPA full-face mask
  - Tyvek & sealed seams
- Production rate:
  - 8 sq ft/min brush blast
  - 2 sq ft/min SP-10
Feasibility

- **Equipment**
  - $34k - own
  - $3k / month - rent

- **All coatings**

- **Cl^- removal**

- **Ventilation Type J1**
  - Dust collector
    - < $1,200

- **Containment**
  - SSPC – Class 3
  - Penetrable wall, overlap seams

- **Waste**
  - Minimal
Recommendation

- “Dust-free/reducing” technologies are feasible for bridge maintenance operations.
- Advance technologies to field applications
  - Demonstrations
- Environmental & Health agency buy-in
- Determine service life extension with implementation of spot painting program.
  - Benefit / cost calculations
- Develop RNS
- Create specifications & standards that facilitate spot painting.
THANK YOU

QUESTIONS or COMMENTS

Peter Weykamp, P.E.
peterweykamp@outlook.com